

Remote Era: Building a Virtual & Telecommuting Future for your Financial Institution

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ABSTRACT

A Virtual Desktop Infrastructure (VDI) references a design in which virtual technology systems are hosted in a data center environment. These virtual systems consist of the desktop and server operating systems, multiple business applications, storage area networks (SAN), and end-user settings hosted on these virtual machines. When an end-user launches an application or executes a task, the application is not executed on a local computer. In its place, the end-user is retrieving their virtual desktop remotely, using a personal computer, laptop, or mobile device. There are vast amounts of vendors who offer VDI solutions for implementing, designing, and hosting a VDI environment. Three several vendors lead the VDI deployment, such as; VMware and Microsoft. These vendors offer a complete series of tools for designing and creating VDI images, security with threat protection, storage management, and cloud services. Additionally, they offer to monitor services for end-user activity and more.

VDI at York Traditions Bank is at its core of technology business efficiency and looks to solve real-world problems such as application deployment, remote access, and data loss prevention. The VDI solution at YTB strives to increase the end-users' access to financial specific applications and reduce administrative overhead.

Executive Summary

The focus of this study is to consider and outline the feasibility considerations to build a virtual infrastructure for your financial institution and include risk assessments and impact analyses. The primary focus of this paper will emphasize Virtual Desktop Infrastructure technology, which is the leading solution to build a virtual future for any organization wanting to telecommute or to allow their employees to work remotely.

Many financial institutions consider Virtual Desktop Infrastructure (VDI) as a replacement for traditional desktop computers for their office employees. These days, minimizing contact between consumers and tellers has become an unfortunate necessity. Financial institutions are now feeling the impact of quarantines and social distancing practices. This leads many to consider new strategies to extend branch hours/teller capabilities and back-office operations, all while practicing safe social distancing.

The perception is that VDI reduces the desktop workstation Total Cost of Ownership (TCO) while delivering a faster and better user experience. The results of implementing a VDI solution would not only be a comparable solution to your current financial offering but also expand access to applications as well as reduce administrative overhead.

Background

York Traditions Bank is a locally owned and managed community bank incorporated in 2002, providing relationship-minded businesses and individuals with financial solutions to achieve growth and prosperity while delivering value to all stakeholders (York Traditions Bank, 2019).

YTB is considered a customer-centric community bank, offering an assortment of risk-appropriate banking products, including and not limited to traditional deposit and credit services, asset management, mortgage lending & services, merchant services, power-up bankcard, and securities services; therefore permitting it to entice and construct consumer, business and established relationships throughout its demographic market.

The primary strategy of YTB is to establish itself as a community-banking leader in competitive markets, which are generally small to mid-size markets, on the borders of larger city-regions.

Location

YTB has eight locations, including six retail banking branches, one remote mortgage office, and a corporate office. Recently, an opportunity for a new branch location within the geographical community, and YTB seized the chance to capitalize on this specific location. The facility is a geographical expansion to the bustling intersection located in Lancaster, PA whereabouts. All YTB branches are considered full-service branches, which offers a full array of retail and lending products. Most of the employees at each location are mainly focused on retail

services. However, each branch also staffs a residential lender and a commercial lender who have separate offices in the branch as an alternative to being centralized at the corporate location.

Additionally, the traditional teller for these locations is transitioning to a Universal Banker model, *which allows* YTB to position Universal Bankers as Relationship Bankers. Universal Bankers can help YTB customers with transaction and account serving needs. Therefore, permitting for a reduction in staffing requirements and a higher customer experience.

Business Model.

At YTB, our culture comes from how we run the bank daily. At the core of our responsible growth approach is our commitment to be responsible, which includes the Bank's commitment to ethical behavior, integrity, and complying with laws, regulations, and policies that support such behavior.

YTB recognizes that a strong culture is an ongoing effort, adopted daily in formal and informal traditions. Creating a united culture requires attentive, focused actions. This method helps YTB bring together all of our associates from different industries and countries and align with our purpose of making community banking lives better.

Being a community bank is something YTB is passionate about, and that stems from the leadership, management, and employees to continue that drive and build our brand within our community. A significant part of YTB's business model originates from its assurance to expand the quality of life in all the communities where YTB serves.

Financial Discipline

For the three quarters ending as of 9/30/2020, York Traditions Bank's ROA as an average percentage asset improved from 0.90 to 1.06, an increase of 17.8%. This compared moderately favorable to its peer group, although higher than York Traditions Bank at 1.23, only increased 16.03% throughout the same period. York Traditions Bank was competitive among its peers during this period and is undoubtedly an indication of an optimistic trend for the Bank. Nevertheless, there is a contrast in the Bank's ROA that continues to be slightly behind its peers. There are various details as to why York Traditions Bank is competitive with its peers from July 2020 to September of 2020.

York Traditions Bank is in an excellent position to benefit from the current decreasing rates. The Bank's loan portfolio focuses on its assets that adjust price within a year- asset concentration, which helps the Bank outpace its peer group in the growth of interest income over time. Furthermore, York Traditions Bank has a solid core deposit foundation, which helps maintain its cost of funds low and keep its interest expenses below its peer groups.

Additionally, this means that the York Traditions Bank's balance sheet is sensitive to its asset management than its peer group. The details of the balance sheet will converse further along in this analysis. It should also be highlighted that York Traditions Bank interest expense improved more than its peer group from July 2020 to September of 2020. York Traditions Bank continues to remain in the low percentage of the peer group in this particular category. Overall, York Traditions Bank (shown above) net interest income increased at 1.17% over this period compared to its peer group of 0.83%.

During this period, the peer group's non-interest expenses continued at a horizontal level from July 2020 to September of 2020. York Traditions Bank was able to minimize its non-

interest expenses by 3% over that timeframe. York Traditions Bank's non-interest expenses continue over double of its peer group, as it is only shy of \$500 million-in-assets and does not have the gage of many of the bigger Banks in its peer group. Nevertheless, with a persistent push to minimize its non-interest expenses has permitted York Traditions Bank to reduce the distance in ROA between York Traditions Bank and its peer group.

York Traditions Bank's continuous profits have positively affected its leverage ratio, which increased by 1.04% from 10.60 on 9/30/2019 to 10.71 on 9/30/2020. York Traditions Bank is a community bank with shareholders. As a result, the Bank does pay a quarterly dividend, impacting some of its profits gains to its Tier 1 Ratio. It should be observed that York Traditions Bank's Other Income decreased over the timeframe to a negative place on 9/30/2020. As a result, the total common equity of the Tier 1 Ratio improved at a much steadier rate than of York Traditions Bank's ROA. York Traditions Bank did not increase any capital during this timeframe.

Credit discipline:

York Traditions Bank has a solid credit discipline, which has transformed into a reliable credit standing during the most current economic growth. As displayed above, York Traditions Bank continues to produce a Non-Performing Loan ratio that is considerably less than its peer group. This was all accomplished even prior to York Traditions Bank moving over the \$500 million thresholds and joining its peer group.

Among the analyzed period, York Traditions Bank Non-Performing Loan rate was steadily lesser than its peer group's average within most loan categories. Based on this analysis it is believed that there are two factors for the Bank's lower Non-Performing Loan rate. The first factor is that York Traditions Bank drills the importance of its credit quality and has adopted a solid credit discipline.

The second factor is the state of the economy and the growth of the York, Pennsylvania region. York, Pennsylvania's unemployment has been holding Bank's. According to BLS, it's reported that the unemployment rate for York rose 0.1 percentage points in July 2020 to 3.4% (York-Hanover, 2020).

The movement in York Traditions Bank's credit quality is stable and improving and with a strong economy at both local, state and national, the position for York Traditions Bank's credit value in the coming twelve months is optimistic. In recent news, the Federal Reserve has been hinting that it may drop the interest rates, but the odds of a significant rate surprise attack should be low. Moreover, York Traditions Bank's solid credit standing provides the assumption the York Traditions Bank will preserve its high degree of credit standing over the next year.

Nevertheless, although the economy is in a position, York Traditions Bank has an appetite to substantially grow in a competitive market with other financial institutions that have a long-standing foothold in the market; York Traditions Bank has only been in business since 2001. For York Traditions Bank to compete in a tightly competitive market they need to remain firm with their core values and continue to pursue more credited borrowers with a good history and have a great position among the community.

Product offerings:

YTB recognizes that women have an extremely important role in the success of their hometown's future; the Bank has focused on meeting the financial needs of relationship-minded women in their local community since its inception. The Bank identifies the financial realities of a woman's life are unique — different stages, different paths, different personalities, different levels of preparedness. There are personal situations that impact financial plans — like buying a home, starting a family, planning for college, changing careers, or retiring. Women are searching

for a welcoming place to strengthen their financial knowledge, with hearts set on goals and minds set on attaining them and that is why YTB has a product to offer called “HER TRADITIONS” (York Traditions, 2020).

There are 1,220 women-owned businesses in Lancaster County-based on numbers collected from S&P Global, which is why Her Traditions would make a great product to target in the new location for Lancaster County.

Market Demographics

According to the United States Census Bureau, the bank utilizes all the necessary demographics information to project market analysis. The following data was collected using the surrounding cities and counties in Harrisburg, York and Lancaster

Population and Population Growth

All Topics	York County, Pennsylvania	Lancaster city, Pennsylvania	Cumberland County, Pennsylvania	York city, Pennsylvania	Lancaster County, Pennsylvania	Camp Hill borough, Pennsylvania
Population estimates, July 1, 2018, (V2018)	448,273	59,420	251,423	44,118	543,557	7,918
PEOPLE						
Population						
Population estimates, July 1, 2019, (V2019)	NA	NA	NA	NA	NA	NA
Population estimates, July 1, 2018, (V2018)	448,273	59,420	251,423	44,118	543,557	7,918
Population estimates base, April 1, 2010, (V2019)	NA	NA	NA	NA	NA	NA
Population estimates base, April 1, 2010, (V2018)	435,008	59,333	235,405	43,807	519,446	7,886
Population, percent change - April 1, 2010 (estimates base) to July 1, 2019, (V2019)	NA	NA	NA	NA	NA	NA
Population, percent change - April 1, 2010 (estimates base) to July 1, 2018, (V2018)	3.0%	0.1%	6.8%	0.7%	4.6%	0.4%
Population, Census, April 1, 2010	434,972	59,322	235,406	43,718	519,445	7,888
Age and Sex						

Income

Income & Poverty						
Median household income (in 2018 dollars), 2014-2018	\$63,902	\$42,632	\$68,895	\$30,283	\$63,823	\$83,082
Per capita income in past 12 months (in 2018 dollars), 2014-2018	\$31,468	\$21,571	\$36,012	\$16,547	\$30,778	\$39,639
Persons in poverty, percent	△ 8.8%	△ 24.8%	△ 7.3%	△ 35.2%	△ 7.9%	△ 7.2%

Housing Market

Housing						
📌 Housing units, July 1, 2018, (V2018)	184,869	X	106,899	X	212,205	X
📌 Owner-occupied housing unit rate, 2014-2018	74.7%	44.0%	70.4%	38.0%	68.0%	65.9%
📌 Median value of owner-occupied housing units, 2014-2018	\$173,200	\$111,800	\$197,900	\$75,200	\$200,400	\$212,900
📌 Median selected monthly owner costs -with a mortgage, 2014-2018	\$1,516	\$1,142	\$1,493	\$1,118	\$1,516	\$1,732
📌 Median selected monthly owner costs -without a mortgage, 2014-2018	\$581	\$492	\$530	\$506	\$571	\$648
📌 Median gross rent, 2014-2018	\$937	\$834	\$973	\$814	\$978	\$1,092
📌 Building permits, 2018	916	X	1,179	X	1,251	X

Business Market

BUSINESSES						
Businesses						
📌 Total employer establishments, 2017	8,689	X	6,122	X	13,060	X
📌 Total employment, 2017	167,130	X	123,084	X	235,331	X
📌 Total annual payroll, 2017 (\$1,000)	7,278,533	X	5,562,032	X	10,126,134	X
📌 Total employment, percent change, 2016-2017	1.5%	X	2.7%	X	3.1%	X
📌 Total nonemployer establishments, 2017	26,281	X	16,104	X	42,955	X
📌 All firms, 2012	30,435	5,142	19,169	2,570	47,876	917
📌 Men-owned firms, 2012	17,577	2,826	10,769	1,337	28,521	471
📌 Women-owned firms, 2012	9,569	1,672	6,262	876	14,101	323
📌 Minority-owned firms, 2012	2,376	1,430	1,431	772	3,569	F
📌 Nonminority-owned firms, 2012	26,851	3,211	16,936	1,602	42,926	813
📌 Veteran-owned firms, 2012	3,169	469	2,010	100	4,103	30
📌 Nonveteran-owned firms, 2012	25,844	4,167	16,033	2,257	41,749	788

Market Competition:

There are various details as to why York Traditions Bank is competitive with its peers as the bank takes pride of its active community involvement, which can at times distinguish the Bank from its local competitors. Based upon the deposit survey in the York county markets the bank has an appetite to substantially grow in a competitive market with other financial institutions who have a long-standing foothold in the market (S&P Global, 2019).

Strategy and Implementation

One strategy being heavily researched and adopted are branch kiosks / ATMs, which extend hours and capabilities. Consumers receive an exceptional experience with on-demand access to advanced services without requiring teller support. Placing a kiosk in the drive-thru

promotes less lobby traffic while enabling you to provide services to multiple customers. Kiosks reduce branch footprints, operating costs, and staffing requirements – while still extending hours and services.

Description of the problem

Financial institutions consider their retail branches as a vital connection for their customer relationship. Comparable to retail commerce, a retail bank branch must display and deliver the bank's products and services, covering from dispensing cash via their ATMs, commercial lending, and mortgage services, to name a few. Conversely, retail branches do bare their set of Technology challenges such as:

- Customer Perception– What directly/indirectly affects the customer's experience
- Security– High risk for a security attack, which is very wide-ranging
- Downtime impact cost – Imperative to meet high Service Level Agreements
- Broadly detached and small group of end-users – High amount of branch locations with minimal groups of various workflows (i.e., tellers, loan officers, and ATMs)
- Limited bandwidth connectivity – low bandwidth is not fit for multimedia and core application productivity
- Decentralized communication infrastructure – Any system outage in the telecommunication services will cause the branch to be non-operable

These pitfalls combine make technology services in the retail branches one of the technology segments that is most in need of transformation. In addition to resolving these pitfalls, visionary IT Professionals are continually researching methods to enhance banker productivity, boost the customers' experience, reduce high overhead operating costs, and reduce the ongoing threat of cyber breaches among financial institutions. Moreover, banks are

continually researching new infrastructure models to deliver optimal end-user computing services as the current infrastructure model is high cost and long time constraints to implement.

Banking professionals are always looking for new methods to increase customer satisfaction at the retail branches to grow revenue. A modern and secure technology solution that can drive competitive advantage for retail bankers, relationship managers, and mortgage lenders, and not to mention the customer service representative who is “always-connected” and available. With immediate access to the correct information at the right time, banking professionals can discover new customer opportunities, assess portfolios, make instantaneous decisions, and more efficiently serve customers.

When designing a new retail branch, managing end-user-computing services must be designed with an always-connected approach built into the core infrastructure. The practice of secure digital workspaces presenting VDI technologies, and centralized workstation imaging and application administration, is a present-day solution for delivering and administering end-user technology services at the branch.

Managing YTB’s endpoint devices can be time consuming and challenging due to each device having individual patch management requirements as well as specific software and hardware configurations. Each application has its own version that might be unlike from other applications installed at multiple branches to meet hardware constraints or for licensing commitments. Furthermore, this process can be difficult when specific hardware systems require repaired or replaced at various branch locations for which IT employees must travel to make the repairs. Obsolete desktop computers and other hardware at these locations will eventually become too expensive to fix.

Solution to the Problem

What is classified as a "Continuous-Connected" technology workspace for the Financial Services Industry?

This VDI design defines the fundamental infrastructure to support the workflow within a typical branch operation, which includes:

- Client Care "Teller" workstation
- The Mobile banker (i.e. Loan Officers, Mortgage Originators)
- Universal banking workspaces
- ATM image administration
- Various Banking kiosks

The outcomes delivered by the Continuous-Connected VDI environment includes:

Convert the end-user technology experiences at the branch – Advance operational productivity by centralizing and automating workstation, core applications, and device administration costs. Deliver real-time application streaming and end-user administration for all branches and staff. Modify IT resources from low-level tasks to higher-level information technology as a service approach.

Enhance employee productivity and customer relations with automated workflow management – Delivering secure and effective access to sensitive customer data, portfolio, and product services when requested by the customer. Expand the customer experience by making it easier for banking professionals to bring the bank into the customers' hands. Increase employee engagement and productivity with the Bring Your Own Device (BYOD) concept to use their preferred device for work-related processes.

Leverage the Business Continuity Plan (BCP) with high-availability replication services– Maintain remote locations with high service level standards and stability of day to day operations. Decrease avoidable system outages from failed patch management for software or hardware updates.

Minimize risk by securing data and remain compliant– Protect Personal Identifiable Information (PII) to confidential applications and restrict access to sensitive data by keeping it centralized within the primary and secondary data center. Promptly apply software and hardware updates as well as security patches to protect workstations from malicious cyber threats. Remain compliant with regulatory services such as the Gramm-Leach-Bliley Act by creating role-based access controls, auditing, and remote enterprise wiping of lost or potential enterprise devices.

To remediate these problems, the VDI solution for the YTB feasibility study, we took an in-depth look into the VMware Horizon solution. VDI can deliver pre-configured and managed desktops to end-users from a High Availability (HA) on premise infrastructure. VDI technology operates with a “resource pooling” and centralized management methodology, which offers an on-demand environment with all core-specific software for each department. The virtual configurations will be available via the internet to distance branches, sales associates, teleworkers, and all remote users who will have the ability to access content from any desktop, laptops, mobile devices, and tablets. The goal of the project is to link and clone virtual desktops, as seen in **Figure 1**.

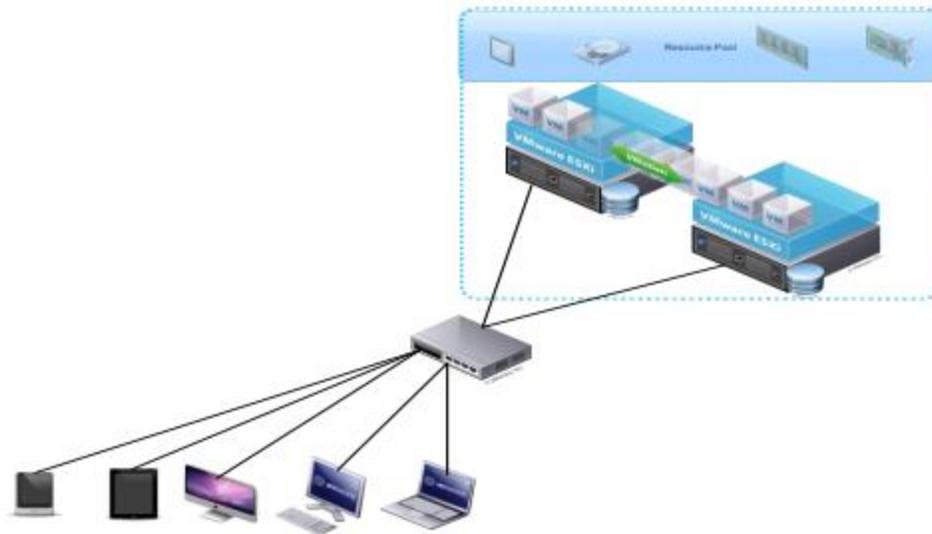


Figure 1

By virtualizing the Retail, Business Services, and Mortgage Originator environments into a virtual clone and linked model has many advantages and opportunities when available. From an information technology point of view, VDI is a simple solution to administer, manage, and maintain a vast amount of workstations. The ability to rollout a large quantity of Windows Operating Systems (OS) to hundreds of virtual desktops from a sole primary image makes IT administration easy. IT System Administrators has the ability to limit end-users to particular workstation groups and assigns applications to that group based upon their pre-configured profile. System Administrators can push applications with a single click to the end-users via virtual workstation pools. This process will help control software licensing fees as well as reducing overall storage costs. The process of cloning virtual workstations makes it very resilient to network outages as any critical error in the operating system can be easily resolved by refreshing or reinstalling the software of a physical workstation.

Cloning virtual computers makes it easy for end user data to travel with them as they authenticate into various workstations and therefore allowing enhanced performance and

roaming profiles for roaming tellers. Additionally, IT administrators can simplify patch management process with a primary image that pushes all patches to the entire workstation pool. YTB's VDI solution supports a Bring Your Own Device (BYOD) framework. End-users have the ability to use the VDI client from a variety of electronic devices including outdated laptops, desktops, tablets, and mobile devices from anywhere around the world wide web. Distance sales associates will have access to a complete functioning desktop session along with their primary use software to complete their workload and perform sales presentation from their own home. Possessing the ability for this highly accessible infrastructure is perfect for any employee that requires access to multiple branch locations.

Considerations and Achievements

To better comprehend the benefits of a VDI implementation a Proof of Concept (POC) organized to display its benefits. The POC was used as a framework for an environment that could be sized to meet the bank's goal of connecting up to two hundred remote end-users. The POC possessed deliverables such as the cloned workstations theory, seamless streaming of core application, and VPN remote access. After the execution of the POC a cost benefit analysis (COB) was gathered along with recommendations to highlight the differences between the POC and a full design supporting two hundred end-users.

The following deliverables were created to represent strategic milestones for the project.

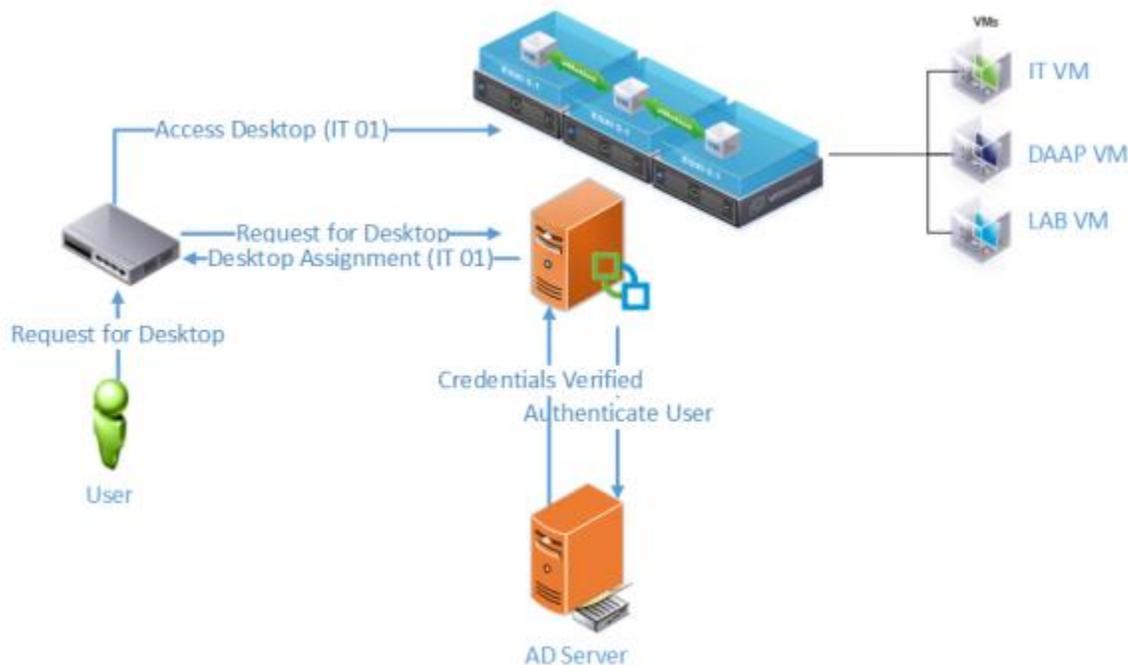
The finalized POC should present valuable awareness to the bank in following a VDI execution.

The list below specifies the information and functions that will be implemented during the project's life cycle.

Physical Prototype – To meet the POC requirements, two physical servers were configured along with our current network infrastructure that was necessary for deployment. Jointly, the said infrastructure will serve as the POC for all testing and exploration.

Cloned-Linked Model – Desktop workstations must be in a cloned environment to simplify the management for all desktops. This option allows the entire workstation fleet to be deployed off one primary image for which it can be easily patched or upgraded with a single click.

Application Deployment– Bank applications will get pushed to desktop fleets via a streaming application tool when needed. This method will be put into practice to reduce application overhead on computers and end-user performance that does not require specific applications. Additionally, this maximizes storage capacity control and reduce the financial burden on storage hardware.



Remote Access Capability – Bank employees must be able to access the test environment from off the production network and remote in from any location.

Figure 2 illustrates the workflow diagram that bank employees would do while authenticating outside the bank's internal network. The primary connection would authenticate through the VDI Security Server, into the ticketing Server, authenticating against the authenticating server (AD), and then into the virtual workstation fleet. Once the employee is authenticated into a chosen workstation fleet, the application will be pushed directly to the employee's client machine.

Cost-Benefit Analysis – Utilizing the data gathered from the POC combined with external research, successfully showed the cost efficiency of a VDI infrastructure over other standardized network computing.

Applying VDI to the right profiles.

Having the ability to know how VDI works and how to implement it successfully is essential. In the POC, VDI provides significant advantages and can have positive outcomes. The end-user typically does not care about the workstation set-up; instead, an adequately configured VDI solution is about distributing core applications to the end-users. This idea is pivotal to VDI's continuing success. A successful VDI solution should always focus on delivering core applications and services to its end-users.

Profile One: Standardized shared workstations

If there is not a need to personalize individual workstations, VDI is the best solution. Some Financial organizations have a majority of their employees using standardized desktops, and sometimes the end-user will share those desktops with others across various branches and or shifts. Employees working in call centers, bank teller workstations, and sales teams are examples of these shared workstations. Such desktops are seldom configured to allow the end-user to personalize their profile. Security configurations only allow the end-user to work out an application and services specific to their role and job functions. This example establishes the

need for a VDI solution. When personalizing a desktop to a specific user is not a concern, many of VDI's benefits become relevant.

Profile Two: Enhanced data security

Protecting data security requires high costs to recover essential functionalities. Regulatory and compliance laws applied to the financial industry can create technical computing challenges and the impact of data compromise or confidential exposure. Past experiences for information technology departments in financial industries have forced them into strict practices to ensure data security controls. As an example, to control exposure to confidential data, some institutions will enforce policies that physically block or disable the ability to use USB ports. Enabling this practice minimizes the risk of confidential data being exposed; on the other hand, this comes at the cost of more significant operational problems. VDI cannot be physically stolen; VDI cannot be left unattended and potentially compromised.

Many information technology departments must then choose to procure software that manages what USB port the end-user can use and then monitor their activity, which can be rather expensive. VDI solves this issue by moving the physical desktop out of the tangible reach of its user. VDI creates a simple solution to not expose USB ports without impacting administrators to effectively perform their daily tasks.

Profile Three: Remote offices and Telecommuting workers

Remote offices and telecommuting workers present a high risk for not only security-related issues but also undergo performance issues. Moreover, the financial industry is presented with a challenge by the regulatory and compliance realities for those employees that are in remote offices and telework from home. These employees generally rely on their internet service provider's (ISP) wide-area network (WAN) and a virtual private network (VPN) connection to

the primary datacenter. In addition, their computers operate applications that are installed locally on those devices. These said employees frequently work in environments that are typically not secure or have minimal security controls, which creates possible security threats leading to high-risk security-related incidents such as theft and exposed data. Additionally, remote employees are often subject to minor oversight and observation to lessen security controls, thus allowing malicious activities or collusion. Internet connectivity can also be a challenge. Many remote employees and remote offices are displeased with application performance and productivity because their applications must access data or databases across slow WAN and VPN connections. Investing to increase speed for each remote office can be costly. Utilizing a VDI solution can enhance the application, bandwidth, and security performance. Shifting to a delivery format of application services through VDI can alleviate these problems. Remote employees who work on virtual workstations can see an improvement in application performance simply because their primary applications are not physically installed on their desktop computer or laptop. The bandwidth required to deliver the virtual desktop's view of those applications is generated from the primary datacenter. Today's logical technology protocols have advanced over the years to generate a more significant performance experience, even over low-bandwidth and slower connections.

Profile Four: Bring Your Own Device (BYOD)

VDI also reduces the strain on information technology departments by permitting BYOD configurations, reducing overhead and added expenses. Today, some information technology departments enforce stringent standards on end-user hardware, often requiring specific hardware configurations to meet certain software criteria' needs. These requirements are essential so that the information technology department can support the device on the network. As a result, these

requirements conflict with the user's mobility and other computing demands. The end-user may prefer comfort to use a more familiar device such as tablets or a different OS like iOS, Android, or Windows. With adequately configured VDI solutions, the type of hardware used for production becomes irrelevant.

Financial Impact

Virtualizing business operations and evaluating the TCO and ROI as we take a holistic view of all costs that go into supporting and maintaining the purchase over time. Banks that take this approach to their technology investments will have an increased advantage comprehending the entire picture as well as revealing other areas where new processes, efficiencies and improvements can be made. An essential component of this analysis is quantifying the financial impact when creating an estimated TCO for desktops and the organization's needs. The first process was to document the bank's gap by evaluating its current and future state. There are many moving parts to this analysis, including the existing operational costs, assessing the highest and optimal use of current technology assets, which helps create a baseline that can be later used to assess the TCO.

The first process in assessing the financial impact is to holistically understand and correctly identify the annual cost to operate technology and support throughout the bank. The information collected was from annual budget reports distributed by the bank's Finance and IT Department and is provided below:

Savings category
PC costs going to thin/zero client (thin/zero clients cost approx. 1/3 of a typical desktop)
Increased Productivity (can work any where, any time, on any device) (employees working more due to access to work via VDI)
Security (data stays in the Data Center, eliminates VPN which could allow hackers access the entire environment)
Energy Savings (less energy used at an office since less employees working in the office)
Centralized Administration - IT staff workload (less IT operations with minimal deskside visits, seamless patching, upgrades, eliminates imaging/reimaging of physical desktops)
Physical computer/laptop theft (more security from stolen devices)
HR onboarding and offboarding (company issued or BYOD eliminates imaging/reimaging of physical desktops)
Commercial Realstate (workspace savings)

Creating TCO Baseline

Number of Users

Knowing the number of users is the first step when creating a baseline. It is the most uncomplicated number required when valuing the amount that needs to be procured on desktops. The fundamental question is: How many desktops will the bank need?

For some banks, it is a 1:1 ratio; one desktop per employee, which is the proper fit for those employees that require continuous access (i.e., working “off-hours”) or the ability to personalize their desktops or save files to the desktops.

Some financial institutions may find that roaming desktops are a better option. Roaming desktops work best for banks that have a rotating shift model. Instead of one dedicated desktop per employee, which goes unused when the employee is not on their shift, the bank has just enough desktops to cover that shift.

When calculating the number of desktops, there should be an inclusion of scaling (i.e., new employees or temps). If that number fluctuates, then create separate data points to work with when calculating the TCO: The minimum number of employees the IT department must continually support and a maximum amount of projected employees.

Devices Currently Supported

Knowing which devices on the bank's network are presently supported is vital to obtaining an accurate budget forecast. Most-likely is, these devices will continue to be maintained and ultimately switched out. The bank will have to evaluate a new desktop strategy that will require a direct shift in what devices will be supported. Any related expenses stemming from that transition must be factored into the TCO. This approach can potentially have a positive outcome on TCO if the bank no longer requires to support costly devices.

Knowing the current state of the bank's devices provides a solid baseline of the level and existing costs to what is currently being supported and then expanded. This is important if the bank compares a possible conversion to the "no change" option and if the bank wants an understanding of VDI's TCO.

The most common devices supported include:

- Desktops
- Laptops
- Thin client computers
- Thick client computers (existing hardware)
- Bring Your Own Device (BYOD)
- Mobile devices (smartphones, tablets, etc.)

Lifespan per Device

If the bank presently decommissions these devices, they must have documentation that specifies these technologies' typical lifecycle. Compared to a desktop, a laptop's average lifespan is short and should not count as a one-time cost. Therefore, having an expectation for its lifecycle and calculating its replacement costs should be included in the TCO. Similarly, the lifecycle and replacement cost for thick and thin clients should be used in a VDI development.

What devices should be included to support?

Different than what devices are presently supported, this is an essential future-minded question. Replacing end-user hardware and data center infrastructure is not a cheap or straightforward task. If the bank has plans to implement new devices, it will need to be considered now. This strategy most likely needs the involvement of the bank executive leadership team. Undeniably the information technology department will have a firm understanding of what devices are presently supported; however, they may not have direct awareness of the banks' three to five-year goal to implement a VDI solution.

Calculating TCO

Having a baseline in place that highlights what is presently supported and the bank's strategic roadmap, it is best to start the cost calculations at this point. The VDI forecast was created by collecting the information mentioned above with the information highlighted below. Now that the devices are identified as to which are supported and their average lifecycle, we can then calculate the cost of procuring and replacing those devices.

To aid this task for each type of device supported, the following was used:

- Average purchase cost per device (including maintenance and support services)
 - cost per non-VDI desktop
 - cost per non VDI laptop/tablet
 - cost per thin & thick client
- Annual device cost (average cost divided by the number of years in the projected lifecycle)
 - desktops
 - Laptops
 - Thin & Thick client
- The aggregate number of end-users per device
 - desktops
 - Laptops
 - Thin & Thick client

When projecting device costs, it is good practice to consider the replacement costs for the present desktop management and estimated costs associated with the bank's growth or device replacement process.

A few primary factors to include are:

- Number of devices replaced on a monthly and yearly basis
- Expected annual net growth (new devices subtracting projected employee turnover)
- Projected device replacement and related scope and costs

When creating the TCO calculations, it is pivotal to understand the cost for current and future state costs based on demands. The future device costs may differ when comparing traditional desktop solutions versus VDI solutions, which will significantly decrease device costs by extending the life of existing devices currently in use. Additionally, if the bank decides to move more to a BYOD model. This variance will have a significant effect on the overall TCO.

York Tradition's Bank - Savings of a VDI solution				
Savings category	Year 1	Year 2	Year 3	Total
PC costs going to thin/zero client (thin/zero clients cost approx. 1/3 of a typical desktop)	\$ 20,000.00	\$ 20,000.00	\$ 20,000.00	\$ 60,000.00
Increased Productivity (can work any where, any time, on any device) (employees working more due to access to work via VDI)	\$ 50,000.00	\$ 50,000.00	\$ 50,000.00	\$150,000.00
Security (data stays in the Data Center, eliminates VPN which could allow hackers access the entire environment)	\$100,000.00	\$100,000.00	\$100,000.00	\$300,000.00
Energy Savings (less energy used at an office since less employees working in the office)	\$ 5,000.00	\$ 5,000.00	\$ 5,000.00	\$ 15,000.00
Centralized Administration - IT staff workload (less IT operations with minimal deskside visits, seamless patching, upgrades, eliminates imaging/reimaging of physical desktops)	\$ 25,000.00	\$ 25,000.00	\$ 25,000.00	\$ 75,000.00
Physical computer/laptop theft (more security from stolen devices)	\$ 25,000.00	\$ 25,000.00	\$ 25,000.00	\$ 75,000.00
HR onboarding and offboarding (company issued or BYOD eliminates imaging/reimaging of physical desktops)	\$ 15,000.00	\$ 15,000.00	\$ 15,000.00	\$ 45,000.00
Commercial Real estate (workspace savings)				\$ -
Total	\$240,000.00	\$240,000.00	\$240,000.00	\$720,000.00
Cost of VDI Solution				\$169,942.46
Total Savings of York's VDI Solution				\$550,057.54
ROI				75.70%

Non-Financial Impact

There are some non-financial impacts that will need to be analyzed and considered in this assessment. These details are factored below that can be a potential risk or decrease the VDI strategy's efficiency, including strategies to mitigate or lessen these risks.

Banks that adopt virtualized and remote infrastructures can expect significant cost savings by having employees either BYOD or the business repurpose old equipment. These cost savings can be shifted for banks to invest significantly in their network to deliver a reliable experience, expand storage capacity, and computing power to process video and data.

Virtual banking services are rapidly becoming popular, especially in this new Pandemic era when businesses utilize the Internet and online video capabilities have become more accessible to a larger audience. As today's customers gravitate online, the traditional brick-and-mortar banks will have to reevaluate their strategies, including their internal workforce.

Some of these risks are intangible but could impact the bank's decision and future solutions, as previously noted.

Conclusion

This feasibility study for VDI contains several factors for consideration all of which produce either a promising valuation or strategy that can be used to mitigate the inherent risk in the decision to purchase a VDI environment and re-locate operations to a virtual infrastructure. The primary benefit is the favorable financial outcome as the timing is very good to monetize the value of the banks operations as well as its real estate asset for telecommuting. The analysis performed generated an annual cost savings of roughly \$100,000 using what are moderately conservative range of value for the bank. Moreover, the benefits from proper sizing our capacity to current needs and moving to a variable cost model is consistent with present Bank strategy. The non-financial impacts that were evaluated and risk mitigation strategies identified to manage the specified risks to reduce the potential for unintentional consequences. Based upon the outcome of this feasibility analysis, I believe timing is best to move forward with purchasing a VDI environment for the bank. Firstly, it will result in an encouraging financial outcome, but it

also places the Bank in a competitive position to respond to the banking industry's technological changes. Especially in a post Covid-19 world.

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