State of Vermont IT Assessment

Recommendations Report

Prepared for the Department of Information and Innovation (DII)

By TPI Inc

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EXECUTIVE SUMMARY

INTRODUCTION

The State of Vermont Department of Information and Innovation (DII) contracted with TPI Inc. to conduct an information technology assessment. The drivers behind the project are:

- In 2009 the legislature passed language requiring that DII analyze specific information technology opportunities such as cloud computing
- The State Technology Committee (STC), consisting of the IT managers at all large agencies recommended that an assessment be conducted
- The recognition by the State's CIO and Technology Leaders that while there have been many improvements in information technology, the State is not on a path to scale up or optimize technology

KEY OBJECTIVES OF THE PROJECT

The following are the key objectives of the project:

- Identify various options for the best utilization of information technology services
- Improved service delivery in a manner that we can afford given the other pressures on the budget
- Independent assessment that will lead to recommendations that are based on industry best practice, with a special focus on how best to deliver services in the public sector
- To obtain an objective assessment that is vendor agnostic
- To produce strategic documents that provide road maps from the current state to the future state based on best practices and leverage the current imbedded technologies
- To produce business cases that will support the work recommended

FUNCTIONAL AREAS IN SCOPE OF THE PROJECT

The following four (4) functional areas are in-scope and being assessed:

- Phase 1 - Infrastructure and data centers including server and system support
- Phase 2 - Networks, both Local and Wide Area
- Phase 3 - Desktop Support
- Phase 5 - Mainframe

FUNCTIONAL AREAS OUT OF SCOPE OF THE PROJECT

The following three (3) functional areas are within the contract with TPI but have been deferred to a later date:

- Phase 4 - Purchasing and Cost Allocation Model
- Phase 6 - IT Governance
- Phase 7 - Security

PROJECT BACKGROUND

The project commenced on September 21, 2009 and completed on December 18, 2009. This Recommendations Report is the second of two reports delivered by TPI. The first report provided a read-out on the "current state" of the State's information technology infrastructure and identified gaps that exist from best practices. This second report provides recommendations and actions that the State should consider to rectify the gaps that were identified in the current state report.

The following 22 agencies and departments participated in the project:

1) Agency of Admin Secretary's Office
2) Agency of Administration
3) Agency of Human Services
4) Agency of Natural Resources
5) Agency of Transportation
6) Agriculture, Food & Markets
7) Auditor of Accounts
8) Banking, Insurances, Securities & Health Care Administration
9) Commerce & Community Development
10) Department of Education
11) Enhanced 911 Board
12) Executive Office
13) Lieutenant Governor
14) Liquor Control
15) Military Department
16) Natural Resources Board
17) Office of the Attorney General
18) Office of the Defender General
19) Department of Public Safety
20) Department of Public Service
21) Lottery Commission
22) Department of Labor

SUMMARY OF FINDINGS

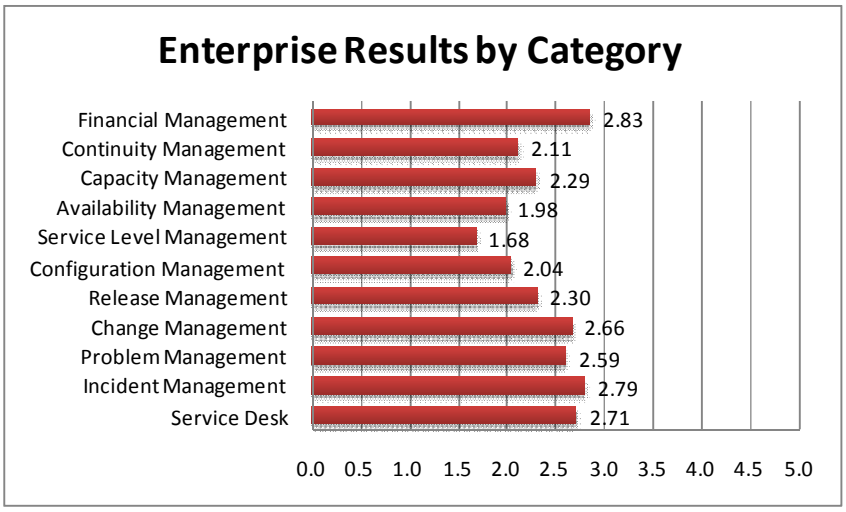
CURRENT OPERATIONAL PROCESSES AND PROCEDURES

To determine the maturity of the respective IT teams across the State of Vermont, TPI used a self assessment survey based on the best practices identified within the globally accepted Information Technology Information Library or "ITIL" as it is commonly referenced. ITIL is a set of concepts and practices for managing Information Technology (IT) services, IT development and IT operations.

The results of the survey show the maturity level rating for each process capability area as defined within the ITIL best practice. These process capability areas cross all functional areas (functional areas being - network, servers, mainframe, desktop and help desk). The below chart and comments show the results of the self assessment survey:

State of Vermont's four (4) weakest IT operational process and procedures areas:

1. Service Level Management
2. Availability Management
3. Continuity Management
4. Configuration Management



RECOMMEDATIONS ON OPERATIONAL PROCESSES AND PROCEDURES

Based on the above survey findings, TPI recommends that the State implements operational improvement programs that build these four (4) areas.

Service level management is the process of defining, agreeing, documenting, and managing levels of customer service that are required and cost justified.

Availability management is the process that defines customers' availability requirements, understands the capabilities of the IT infrastructure to deliver those levels of availability, and takes action to improve availability.

Continuity management is the process of assessing and managing risks to IT Services by examining configuration item (CI) values, threats and vulnerabilities, developing appropriate countermeasures, creating an IT Service continuity plan, and managing any disaster situations that occur.

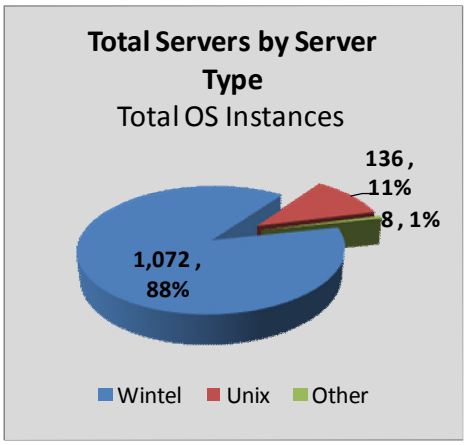
Configuration management is the process of maintaining information about all the assets (Configuration Items or CIs) required to deliver an IT service, including their relationships. This information is managed throughout the lifecycle of the CI.

SERVERS

CURRENT SERVERS QUANTITIES AND OPERATING SYSTEM TYPES

The State has 1216 operating system instances (physical and virtual servers) installed and being supported. With the exception of a small number of legacy servers, these 1216 servers utilize both Microsoft Windows and the UNIX operating systems with the majority (88%) using Microsoft Windows.

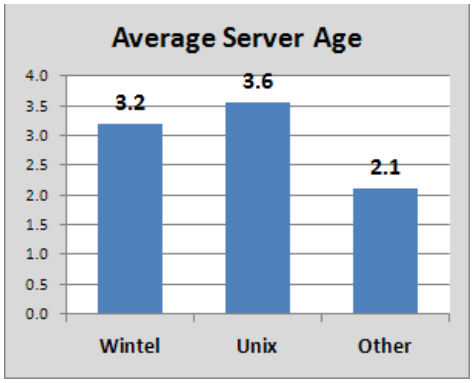
Of the 1216 servers, 72 % are used to support applications. The balance, 28%, is used to support underlying IT infrastructure and other back office functions (E-mail, file servers).



AGE OF SERVERS

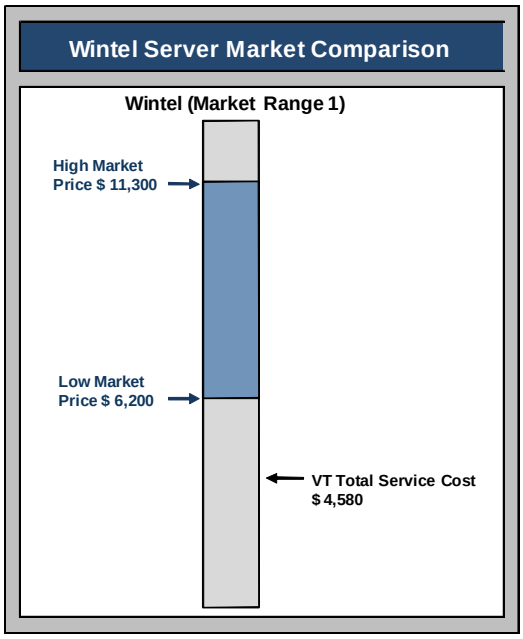
The typical server useful life is around 5 years.

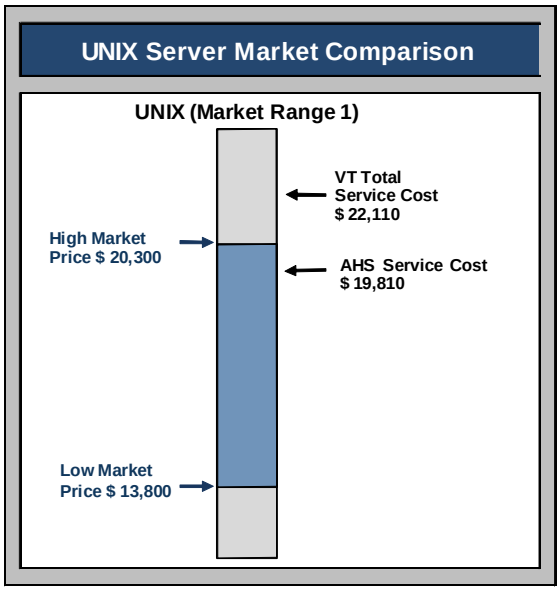
The average age of the State's server equipment is between 3 and 4 years.



SERVER SUPPORT COSTS

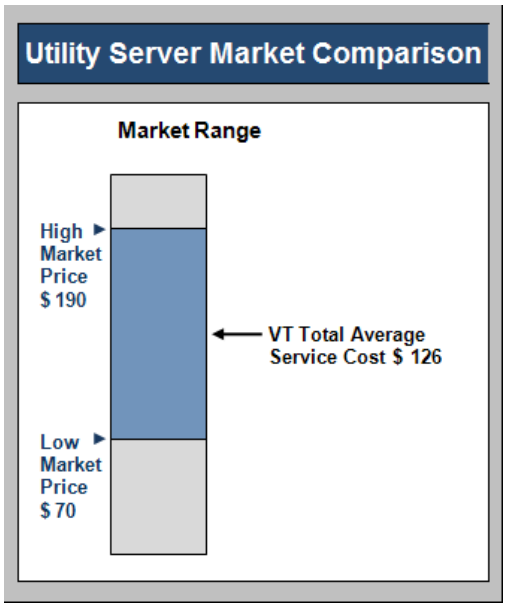
The State's average cost to maintain and support Microsoft Windows servers used for applications is below the typical market range.





The State's average cost to maintain and support UNIX servers used for applications is above the typical market range.

The State's average cost to maintain and support Utility servers (E-mail and file servers) falls in the middle of the typical market range.



OPTIMIZING SERVER ENVIRONMENT THROUGH CONSOLIDATION AND VIRTUALIZATION

Even though the operational costs of the State of Vermont's server environment already fall within the typical market ranges or lower than the typical market range it is always desirable to achieve even greater cost reductions by reducing the size of the server environment. Two common approaches to achieving this are through the use of consolidation and virtualization of server environments.

Consolidation consists of eliminating physical servers from the environment by using one of the following approaches:

a) Eliminating servers that are no longer required or where the functionality can be moved /consolidated to other servers

b) Employing application stacking which is a technique of moving applications of similar requirements onto the same physical server thus more fully utilizing the capacity of existing servers and freeing up and eliminating servers from the environment

Virtualization consists of deploying new software which allows for the virtualization of a single physical server into multiple operating system environments. This in turn allows for moving of multiple physical servers onto one virtual server. The overall goal of virtualization is to maximize the capacity on each physical server.

TPI assessed the potential for the State of Vermont to utilize consolidation and virtualization to further reduce their server environment costs. The analysis by TPI are intended to be at a high level with the goal to help the State determine if consolidation and virtualization should be part of the State's overall IT strategy. If the State embarks on either a consolidation and/or virtualization project one of the first steps would be to conduct detailed server by server and application by application analysis.

In addition, TPI's analysis looked at virtualization and consolidation separately and in practice there is a potential that the State could use a combination of both consolidation and virtualization.

A number of the State's agencies and departments already use virtualization within their server environments and the following points were summarized from the data provided:

- 6 agencies/departments are already using virtualization
- 432 virtual instances are in use (36% of the total 1216 instances mentioned above)
- These 432 virtual instances are supported by 57 physical servers
- The virtualization ratio of physical to virtual servers varies from a low of 2.8 to1 to a high of 14.5 to 1
- The average virtualization ratio is 8.6 to 1
- Almost 100% of the virtualization is for application servers

SERVER CONSOLIDATION

In general, server consolidation is the best option to use when attempting to reduce the overall server environment size as it reduces the overall number of servers in the environment without the need for additional capital. The negative side of server consolidation is that it requires a significant amount of upfront planning and analysis just to determine if consolidation can take place. The risk is that the analysis is conducted and very little consolidation can take place thus resulting in lost invested resources and time used to conduct the analysis.

TPI's analysis showed that potentially 397 of the State's 784 physical servers could be candidates for consolidation and using a 3 to 1 consolidation ratio the State could potentially reduce their server count by 260 servers. The resulting 5 year Net Present Value (NPV) savings for such a project would be approximately $15,395,000. See the below table for additional details.

State Level Consolidation
Server Consolidation Summary

Server Configuration Summary		
Servers Before Consolidation	397	servers
Servers After Consolidation	137	servers
Consolidation Ratio	3	to 1
Financial Summary - One Year View		
Current Costs (Operating & Capital)	$4,873,575	recurring
New Cost (Operating & Capital):		
Consolidation Investment	$1,397,440	one-time
Consolidation Recurring Costs	$1,813,844	63% Savings
Total Consolidation Costs	$3,211,284	
Total Consolidation Savings	**$1,662,291**	34% Savings
Return on Investment (ROI)	119%	
Financial Summary - Five Year View		
Total ROI	1102%	
Total investment	$1,397,440	
Projected Capital Savings	$11,393,764	63% Savings
Projected Operating Savings	$4,001,110	46% Savings
Total 5 Year Savings	$15,394,874	57% Savings
Annual Recurring Savings	63%	by 2nd year
Total 5 Year Savings	57%	
Net Present Value (NPV @ 6%)	$12,674,955	
Payback Period	< 1	Year(s)

SERVER VIRTUALIZATION

TPI's analysis showed that potentially 402 of the State's 784 physical servers could be candidates for consolidation and using an 8 to 1 consolidation ratio the State could potentially reduce their server count by 347 servers. The resulting 5 year Net Present Value (NPV) savings for such a project would be approximately $18,236,000. See the below table for additional details.

Enterprise Level Virtualization Server Virtualization Summary		
Server Configuration Summary		
Servers Before Virtualization	402	servers
Servers After Virtualization	55	servers
Target Consolidation Ratio	8	to 1
Financial Summary - One Year View		
Current Costs (Operating & Capital)	$4,919,291	recurring
New Cost (Operating & Capital):		
Virtualization Investment	$1,417,380	one-time
Virtualization Recurring Costs	$1,292,369	74% Savings
Total Virtualization Costs	$2,709,749	
Total Virtualization Savings	**$2,209,542**	45% Savings
Return on Investment (ROI)	156%	
Financial Summary - Five Year View		
Total - Five Year ROI	1043%	
Total investment	$1,747,844	
Projected Capital Savings	$14,928,906	81% Savings
Projected Operating Savings	$3,307,468	38% Savings
Total 5 Year Savings	$18,236,374	67% Savings
Annual Recurring Savings	72%	by 2nd year
Total 5 Year Savings	67%	
Net Present Value (NPV) @ 6%	$15,061,472	
Payback Period	< 1	Year(s)

CLOUD COMPUTING WITHIN THE SERVER ENVIRONMENT

Cloud computing is an IT infrastructure in which dynamically shared computing resources are accessed as a service over the internet. This new technology replaces the traditional data center model in which organizations both own and manage stand-alone hardware and software systems or outsource the data center to service providers who deliver IT services using this same model.

For the server environment, there are a number of both large and small service providers who have developed the dynamically shared computing resources, referred to a "cloud computing". The most commonly used service today in the data center infrastructure space are for resizable compute capacity that is designed to make web-scale computing easier for developers. This service allows a customer to obtain and configure capacity with minimal effort.

The ability to leverage a development environment for a short period of time without significant capital investments is attractive to not only well established application development groups, but those who have to meet the rapid demands of application development and/or change due to pressing user requirement changes.

CLOUD COMPUTING PRICING WITHIN THE SERVER ENVIRONMENT

Most cloud-based services use a pay-as-you-go pricing model, charging your business based on usage. There is usually a one-time entry payment that accompanies the pay-as-you-go pricing model. Since using this type of service is an ongoing operating expense, over the long term the business may spend more on the cloud-based service than the outright purchase and support of the software or hardware.

For comparative purposes, TPI priced one month of a typical medium sized server environment of cloud computing service from a large cloud computing service provider. The monthly service fee quoted for the medium sized environment would be $1,662 per month. Comparing this to the State of Vermont's fully burdened cost for a standard server, which is $605 per month, shows that cloud computing is significantly more expensive option to utilize.

CLOUD COMPUTING RECOMMENDATION WITHIN THE SERVER ENVIRONMENT

For longer term server requirements, TPI's recommendation is that cloud computing does not look attractive as an alternative at this time. The State should continue to watch this area as pricing will change as the products on the market become more mature.

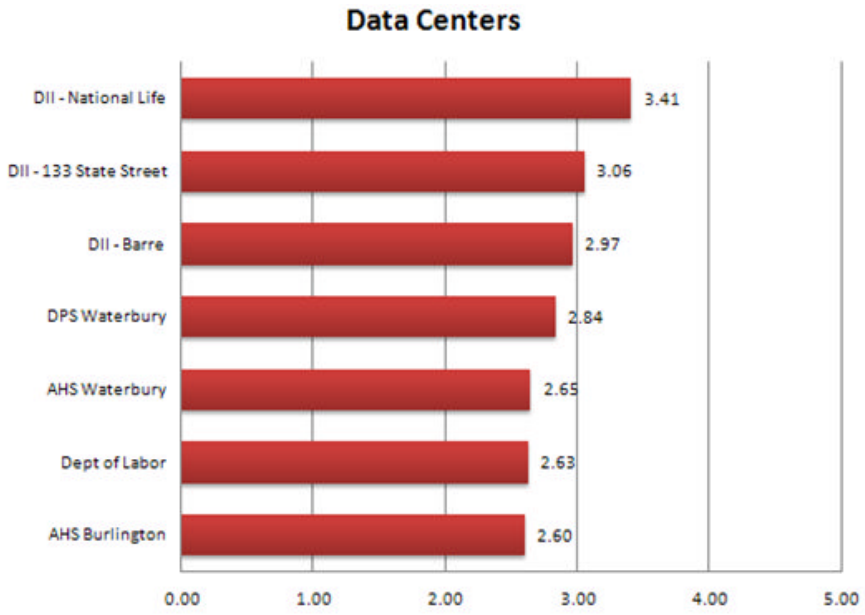
For very short term server requirements such as the need for a development server it may be attractive to utilize cloud particular when development is needed quickly. In such cases, the State would need to make a decision based upon the realistic timeframes required to complete the application development work. When the time frames are stringent and short, the use of the environment would be effective. When the time frames are longer and enter the realm of long term support models, the cloud computing environment is most likely not cost efficient.

DATA CENTERS

The assessment reviewed 7 (seven) of the State's data center locations. The capabilities of these data centers were ranked based on a 1 to 4 tier scale (4 being the best) with the following results:

- DII National Life – Tier 3
- DII 133 State Street – Tier 2
- DII Barre – Tier 2
- DPS Waterbury – Tier 2
- Dept of Labor – Tier 2
- AHS Waterbury – Tier 2
- AHS Burlington – Tier 2

In addition, for each data center location TPI assessed a number of additional operational elements on a 1 to 5 scale (5 being the best). The below graph shows the resulting score for each of the data centers:



DATA CENTER RECOMMENDATIONS

In order to more adequately protect State of Vermont data and ensure that the underlying infrastructure and communication equipment is housed and maintained in a facility that provides the appropriate security and capability, TPI would recommend migrating to two data center facilities. The suggest recommendation is to utilize the National Life facility as the primary site and the Barre facility as the backup data center.

Depending upon the plans adopted by the State for server consolidation/virtualization, a plan that incorporates this migration could be developed that would minimize the risk associated with physical movement of infrastructure. In order words, instead of performing consolidation/virtualization at an existing non-primary data center and then migrating to the National Life facility, the consolidation/virtualization should be done once at the primary data center. This would eliminate the second physical move of equipment and reduce the associated risk and cost of migration.

An analysis was conducted to determine whether or not the National Life data center has the required amount of floor space/square footage to accommodate the migration of the current agency data centers to the recommended 'Primary data center'. The National Life data center currently uses approximately 1,000 square foot of space, and can be expanded another 1,400 square feet for a total of 2,400 square feet. The current floor space requirements, assuming a certain percentage of actual floor space being used versus the amount available totaled 2,610 square feet. Therefore, there is not enough space for the current numbers of servers being hosted among the agency data centers. However, if the recommended virtualization and consolidation efforts are conducted and completed, the square foot projections are 1,431, and well within the square footage amounts available at the National Life data center.

Moving all of the State's data center infrastructure to two locations that would provide the necessary underlying infrastructure that would protect the State's data and investment would actually increase the State's costs for data center space by $290K to $350K per year depending on the amount of space that would be required after consolidation and virtualization projects are completed.

NETWORK

CURRENT STATE

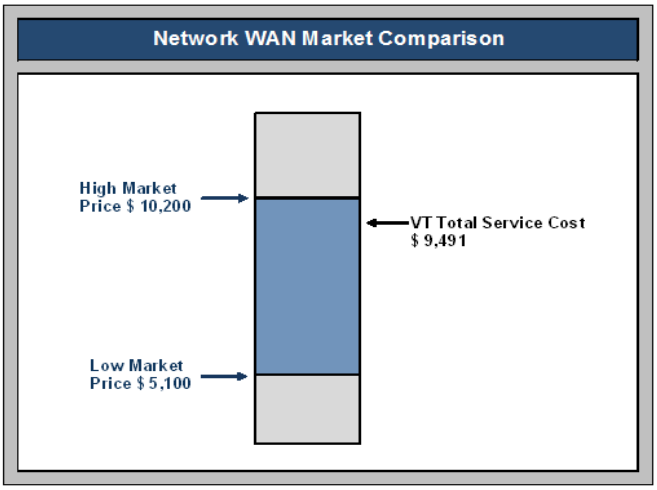
For the most part, all agencies and departments obtain their Wide Area Network (WAN) connectivity through one source, GovNet. The exception to this is the following areas: Public Service, E911, Department of Transportation and Department of Tax. Each of these areas operates their own WAN or portions of their own WAN in combination with the use of GovNet. All areas purchase their circuits from the State contacts.

GovNet is operated and supported by the Department of Information and Innovation (DII). Four (4) DII staff make up the centralized support team.

GovNet provides the wide area network connectivity between agency and department locations across the State.

CURRENT NETWORK COSTS

Managed Network Services: WAN Market Comparison



RECOMMENDATIONS

TPI determined that no major capital projects were required within the network areas.

The following network devices have reached or are very close to end of life and require replacement:

- Hubs – Transportation
- Switches - Defender General and Transportation

- Routers – Public Safety, Defender General, and Transportation
- Firewalls – Transportation, DII verbally reported that they had two firewalls past end of life support

The State should make provisions to update these devices as they will soon reach end of life support periods from the original manufacturing company. In addition, maintenance costs are higher for this older equipment and in some cases not supportable.

Operational recommendations:

DII should make the following improvements to their operational services:

- Establish monthly reporting on meeting the published network uptime goal of 99.99%
- Enhance their network capacity planning by include:
  - Regular reporting on peak traffic for all circuits
  - Establish capacity management policies and guidelines
- Administratively manage all telecom related circuits used in the state and put in place the following:
  - Establish a circuit database that contains all circuits and related costs so that a complete "picture" of all circuits is maintained. This database should have the ability to track service level credits that the newer telecom contracts have established
  - Use the circuit database to ensure that each month's telecom bills are accurate and that the state is not charged for circuits that do not exist or that disconnects have been issued in previous months. Ensure that service credits are issues in the case of non-performance by the carriers.
  - Conduct a yearly audit of the circuit database as compared to the real installed network.
- Establish a governance body to oversee the strategic direction of the network resources across the state. The members of this governance board should consist of business leaders as opposed to technical leaders from the state agencies and departments. The mission of this board should be to provide oversight and in particular strategic direction for GovNet.

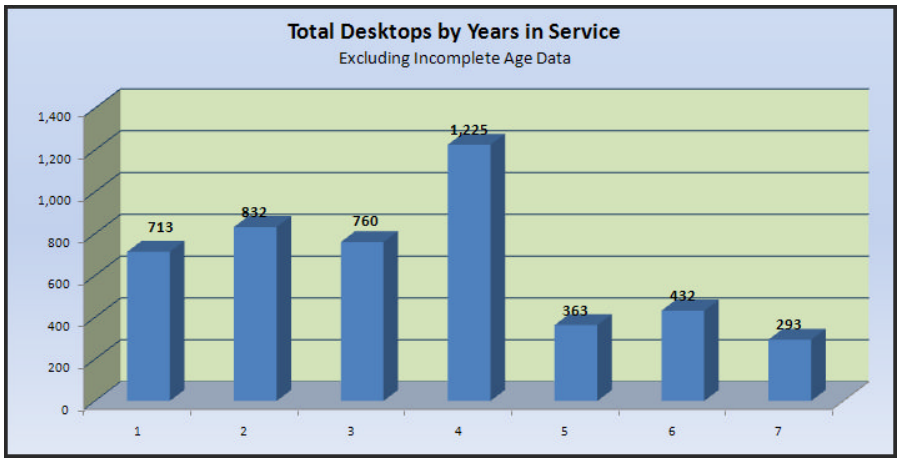
DESKTOP

CURRENT STATE

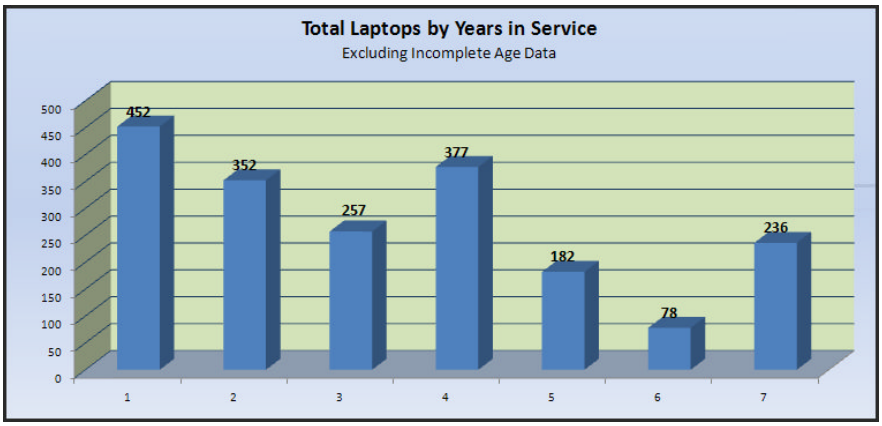
The State of Vermont has a large amount of End User Computing (EUC) devices, 13,000+. The largest numbers of these devices are desktops and laptops with over 8,000. Additionally, support is provided for local printers, network printers, PDAs (Personal Digital Assistants), thin client devices, and a variety of other peripheral devices. The following chart shows a summary of the devices recognized from the collection templates.

AGE OF DESKTOPS AND LAPTOPS

For those desktops where the age was available, 50% are 4 years or older with an average age of 3.5 years



For those laptops where the age was available, 45% are 4 years or older with an average age of 3.4 years

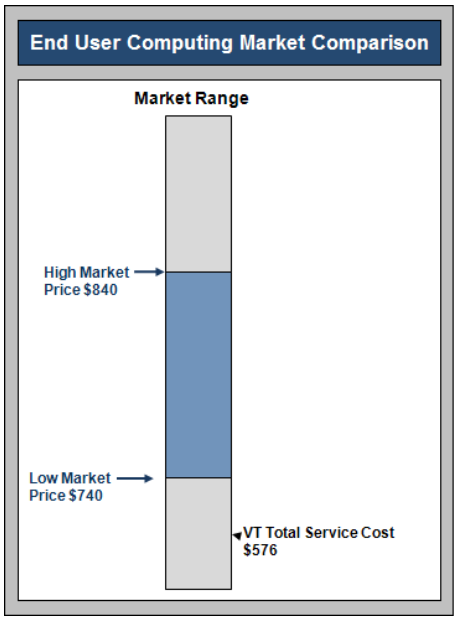


CURRENT DESKTOP AND LAPTOP COSTS

The average desktop and laptop support costs are below the typical market range.

Average age of the State's desktops and laptops (approx. 3.5 years) is greater than the market average of 1.5 to 2 years.

State's ratio of 70% desktops/30% laptops is higher than the market range of 50 - 60% desktops to 40 - 50% laptops. This contributes to a lower support cost.



DESKTOP AND LAPTOP RECOMMENDATIONS

The State of Vermont's annual average PC support cost is $576 which is well below the market range of $740 to $810. Because the state is much lower than the average PC support costs, it is very difficult to make any business case justifications for service and support improvements. It is suspected that PC support areas are understaffed and it was observed that very few service levels were reported on or measured. However, improvements in the PC support area would increase operational costs, but would also increase productivity and potentially improve satisfaction to end users and citizens of the State.

CLOUD COMPUTING WITHIN THE DESKTOP ENVIRONMENT

The use of cloud computing as part of the State's desktop environment may be an attractive solution considering that some of the larger cloud computing service providers offers their cloud e-mail and desktop solutions for approximately $50.00 per user per year. Considering that the mark to market range for an internally provided E-mail solution ranges from $70 to $190 per user per year, and with the State's average cost of $126 per user per year for utility computing (which includes E-mail and file/print servers) there is a potential for additional savings in the desktop area. A cloud computing solution would not work for all employees in the State and because the cloud service offerings are relatively new on the market it is recommended that the State proceed with caution in this area.

In order to understand the features and capabilities that exist in cloud computing, particularly within the desktop environment, TPI recommends that two pilots be undertaken to more fully inspect and analyze the advantages/benefits as well as the drawbacks that may come through the use of cloud computing.

The first pilot should be a larger agency, perhaps one that has a separate E-mail domain that could test the features of E-mail services and provide some analysis of reliability, assurance, innovation, technology, responsiveness, flexibility, and accessibility.

The second pilot should be a smaller agency that has a variety of support characteristics, i.e. central support and remote support that also could test the features of E-mail services and provide some analysis of reliability, assurance, innovation, technology, responsiveness, flexibility, and accessibility.

MAINFRAME

CURRENT STATE

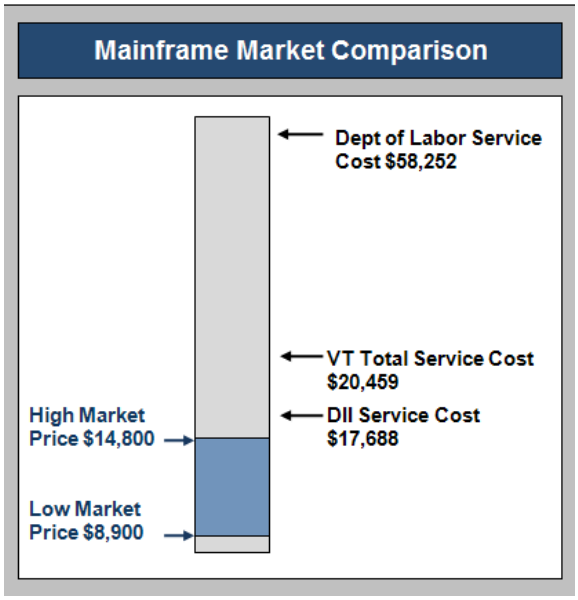
The State currently has 2 (two) mainframe environments in operations. One is operated by DII and the other by the Department of Labor.

The DII operated mainframe environment provides support to most agencies and more than 40 applications. The Agency of Human Services is the largest user of the DII operated mainframe, driving 75% of the usage.

The Department of Labor is the exclusive user of the Department of Labor mainframe environment.

CURRENT MAINFRAME SUPPORT COSTS

The State's average cost to maintain and support two mainframe environments is significantly above the typical market range.



MAINFRAME RECOMMENDATIONS

Three alternatives were reviewed to improve the cost structure of the existing mainframe environments:

1) Optimize the current DII mainframe environment

   Optimization projects typically result in a 5% to 10% annual savings. With the current DII mainframe operating budget of approximately $2,650,000 the potential resulting savings could be $132,500 to $265,000

2) Merge Department of Labor's mainframe environment onto DII's mainframe environment

This alternative requires an initial investment of $60,000 and could potentially result in approximately $458,000 per year in cost savings

3) Source the mainframe environment - Issue RFP for competitive bid

   This option required an initial investment of $580,000 and could potentially result in approximately $1,600,000 per year in cost savings

Of the three alternatives, alternative 3, sourcing the mainframe environment, provides the greatest return on investments and therefore is the recommended approach.

TPI'S APPROACH TO DATA COLLECTION

TPI used a number of approaches to collect and validate the "current state" data including:

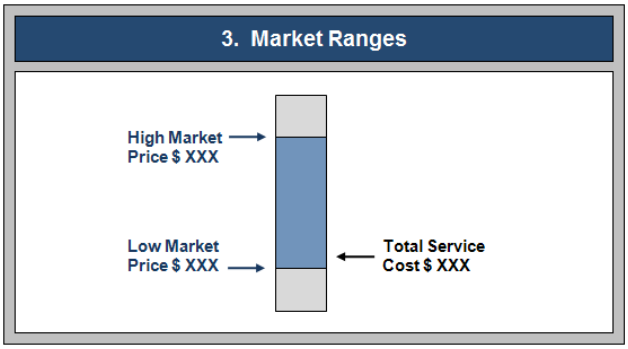
- Conducting 44 one on one business, technical or a combination of business and technical interviews with a cross sectional sampling of the in-scope agencies and departments
- Tours and inspection of 7 data center locations
- All in-scope agencies and departments attended data collection training and completed two rounds of data collection which consisted of completing the following data collection files
    - Financial detail on costs for FY09
    - Service levels
    - Server complexity profiles
    - Information Technology Infrastructure Library (ITIL) assessment survey
    - IT infrastructure asset details for servers, network, desktops, and mainframe
    - Application profiles
- A data validation step which consisted of TPI reviewing and summarizing the data collection files and then providing them back to each of the agencies and departments for verification that the data was interpreted and summarized correctly by TPI
- An initial findings review meeting of the "current state" was conducted with the project committees. The purpose of this review was to present the preliminary "current state" finding and obtain feedback from the committee members on any data that seemed incorrect

GENERAL COMMENT REGARDING TPI'S MARK TO MARKET COMPARISONS

TPI's Mark-to-Market (M2M) analysis provides a detailed comparison of the State's IT operating costs compared to marketplace alternatives. With this qualitative and quantitative data in hand, the State can determine how their cost of operations compares to what is readily available in the market place.

The results of the Mark-to Market (M2M) analysis will map, for each functional area (mainframe, servers, network, and desktop) the State's current operation cost against a high and low cost range for equivalent services on the market. An example of the results chart is shown here:

Example



The State should understand that the outsourcing market itself, and market pricing, is non linear. Although the range shown encompasses a set of reference data points, it is not necessarily true that any individual point, low or high, will be consistently bid or obtainable in the future.

There are many different factors that go into service provider pricing. These include things such as service requirement, contract size, attractiveness of deal, 'fit', proposed contract terms, etc. Considering this, there is no guarantee of individual price points – only general trending

REFERENCE MARKET DATA USED IN THE STATE OF VERMONT M2M ANALYSIS

Each functional area was compared to actual transactions consummated within the past 0 – 18 months, ranging between 3 and 6 clients of similar scale and scope. Due to confidentiality agreements, TPI cannot release the actual client names that were included in the market reference data.

Transactions used were with Tier 1 and Tier 2 service providers and U.S. based.

Data used for comparisons excludes the following items as part of normalization:

- Depreciation for hardware in application servers and End User Computing
- Application software
- Carrier charges for network

TOPICS THAT CROSS ALL FUNCTIONAL AREAS

Two of the areas that TPI reviewed as part of the assessment span across all of the functional IT areas (network, mainframe, desktop, servers and data center) and therefore have been placed at the beginning of the report before the individual functional areas are discussed. These two areas are:

1) The review of cross functional processes and procedures against best practices and;

2) The summary feedback from the technical and business interviews that were conducted with a cross section of the agencies and departments

This section of the document provides the result for these two cross functional areas.

1. CROSS FUNCTIONAL REVIEW OF PROCESSES AND PROCEDURES

Today, as every organization tries to deliver value from IT while managing an increasingly complex range of IT-related risks, the effective use of best practices can help avoid re-inventing wheels, optimize the use of scarce IT resources and reduce the occurrence of major IT risks, such as:

- Project failures
- Wasted investments
- Security breaches
- System crashes
- Failures by service providers to understand and meet customer requirements

IT best practices are important because:

- Management of IT is critical to the success of the State enterprise strategy
- They help enable effective governance of IT activities
- They provide many benefits, including efficiency gains, less reliance on experts, fewer errors, and increased trust from the business side of the organization
- Best practices help meet regulatory requirements for IT controls in areas such as privacy and financial reporting
- Best practices help organizations assess how they are performing against generally accepted standards and against their peers

To determine the maturity of the respective IT teams across the State of Vermont, TPI used a self assessment survey based on the best practices identified within the globally accepted Information Technology Information Library or “ITIL” as it is commonly referenced. ITIL is a set of concepts and practices for managing Information Technology (IT) services, IT development and IT operations.

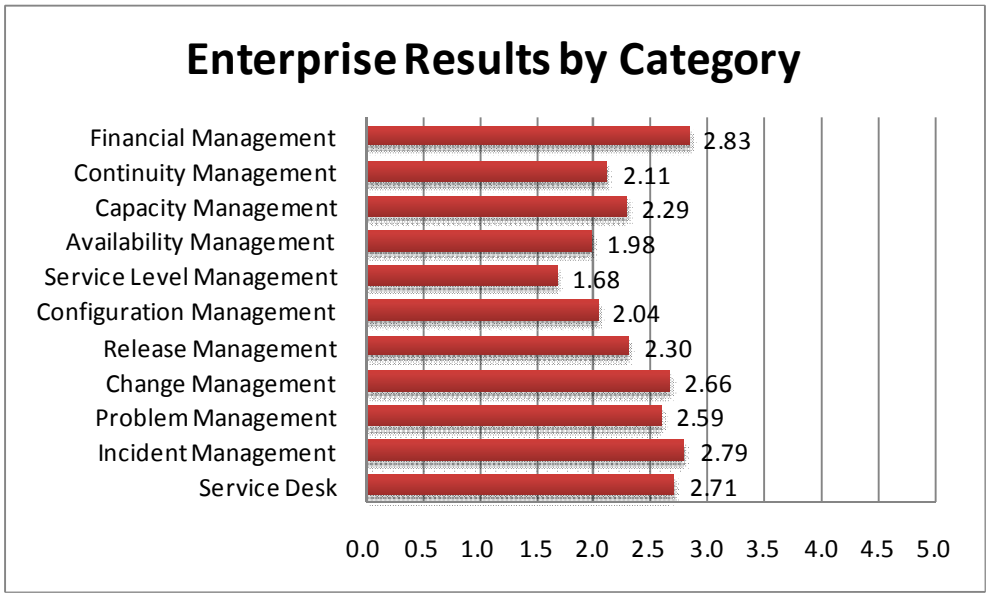
The results of the survey show the maturity level rating for each process capability area as defined within the ITIL best practice. These process capability areas cross all functional areas (functional areas being - network, servers, mainframe, desktop and help desk). Examples of the capability areas are: problem management, change management, release management, and so on.

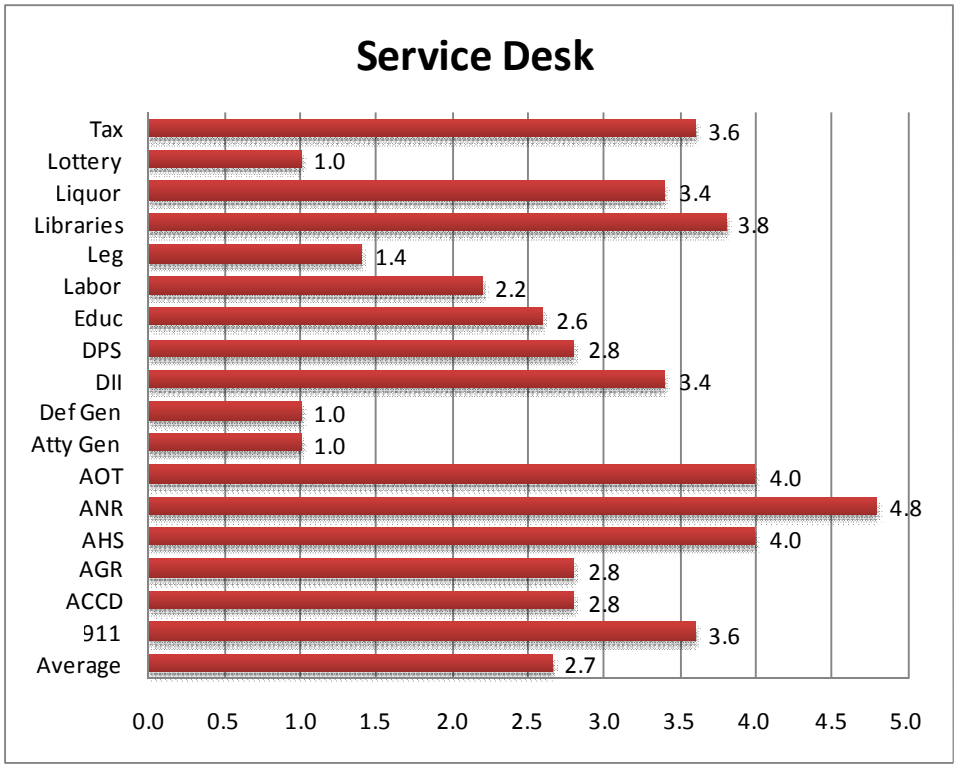
As previously mentioned the data was gathered from the agencies and departments through the use of a self assessment surveys and were validated during the many interview sessions. The survey template was released at the same time as all other data gathering templates.

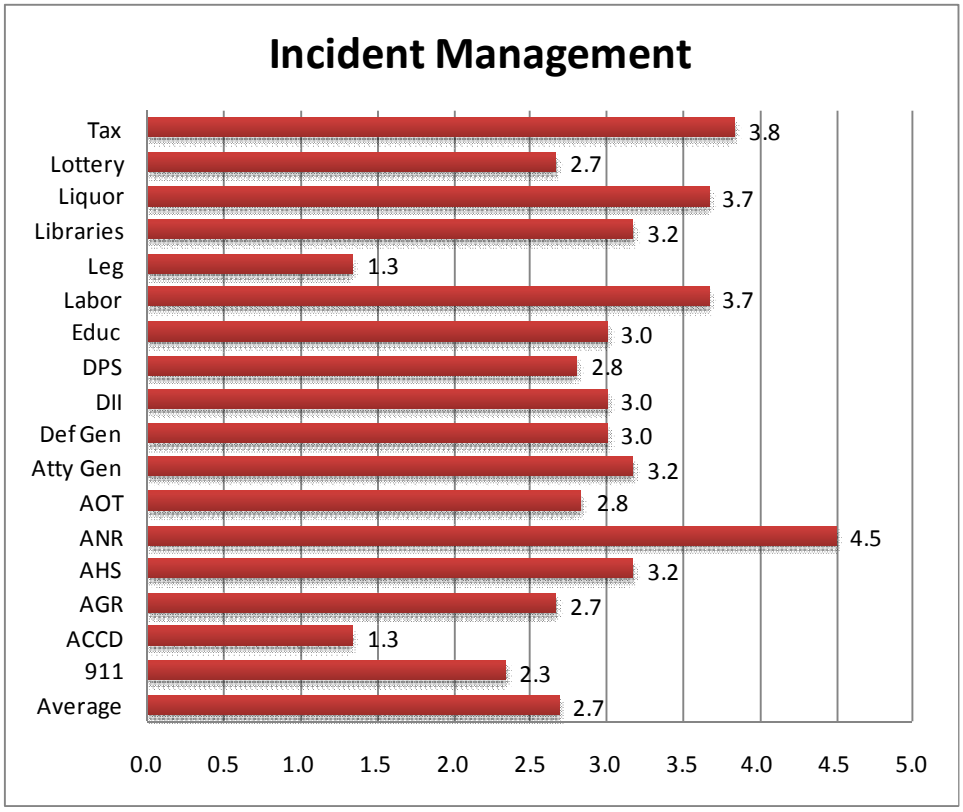
The results of the survey provide valuable information about the maturity of the process used in support of the functional areas. These results are compared to what is considered fully mature and ideal process performance in the marketplace. Even though there is variability in the marketplace in what constitutes maturity and ideal processes, an achievable and reasonable target for the State of Vermont and its respective agencies should be in the 3 to 4 range on the ITIL rating scale of 1 to 5. Efforts should be directed to improve in those areas that are below the 3 to 4 range of maturity.

The graph below shows the overall enterprise results for each process category assessed. The enterprise results were derived by averaging the process category scores from all of the individual surveys.

Following the enterprise results are eleven (11) process category graphs that show the scores that each agency/department provided within their self assessment survey.




Service Desk
Tax 3.6
Lottery 1.0
Liquor 3.4
Libraries 3.8
Leg 1.4
Labor 2.2
Educ 2.6
DPS 2.8
DII 3.4
Def Gen 1.0
Atty Gen 1.0
AOT 4.0
ANR 4.8
AHS 4.0
AGR 2.8
ACCD 2.8
911 3.6
Average 2.7
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0


Incident Management
Tax 3.8
Lottery 2.7
Liquor 3.7
Libraries 3.2
Leg 1.3
Labor 3.7
Educ 3.0
DPS 2.8
DII 3.0
Def Gen 3.0
Atty Gen 3.2
AOT 2.8
ANR 4.5
AHS 3.2
AGR 2.7
ACCD 1.3
911 2.3
Average 2.7
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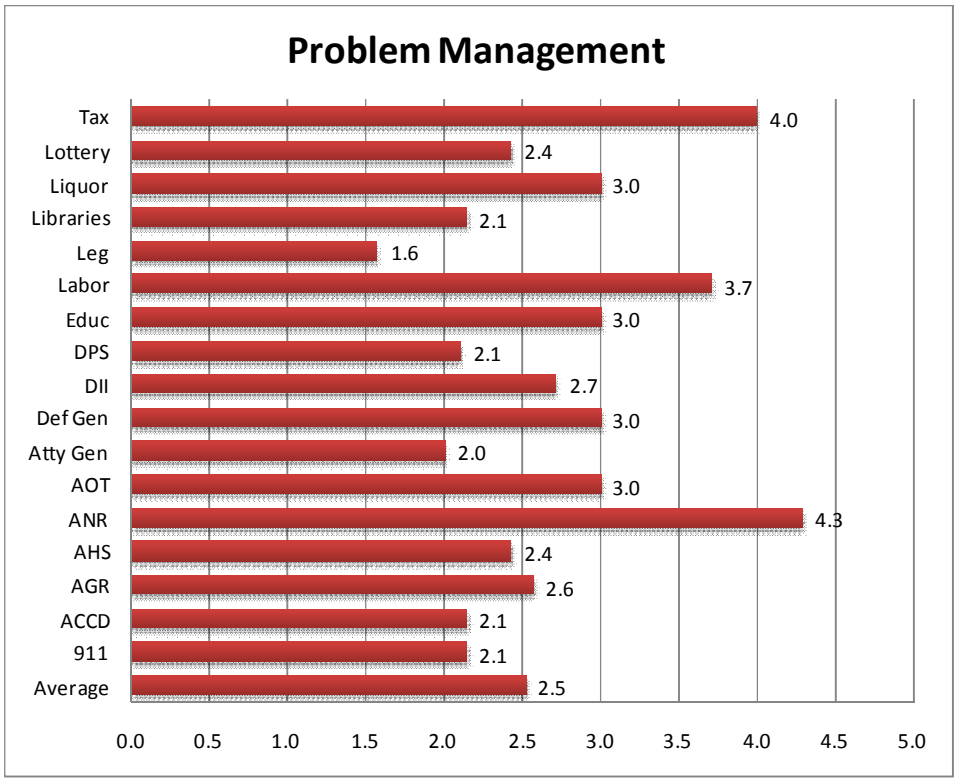
Problem Management
Tax 4.0
Lottery 2.4
Liquor 3.0
Libraries 2.1
Leg 1.6
Labor 3.7
Educ 3.0
DPS 2.1
DII 2.7
Def Gen 3.0
Atty Gen 2.0
AOT 3.0
ANR 4.3
AHS 2.4
AGR 2.6
ACCD 2.1
911 2.1
Average 2.5
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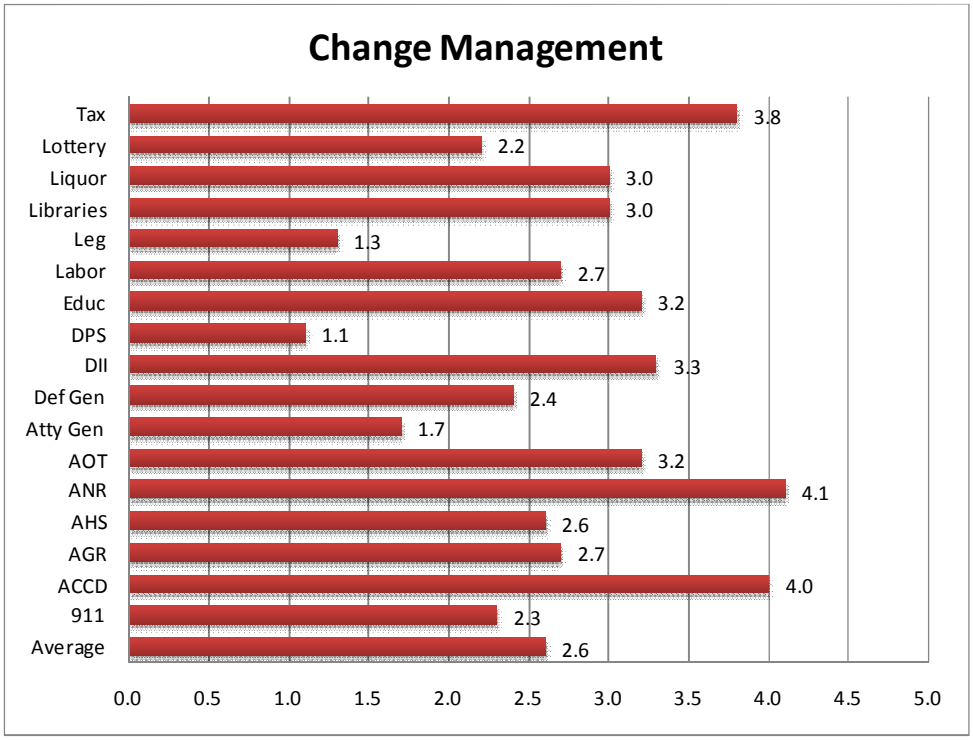
Change Management
Tax 3.8
Lottery 2.2
Liquor 3.0
Libraries 3.0
Leg 1.3
Labor 2.7
Educ 3.2
DPS 1.1
DII 3.3
Def Gen 2.4
Atty Gen 1.7
AOT 3.2
ANR 4.1
AHS 2.6
AGR 2.7
ACCD 4.0
911 2.3
Average 2.6
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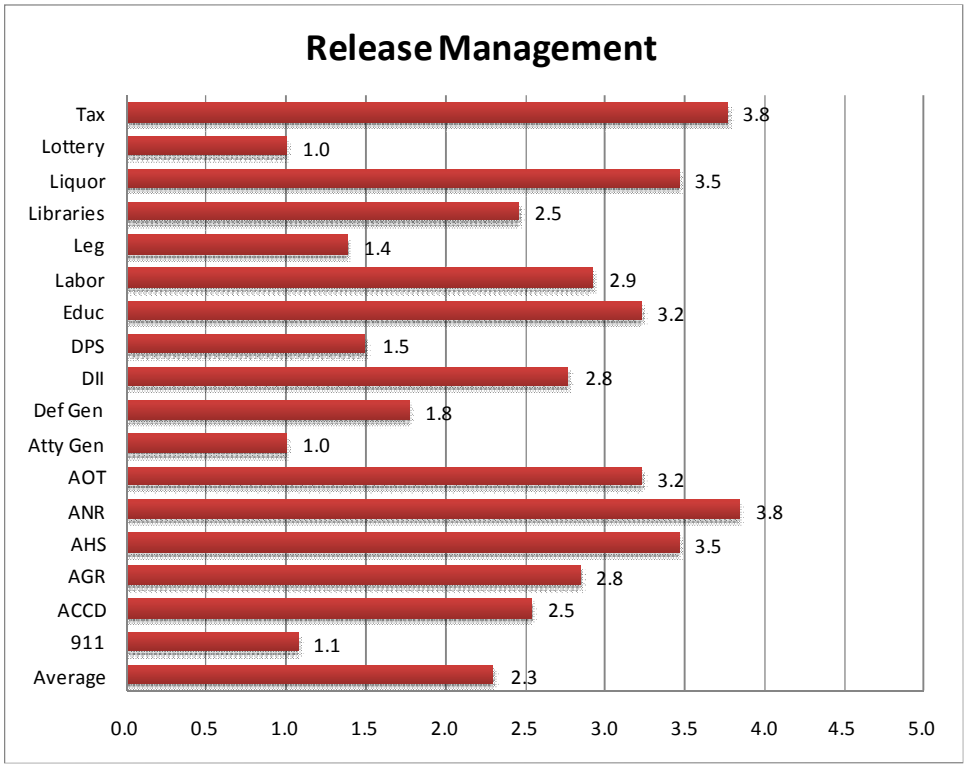
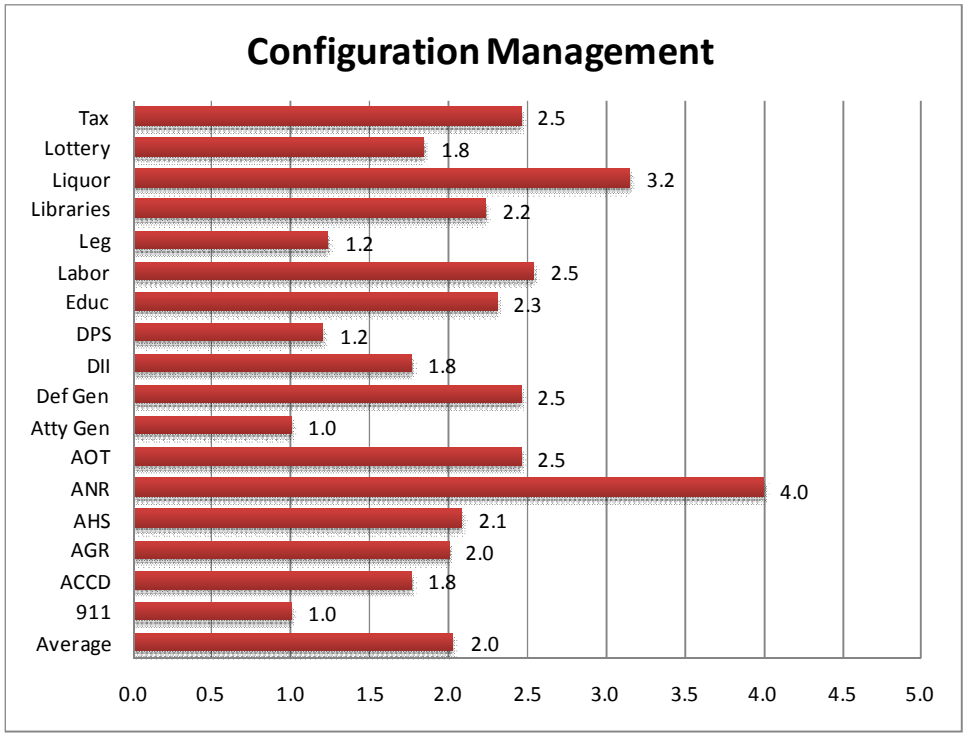
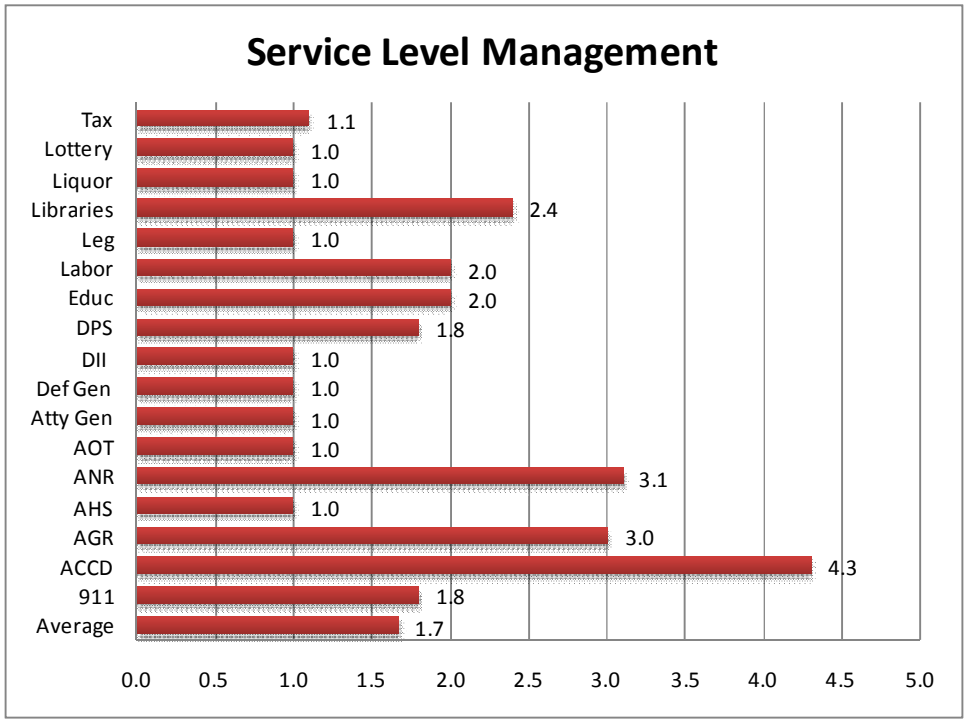
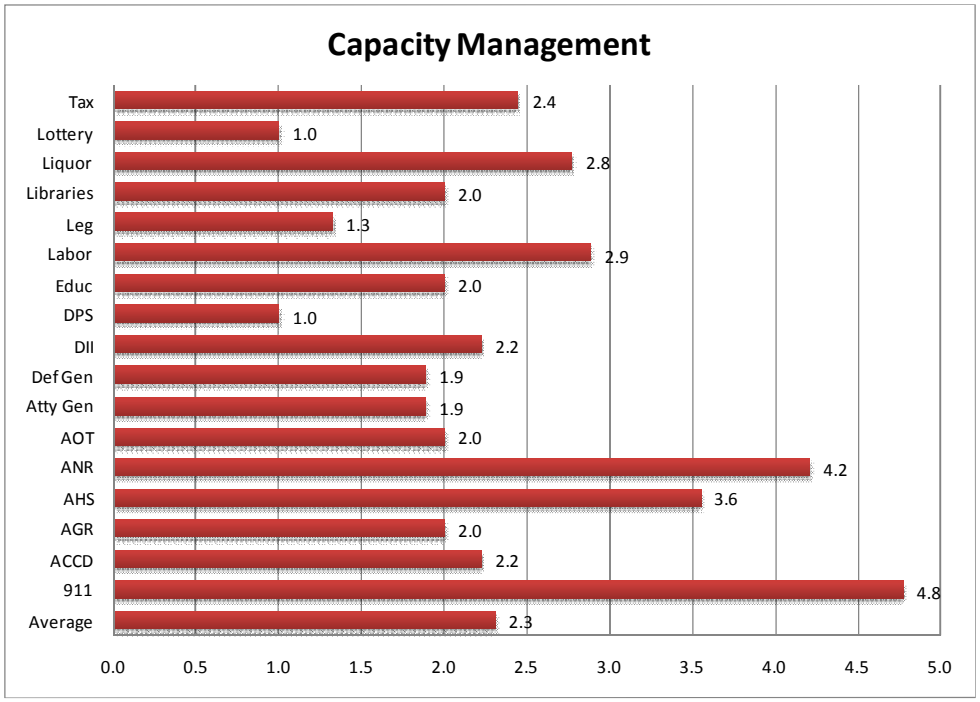
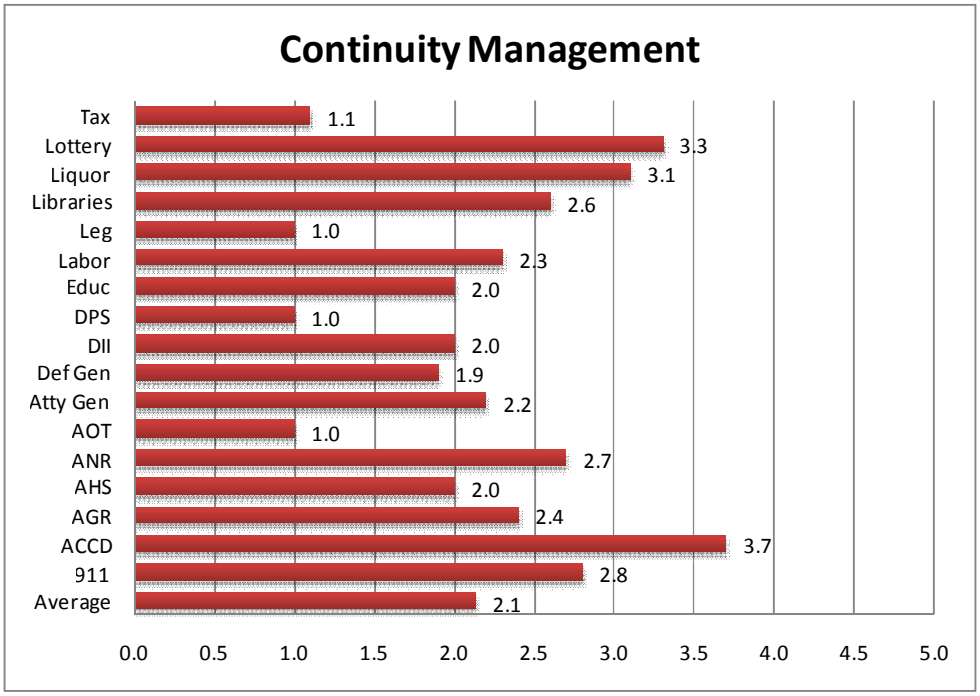

Release Management
Tax 3.8
Lottery 1.0
Liquor 3.5
Libraries 2.5
Leg 1.4
Labor 2.9
Educ 3.2
DPS 1.5
DII 2.8
Def Gen 1.8
Atty Gen 1.0
AOT 3.2
ANR 3.8
AHS 3.5
AGR 2.8
ACCD 2.5
911 1.1
Average 2.3
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

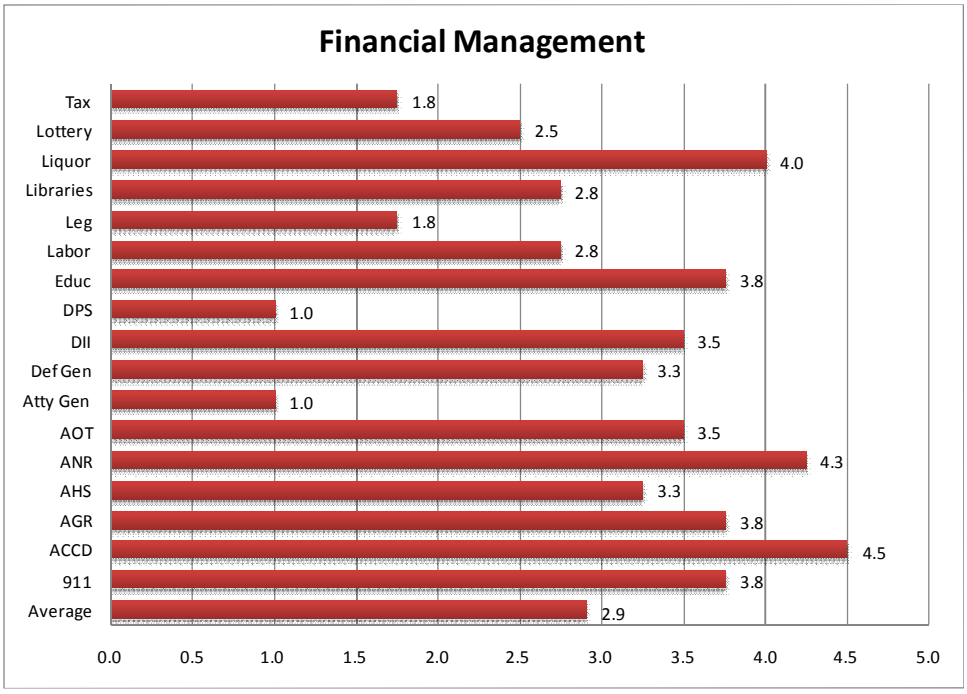

Configuration Management
Tax 2.5
Lottery 1.8
Liquor 3.2
Libraries 2.2
Leg 1.2
Labor 2.5
Educ 2.3
DPS 1.2
DII 1.8
Def Gen 2.5
Atty Gen 1.0
AOT 2.5
ANR 4.0
AHS 2.1
AGR 2.0
ACCD 1.8
911 1.0
Average 2.0
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0


Service Level Management
Tax 1.1
Lottery 1.0
Liquor 1.0
Libraries 2.4
Leg 1.0
Labor 2.0
Educ 2.0
DPS 1.8
DII 1.0
Def Gen 1.0
Atty Gen 1.0
AOT 1.0
ANR 3.1
AHS 1.0
AGR 3.0
ACCD 4.3
911 1.8
Average 1.7
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

Availability Management
Tax 2.4
Lottery 1.0
Liquor 1.0
Libraries 2.3
Leg 1.1
Labor 2.6
Educ 2.4
DPS 1.0
DII 1.0
Def Gen 1.0
Atty Gen 2.0
AOT 2.0
ANR 4.6
AHS 2.8
AGR 2.4
ACCD 2.8
911 2.9
Average 2.0
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0


Capacity Management
Tax 2.4
Lottery 1.0
Liquor 2.8
Libraries 2.0
Leg 1.3
Labor 2.9
Educ 2.0
DPS 1.0
DII 2.2
Def Gen 1.9
Atty Gen 1.9
AOT 2.0
ANR 4.2
AHS 3.6
AGR 2.0
ACCD 2.2
911 4.8
Average 2.3
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0


Continuity Management
Tax 1.1
Lottery 3.3
Liquor 3.1
Libraries 2.6
Leg 1.0
Labor 2.3
Educ 2.0
DPS 1.0
DII 2.0
Def Gen 1.9
Atty Gen 2.2
AOT 1.0
ANR 2.7
AHS 2.0
AGR 2.4
ACCD 3.7
911 2.8
Average 2.1
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0


Financial Management
Tax
Lottery
Liquor
Libraries
Leg
Labor
Educ
DPS
DII
Def Gen
Atty Gen
AOT
ANR
AHS
AGR
ACCD
911
Average
1.8
2.5
4.0
2.8
1.8
2.8
3.8
1.0
3.5
3.3
1.0
3.5
4.3
3.3
3.8
4.5
3.8
2.9
0.0
0.5
1.0
1.5
2.0
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3.0
3.5
4.0
4.5
5.0

2. INTERVIEW SUMMARY FEEDBACK

Interviews were conducted with a number of business and technical representatives from the in-scope agencies. These interviews allowed TPI to gather qualitative data regarding the delivery of services from the respective IT organizations. TPI also collected quantitative information to understand if certain activities and/or processes are performed (i.e. do you have contract employees on your staff; does your organization conduct a customer satisfaction survey). These interviews were conducted with a technical representative or a business representative separate from each interview; however, in some cases a business and technical representative were present in a single interview session.

Some of the quantitative information collected is:

- 31% of those agencies interviewed have contract employees
- 13% of those agencies reviewed have Service Levels in place, measure them, and report on them on a regular basis
- 6% of those agencies interviewed conduct a customer satisfaction survey
- 73% of those agencies interviewed have business continuity plans
- 96% of the respondents say their internet and/or application response time is satisfactory
- 100% of those agencies state their issues are resolved on the first call to the help desk/service desk
- 96% believe their IT issues are handled in a timely manner
- 38% of those agencies state there is a strategic plan for their organization

The interview information was summarized in a spreadsheet format, with quantitative information and agency comments represented. The following are extracts from these interviews:

- Would like to have more staff – resource constraints
- Service Level to users could be better but resources are stretched to their limits
- Process is very slow, reflection of staffing in central office. Review time takes too long, not enough people. Limited amount of resources
- Very good service, excellent
- Sometimes the network is slow (not every day)
- Biggest complaint is “E-mail is down”
- Some applications won’t talk to other applications

- IT is understaffed and can't keep up with demand of the 2,000 users
- Need to redesign network, look at the way servers are approached
- Have some money but no staff
- The shift has been to use more remote access and we have four different VPN clients and it's not standardized. This is difficult to manage
- DII has been really responsive (software, hardware, etc.)
- Communication is the biggest issue (needs to improve)
- We need to comprehensively be able to plan for business needs, equipment needs
- When we have issues on policies or direction we need a meaningful way to get input from users
- Things aren't driven by business needs, there is no mitigation strategy – this appears to be related to a communications issue
- We have many old in-house, legacy systems. We relying on in-house development – we want to move away from this approach
- Need one-time investment to eliminate the burden of maintaining/developing in-house systems
- Timeliness has changed – for the worse
- No complaints of DII services

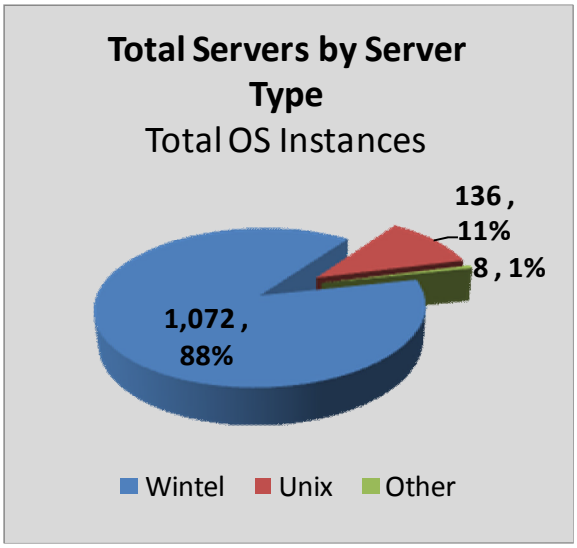
PHASE 1 – INFRASTRUCTURE AND DATA CENTER – CURRENT STATE

Phase 1 scope includes the review of the State's data center infrastructure and servers.

1. SERVER AND APPLICATION INVENTORY

The State's server inventory consists of both Microsoft Windows (Wintel) and UNIX based systems with a few other miscellaneous operating systems (such as OpenVMS) – see below table for specific counts of each and the graph for percentage mix.

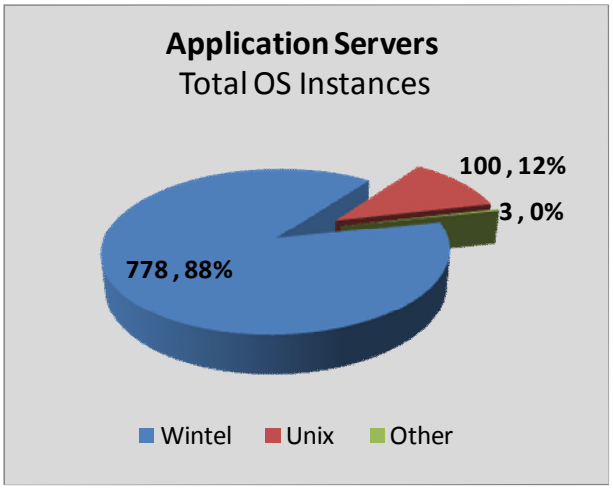
Servers by Type - Physical & Virtual				
Server Type	*Wintel*	*Unix*	*Other*	*Total*
Application	778	100	3	881
Utility	287	23	5	315
Other	7	13	0	20
Total	1,072	136	8	1,216

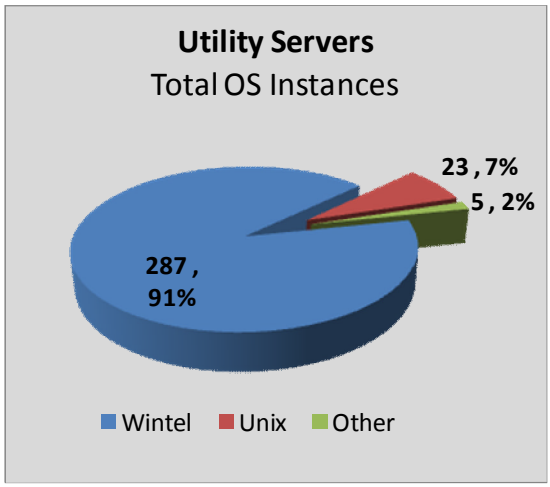


These servers are also divided up into two main functions:

1. Application servers - Servers used to support business applications

2. Utility servers - Servers used to support back office services such as E-mail, file servers, active directory, etc.





The next table shows the number of servers each agency/department supports:

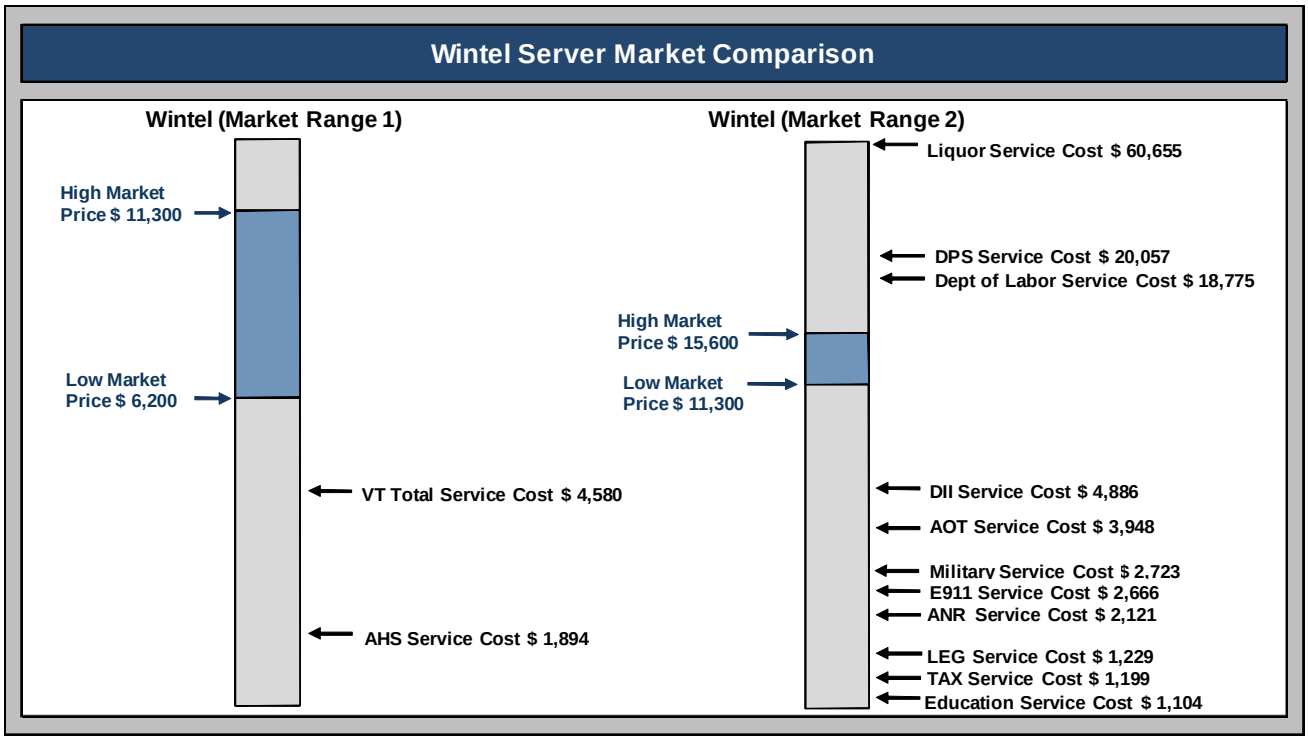
Total Servers by Function and Type - Physical and Virtual

Server Function:	Application				Utility				Other				Total				
Agency / Server Type	Wintel	UNIX	Other	App Servers	Wintel	UNIX	Other	Utility Servers	Wintel	UNIX	Other	Other Servers	Wintel	UNIX	Other	Total Servers	% of Total
Agency of Admin (Exc. Tax)	260	43	0	**303**	32	4	0	**36**	0	0	0	**0**	292	47	0	**339**	**28%**
Agriculture	0	1	0	**1**	0	0	0	**0**	0	0	0	**0**	0	1	0	**1**	**0%**
ACCD	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0%**
AHS	221	5	1	**227**	57	0	0	**57**	1	0	0	**1**	279	5	1	**285**	**23%**
ANR	22	0	1	**23**	8	0	0	**8**	0	0	0	**0**	30	0	1	**31**	**3%**
Transportation	103	0	0	**103**	94	2	0	**96**	4	12	0	**16**	201	14	0	**215**	**18%**
Attorney General	0	3	0	**3**	4	0	0	**4**	0	0	0	**0**	4	3	0	**7**	**1%**
Auditors Office	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0%**
BISHCA	9	0	0	**9**	3	0	0	**3**	0	0	0	**0**	12	0	0	**12**	**1%**
Defender General	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0%**
Dept. of Labor	26	3	0	**29**	31	9	0	**40**	0	0	0	**0**	57	12	0	**69**	**6%**
Public Safety	25	16	1	**42**	26	5	5	**36**	2	0	0	**2**	53	21	6	**80**	**7%**
Dept. of Taxes	25	28	0	**53**	12	2	0	**14**	0	1	0	**1**	37	31	0	**68**	**6%**
Enhanced 911	21	0	0	**21**	6	0	0	**6**	0	0	0	**0**	27	0	0	**27**	**2%**
Education	34	0	0	**34**	0	0	0	**0**	0	0	0	**0**	34	0	0	**34**	**3%**
Legislature	23	0	0	**23**	2	0	0	**2**	0	0	0	**0**	25	0	0	**25**	**2%**
Liquor Control	3	1	0	**4**	4	1	0	**5**	0	0	0	**0**	7	2	0	**9**	**1%**
Lottery Comm.	1	0	0	**1**	2	0	0	**2**	0	0	0	**0**	3	0	0	**3**	**0%**
Military Dept.	5	0	0	**5**	6	0	0	**6**	0	0	0	**0**	11	0	0	**11**	**1%**
Natural Resources	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0%**
Public Services	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0%**
State's Attorneys	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0%**
Total OS Instances	**778**	**100**	**3**	**881**	**287**	**23**	**5**	**315**	**7**	**13**	**0**	**20**	**1,072**	**136**	**8**	**1,216**	**100%**
% of Function	**88%**	**11%**	**0%**	**100%**	**91%**	**7%**	**2%**	**100%**	**35%**	**65%**	**0%**	**100%**	**88%**	**11%**	**1%**	**100%**	
% of Total				**72%**				**26%**				**2%**				**100%**	

2. SERVER AND APPLICATION BUSINESS IMPACT STATEMENT

One of the methods TPI uses to analyze server information is by comparing the State of Vermont server information to the information gathered by TPI from previous transactions that have been consummated within the last 18 months. These transactions included between 3-6 clients of similar scale and scope. This information provides a comparison of the total service cost for a specific tower (i.e. server tower) against a high and low market price. The following depicts the current state of application servers for the State of Vermont against the current market material:

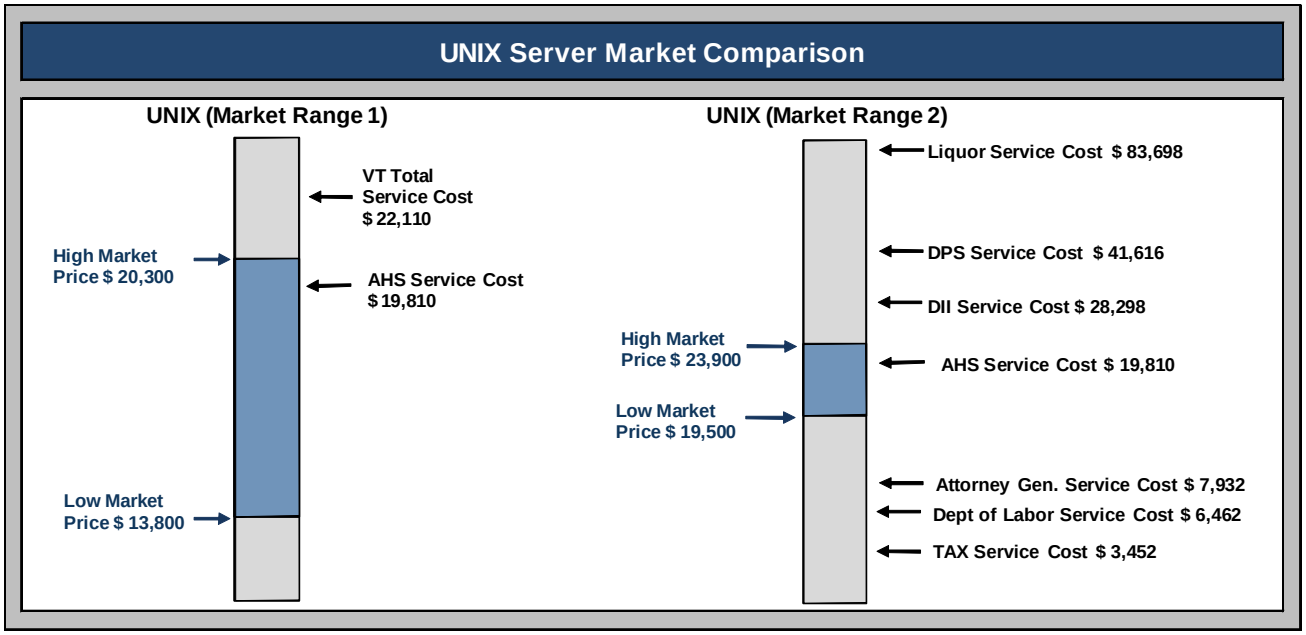
This graph is for total support cost per server/per year for the Wintel (Windows) servers:



Comments related to the above Wintel market comparison:

- The State of Vermont has a greater level of Wintel virtualization deployed then what is typically found on the market. This may partially explain the reason for a lower then market range cost. Additional details regarding the current level of virtualization is presented in the virtualization section of the document
- Almost all agencies/departments are below the market range. Typically agencies/departments that are significantly below the market range are under invested in equipment (old equipment with long or no refresh cycles), have reduced service levels and very "thin" staffing levels
- Currently Vermont supports 32 Wintel servers per full time equivalent (FTE). Market range is from 25 to 30 servers per FTE

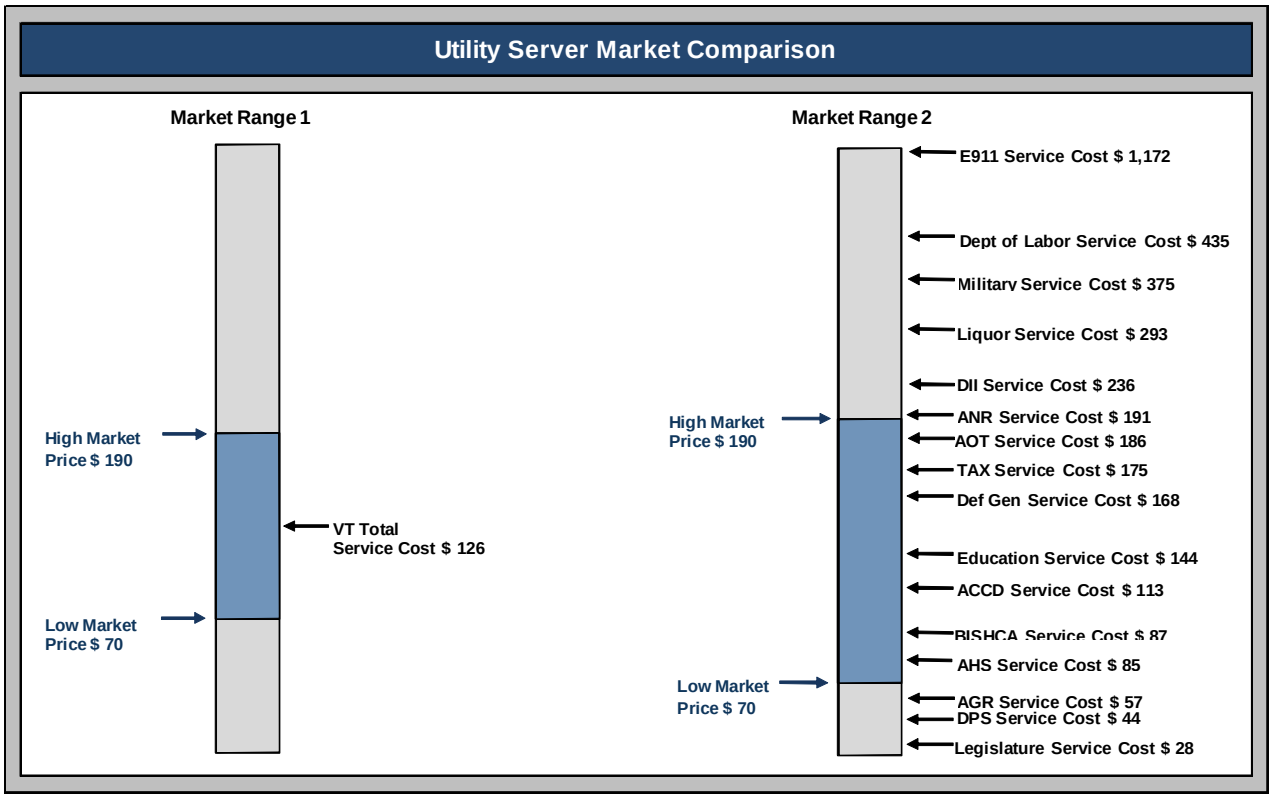
This graph is for the total support cost per server/per year for UNIX servers:



Comments related to the above UNIX market comparison:

- The overall average cost is at the middle of the market range
- Currently Vermont supports 16 UNIX servers per FTE. The market range is 15 to 20 servers per FTE
- The State of Vermont is using limited virtualization for UNIX servers
- Similar to Wintel servers; agencies/departments that are significantly below the market range typically are under invested in equipment (old equipment with long or no refresh cycles), have reduced service levels and very "thin" staffing levels

The following depicts the current state of utility servers for the State of Vermont against the current market material:



Comments related to the above utility server market comparison:

- There is a wide variation in the individual agency costs that could be due to how the cost were allocated to the utility servers
- As with other areas, agencies/departments that are significantly below the market range typically are under invested in equipment (old equipment with long or no refresh cycles), have reduced service levels and very "thin" staffing levels
- The State supports 852 E-mail accounts per full time equivalent (FTE). The market range is between 2,000 to 3,000 E-mail accounts per FTE

TPI also reviews a number of attributes about the server environment that can provide insight into the state of the infrastructure currently in place for the State of Vermont. Analysis of the physical counts of servers versus the virtualized count of servers provides insight into what percent of the total environment has been virtualized.

Total Servers by Function and Type - Virtual

Server Function:	Application				Utility				Other				Total				
Agency / Server Type	Wintel	UNIX	Other	App Servers	Wintel	UNIX	Other	Utility Servers	Wintel	UNIX	Other	Other Servers	Wintel	UNIX	Other	Total Servers	% of Total
Agency of Admin (Exc. Tax)	166	13	0	**179**	0	0	0	**0**	0	0	0	**0**	166	13	0	**179**	**41%**
Agriculture	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0%**
ACCD	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0%**
AHS	175	0	0	**175**	0	0	0	**0**	0	0	0	**0**	175	0	0	**175**	**41%**
ANR	7	0	0	**7**	0	0	0	**0**	0	0	0	**0**	7	0	0	**7**	**2%**
Transportation	8	0	0	**8**	0	1	0	**1**	0	0	0	**0**	8	1	0	**9**	**2%**
Attorney General	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0%**
Auditors Office	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0%**
BISHCA	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0%**
Defender General	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0%**
Dept. of Labor	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0%**
Public Safety	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0%**
Dept. of Taxes	15	25	0	**40**	4	0	0	**4**	0	0	0	**0**	19	25	0	**44**	**10%**
Enhanced 911	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0%**
Education	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0%**
Legislature	18	0	0	**18**	0	0	0	**0**	0	0	0	**0**	18	0	0	**18**	**4%**
Liquor Control	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0%**
Lottery Comm.	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0%**
Military Dept.	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0%**
Natural Resources	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0%**
Public Services	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0%**
State's Attorneys	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0%**
Total OS Instances	**389**	**38**	**0**	**427**	**4**	**1**	**0**	**5**	**0**	**0**	**0**	**0**	**393**	**39**	**0**	**432**	**100%**
% of Function	91%	9%	0%	**100%**	80%	20%	0%	**100%**	0%	0%	0%	**0%**	91%	9%	0%	**100%**	
% of Total				**99%**				**1%**				**0%**				**100%**	

The age of the server inventory provides insight into the relative support costs associated with maintaining older equipment and also the potential capital investment that might be required to refresh older devices.

Total Server Age by Agency and Server Type

Server Vol. & Avg. Age	Physical Servers with Age Provided				Server Avg. Age (Years)				Serves Without Age Provided			
Agency / Server Type	*Application*	*Utility*	*Other*	*Total*	*Application*	*Utility*	*Other*	*Average*	*Wintel*	*UNIX*	*Other*	*Total*
Agency of Admin (Exc. Tax)	118	35	0	**153**	2.7	3.2	0.0	**2.8**	**5**	**2**	**0**	**7**
Agriculture	1	0	0	**1**	5.0	0.0	0.0	**5.0**	**0**	**0**	**0**	**0**
ACCD	0	0	0	**0**	0.0	0.0	0.0	**0.0**	**0**	**0**	**0**	**0**
AHS	47	57	1	**105**	3.7	3.5	2.0	**3.5**	**4**	**1**	**0**	**5**
ANR	16	8	0	**24**	4.1	4.0	0.0	**4.1**	**0**	**0**	**0**	**0**
Transportation	18	24	12	**54**	3.0	3.8	2.0	**3.1**	**151**	**1**	**0**	**152**
Attorney General	3	4	0	**7**	2.0	4.5	0.0	**3.4**	**0**	**0**	**0**	**0**
Auditors Office	0	0	0	**0**	0.0	0.0	0.0	**0.0**	**0**	**0**	**0**	**0**
BISHCA	1	0	0	**1**	3.0	0.0	0.0	**3.0**	**11**	**0**	**0**	**11**
Defender General	0	0	0	**0**	0.0	0.0	0.0	**0.0**	**0**	**0**	**0**	**0**
Dept. of Labor	28	38	0	**66**	4.2	4.0	0.0	**4.1**	**2**	**1**	**0**	**3**
Public Safety	42	36	2	**80**	3.3	3.1	3.0	**3.2**	**0**	**0**	**0**	**0**
Dept. of Taxes	13	10	1	**24**	2.3	3.4	1.0	**2.7**	**0**	**0**	**0**	**0**
Enhanced 911	21	6	0	**27**	3.0	3.0	0.0	**3.0**	**0**	**0**	**0**	**0**
Education	34	0	0	**34**	3.8	0.0	0.0	**3.8**	**0**	**0**	**0**	**0**
Legislature	3	2	0	**5**	3.0	1.5	0.0	**2.4**	**2**	**0**	**0**	**2**
Liquor Control	4	4	0	**8**	3.3	4.8	0.0	**4.0**	**1**	**0**	**0**	**1**
Lottery Comm.	1	2	0	**3**	6.0	7.0	0.0	**6.7**	**0**	**0**	**0**	**0**
Military Dept.	5	6	0	**11**	3.2	4.2	0.0	**3.7**	**0**	**0**	**0**	**0**
Natural Resources	0	0	0	**0**	0.0	0.0	0.0	**0.0**	**0**	**0**	**0**	**0**
Public Services	0	0	0	**0**	0.0	0.0	0.0	**0.0**	**0**	**0**	**0**	**0**
State's Attorneys	0	0	0	**0**	0.0	0.0	0.0	**0.0**	**0**	**0**	**0**	**0**
Total	**355**	**232**	**16**	**603**	**3.2**	**3.6**	**2.1**	**3.3**	**176**	**5**	**0**	**181**
% of Server Type	59%	38%	3%	**100%**	1%	1%	0%	**1%**	29%	1%	0%	**30%**
% of Total				**77%**								**23%**

We also segmented the server environment into whether the server was an application server (application, database, middleware, web server) versus a utility server (anything other than an application server, i.e. file & print, domain, E-mail). This can provide information about the opportunities and ability to consolidate or virtualize servers based on the function they are performing.

Total Physical and Virtual Instances by Function

Instance Type:	Physical				Virtual				Total				
Agency / Server Function	*Application*	*Utility*	*Other*	*Physical Instance*	*Application*	*Utility*	*Other*	*Virtual Instance*	*Application*	*Utility*	*Other*	*Total Instances*	*Virtualization Ratio*
Agency of Admin (Exc. Tax)	124	36	0	**160**	179	0	0	**179**	303	36	0	**339**	**2.1 : 1**
Agriculture	1	0	0	**1**	0	0	0	**0**	1	0	0	**1**	**1 : 1**
ACCD	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0.0**
AHS	52	57	1	**110**	175	0	0	**175**	227	57	1	**285**	**2.6 : 1**
ANR	16	8	0	**24**	7	0	0	**7**	23	8	0	**31**	**1.3 : 1**
Transportation	95	95	16	**206**	8	1	0	**9**	103	96	16	**215**	**1 : 1**
Attorney General	3	4	0	**7**	0	0	0	**0**	3	4	0	**7**	**1 : 1**
Auditors Office	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0.0**
BISHCA	9	3	0	**12**	0	0	0	**0**	9	3	0	**12**	**1 : 1**
Defender General	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0.0**
Dept. of Labor	29	40	0	**69**	0	0	0	**0**	29	40	0	**69**	**1 : 1**
Public Safety	42	36	2	**80**	0	0	0	**0**	42	36	2	**80**	**1 : 1**
Dept. of Taxes	13	10	1	**24**	40	4	0	**44**	53	14	1	**68**	**2.8 : 1**
Enhanced 911	21	6	0	**27**	0	0	0	**0**	21	6	0	**27**	**1 : 1**
Education	34	0	0	**34**	0	0	0	**0**	34	0	0	**34**	**1 : 1**
Legislature	5	2	0	**7**	18	0	0	**18**	23	2	0	**25**	**3.6 : 1**
Liquor Control	4	5	0	**9**	0	0	0	**0**	4	5	0	**9**	**1 : 1**
Lottery Comm.	1	2	0	**3**	0	0	0	**0**	1	2	0	**3**	**1 : 1**
Military Dept.	5	6	0	**11**	0	0	0	**0**	5	6	0	**11**	**1 : 1**
Natural Resources	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0.0**
Public Services	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0.0**
State's Attorneys	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	**0.0**
Total OS Instances	**454**	**310**	**20**	**784**	**427**	**5**	**0**	**432**	**881**	**315**	**20**	**1,216**	**1.6 : 1**
% of Instance Type	**58%**	**40%**	**3%**	**100%**	**99%**	**1%**	**0%**	**100%**	**72%**	**26%**	**2%**	**100%**	
% of Total				**64%**				**36%**				**100%**	

Lastly, TPI collected information about the criticality of applications contained within the applications portfolio that was reported. A selection guide was provided with definitions to assist in determining the priority of an application based on its criticality to the business. Additionally, the respective agencies were also asked to identify the disaster recovery priority of the aforementioned applications. Again a selection guide with definitions was provided to assist in the priority.

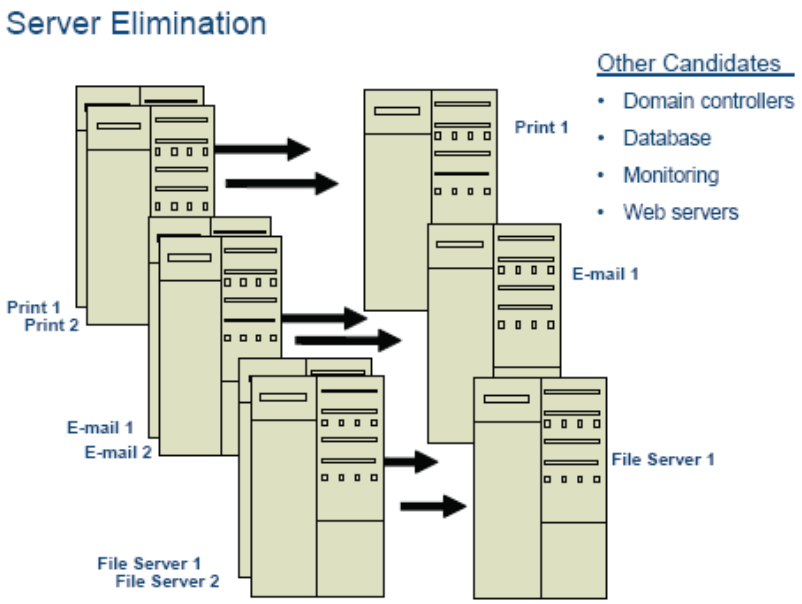
Business & Utility Applications by Application Priority							
Agency	P0	P1	P2	P3	P4	Blank	Total Bus. & Util. Apps
DII (Admin. Agency Exc. Tax)	22	8	4	6	15	56	111
Agriculture	0	0	0	6	3	0	9
ACCD	5	6	0	2	4	0	17
AHS	4	24	39	26	16	284	393
ANR	0	5	8	42	99	0	154
Transportation	1	0	191	0	0	122	314
Attorney General	1	2	3	5	1	0	12
Auditors Office	0	0	0	0	0	0	0
BISHCA	0	0	0	0	0	9	9
Defender General	0	0	0	0	0	0	0
Dept. of Labor	0	1	0	0	0	41	42
Public Safety	0	0	0	0	0	0	0
Dept. of Taxes	2	9	8	10	3	0	32
Enhanced 911	4	2	0	0	0	4	10
Education	0	0	0	0	0	24	24
Legislature	0	8	4	4	0	0	16
Liquor Control	1	1	2	2	0	0	6
Lottery Comm.	2	1	0	2	0	0	5
Military Dept.	1	4	2	2	2	0	11
Natural Resources	0	0	0	0	0	0	0
Public Services	0	0	0	0	0	0	0
State's Attorneys	0	0	0	0	0	0	0
Total Bus. & Util. Apps	**43**	**71**	**261**	**107**	**143**	**540**	**1,165**
% of Total	**4%**	**6%**	**22%**	**9%**	**12%**	**46%**	**100%**

Business & Utility Applications by DR Priority								
Agency	D0	D1	D2	D3	D4	None	Blank	Total Bus. & Util. Apps
DII (Admin. Agency Exc. Tax)	9	2	8	0	3	33	56	111
Agriculture	0	0	6	0	0	3	0	9
ACCD	11	1	2	0	3	0	0	17
AHS	3	11	6	7	6	46	314	393
ANR	0	15	3	136	0	0	0	154
Transportation	2	0	190	0	0	0	122	314
Attorney General	0	0	0	0	12	0	0	12
Auditors Office	0	0	0	0	0	0	0	0
BISHCA	0	0	0	0	0	0	9	9
Defender General	0	0	0	0	0	0	0	0
Dept. of Labor	0	0	0	0	1	0	41	42
Public Safety	0	0	0	0	0	0	0	0
Dept. of Taxes	0	0	0	0	0	32	0	32
Enhanced 911	5	1	0	0	0	0	4	10
Education	0	0	0	0	0	0	24	24
Legislature	0	0	0	0	0	16	0	16
Liquor Control	0	0	0	5	0	1	0	6
Lottery Comm.	2	1	2	0	0	0	0	5
Military Dept.	0	0	0	0	0	11	0	11
Natural Resources	0	0	0	0	0	0	0	0
Public Services	0	0	0	0	0	0	0	0
State's Attorneys	0	0	0	0	0	0	0	0
Total Bus. & Util. Apps	**32**	**31**	**217**	**148**	**25**	**142**	**570**	**1,165**
% of Total	**3%**	**3%**	**19%**	**13%**	**2%**	**12%**	**49%**	**100%**

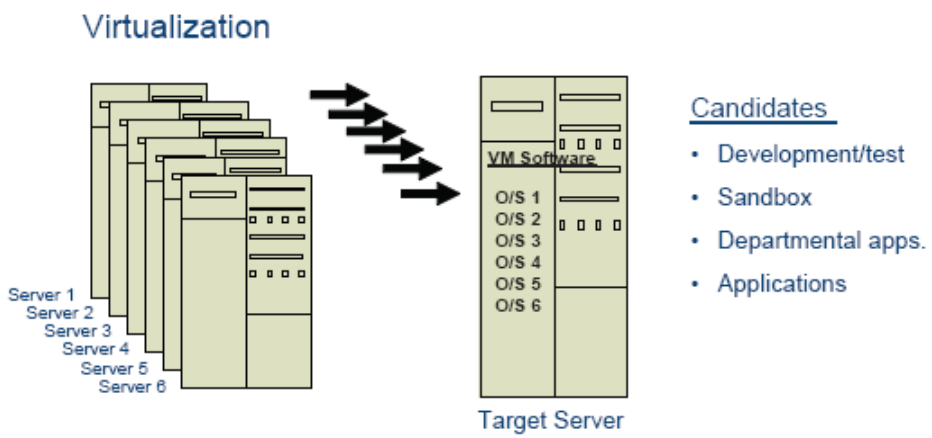
3. BUSINESS CASE FOR SERVER CONSOLIDATION

A complete definition of server consolidation encompasses the following 4 (four) components:

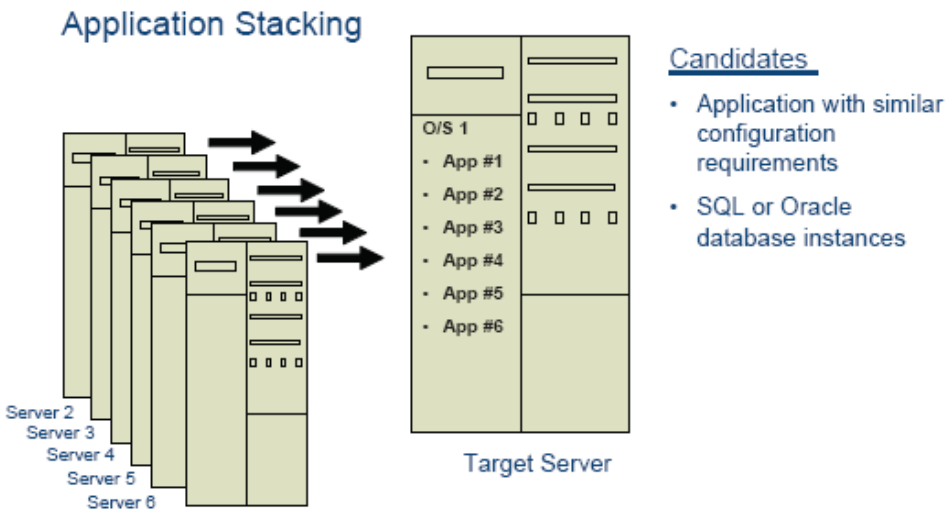
1. Server elimination involves the physical removal of servers from an environment, either by transferring responsibility for a specific function (for example, print or E-mail services) to another existing device or by eliminating the function itself because it no longer provides sufficient business value. Candidate for elimination are utility servers (print, E-mail, DNS) and application servers that are identified as database or web.



2. Virtualization is the combining of multiple server operating systems onto a single server. Sometimes this is referred to as 'logical consolidation'. Candidates for virtualization are application servers that require single operating systems.



3. Application stacking, sometimes referred to as physical consolidation, is the act of moving multiple applications onto a single operating system. Research is required to determine possible candidates, full application testing and stress testing is demanded, and it provides the largest savings opportunity.



4. Combination of application stacking and virtualization

There are a number of considerations that must be addressed before embarking on a consolidation/virtualization/application stacking effort.

Server elimination requires minimal investment, other than the labor and business input to clearly identify the impact of removing these servers from the environment.

Virtualization will reduce the capital requirements for hardware and maintenance, but does not significantly reduce labor to support a virtualized environment. Virtualization can yield additional savings, but has increased risk based on the servers/functions selected. The process requires input/testing from the business.

Application stacking yields the most savings but has the highest risk based on the servers/functions selected and the complexity of testing. It requires the most input/testing from the business, and the need for ongoing capacity planning and monitoring is significantly increased.

4. RETURN ON INVESTMENT FORMULAS

Specific virtualization and consolidations ROI formulas and calculations are provided in the respective recommendations sections of the document.

For server consolidation see section: "1.2.1 ROI CALCULATIONS AND POTENTIAL FOR TECHNOLOGY RELATED SAVINGS" on page 57

For server consolidation see section: "1.2.1 ROI CALCULATIONS AND POTENTIAL FOR TECHNOLOGY RELATED SAVINGS" on page 66

4.1 QUANTITATIVE AND QUALITATIVE FORMULAS

The goal of Return on Investment (ROI) formulas is to provide the leadership team with a concise and accurate financial summary, based on a sufficient amount of underlying financial data, for which a confident decision can be made for consolidation. As a matter of course, no one financial formula or ratio should be used as the sole yard stick for which a project's go or no-go decision should be made. Each formula has strengths and weaknesses. With that in mind, several formulas should be used for the financial analysis of the consolidation project for the State of Vermont's server environment.

For the State of Vermont, the following financial formulas are included in the analysis:

- **Operational and capital cost** savings estimates for a 1 year and 5 year view. This formula compares the savings or additional costs of the current environment to the future consolidated environment, including both dollar and percentage benefits. The components of the operational and capital costs included in the analysis are listed below.
- **Return on Investment (ROI)** formula represents a measure of the net consolidated server savings divided by the investment incurred for the consolidation of the server environment. The net operational and capital cost savings as a result of the project are divided by the net investment cost of the project. The components of the operational, capital and project investment costs included in the analysis are listed below.
- **Payback Period** is the length of time (e.g. months) required to recoup the initial project investment. When the project's cumulative operational and capital cost savings equals the initial investment for the consolidation project the breakeven point is reached.
- **Net Present Value (NPV)** is the present value of all future cash flows at the organization's weighted average cost of capital or the average interest rate to acquire funding (e.g. federal loans). Operational, capital and investment costs for the entire length of the project will be discounted at an interest rate (e.g. 6%) so the value of all future costs are compared to the value of current costs.

In order to calculate the financial formulas, fiscal year 2009 financial data and asset inventories have been provided by the agencies and departments included in this assessment. For server consolidation, the following components were included in the formulas for operational and capital costs.

- Operational Costs:
    - Staffing including salary and benefits
    - Server power and cooling energy requirements
    - Server space requirements
    - Provisioning

- Server administration
- Server networking requirements

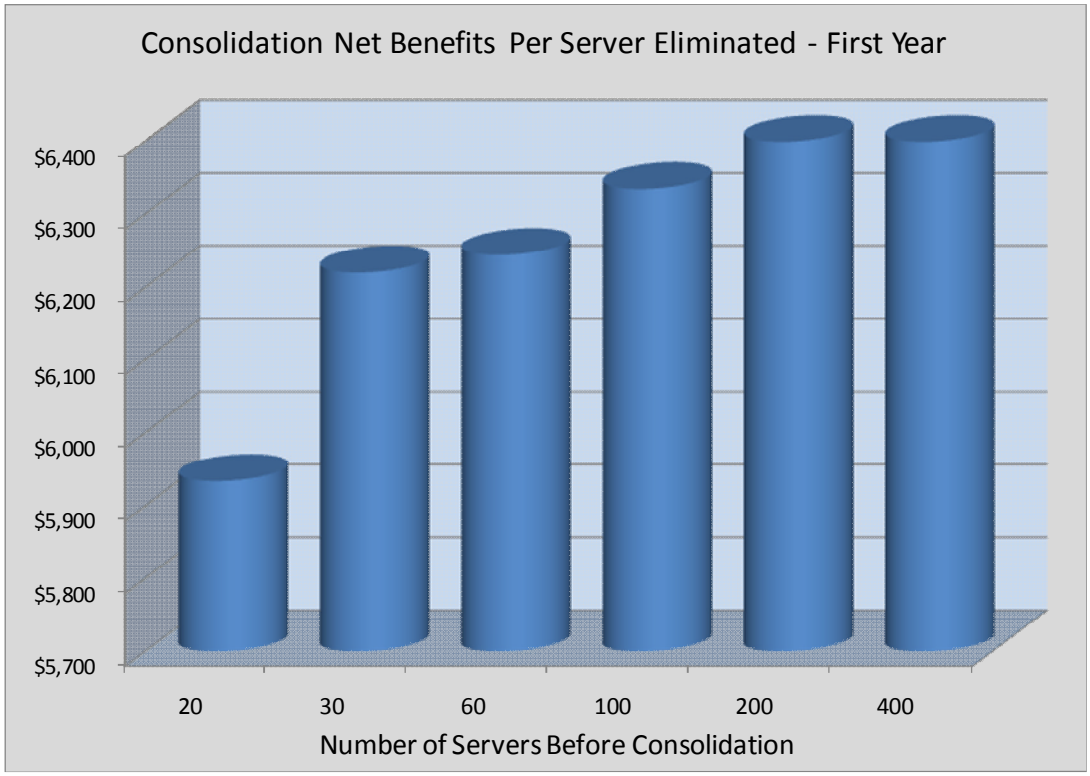
- Capital Costs:
  - Hardware
    - Annual amortization and maintenance
    - Server, storage, and racks
  - Software
    - Annual license and maintenance
    - OS and application
  - Data center storage
  - Server networking
- Project Investment Costs:
  - Operational - Implementation costs (design, plan, deploy)

Expected server consolidation results

Consolidation is all about investing time and money to receive a downstream return in labor, software licenses and capital costs. For every server that can be taken out of service, results include reductions in the labor required to maintain and operate the equipment as well as floor space, utility costs, software licenses (operating system, monitoring, scheduling, etc.), environmental requirements and network ports. When such consolidation can yield a reduction of 5 to 10 percent in operating and capital expenses, the opportunities become clear.

Using the State's current costs, TPI modeled the typical cost savings that could be achieved by consolidating servers. The results of this modeling is shown in the below graph for a selected range of servers. The graph shows that the initial implementation costs including design, plan, and deploy are recovered with a relatively low number of consolidated servers. In addition, the net savings of consolidation, on a per server basis, will continue to be positive but will flatten out as the number of servers reaches the 100 and greater mark.

The analysis below assumes a consolidation ratio of 3 to 1.



5. BUSINESS CASE FOR SERVER VIRTUALIZATION

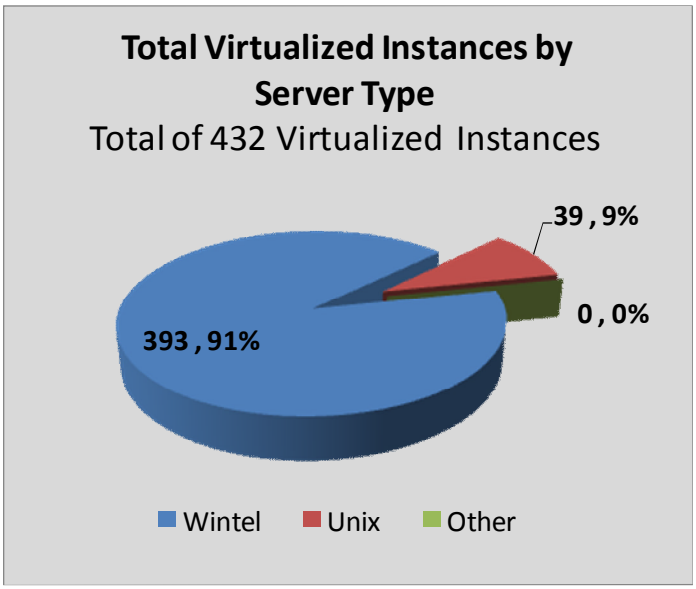
There were additional insights into the current levels of virtualization with the State of Vermont. The following chart depicts the information collected:

Virtualized Servers by Server Type

Instance Type:	Physical				Virtual				Total				
Agency / Server Type	*Wintel*	*UNIX*	*Other*	*Physical Instance*	*Wintel*	*UNIX*	*Other*	*Virtual Instance*	*Wintel*	*UNIX*	*Other*	*Total Instances*	*Virtualization Ratio*
Agency of Admin (Exc. Tax)	20	4	0	**24**	166	13	0	**179**	186	17	0	**203**	**8.5 : 1**
AHS	13	0	0	**13**	175	0	0	**175**	188	0	0	**188**	**14.5 : 1**
ANR	3	0	0	**3**	7	0	0	**7**	10	0	0	**10**	**3.3 : 1**
Transportation	4	1	0	**5**	8	1	0	**9**	12	2	0	**14**	**2.8 : 1**
Dept. of Taxes	8	2	0	**10**	19	25	0	**44**	27	27	0	**54**	**5.4 : 1**
Legislature	2	0	0	**2**	18	0	0	**18**	20	0	0	**20**	**10 : 1**
Total OS Instances	**50**	**7**	**0**	**57**	**393**	**39**	**0**	**432**	**443**	**46**	**0**	**489**	**8.6 : 1**
% of Instance Type	88%	12%	0%	100%	91%	9%	0%	100%	91%	9%	0%	100%	
% of Total				12%				88%				100%	

- 6 agencies/departments are already using virtualization
- 57 physical servers support 432 virtual instances

- Ratio of physical to virtual servers varies from a low of 2.8 to1 to a high of 14.5 to 1
- The average virtualization ratio is 8.6 to 1
- Almost 100% of the virtualization is for application servers



- Today, the State primarily virtualizes Windows servers

6. RETURN ON INVESTMENT FORMULAS

Specific virtualization and consolidations ROI formulas and calculations are provided in the respective recommendations sections of the document.

For server consolidation see section: "1.2.1 ROI CALCULATIONS AND POTENTIAL FOR TECHNOLOGY RELATED SAVINGS" on page 57

For server consolidation see section: "1.2.1 ROI CALCULATIONS AND POTENTIAL FOR TECHNOLOGY RELATED SAVINGS" on page 66

6.1 QUANTITATIVE AND QUALITATIVE COMPONENTS

The goal of Return on Investment (ROI) formulas is to provide the leadership team with a concise and accurate financial summary, based on a sufficient amount of underlying financial data, for which a confident decision can be made for virtualization. As a matter of course, no one financial formula or ratio should be used as the sole yard stick for which a project's go or no-go decision should be made. Each formula has strengths and weaknesses. With that in mind, several formulas should be used for the financial analysis of the virtualization project for the State of Vermont's server environment.

For the State of Vermont, the following financial formulas are included in the analysis:

- **Operational and capital cost savings** estimates for a 1 year and 5 year view. This formula compares the savings or additional costs of the current environment to the future virtualized environment, including both dollar and percentage benefits. The components of the operational and capital costs included in the analysis are listed below.

- **Return on Investment (ROI)** formula represents a measure of the net virtualized server savings divided by the investment incurred for the virtualization of the server environment. The net operational and capital cost savings as a result of the project are divided by the net investment cost of the project. The components of the operational, capital and project investment costs included in the analysis are listed below.

- **Payback Period** is the length of time (e.g. months) required to recoup the initial project investment. When the project's cumulative operational and capital cost savings equals the initial investment for the virtualization project the breakeven point is reached.

- **Net Present Value (NPV)** is the present value of all future cash flows at the organization's weighted average cost of capital or the average interest rate to acquire funding (e.g. federal loans). Operational, capital and investment costs for the entire length of the project will be discounted at an interest rate (e.g. 6%) so the value of all future costs are compared to the value of current costs.

In order to calculate the financial formulas, fiscal year 2009 financial data and asset inventories have been provided by the agencies and departments included in this assessment. For server virtualization, the following components were included in the formulas for operational and capital costs.

- Operational Costs:
    - Staffing including salary and benefits
    - Server power and cooling energy requirements
    - Server space requirements
    - Provisioning
    - Server administration
    - Server networking requirements

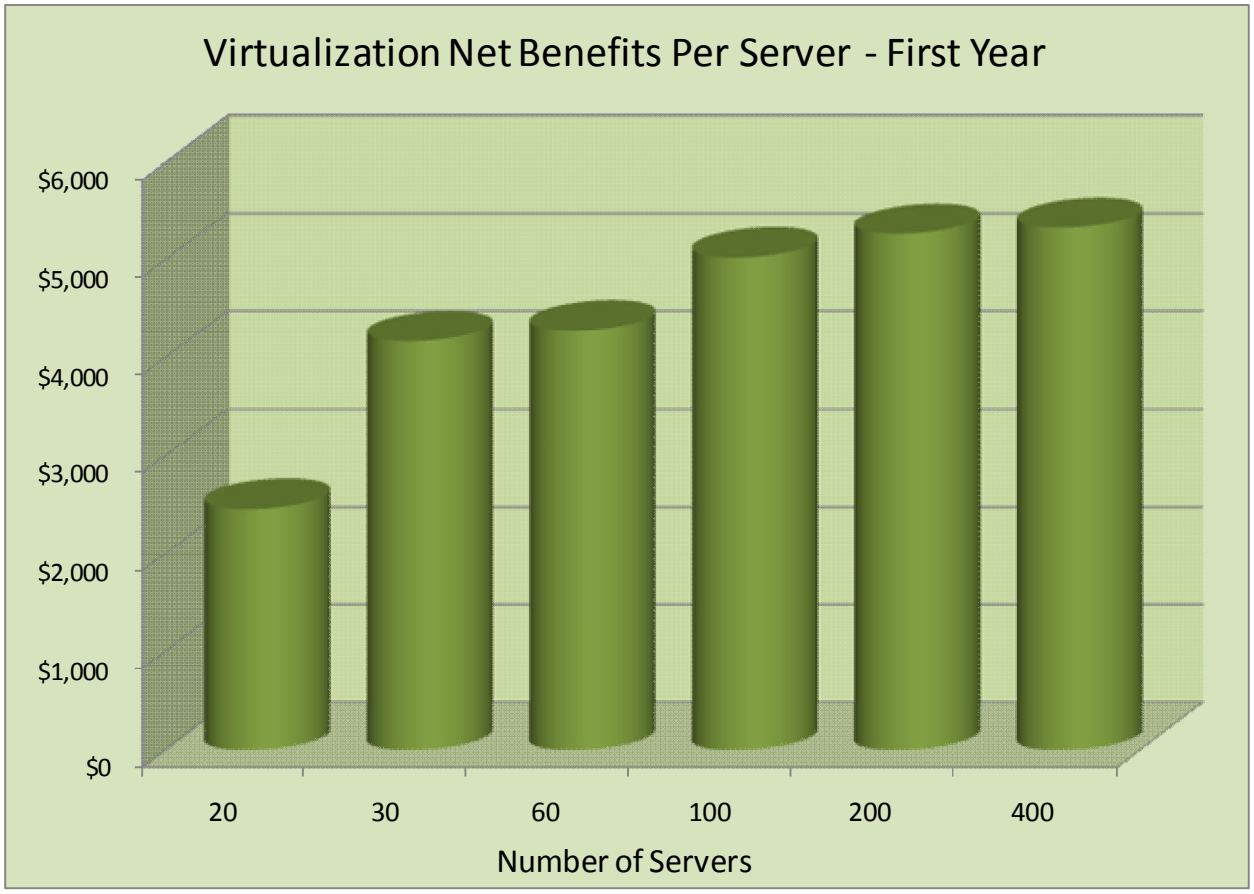
- Capital Costs:
  - Hardware
    - Annual amortization and maintenance
    - Server, storage, and racks
  - Software
    - Annual license and maintenance
    - OS, application, and virtualization
  - Data center storage
  - Server networking
- Project Investment Costs:
  - Capital
    - Virtualization software license fees
    - Virtualization software licenses annual maintenance
  - Operational
    - Implementation costs (design, plan, deploy)
    - Virtualization software training

Expected server Virtualization Results

Virtualization is all about investing time and money to receive a downstream return in labor, software licenses and capital costs. For every server that can be taken out of service, results include reductions in the labor required to maintain and operate the equipment as well as floor space, utility costs, software licenses (operating system, monitoring, scheduling, etc.), environmental requirements and network ports. When such virtualization can yield a reduction of 5 to 10 percent in operating and capital expenses, the opportunities become clear.

Using the State's current costs, TPI modeled the typical cost savings that could be achieved by virtualizing servers. The results of this modeling is shown in the below graph for a selected range of servers. The graph depicts that the cost recovery is more gradual with virtualization as compared to previously shown for consolidation. In addition, the net savings of virtualization, on a per server basis, will continue to be positive but will flatten out as the number of servers reaches the 200 and greater mark.

The virtualization ratio that used was 8 to 1. This is at the low end of what the State is currently achieving.



7. DATA CENTER ASSESSMENT

APPROACH

Physical site visits and interviews were conducted for data centers identified by the State of Vermont. Separately, the Agency of Transportation (AOT) has infrastructure devices located within the National Life data center; however, TPI did not specifically analyze their section of the site, but assumed the status was the same Tier and condition as the DII data center at National Life. Specific questions were asked and answered involving multiple focus points and areas of concern. A summary of these questions and answers were provided for verification and validation to ensure information was being captured and perceived correctly and objectively.

The collected information was used to determine TPI's interpretation of the data center's capability against the standards set by the Uptime Institute's criteria for data centers and provide some observational information about other data center characteristics and attributes. These physical visits and interviews were not intended to be an assessment to **qualify** the data centers or facilities, but to provide considerations for client awareness.

ASSESSMENT AND OBSERVATIONS

The following table represents the Tier Criteria based on the Uptime Institute's classification of data center Tiers:

Uptime Institute Data Center Classification Key Attributes

- TPI recommends that SOV should have their servers a Tier 3 data center

Capability	Tier 1	Tier 2	Tier 3	Tier 4
Distribution paths (power source)	1	1	2	2
Redundancy in the distribution paths (power source)	No	No	Yes	Yes
Redundant and physically separate power	No	No	No	Yes
Redundant components in equipment	No	Yes	Yes	Yes
Redundant HVAC	No	No	Maybe	Yes
Staffing	None	None	1+ Shift	24 x 7
Site Availability	99.67%	99.75%	99.98%	99.99%
Annual Site Downtime (base on Availability)	28.8 Hrs	22.0 Hrs	1.6 Hrs	0.8 Hrs
Single points of failure	Many	Many	Some	None

The following represents the Tier classification of the State of Vermont data centers based on the Uptime Institute's classification of data center Tiers:

Data Center Ranking based on Uptime Institute Classification of Data Center Tiers

- DII National Life – Tier 3
- DII 133 State Street – Tier 2
- DII Barre – Tier 2
- DPS Waterbury – Tier 2
- Dept of Labor – Tier 2
- AHS Waterbury – Tier 2
- AHS Burlington – Tier 2

The following additional assessment criteria were evaluated by TPI for those identified data centers:

Additional Objective Assessment Categories

- TPI conducts an assessment to rate a data center
- The assessment is comprised of a physical observation, discussion with a data center representative, and formulation of validated notes
- The following categories are interrogated and addressed:
    - Capabilities – 7 elements
        1. Backup site > 100 miles away
        2. 7 X 24 full time operation
        3. Automated availability tracked
        4. Meets Tier level requirements of client
        5. Physical capacity planning performed
        6. Adequate floor space for growth
        7. Well organized and documented
    - Redundancy – 9 elements
        1. Dual power feeds from separate sources
        2. Redundant supply source for HVAC (Heat, Ventilation, Air Conditioning)

3. Separate UPS (Uninterruptable Power Systems)
4. Backup generator
5. Capability to add fuel to generator while running
6. Dual entrances for phone and data services
7. Access from at least 2 different carriers
8. Utility consumption monitored
9. Any single points of failure

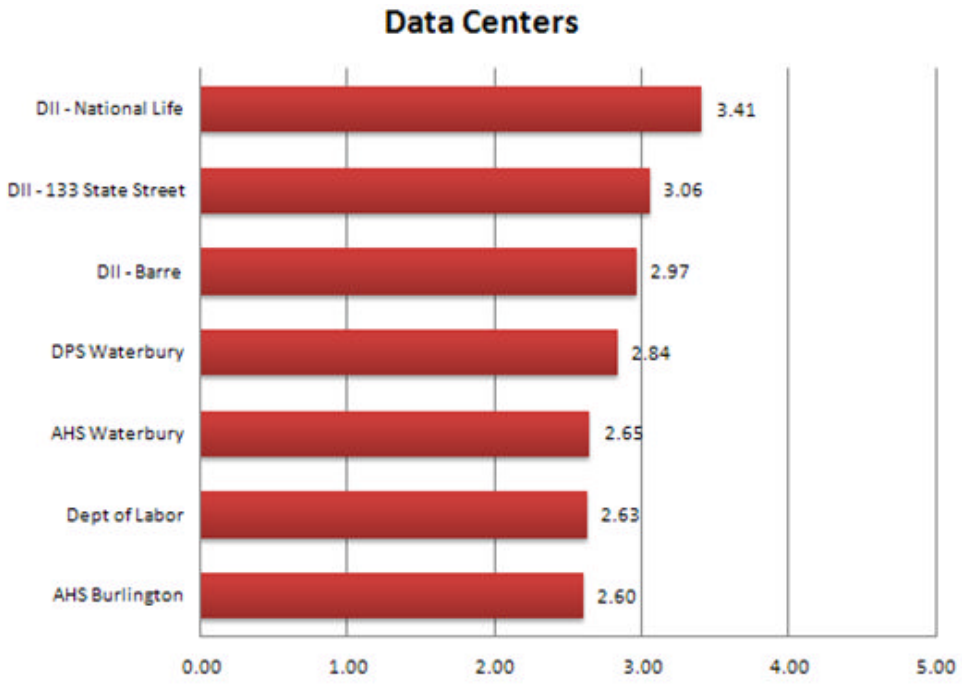
- Building Structure – 7 elements
    1. Equipment room located away from windows
    2. Data center has raised floor
    3. Loading dock can accept/move large equipment
    4. Entry ramp
    5. Meets local fire codes
    6. Building maintained, cleaned, and no structural issues
    7. Building is hardened to level required by client
- Protection and Security – 9 elements
    1. Friendly fire extinguishing system
    2. Automatic activated fire alarm system
    3. Access to data center controlled and limited
    4. Security checkpoints in place in shipping area
    5. Automated badge system
    6. Follows security procedures
    7. Adequate security alarm system
    8. Cameras located both outside and within building
    9. No external signs identifying building as a data center

- Location – 6 elements
    1. Easy access to data center
    2. Data center located where required skills and resources available
    3. Area around building is well maintained and safe
    4. Not close to items of risk, such as chemical or gas
    5. Located in an area subject to harmful weather (e.g. floods)
    6. Adequate procedures to manage emergency events

- Each element is scored on a scale of 1 to 5 (low to high)
- Each element is weighted and a score is calculated for the category
- Category scores are summarized and a total score is developed

The following charts represent the scores of those data centers that were assessed:

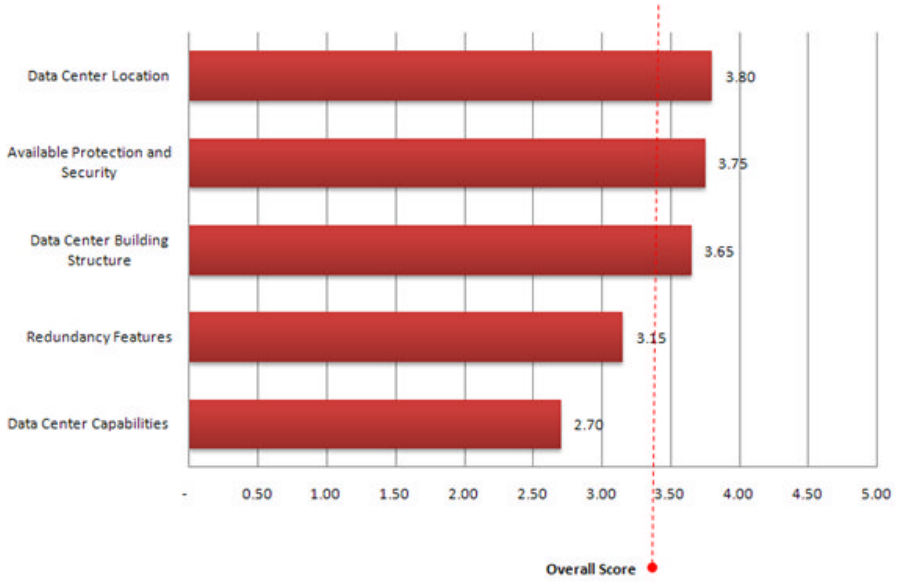
Note that the scores represent the 1 to 5 relative scoring and does not correspond to the data center tier ratings. The data center graphs below seems blurry



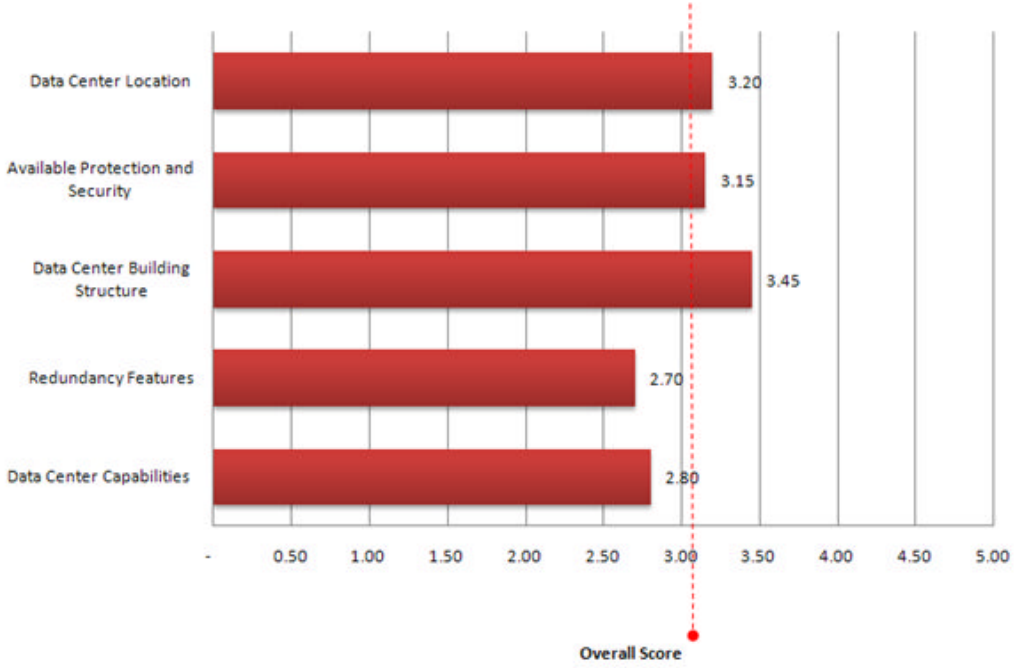
- Ideally all data centers should meet a 3.0 score or greater

The following charts represent the total scores for each respective data center:

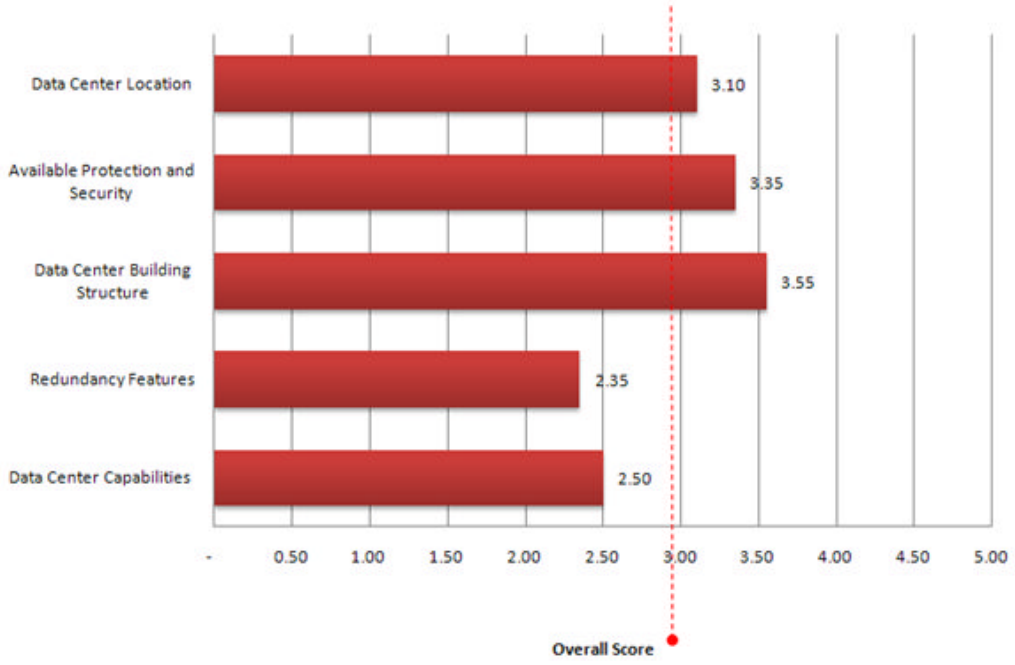
National Life



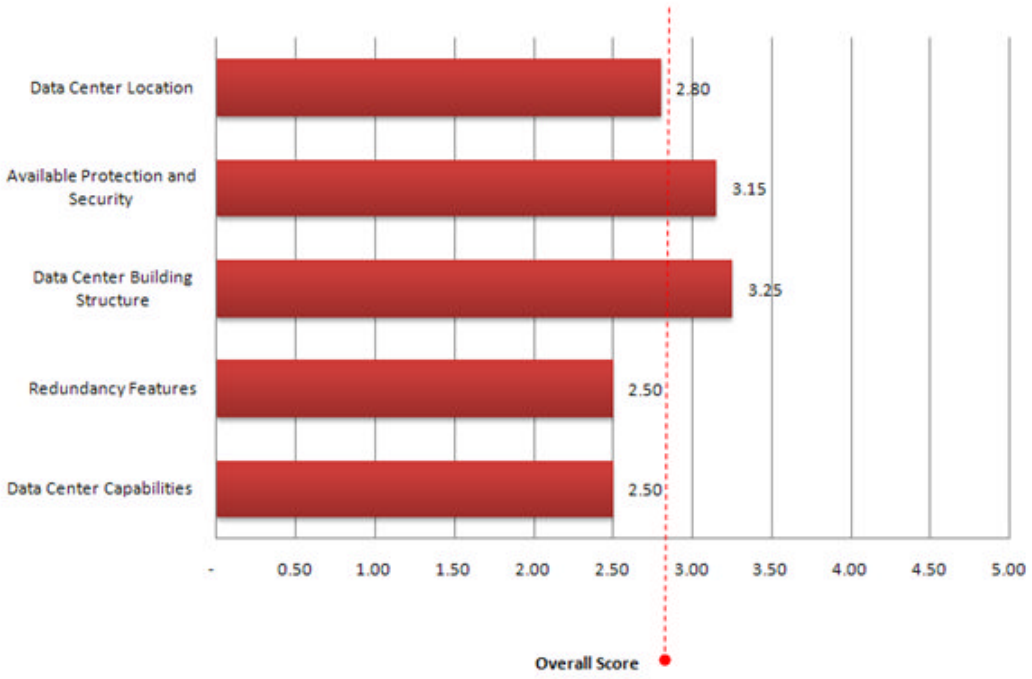
DII – 133 State Street



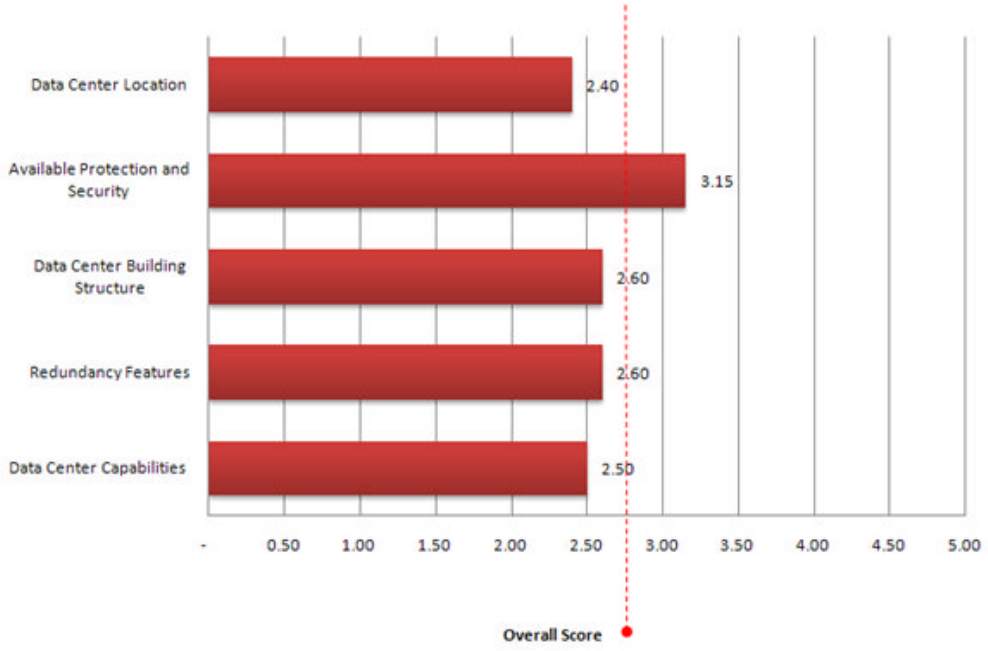
DII – Barre



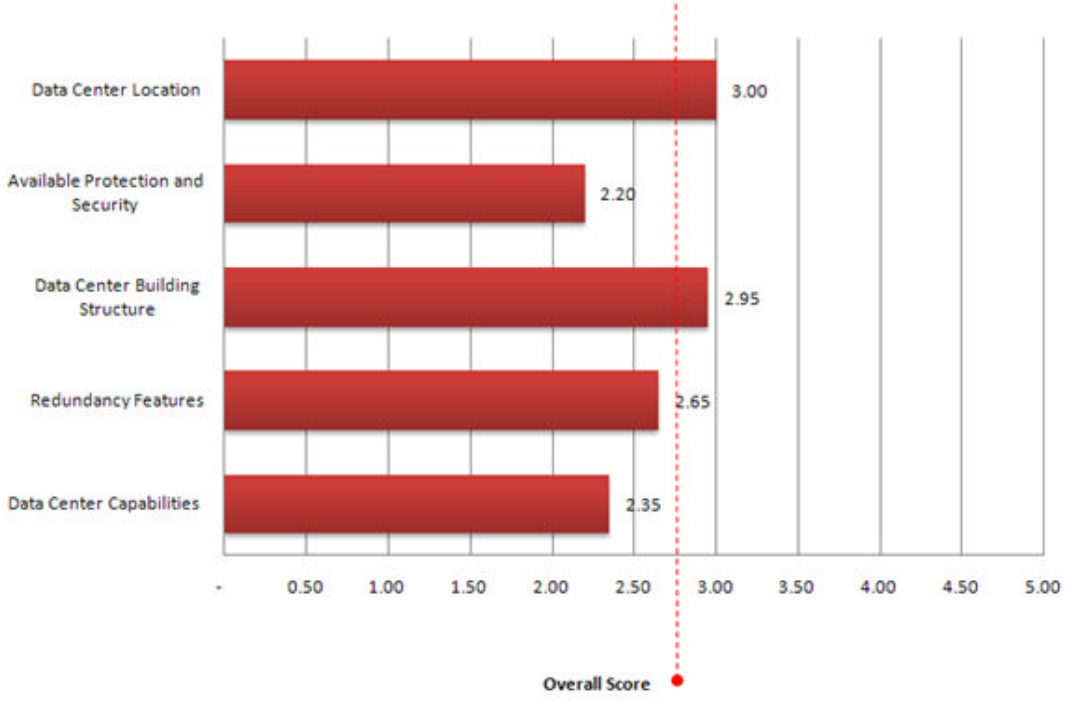
DPS Waterbury



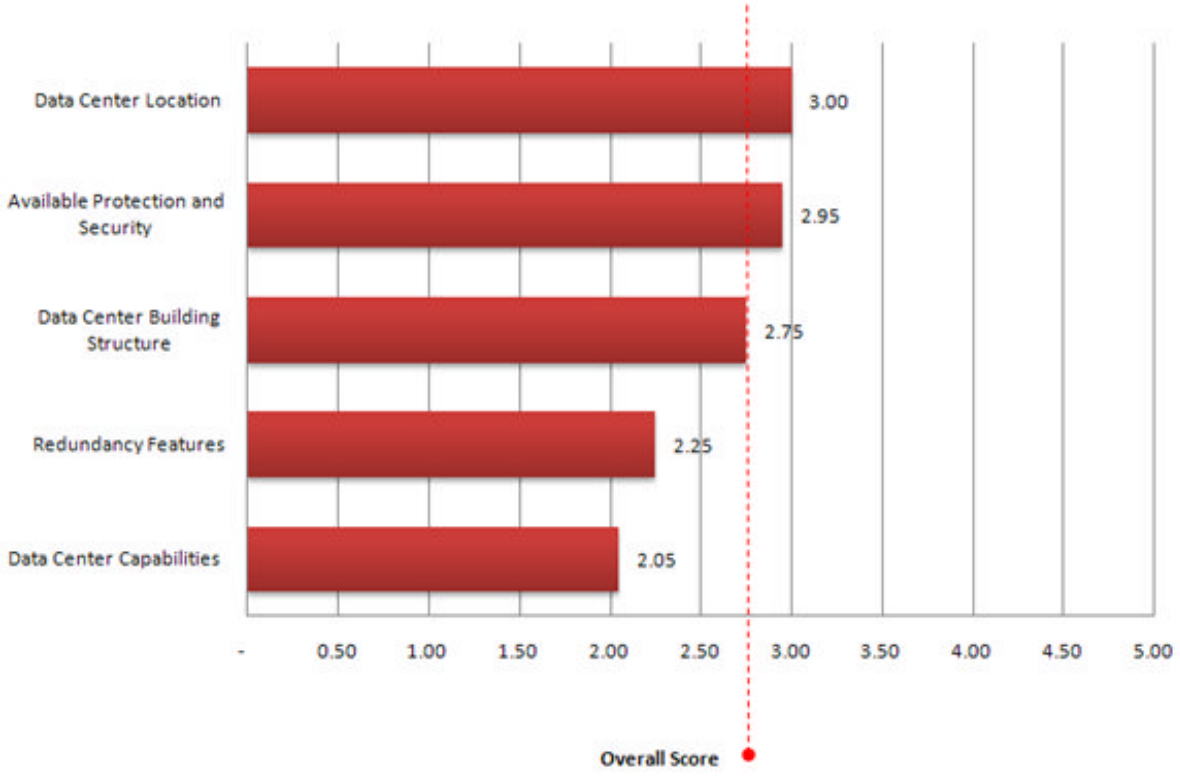
AHS Waterbury



Dept of Labor



AHS Burlington



A number of general observations were noted during the site visit and interview of the indentified data centers:

General Observations

- Generators - All data centers have backup generators (diesel or natural gas) with sufficient amounts of fuel to provide emergency power
- Expansion - Most data centers have adequate room for expansion, most have decreasing space requirements due to migration/consolidation/virtualization
- HVAC - All data centers have sufficient cooling requirements through multiple (backup or redundant) air handling/conditioning units
- Raised Floor - Almost all data centers are on raised floor (exception AHS Waterbury)
- Network - Almost all data centers have dual carrier services into facility (i.e. FairPoint, Sprint)
- Fire Protection - Almost all data centers (exception DOL) have automatic sprinkler systems for fire protection, most are H20; however, one utilizes Halon (old style), one utilizes FM200 (new style)
- Physical Condition - Most data centers were fairly clean, orderly, and organized. Some empty boxes, spare parts, cables
- Security Cameras - Almost all data centers use security cameras (inside or outside) the facility
- UPS - All data centers utilized UPS for interruption in power (some had multiple power sources or dual UPS - A/B side)
- Security Access - All data centers had badge access devices to allow entry. Sign in sheets additionally required in some sites
- Miscellaneous - All relevant equipment is stored in racks
- Miscellaneous - DII 133 State Street, AHS Waterbury, DPS Waterbury in flood plain (DII Barre – utilities and power in flood plain)

GAPS

A number of gaps were identified and should be considered when determining future data center requirements and respective capabilities and attributes required:

- The location of many of the **data centers are within flood plains** or the power sources and network conveyances are within a flood plain. Considerations to migrate these sites to other data centers or locations are imperative
- Most of the data centers would be considered Tier 2 sites according to the Uptime Institute tier ratings. **The goal for the State of Vermont should be Tier 3 for any/all data center locations**
- Most of the data centers had sufficient cooling capability. However, not all cooling units were specifically designed for operation in a data center. Cooling systems and air handlers within a data center require appropriate air filtration and cooling capacity. **High air quality requirements in data centers are** required for extremely sensitive and expensive electronic equipment.
- **Dual Power Sources into a data center is required** in order to be considered a Tier 3 facility. The redundancy and criticality of maintaining consistent and steady power to the facility is imperative. Only National Life has this capability.
- **Security and protection are** critical within data center facilities. Fire detection and fire suppression need to be 'state of the art'. Many of the current data centers use outdated protection and are at risk for damage and/or destruction of equipment contained within.
- **Service Levels for availability, time to respond, and time to restore are generally not in place** nor tracked with any consistency or rigor. In order to achieve improvement and reliability consistent with Tier 3 levels of operation, these performance statistics must be captured and monitored.
- **Backup sites and facilities are not clearly identified** for many of the respective data centers; only the 133 State Street site has an identified backup site (Barre).

7.1 CURRENT SERVICE LEVEL NEEDS AND SCALABILITY

Service Level Agreements and performance metrics for services delivered to users is almost non-existent. One of the few exceptions was the DII Customer Support Service Level Agreement that was provided to TPI for consideration as an example of the agreements established by DII for those agencies that are receiving some form of infrastructure service from DII (i.e. server hosting, file and print capabilities, E-mail hosting, etc.). However, this Service Level Agreement was more of a description of services rather than a performance agreement with minimum or expected levels of services contractually agreed to by an agency. Although there was some attempt to describe problem severity, response time, and acknowledgement time, no risk, reward, or penalty was described within the document.

Very few of the agencies had service levels to report in the data collection forms. Of the 30+ interviews that were conducted with both the technical and business representatives within the agencies only a few collected any performance metric data. Of those few that did collect performance metric data, the data was only used internally, was generally not formalized or documented, and in most cases only used as an indicator of 'processes behaving normally'.

8. BUSINESS CASE FOR DATA CENTER IMPROVEMENTS

8.1 CONSOLIDATION ALTERNATIVE, 8.2 REDESIGN, 8.3 DISASTER RECOVERY

In order to more adequately protect State of Vermont data and ensure that the underlying infrastructure and communication equipment is housed and maintained in a facility that provides the appropriate security and capability, TPI would recommend migrating to two data center facilities. A **primary data center** and a **backup data center** with sufficient space, redundancy, and operating capability to assure critical operations and processing are provided until restoration of service can be achieved at the primary site. Given the data center sites and operations that currently exist, the more logical choice would be to utilize the National Life facility as the primary site and to use the Barre facility as the backup data center. The National Life facility has approximately 1,000 square feet of floor space with the ability to expand to 2,000 square feet.

The National Life facility can be classified as a Tier 3 site, has multiple power sources, is not contained within a flood plain, and has expansion capability to accommodate the increase in computing requirements. The Barre site, which already serves as the backup site to the 133 State Street data center, might continue to serve as the backup site, with modification to improve the location of power and communication sources (which are in the flood plain). Additionally, analysis will need to be done to determine whether there is space sufficient to house the required equipment necessary to ensure continued services when needed from the National Life facility.

In addition to this recommendation of establishing a primary and backup data center, strong consideration should be addressed for the combining or elimination of the remaining identified data centers, particularly those in close physical proximity to each other (AHS Waterbury, DPS Waterbury). The cost and resources required to maintain multiple data centers (even though they were not initially designed as a data center facility) bears some scrutiny and analysis. The remaining sites have multiple gaps in their capabilities to host infrastructure equipment. Many are in the flood plain, do not have multiple power or communication sources, lack modern fire detection or prevention, do not have sufficient air handlers, and do not have formally identified back up sites. Although these sites have reduced the number of separate 'computing closets' throughout the respective agencies and overall for the State of Vermont, they were not designed nor are they capable of providing long term data center processing capabilities, and they pose a significant risk to the State.

If the establishment and consolidation to a primary and secondary data center is not feasible in the short term, capital improvements and facility modification should be considered in order to improve the capability and service delivery at the existing data centers. Specifically, in order for each of the data centers to meet the recommended Uptime Institute Tier Level ratings and address shortcomings identified from the data center assessment compared to best practices, they need to consider providing/implementing the following features/capabilities:

- AHS Burlington: Add additional separate power source to facility; add additional UPS with dual separate power sources; increase redundancy in device components (servers, storage, HVAC) to improve site availability to meet or exceed 99.98% uptime (1.6 hours/annually), conduct a formal capacity planning exercise, create redundant and separate voice and data entrances.

- National Life: Tie both UPS to dual separate power sources, increase redundancy in device components (servers, storage, HVAC) to improve site availability to meet or exceed 99.98% uptime (1.6 hours/annually).

- DII – Barre: Add redundant and separate power source to facility, add additional UPS with dual separate power sources, increase redundancy in device components (servers, storage, HVAC) to improve site availability to meet or exceed 99.98% uptime (1.6 hours/annually), conduct a formal capacity planning exercise, create redundant and separate voice and data entrances.

- AHS – Waterbury: Add redundant and separate power source to facility, tie both UPS to dual power sources, increase redundancy in device components (servers, storage, HVAC) to improve site availability to meet or exceed 99.98% uptime (1.6 hours/annually), conduct a formal capacity planning exercise, create redundant and separate voice and data entrances.

- DII – 133 State Street: Add redundant and separate power source to facility, tie both UPS to dual power sources, increase redundancy in device components (servers, storage, HVAC) to improve site availability to meet or exceed 99.98% uptime (1.6 hours/annually), conduct a formal capacity planning exercise, create redundant and separate voice and data entrances (this is in progress and will be completed during the first quarter of 2010).

- DPS – Waterbury: Add redundant and separate power source to facility, tie both UPS to dual power sources, increase redundancy in device components (servers, storage, HVAC) to improve site availability to meet or exceed 99.98% uptime (1.6 hours/annually), conduct a formal capacity planning exercise, create redundant and separate voice and data entrances.

- Dept of Labor: Add redundant and separate power source to facility, tie both UPS to dual power sources, increase redundancy in device components (servers, storage, HVAC) to improve site availability to meet or exceed 99.98% uptime (1.6 hours/annually), conduct a formal capacity planning exercise.

If the aforementioned improvements are not able to be made, protecting State data, ensuring business processes continue uninterrupted, and avoiding the loss of data is at risk. Even though many of these risks are mitigated through other preventive processes (i.e. back-up generators, off-site tape storage), the costs associated with these prevention techniques still exist and in many cases will increase over time.

Disaster Recovery procedures and processes within the identified data centers (with the exception of 133 State Street and Barre) are limited to tape backup and offsite storage. 133 State Street and Barre have asynchronous data mirroring from 133 State Street to Barre, in addition to tape backup and offsite storage. Even though most data center site perform some form of tape backup and offsite storage to address disaster recovery concerns, the processes are not formalized nor has disaster recovery testing been performed, either on a regular or ad-hoc

basis. The State of Vermont is at risk to ensure and protect the data that is processed within these sites on an ongoing basis, Risk mitigation assessment and introduction of formalized disaster recovery processes and procedures is strongly recommended.

Specifically, in order for each of the data centers to meet recommended disaster recovery requirements based on the Uptime Institute Tier Level ratings, they need to uplift their capability by providing/implementing the following features/capabilities:

- AHS Burlington: Develop a formal written disaster recovery plan, test the plan annually, remediate and successfully re-perform those tests that fail to produce desired results within a specified time period
- National Life: Develop a formal written disaster recovery plan, remediate and successfully re-perform those tests that fail to produce desired results within a specified time period.
- DII – Barre: Develop a formal written disaster recovery plan, remediate and successfully re-perform those tests that fail to produce desired results within a specified time period.
- AHS – Waterbury: Develop a formal written disaster recovery plan, test the plan annually, remediate and successfully re-perform those tests that fail to produce desired results within a specified time period.
- DII – 133 State Street: Develop a formal written disaster recovery plan, remediate and successfully re-perform those tests that fail to produce desired results within a specified time period.
- DPS – Waterbury: Develop a formal written disaster recovery plan, test the plan annually, remediate and successfully re-perform those tests that fail to produce desired results within a specified time period.
- Dept of Labor: Develop a formal written disaster recovery plan, test the plan annually, remediate and successfully re-perform those tests that fail to produce desired results within a specified time period.

PHASE 1 – INFRASTRUCTURE AND DATA CENTER – RECOMMENDATIONS

1. SERVER CONSOLIDATION TARGETS, RISKS, AND ROADMAPPING/SEQUENCING BY AGENCY

APPLICATION SERVERS

One of the first assumptions made in the consolidation of servers is those servers that have already been virtualized should be removed. Of the 784 servers 57 had already been virtualized, thereby leaving 727 servers available for consolidation. Of the 727 that are available, 399 were identified as application servers.

Total servers:	784
Already virtualized	- 57
Available:	727

727 available
399 application servers
308 utility servers
20 other servers

Of the 399 application servers 91 had a server complexity of high and were removed from consideration. An assumption was made that 43% of the servers with no complexity listed (blank servers) were considered high complexity and therefore 102 were removed from the count. This left 206 servers. There were 83 servers that were identified as either medium or low complexity and we assumed 57% or 123 of those with no complexity listed (again blank servers) were also considered medium or low complexity servers and therefore included in the count to be consolidated. This left a total of 206 application servers still available for consolidation.

399 application servers
91 high complexity servers
102 high blank servers
83 medium/low complexity servers
123 medium/low blank servers
206

Of these 206 application servers, 184 were classified as Wintel devices, 21 UNIX, and 1 other

206
184 Wintel
21 UNIX
205
1 other

Of the 184 Wintel servers, 99 were application servers, 51 database servers, 0 (zero) middleware servers, 15 web servers, and 19 other servers.

184 Wintel
99 application servers
51 database servers
0 middleware servers
15 web servers
19 other servers

Of the 21 UNIX devices, there were 14 application servers, 0 (zero) database servers, 1 middleware server, 6 web servers, and 0 (zero) other servers.

21 UNIX
14 application servers
0 database servers
1 middleware servers
6 web servers
0 other servers

The following assumptions for application servers are identified and should be taken into consideration during subsequent reviews and analysis on server consolidation:

- High complexity application servers were not considered candidates for consolidation
- All server consolidation candidates are required to be looked at individually to determine whether or not a successful consolidation can be done. Analysis should include application complexity, storage requirements, memory requirements, CPU usage, utilization, OS (Operating System) and application compatibility, application interconnect ability, and disaster recovery requirements, and resource support
- Lower operating systems (i.e. Windows 2000, Windows 2003) can be upwardly migrated/consolidated successfully. (Over 90% of the application servers are Windows 2003, with the remaining being a mix of Windows types)
- Wintel and UNIX cannot be intermixed in a consolidated server
- Database servers can be consolidated even with different databases being combined

APPLICATION AND UTILITY SERVER CONSOLIDATION FILTER

The following steps were applied to the server list to determine which servers were candidate for consolidation.

- Consolidated the individual data collection server list from each agency
- Kept only the servers on the list thus removing all peripherals from the list

- Kept physical servers only – remove servers that are already virtualized from list
- Kept the medium and low complexity servers on the list. Remove the high complexity servers.
- A significant number of the servers did not have a complexity rating assigned so TPI calculated the overall percentage of complexity of high, medium and low complexity over the total servers that had complexity indicated and applied this same percentage across the servers that did not have the complexity filled out. Based on this approach an additional percentage of the servers were retained on the list. These servers are noted as "blank servers".
    - Sort by Operating System
        - Separate by function (utility & application)
            - Application
                - Sort remaining into
                - Application
                - Database
                - Web server
                - Middleware
            - Utility
                - Sort remaining into
                - File server
                - E-mail
                - Other
- Applied a 3:1 consolidation ratio to each of application and utility server types in the final sorts (application, database, web servers …)

UTILITY SERVERS

One of the first assumptions made in the consolidation of servers is those servers that have already been virtualized should be removed. Of the 784 servers 57 had already been virtualized, thereby leaving 727 servers available for consolidation. Of the 727 that are available, 308 were identified as utility servers.

Total servers:	884
Already virtualized	-57
Available:	727

727 available
399 application servers
308 utility servers
20 other servers

For the 308 utility servers, the most likely candidates for consolidation are file/print and E-mail servers. Of the 308 utility servers 23 had a server complexity of high and were removed from consideration. We assumed approximately 43% of the blank servers were considered high and removed 94 of them. This left 191 servers. There were 70 servers that were identified as either medium or low complexity and we assumed approximately 57% or 121 blank servers were also considered medium or low complexity.

308 utility servers
23 high complexity servers
94 high blank servers
70 medium/low complexity servers
121 medium/low blank servers
191

Of these 191 utility servers, 174 were classified as Wintel devices, 15 UNIX, and 2 other.

191
174 Wintel
15 UNIX
189
2 Other

Of the 174 Wintel servers, 60 were file/print servers, 4 E-mail servers, and 110 other servers.

174 Wintel
60 file/print servers
4 E-mail servers
110 Other servers

Of the 15 UNIX devices, there were 5 file/print servers, 0 (zero) E-mail servers, and 10 other servers.

40 UNIX
5 File/print servers
0 E-mail servers
10 Other servers (domain, backup, etc.)

The following assumptions for utility servers are identified and should be taken into consideration during subsequent reviews and analysis on server consolidation:

- All server consolidation candidates are required to be looked at individually to determine whether or not a successful consolidation can be done. Analysis should include application complexity, storage requirements, memory requirements, CPU usage, utilization, operating system (OS) and application compatibility, application interconnect ability, and disaster recovery requirements, and resource support
- Lower operating systems (i.e. Windows 2000, Windows 2003) can be upwardly migrated/consolidated successfully.
- Wintel and UNIX cannot be intermixed in a consolidated server

ENTERPRISE CONSOLIDATION

Server consolidation is determined by a number of factors and attributes of the current server environment. These factors and attributes either allow or prevent the consolidation from occurring. TPI has estimated the amount of consolidation the State of Vermont might realize for its current server environment. These estimates are based on a number of assumptions and exclusions that are identified and will affect the total number of possible consolidations.

Of the 784 servers that were identified, 57 of the servers have already been virtualized, and would not be candidates for consolidation; leaving 727 servers that could be consolidated.

The 727 servers were then divided by the server type. The two possible server types are application servers (which are comprised of application, database, middleware, or web) and utility servers (file/print, E-mail, and other). There are 399 application servers, 308 utility servers, and 20 others.

Server Type:	Application				Utility				Other				Total				
Function	*Wintel*	*UNIX*	*Other*	*Total Apps*	*Wintel*	*UNIX*	*Other*	*Total Utility*	*Wintel*	*UNIX*	*Other*	*Total Other*	*Wintel*	*UNIX*	*Other*	*Total Servers*	*% of Total*
Application	192	26	1	**219**	0	0	0	**0**	0	0	0	**0**	192	26	1	**219**	**30%**
Database	77	12	1	**90**	0	0	0	**0**	0	0	0	**0**	77	12	1	**90**	**12%**
Middleware	1	9	1	**11**	0	0	0	**0**	0	0	0	**0**	1	9	1	**11**	**2%**
Web Server	36	9	0	**45**	0	0	0	**0**	0	0	0	**0**	36	9	0	**45**	**6%**
File/Print	0	0	0	**0**	99	5	0	**104**	0	0	0	**0**	99	5	0	**104**	**14%**
Email	0	0	0	**0**	9	0	0	**9**	0	0	0	**0**	9	0	0	**9**	**1%**
Other	34	0	0	**34**	174	16	5	**195**	7	13	0	**20**	215	29	5	**249**	**34%**
Total Servers	340	56	3	**399**	282	21	5	**308**	7	13	0	**20**	629	90	8	**727**	**100%**
% of Function	85%	14%	1%	100%	92%	7%	2%	100%	35%	65%	0%	100%	87%	12%	1%	100%	
% of All Servers				55%				42%				3%				100%	

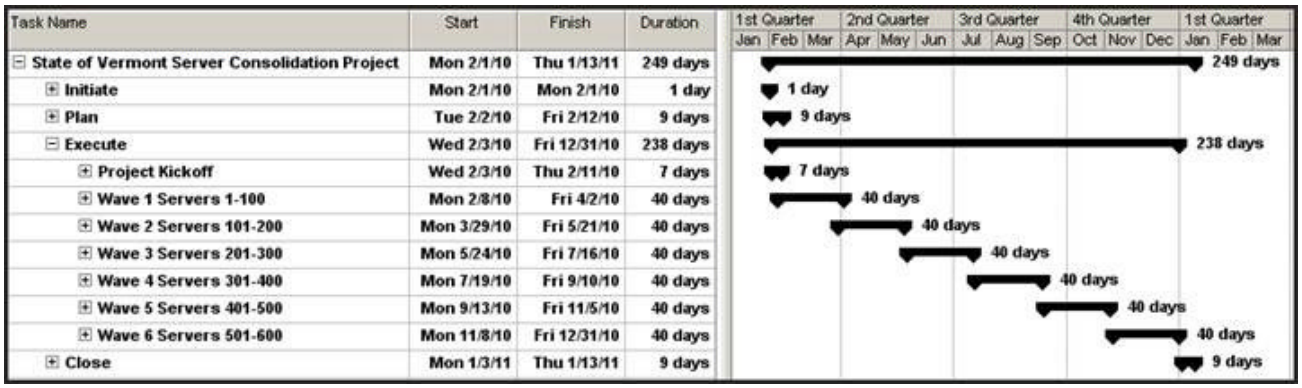
AGENCY CONSOLIDATION

Agency consolidation should be approached using the same algorithm as described in the "Enterprise Consolidation" section, but selecting the server population from the originally submitted asset listing of servers identified during the data collection phase. Additional assumption and/or exclusions might be necessary to further refine the list of possible consolidation candidates, but the agency would be in the best position to make these decisions based on their profound knowledge and understanding of the assets themselves and the associated hosted applications. TPI has created the charts that represent the number of possible server consolidation candidates based on the aforementioned enterprise consolidation approach.

Server Consolidation Summary Target Ratio: 3 to 1						
Agency Level Consolidation	*Starting Servers*	*Virtualized Servers*	*Servers Excl. Virtual*	*Servers Avail. For Consolidation*	*Servers Eliminated*	*Total Servers: After Consol.*
DII	160	24	136	47	28	132
Agency of Agriculture	1	0	1	1	0	1
ACCD	0	0	0	0	0	0
Agency of Human Services	110	13	97	71	44	66
Agency of Natural Resources	24	3	21	14	9	15
Agency of Transportation	206	5	201	103	67	139
Attorney General	7	0	7	7	3	4
Auditors Office	0	0	0	0	0	0
BISHCA	12	0	12	5	2	10
Defender General	0	0	0	0	0	0
Dept. of Labor	69	0	69	44	27	42
Dept. of Public Safety	80	0	80	40	24	56
Dept. of Taxes	24	10	14	9	4	20
E911 Board	27	0	27	2	0	27
Education	34	0	34	19	12	22
Legislature	7	2	5	1	0	7
Liquor Control	9	0	9	9	3	6
Lottery Commission	3	0	3	2	0	3
Military Department	11	0	11	11	6	5
Natural Resources Board	0	0	0	0	0	0
Public Service Department	0	0	0	0	0	0
State Attorneys and Sheriffs	0	0	0	0	0	0
Total Servers	784	57	727	385	229	555
State Level Consolidation	784	57	727	397	260	524
Add'l Servers Eliminated at State Level v. Agency Level:					31	14% More

A greater number of servers can be consolidated using a state wide approach as opposed to an agency by agency approach. Even though this is the case, TPI used the agency level approach (totals) in the business case to provide a more conservative view.

1.1 GANTT CHARTS



Task Name	Start	Finish	Duration
State of Vermont Server Consolidation Project	Mon 2/1/10	Thu 1/13/11	249 days
Initiate	Mon 2/1/10	Mon 2/1/10	1 day
Plan	Tue 2/2/10	Fri 2/12/10	9 days
Execute	Wed 2/3/10	Fri 12/31/10	238 days
Project Kickoff	Wed 2/3/10	Thu 2/11/10	7 days
Wave 1 Servers 1-100	Mon 2/8/10	Fri 4/2/10	40 days
Wave 2 Servers 101-200	Mon 3/29/10	Fri 5/21/10	40 days
Wave 3 Servers 201-300	Mon 5/24/10	Fri 7/16/10	40 days
Wave 4 Servers 301-400	Mon 7/19/10	Fri 9/10/10	40 days
Wave 5 Servers 401-500	Mon 9/13/10	Fri 11/5/10	40 days
Wave 6 Servers 501-600	Mon 11/8/10	Fri 12/31/10	40 days
Close	Mon 1/3/11	Thu 1/13/11	9 days

1.2 LIFECYCLE COST MODEL ESTIMATES

IT Assessment Server Consolidation - First Year Costs

	Current	Consolidation	Savings	% Savings
Total Server Count	385	156	**229**	**60%**
Annual IT Capital Costs				
Server Hardware	$2,768,798	$1,208,225	**$1,560,573**	**56%**
Server Software Licenses	$365,750	$147,915	**$217,835**	**60%**
Server Networking	$43,973	$17,323	**$26,650**	**61%**
Total Annual IT Capital Costs	$3,178,520	$1,373,462	**$1,805,058**	**57%**
Annual IT Operating Cost				
Data Center Server Space	$13,524	$74,113	**($60,589)**	**-448%**
Data Center Server Provisioning	$47,144	$0	**$47,144**	**100%**
Server Administration	$1,459,223	$590,133	**$869,091**	**60%**
Total Annual IT Operating Costs	$1,519,891	$664,245	**$855,646**	**56%**
Total Annual IT Capital & Operating Costs	$4,698,411	$2,037,707	**$2,660,704**	**57%**
IT Operating Costs - Consolidation Project				
Implementation Costs	$0	$1,355,200		
Total Consolidation Project IT Operating Costs	**$0**	**$1,355,200**		
Total Investment Costs	$0	$1,355,200	**($1,355,200)**	**n/a**
Total Server Consolidation Costs	**$4,698,411**	**$3,392,907**	**$1,305,504**	**28%**

Cost Summary - Five Year	Current	Consolidation	Savings	% Savings
Total IT Capital Costs	$17,494,899	$7,596,381	$9,898,518	**57%**
Total IT Operating Costs	$8,415,568	$3,717,720	$4,697,849	**56%**
Total IT Capital & Operating Costs	$25,910,467	$11,314,101	$14,596,366	**56%**
Total Consolidation Project IT Capital Costs	$0	$0	$0	**n/a**
Total Consolidation Project IT Operating Costs	$0	$1,355,200	($1,355,200)	**n/a**
Total Investment Costs	$0	$1,355,200	($1,355,200)	**n/a**
Total Server Consolidation	**$25,910,467**	**$12,669,301**	**$13,241,166**	**51%**

Server Consolidation Summary

Server Configuration Summary

Servers Before Consolidation	385	servers
Servers After Consolidation	156	servers
Target Consolidation Ratio	3	to 1

Financial Summary - One Year View

Current Costs (Operating & Capital)	$4,698,411	recurring
New Cost (Operating & Capital):		
Consolidation Investment	$1,355,200	one-time
Consolidation Recurring Costs	$2,037,707	57% Savings
Total Consolidation Costs	$3,392,907	
Total Consolidation Savings	$1,305,504	28% Savings
Return on Investment (ROI)	96%	

First Year - One Time Costs

Hardware Purchase - Servers	$0	n/a
Consolidation Investment	$1,355,200	
Total One Time Costs	$1,355,200	

Financial Summary - Five Year View

Total ROI	977%	
Total investment	$1,355,200	
Projected Capital Savings	$9,898,518	57% Savings
Projected Operating Savings	$3,342,649	40% Savings
Total 5 Year Savings	$13,241,166	51% Savings
Annual Recurring Savings	56%	by 2nd year
Total 5 Year Savings	51%	
Net Present Value (NPV) @ 6%	$10,877,163	
Payback Period	< 1	Year(s)

Server Consolidation Financial Summary	Year 1			Year 2	Year 3	Year 4	Year 5	
	Initial	Ongoing	Total	Ongoing	Ongoing	Ongoing	Ongoing	Total
Consolidation Project Investment	$1,355,200	$0	$1,355,200	$0	$0	$0	$0	$1,355,200
IT Capital Savings by Year	$0	$1,805,058	$1,805,058	$1,887,888	$1,971,176	$2,069,579	$2,164,817	$9,898,518
IT Operating Saving by Year	($1,355,200)	$855,646	($499,554)	$900,211	$935,791	$981,235	$1,024,966	$3,342,649
Total IT Cost Savings by Year	($1,355,200)	$2,660,704	$1,305,504	$2,788,098	$2,906,967	$3,050,814	$3,189,783	$13,241,166
IT Capital Savings by Year as %			57%	57%	57%	57%	56%	57%
IT Operating Cost Saving by Year as %			-33%	56%	56%	56%	55%	40%
Total IT Cost Savings by Year as %			28%	56%	56%	56%	56%	51%
Cumulative Savings			$1,305,504	$4,093,602	$7,000,570	$10,051,383	$13,241,166	

1.2.1 SERVER CONSOLIDATION ROI CALCULATIONS AND POTENTIAL FOR TECHNOLOGY RELATED SAVINGS

The Return on Investment (ROI) formula is calculated as follows:

ROI = (net dollar value of savings ÷ dollar value initial project investment)

Here are the calculations for the State of Vermont's server consolidation project: * see note

	First Year	Five Years
Savings:	$1,305,504	$13,241,166
Investment:	$1,355,200	$1,355,200
ROI:	net savings / investment	net savings / investment
Server Consolidation ROI:	96%	977%

* Note : Although the ROI calculation provides a quick view on a project's return, other financial indicators, such as net present value, should also be included in the decision making process.

1.3 PHYSICAL DATA SECURITY AND RECOVERY

Security strategies for physical server environments rely heavily on physical isolation, segmentation of information and systems, and proper backup and recovery processes.

Physically housing servers in non-accessible facilities and/or data centers is the most critical. For the most part, this physical separation is adhered to within the State of Vermont and its respective agencies. For those locations where there are physical servers on-site and not within a designated data centers, there is a continued risk.

Using rack mounted servers in data centers not only take up less server room real estate; they are also easier to secure. Although smaller and arguably lighter than (some) tower systems, they can easily be locked into closed racks that, once loaded with servers, can then be bolted to the floor, making the entire package almost impossible to move, much less to steal.

Even if the physical server is in a secure room, the file server might still be accessible through remote administration tools. Therefore, methods for restricting access to remote administration of file servers need to be incorporated, and steps taken to ensure that remote administration tools do not weaken your organization's security model.

For example, remote administration tools do not always use strong authentication protocols to authenticate users across the network. This makes your data vulnerable, and as such a strong method of authentication is strongly recommended.

Backing up important data is an essential element in disaster recovery, but don't forget that the information on those backup tapes, disks, or discs can be stolen and used by someone outside the organization. Backups should be locked in a drawer or safe at the very least. Ideally, a set of backups should be kept off site, and you must take care to ensure that they are secured in that offsite location.

Confidential data and systems must be backed up (at least weekly) on a predefined, regular basis, using durable media and documented handling procedures that should include provisions for keeping a backup or a copy of a backup in off-site storage. It must be protected from theft, environmental and physical threats, and unauthorized access. Reasonable efforts must be made to encrypt backup media that stores confidential data. Backup systems must be capable of providing an inventory of the systems backed up, including a record of backups residing on each individual piece of media (e.g. backup tapes). The availability and accuracy of this inventory must be tested at least yearly.

Confidential data and systems must be disposed of in such a way as to ensure that data cannot be retrieved or recovered. Ensure that confidential data is rendered unreadable or unrecoverable.

2. SERVER VIRTUALIZATION TARGETS, ROADMAP/SEQUENCING BY AGENCY

APPLICATION SERVERS

One of the first assumptions made in the virtualization of servers is those servers that have already been virtualized should be removed. Of the 784 servers 57 had already been virtualized, thereby leaving 727 servers available for virtualization. Of the 727 servers that are available, 399 were identified as application servers.

Total servers:	784
Already virtualized	-57
Available:	727

727 Available
399 Application servers
308 Utility servers
20 Other servers

Of the 399 application servers 91 had a server complexity of high and were removed from consideration. An assumption was made that approximately 43% of the blank servers were considered high and 98 were removed. This left 210 servers. There were 83 servers that were identified as either medium or low servers and we assumed 57% or 127 blank servers were also considered medium or low servers.

399 Application servers
91 High complexity servers
98 High complexity blank complexity servers
127 Medium/low blank complexity servers
83 Medium/low complexity servers
210 Servers

Of these 210 application servers, 114 were application servers, 53 database servers, 2 middleware servers, 22 web servers, and 19 other servers.

210
114 Application servers
53 Database servers
2 Middleware servers
22 Web servers
19 Other servers

The following assumptions for application servers are identified and should be taken into consideration during subsequent reviews and analysis on server virtualization:

- High complexity application servers were not considered candidates for virtualization.
- All server virtualization candidates are required to be looked at individually to determine whether or not a successful virtualization can be done. Analysis should include application complexity, storage requirements, memory requirements, CPU usage, utilization, OS and application compatibility, application interconnect ability, disaster recovery requirements, and resource support
- Lower operating systems (i.e. Windows 2000, Windows 2003) can be upwardly migrated/consolidated successfully. (Over 90% of the application servers are Windows 2003, with the remaining being a mix of Windows types)
- Database servers can be consolidated even with different databases being combined

APPLICATION AND UTILITY SERVER VIRTUALIZATION FILTER

The following steps were applied to the server list to determine which servers were candidate for virtualization:

- Started with the consolidated data collection server list from each agency
- Kept servers only - removed all peripherals from server list
- Kept physical servers only – remove servers that are already virtualized from list

- Complexity – remove High complexity – keep med & low – combined in % of blanks
  - Separate by Function (utility & application)
    - Application
      - Sort remaining into
        - Application
        - Database
        - Web server
        - Middleware
    - Utility
      - Sort remaining into
        - File/print server
        - E-mail
        - Other
- Applied 8:1 consolidation ratio

UTILITY SERVERS

One of the first assumptions made in the virtualization of servers is those servers that have already been virtualized should be removed. Of the 784 servers 57 had already been virtualized, thereby leaving 727 servers available for virtualization. Of the 727 that are available, 308 were identified as utility servers.

Total servers:	784
Already virtualized	- 57
Available:	727

727 Available
399 Application servers
308 Utility servers
20 Other servers

For the 308 utility servers, the most likely candidates for consolidation are file/print and E-mail servers. Of the 308 utility servers 23 had a server complexity of high and were removed from consideration. We assumed approximately 47% of the blank servers were considered high servers and removed 93 of them. This left 192 servers. There were 70 servers that were identified as either medium or low complexity servers and we assumed approximately 57% or 122 blank servers were also considered medium or low complexity servers.

308 Utility servers
23 High complexity servers
93 High blank servers
70 Medium/low complexity servers
122 Medium/low blank servers
192

Of these 192 utility servers, 65 were file/print servers, 4 E-mail servers, and 123 other servers.

192
65 File/print servers
4 E-mail servers
123 Other servers (domain, backup, etc.)

The following assumptions for utility servers are identified and should be taken into consideration during subsequent reviews and analysis on server virtualization:

- All server virtualization candidates are required to be looked at individually to determine whether or not a successful virtualization can be done. Analysis should include application complexity, storage requirements, memory requirements, CPU usage, utilization, OS and application compatibility, application interconnect ability, disaster recovery requirements, and resource support
- Lower operating systems (i.e. Windows 2000, Windows 2003) can be upwardly migrated/consolidated successfully.

ENTERPRISE VIRTUALIZATION

Server virtualization is determined by a number of factors and attributes of the current server environment. These factors and attributes either allow or prevent the virtualization from occurring. TPI has estimated the amount of virtualization the State of Vermont might realize for its current server environment. These estimates are based on a number of assumptions and exclusions that are identified and will affect the total number of possible virtualizations. The enterprise virtualization approach is based upon the consolidation approach with the exception that virtualization does not filter on the operating system (i.e. Wintel, UNIX)

Of the 784 servers that were identified, 57 of the servers have already been virtualized, and would not be candidates for virtualization; leaving 727 servers that could be virtualized.

The 727 servers were then divided by the server type. The two possible server types are application servers (which are comprised of application, database, middleware, or web) and utility servers (file/print, E-mail, and other). There are 399 application servers, 308 utility servers, and 20 others (not identified).

Server Complexity	Low & Medium				High				Blank				Total				
Function	*Application*	*Utility*	*Other*	*Total*	*Application*	*Utility*	*Other*	*Total*	*Application*	*Utility*	*Other*	*Total*	*Application*	*Utility*	*Other*	*Total*	*% of Total*
Application	43	0	0	**43**	52	0	0	**52**	124	0	0	**124**	219	0	0	**219**	30%
Database	30	0	0	**30**	19	0	0	**19**	41	0	0	**41**	90	0	0	**90**	12%
Middleware	1	0	0	**1**	7	0	0	**7**	3	0	0	**3**	11	0	0	**11**	2%
Web Server	9	0	0	**9**	13	0	0	**13**	23	0	0	**23**	45	0	0	**45**	6%
File/Print	0	26	0	**26**	0	9	0	**9**	0	69	0	**69**	0	104	0	**104**	14%
Email	0	0	0	**0**	0	1	0	**1**	0	8	0	**8**	0	9	0	**9**	1%
Other	0	44	1	**45**	0	13	0	**13**	34	138	19	**191**	34	195	20	**249**	34%
Total Servers	83	70	1	**154**	91	23	0	**114**	225	215	19	**459**	399	308	20	**727**	**100%**
% of Total				21%				16%				63%				100%	

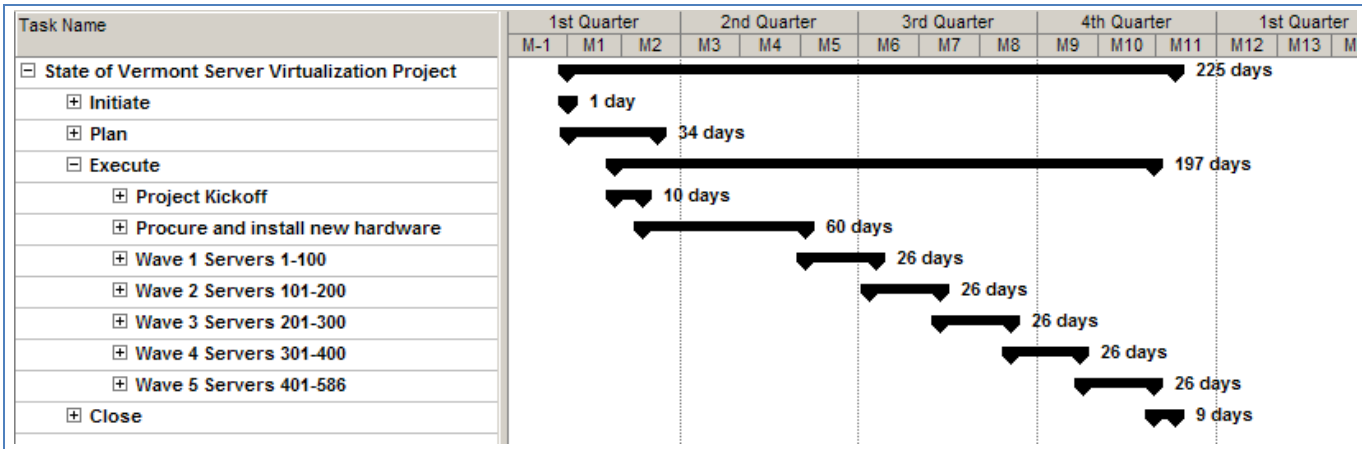
AGENCY VIRTUALIZATION

Agency virtualization should be approached using the same algorithm as described in the "Enterprise Virtualization" section, but selecting the server population from the originally submitted asset listing of servers identified during the data collection phase. Additional assumption and/or exclusions might be necessary to further refine the list of possible virtualization candidates, but the agency would be in the best position to make these decisions based on their profound knowledge and understanding of the assets themselves and the associated hosted applications. TPI has created the charts that represent the number of possible server virtualization candidates based on the aforementioned enterprise virtualization approach.

Server Virtualization Summary Target Ratio: 8 to 1						
Agency Level Virtualization	*Starting # of Servers*	*Virtualized Servers*	*Non-Virtual Servers*	*Servers Avail. For Virtualization*	*Servers: Eliminated*	*Total Servers: After*
DII	160	24	136	50	41	119
Agency of Agriculture	1	0	1	1	0	1
ACCD	0	0	0	0	0	0
Agency of Human Services	110	13	97	71	60	50
Agency of Natural Resources	24	3	21	15	12	12
Agency of Transportation	206	5	201	103	88	118
Attorney General	7	0	7	7	3	4
Auditors Office	0	0	0	0	0	0
BISHCA	12	0	12	5	3	9
Defender General	0	0	0	0	0	0
Dept. of Labor	69	0	69	44	36	33
Dept. of Public Safety	80	0	80	44	33	47
Dept. of Taxes	24	10	14	9	6	18
E911 Board	27	0	27	2	0	27
Education	34	0	34	19	16	18
Legislature	7	2	5	1	0	7
Liquor Control	9	0	9	9	5	4
Lottery Commission	3	0	3	2	0	3
Military Department	11	0	11	11	7	4
Natural Resources Board	0	0	0	0	0	0
Public Service Department	0	0	0	0	0	0
State Attorneys and Sheriffs	0	0	0	0	0	0
Total Servers	784	57	727	393	310	474
Enterprise Level Virtualization	784	57	727	402	347	437
Add'l Srvrs Virt. @ State Level			37		8% More	

A greater number of servers can be virtualized using a state wide approach as opposed to an agency by agency approach. Even though this is the case, TPI used the agency level approach (totals) in the business case to provide a more conservative view.

2.1 GANTT CHARTS



2.2. LIFECYCLE COST MODEL ESTIMATES

Server Virtualization - First Year Costs				
	Current	Virtualization	Savings	% Savings
Total Server Count	393	83	**310**	**79%**
Annual IT Capital Costs				
Server Hardware	$2,819,069	$640,884	**$2,178,185**	**77%**
Software Licenses	$373,350	$79,202	**$294,148**	**79%**
Server Storage	$21,000	$63,700	**($42,700)**	**n/a**
Server Networking	$43,973	$9,328	**$34,645**	**79%**
Total Annual IT Capital Costs	$3,257,391	$793,113	**$2,464,278**	**76%**
Annual IT Operating Cost				
Server Power and Cooling	$0	$0	**$0**	**n/a**
Data Center Server Space	$13,800	$39,566	**($25,766)**	**n/a**
Data Center Server Provisioning	$48,124	$0	**$48,124**	**100%**
Server Administration	$1,489,545	$695,121	**$794,424**	**53%**
Total Annual IT Operating Costs	$1,551,468	$734,687	**$816,781**	**53%**
Total Annual IT Capital & Operating Costs	$4,808,860	$1,527,801	**$3,281,059**	**68%**
IT Capital Costs - Virtualization Project				
Virtualization Software License Fees		$548,572		
Virtualization Software Licenses Annual Maint.		$109,714		
Total Virtualization Project IT Capital Costs		**$658,287**		
IT Operating Costs - Virtualization Project				
Implementation Costs (Design, Plan, Deploy)		$899,184		
Virtualization Software Training		$58,500		
Total Virtualization Project IT Operating Costs		**$957,684**		
Total Investment Costs		$1,615,971	**($1,615,971)**	**n/a**
Total Server Virtualization Costs	**$4,808,860**	**$3,143,771**	**$1,665,088**	**35%**

Cost Summary - Five Year	Current	Virtualization	Savings	% Savings
Total IT Capital Costs	$18,002,928	$4,438,551	$13,564,377	**75%**
Total IT Operating Costs	$8,604,900	$4,117,747	$4,487,153	**52%**
Total IT Capital & Operating Costs	$26,607,829	$8,556,298	$18,051,530	**68%**
Total Virtualization Project IT Capital Costs	$0	$548,572	($548,572)	**n/a**
Total Virtualization Project IT Operating Costs	$0	$1,562,598	($1,562,598)	**n/a**
Total Investment Costs	$0	$2,111,171	($2,111,171)	**n/a**
Total Server Virtualization	**$26,607,829**	**$10,667,469**	**$15,940,359**	**60%**

Server Virtualization Summary

Server Configuration Summary

Servers Before Virtualization	393	servers
Servers After Virtualization	83	servers
Target Virtualization Ratio	8	to 1

Financial Summary - One Year View

Current Costs (Operating & Capital)	$4,808,860	recurring
New Cost (Operating & Capital):		
Virtualization Investment	$1,615,971	one-time
Virtualization Recurring Costs	$1,527,801	68% Savings
Total Virtualization Costs	$3,143,771	
Total Virtualization Savings	$1,665,088	35% Savings
Return on Investment (ROI)	103%	

First Year - One Time Costs

Hardware Purchase - Servers	$3,204,418	5 Year Life
Virtualization Investment	$1,615,971	
Total One Time Costs	$4,820,389	

Financial Summary - Five Year View

Total - Five Year ROI	755%	
Total investment	$2,111,171	
Projected Capital Savings	$13,015,805	72% Savings
Projected Operating Savings	$2,924,555	34% Savings
Total 5 Year Savings	$15,940,359	60% Savings
Annual Recurring Savings	66%	by 2nd year
Total 5 Year Savings	60%	
Net Present Value (NPV) @ 6%	$13,112,341	
Payback Period	< 1	Year(s)

▼ Financial Summary ▼	Year 1			Year 2	Year 3	Year 4	Year 5	
	Initial	Ongoing	Total	Ongoing	Ongoing	Ongoing	Ongoing	Total
Virtualization Project Investment	$1,506,256	$109,714	$1,615,971	$115,000	$120,632	$126,648	$132,920	$2,111,171
IT Capital Savings by Year	($548,572)	$2,464,278	$1,915,706	$2,581,194	$2,707,651	$2,836,829	$2,974,426	$13,015,805
IT Operating Saving by Year	($957,684)	$707,067	($250,617)	$740,921	$775,415	$811,111	$847,725	$2,924,555
Total IT Cost Savings by Year	($1,506,256)	$3,171,345	$1,665,088	$3,322,114	$3,483,065	$3,647,939	$3,822,152	$15,940,359
IT Capital Savings by Year as %			59%	75%	75%	75%	75%	72%
IT Operating Cost Saving by Year as %			-16%	45%	45%	45%	45%	34%
Total IT Cost Savings by Year as %			35%	66%	66%	65%	65%	60%
Cumulative Savings			$1,665,088	$4,987,203	$8,470,268	$12,118,207	$15,940,359	

2.2.1. SERVER VIRTUALIZATION ROI CALCULATIONS AND POTENTIAL FOR TECHNOLOGY RELATED SAVINGS

The Return on Investment (ROI) formula is calculated as follows:

ROI = (net dollar value of savings ÷ dollar value initial project investment)

Here are the calculations for the State of Vermont's server virtualization project the calculation: * see note

	First Year	Five Years
Savings:	$1,665,088	$15,940,359
Investment:	$1,615,971	$2,111,171
ROI:	net savings / investment	net savings / investment
Server Virtualization ROI:	103%	755%

* Note : Although the ROI calculation provides a quick view on a project's return, other financial indicators, such as net present value, should also be included in the decision making process.

2.3. VIRTUAL DATA SECURITY AND RECOVERY

Security strategies for virtualized servers are similar but not the same for physical server environments. Physical server environment rely on physical isolation and segmentation of information and systems.

In virtual environments, however, information and infrastructure are more dynamic and fluid. For example, entire virtual machines can be moved from one physical server to another. While this provides significant benefits in terms of efficiency and optimization, it can also reduce the segmentation afforded by physical separation

The proper approach to understanding the security requirements within a virtualized environment need to take the following 3 steps:

1. Assess and Understand Risks - In order to understand the security implications of implementing virtual strategies and technologies, organizations must systematically analyze the virtual environment to discover and classify all information assets, document existing security controls, determine vulnerabilities within the system and identify viable threats.

2. Secure Virtual Infrastructure - The goals of securing the virtual infrastructure include ensuring the security of the virtualization platform. It's important to validate that hardware vendors develop secure virtual platforms and deliver timely patches. It's also critical that organizations validate that their current controls continue to function when deployed on virtualized resources, and then expand those controls to secure the virtual infrastructure, including the management interfaces.

3. Leverage Virtual Infrastructure - Leveraging the virtual infrastructure enables organizations to take advantage of the unique characteristics of the virtual layer to both optimize security and improve productivity.

For example, security solutions can be deployed as a virtual application within a virtual server and these applications can monitor data as it moves within virtual machines. An example of a virtual security solution could be a virus detection application that would follow data across logical components of a virtual environment. This tracking is unlike a non-virtualized solution that would be incapable of monitoring this data because it is limited to travel from and to a physical device.

Virtual machines are often pooled together on physical resources. While it's important that virtual applications are properly segmented, the benefit of centralization is that it allows the efficient deployment of patches and updates to many virtual machines. If leveraged correctly, the virtual infrastructure allows organizations to deploy security controls in a scalable manner that is generally impossible or impractical in the physical world.

3. ANALYSIS OF AGENCIES/DEPARTMENTS' SERVER POLICY/PROCEDURE AND IMBEDDED TOOLS AND TECHNOLOGIES TO BE LEVERAGED AND EXIST IN FUTURE STATE

Formal policies and procedures for infrastructures services with the State of Vermont are limited and in general not documented. An ITIL (Information Technology Information Library) self assessment was conducted by a majority of the agencies, and although sometimes liberal in their interpretation of compliance, still yielded scores that identified immaturity in process and control. Furthermore, interviews with both technical and business associates also identified the lack of formalized process within policies and procedures.

4. FUTURE STATE DATACENTER STRUCTURE, ASSOCIATED RISKS AND IMPLEMENTATION ROADMAP

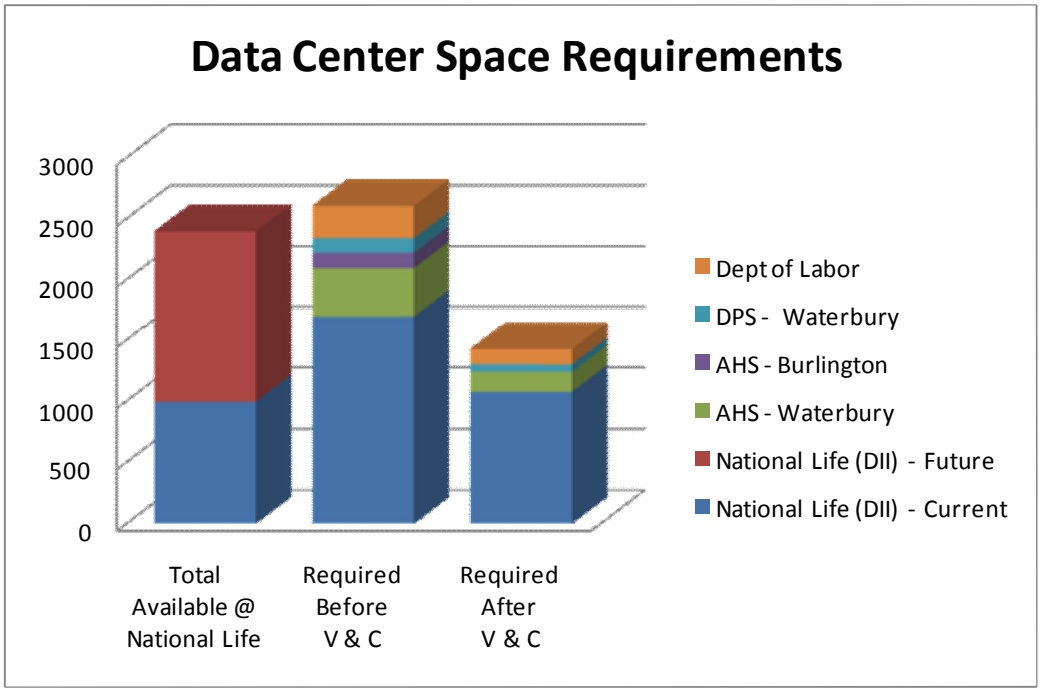
As described in the BUSINESS CASE FOR DATA CENTER IMPROVEMENT section, " In order to more adequately protect State of Vermont data and ensure that the underlying infrastructure and communication equipment is housed and maintained in a facility that provides the appropriate security and capability, TPI would recommend migrating to two data center facilities. The suggest recommendation is to utilize the National Life facility as the primary site and the Barre facility as the backup data center.

Because the National Life facility has multiple power sources, is not contained within a flood plain, and has expansion capability to accommodate the increase in computing requirements, this site would be identified as the primary site. Certain migration efforts of infrastructure are already underway, and depending upon the plans adopted by the State for server consolidation/virtualization, a plan that incorporates this migration could be developed that would minimize the risk associated with physical movement of infrastructure. In order words, instead of performing consolidation/virtualization at an existing non-primary data center and then migrating to the National Life facility, the consolidation/virtualization should be done once at the primary data center. This would eliminate the second physical move of equipment and reduce the associated risk and cost of migration.

Prior to initiating consolidation/virtualization efforts, forward looking models that identify the targeted number of devices that would be in use after consolidation/virtualization need to be developed. The mechanical, electrical, plumbing, air handling and space requirements need to be fully developed and planned for.

An analysis was conducted to determine whether or not the National Life data center has the required amount of floor space/square footage to accommodate the migration of the current agency data centers to the recommended 'Primary data center'. The National Life data center currently uses approximately 1,000 square foot of space, and can be expanded another 1,400 square feet for a total of 2,400 square feet. The current floor space requirements, assuming a certain percentage of actual floor space being used versus the amount available totaled 2,610 square feet. Therefore, there is not enough space for the current numbers of servers being hosted among the agency data centers. However, if the recommended virtualization and consolidation efforts are conducted and completed, the square foot projections are 1,431, and well within the square footage amounts available at the National Life data center.

Additionally, assets from data centers that are being closed could be relocated and utilized within the National Life data center (i.e. UPS, air handlers, etc…). The analysis does not address the potential recovery/saving of assets that might be disposed of as a result of the consolidation/virtualization.



4.1. FUTURE SERVICE LEVEL NEEDS

Service Level Agreements and performance metrics for services delivered to users is almost non-existent. One of the exceptions is the DII Customer Support Service Level Agreement that was provided as an example of the agreements established by DII for those agencies that are receiving some form of infrastructure service from DII (i.e. server hosting, file and print capabilities, E-mail hosting, etc.). Aside from this document, there were limited Service Level examples or material that was returned from the Service Level templates that were provided to all participants of the assessment. There was some information provided from a variety of 3rd party service providers that have contractual agreements in place with the Agencies. These Service Level Agreements were

however, commitments from the service providers to the Agency relative to those services being provided. These performance commitments were not to the end user, but to the contracting Agency. In almost all interviews with technical and business representatives when asked if formal service level agreements existed, the answer was "no". There may have been some metrics that are/were being collected; however, none of these were able to be provided in a documented format. The DII Support Service Level Agreement (SLA) that exists does address certain key performance indicators such as problem severity, response time, and acknowledgement time, but it is unclear whether or not certain levels of performance are contractually agreed upon by the receivers of services or if these are best effort performance indicators.

For organizations to become more customer focused; they must be able to determine whether performance is improving (or degrading). Minimum levels of performance as well as expected levels of performance need to be established, published, and tracked and monitored on a regular basis.

The more important elements of service performance involve availability, response to problems, and problem resolution. These need to be established by the provider of service (either DII or the Agency IT organization) based on current performance, but they must be adequately established to meet the needs of the business who determine what is considered an acceptable level of performance. Meetings need to be established to agree on these performance levels. Current information needs to be collected and historical data collected to be able to determine what the levels of performance are currently being provided. Process capability should be discussed to understand what the IT systems are capable of providing given their current configuration.

After the initial performance objectives have stabilized and performance delivery is providing the minimum and expected levels of performance, the introduction of additional business required metrics can be introduced. These can cover areas such as backup and recovery, service desk, incident response, change control, and project management. The areas of interest should be for those levels of performance that have a direct impact to the services that are considered the most important to the business or that reduce the risk associated with failures of performance having a negative effect on the delivery of services to the end users and customers.

4.2. OPPORTUNITIES FOR IMPROVED SYSTEMS PERFORMANCE AND CAPACITY

In order to achieve improved systems performance and capacity, it must be measured and a baseline established. Only then can improvement be measurably identified that is not purely anecdotal. Capacity in its strictest definition is the understanding of how much demand for services is required both in a current state, but also in a future state. Capacity planning is one of the ITIL process categories. The self assessment score for all agencies was 2.3 on a scale of 1 to 5. This score is an assessment of the maturity of capacity planning that exists within an organization. Although there were some agencies that self-assessed themselves higher than the 2.3, the overall average indication there is considerable room for growth and maturity in this area. With regard to systems performance and capacity planning within the data center environments, the most capable environment that is addressing the issue (from observation) is the 133 State Street data center. This was observed during discussion with the data center manager who addressed migration plans to address capacity planning requirements in the delivery of services to respective users (agencies). Furthermore, plans and blueprints were in place and being followed for the purpose of transferring and transitioning infrastructure components from the 133 State Street data center to the National Life data center facility. For those other data

centers within the assessment scope, although there may be plans to address capacity and performance issues, they seemed to be informal, addressed when the situation called for it, and ad-hoc in nature.

4.3. SPECIFIC VENDORS AND RELEVANT VENDOR POLICIES

Not applicable. Continue use of existing data center.

4.4. POTENTIAL FOR LEGAL AND REGULATORY OBSTACLES

The act of consolidating data centers by relocating assets from one data center to another, in and of itself does not create any incremental legal or regulatory obstacles. However, when the physical data center relocation is integrated with consolidation and virtualization, there are a number of issues that need to be addressed. There may need to be some security control reviews to ensure that appropriate controls are in place for confidential or sensitive information. For example, if a server consolidation is effected, and there are multiple, but separate agency applications on a single server, what are the new security controls and administrative rights for each agency's administrator? Does allowing multiple administration rights and access permission violate a security control that permits only one agency administrator to view/review the data and information? These reviews and possible changes to the security controls need to be addressed.

Many state IT organizations have adopted guidelines for security and protection of information systems from the Federal Information Security Management Act (FISMA). This federal act requires each federal agency to develop, document, and implement an agency-wide program to provide information security for the information and information systems that support the operations and assets of the agency, including those provided or managed by another agency, contractor, or other source. This means that when hosted environments change or the underlying infrastructure is altered, reviews are required to be conducted and controls affirmed to be in compliance or steps required to re-established the necessary controls and processes.

Federal, and states who have adopted FISMA as their guideline in establishing their security programs and controls, require IT management (and respectively Agency Management as defined within the State of Vermont) to:

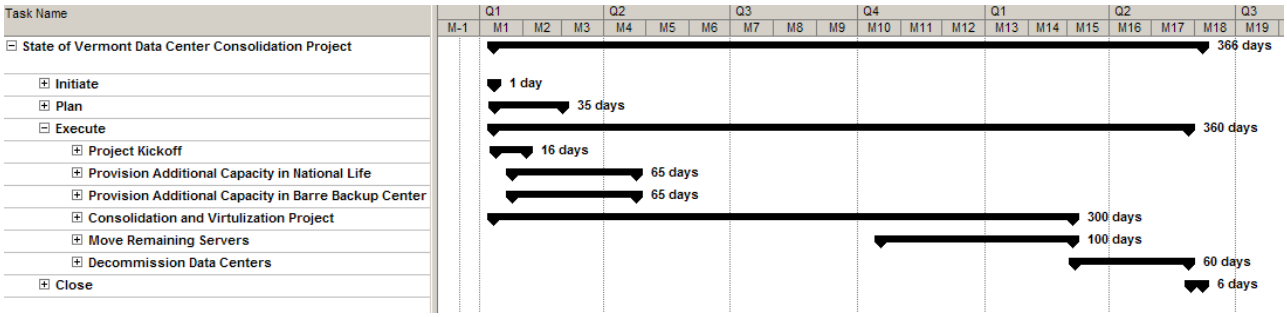
- Plan for security
- Ensure that appropriate officials are assigned security responsibility
- Periodically review the security controls in their information systems
- Authorize system processing prior to operations and, periodically, thereafter

These management responsibilities presume that responsible agency officials understand the risks and other factors that could adversely affect their missions. Moreover, these agency officials must understand the current status of their security programs and the security controls planned or in place to protect their information and information systems in order to make informed judgments and investments that appropriately mitigate risk to an acceptable level. The ultimate objective is to conduct the day-to-day operations of the agency and to accomplish the agency's stated missions with adequate security, or security commensurate with risk, including

the potential harm resulting from the unauthorized access, use, disclosure, disruption, modification, or destruction of information.

Aside from the protection and security of data that is 'at risk' due to the physical location (i.e. site located in flood zone), the migration to a primary data center located at the National Life facility, will improve the protection of data by housing the data in a higher tier level than is currently being provided. However, the adoption and subsequent review of the security policies, procedures, and controls will need to take place as a result of the migration of equipment and assets from one existing site to the preferred primary site.

5. GANTT CHARTS



6. LIFECYCLE COST MODEL ESTIMATES

There is an increase in space related charges as a result of the relocation of the data centers from State owned facilities to the National Life building.

Additional Space Cost Estimate	Low Estimate	High Estimate
Racks Requires at National Life -		
Server Racks:		
Total Number of Servers	555	555
U per Server	3.0	3.5
Total U Requirements	1,665	1,943
U per Rack	24	24
Total Server Racks Required	70	81
Mainframe Racks:		
Mainframe	3	3
Storage	1	1
2 Tape Units	4	4
SAN	4	4
Total Mainframe Racks Required	12	12
Total Racks Required at National Life	94	105
Annual Space Charges*		
Current Data Center Space	$119,900	$119,900
National Life @ $3,500/Rack	$329,000	$367,500
Additional Space Cost	($209,100)	($247,600)
Data Center Migration		
Capacity Expansion - National Life	$25,600	$30,720
Capacity Expansion - Barre	$25,600	$30,720
Server Move & Project Mgmt	$92,928	$116,160
Data Center Migration	($67,328)	($85,440)
	($276,428)	($333,040)

* Space charges include raised floor, power, cooling, common areas, etc.

7. ANALYSIS OF AGENCIES/DEPARTMENTS' DATACENTER POLICY/PROCEDURE AND IMBEDDED TOOLS AND TECHNOLOGIES TO BE LEVERAGED.

For those agencies that have data centers, there are a number of policies/procedures that are in place that protect, secure, and ensure the continued operation in support of their respective businesses. All of the data centers require controlled access through the use of an encoded badge or keypad. Additionally, some of them are also protected with lock and key entrance. Further security is enhanced by requiring persons who enter the data center to manually log in through the use of a signed manual entry log. And the highest level of automated data center access is an electronic time stamp that is recorded for each entry and exit. This highest level of

access security is provided at the DII 133 State Street, DII – Barre, and National Life. The continued use of these access policies/procedures and enhancement to any of these features is certainly encouraged and desired.

Almost all facilities have a security alarm system that protects the facility from intrusion. Also, all facilities have security cameras located at either the entrance to the facility or at the data center entrance. These cameras allow an additional level of security in determining that only authorized persons be allowed entrance to the data center. In some cases there are two or more cameras, auditing multiple entry points near the facility. This is ideal and all data centers should strive to incorporate multiple cameras for security purposes. Additionally, almost all do not have external signage that indicates there is a data center within the facility. This is extremely important to protect the data, equipment, and resources within these sites by not publically advertising their existence.

We have already addressed the current levels of disaster recovery processes that exist within the in-scope agencies, but it is worth note to address them at the data center level. There are some policies and processes in place for the protection of assets and data within the respective data centers; however, the only disaster recovery site that has been uniquely established as a backup site for the DII – 133 State Street data center is the DII Barre site. The Barre site is configured as a backup site and would be used in the event of a disaster declaration at the DII – 133 State Street site. The remaining data centers do not have formal backup sites to be used in the event of a disaster declaration from the primary site, and as such the data and business support is at risk. Consideration and an identification of an alternate site needs to be determined as soon as possible, and disaster recovery plans need to be finished and tested effectively.

8. CLOUD COMPUTING INFRASTRUCTURE RECOMMENDATIONS

Cloud computing is an IT infrastructure in which dynamically shared computing resources are accessed as a service over the internet. This new technology replaces the traditional data center model in which companies both own and manage stand-alone hardware and software systems or outsource the data center to service providers who deliver IT services using this same model. This technology transition presupposes that users of cloud computing are more concerned with services that can be performed (as well as the variable demand/consumption capabilities) than the underlying technologies used to deliver requested services.

The underlying architecture is a massive network of scalable interconnected cloud servers which store data and software and uses virtualization to optimize computing power per server. Cloud computing can be hosted within a Service Provider's environment (cloud) or a separate environment (private cloud) can be created behind a firewall to allow completed control by the user.

Within the server environment, there are a number of both large and small service providers who have developed the dynamically shared computing resources, referred to a "cloud computing". The most common use and service today in the data center infrastructure space are for resizable compute capacity that is designed to make web-scale computing easier for developers.

This service allows a customer to obtain and configure capacity with minimal effort. It claims to allow a customer complete control of computing resources, reduce the time required to obtain and boot new server instances to minutes, and quickly scale capacity up and down, as computing requirements change. These

services provide the ability to pay only for capacity that you actually use. There are also development tools to build failure resilient applications and reduce the number of failure scenarios that exist in a traditional infrastructure environment.

There are many Service Providers who have the capability in the marketplace to provide cloud computing services; however, there are a number of advantages and disadvantages that must be looked at when exploring the use of this technology.

These offerings are primarily directed at the server environment and are particularly well suited for application development environments where flexibility, elasticity, and scalability are required for the rapid development of applications. The ability to leverage a development environment for a short period of time without significant capital investments is attractive to not only well established application development groups, but those who have to meet the rapid demands of application development and/or change due to pressing user requirement changes. This is certainly of interest to support teams who have to modify applications based on legislative mandates or major enhancement requirements.

ADVANTAGES

Cloud computing enables cost savings, easier access for users, shorter time-to-use for applications and other changes, and enhanced service delivery reliability

Faster time to market:

- Clouds can provide an almost immediate access to hardware resources
- No upfront capital investments for users
- Cloud computing can lower IT barriers to innovation and increase interoperability between disjoint technologies

Lower upfront IT costs

- Pay-per-use billing reduces upfront costs

Easier to scale-out

- Enterprises of all sizes can scale their services in correlation with client demand

Reduced Operational Support

- Capacity planning and demand management are addressed more rapidly and with narrower margins of error

OBSTACLES AND CONCERNS

- Depending on the size and structure of your IT organization it may be more cost effective to purchase and support your own servers
- Storing large amounts of data about users' identity and preferences is likely to raise new concerns about privacy protection. Therefore, private clouds may need to be established, generally with higher cost structures than shared public environments. Agencies will need to standardize their requirements on issues like security and privacy to gain the benefits of cloud computing
- Statutes and regulations may require that facilities and equipment are located only in the United States

CLOUD COMPUTING AND GOVERNMENT

Government entities are likely to choose a mix of commercial and private cloud services as the concept evolves. These decisions will revolve around the importance and sensitivity of data and applications. Information that may be public in nature, that's not classified or sensitive, are good candidates for cloud computing.

Business-critical applications should be maintained internally so that the environment can be controlled.

Support function / applications are good candidates to put in a vendor based cloud.

Information that may be classified in nature would have to be retained on infrastructure that is government owned and operated. Because of this sensitivity, some applications will remain on government servers for the foreseeable future.

PRICING

Most cloud-based services use a pay-as-you-go pricing model, charging your business based on usage. There is usually a one-time entry payment that accompanies the pay-as-you-go pricing model. Additionally, using the cloud is an ongoing operating expense—similar to a utility or subscription. Over the long term, the business may spend more on the cloud-based service than the outright purchase and support of the software or hardware. The cloud service could also raise rates or add fees, just like a utility or subscription, and some providers have a laundry list of costs for add-on services. There is also a new concept of pricing that has come into existence recently. This eBay style service will let users bid on unused virtual server capacity, and the price of this cloud-based server capacity changes based upon supply and demand, unlike the usual fixed prices for server instances.

A pricing example for one month of service from a large cloud computing service provider with the following environment characteristics:

- A pre-configured, template image
- Security and network access on the utilized instance

- Choice of instance type(s) and operating system
- Utilization of a static IP endpoints
- Pay only for the resources that you actually consume

For a server utilizing 700 GB of storage per month, 80 GB per month of data transfer in, 2000 GB per month of data transfer out, 60,000 requests (entries into the application) the monthly service fee is $1,662 per month.

The average amortized cost of a standard server is $3142/year or $262 month.

The State of Vermont's average server support costs is $382/month.

Therefore, the State of Vermont's fully burdened costs for a standard server is $644 per month which is significantly below the standard cloud computing server pricing.

RECOMMENDATIONS

The conclusion is that cloud computing does not look attractive as an alternative at this time. The State should continue to watch this area as pricing will change as the products on the market become more mature.

The State of Vermont might be able to take advantage of the features of cloud computing as part of their application development services, particular when development is needed quickly. The establishment of an environment based on user instances can be rapidly created and most importantly when the development has been completed the environment goes away.

It is also important to understand that long term usage of a cloud computing environment becomes unattractive when the cost of the services becomes greater than the initial capital outlay and ongoing support costs that would have been incurred should the environment been created in-house.

Given these development characteristics that take advantage of the benefits offered by cloud computing, the State would need to make decisions based upon the realistic timeframes required to complete application development work. When the time frames are stringent and short, the use of the environment would be effective. When the time frames are longer and enter the realm of long term support models, the cloud computing environment is most likely not cost efficient.

PHASE 2 - NETWORK ASSESSMENT - CURRENT STATE

The scope of Phase 2 includes the review of the State's Wide Area Networks (WANs) and Local Area Networks (LANs).

1. ANALYSIS OF CURRENT STATE OF WAN INCLUDING LANS AND CARRIER ATTRIBUTES

For the most part, all agencies and departments obtain their Wide Area Network connectivity through one source, GovNet. The exception to this is the following areas: Public Service, E911, Department of Transportation and Department of Tax. Each of these areas operates their own WAN or portions of their own WAN in combination with the use of GovNet. During the assessment it was explained by these areas what the rational was for not having all networks supported within the GovNet structure. The following reasons were provided: a) funding sources such as Federal or special grants that require the equipment or funds to be dedicated to one specific area and not shared, b) additional security requirements necessitate total separation from other areas on the network, and c) the need to have a greater level of operational support than what GovNet offers/provides.

All areas purchase their circuits from the State contacts.

GovNet is operated and supported by the Department of Information and Innovation (DII). Four (4) DII staff make up the centralized support team.

GovNet provides the wide area network connectivity between agency and department locations across the State. GovNet does not typically provide or directly support the local area networks (LANs) within each building. It is the responsibility of each agency/department to support the LANs within their buildings including all related patching for these LANs. The DII support demarcation point at these building is typically the router located at the site and back into the network cloud.

NETWORK PROTOCOLS

Transmission Control Protocol/Internet protocol (TCP/IP) is the only LAN protocol in use on GovNet. As for the WAN transport protocols both frame relay and Asynchronous Transfer Mode (ATM) protocols are in use.

INTERVIEW FEEDBACK

During the interview process specific network related questions were asked of end users with the intent to obtain a general sense of user satisfaction with GovNet and DII network services. The following generalizations were collected during the interview phase of the assessment. This type of feedback is normally indicative of problem areas but care needs to be taken with how these statements are used as they do not represent formal data collected from customer surveys.

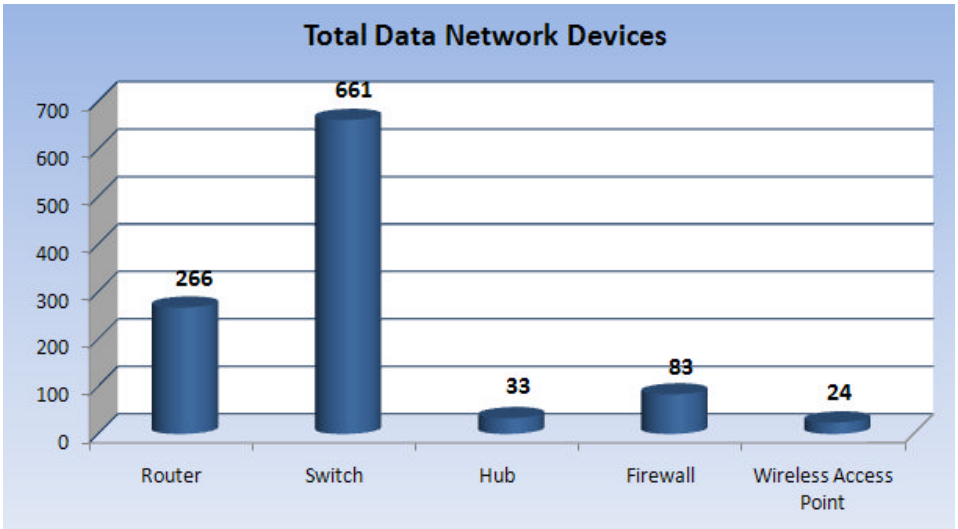
- When asked about network responsiveness, no users reported network response time problems

- A couple of agencies indicated that outages at remote sites had been a problem in the past
- No issues were reported with voice services
- A couple of agencies indicated that they would like DII to take over all WAN circuit tracking and billing
- A few agencies indicated that it took a long time to obtain network engineering and firewall services for project related work from DII

NETWORK DEVICES

The following graph shows the total count of network devices being operated across all agencies/departments.

Graph 1 – Total Data Network Devices



The next table shows a breakout of the type and count of network devices that each agencies/departments has installed and manages.

Total Data Network Devices

State of Vermont: Total Data Network Devices

Agency	Router	Switch	Hub	Firewall	Wireless Access Point	Total Devices
Agency of Admin (Exc. Tax)	104	166	0	12	2	284
Agriculture	0	5	0	0	0	5
ACCD	0	0	0	0	0	0
AHS	0	197	0	0	0	197
ANR	0	23	0	0	0	23
Transportation	19	126	33	41	20	239
Attorney General	0	3	0	2	0	5
Auditors Office	0	0	0	0	0	0
BISHCA	0	0	0	0	0	0
Defender General	9	13	0	0	0	22
Dept. of Labor	7	17	0	2	0	26
Public Safety	94	29	0	5	0	128
Dept. of Taxes	0	20	0	3	0	23
Enhanced 911	31	26	0	4	0	61
Education	0	0	0	0	0	0
Legislature	0	13	0	1	0	14
Liquor Control	1	3	0	1	1	6
Lottery Comm.	1	2	0	7	0	10
Military Dept.	0	18	0	5	1	24
Natural Resources	0	0	0	0	0	0
Public Services	0	0	0	0	0	0
State's Attorneys	0	0	0	0	0	0
Total Data Network Devices	**266**	**661**	**33**	**83**	**24**	**1,067**
% of Total	25%	62%	3%	8%	2%	100%

AGE OF NETWORK DEVICES

One of the aspects that the assessment reviewed was the age of the network devices. As devices age they require additional support, fail more frequently, are no longer supported by manufacturers and do not have the functionality and capabilities to support the latest applications. The typical useful life span for network devices is from 5 to 7 years before they become obsolete and needs replacement.

Below you will find tables that show the average age by network device type.

Routers by Years in Service

Agency / Routers	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7+*	*No Age Provided*	*Total Devices*
Agency of Admin (Exc. Tax)	0	0	0	0	0	0	0	0	104	104
Transportation	0	0	0	0	4	0	0	1	14	19
Defender General	1	0	7	0	0	0	0	1	0	9
Dept. of Labor	1	0	3	1	2	0	0	0	0	7
Public Safety	0	0	3	0	0	91	0	0	0	94
Enhanced 911	0	0	0	31	0	0	0	0	0	31
Liquor Control	0	0	0	0	0	0	1	0	0	1
Lottery Comm.	0	0	0	0	1	0	0	0	0	1
Total	**2**	**0**	**13**	**32**	**7**	**91**	**1**	**2**	**118**	**266**
% of Total	1%	0%	5%	12%	3%	34%	0%	1%	44%	100%

- For those router devices where the age was available, 64% are 5 years or older and have an average age of 4.1 years
- Department of Public Safety has a large number of routers that are 5 years and older

Switches by Years in Service

Agency / Switches	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7+*	*No Age Provided*	*Total Devices*
Agency of Admin (Exc. Tax)	0	0	0	0	0	0	0	0	166	166
Agriculture	0	5	0	0	0	0	0	0	0	5
AHS	73	3	8	81	32	0	0	0	0	197
ANR	1	6	9	2	3	1	0	0	1	23
Transportation	5	0	15	8	5	0	0	55	38	126
Attorney General	0	0	1	1	0	0	1	0	0	3
Defender General	3	0	0	7	1	0	0	2	0	13
Dept. of Labor	0	17	0	0	0	0	0	0	0	17
Public Safety	0	0	0	0	0	29	0	0	0	29
Dept. of Taxes	0	0	0	0	20	0	0	0	0	20
Enhanced 911	0	0	0	26	0	0	0	0	0	26
Legislature	2	0	3	8	0	0	0	0	0	13
Liquor Control	0	1	0	0	2	0	0	0	0	3
Lottery Comm.	1	0	0	0	1	0	0	0	0	2
Military Dept.	2	6	1	0	1	3	0	0	5	18
Total	**87**	**38**	**37**	**133**	**65**	**33**	**1**	**57**	**210**	**661**
% of Total	13%	6%	6%	20%	10%	5%	0%	9%	32%	100%

- For those switch devices where the age was available, 20% are 5 years or older and have an average age of 3.1 years
- The Department of Transportation has a significant number of switches that are 7 years old or greater

Hubs by Years in Service

Agency / Hubs	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7+*	*No Age Provided*	*Total Devices*
Transportation	0	0	0	0	0	0	0	23	10	33
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**23**	**10**	**33**
% of Total	0%	0%	0%	0%	0%	0%	0%	70%	30%	100%

- For those hub devices where the age was available, 100% are 7 years or older

Firewalls by Years in Service

Agency / Firewalls	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7+*	*No Age Provided*	*Total Devices*
Agency of Admin (Exc. Tax)	0	0	0	0	0	0	0	0	12	12
Transportation	0	8	2	5	4	0	0	1	21	41
Attorney General	0	0	1	0	0	0	0	0	1	2
Dept. of Labor	0	0	0	0	0	0	2	0	0	2
Dept. of Taxes	0	0	2	1	0	0	0	0	0	3
Enhanced 911	0	0	0	4	0	0	0	0	0	4
Legislature	0	1	0	0	0	0	0	0	0	1
Liquor Control	0	0	0	0	0	0	0	1	0	1
Lottery Comm.	6	0	0	0	0	0	1	0	0	7
Military Dept.	0	1	3	0	0	1	0	0	0	5
Total	**6**	**10**	**8**	**13**	**4**	**3**	**3**	**2**	**34**	**83**
% of Total	7%	12%	10%	16%	5%	4%	4%	2%	41%	100%

- For those firewall devices where the age was available, 16% are 5 years or older and have an average age of 2.7 years

Wireless Access Points by Years in Service

Agency / Wireless Access Points	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7+*	*No Age Provided*	*Total Devices*
Agency of Admin (Exc. Tax)	0	0	0	0	0	0	0	0	2	2
Transportation	0	0	10	0	5	0	0	0	5	20
Liquor Control	0	0	0	1	0	0	0	0	0	1
Military Dept.	0	0	1	0	0	0	0	0	0	1
Total	**0**	**0**	**11**	**1**	**5**	**0**	**0**	**0**	**7**	**24**
% of Total	0%	0%	46%	4%	21%	0%	0%	0%	29%	100%

- For those Wireless Access Point devices where the age was available, 0% are 5 years or older and have an average age of 2.6 years

TELECOM CARRIERS

The primary telecom carriers used by the State are:

- FairPoint Communications
- Level 3 Communications
- Telephone Operating Company of Vermont (d/b/a FairPoint Communications)
- Vermont Telephone Company (VTEL)

TELECOM CONTRACTS

The State recently completed relegating contracts with the following network providers:

- FairPoint Communications – for Voice Service – Contract #15601
- FairPoint Communications – for Data Network Services - Contract #15638
- Level 3 – for Enhanced Toll Free Services - Contract #14876

The State in the process of renegotiated contracts with the following network providers:

- Burlington Telecom
- Vermont Telephone – VTEL – Voice Service
- Vermont Telephone – VTEL – Data Services
- Level 3 – for Data Services
- Verizon Business – for Calling Cards service

TPI reviewed the service and operational aspects of the three recently negotiated contracts and have summarized the findings in the below tables. Note that TPI is not a law firm and cannot provide feedback regarding the terms and conditions of these contracts.

Contract Review Summary for Telephone Operating Company of Vermont (FairPoint) Contract #15601		
Contract Area	**What is in the contract**	**TPI Comments**
Type of Services	Voice Centrex Service and related voice services	--
Effective date	August 31, 2009	--
Term	2 years	--
Contract extension possible	Yes	Two one year periods at the discretion of the State
Installation fees for services	No	--
Early termination fees for services	Yes – if service terminated within the first 12 months - prorated	Common approach used by service providers to recover installation costs for early terminate services
Pricing	Overall Contract does provide favorable pricing for base services (such as voice Centrex, business lines and related features). Per minute fees are in-line with market with the exception of calling card per minute rates	Calling card per minute rates high
Service Levels	No	
Notes	1. Supplier must provide a dedicated account / support team	

Contract Review Summary for FairPoint Communications – for Data Network Services Contract #15638		
Contract Area	**What is in the contract**	**TPI Comments**
Type of Services	Data Network Services	Nice array of services included
Effective date	September 30, 2009	--
Term	2 years	--
Contract extension possible	Yes	Two one year periods at the discretion of the State
Installation fees for services	No for base services – yes for special services	Normal
Early termination fees for services	Yes – if service terminated within	Common approach used by service

	the first 12 months - prorated	providers to recover installation costs for early terminated services
Pricing	Overall, contract does provide favorable pricing – ATM DS1 pricing slightly high	
Service Levels	Yes – starts Q1 2010 – monthly reporting covers availability, latency, delivery and throughput	Good set of SLAs but limited service credits with many of the SLAs so impact/incentive to correct issue for Service Provide many be limited
Notes	1. FairPoint has the right to change, amend or revise service level agreement at their discretion. This is not what is typically seen in the market.	

Contract Review Summary for Level 3 – for Enhanced Toll Free Services **Contract #14876**		
Contract Area	**What is in the contract**	**TPI Comments**
Type of Services	Interstate and Intrastate Toll Free Services	--
Effective date	June 1, 2009	--
Term	3 years	--
Contract extension possible	Yes	Two one year periods at the discretion of the State
Installation fees for services	No – all one time fees waived	
Early termination fees for services	No	
Pricing	Overall, contract provides favorable pricing. Pricing includes migration from existing providers. All installation fees for toll free lines waived. Rates are capped for duration of the contract	Fixed charges are billed in advance and usage charges in arrears.
Service Levels	No	Normal for toll free services
Notes	None	

SERVICES AND OPERATIONAL REVIEW

TPI assessed the wide area and local area network operational services provided by DII to what is typically offered in the market by comparable network teams. The below table summarizes the findings of the review.

Area or Type of Service Typically Offered	Performed by DII	TPI Comments
Domain name services	Y	
IP Address/subnet assignments	Y	DII serves as the overall administrator for the States IP addresses. Larger agencies are provided a range of IP addresses to manage on their own – this is a normal practice
Firewall management	Y	
Intrusion detection	Y	
Mail gateway service	Y	
Multi-factor authentication	N	Not a standard service offered by DII – TPI generally only finds this service provided to high security organization – it may be applicable to some agencies and DII may want to consider adding this service if demand exists
Manage Internet connectivity	Y	
Network consulting and design support	Y	DII is able to provide a wide array of these services to other agencies and departments across the State
Network capacity planning	N	No reports provided or observed
Network Monitoring	Y	Use Solarwinds as primary tool for network management and monitoring
Network reporting	N – limited	DII has published a target of 99.99% up time but no reporting on actual uptime observed
Network modeling	N	This is not a big issue as the State of Vermont network is not large and complex enough to warrant the need for modeling
Network Change management process	Y	Review by peers with manager signoff – notice in Footprints
Maintain master list of all circuits used be state	N	Some form of circuits inventory is kept in spreadsheets but does not appears to be up to date
Help desk support – 2nd and/or 3rd level support	Y	

Area or Type of Service Typically Offered	Performed by DII	TPI Comments
Trouble ticket system used	Y	Footprints - same system as other IT areas use
SSL certificate management	Y	Use GeoTrust for SSL certificates
Service levels with users	N or limited	Very few service level commitments to internal customers – DII does have and reports on the following SLAs: 1) response time to problems and 2) response time to service requests
Virtual private network access – client side	Y	
Virtual private network access – site to site	Y	
Wireless Access	Y	Planned and installed through contract with Summit Technologies – limited locations available up to this point
Video conferencing	N	DII does not support video conferencing. Correction and Judicial area support their own video
LAN support	Primarily N	Each agency supports their own LANs
Inside wire and cabling support	Y – Voice Y – LAN	Punch down of voice service is the responsibility of DII Cabling for LANs is the responsibility of DII Patching for LANs is the responsibility of each agency/department
Have selected common equipment provider	Y	Cisco used for GovNet. Agencies/departments use a variety of switch vendors for their LANs
Voice Support	Y	Provided by using Centrex service. Invoicing system used for chargeback is very old
Voice Over IP (VOIP)	Y	DII supports VOIP used in conjunction with IVR. E911 support their own VOIP for their E911 call centers
Automatic call distribution system (ACD)	Y	DII supports for Department of Motor Vehicles (within Department of Transportation), Agency of Labor, Agency of Human Services, Department of Tax
Interactive voice response (IVR) system	Y	VOIP based IVR
Statewide oversight/governance board	N	

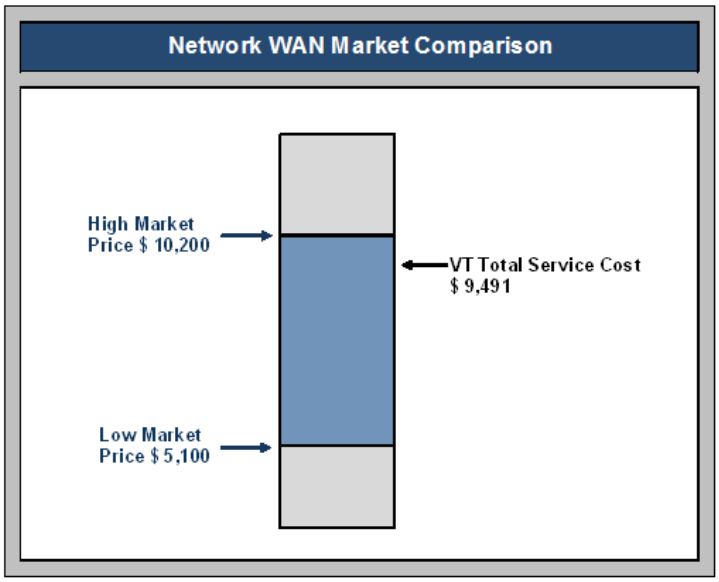
2. BUSINESS CASE FOR WAN DESIGN ENHANCEMENTS

One of the methods TPI uses to analyze how cost effective the State is at providing network services is by comparing the State of Vermont total network costs to what is available on the market. TPI has a substantial database of this information gathered from previous transactions that have been consummated within the last 18 months. These transactions included between 3-6 contracts of similar scale and scope. This information provides a comparison of the State's total network service cost against a high and low market price. For additional information on TPI's approach see the introductory section at the beginning of this document (section titled – "General comments regarding TPI's Mark to Market Comparisons")

The following chart depicts the State of Vermont network costs against the current market range.

Comparison of WAN Costs to External Market Range – costs per WAN site supported*

Managed Network Services: WAN Market Comparison

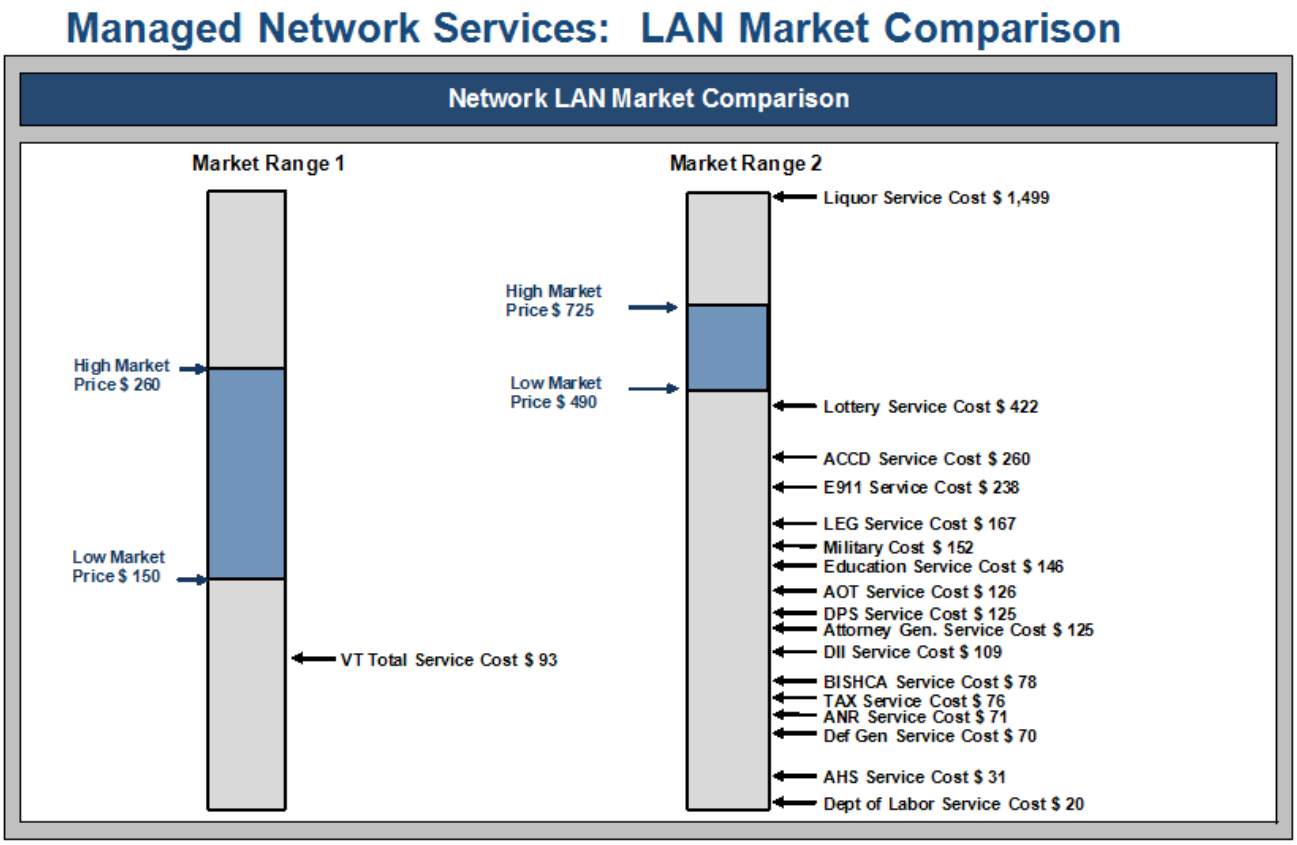


* Note: A "WAN site" is considered to be any site that interconnects to GovNet or is considered part of the State's wide area network.

Comments related to the WAN market comparison:

- State of Vermont cost are within the market range
- Very few if any metrics are tracked by the State – the market services have an extensive array of service levels

The next graph shows local area network costs for each agency/department as compared to the current market range.



- Almost all agencies/departments are below the market range. Typically this is caused by under investment in equipment, reduced service levels and very “thin” staffing levels
- Some agency’s cost per LAN port may be understated due to expenses not being fully captured for people, hardware, software, maintenance, etc.
- Note that typically the same staff resources support the LAN and the desktop areas. If there are cases where the desktop costs are high and the LAN costs are low the issue may be with allocation of staffing costs across the two areas

PHASE 2 - NETWORK ASSESSMENT – GAP ANALYSIS AND RECOMMENDATIONS

1. FUTURE STATE WAN DESIGN, ASSOCIATED RISKS AND IMPLEMENTATION ROADMAP

MPLS REVIEW

Many large enterprise organizations that have large wide area networks are changing their core backbone connections that "run" between routers from ATM (Asynchronous Transfer Mode) protocol to a more recently defined protocol know as Multiprotocol Label Switching (MPLS). The drivers for the change over to the MPLS protocol are typically due to reduced monthly telecom circuit cost. Some organizations have reported achieving 40% reductions in their monthly circuit costs. The feasibility of achieving this amount of savings is dependent on the ability of your existing routers to handle MPLS, the availability of MPLS for your sites and the port pricing that can be negotiated with the network carrier. The review of this option revealed that MPLS is priced within the recent telecom contracts but not at a rate that is better than the existing ATM port costs. In addition, it appears that the State's primary data network transport carrier, FairPoint, does not have MPLS widely deployed across the state. Therefore the use of MPLS is not an option at this time. As the state continues to enhance the network services provided and continues to grow the bandwidth at the core of the network this option should be revisited. In addition, the State should "encourage" their data network carriers to continue to expand their MPLS install base and work towards obtaining more favorable pricing on this service in future telecom contracts.

EQUIPMENT REACHING END OF LIFE

The following network devices have reached or are very close to end of life and require replacement:

- Hubs – Transportation
- Switches - Defender General and Transportation
- Routers – Public Safety, Defender General, and Transportation
- Firewalls – Transportation, DII verbally reported that they had two firewalls past end of life support

The State should make provisions to update these devices as they will soon reach end of life support periods from the original manufacturing company. In addition, maintenance costs are higher for this older equipment and in some cases not supportable.

2. IMPLEMENTATION GANTT CHARTS

No implementation Gantt charts are required as no project related recommendations have been made.

3. LIFECYCLE COST MODEL ESTIMATES

No lifecycle cost models are required since there are no projects being recommended.

4. ANALYSIS OF CURRENT AGENCIES/DEPARTMENTS' NETWORK POLICY/PROCEDURE AND IMBEDDED TOOLS AND TECHNOLOGIES THAT SHOULD BE LEVERAGED AND ALSO EXIST IN FUTURE STATE

DII should make the following improvements to their operational services:

- Establish monthly reporting on meeting the published network uptime goal of 99.99%
- Enhance their network capacity planning by include:
    - Regular reporting on peak traffic for all circuits
    - Establish capacity management policies and guidelines
- Administratively manage all telecom related circuits used in the state and put in place the following:
    - Establish a circuit database that contains all circuits and related costs so that a complete "picture" of all circuits is maintained. This database should have the ability to track service level credits that the newer telecom contracts have established
    - Use the circuit database to ensure that each month's telecom bills are accurate and that the state is not charged for circuits that do not exist or that disconnects have been issued in previous months. Ensure that service credits are issues in the case of non-performance by the carriers.
    - Conduct a yearly audit of the circuit database as compared to the real installed network.
- Establish a governance body to oversee the strategic direction of the network resources across the state. The members of this governance board should consist of business leaders as opposed to technical leaders from the state agencies and departments. The mission of this board should be to provide oversight and in particular strategic direction for GovNet.

PHASE 3 - DESKTOP ASSESSMENT - CURRENT STATE

Phase 3 scope includes the review of the State's desktop infrastructure and support.

1. DESKTOP/LAPTOP ASSESSMENT

The State of Vermont has a large amount of End User Computing (EUC) devices, 13,000+. The largest numbers of these devices are desktops and laptops with over 8,000. Additionally, support is provided for local printers, network printers, PDAs (Personal Digital Assistants), thin client devices, and a variety of other peripheral devices. The following chart shows a summary of the devices recognized from the collection templates.

Agency	*Standard Desktops*	*Standard Laptops*	*Total Desktops & Laptops*	*Unix Workstation*	*Local Printers*	*Network Printers*	*BlackBerry /PDA/Other Wireless*	*Thin Client*	*Other Peripheral Device*	*Total EUC Devices*
Device Count by Agency										
Admin (Exc. Tax)	574	220	794	0	178	130	0	0	0	1,102
Agriculture	47	55	102	0	4	13	0	0	0	119
ACCD	82	46	128	0	16	22	0	0	0	166
AHS	1,782	525	2,307	0	0	561	0	466	1,971	5,305
ANR	754	258	1,012	0	0	131	0	0	0	1,143
Transportation	978	343	1,321	0	0	417	0	0	4	1,742
Attorney General	88	35	123	0	19	0	0	0	0	142
Auditors Office	0	0	0	0	0	0	0	0	0	0
BISHCA	86	73	159	0	15	18	0	0	0	192
Defender General	34	58	92	0	27	18	0	0	0	137
Dept. of Labor	132	98	230	0	4	121	0	260	0	615
Public Safety	468	468	936	0	46	10	0	0	9	1,001
Dept. of Taxes	272	59	331	0	20	19	0	0	21	391
Enhanced 911	39	9	48	0	0	13	0	0	0	61
Education	88	170	258	0	42	0	0	0	259	559
Legislature	154	30	184	0	0	28	0	0	0	212
Liquor Control	114	43	157	0	110	6	0	0	17	290
Lottery Comm.	23	6	29	0	23	0	0	0	1	53
Military Dept.	38	34	72	0	24	19	0	0	1	116
Natural Resources	0	0	0	0	0	0	0	0	0	0
Public Services	0	0	0	0	0	0	0	0	0	0
State's Attorneys	0	0	0	0	0	0	0	0	0	0
Total EUC Devices	5,753	2,530	8,283	0	528	1,526	0	726	2,283	13,346
% of Total	43%	19%	62%	0%	4%	11%	0%	5%	17%	100%

MANUFACTURERS

In the analysis conducted of the End User Computing (EUC) equipment, we looked at the manufacturers of the desktops and laptops. This information can provide insight into a strategic direction that might have been initiated with a particular vendor or product line in the past, as well as how many manufacturer configurations have to be supported. The following provides information about the number of manufacturers of desktops and laptops were recognized with the collected end user computing information.

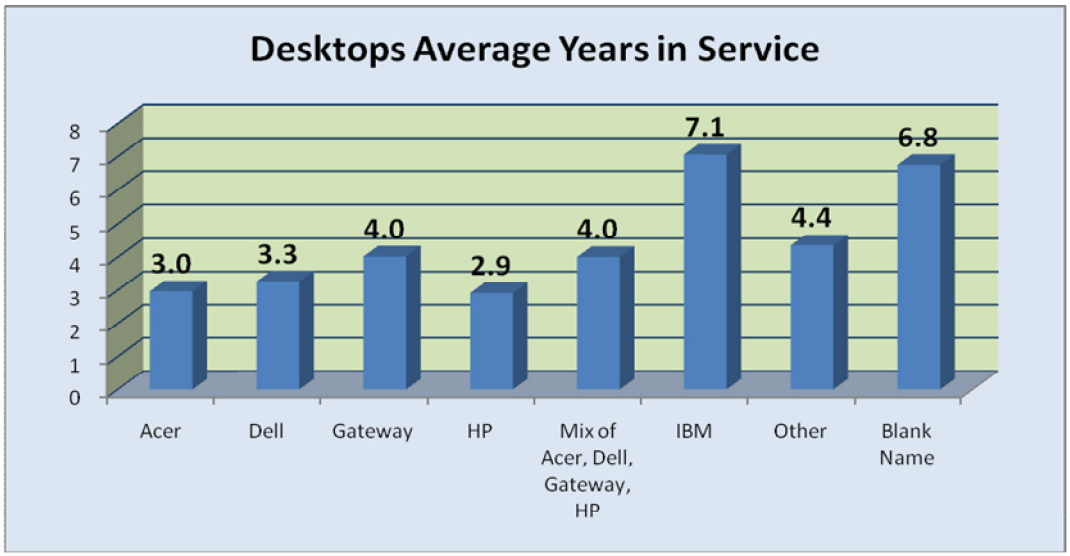
AGE OF ASSETS

Additionally, the age of the devices can provide insight into the refresh strategies that might need to be incorporated to replenish aged assets.

Because there are different support models for desktops versus laptops, we have provided the information separately for both. The next two tables/charts depict desktops:

Standard Desktops	Device Count by Manufacturer and Years in Service (less than 1 year to 7 + years)										
Years in Service:	0	1	2	3	4	5	6	7	Total Desktops	% of Total	Avg. Years in Svc.
Acer	0	0	1	25	0	0	0	0	26	0%	3.0
Dell	234	587	398	652	1,025	127	337	25	3,385	59%	3.3
Gateway	151	1	271	70	91	173	45	104	906	16%	4.0
HP	407	125	162	6	18	63	2	50	833	14%	2.9
Mix of Acer, Dell, Gateway, HP	231	0	0	0	91	0	0	0	322	6%	4.0
IBM	9	0	0	0	0	0	45	108	162	3%	7.1
Panasonic	0	0	0	0	0	0	0	0	0	0%	
Other	8	0	0	6	0	0	3	1	18	0%	4.4
Blank Name	95	0	0	1	0	0	0	5	101	2%	6.8
Total Desktops by Manf. & Age	1,135	713	832	760	1,225	363	432	293	5,753	100%	3.5
% of Total	20%	12%	14%	13%	21%	6%	8%	5%	100%		

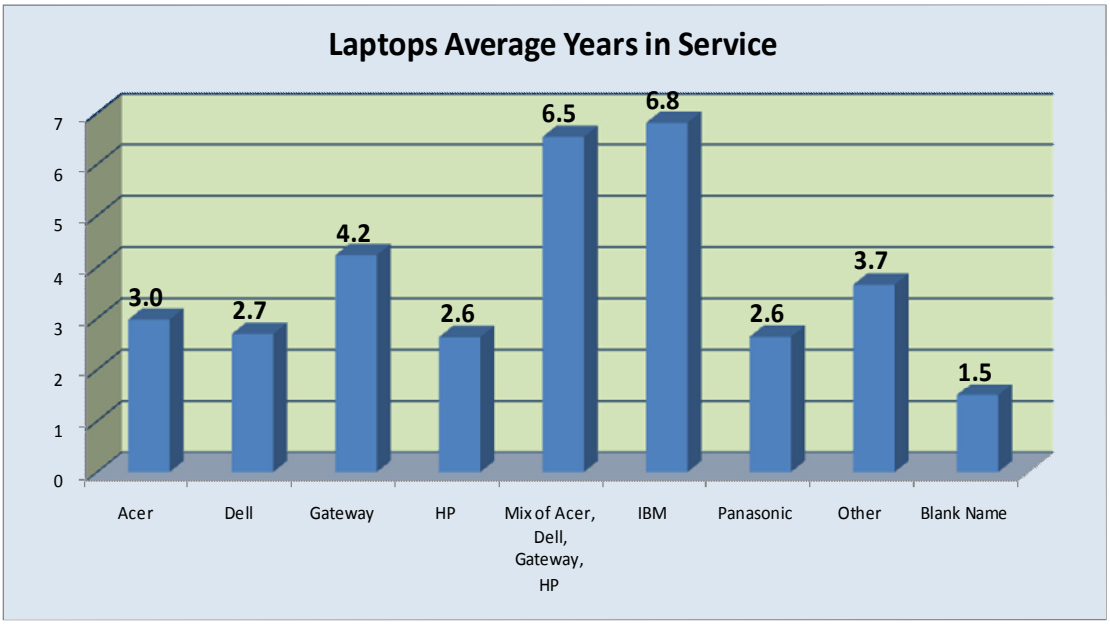
- For those desktops where the age was available, 50% are 4 years or older with an average age of 3.5 years



The next two tables/charts depict laptops:

Standard Laptops	Device Count by Manufacturer and Years in Service (less than 1 year to 7 + years)										
Years in Service:	0	1	2	3	4	5	6	7	Total Laptops	% of Total	Avg. Years in Svc. Exc. "0"
Acer	0	0	1	41	0	0	0	0	42	2%	3.0
Dell	158	361	171	144	265	40	28	34	1,201	47%	2.7
Gateway	26	0	36	11	32	27	23	12	167	7%	4.2
HP	195	53	66	33	37	3	2	11	400	16%	2.6
Mix of Acer, Dell, Gateway, HP	112	0	0	0	0	86	0	139	337	13%	6.5
IBM	11	0	0	1	1	1	22	39	75	3%	6.8
Panasonic	29	35	68	23	31	22	0	0	208	8%	2.6
Other	16	1	8	4	11	3	3	1	47	2%	3.7
Blank Name	49	2	2	0	0	0	0	0	53	2%	1.5
Total Devices	596	452	352	257	377	182	78	236	2,530	100%	3.4
% of Total	24%	18%	14%	10%	15%	7%	3%	9%	100%		

- For those laptops where the age was available, 45% are 4 years or older with an average age of 3.4 years



1.1. HARDWARE, OPERATING SYSTEMS, OFFICE APPLICATIONS AND LICENSING

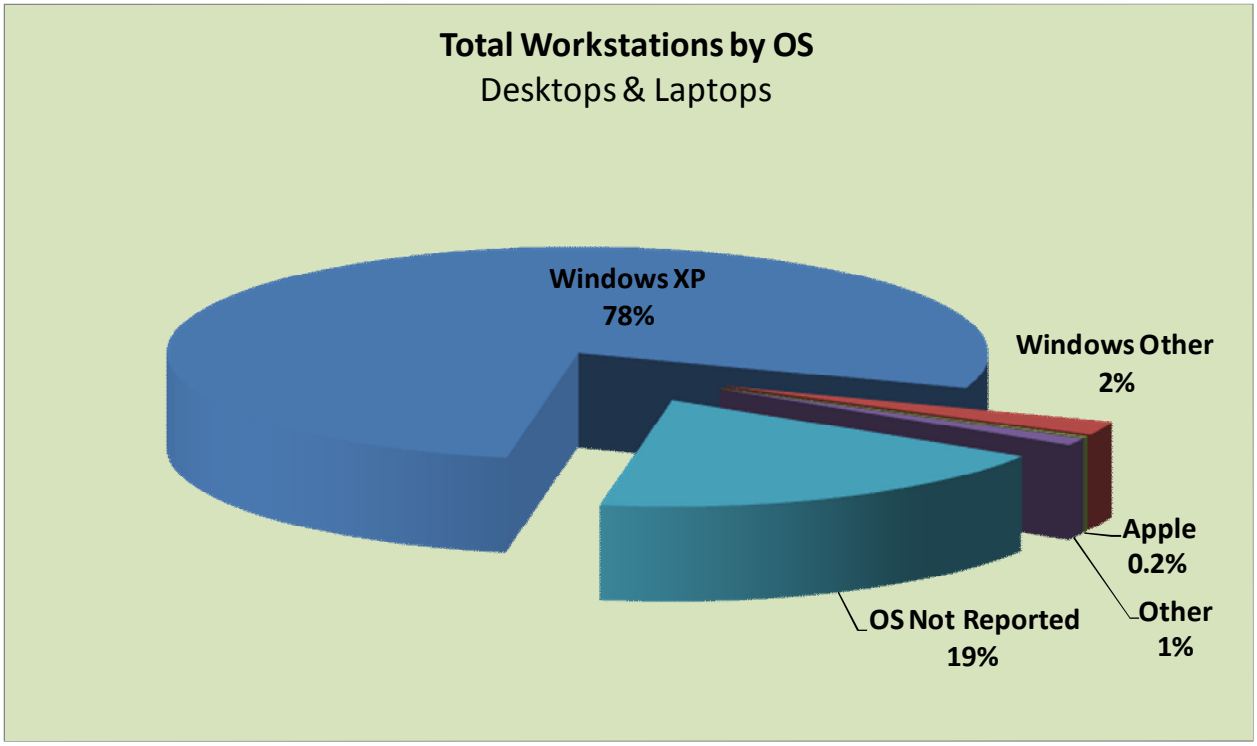
HARDWARE

Multiple manufacturer configurations require additional knowledge and generally more personnel to support. This shows up in not only in the break/fix personnel that provide physical visits to a desktop/laptop location for problem resolution, but when calls are received by the help/service desk. Personnel have to be trained and have knowledge of these multiple configurations. Multiple assistance scripts have to be maintained in order to support these configurations.

OPERATING SYSTEMS

There does not appear to be a standard single image for a desktop/laptop throughout the enterprise. And in many cases there is not a standard single image for a desktop/laptop within an agency.

There does not appear to be a consistent operating system version for this environment. Multiple operating systems are deployed and supported. A wide variety of operating environments exist; including Windows 98, Windows NT, Windows 2000, Windows 2003, Windows 2007, Windows XP, and Windows Vista.



Upgrades and refreshes are not rolled out consistently throughout the enterprise. Agencies enable upgrades and migrations based on the availability of funds to support enhanced refreshes. Some agencies have had

recent refreshes of not only hardware, but operating environments and business office products; while others maintain older versions that soon will not be supported by the manufacturer.

As depicted in the desktop/laptop charts, approximately 40% of the hardware is over 4 years old. And the variance in the ages of the hardware varies from 12% - 18% from years 1 through 3. This indicates that a refresh strategy is not consistently applied nor followed. If it were, the percentage of devices from one year to another should be around 20% - 25%, which would reflect a refresh policy of 4-5 years.

Again, the cost to support aged assets increases as the assets remain in service and fall out of warranty.

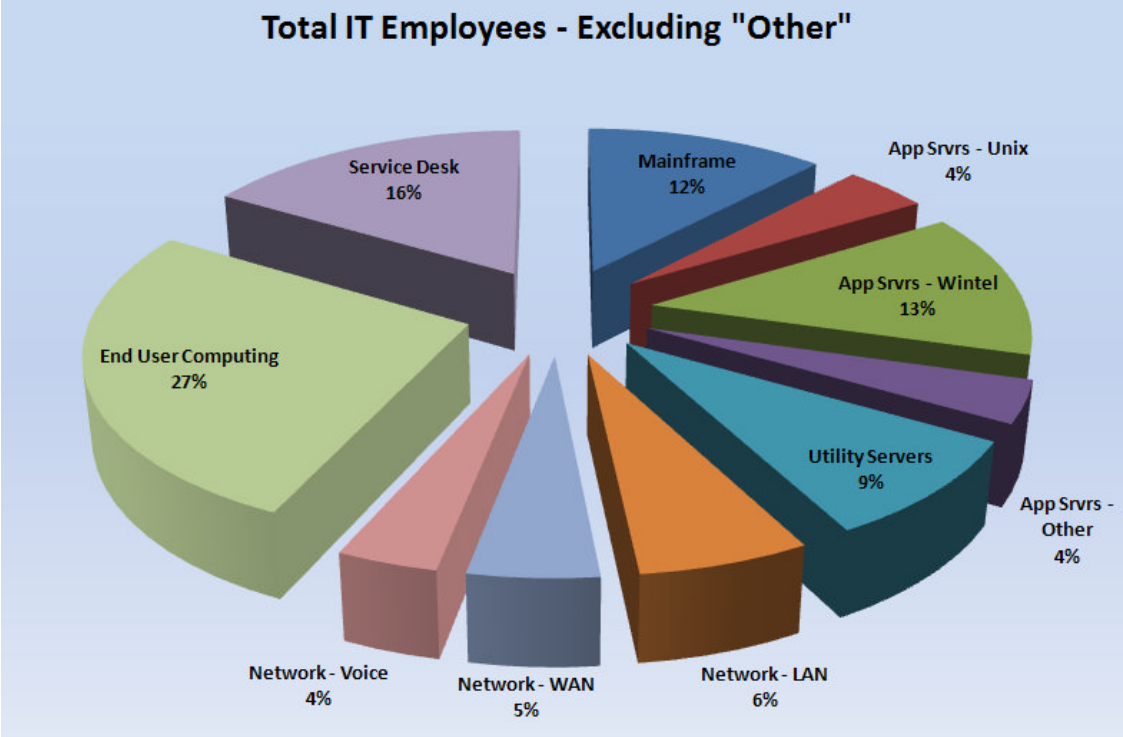
OFFICE APPLICATIONS AND LICENSING

There is no enterprise wide Configuration Management database to allow for an accounting and system configuration identification of the license inventory in the desktop/laptop environment; however, during interviews and information collected with the IT asset templates, it has been noted that the office applications are primarily Windows based, and the Office Systems range from Office 97 through Office 2007, with a majority of the systems running Office XP.

ADDITIONAL COMMENTS

Use of thin clients - There is some focus on the use of thin client as a method to provide the necessary computing capabilities. Thin clients typically require fewer numbers of operating licenses, and the effort to filter and prevents virus and malware is reduced. There are a few agencies using thin clients.

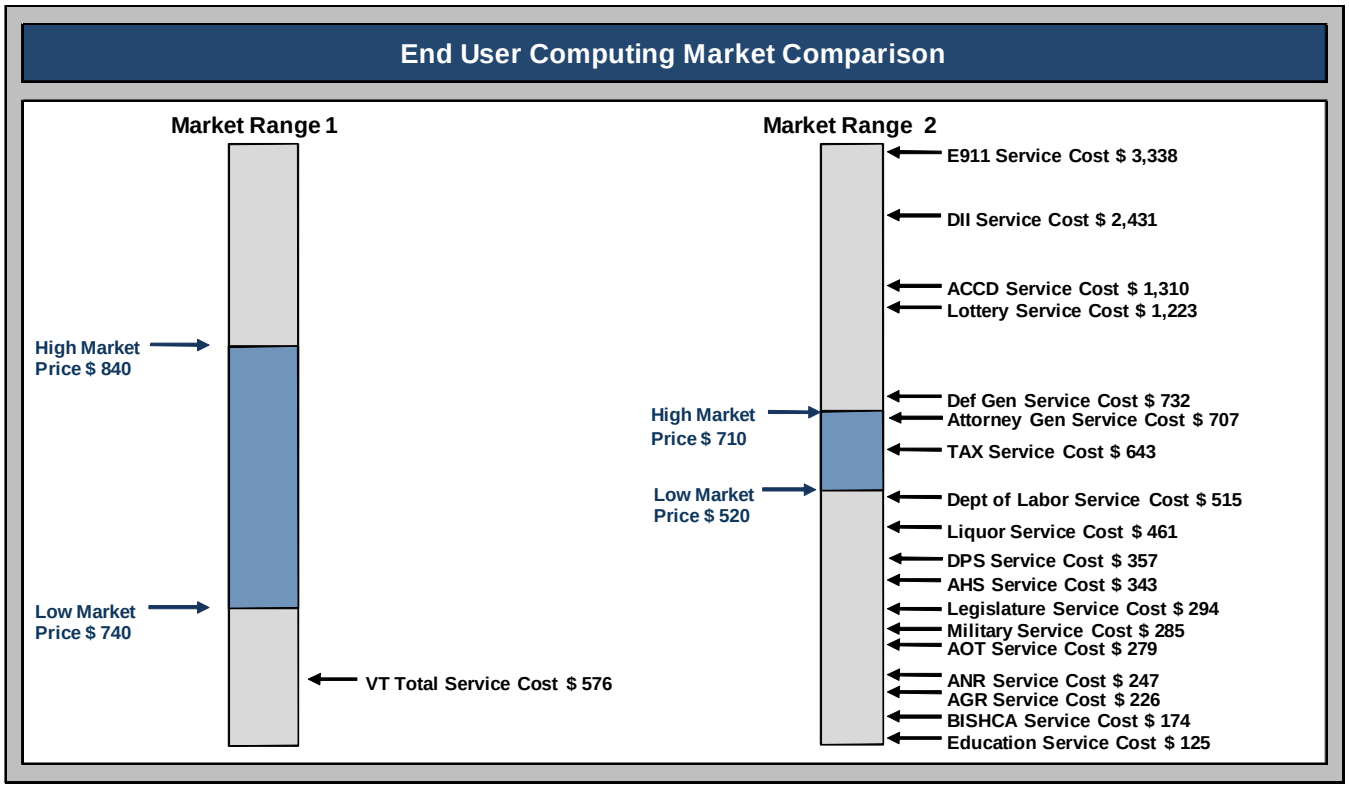
Staffing - As previously mentioned, a higher number of manufacturers combined with multiple operating instances and images require greater support from the help/service desk organization. There are multiple help/service desks throughout the State. Of the 22 Agencies and departments, 15 provide some form of help/service desk. This makes up 16% of the total in-scope staffing. This amount, combined with the 27% of staffing resources providing end user computer support, has a significant impact to overall support costs.



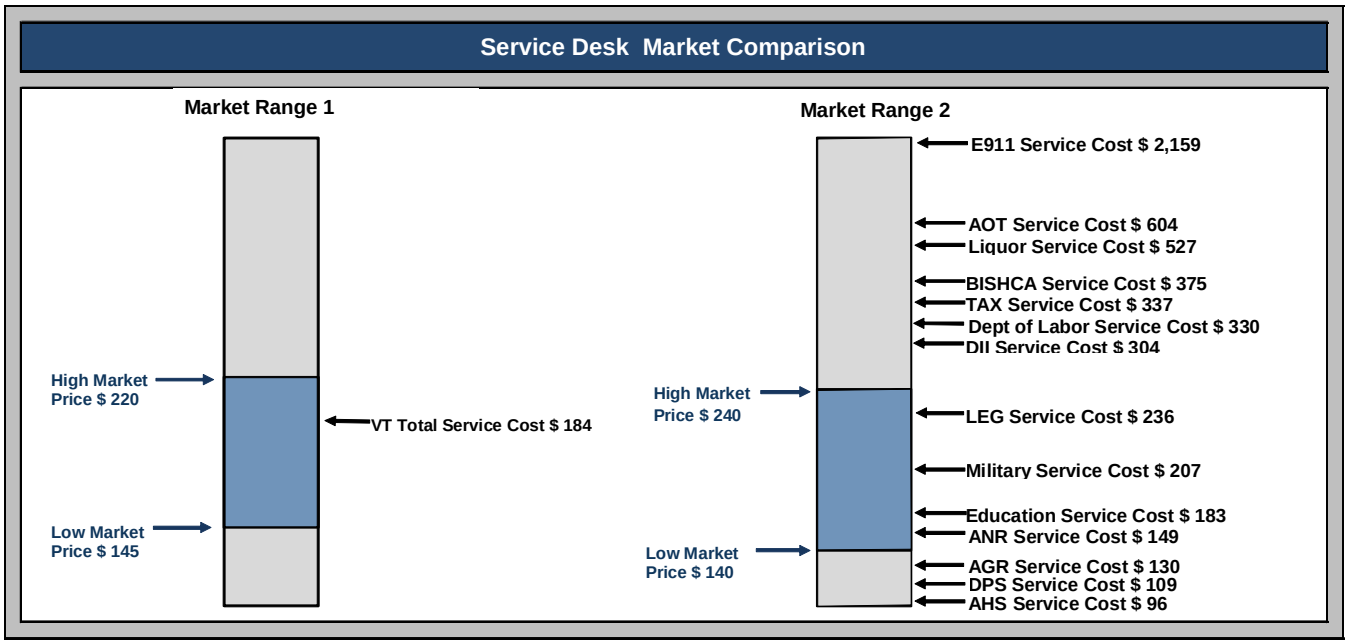
Service Catalog - There is no use of a 'Service Catalog' that outlines and describes the recommended, available hardware purchase options that can be purchased. The use of such catalog would increase the degree of standardization among the desktop and laptop population.

2. BUSINESS CASE FOR DESKTOP STANDARDS

One of the methods TPI uses to analyze desktop standards is by comparing the State of Vermont desktops/laptops and service desk information to the information gathered from previous transactions that have been consummated within the last 18 months. These transactions included between 3-6 clients of similar scale and scope. This information provides a comparison of the total service cost for a specific functional area (i.e. end user computing) against a high and low market price. The following depicts the current state of desktops/laptops and service desk for the State of Vermont against the current market material:



- Average age of SOV desktops and laptops (approx. 3.5 years) is greater than the market average of 1.5 to 2 years.
- State's ratio of 70% desktops/30% laptops is higher than the market range of 50 - 60% desktops to 40 - 50% laptops. This contributes to a lower support cost.
- The LAN and end user computing areas are supported by the same staff so in case where one of these areas is high and the other low there may be an indication of a cost allocation issue between the two areas



- FTE to authorized user ratio of 423 users per service desk FTE is on the low end of the market range of 400 to 900 users per service desk
- VT approach of 5 to 6 service desks is less efficient than the market approach of a consolidated service desk
- Limited tools in use

PHASE 3 - DESKTOP ASSESSMENT - GAP ANALYSIS AND RECOMMENDATIONS

1. DESKTOP STANDARDIZATION RECOMMENDATIONS, ASSOCIATED RISKS AND ROADMAP/SEQUENCING BY AGENCY

There were over 8,000 desktops and laptops identified during the data collection period as part of the IT assessment for the State of Vermont. Of these desktops and laptops that reported their operating systems, over 80% are Windows based. Less than 1% was identified as Apple or other, and approximately 19 % did not designate an operating assessment. We believe that most of these unidentified desktops and laptops were Windows based; therefore, the number of Windows operating systems for desktops and laptops is well over the 90% rate.

Of those desktops and laptops that were reported, approximately 80% of these had operating systems that were identified as Windows XP. Windows XP is at the moment considered the N-1 standard operating system in use by both private and government sectors (with Windows 7 considered the N). Of the total desktop and laptops identified, 40% of these devices are 4 years or older and are due for refresh. The cost associated with upgrading to Windows XP is only slightly less than the cost associated with refreshing the entire asset including the operating system. Therefore, instead of recommending that the desktop and laptop community be upgraded to Windows XP, TPI would suggest that the older assets be replaced with new devices with Windows 7. This approach would eliminate the older assets that are in need of replacement and their respective non-Windows XP operating systems. The incremental cost to replace aged assets and respective operating systems with new equipment running Windows 7 eliminates the multiple operating systems, reduces support costs, reduces hardware failure instances, and increase productivity.

The following are some of the features and benefits as described by Microsoft:

- Power savings - Reports have shown that the power improvement in Windows 7 can result in savings of up to $50 in power per machine per year. For laptops, the power savings can translate in up to a 30% increase in battery life, which could give your laptop users additional productivity.

- Application compatibility - One of the biggest headaches of operating system upgrades is dealing with the incompatibilities in drivers and software. This is one of the things that plagued Windows Vista from becoming the standard business operating system. Early reports attest that virtually any software or devices that run in Vista will also run in Windows 7. And if you have old software that ran in Windows XP or earlier, there's an XP Compatibility Mode in Windows 7 that runs those older apps in a virtualization layer.

- Performance - Microsoft has slimmed down the OS to the point that it takes fewer resources to run. In fact, Windows 7 can even run on net books, unlike Vista. Microsoft has also taken some programs out of the default installation and made them available as free downloads. This, combined with the fact that Windows 7 takes advantage of the latest CPU and graphics hardware, makes the new OS boot faster and feel generally more responsive than Windows XP machines.

- User interface - Windows 7 introduces the most radical change to the Taskbar since it was first introduced in Windows 95. It now relies almost exclusively on icons, mouse-overs, and thumbnail previews. Some users will easily adapt to the feature, but others are going to be confused by the changes. This learning curve is expected to mirror the reaction displayed with the introduction of the new "Ribbon interface" in Office 2007.

- New tools for IT professionals - For the IT professionals within the State who will likely be working from Windows 7 machines and managing lots of Windows 7 systems, there are some new tools that come with Windows 7, including Problem Steps Recorder, Power Shell version 2, Credential Manager, the Action center, and more.

TPI would recommend that the operating systems be identified for those assets that were reported with missing or blank information regarding the operating system residing on the asset. The establishment and maintenance of a data directory with this missing or blank information along with the correctly reporting information could be used as a guide to ensure currency and correct identification of the operating systems in use.

The State, and the respective agencies, has multiple software images on these multiple operating systems. The ideal state is a single "core" image (OS, virus package, office productivity suite, etc) and then some "add-ons" or business-specific applications that are added on after the core. This single "core" reduces build time, test time, integration time. TPI would recommend that the number of software images be reduced to a few, with a single "core" image being the ideal state. We realize this may not be possible within the enterprise; therefore, this reduction is directed to those entities that have responsibility for the support of the desktop environment under their span of responsibility. One of the risks associated with not adopting a single 'core' image is an increased amount of resources required to support these multiple images.

The number of different manufacturer devices of desktops and laptops is also a concern. The multiple numbers of manufacturers requires the installation, maintenance, and support of multiple drivers and configurations. The fewer number of manufacturer devices that the State of Vermont has to support the better. Multiple skill sets and knowledge bases need to be maintained and supported and these required additional resources. Additional testing of application/programs has to be conducted on the various manufacturer devices before a distribution of software can be accomplished. TPI recommends that the State of Vermont identify and consider limiting their purchasing with not more than two (2) vendors to acquire their future desktops and laptops inventory. The risk associated with not limiting the manufacturer models to a fewer number is the continued or increased amount of resources to support these multiple manufacturer platforms and devices.

As previously noted, the current ages of the desktop and laptop inventory is approaching beyond what would be considered an ideal refresh strategy and approach. The average age of desktops is 3.5 years and the average age of laptops is 3.4. Most marketplace refresh strategies assume a refresh for a desktop to occur every 4 years and a laptop to occur every 3 years. Therefore, the State of Vermont is approaching the ideal age (on a collective basis) for desktops and has exceeded the ideal age (on a collective basis) for laptops. The increased support costs to support an aged environment and the loss of productivity as a result of failed hardware are the risks with not refreshing assets on a more frequent basis. Therefore, TPI would recommend that a strategy be developed to allow for an incremental refresh of assets annually for approximately 20-25% of the oldest, aged

assets. This strategy would also align with the recommendation of migrating to Windows 7 when replacing those aged assets that are running on an operating system other than Windows XP.

The Agency for Human Services (AHS) and the Department of Labor (DOL) use thin clients in their organization. The opportunity to utilize these devices in increasing quantities has some significant cost advantages and could possibly be used in replacement of some of the aged and outdated desktops and laptops. The savings between a thin client and a desktop/laptop occur in the following areas:

- Hardware expense – an adequate thin client can be obtained for approximately $250 compared to the average price for a desktop is about $750 and a laptop is about $1000. This results in a saving between $500 and $750 respectively.
- Desktop/laptop administration – beyond day-to-day maintenance of installation of patches, software upgrades, etc., administration is simplified and an enterprise will require fewer IT staff to perform the same functions.
- Operation/productivity – according to a META Group Study, savings can results from 80% less cost for maintenance per year, 23% less cost to operate, and a 25% increase in productivity.

There are some post-warranty break-fix agreements within some of the agencies, but TPI has seen in the marketplace that it is cheaper to refresh desktop and laptop inventory and keep things under warranty than it is to enter in to a post-warranty break fix agreement. The State may be more aligned with a philosophy of "replace when it breaks" or "fix when it breaks" but then you are faced with substantial administrative costs associated with logistics of provisioning and staffing a parts depot or some other location that retains an inventory of parts, and/or having a technician and spare parts at the ready to fix damaged machines. Desktops are much easier to fix, and cheaper, therefore, this might be where the State could extend its refresh philosophy. Laptops are scattered everywhere, usually in remote locations where you won't have parts or technicians, so it is a more strategic place for a consistent and shorter refresh cycle.

The loss of assets and improper accounting of purchased and leased assets is one of the most significant costs associated with an enterprise's desktop and laptop environment. Asset life cycle management runs from acquisition to disposal and organizations continually struggle to implement solutions that properly track and manage their technology assets. This is particularly important today as businesses consider refreshing their hardware and software assets. The State should explore the use of an asset life cycle management tool to help in the decision making about the tracking and replacement of desktop assets.

Break/fix support is an important element within the desktop/laptop environment as most organizations are attempting to move support away from the expensive desk-side and to help/service desk or a self help solution. The State of Vermont should consider the direction it would like to pursue relative to this indicator.

Many organizations cannot adequately quantify and forecast their "Install, Move, Add, or Change (IMAC)" for hardware and software at the desktop — particularly for hardware. This creates an unknown in terms of the real cost associated with supporting the desktop and laptop environment. This becomes increasingly difficult to predict when the resources are dispersed and is not limited to solely end user computing services (i.e. a

resource performing multiple functions, EUC, network, help desk functions, etc.) Therefore, a plan to record the number of IMACs that are initiated and completed on an annual basis would provide some statistical information to determine whether or not there is sufficient staffing remotely to handle these requests or if a centrally staffed organization would be more effective and/or efficient.

2. GANTT CHARTS

There are no recommendations that are contained or classified as a project with the desktop/laptop environment.

3. LIFECYCLE COST MODEL ESTIMATES

The State of Vermont's annual average PC support cost is $576 which is well below the market range of $740 to $810. Because the state is much lower than the average PC support costs, it is very difficult to make any business case justifications for service and support improvements. It is suspected that PC support areas are understaffed and it was observed that very few service levels were reported on or measured. However, improvements in the PC support area would increase operational costs, but would also increase productivity and potentially improve satisfaction to end users and citizens of the State.

4. ANALYSIS OF CURRENT AGENCIES/DEPARTMENTS' DESKTOP POLICY/PROCEDURE IMBEDDED TOOLS AND TECHNOLOGIES THAT SHOULD BE LEVERAGED AND ALSO EXIST IN FUTURE STATE

As previously mentioned in the current state analysis, refresh strategies and policies are varied from agency to agency, and an agency's ability to refresh technology, particularly within the End User Computing area varies from budget year to budget year, from legislative session to legislative session, and from administration to administration. However there is some need to relook at those agencies that have a proportionally longer aged asset list of desktops and laptops. Upon further analysis, the Department of Taxes, Agency of Transportation, Vermont Lottery Commission, Agriculture, and Department of Public Safety have a desktop and laptop population that heavily aged. The percentage of desktops and laptops that are 5 years or older are respectively, 56%, 48%, 47%, 38%, and 35%.

All agencies have a help/service desk function either with formal seats and a central phone number or a locally known process/procedures to report desktop and laptop issues and problems. However, the maturity level of the service desk process as self reported from the agencies was 2.7 on a scale of 1 to 5. Although this is approaching the minimal maturity level as suggested by ITIL, there is still a gap that should be closed. As such a more rigorous collection of statistics regarding whether the calls require a physical visit to a desktop (commonly referred to in the industry as a Hard IMAC) versus a soft resolution (commonly referred to in the industry as a Soft IMAC) via a phone call, and formal reporting, would allow the State to understand whether repairing desktops and laptops is more cost efficient than either extending maintenance service contracts or refreshing the equipment. Without these tools and information, the decision to repair/replace is not based on good data.

It is not clear whether or not an IMAC process or procedure is formally addressed within the in-scope agencies. There must be an informal process for an end user to effect an action regarding their desktop or laptop.

However, a practice should be formalized in order to determine how much time and resources are dedicated to this function. More importantly, if these actions are performed by a dedicated resource, how much of this effort is taking place that could be re-directed and/or accomplished through other means, i.e. help/service desk. Gathering statistics on the volume of actions that occur on a monthly basis, and with an identified level of performance (service level agreement) would help identify areas for improved service as well as where costs are being generated from.

5. CLOUD COMPUTING DESKTOP RECOMMENDATIONS

INTRODUCTION TO CLOUD COMPUTING

Cloud computing is an IT infrastructure in which dynamically shared computing resources are accessed as a service over the internet. One perspective is to think of "cloud services" as simply meaning that you're IT service is coming to you over the internet as opposed to your company's data center or "running" on your local desktop. Two attributes define cloud computing: Someone else runs it, and it runs in someone else's data center. One of the key attribute of cloud is that you reach all of your services using a web browser. This new approach to providing IT services replaces the traditional data center model in which organizations both own and manage stand-alone hardware and software systems or outsource to service providers who deliver IT services using this same model. This technology transition presupposes that users of cloud computing are more concerned with services that can be performed (as well as the variable demand/consumption capabilities) than the underlying technologies used to deliver requested services.

The underlying architecture is a massive network of scalable interconnected cloud servers which store data and software and uses virtualization to optimize computing power per server. Cloud computing can be hosted within a Service Provider's environment (cloud) or a separate environment (private cloud) can be created behind a firewall to allow complete control by the user.

Consumption is usually billed on a utility (resources consumed, like electricity) or subscription (time-based, like a newspaper) basis with little or no upfront cost.

Within the desktop environment, the primary relevant service is E-mail and common desktop applications (like word processing, spreadsheets, and presentations). In this arena there are a number of both large and small service providers who have developed the dynamically shared E-mail computing resources within the "cloud computing" paradigm.

SERVICE PROVIDERS

One of the larger and more experienced providers within the desktop environment is Google. In 2007, Google, IBM, and a number of universities embarked on a large scale cloud computing research project, which altered the way that computing environments are built and maintained. The saw an opportunity for cloud computing to change the thinking among providers of IT services who retained the concepts of company-owned hardware and software assets compared to a per-use service-based model.

One of Google's services is an E-mail service with storage, word processing, spreadsheet and presentation applications, as well as a video channel. Google sells the aforementioned services from $50 per user annually. A user receives 25 gigabytes of E-mail storage per account. Google says its corporate users now number in the "hundreds of thousands".

Since the joint endeavor by Google and IBM, IBM has introduced a bare-bones E-mail service that sells for $36 annually per worker, which provides less than the more comprehensive package of software applications that Google sells for $50 per user annually. IBM believes its service, called LotusLive iNotes, can overcome Google in the marketplace because it has a much larger sales force and relationships with corporate customers going back long before Google existed.

ADVANTAGES

The following advantages are available through the use of cloud computing:

- **Agility and scalability** - Via dynamic ("on-demand") provisioning of resources on a self-service basis near real-time, without users having to engineer for peak loads. Performance is monitored, and adjustments made quickly
- **Rapid provisioning of new users -** A cloud-based E-mail provider can provision a large fluctuation in users quickly. For example, universities are using cloud-based E-mail providers like Microsoft and Google to provision their alumni or incoming freshmen
- **Allocation of valuable IT professionals to more business-centric projects -** The opportunity cost of running E-mail on-premise is that your staff must spend time on E-mail support, rather than critical projects
- **Always run the latest software and configurations without upgrade hassles -** As any IT professional knows, keeping client and server software upgraded and safe is time consuming. A cloud-based provider takes on the burden of keeping your message filtering software and configurations always up to date, so new viruses don't sneak through
- **Shift the financial burden from upfront capital expense to ongoing operating expense -** The biggest benefit of cloud computing is that you no longer carry the debt liability and the ownership and responsibility for the hardware and software assets. The financing benefit of paying as you go rather than in a big upfront investment is appealing to any budget holder, particularly in these capital-constrained times
- **Device and location independence** - Enables users to access systems using a web browser regardless of their location or what device they are using (e.g., PC, mobile). Since the infrastructure is off-site and accessed through the Internet, users can be productive from anywhere they have connectivity
- **Reliability improves** - Through the use of multiple redundant sites, which makes cloud computing suitable for business continuity and disaster recovery

- **Security typically improves** - Due to centralization of data and increased security-focused resources. Security is often as good as or better than under traditional systems, in part because providers are able to devote resources to solving security issues that many customers cannot afford

OBSTACLES AND CONCERNS

The following are obstacles for using cloud computing:

- **High-speed connectivity** - Is a requirement for access to cloud computing resources
- **Privacy protection** - The complexity of security is greatly increased when data is distributed over a wider area and/or a greater number of devices. Storing large amounts of data about users' identity and preferences is likely to raise concerns about privacy protection. Therefore, private clouds may need to be established, generally with higher cost structures than shared public environments. Agencies will need to standardize their requirements on issues like security and privacy to gain the benefits of cloud computing
- **Statutes and regulations** - May require that facilities and equipment are located only in the United States
- **Lose control during outages** - Some major cloud computing services have suffered outages, and IT and business managers can at times do little when they are affected
- **Access to detailed security records** - Service Providers typically log all user accesses, but gaining access to the audit logs themselves can be difficult or impossible

CLOUD COMPUTING AND GOVERNMENT

Government entities are likely to choose a mix of commercial and private cloud services as the concept evolves. These decisions will revolve around the importance and sensitivity of data and applications. Information that may be public in nature, that's not classified or sensitive, are good candidates for cloud computing.

Business-critical applications should be maintain internally so that the environment can be controlled.

Support function/applications are good candidates to put in a vendor provided cloud.

Information that may be classified in nature would have to be retained on infrastructure that is government owned and operated. Because of this sensitivity, some applications will remain on government servers for the foreseeable future.

PRICING

Pricing is typically on a subscription bases with optional usage-based features available. Prices vary widely depending on the type of solution that fits an organization's needs. One of the larger providers currently offers

their service for $50.00 per year per user or about $4.20 per month per user. When evaluating the cost of a cloud solution it is important to also include internal support costs for support, administration, and possible additional features such as messaging archiving.

RECOMMENDATIONS

Considering that the mark to market range for an internally provided E-mail solution ranges from $70 to $190 per user per year, and with the State's average cost of $126 per user per year for utility computing (which includes E-mail and file/print servers), it may be an attractive alternative to review. However, because the service offerings are relatively new on the market, the State should proceed with caution in this area.

In order to understand the features and capabilities that exist in cloud computing, particularly within the desktop environment, TPI recommends that two pilots be undertaken to more fully inspect and analyze the advantages/benefits as well as the drawbacks that may come through the use of cloud computing.

The first pilot should be a larger agency, perhaps one that has a separate E-mail domain that could test the features of E-mail services and provide some analysis of reliability, assurance, innovation, technology, responsiveness, flexibility, and accessibility.

The second pilot should be a smaller agency that has a variety of support characteristics, i.e. central support and remote support that also could test the features of E-mail services and provide some analysis of reliability, assurance, innovation, technology, responsiveness, flexibility, and accessibility.

The following steps are suggested for the pilot(s):

1. Select the cloud service provider(s) – as part of this decision determine how to handle the domain for the users during the trial. Note that during the trial you will be using a hybrid situation where all of the participants can still have the same E-mail domain (the same "state.vt.us" address, for example) and an E-mail router splits the domain. Almost all cloud-based providers can support this architecture

2. Finalize the type of users for each pilot

3. Select agencies and departments that will be participating in pilots

4. Write test cases scenarios that users and administrators will evaluate

5. Design method of collecting mid-term and final feedback from all that are participating in pilot

6. Communicate objectives of pilot to those participating in pilot

7. Create the user accounts

8. Users pilot service and document feedback

9. Collect mid-term data collection. Adjust or add use cases as needed.

10. Collect feedback at end of pilot
11. Consolidate data
12. Analyze data and draft report of findings
13. Circulate report for comments
14. Finalize and publish the final reports

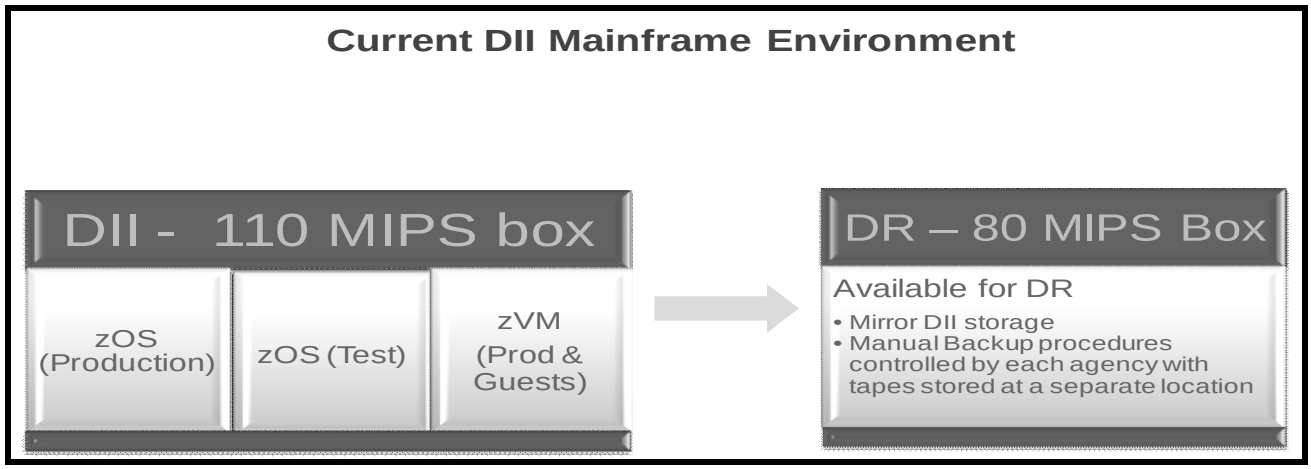
PHASE 5 - MAINFRAME ASSESSMENT - CURRENT STATE

The scope of Phase 5 includes the review of the State's Mainframe infrastructure and support.

Two agencies, DII and the Department of Labor, provide mainframe IT services. These two agencies support the mainframe service independently of each other, in separate locations.

1. DII MAINFRAME ASSESSMENT

DII has two mainframes of approximately the same size running the zOS operating system. DII's primary mainframe is located in the 133 State Street data center in Montpelier and the backup mainframe is located in the Barre data center. The following picture shows the primary mainframe on the left and the backup mainframe on the right. The primary mainframe is logically partitioned into 3 environments: 1) a production partition, 2) a test partition, and 3) a VM production & guest partition.



DII MAINFRAME OBJECITVES

DII has identified several objectives for the mainframe platform which include expandability, technology refresh and optimization. DII needs to:

- Address 'End of life' issues with hardware
- Manage and reduce the increasing costs of software and maintenance
- Improve the backup process
- Develop a data archival strategy
- Modernize disaster recovery services
- Application modernization

CURRENT COSTS

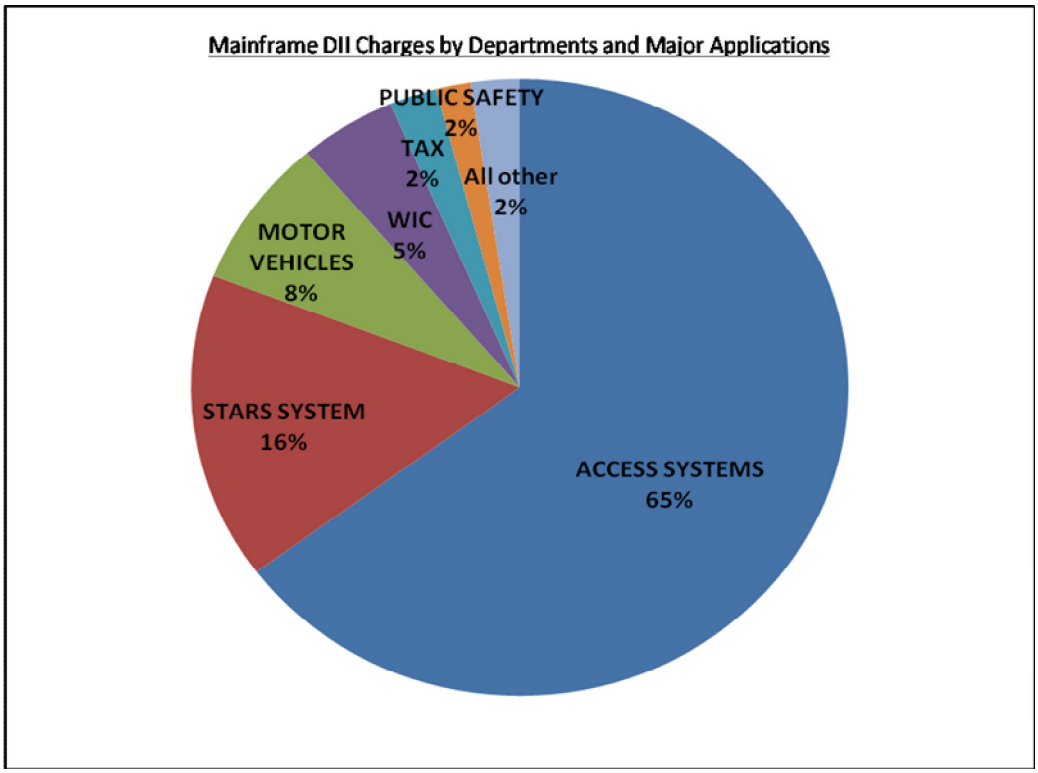
The following table shows the annual DII mainframe costs:

Current Mainframe Annual Cost ($ 000)	DII
Salaries and related costs	$ 705
Hardware Maintenance and Depreciation	$ 320
Software Maintenance and Depreciation	$ 1,300
Indirect IT costs (facilities, overhead…)	$ 324
Total	$ 2,649

One of the challenges with an aging platform, is the need to fund the continued increases in sustain costs as both utilization and maintenance on older platforms rise. Not only do the maintenance costs increase, but the frequency of outages and the increased recovery time requires additional staff resources to manage the outages. DII has expressed concern on how to fund refresh projects when the platform is no longer considered a part of the strategic direction for IT.

CUSTOMERS

DII mainframe services provide support to most agencies and more than 40 applications. The Agency of Human Services is the largest user of the mainframe, driving 75% of the usage.



The mainframe platform is not considered a strategic platform within the State of Vermont. This is a fairly common position within the industry. For years, CIOs have stated their intention to transition off the mainframe while the use of mainframe continues to grow because so many of the mainframe applications support key business processes and the data is interwoven within many other IT systems. As such, the complexity and cost to transition to other applications remains high. The Department of Children and Family Service's (DCF) primary application, Access, developed 30 years ago, is not as flexible as the required changes demand. The Agency of Human Services is looking for alternatives to reduce the cost of the application on the mainframe and to modernize or replace Access with a more nimble solution. Separately, agencies have expressed concern that they will be the last application remaining on the mainframe, and will have to carry the high cost of a platform that is structured to be shared. As the platform is seen as non strategic, future investments are hard to justify.

OPERATIONS

Although the mainframe runs 24X7, the operations staff is only on site for the first and second shift, leaving the third shift as a lights out facility. Extended hours of support are available on demand. With the reductions taken over the last few years, there is a minimal support staff in place to support the environment.

PRINTING

Print services for DII have been moved to Building and General Services (BGS).

BACKUPS AND DISASTER RECOVERY

For DII, disaster recovery includes another machine configured in a separate location, (the Barre data center) with most of the direct access storage device (DASD), copied (mirrored) in the Barre data center. In addition to mirroring the production data, tape backups are performed by the application teams, as each agency controls their own backup policy, for both frequency and content. The tape backups are sent off site. The disaster recovery plan will restore the base operating system within 8 hours. If the application data has to come from the tape backups instead of the mirrored copy, the application recovery will take days.

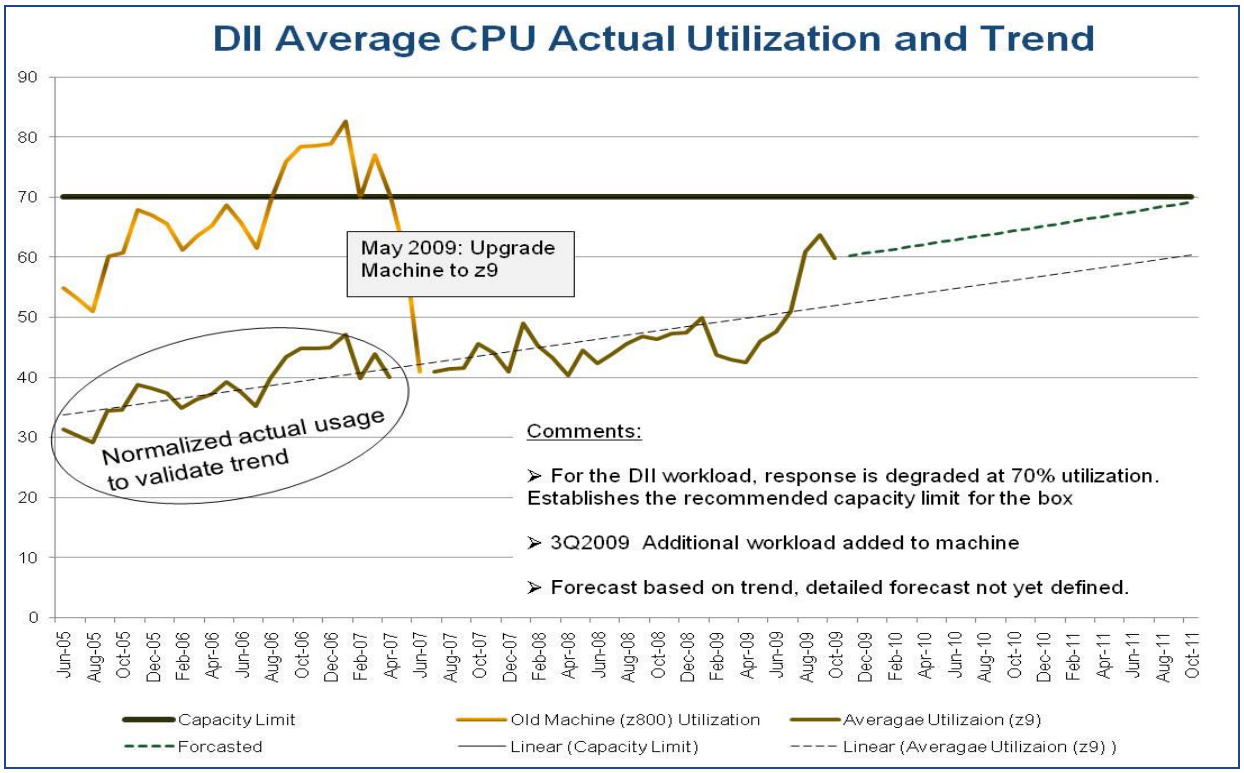
PROCESSES AND PROCEDURES

It was identified in the ITIL self assessment that service level management is one of the lowest category rankings across the agencies. The State's IT teams have limited service levels in place and limited Service Level Agreements (SLAs) or Operational Level Agreements (OLAs) with their internal customers to manage the environment. Expectations are often verbalized and there is not a formal process for communication of problem resolution.

Formal policies and procedures for infrastructure services are limited and in general, not documented. The self assessment was conducted by a majority of the agencies, and yielded scores that identified immaturity in process and control. Furthermore, interviews with both technical and business associates also identified the lack of formalized process within policies and procedures.

USAGE TRACKING AND USAGE TRENDS

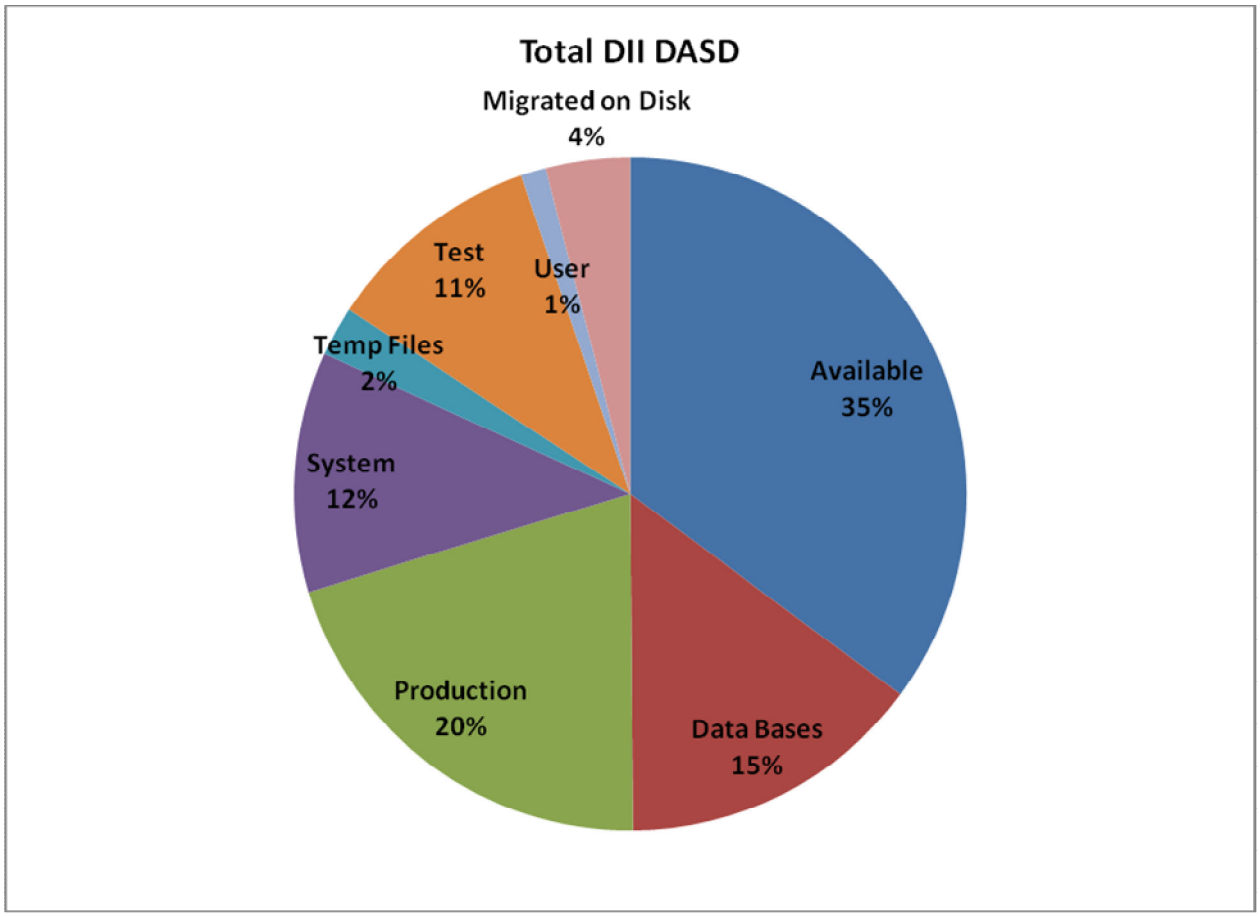
Charges for mainframe services to other agencies are based on typical mainframe environment resource units including Million Instructions Per Second (MIPS), storage, tape, and others. DII uses an IBM product, "SIMS", to track usage of mainframe resources.



Understanding the current utilization of the mainframe and its trends is important. The DII processor was upgraded two years ago and has sufficient capacity for the next few years. Upon review of the historical utilization, the applications have grown steadily at a rate of around 5% which is within the industry average. With these applications, under the current configuration, performance is expected to degrade when the mainframe is around 70% busy. Seventy percent utilization defines the current capacity limit of the machine for this type of workload and again, this is within industry norms.

Presently there are limited tools and processes for both capacity planning and performance tuning. These resources are considered key to improving the overall cost of the platform.

DII has approximately 1800 GB of storage. Currently, DII has allocated 1200 GB of disk to the 3 LPARS (system images) within the data center.



DII needs to address an archival strategy for storage, since it is not sustainable to keep all production data online, without end, as storage response time and database performance will be impacted by the increasing amount of data that needs to be processed by the applications

While the amount of data is increasing, the online storage is still over capacity. To reduce costs, older data should be stored on a lower cost platform separated from the active data. Although the online disk hardware is underutilized, the technology is old and there is an increased risk for both performance problems and data failures.

STAFFING

The DII mainframe organization includes eleven (11) system developers and operation personnel located close to or within the data center. These personnel ensure the system is available, install upgrades and patches, monitor batch jobs, run reports on utilization and performance, and run the SIMs billing software for chargeback to agencies. This team does not support the applications that reside on the mainframe. Application support resides with each agency or department that is the primary user of the application.

Both funding and staffing of personnel with appropriate mainframe job skills is a serious challenge for DII. The State of Vermont interviews identified the need for additional training for these resources. In addition, the average mainframe salary within the State of Vermont is approximately 20% lower than the current market

place for mainframe analysts. There may be a loss of good employees due to salary limitations of the State's pay structure. Further, finding qualified individuals to fill the mainframe positions is difficult since there is not a lot of demand for this skill set locally.

2. DII MAINFRAME INVENTORY

The following table provides the quantities of available and utilized capacities for the DII mainframes:

DII Mainframe Services			DII Production	DII Disaster Recovery
CPU		Units	Volumes	
	MVS - IBM - Utilized MIPS	MIPS	60	0
	MVS - IBM - Installed MIPS	MIPS	110	80
Disk Storage				
	MVS - IBM - Utilized DASD	GB	1,200	1,200
	MVS - IBM - Installed DASD	GB	2,000	2,000
Tape Storage				
	Number of Tapes	Reel/Cartridge	2,650	0
	Number of Tape Mounts	Mounts	543	0
	Automated Tape Storage	GB	21,300	0
Other				
	Print Images (000s)	Images	510	0
	Mailing Insertions (000s)	Envelopes	65	0

The following table provides the hardware inventory for each of the DII data centers:

Manufacturer	Model	Function	Installed	Utilized
DII 133 State Street				
IBM	**z9**	Application Server	110 MIPS	60 MIPS
EMC	**Symmetrix 8530**	DASD	2000 GB	1200 GB
Brocade	**UltraNet Storage Director 9006**	Storage Director	2	
IBM	**MagStar 3494**	Tape Library	1	
IBM	**IBM 3490E**	Tape Drive	2	
IBM	**IBM 3174**	Controller	4	
DII Barre Location				
IBM	**z800**	Application Server	80	0
EMC	**Symmetrix 8530**	Mirrored DASD	2000 GB	1200 GB
Brocade	**UltraNet Storage Director 9006**	Storage Director	1	
IBM	**IBM 3490E**	Tape Drive	2	
IBM	**IBM 2074**	Controller	1	

The operating system software is upgraded every two years. The next upgrade from zOS1.9 to zOS 1.11 is scheduled for 2010. Other software may require upgrades as well. DII articulated concerns on the ability of some of the older legacy applications to migrate to the new software release. Additional tools or expertise may be required to support the upgrade project from both operations and the applications. This issue is common within the market place.

The software inventory includes:

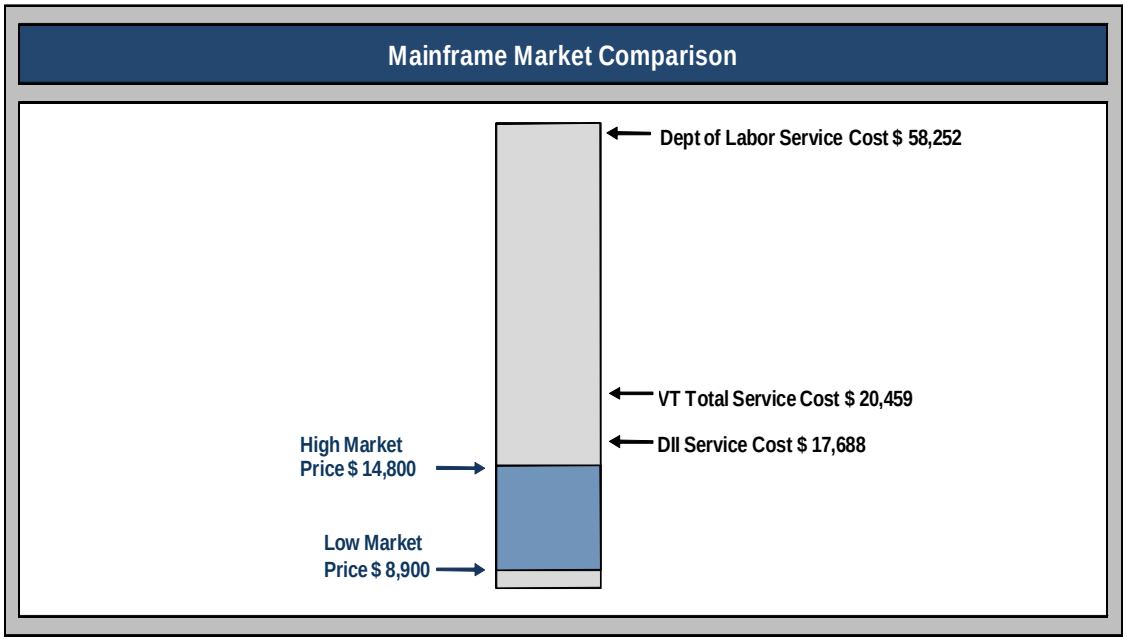
Software	Vender
ACF/SSP V4R6 OS/390	IBM
Adabas MVS ESA	Software AG
Adabas Online System	Software AG
ADAPREP OS390	SPL Worldgroup
ADASAF	Software AG
Advantage CA-EARL	Computer Associates Inter Inc.
Advantage CA-Gener/OL	Computer Associates Inter Inc.
Advantage	Computer Associates Inter Inc.
ALPHA SEARCH INQ SYS	IBM
Brightstor CA-1 Tape	Computer Associates Inter Inc.
C/370 LIBRARY	CIMS Lab Inc. (now IBM)
CA Common Services for	Computer Associates Inter Inc.
CICS / CEMT	IBM
CICS 7682	IBM
CIMS Enterprise	CIMS Lab Inc. (now IBM)
Connect Direct	Sterling Commerce
Data Propogation System	TreeHouse
DITTO ESA FOR MVS	IBM
DOCU/TEXT	Allen Systems Group
DRS Version	Levi Ray & Shoup Inc.
Dynamic Report System	Levi Ray & Shoup Inc.
DYNAPRINT MVS	Software Diversified Services
Entire Access for TCP/IP	Software AG
Entire Network	Software AG
EntireX Message Broker	Software AG
FDReport	Innovation Data Processing Inc.
IBM LIBRARY FOR	IBM
IPCP PLUS/MVS	Software Diversified Services
LANGUAGE	IBM
Natural	Software AG
Natural Construct	Software AG
Oasis	Allen Systems Group
PKZIP for MVS	Ascent Solutions Inc.
Predict	Software AG
PRO-JCL	Allen Systems Group
Secure+	Sterling Commerce
SRDF	EMC
SSCF	Allen Systems Group
TMON for CICS	Allen Systems Group
TMON Naviplex	Allen Systems Group
Trelational	TreeHouse
Unicenter CA - SORT -	Computer Associates Inter Inc.
UNICENTER CA-APAS	Computer Associates Inter Inc.
V - Tape	Computer Associates Inter Inc.
VPS Print	Levi Ray & Shoup Inc.
VPS Version	Levi Ray & Shoup Inc.
VPS/TCPIP	Levi Ray & Shoup Inc.
VPS/VMCF	Levi Ray & Shoup Inc.
VPS-EMAIL	Levi Ray & Shoup Inc.
VSV Report Browse	Levi Ray & Shoup Inc.
VSV Version	Levi Ray & Shoup Inc.
Web Focus Client for HTTP	Information Builders
Web Focus Reporting	Information Builders
Zeke	Allen Systems Group

Other key elements of DII Systems as provided by State of Vermont:

- 9 Total CICS regions
- Over 2,000 batch jobs
- 7,500 Natural Modules
- 1,200 users – approximately 650 concurrent
- 2 million lines of code
- 1000 JCL members

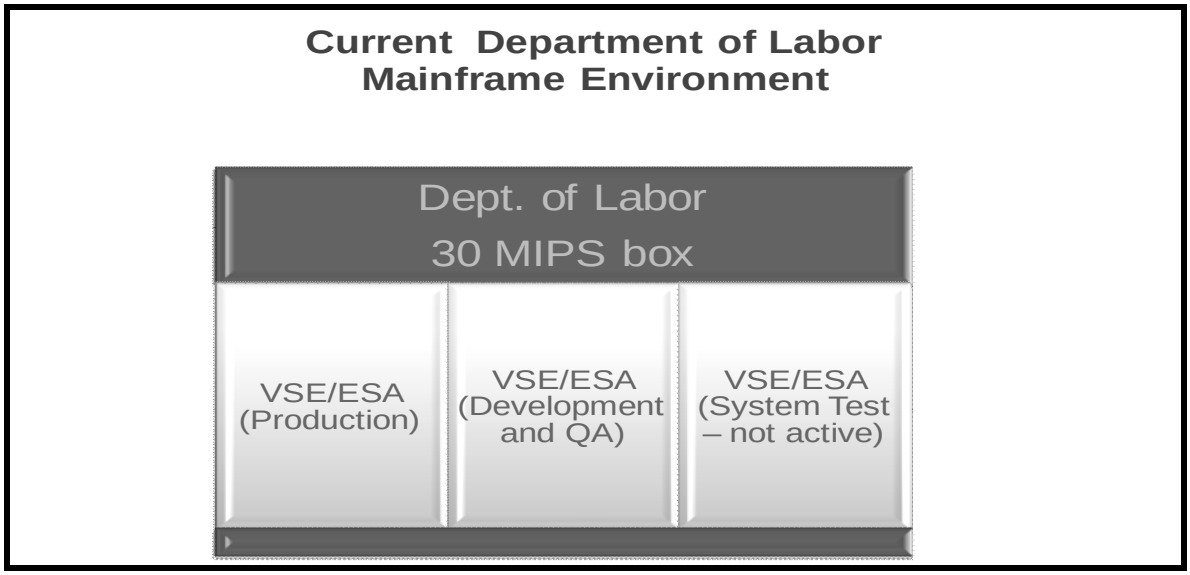
3. DII MAINFRAME BUSINESS IMPACT STATEMENT

One of the methods TPI uses to analyze mainframe costs is by comparing the State of Vermont mainframe costs to the costs gathered from previous transactions that have been consummated within the last 18 months. These transactions included between 3-6 clients of similar scale and scope. This information provides a comparison of the total service cost for a specific tower (i.e. Mainframe Tower) against a high and low market price. The following depicts the current cost of the mainframe for the State of Vermont against the current market cost range on a cost per MIP comparison:



1. DEPARTMENT OF LABOR MAINFRAME ASSESSMENT

The Department of Labor has a server class machine that supports a mainframe S/390 type operating system, Virtual Storage Extended (VSE). The Department of Labor mainframe is located in the Department of Labor data center in Montpelier. The Department of Labor mainframe is logically partitioned into 3 environments: 1) a production partition, 2) a development and QA partition, and 3) a system test area that is used as needed.



DEPARTMENT OF LABOR MAINFRAME OBJECITVES

The Department of Labor has identified several objectives for the mainframe platform which include expandability, technology refresh and optimization. Department of Labor needs to:

- Address 'End of life' issues with hardware
- Manage and reduce the increasing costs of software and maintenance
- Improve the backup process
- Develop a data archival strategy
- Modernize disaster recovery services
- Operating system and application modernization

CURRENT COSTS

The following table shows the annual Department of Labor mainframe costs:

Current Mainframe Annual Cost ($ 000)	DOL
Salaries and related costs	$ 231
Hardware Maintenance and Depreciation	$ 55
Software Maintenance and Depreciation	$ 195
Indirect IT costs (facilities, overhead…)	$ 102
Total	$ 583

One of the challenges with an aging platform, is the need to fund the continued increases in sustain costs as both utilization and maintenance on older platforms rise. Not only do the maintenance costs increase, but the frequency of outages and the increased recovery time requires additional staff resources to manage the outages.

CUSTOMERS

The Department of Labor mainframe supports 20 small applications for their department.

The Department of Labor has one machine with two active VSE LPARS supporting several applications, including Inventory, Federal Accounting and Reporting System (FARS), Tax and Benefits. One additional LPAR is available for system testing when required. The Department of Labor prints 200-300K pages per month including the printing and mailing of checks.

OPERATIONS

Although the Department of Labor mainframe runs 24X7, the operations staff is available for first and second shift, leaving the third shift as a lights out facility. Extended hours of support are available on demand. With the reductions taken over the last few years, there is minimal support staff in place to support the environment.

PRINTING

The Department of Labor provides their own printing services.

BACKUPS AND DISASTER RECOVERY

For the Department of Labor, tape backups are sent to the National Life call center, where the Department of Labor has additional space. In addition to storing the backup tape files, there is a backup printer within the National Life data center. The Department of Labor does not have a documented disaster recovery plan and equipment would have to be acquired at the time of the disaster.

PROCESSES AND PROCEDURES

It was identified in the ITIL self assessment that service level management is one of the lowest category rankings across the agencies. The State's IT teams have limited service levels in place and limited Service Level Agreements (SLAs) or Operational Level Agreements (OLAs) with their internal customers to manage the environment. Expectations are often verbalized, and there is not a formal process for communication of problem resolution.

Formal policies and procedures for infrastructure services are limited and in general, not documented. The self assessment was conducted by a majority of the agencies, and yielded scores that identified immaturity in process and control. Furthermore, interviews with both technical and business associates also identified the lack of formalized process within policies and procedures.

USAGE TRACKING AND USAGE TRENDS

The Department of Labor does not perform on-going capacity planning or proactive performance measurements as the workload is very stable and the machine is underutilized.

While the amount of data is increasing, the online storage is still over capacity. To reduce costs, older data should be stored on a lower cost platform separated from the active data. Although the online disk hardware is underutilized, the technology is old and there is an increased risk for both performance problems and data failures.

STAFFING

The Department of Labor organization has four operations personnel and a system programmer to support the environment.

Both funding and staffing of personnel with appropriate mainframe job skills is a serious challenge for the Department of Labor. The State of Vermont interviews identified the need for additional training for these resources. In addition, the average mainframe salary within the State of Vermont is approximately 20% lower than the current market place for mainframe analysts. There may be a loss of good employees due to salary limitations of the State's pay structure. Further, finding qualified individuals to fill the mainframe positions is difficult since there is not a lot of demand for this skill set locally.

2. DEPARTMENT OF LABOR MAINFRAME INVENTORY

The following table provides the quantities of available and utilized capacities for the Department of Labor mainframes:

Department of Labor Mainframe Services			Dept of Labor
CPU		Units	Volumes
	MVS - IBM - Utilized MIPS	MIPS	8
	MVS - IBM - Installed MIPS	MIPS	30
Disk Storage			
	MVS - IBM - Utilized DASD	GB	134
	MVS - IBM - Installed DASD	GB	402
Tape Storage			
	Number of Tapes	Reel/Cartridge	2,945
	Number of Tape Mounts	Mounts	3,900
	Automated Tape Storage	GB	0
Other			
	Print Images (000s)	Images	350
	Mailing Insertions (000s)	Envelopes	100

The hardware inventory for the Department of Labor includes:

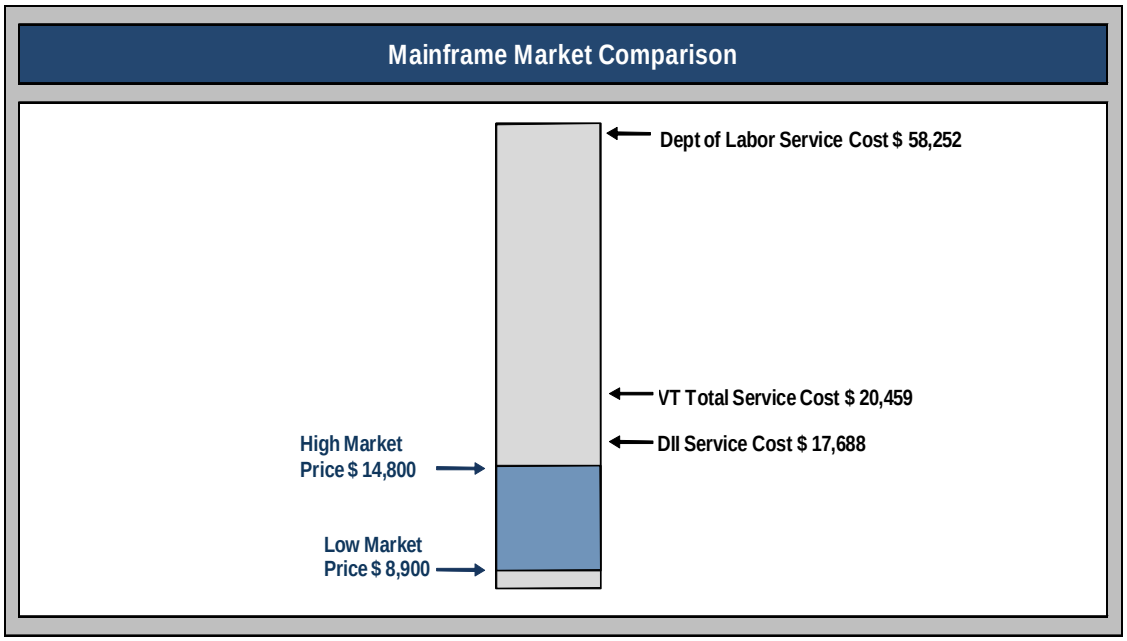
Department of Labor				
IBM		Application Server	30 MIPS	8 MIPS
EMC	**Symmetrix 8530**	DASD	435 GB	300 GB
IBM	**IBM 3490E**	Tape Drive	2	
IBM	**Line**	Printer	1	

The software inventory for the Department of Labor includes:

Software	Vender
Cobol for Kodak	For VSE
CICS / Qeditor	IBM
CICS TS	IBM
Cobol	IBM
EZ IQ online query	Computer Associates Inter Inc.
Eztrieve	Computer Associates Inter Inc.
Flex - ES	Fundementatl Software
Secure FTP	For VSE environment
TCPIP for VSE	IBM
Top Secret	Computer Associates Inter Inc.
VSE OS	IBM

3. DEPARTMENT OF LABOR MAINFRAME BUSINESS IMPACT STATEMENT

One of the methods TPI uses to analyze mainframe costs is comparing the State of Vermont mainframe costs to the costs gathered from previous transactions that have been consummated within the last 18 months. These transactions included between 3-6 clients of similar scale and scope. This information provides a comparison of the total service cost for a specific tower (i.e. Mainframe Tower) against a high and low market price. The following depicts the current state of the Mainframe for the State of Vermont against the current market material on a cost per MIP comparison:



It is not surprising that the cost of the Department of Labor system is high since it is a very small system as compared to the typical mainframe environment. There is a significant amount of overhead to support a leveraged platform, like mainframe services. The analysis and recommendations will identify the opportunities to address the high cost of delivery within the State of Vermont.

PHASE 5 - MAINFRAME ASSESSMENT - RECOMMENDATIONS AND GAP ANALYSIS

1. ALTERNATIVES, ASSOCIATED RISKS, AND IMPLEMENTATION STRATEGIES.

The Department of Innovation and Information (DII) and the Department of Labor (DOL) identified several objectives for the mainframe platform which include building on three pillars: optimize, eliminate, and provide flexibility.

Optimization	Elimination	Flexibility
• Reduce Costs • Improve Processes • Leverage Resources • Technology Refresh	• Consolidation • Re platforming • Retirement • Archival	• Leverage model to reduce or eliminate stranded costs

In determining the alternatives available to the State, each alternative needed to address the primary objectives defined by the State of Vermont. Three alternatives/options were considered after assessing the current state the mainframe services for DII and DOL.

Alternatives

1) **Optimize the current DII environment**
2) **Merge DOL's mainframe environment onto DII's mainframe environment**
3) **Source the mainframe environment - Issue RFP for competitive bid**

These three options are not necessarily standalone solutions. It may make sense for the State of Vermont to implement parts of each recommendation to get the final solution that best fits the State's needs. The approach the State will be determined by the amount of resources available within DII, DOL and the application teams to make the changes necessary to implement the recommendations.

ALTERNATIVE 1 - OPTIMIZE THE CURRENT DII ENVIRONMENT

While there is always an increased demand for IT Services, the current economic challenges facing most industries, including the State of Vermont, require data center managers to deliver more with less. The cost of IT infrastructure and legacy applications must decrease. CIO's expect their organizations to achieve a 10%-20% overall reduction for infrastructure services. Mainframe organizations are a target for cost cutting because they consume critical resources – such as people, power, software licenses and maintenance fees. The mainframe is reliable and powerful but is often an inflexible system that does not easily adapt to changing business requirements. In a time when IT productivity is measured, in part, on an organization's ability to do more with fewer resources, optimizing the mainframe remains a critical operational challenge for the State.

In reviewing the State of Vermont's current environment, some key areas within mainframe services need to be developed for the State of Vermont to implement an optimization program.

The first step in an optimization program is to develop a project charter and plan that defines the objectives for annual cost reductions needed for the program. The team should include resources from operations, the applications, and the agencies affected by the changes. A communication plan must address the strategy to optimize the platform and define the cost reduction objectives that are shared across the teams.

An optimization program leverages the overall Information Technology Infrastructure Library (ITIL) process strategy. ITIL provides comprehensive guidelines for delivering IT services from "cradle to grave". The processes within ITIL can better match capacity to needs and reduce resources through simplification. According to Gartner Group, full adoption of ITIL can reduce Total Costs of Ownership (TCO) by as much as 48%. The mainframe organization within the State is small, but there are a few key areas where additional enhancements will set the stage for better management of the resources which will lead to cost reductions. The State needs to:

1) Develop better information regarding the use of the mainframe. For DII, there are Simple Invoice Management System (SIMS) reports for chargeback but the information is not tied back to the utilization of the Central Processing Unit (CPU) or disk. This limits the ability to understand the impact of application changes to the infrastructure resources, including CPU, disk, tape and print. In addition, the rates within SIMS may not accurately reflect the cost drivers.

   Additional reports should include CPU utilization by application, by user, by Logical Partition (LPAR) and for the box. These reports should tie to the CPU Minutes in the usage reports. Storage is tracked by allocated disk drive. Reports should include the utilization of the disk drives to better plan for the replacement of storage.

2) Leverage capacity management to drive the utilization of the machines up. Increasing the utilization will not only extend the useful life of a machine, but can also reduce the amount of hardware and software needed on the machine. For both DII and DOL, the CPU and disk hardware is underutilized. The available capacity is underutilized for two primary reasons. IT purchases sufficient capacity to last three to five years or more, and information on actual utilization is limited. When there is limited data available, systems often have too much capacity. The DII production environment is 75% batch processing. Normally, batch processing can run at very high levels of utilization, close to 90% without impacting performance.

3) Define architecture standards. The approach is twofold. Defining the architecture standards within the environment can help set the strategy for future changes. Standards can also eliminate custom solutions or set the stage to modernize or retire old applications. Eliminating customization is not only a better use of technology; the staff can be further leveraged across applications if they are not tied to specific platforms or applications maintaining highly customized or unique systems. The Department of Labor applications are running on a legacy operating system, VSE. Both the applications and the VSE operating systems are old and it is often difficult to find resources to support the applications and the system. There are many tools and vendors that can assist in the modernization of the VSE platform. Often the

applications can be converted to zOS or zVM, the DII supported operating systems. With this conversion, no additional hardware or software is required. Currently, the Department of Labor is investing in options to modernize the VSE platform and still meet the regulatory requirements to manage the critical information supported with these VSE applications.

4) Invest in tools and resources wisely. As mentioned in the assessment, one of the challenges with an aging platform is the need to fund the increasing operating costs. New hardware can actually reduce total cost, however, is the State willing to fund refresh projects when the platform is no longer considered a part of IT's strategic direction? A part of the challenge to migrate or optimize the system and applications is finding the right resources for the projects. The staffs in DII, DOL, and many of the application analysts are trained to keep the systems running within the legacy environments. New tools or solutions may require additional expertise to get the project structured and the teams trained. It is not uncommon to purchase software, only to leave it on the shelf because no one understands the potential of the product.

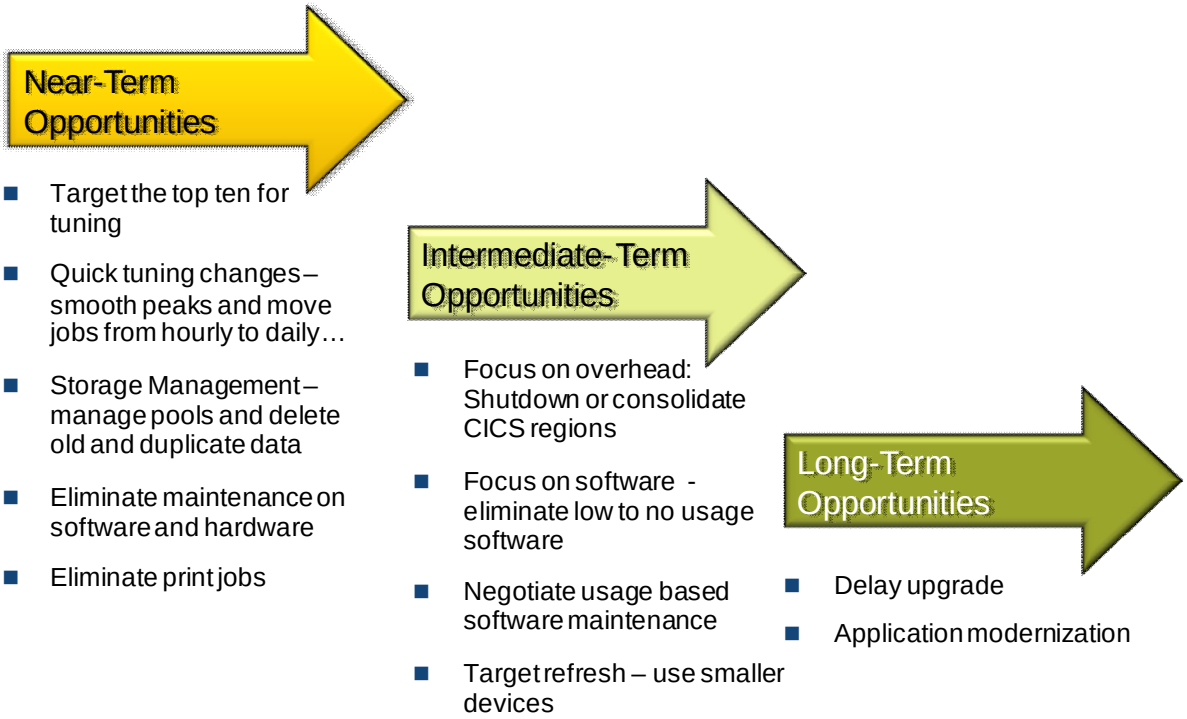
5) Develop a self-funding program. In an environment, where cost reductions are a priority, finding the investment dollars to achieve future savings is difficult especially when each cost-saving initiative is managed independently. Often, the initial cost savings from an optimization or other cost reduction programs are re-invested inside IT to fund the technology and people resources needed to provide further cost reductions. By establishing a program for optimization, early savings are 'reinvested' in the department to fund future savings projects.

IMPLEMENTATION STRATEGY: DETERMINE AND EXECUTE IN WAVES

When looking at mainframe optimization as a whole; the numerous tasks, the work, and the cost associated with them can be daunting. As mentioned above, the State of Vermont will need to spend time and resources to realize cost savings. We recommend starting the project by first addressing the easiest and quickest tasks that are the least expensive to be undertaken. By optimizing this "low-hanging fruit" first, immediate benefits are delivered, which can help propel and fund future projects. As a result, you will the find these waves of execution starting out quickly (maybe a few months) and then taking longer as the more complex aspects are undertaken.

SOV Optimization Approach

Size of the prize = 5-10% of the mainframe spend



1) Identify largest batch jobs and transaction volumes – Usually 20% or less of the jobs drive 80% of the usage. Begin the evaluation with the largest jobs or transactions. The Access application is the largest application on the DII machine. In discussion with the systems analysts, they mentioned they review the jobs based on the SIMS reports. All jobs/transactions should be included in the analysis. Look for ineffective sort run times or too many calls within a job. In the case of transactions, examine the total CPU per transaction. Usage is driven by the CPU per transaction or by the sheer volume of transactions.

   Look beyond tuning the jobs or transactions; instead, look for opportunities to eliminate the jobs or transactions. Throttling back jobs or transactions can cut usage. By running jobs or transactions less often (daily instead of hourly, once a week, etc.) the State can reduce CPU time.

2) Validate test usage – Often test applications or systems are put in place when an application is early in its life cycle, when detailed testing is required. As applications move through the life cycle, the testing requirement can be reduced, quickly eliminating non-value added resources. A good rule of thumb is to make sure that testing of legacy applications does not exceed 10% of production usage.

3) Examine abnormal ends (abends) and reruns – When abends occur, some administrators just restart the job (sometimes over and over) without questioning why it is failing. Restarting jobs creates additional CPU cycles. If problems are consistently occurring, examine whether they are taking place at the system

or application level. As part of the optimization, restart jobs as the last step, not as the first step. Unnecessary reruns drive up usage and provide no incremental value. A word of caution, it is important to balance fixing the problem with the size of the job.

4) Identify largest storage pools – In addition to eliminating data that is not needed, optimizing stored data is a critical element of mainframe utilization.

   - For Access, information is replicated to and from other applications. Deduplication tools will identify and eliminate multiple copies of data.
   - For historical information that needs to be stored but doesn't require quick access, place data on inexpensive removable tape drives.
   - The system programmer should adjust the data placement parameters to move data quickly using the lowest cost storage device. Because data volumes grow rapidly, parameters set by the system need to be adjusted to ensure the pools are set to optimum levels. Adjusting the parameters to reflect the current situation will improve efficiency and save money

5) Identify print strategies – Is the data that is printed really looked at or shipped in boxes for storage? Can data print to electronic storage media instead? All data is a candidate for electronic storage. Further, how many jobs are re-run because the printout is lost? If it is stored electronically, it will not get lost in the mail or on someone's desk. Look for jobs that are not picked up or delivered to locations without a person to accept the printout. Change the jobs to 'no print' and see the measureable results.

6) Optimize overhead – As a general rule, usage on the mainframe is divided into three categories: application usage, system overhead (usage driven by the operating system, control regions, tools, and monitors) and available capacity. It's critical to look at the entire picture when analyzing overhead. Just evaluating application usage is only examining roughly 30% to 40% of the entire machine. Do not forget to look at the remaining 60% to 70% of the machine's overall functions, which are contained within overhead and available capacity. Consolidating control regions will not only reduce the specific overhead tied to it, but can provide additional capacity as the other systems do not have to accommodate the demand from it.

7) Eliminate unused software – Because of the mainframe's longevity, software components can evolve from business-critical to no longer being needed. How do you determine what products are really not used? There are tools to help determine what is not being used. Removing the software can simplify the environment, reduce the risk of system changes, and drive down usage. Although there is risk to any change, turning the software off before removal for 90 days is a good practice to insure that the software is just not used infrequently.

8) Renegotiate – Both DII and the Department of Labor must relentlessly examine and where necessary, renegotiate contractual arrangements. Most of the software contracts are currently based on installed capacity; however, many vendors have usage based pricing. Since the machines are underutilized, usage based pricing can reduce costs even though hardware cannot be removed. Usage based agreements will

require measurement tools or processes to capture the appropriate utilization data. Looking beyond usage based contracts, for some software or hardware, it makes sense to reduce the level of maintenance or simply implement time and material contracts.

9) Refresh technology – Much of the mainframe infrastructure is over five years old. Older technology has higher maintenance costs and failure rates. For example, replacing the current tape system with new technology, like a virtual tape system, would eliminate most of the tape handling and tape management and; therefore, reduce staffing required for these activities. Currently the State pays $68,000 per year for the maintenance of the existing mainframe tape handling system. It is believe that the State could move to a virtual tape solution and recover their investment within a short period of time by the reduction in maintenance costs.

   In addition, disk storage needs to be updated. It is recommended that the State investigate the purchase of a mainframe disk storage system to replace the existing aged mainframe storage. The justification for this, is that the State is currently paying $75,000 annually for maintenance of this existing storage and would be able to justify the purchase of this new storage by reduce maintenance costs.

10) Application modernization – According to AHS, it takes AHS too long to respond to many of the mandated change requirements today by both the state and federal agencies. For the primary application, Access, and some of its related applications, the only way to provide the flexibility needed is to change the underlying software and to use a more modern architecture that allow for quick changes often demanded in the marketplace. The Access application is a legacy NATURAL/ADABAS application. NATURAL/ADABAS is non-strategic within the industry and as organizations continue to leave NATURAL/ADABAS, the remaining customers are paying ever-higher maintenance costs. Furthermore, the skilled staff that know NATURAL/ADABAS are becoming harder to find and more expensive to retain. The architecture of NATURAL applications, including Access, is not able to make full use of modern development concepts. There are many options to re-architect Access, through vendor solutions and processes, automated tools, and specialized program resources.

    In addition to the challenges with re-architecting, there is also the underlying infrastructure fixed cost for the mainframe. If Access migrates from the mainframe, the stranded costs will be charged to the remaining users. As the largest application on the mainframe, these costs are significant. To address the stranded costs, options to re-architect within the mainframe platform on zOS or Linux should be given consideration.

RISKS

Organizations must balance the impact of cost cutting against quality of service and business risk. Change always has some risk associated with it. Often an optimization strategy increases the tension between the finance organization and operations, between operations and agencies, or between agencies and the end users. It is not

cost savings at the price of service, nor is it service at any cost. A healthy balance between the optimization initiative and operations deliver a successful cost reduction program.

Specifically, there are risks associated with the optimization changes recommended. These risks include:

1. Driving utilization too high which impacts application or system performance
2. Collecting too much data often leads to analysis paralysis and the inability to get to meaningful data
3. Changes to jobs or schedules may cause outages
4. Reducing test environments may lead to untested changes
5. Potential lost data with storage changes
6. Consolidation leads to greater change management and coordination
7. Inadvertently eliminating software that is needed
8. The spaghetti network of interfaces for legacy applications, like Access, makes any structural changes difficult
9. The required timing of a change could delay the savings

There are three keys to mitigating the aforementioned risks:

1. Communication - defining and communicating the strategy and objectives for the optimization program
2. Participation – insure all agencies and departments impacted by the initiatives are a part of the planning effort. Allowing staff to have input in the plan provides ownership
3. Planning – project management, schedules, tasks, and timing is critical

BUSINESS CASE

Most of the savings in an optimization program will be realized when there are acquisitions or when maintenance changes are due. Optimization changes the timing of expenditures (by delaying upgrades or reducing the total cost structure of expenditure) rather than in direct reductions. Individual projects will have specific ROIs based on the timing of the effort. Below are some initial optimization recommendations for consideration.

Optimization Opportunity	Effort (High, Med, Low)	Financial Impact	Comment
Refresh the DII EMC Disk subsystem	Low	Reduced maintenance and improved reliability. Cost neutral or potential savings from reduced maintenance	The current storage is very old, with increasing maintenance cost and increased risk for failure and data loss. Propose new storage. If DOL does not merge with DII, DII should purchase 25% less capacity than currently in place.
Refresh DII and DOL tape subsystems	Medium-High	Eliminate manual tape handling. Reduce maintenance costs and operations resources	Replace tapes drive and tape library with a virtual tape system
Renegotiate software agreements	Medium	Expect 10-20% savings	Machines are underutilized, usage based agreements should leverage lower capacity. May require additional reporting by operations
Establish archival policies	Medium	Reduced storage and risk of keeping data too long	Policies need to be defined and will require some application and system changes
Tune and smooth batch jobs	Medium	Manage growth, further reduction in usage	Address performance bottlenecks by focusing on large jobs and critical batch schedules.
Deduplication	High	Invest in tool and save storage across platforms. Deduplication will reduce demand for network bandwidth, storage and improve application performance	Data is often pushed or pulled between application and users across mainframe and servers. Tools will identify and recommend solutions to keep data in one place

An optimization program with participation from key stakeholders, including personal from operations, application and end user can expect to reduce mainframe costs by 5-10% per year.

If the State implements a sourcing solution, the cost reductions from the optimization initiatives may be achieved sooner, as the billing structure is tied to utilization – reduce usage, realize immediate savings.

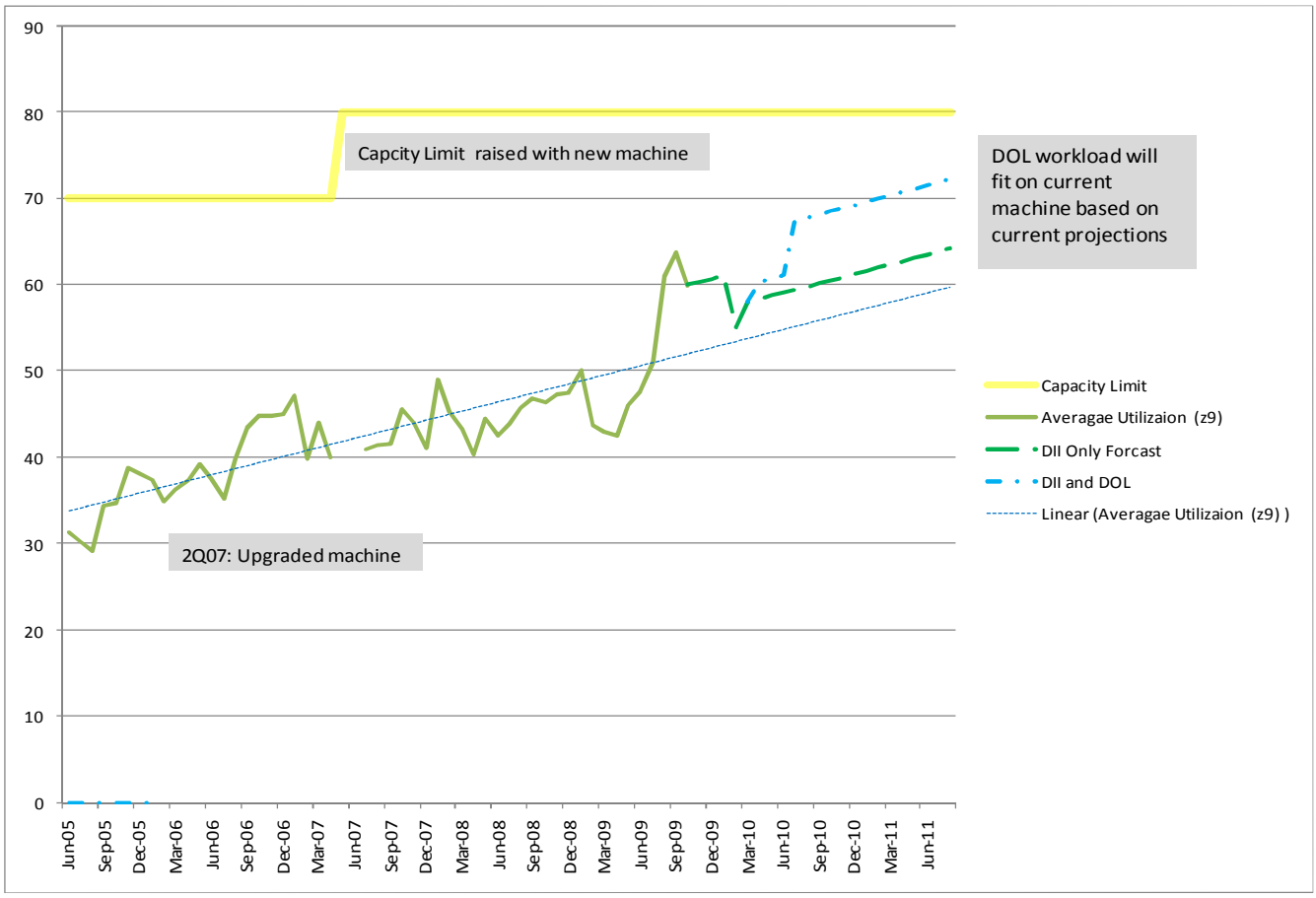
ALTERNATIVE 2 - MERGE DOL ONTO DII ENVIRONMENT

Two agencies, DII and the DOL, provide mainframe IT services. These two agencies support the services independently of each other, in separate locations.

DII has two machines of relatively the same size running the zOS operating systems. DOL has a server class machine that supports a mainframe S/390 type operating system, VSE. Both production machines and the associated disk are underutilized. The DII production machine has sufficient capacity to add approximately 8 MIPS that DOL requires.

MAINFRAME CPU PROCESSING PROJECTIONS

Mainframe forecast depicting DOL on DII mainframe:



MAINFRAME DISK STORAGE PROJECTIONS

In addition to 292 GB free disk space already defined to the DII system, there is 400 GB of reconfigurable disk space available for use. DOL requires approximately 300 GB of disk space. Therefore, there is sufficient disk space available for both.

SOLUTION DESIGN

1) Define the DOL VSE user acceptance/test image as a guest under VM on the DII mainframe
2) Define the DOL VSE system test image as a guest under VM on the DII mainframe. This image will only be active when scheduled through a change request
3) Define the DOL VSE production image as a native LPAR on the DII mainframe. Use available disk space in DII for the images
4) Integrate the tapes from DOL to DII
    a. Only merge in the necessary (current) tapes, older tapes may be logged and managed as foreign tapes, on request
    b. Consider refreshing the DII tape library before consolidating the DOL workload. This will avoid a conversion for DOL to the DII old tape system with the consolidation project, then again when the DII tape library is replaced at a later date
5) Use the same print service as DII., BGS could provide the services to DOL. Relocate the backup printer for DOL from the National Life data center to the Barre data center or give the backup printer to BGS for print backup solution
6) Establish a disaster recovery plan leveraging the Barre data center for the new migrated DOL systems

OPPORTUNITIES

1) Eliminate the DOL hardware - eliminate depreciation and maintenance charges and sell the DOL hardware
2) Limited refresh - The DII environment is more current than the DOL environment
3) Reduce some software charges for DOL. Since the DOL is a different operating system, not all software charges are eliminated
4) Provide improved disaster recovery solution for DOL applications
5) Reduce operational headcount with the merged environment. Provide additional knowledgeable resources to DII with the transfer of operations personal
6) Leverage DII charges across departments and agencies

RISKS

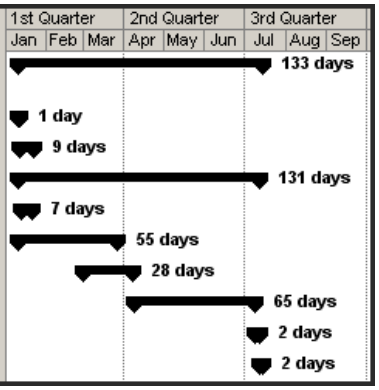
Consolidating the DOL systems into DII means that there is a loss of direct control by DOL for these systems. Again communication and active participation in the migration effort are key to the success of the consolidation

Specifically, there are risks associated with a consolidation:

Merge Project Risk	Probability (High, Med, Low)	Financial Impact	Comment
Loss of Key Staff	Medium		Develop and deliver a timely and fact based communications with a waterfall to the entire organization. Ensure small groups of the key employees are held with selected one on ones to reassure those key employees of their status. Selected calls from CIO to provide another level of reassurance is highly recommended.
Implementation Delays	Medium-High		Integrated teams of operational and application resources
Process Standardization Not Achieved	Low		Process standardization drives some of the savings projections through productivity improvements
Additional Software Licensing Scalability	Medium	$10-$100	Ability to leverage existing Software License Agreements . Manage timing for renewals based on project schedule.
Agency "Buy-in"	Medium		Without effective "buy-in" shadow IT organizations could be increased to absorb current demand for IT activities.
Dedication During Transition	High		Transition will require project dedication to accomplish required activities. The impact results in transition delays.
Capacity under estimated	Low		DII machine is stable. Limit available test capacity to insure production throughput
Loss of data during Migration	Low		Copy data before final conversion.

TIMELINE

	Task Name	Start	Finish	Duration
1	State of Vermont Merge DOL with DII Project	Mon 1/11/10	Wed 7/14/10	133 days
2	Initiate	Mon 1/11/10	Mon 1/11/10	1 day
4	Plan	Tue 1/12/10	Fri 1/22/10	9 days
45	Execute	Mon 1/11/10	Mon 7/12/10	131 days
46	Project Kickoff	Wed 1/13/10	Thu 1/21/10	7 days
52	Planning	Mon 1/11/10	Fri 3/26/10	55 days
57	Image Build	Mon 3/1/10	Wed 4/7/10	28 days
60	Test and Build Process/Procedures	Fri 4/9/10	Thu 7/8/10	65 days
65	Production	Fri 7/9/10	Mon 7/12/10	2 days
67	Close	Tue 7/13/10	Wed 7/14/10	2 days



BUSINESS CASE

Merging the two production data centers provides a significant opportunity for savings for the State of Vermont. The business case below provides strong financial incentive for consolidation of the locations. With a small investment of $60,000, the State of Vermont will save approximately 13% a year. The investment include some transfer charges for software, project management and some testing for the move from the DOL data center to the DII data center leveraging existing capacity.

State of Vermont - DOL & DII Mainframe Merge

▼ Financial Summary ▼	Investment	Ongoing	Total Year 1	Year 2	Year 3	Year 4	Year 5	Total
Current Costs (Operating & Capital)	$0	$3,273,368	$3,273,368	$3,273,368	$3,273,368	$3,273,368	$3,273,368	$16,366,838
Investment Cost (Migration/Transition)	$60,000	$0	$60,000	$0	$0	$0	$0	$60,000
Vermont Ongoing Operating Costs	$0	$3,251,010	$3,251,010	$2,878,142	$2,815,001	$2,815,001	$2,815,001	$14,574,156
Total Future State Costs	$60,000	$3,251,010	$3,311,010	$2,878,142	$2,815,001	$2,815,001	$2,815,001	$14,634,156
Annual Savings (Operating & Capital)	($60,000)	$22,358	($37,642)	$395,225	$458,366	$458,366	$458,366	$1,732,682
IT Capital Savings by Year	$0	$10,057	$10,057	$40,227	$40,227	$40,227	$40,227	$170,963
IT Operating Saving by Year	($60,000)	$12,301	($47,699)	$354,999	$418,140	$418,140	$418,140	$1,561,719
Total IT Cost Savings by Year	($60,000)	$22,358	($37,642)	$395,225	$458,366	$458,366	$458,366	$1,732,682
IT Capital Savings by Year as %			3%	13%	13%	13%	13%	11%
IT Operating Cost Saving by Year as %			-2%	12%	14%	14%	14%	11%
Total IT Cost Savings by Year as %			-1%	12%	14%	14%	14%	11%
Cumulative Savings			($37,642)	$357,583	$815,950	$1,274,316	$1,732,682	
5 Year Cost Savings	$1,732,682							
NPV @ 6%	$1,403,282							
ROI - First Year	-63%							
ROI - 5 Year	2888%							
Payback Period (Yrs)	1.1							

1. RECOMMENDATION, ASSOCIATED RISKS, AND IMPLEMENTATION STRATEGIES

ALTERNATIVE 3 SOURCE - ISSUE RFP FOR COMPETITIVE BID

The cost opportunity for sourcing was identified with the Market to Market during the assessment, as State of Vermont mainframe services is 38% to 130% higher than the market. The State's mainframe environment is relatively small and is not able to leverage the technology or resources as larger firms or service providers can.

A recommendation to source IT functions usually evokes a strong reaction both for and against the strategy. For governmental organizations, politics can make it even more sensitive and challenging; however, just as in the business industry, there are many sound reasons for a sourcing solution. For the State of Vermont, a sourcing solution will provide cost savings and address both the objectives defined by the State of Vermont and the gaps found within the assessment.

OBJECTIVES

1) Optimize

- Significant reduction in capital and operating costs to support the mainframe environment
- Outsourced companies can provide 24x7 support at a fraction of the cost

- Technology refresh is built into the unit cost, so additional business cases for refresh are no longer required
- Outsourced services use approved lists of reliable vendors, which improves the quality of goods and services received

2) Eliminate

- The solution will consolidate the DII and DOL data centers. The service provider will provide an infrastructure archival solution to meet the State of Vermont requirements
- The State of Vermont will have access to technical competence beyond the skillet of the current team. For example, the service provider will provide tools and additional expertise on the opportunities for further consolidation or migrating from the VSE operating system

3) Flexibility

- Outsourced services are utilized as needed, and organizations pay only for what services are actually used
- Staffing levels can be adapted quickly to client requirements, thereby avoiding gaps due to attrition, business growth or economic downturns
- Address the challenge of retaining technically qualified in-house personnel when external job opportunities are rapidly changing

ADDRESSING GAPS

- Outsourced companies provide performance reports and measurements available to their clients
- Communications between business functions improve at all levels and ensure that IT resources are not being misused
- Service Level Agreements (SLAs) are established
- IT consultants are fully trained on the latest technologies
- Continuous IT support coverage without having to rely on only one or two key people Improve disaster recovery solution

2. BUSINESS CASE

A sourcing solution addresses the objectives defined the State of Vermont, closes the gaps raised by the agencies and provides significant cost savings to the State. After the initial investment of $580,000 is recovered in the first year, the State's cost to support the DII and DOL data centers are cut in half, from $3.2M per year to $1.6M per year. The upfront investment includes the project costs to manage the RFP and transition, service provider transitional investments, and one time software charges for the migration of the software to the service provider hardware.

State of Vermont - Mainframe Sourcing

▼ Financial Summary ▼	Investment	Ongoing	Total Year 1	Year 2	Year 3	Year 4	Year 5	Total
Current Costs (Operating & Capital)	$0	$3,273,368	$3,273,368	$3,273,368	$3,273,368	$3,273,368	$3,273,368	$16,366,838
Investment Cost (Migration/Transition)	$580,600	$0	$580,600	$0	$0	$0	$0	$580,600
Mainframe Sourcing Services	$0	$251,600	$251,600	$1,036,592	$1,067,690	$1,099,720	$1,132,712	$4,588,314
Vermont Ongoing Operating Costs	$0	$2,462,509	$2,462,509	$548,649	$548,649	$548,649	$548,649	$4,657,107
Total Future State Costs	$580,600	$2,714,109	$3,294,709	$1,585,241	$1,616,339	$1,648,370	$1,681,362	$9,826,021
Annual Savings (Operating & Capital)	($580,600)	$559,259	($21,341)	$1,688,126	$1,657,028	$1,624,998	$1,592,006	$6,540,817
IT Capital Savings by Year	$0	$80,953	$80,953	$80,953	$80,953	$80,953	$80,953	$404,767
IT Operating Saving by Year	($580,600)	$478,305	($102,295)	$1,607,173	$1,576,075	$1,544,044	$1,511,053	$6,136,050
Total IT Cost Savings by Year	($580,600)	$559,259	($21,341)	$1,688,126	$1,657,028	$1,624,998	$1,592,006	$6,540,817
IT Capital Savings by Year as %			26%	26%	26%	26%	26%	26%
IT Operating Cost Saving by Year as %			-3%	54%	53%	52%	51%	42%
Total IT Cost Savings by Year as %			-1%	52%	51%	50%	49%	40%
Cumulative Savings			($21,341)	$1,666,785	$3,323,813	$4,948,811	$6,540,817	
5 Year Cost Savings	$6,540,817							
NPV @ 6%	$5,317,491							
ROI - First Year	-4%							
ROI - 5 Year	1127%							
Payback Period (Yrs)	1.0							

3. RETURN ON INVESTMENT FORMULAS

The Return on Investment (ROI) formula is calculated as follows:

ROI = (net dollar value of savings ÷ dollar value initial project investment)

Here are the ROI calculations for the State of Vermont' mainframe sourcing project: *see note

	First Year	Five Years
Savings:	($21,341)	$6,540,817
Investment:	$580,600	$580,600
ROI=	net savings / investment	net savings / investment
Mainframe Sourcing ROI:	-4%	1127%

Here are the ROI calculations for the State of Vermont's DOL/DII mainframe merge project: *see note

	First Year	Five Years
Savings:	($37,642)	$1,732,682
Investment:	$60,000	$60,000
ROI=	net savings / investment	net savings / investment
Mainframe Merge ROI:	-63%	2888%

* Note : Although the ROI calculation provides a quick view on a project's return, other financial indicators, such as net present value, should also be included in the decision making process.

QUANTITATIVE AND QUALITATIVE COMPONENTS

The goal of Return on Investment (ROI) formulas is to provide the leadership team with a concise and accurate financial summary, based on a sufficient amount of underlying financial data, for which a confident decision can be made for sourcing. As a matter of course, no one financial formula or ratio should be used as the sole yard stick for which a project's go or no-go decision should be made. Each formula has strengths and weaknesses. With that in mind, several formulas should be used for the financial analysis of the project alternatives for the State of Vermont's mainframe environment.

For the State of Vermont, the following financial formulas are included in the analysis:

- **Operational and capital cost savings** estimates for a 1 year and 5 year view. This formula compares the savings or additional costs of the current environment to the future environment, including both dollar and percentage benefits. The components of the operational and capital costs included in the analysis are listed below.
- **Return on Investment (ROI)** formula represents a measure of the savings divided by the investment incurred for the project. The net operational and capital cost savings as a result of the project are divided by the net investment cost of the project. The components of the operational, capital and project investment costs included in the analysis are listed below.
- **Payback Period** is the length of time (e.g. months) required to recoup the initial project investment. When the project's cumulative operational and capital cost savings equals the initial investment for the virtualization project the breakeven point is reached.
- **Net Present Value (NPV)** is the present value of all future cash flows at the organization's weighted average cost of capital or the average interest rate to acquire funding (e.g. federal loans). Operational,

capital and investment costs for the entire length of the project will be discounted at an interest rate (e.g. 6%) so the value of all future costs are compared to the value of current costs.

In order to calculate the financial formulas, fiscal year 2009 financial data and asset inventories have been provided by the agencies and departments included in this assessment. For mainframe services, the following components were included in the formulas for operational and capital costs.

Operational Costs:

- Staffing including salary and benefits
- Space requirements
- System administration
- Service provider mainframe usage fees

Capital Costs:

- Hardware
- Annual amortization and maintenance
- Mainframe and storage
- Software
- Annual license and maintenance

Project Investment Costs:

- Migration and transition expense
- Software license fees
- Software upgrade fees
- Software transfer fees
- Network
- RFP costs

1. FOR RECOMMENDATION - ASSOCIATED RISKS, AND IMPLEMENTATION STRATEGIES.

Implementation strategy and suggested solution approach:

The following sections assume the State follows the sourcing alternative and the questions are answered based on this alternative.

DII delivers services today in a similar fashion as a mainframe service provider. DII provides the infrastructure (hardware, operating system software, and tools), operates the system, and installs the program products for the applications. The demarcation line between the infrastructure, application, and end users is consistent with industry standard solutions.

The service provider will:

1. Complete a due diligence effort to understand the environment
2. Install the necessary hardware and network connections within the data center
3. Build the images, customize the software
4. Move some of the data
5. Mirror the online data
6. Test internally
7. Test with the State of Vermont's team
8. Cut over
9. Transform to leverage additional services and standardize

Before a service provider is determined, the State of Vermont will need to define the requirement and detailed services for the RFP process. Service Levels and a pricing approach will need to be defined.

Risks

There are some known risks with moving to a sourcing solution. It is important to select a supplier that will work well within the State's environment and fit into the culture. Below are the primary risks that come with a decision to source and the steps to mitigate those risks.

Sourcing Project Risk	Probability (High, Med, Low)	Financical Impact	Comment
Loss of Key Staff	Medium		Develop and deliver a timely and fact based communications with a waterfall to the entire organization. Ensure small groups of the key employees are held with selected one on ones to reassure those key employees of their status. Selected calls from CIO to provide another level of reassurance is highly recommended.
Sourcing as a Solution	Medium-High		Develop and deliver a timely and fact based communications internally and externally, if needed, on objectives for the State and the benefits of the sourcing decision.
Transaction Delays	Medium-High		Integrated teams of operational / procurement / legal and support Reources
Implementation Delays	Medium-High	Monthly	Integrated teams of operational / procurement / legal and supplier Reources
Additional Software Licensing Scalability	Medium	$10-$100K	Ability to leverage existing Software License Agreements
Agency "Buy-in"	Medium		Without effective "buy-in" shadow IT organizations could be increased to absorb current demand for IT activities.
Dedication During Transition	High		Transition will require project dedication to accomplish required activities. The impact results in transition delays.

Specific Questions identified in the RFP:

1.1.1. USERS

1.1.1.1. WILL THE USER EXPERIENCE NOTABLE RESPONSE DECREASE?

The users will not experience notable response time changes. Additional reporting is available for performance usually defined by the SLA's defined for the provider.

1.1.1.2. WHAT WILL THE INTERFACE LOOK LIKE IF IT CHANGES? QWS3270?

The application interfaces usually change only to point to the new systems.

1.1.1.3. WILL WE NEED TO PURCHASE NEW TERMINAL EMULATION SOFTWARE?

No

1.1.1.4. ADDITIONAL CHANGES FOR THE USER

The end user will usually interface with a new service desk unless the State of Vermont service desk provides the front end to the end user.

1.1.2. OPERATORS

1.1.2.1. WHAT WILL THE STAFFING MODEL LOOK LIKE?

The operational staffing model is provided by the service provider. Under an agreement, the State of Vermont defines the services that must be delivered and the service provider determines the operational staffing model.

DII and DOL will build a governance organization to manage the service provider. For an account of this size, two resources are required to provide oversight, invoice review, and change management to the agreement.

1.1.2.2. WILL THERE BE ADDITIONAL REQUIREMENTS FOR SOFTWARE FOR OPERATORS?

Any additional software will be determined by the service provider.

1.1.2.3. ADDITIONAL CHANGES FOR THE OPERATOR ENVIRONMENT

The operator environment will be designed and supported by the service provider

1.1.3. DEVELOPERS

1.1.3.1. HOW WILL THE DEVELOPMENT ENVIRONMENT CHANGE?

The development environment will remain the same with little change. Any changes would be to enhance or expand the capabilities offered by the service provider.

1.1.3.2. ARE THERE ADDITIONAL TOOLS THAT NEED TO BE PURCHASED FOR DEVELOPERS IN THE PROPOSED SOLUTION?

No

1.1.3.3. ADDITIONAL CHANGES FOR THE DEVELOPER ENVIRONMENT.

The developer will have to update change processes to incorporate with the service provider.

1.1.4. IDENTIFY OTHER STAKEHOLDERS AND HOW THEY WILL BE AFFECTED.

The stakeholders remain the same as the current environment. The service provider will support the stakeholders and new relationships with the service provider will evolve.

1.2. IDENTIFY AND PROVIDE COST BENEFIT ANALYSIS FOR RECOMMENDED OPERATIONS, BUSINESS PROCESS OR TOOL IMPLEMENTATIONS.

See Business Case section

1.2.1. COMPARE THE "MAINFRAME MODEL" TO "SERVER MODEL" OPERATIONS.

The solution is a mainframe model with the capability to expand or contract the resources as required by the State of Vermont. The solution for mainframe hosting services is based on utilization of the mainframes. This model better positions the State of Vermont to achieve immediate cost savings if an application moves to a different platform.

1.2.2. ASSOCIATE PROBABILITY TO ACHIEVE SAVINGS AND RISK ASSOCIATED WITH ANY OPTIONS PROPOSED.

The risks are identified for all three options. The probability to achieve the savings is excellent.

1.2.3. IDENTIFY ORGANIZATIONAL/CULTURE CHANGES REQUIRED OF OTHER SERVICE MODELS THAT WOULD ACHIEVE DESIRED OBJECTIVES.

The organization and cultural changes are discussed in the document.

1.3. DII BILLING STRUCTURE. (IF THE CHANGE IS A MIGRATION, THE SERVERS WILL REMAIN AT DII)

Monthly charges will include resource units for CPU, storage, tape and print, very similar to the SIMS chargeback to the users based on actual usage.

1.3.1. WHAT WILL THE BILLING MODEL LOOK LIKE?

Charges will include CPU, storage, tape and print, very similar to the SIMS chargeback to the users based on actual usage. The sourcing model is more variable than today as the investments in hardware, software and operations personal are leverages across many firms.

1.3.2. ADDITIONAL CONSIDERATIONS/CHANGES FOR THE BILLING STRUCTURE.

In the mainframe sourcing model, hardware, operating system software, and utility software is included in the charges. Application software is retained by the State of Vermont.

Additional network charges to connect back to the State of Vermont locations (for servers and users) are not included in the sourcing solution.

1.4. SOFTWARE TOOLS

Question from deliverables list: "If the proposal is a platform migration, verify that Dept. of Children and Families software tools, to include any third party software will work in the proposed environment or define specifically how to accomplish the current functionality in the new environment. Include any software/hardware purchases that are needed to maintain the current functionality."

TPI response: TPI is not proposing a platform change.

1.5. DEFINE HOW DEVELOPMENT AND TEST ENVIRONMENTS WOULD BE AFFECTED WITH THE PROPOSED SOLUTION.

The environments would not change unless the State of Vermont determines the need to leverage other services from the service provider.

1.6. DEFINE THE IMPACT ON INTERFACES WITH THE PROPOSED SOLUTION.

The initial plan is to port the systems as they are currently configured for interfaces. The actual solution is provided by the service provider.

1.7. DEFINE THE BACKUP/RECOVERY MODEL FOR THE PROPOSED SOLUTION IF A SIGNIFICANT CHANGE IS IDENTIFIED.

Under the current design, the operating system and hardware can be restored within a few hours, although the applications have the risk of requiring application recovery from tape, which could take days. The service provider will provide a clearly documented solution based on the State of Vermont requirements. For both DII and the DOL, the service provider will document the process.

Application data backup schedules will still be defined by the application teams. No change.

1.8. DEFINE HOW PRINTING WILL BE AFFECTED BY THIS PROPOSAL.

DOL will need to utilize the BGS services within the State of Vermont or include the printing requirements as a part of the sourcing solution.

1.9. IDENTIFY ALL RESOURCES NEEDED FOR THE PROPOSED SOLUTION.

RFP Process:

- CIO
- Project management
- Purchasing
- Outsourcing experts to guide through the RFP process or help with RFP requirements
- DII mainframe staff

- DOL mainframe staff
- Mainframe application teams to plan, test and validate move
- End users for testing
- Legal

1.10. IDENTIFY TRAINING REQUIREMENTS.

- RFP process – training on approach, process and methodology for a mainframe sourcing solution and RFP
- Governance process – training on the organization, tools, process and methodology to manage an sourcing agreement and solution
- Service provider tools and process integration - provided by service provider

1.11. CLEARLY STATE ASSUMPTIONS AND RISKS.

ASSUMPTIONS:

- The sourcing migration timeline is 9 months from project kick off to cutover to new supplier
- The resources from the application and user community are available for testing and validation
- Disaster recovery services will provide a recovery solution for both DII and D

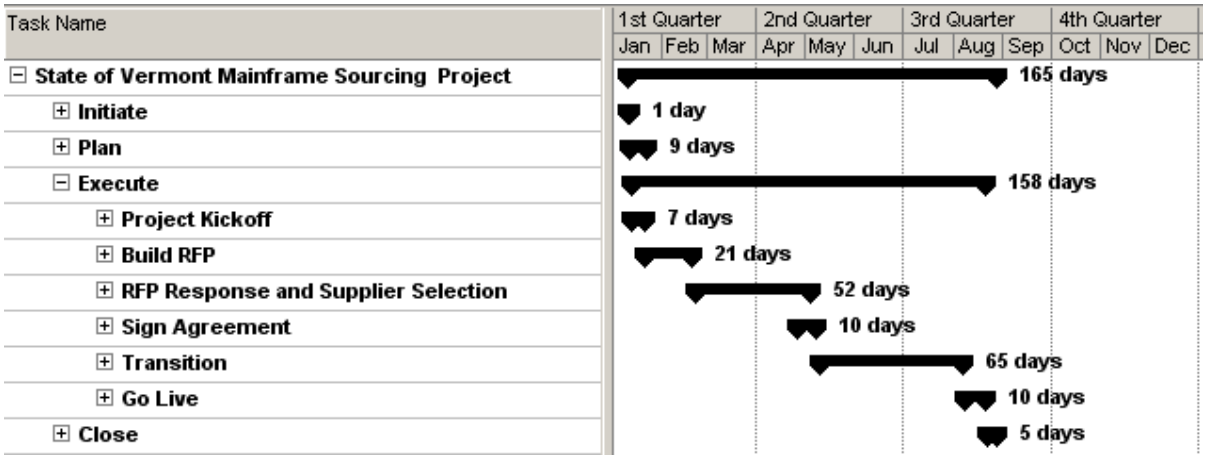
RISKS:

See Risk Section above

1.12. IDENTIFY ADDITIONAL FACTORS PERTINENT TO THE PROPOSED SOLUTION.

No additional factors have been identified

2. GANTT CHARTS



3. COST MODEL ESTIMATES INCLUDING FTE REQUIREMENTS

See Business Case Section