



Access. Security. Trust.

Town of Needham

Information Technology Audit
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Table of Contents

I) EXECUTIVE OVERVIEW	4
II) TOWN OF NEEDHAM INFORMATION TECHNOLOGY TODAY	6
III) CATEGORIZING TOWN-WIDE NEEDS – OVERVIEW	8
1. Infrastructure	8
2. Software Applications and Process Improvements	10
3. Security	11
4. User Support & Training	12
IV) NEEDS ANALYSIS/OBSERVATIONS BY DEPARTMENT	14
V) SUMMATIONS	15
VI) RECOMMENDATIONS	16
APPENDIX A – AUDITED INFRASTRUCTURE INVENTORY	21
APPENDIX B – ASSESSMENT REPORT CARDS	21
Overview	21
Health Check Details - VMware.....	22
Hosts	22
Networking.....	23
Storage.....	24
Security	25
Virtual Machines	26
VirtualCenter	27
Best Practice - VMware	28

I) Executive Overview

In January 2015, Governor Charlie Baker established the Community Compact Cabinet to strengthen partnerships between the administration and municipalities. Since then multiple municipalities have joined this program.

The Community Compact initiative gives Massachusetts cities and towns the chance to make needed improvements through collaboration with and support from the Commonwealth. Each compact is a voluntary agreement between the Baker-Polito Administration and the local government. The cabinet, headed by the Lieutenant Governor, enables the state to work closely with leaders from these municipalities to support public interests and develop mutual standards for governing effectively.

A Community Compact agreement between the Commonwealth and the Town of Needham was signed by the Baker administration on October 13, 2016. With this agreement the Town of Needham pledged to perform an Information Technology Audit of the Information Technology Center (ITC) that will evaluate the existing Information Technology (IT) structure and current staffing against the Town's long and short-term IT strategies and needs. Subsequently the Town of Needham reached out to IntraSystems, Inc. of Braintree Massachusetts to assist with this project. This project included interviews with all the town departments to get an idea of their needs and challenges with respect to information technology.

The speed with which technological changes occur has impacted the way that business is conducted in both the public and the private sectors. The Town of Needham, in many instances, has done an admirable job in keeping pace with these changes. From a datacenter and building interconnectivity perspective the Town of Needham is well ahead of most other municipalities. The main datacenter located at the Town Hall is far and away superior to the facilities that can be found in similar sized and larger municipalities; in fact, the disaster recovery datacenter located at the Public Services Administration Building (PSAB) is more comparable to the main datacenter for other municipalities. Most of the interconnectivity between buildings is over 10Gbps fiber. Cooling and security systems deployed in the main datacenter are enterprise class.

Recent trends in the industry have included moving applications and software from dedicated servers to virtual servers backed by storage area networks (SANs). This trend has helped to establish a downsized yet more versatile IT infrastructure that has helped to reduce the datacenter footprint and provides for easier administration and reduced energy costs. The Town of Needham's Information Technology Center was an early adopter of server virtualization, utilizing VMware technology and Dell EqualLogic Storage Area Networks (SANs).

Current trends see a shift of technology from internal infrastructure solutions to cloud-based strategies that deliver increased functionality and flexibility using a mix of public and private cloud-based application and platform services. Many of the common drivers for such a move to the cloud, such as the lack of adequate facilities or supporting staff, are not existent in the Town of Needham; however, this does not mean that cloud services will not be a bigger component for the Town of Needham in the future.

From a staffing perspective the Information Technology Center (ITC) is under resourced and should look to hire more staff and/or leverage outsourcing for certain support functions to meet customer demand moving forward. The in-house ITC staff will require a rebalance in personnel skills as well as technology knowledge and experience by the team to become more efficient in the execution of its duties. Most desktop support issues (95% or greater) should be able to be resolved remotely. Remote tools must be leveraged by any support element of the ITC if they hope to maintain a high level of responsiveness to end-user requests.

As stated above, through the efforts of the ITC, the Town of Needham is well advanced in many infrastructure areas; however, in software, software support, data integration, and end user support the town is lagging. Specifically, the reliance on an IBM System i AS/400 model server that is not well integrated with other town systems creates the need for data manipulation and data transfer challenges often times relying on third party patches or dated coding. From a process perspective there are many manual processes that contribute to department inefficiencies.

Going forward the Town of Needham could benefit from greater network segmentation and separation via firewalling of client and server resources.

II) Town of Needham Information Technology Today

In many areas, such as datacenter facilities, high speed interconnectivity between buildings and server virtualization the Town of Needham is well advanced of comparable communities.

In FY2018 and FY2019 the Town of Needham is planning on a hardware and software refresh of the existing VMware virtualization environment, including SAN and switching technologies. This virtualization environment is the underlying infrastructure for most systems, excluding the IBM System i AS/400 server, in use by the Town of Needham today.

With the availability of fiber, designed as a star network connecting all major buildings with core switching located at Town Hall, the Information Technology Center has been able to mirror its virtualized environment. Using dedicated fiber, the storage area network (SAN) hardware at the Town Hall is replicated for disaster recovery off site at the Public Services Administration Building. This allows the ITC to fully recover if something were to happen to the primary systems, continuing to offer resources and data to employees who depend on it to serve the public. While this disaster recovery strategy covers most of the systems in use by the Town of Needham it does not extend to the IBM System i AS/400 server. Recovery of the IBM System i AS/400 server would require additional manual steps to recover functionality. A spare IBM System i AS/400 server was previously acquired for use in this manual recovery process.

The IBM System i AS/400 server is the primary piece of hardware that houses the application (Superion) used by the Treasurer's Office for the collection of revenue and the generation of files that are used to create Real Estate, Personal Property, and Utility billing. The IBM System i AS/400 server is the primary avenue for the import of the Assessor's valuation file and is used by Accounting for reference of accounts to the General Ledger which is currently maintained on different software. The Finance Director also accesses the IBM System i AS/400 server for historical research. With the advent of modern processing and server design it is becoming more difficult to find the support needed for the IBM System i AS/400 server. The ITC currently relies on third party consultants for local day to day support as well as the services from a previous employee who retired five years ago after twenty-six years of service. This employee provided COBOL programming for many of the processes currently used for importing and processing data to be used for billing and is called upon whenever the COBOL programs is not run properly.

Over the past dozen years, technology has evolved to become more social and mobile where simple flip cell phones have transitioned into hand held computers that not only give a person the ability to make calls, take pictures, and text message but to also utilize the internet, send emails, and run applications. This shift makes it reasonable to anticipate the desire of more mobile citizens and employees looking for an improved user experience that could help to eliminate current paper based or other manual processes. This shift or evolution will come at a cost due to already tight ITC support resources that have been stretched to accommodate the increased number of Town of Needham end users. Over this same time period, in the Town of Needham, the number of ITC supported employees has remained relatively stable while the number of ITC supported information technology users has tripled.

It is evident through interviews with the various town departments that there is a perception that the ITC is under staffed. We do find that this perception is a reality and will outline the findings and recommendations in this regard in the next section of this report.

III) Categorizing Town-wide Needs – Overview

Four categories are defined in this report to help construct a framework for better interpretation and planning. These four categories are:

- Infrastructure
- Software/Applications and Process Improvement
- Security
- User Support/Training

These four categories form the basis of all initiatives and technology concerns.

1. Infrastructure

Components: Physical Plant, Fiber, Copper, Redundancy, Data Centers, Wireless, Convergence and the future of voice, data and video

Overview: Providing the Town of Needham with an Infrastructure capable of handling current and future technology needs is the foundation upon which all projects, both current and future, will rely. The Town of Needham is well positioned in this area with the current state of building interconnectivity and with the early adoption of virtualization technology. As stated previously FY2018 and FY2019 the ITC has plans to upgrade the software and hardware of their virtualization environment which should help the Town of Needham to stay ahead of the curve in this aspect of IT Infrastructure technology.

One area where the Town of Needham should focus on moving forward would be in network segmentation of the larger Local Area Network (LAN). This would apply specifically to firewalling between the servers and the end users but should also include segmentation and routing of different subnets in the various buildings. This design would be similar to how Public Safety is segmented today. Further attention to the common threat vectors (web browsing and email) faced by most organizations today could be addressed with a sandboxing solution, a process of isolating applications or processes from critical system resources, where attachments and downloads are analyzed before being allowed to the end user.

The existence of a modern, redundant fiber network to interconnect buildings in the Town of Needham is paramount in enabling the ITC to design and build a mirror-imaged, disaster-prepared system capable of keeping financial systems, public safety and other critical data available in the event of a catastrophe. The Town of Needham's fiber network makes it possible for the ITC to design and implement projects for things like enhanced building security, communication, and back-ups. A recommended project that could take full advantage of this fiber network would be the development of VoIP

phone system. VoIP, or Voice over Internet Protocol, is a combination of hardware and software that uses the Internet as a way to make telephone calls.

To a limited extent Bring Your Own Device (BYOD) has already arrived at the Town of Needham. Using Citrix, the ITC is able to promote applications through a standard browser. This in combination with a remote access device (RAD) allows an individual to work remotely or even bring in their own laptop or tablet and access network files, folders, and applications. This typically presents additional support challenges to the ITC. Users bring in devices that they are comfortable with such as Apple and Samsung that may not conform to the standard devices maintained by the ITC or have only minimal levels of virus or malware protection. Policies, practices and procedures should be implemented to set the boundaries of expected ITC support in the BYOD area and to define user responsibilities before devices can have access to the internal network. Some examples of the policies, practices and procedures are eligibility, guidance on participation and enrollment procedures, acceptable devices, minimal standards of operating systems and device platforms, requiring users to have passwords enabled, acceptable level of security applications, support and maintenance or personal devices, development of a mobility suite of programs, and monitoring and management while users are on the network.

The Town of Needham's wireless access, manufactured by Aruba Networks, a Hewlett Packard Enterprise company, is currently available in the Town Hall, PSAB, Public Safety, Center at the Heights, and will be available at the Rosemary Recreation Complex when the building is complete. All the building wireless is connected through fiber to the Town Hall where ITC manages the network. Part of the Rosemary Recreation Complex project is to add additional bandwidth to the wireless network to allow pool users and visitors access while onsite. The ITC has also been asked to investigate the ability of the wireless network to be available in the Downtown Commons as well. Several communities around Needham have started expanding their wireless network into public areas which puts a greater demand on IT staff and increases the complexity of the relationship between the community and the municipal government. The ITC actively advocates that all new buildings, and older buildings that can be retrofitted, be outfitted for wireless access. There are some problems with wireless access, such as dead spots and capacity issues, which ITC will need to address moving forward.

One of the challenges of the ITC is the need to meet public records requests as directed under Massachusetts General Law (M.G.L) 66. The current process to meet these public record requests specific to email is inefficient due to the current email archiving system. The Town of Needham would benefit from the implementation of a commercial email archiving system such as Barracuda's Message Archiver. Having a commercial email archiving system would allow for faster less resource intensive compliance with future public record requests. Another option that can also help with this challenge is one that the ITC is planning for FY2019. The ITC has asked for funds to implement the

move to Microsoft's Office 365 which also includes a significant level of email archiving. When then funds for this project become available, Office 365 will help alleviate any current complexities concerning public record requests of email. A combination of a commercial email archiving appliance and Microsoft Office 365 would provide a robust system of retrieval for public record requests of email.

2. Software Applications and Process Improvements

Components: Financial Systems, Email and Calendaring Systems, Asset Management, Work-Order Processing, Integrated Solutions, Increased Operational Efficiencies, Better Decision Making, Coordinated Resources, Interdepartmental Collaboration, Increased Communication with the Public.

Overview: The Town of Needham currently, as partially listed below, has multiple on premise and online departmental and enterprise applications that try to address the needs of the various town departments:

- Superior Software – NaviLine
- Tyler Tech – Infinite Visions
- Massachusetts - State CAMA
- ComPlus – Parking Management Solution (web based)
- MS Harris Govern
- PeopleGIS
- Granite XP Camera Truck
- Browntech via Norfolk County Registry of Deeds
- Schneider Control System for HVAC
- SchoolDude Work Order and Scheduling System
- SeeClickFix web-based application
- Fairbanks used by Solid Waste
- Sportsman by Peak Software (web based)
- Survey Monkey
- Adobe Acrobat
- Adobe Creative Cloud
- Microsoft Office
- Microsoft Power BI
- Goldmine CRM
- VIRS – Vital Records
- Autodesk AutoCAD
- ESRI ArcGIS
- TriTech Public Safety Computer Aided Dispatch
- Stellar Corporations
- LL Data Design

- ArchiveSocial (web based)
- ShareFile FTP (web based)

The Town of Needham should take the time to look across the different departments finding as many as possible to move from paper to electronic processes. It was brought up during departmental interviews that typewriters were still being used for certain processes which would be a good place to start any transition. The Personnel/Payroll Action Form (PPAF) is one example of a paper-based process that is time consuming and that many end users would like to see automated. Other processes that could be streamlined with additional software are applicant tracking along with a miscellaneous receivables application for the collection of payments. Any miscellaneous receivables application should be integrated with the revenue and general ledger application which would benefit both the Treasurer's Office and the Accounting Department. In that same vein updating the revenue application away from the IBM System i AS/400 server would help in automating processes between the Treasurer's Office and the Accounting Department and the Town of Needham through FY2018 and FY2019 should begin internal dialogues considering a replacement.

3. Security

Components: Disaster Recovery, Alarms, Monitoring, Video-Based Security, Policy, Firewalls, Consistent Solutions across Departments.

Overview: There are many components to a comprehensive security approach, specifically the following:

- Protection from the Internet – On the perimeter this protection is provided by firewalls, but just as important, for the proper protection from Internet-based vulnerabilities, is the patching of internal systems.
- Protection from Internet Browsing-based threats – Proper protection when users browse the Internet is provided at the firewall/edge.
- Protection from Email-based threats – It is important to provide Spam Filtering and Antivirus protection on the incoming email stream since most attacks originate from this vector.
- Protection from BYOD devices – Education and awareness will help mitigate issues caused by users bringing and using unsecured devices in the workplace.
- Protection from disgruntled or departing staff – The standardization of employee onboarding and termination procedures would help to mitigate the exposure in this area.
- Protection during remote access – Every department has key employees who need to remotely access systems even during catastrophic weather events that leave the town shutdown to all but essential personnel.

The protection of the Town's data and networks begins on the inside. The ITC must continually review and upgrade security systems and practices to address new threats as they emerge. With the installation of new technology and solutions the ITC must remain vigilant in the fight to eliminate potential exploits to protect the Town, its employees and its residents.

For Internet browsing, users have complained about work-related sites getting blocked, the ITC needs to look at providing the ability for users to override the blocking for such sites.

For email-based threats the ITC has a system in place for email filtering however some tweaking will always be needed as sometimes spam is getting through or legitimate emails are getting blocked.

Sandboxing on both browsing and email attachments should be explored as these are the two most common sources of computer virus/malware/ransomware today.

Video monitoring of public buildings, public spaces, traffic and known crime zones are a high priority. Such video monitoring is an important component to help ensure the safety of the community. Consistent solutions that work across all departments will provide efficiency, enable cooperation, and will enable the consolidation of back end equipment to help minimize server needs, licensing, maintenance and support costs. Additionally, the ITC will need to standardize the storage of historic video, develop consistent means of retrieval and insure compliance with State and Federal laws while protecting the rights of all citizens.

4. User Support & Training

Components: Training for IT Staff and End Users, Enhanced User Awareness, Remote Access, BYOD

Overview: In-house training for technical staff is critical in preserving the Town's technology investments. Rapid changes in technology require frequent, in-depth training on new or updated systems and solutions.

Keeping the ITC staff knowledgeable in current systems and applications is only one piece of the puzzle; training for end-users and documentation of processes must be available. Functions and processes that are performed infrequently can often be the source of mistakes. The most effective training practices typically include repetition. If that is not an option, frequent training opportunities are critical to keeping all staff current.

Ensuring that all employees are aware and informed of changes in policy and how it impacts them is very important and should have a structure and delivery mechanism that insures everyone remains knowledgeable.

Training delivery methods have evolved. New methods of training such as pre-recorded classes, FAQ web pages or user groups can supplement traditional methods.

IV) Needs Analysis/Observations by Department

Departments Interviewed	
1. Accounting	9. Public Facilities Construction
2. Assessing	10. Public Safety
3. Building Department	11. Public Works
4. Health and Human Services	12. Purchasing
5. Human Resources Department	13. Retirement Department
6. Information Technology Center	14. Tax Collector / Town Treasurer
7. Park and Recreation	15. Town Clerk
8. Planning and Community Development	16. Town Manager

Over the course of several days fifty individuals encompassing sixteen departments were interviewed. The majority of these individuals were Managers, Assistant Managers, Superintendents, and Assistant Superintendents. The remainder of those interviewed consisted of Administrative and Professional staff. The interviews ranged far and wide but always fell back on the day to day needs of each department. These needs consisted primarily of software and hardware requests that impacted the ability of the individual, or department, to perform their job. With respect to software the issues have to do with updates, upgrades, connectivity, training, and support any of which, if not acted upon, can impede the performance of these employees. In regards to training this was mentioned with respect towards helping new employees, as well as existing staff, better understand the hardware and software they use daily. To specific software needs several departments did mention that the Town would benefit from a document management application as well as a centralized person to coordinate the Town's web site. The hardware issues consisted of requests about printers and similar devices and how the response specific to them was not always consistent. Several departments had requests for hardware that would be used by the departments to improve efficiency and productivity. For example multiple departments mentioned wanting tablets for staff in the field to help coordinate different processes out in the field. Others were looking for hardware upgrades at the desktop, either new or additional hardware, in hopes of working more efficiently. There was concern about the process to submit requests and that it was difficult, if not impossible, to determine the status of any request. Some individuals mentioned having to resubmit requests because there had not been a response to an email within a desired time frame. Several departments suggested that a ticketing and tracking system would be beneficial. In general the departments felt that the Information Technology Center was understaffed specific to desktop help support.

V) Summations

As mentioned previously, in many ways, the Town of Needham is well ahead of other communities when it comes to technology however there are a few areas, as listed in the recommendations below, where we believe it would be worthwhile for the Town of Needham to invest. From a datacenter and building interconnectivity perspective the Town of Needham is well ahead of most other municipalities with the main datacenter in many ways superior to the facilities that can be found in similar sized and larger municipalities. With approximately 350 users and upwards of 500 plus managed devices it is difficult for the Information Technology Center to support the growing needs of the other Town Departments mainly because annually other departments continue to add more technology users, systems, and processes. The current needs and demands of those departments have made it difficult for the Information Technology Center, as it is currently designed, to sustain a time efficient level of support.

Within the ITC the employees responsible for the daily support of end users are also responsible for many short term and long term projects. This responsibility has become a struggle to maintain a balance between end user support and these short term and long term projects. Often one suffers to the benefit of the other. The Information Technology Center struggles to address requests for more technology by users, to make their processes more efficient and productive, and the demand by more technology users for day to day support is directly related to the lack of personnel in the proper positions for support, project management, and planning within the Information Technology Center. Both the Director, MIS and the Network Manager, who should be involved in management, project planning, office budgeting, network engineering and security, staff development, departmental development, and any other higher level needs of the Information Technology Center are daily drawn into multiple low level requests which cause higher level needs to be disrupted or delayed. It is not uncommon for a project that should take six to ten weeks to complete take four to six months or more. The structure of this department needs to be revamped if the department is going to meet the needs of the end users and the Information Technology Center moving forward.

VI) Recommendations

Infrastructure Recommendations

Consolidation of Firewall Technologies:

The town of Needham currently utilizes both SonicWall and FortiGate firewalls but lately has standardized on the later. We would recommend eliminating the SonicWall and subsequently adding a FortiManager for central management and configuration change management on the various deployed FortiGates.

Defense in Depth:

The prevalence of Internet-based threats makes it imperative for any organization to deploy a defense-in-depth strategy to protect their organization. For completeness this protection would have an edge element provided by firewalls and spam/AV filters for email, URL filtering which can be provided by the edge firewall. At the client, protection should be in place against viruses and malware. Currently this client protection element causes a lot of disruption for end users, based on the interviews. The Town of Needham should consider a replacement for the current suite. Another element that should be considered would be sandboxing that would evaluate email attachments and internet downloads before they are allowed onto the end-user systems.

Network Segmentation:

The current network at the Town of Needham could benefit from segmentation, especially when it comes to client to server segmentation. Currently the clients and the servers exist on the same subnet with no firewalling in between. Proper segmentation would help to protect the servers from the clients which are the most likely source of any virus/malware/ransomware infection. Further segmentation between buildings would also provide for more efficient network communications and could provide for another avenue of protection if implemented with firewalling.

Upgrade to vSphere 6.5

VMware vCenter Server® 6.5 has many new and innovative features. The installer has been overhauled, resulting in a new, modern look and feel. It is now supported on Microsoft Windows, macOS, and Linux operating systems (OSs) without the need for any plug-ins. With vSphere 6.5, the VMware vCenter Server Appliance™ has surpassed the Windows installable version. It offers the following exclusive features:

- Migration Tool
- Improved appliance management
- Native high availability

- Native backup and restore

There are also general improvements to vCenter Server 6.5, including the vSphere Web Client and the fully supported HTML5-based vSphere Client.

VMware Training

It is recommended that The Town of Needham send key personnel to VMware authorized training from time to time to keep up with the product knowledge. Cross training of staff should be encouraged to help ensure that support for a particular technology is always available.

Department Operational Recommendations

During the departmental interviews there was a lot of discussion about the Information Technology Center's (ITC) ability to efficiently respond to the needs and requests of the end users. From our perspective this has mainly to do with the lack of redundancy in ITC positions to support end user requests as well as the lack of an application to manage end user requests. The ITC needs to procure an end user request ticketing and tracking system. The ITC currently uses an application, TrackIT, for asset management and some remote desktop access however this application also includes a request ticketing and tracking system module. Training on this module would assist in moving forward with an end user request ticketing and tracking system.

In conjunction with an end user request tracking/ticketing system we feel that the ITC needs to develop a tiered system of support for end user requests, higher level projects, and long-term planning. Typically, a tiered system of support breaks down end user requests into three tiers:

- Tier 1 is the initial support level responsible for basic end user requests. This position should predominantly use remote tools and should only go onsite for support as a last resort since 90% of support issues managed by the Tier should be handled remotely. Tier 1 is often lower level technical personnel, trained to solve known problems and to fulfill service requests using learned knowledge or defined SOPs as well as day to day management of a ticketing system to help make sure that support issues are handled in a timely manner. In the case of the ITC this position would be available in the department for walk-in request as well. It was noticed that these walk-ins can take significant time away from staff that are working on higher level requests, processes, or projects delaying their completion. If Tier 1 is unable to provide a solution the Tier 1 personnel will escalate incidents to a next level tier, in this case Tier 2. The Tier 1 position should coordinate onsite visits with the Tier 2 position and should work towards assisting on documented repeatable Tier 2 tasks creating an in-house knowledge base. A Tier 1 position, for example Helpdesk Specialist, would have to be created since it is currently not part of the ITC personnel structure. Another

opportunity for efficiency of processes with this position would be to incorporate administrative and low level repetitive tasks currently handled by the Director, MIS and other members of the staff. This would include initiating procurement requisitions, purchasing of supplies, managing deliveries, inventory, packing lists, weekly and monthly invoice processing, budgeting reviews based on reports, software renewals notifications, time sheets, phone calls, and mail.

- Tier 2 is a more experienced and knowledgeable member of the staff that will assess issues and provide solutions for problems not handled by Tier 1. Tier 2 would also be responding to alerts, system and network patching, hardware builds, and project work as assigned. Any issue or request that Tier 2 could not finalize would be escalated to Tier 3. Much like Tier 1, Tier 2 should work towards assisting on documented repeatable Tier 3 tasks.
- Tier 3 is the highest level of support and would be responsible for handling the most difficult or advanced problems. Tier 3 duties would include recommending and managing network engineering, security needs, and infrastructure design as well as working with the Director, MIS in the coordination and execution of technology projects for both the Information Technology Center and other Town Departments. This tier would be involved in future planning and work with the Director, MIS to development IT Policy to be used within the Information Technology Center as well as other Town departments.

A major advantage to this type of tiered support is overlapping of duties. The Tier 1 position should be cross trained / mentored by Tier 2 and the Tier 2 position should be cross trained / mentored by Tier 3. This helps in creating a degree of duplicity in support as well as a level of succession as personnel move on. To put these tiers into relative current ITC position Tier 2 would be associated with the Technology Support Technician and Tier 3 would be associated with Network Manager.

It was noticed that the Information Technology Center is one of the few departments that does not have an assistant. To incorporate this thought into a succession concept as mentioned above it would be our recommendation that the Tier 3 position be designated as the Assistant Director of the Information Technology Center and that the Tier 3 level support and knowledge be associated with this position. An Assistant Director would help the Director in planning, organizing, and coordinating projects, policies, and procedures. As the Assistant Director this person would advise on project feasibility, policy implementation considerations, and other specialized or technical questions. This position could also assist in providing direction and guidance for development and operational activities. The Town has an exceptional network and infrastructure which has allowed it to move forward in many areas that other communities of the same size still struggle to reach. Having a person with the knowledge of networking, security, engineering, planning, and software is integral to the Town's technology forward movement.

With regards to duplicity of support, another area of concern is the Application Administrator position. Within the ITC there is currently only one Application Administrator and this position is currently staffed to directly support the General Ledger and Human Resources module of the Financial Application (Infinite Visions). It is anticipated that in the future a new Revenue Application will be purchased transitioning from the Revenue Application currently residing on the IBM System i AS/400 server. The current Application Administrator would transition to supporting both the General Ledger and Revenue pieces of the Financial Application as well as any other modules associated with the application. This causes concern because there is no backup or second Applications Administrator within the department. If there is a personnel transition or issue with the Application Administrator there is no person to readily step up to cover the demands of that position. Based on conversations with the Director, MIS about future enterprise wide application projects, document management, permitting, Office 365, as well as departmental application needs, import/export of transactional files, and the Town's web site it is recommended that a second Applications Administrator position be created. This second position would take on the support functions of new or upgraded departmental and enterprise wide applications. There would be cross training between the two Applications Administrators to ensure for better transitions in the case of personnel changes. These positions would also develop and be involved in training for the applications they support or that are provided by the Information Technology Center. These positions could also help in the documentation of the duties for the different tiered positions.

The revenue application as mentioned above, which has been in use since the mid-1990s, currently resides on an IBM System i AS/400 server and is supported by a Computer Operator. The Computer Operator provides support mostly to the Treasurer's Office with lesser support to the Accounting Department. The responsibilities of this position center around revenue file transfers from vendors into the revenue application, file transfers to bill print vendors, file transfers to banks and benefit vendors, Accounts Payable and Payroll processes, mailing services, and banking processes when needed. This job has not changed significantly since the mid-1980s however many of the processes supported by this position would be incorporated into any position that would be supporting the current General Ledger and new Revenue Application. More than likely there will be a hardware change from the IBM System i AS/400 server to an Intel style server that would be managed by either Tier 2 or Tier 3 support. Within the department there is no one with IBM System i AS/400 server knowledge and many of the transactional processes were written in COBOL when the Town had a COBOL programmer. It is our recommendation that when needed that this position be transitioned to an Applications Administrator position.

The last position in the ITC is the Geographic Information Systems Administrator. The position works with many departments across both the Town and School and when required incorporates multiple databases into the Geographic Information Systems to develop cartographic and data analysis. In several of our conversations with other

departments, and with the Director, MIS, it was brought up that perhaps the Geographic Information Systems Administrator should be involved more directly with other departments. The Director, MIS is of a general feeling that users are unsure of what their needs are when thinking of Geographic Information Systems. Our recommendation would be to find ways for the Geographic Information Systems Administrator to bring examples to the different departments, to integrate the workings of GIS, with specific examples that will encourage the use of the Geographic Information Systems across the enterprise.

Based on our conversation with the Director, MIS we also see the need for an Administrative Assistant for the department. The Administrative Assistant would be responsible for administrative and low level repetitive tasks that are currently handled by the Director, MIS and other members of the staff. This would include initiating procurement requisitions, purchasing of supplies, managing deliveries, inventory, packing lists, weekly and monthly invoice processing, budgeting reviews based on reports, software renewals notifications, time sheets, phone calls, and mail. This position could be incorporated into the Tier 1 position who would also assist with the day to day management of a ticketing system to help make sure that support issues are handled in a timely manner.

Lastly, we would recommend if there is a possible location, that a dedicated space for training be developed. Some of the ITC limitations to training are the amount of energy it takes to setup and take down the hardware as well as the coordination of rooms. The Information Technology Center uses a handful of laptops and switches to setup for trainings which require running wires and extension cords under and around tables and chairs as well as limits the number of users to the 7 – 10 laptops they may have at any one time. They often schedule a room for a half day before and a half day after to give them time to setup and take down when there are many people. In the case where they might have multiple day trainings in a row they have also scheduled into the evenings so that they don't have to breakdown the equipment if someone happened to schedule meetings after 5:00PM in those rooms. It might be more efficient to find a permanent or dedicated location with desktops and smart boards. The room can be shared with other departments for their training needs as well. Having a permanent space would let the ITC, and other departments, more efficiently and more often schedule training.

Appendix A – Audited Infrastructure Inventory

Not included for security reasons.

Appendix B – Assessment Report Cards

Overview

The Health Check Report Card presents an overview of the Health Check assessment results using the following grades.

Health Check Report Card	
Grade	Definition
Needs Attention	We identified specific items of concern and have recommended actions to address them.
Caution	Items of potential concern. The items are either non-critical or require further investigation.
OK	We observed adherence to best practices guidelines. There are no apparent signs of items for concern.
No Data	We were unable to gather data to evaluate.
Not applicable	This item is not applicable

Table 1 Health Check Report Card

For each assessment area, we check against specific best practice guidelines. Guidelines are categorized by impact as follows.

Best Practice Guidelines	
Impact	Definition
Management	Proactive facilitation to make Infrastructure easier to manage, including more streamlined processes and improved security.
Performance	Opportunity for potential utilization gain or avoidance of performance problems.
Troubleshooting	Facilitation to make Infrastructure easier to support and problems easier to diagnose, or proactive avoidance of common pitfalls.

Table 2: Best Practice Guidelines

Health Check Details - VMware

Hosts

ESXi Best Practice Guidelines				
Best Practice Guideline	Impact	Description	Issue	Grade
Consider enabling Hyper Threading, if applicable	Troubleshooting, Performance	HT can improve processor performance by taking advantage of additional CPU interrupt controllers and registers, thereby enabling slightly higher utilization levels across the virtual infrastructure. A small improvement in performance can be gained, provided applications within the Guest OSes are optimized for HT.		OK
Configure time synchronization using NTP	Troubleshooting	Ensure that each ESXi host is configured to synchronize time with a NTP (Network Time Protocol) server. Synchronizing with NTP keeps the timestamps of the various ESXi monitoring and reporting logs in synch		OK
Maintain Patch and version levels and maintain host driver and firmware versions	Maintenance	Patches for VMware should be maintained and if possible organizations should not fall too far behind in versions. Hardware firmware should be maintained.	VMware is 3 versions behind the current version. All of the hosts are in need of firmware updates	Needs Attention
Configure Clusters with Adequate resources for maintenance	Maintenance	Clusters should be built with sufficient resources to allow for the evacuation of a host for maintenance	3 of the 4 clusters are resource deficient (memory) and would not allow comfortable evacuation of hosts for maintenance purposes	Needs Attention

Table 3: ESXi Best Practice Guidelines

Networking

Network Best Practice Guidelines				
Best Practice Guideline	Impact	Description	Issue	Grade
Use separate virtual switches	Performance	Use separate virtual switches, each connected to its own physical network adapter, to avoid contention between the ESXi service console, the VMkernel, iSCSI, and virtual machines, especially virtual machines running heavy networking workloads.		OK
Configure vSwitches with optimal redundancy	Troubleshooting, Management	VMware recommends that there be a minimum of four Gigabit network adapters per ESXi host—two attached to a vSwitch for the management network (service console, VMkernel, and VMotion), and two attached to a vSwitch for the VM network to support the virtual machines.		OK
Use vSwitch port groups to segment traffic	Management	By default vSwitch ports are used to segment out management network traffic, specifically the service console and VMkernel traffic, from general VM traffic.		OK
Physical Switches should be maintained	Maintenance	Firmware on physical switches used to connect the hosts to the storage, to other hosts, to vCenter and to the users should be updated regularly	Switches used to connect to iSCSI storage, to end users and for building interconnection are all behind on firmware versions	Needs Attention

Table 4: Network Best Practice Guidelines

Storage

Storage Best Practice Guidelines				
Best Practice Guideline	Impact	Description	Issue	Grade
Use shared storage for VMs instead of local storage	Management	<p>Store all VM-related files on shared storage so that hosts can be easily interchanged. This way, VMotion and VMware DRS can be used to shift running VMs onto other hosts for scheduled maintenance. Using shared storage also is required to facilitate VMware HA.</p> <p>By placing all workload-related items on shared storage instead of local storage, hosts become more uniform in configuration and can be easily and quickly swapped out or recreated.</p>		OK
Configure multipathing to storage properly	Troubleshooting	<p>Multipathing allows an ESXi host to maintain a constant connection between the host and a storage device in case of failure of a host bus adapter (HBA), switch, storage controller, storage processor, or a Fibre Channel/iSCSI network connection. Leveraging this functionality requires at least two HBA cards per host and specific SAN settings.</p>		OK
Maintain firmware version on Storage	Maintenance	<p>Storage firmware versions should be maintained on a regular basis to help with stable storage operation</p>	Firmware updates are available for all of the appliances deployed	Needs Attention

Table 5: Storage Best Practice Guidelines

Security

Security Best Practice Guidelines				
Best Practice Guideline	Impact	Description	Issue	Grade
Limit remote access to hosts by root	Management	By default remote access via ssh using root is disabled for greater security. Create an administrative account to use for remote access and data transfers.		OK

Table 6: Security Best Practice Guidelines

Virtual Machines

VM Best Practice Guidelines				
Best Practice Guideline	Impact	Description	Issue	Grade
Install VMware Tools	Performance	Install VMware Tools in all guests that have supported VMware Tools available. VMware Tools optimize the guests to make them run better inside virtual machines by providing optimized virtual NIC and storage drivers. VMware Tools also provides a balloon driver to assist with ESXi memory management. To ensure compatibility and optimal performance, upgrade VMware Tools for older virtual machines to the highest versions supported by their ESXi hosts.	One VM did not have VMware Tools installed. A number of VMware Tools are out of date.	Caution
Avoid using screen savers	Performance	Screen savers are often extremely CPU-intensive and can generate unnecessarily high CPU utilization. Disabling screen savers is recommended. Blank, locked screens can be used to achieve security on unattended consoles and these do not create any unnecessary CPU load.		No Data

Table 7: VM Best Practice Guidelines

VirtualCenter

VirtualCenter Best Practice Guidelines				
Best Practice Guideline	Impact	Description	Issue	Grade
Limit number of managed hosts in vCenter		Large numbers of managed hosts, managed virtual machines, and connected VMware vSphere Clients can affect the performance of a vCenter Server. Exceeding the supported maximums, though it might work, is even more likely to impact vCenter performance.		Ok
Run vCenter with sufficient resources		Make sure you are running vCenter Server and the vCenter Server database on hardware with sufficient CPU, memory, and storage resources for your deployment size.		Ok
vCenter Location		To minimize the latency of vCenter operations, keep to a minimum the number of network hops between the vCenter Server system and the ESXi hosts.		Ok
vCenter Alarms		For the best performance, avoid overly-aggressive vCenter alarm settings. Each time an alarm condition is met the vCenter Server must take appropriate action. If this happens very often, the added load could affect system performance.		ok

Table 8: VirtualCenter Best Practice Guidelines

Best Practice - VMware

The VMware environment conforms to best practices for the most part. There are a few areas that should be addressed. The single biggest change that may provide an immediate impact within the VMware environment would be to upgrade all ESXi hosts to the latest available version (if the hosts support drivers for VMware 6.5) and to make sure that the VMware Tools for the VMs are at the latest version. This will provide stability and uniformity across the enterprise. Other than this, firmware updates to the host hardware should be maintained in conjunction with updates to the host OS.