VMware Horizon Mirage Evaluation
For The University of Cincinnati
Department of Administration & Finance IT
by
Brian Johnston & Jacob Ellis

Submitted to
the Faculty of the School of Information Technology
in Partial Fulfillment of the Requirements for
the Degree of Bachelor of Science
in Information Technology

© Copyright 2014 Brian Johnston & Jacob Ellis

The author grants to the School of Information Technology permission
to reproduce and distribute copies of this document in whole or in part.

Brian Johnston
4/17/14
Date

Jacob Ellis
4/17/14
Date

Professor Mark Stockman
4/17/14
Date

University of Cincinnati
College of Education, Criminal Justice, and Human Services
April 2014
Acknowledgements

We would like to take this opportunity to thank all of those who helped us over the course of this Senior Design project. We would like to thank Professors Patrick Kumpf and Jim Scott for helping us through this project all year long. Without their guidance we would not be where we are today. We would also like to thank Professor Mark Stockman as our academic advisor for this course. His advice and support helped us on this project immensely. We also want to thank Craig Stoelting and the rest of the Administration and Finance IT department for offering his support and providing us with his department’s resources to pursue this project. Finally, we would like to thank our friends and family for supporting us through our college careers. These past five years have been an extremely rewarding experience.
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledgments</td>
<td>i</td>
</tr>
<tr>
<td>Abstract</td>
<td>iv</td>
</tr>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Problem</td>
<td>2</td>
</tr>
<tr>
<td>Solution</td>
<td>3</td>
</tr>
<tr>
<td>Layering</td>
<td>5</td>
</tr>
<tr>
<td>Base Layers</td>
<td>5</td>
</tr>
<tr>
<td>Application Layers</td>
<td>7</td>
</tr>
<tr>
<td>Backup and Recovery</td>
<td>10</td>
</tr>
<tr>
<td>Migration</td>
<td>12</td>
</tr>
<tr>
<td>User Profile</td>
<td>14</td>
</tr>
<tr>
<td>End User</td>
<td>14</td>
</tr>
<tr>
<td>Help Desk Technicians</td>
<td>14</td>
</tr>
<tr>
<td>System Administrators</td>
<td>14</td>
</tr>
<tr>
<td>Software and Interface Experience</td>
<td>15</td>
</tr>
<tr>
<td>Experience with Similar Applications</td>
<td>15</td>
</tr>
<tr>
<td>Frequency of Use</td>
<td>15</td>
</tr>
<tr>
<td>Timeline</td>
<td>16</td>
</tr>
<tr>
<td>Budget</td>
<td>18</td>
</tr>
<tr>
<td>Project Budget</td>
<td>18</td>
</tr>
<tr>
<td>Production Budget</td>
<td>18</td>
</tr>
<tr>
<td>Compatibility Issues &amp; Setbacks</td>
<td>20</td>
</tr>
<tr>
<td>Presentation to AFit</td>
<td>21</td>
</tr>
<tr>
<td>Conclusion</td>
<td>22</td>
</tr>
<tr>
<td>References</td>
<td>24</td>
</tr>
</tbody>
</table>
Figures

Figure 1: Previous network diagram of backup solution.........................................................3
Figure 2: Current network diagram after Mirage implementation.........................................4
Figure 3: Mirage layering breakdown..................................................................................5
Figure 4: Mirage base layer capture sequence......................................................................6
Figure 5: Mirage app layer capture sequence........................................................................9
Figure 6: Use Case Diagram.................................................................................................16
Figure 7: Horizon Mirage Evaluation Project Timeline.........................................................17

Tables

Table 1: Cost for minimal implementation..............................................................................19
Table 2: Cost of different packages for VMware Mirage......................................................20
Abstract

The Administration and Finance IT of the University of Cincinnati is evaluating the VMware Mirage software for use in their department. Their environment consists both of a virtual desktop infrastructure (VDI) and a physical environment. VMware Mirage will be implemented into both environments and tested to determine if the software will meet the department’s long-term needs. Mirage is a new software by VMware its purpose is to centralize desktop management. Mirage scans the client computer's hard drive and organizes the files into two logical layers, the base and app layer. Mirage also uploads the contents of the drive to the server and synchronizes at set intervals. Base layers are designed to include core software for all users and app layers are for users who need specific software for their department. Mirage helps desktop support to readily image computers with ease and it helps cuts down on support time with users.
Introduction

Desktop support is one of the most crucial parts of any type of business. Businesses need to adapt to new technologies in order to keep from falling behind. Unfortunately, it is difficult for desktop support to keep up with current technology when they have many users to manage. Time is mostly spent “fighting fires,” which prevents the desktop support staff from pursuing projects to better their support and services (2).

The term “fighting fires” means that desktop support’s job has been restricted to respond to the consistent issues of their users, rather than on improving on their already existing systems. Many of these issues include lost or corrupted files, viruses, hardware failures, application installation and desktop provisioning (2). Desktop support often has only enough time to work on maintaining the current environment and solve issues for users as soon as they can. Desktop support often has little time to pursue projects, such as desktop migration, because they simply do not have the time or resources. This, in turn, also affects users as they are often unable to complete their work as desktop support is too busy.

This project was designed to help find a way to centralize desktop management that would help make desktop support fast, easy and effective. The product we have chosen to help us with this project is VMware Horizon Mirage. Mirage allows for desktop support to centrally manage users’ desktops and files, as well as increasing the efficiency of the current work environment (1). We will be designing and evaluating a VMware Mirage instance to both an existing VDI and Physical environment to determine if the software meets AFit’s departmental needs (2).
**Problem**

The department we were working with was the University of Cincinnati's Administration & Finance IT, also known as AFit. AFit wanted to implement this software into their existing VDI environment to help minimize time spent on desktop deployment, provisioning, and recovery. The following was one of the examples of a situation AFit had encountered that they hoped to resolve with this project.

A VIP needed to go to a meeting and their laptop hard drive had failed. The VIP needed certain files off of the computer and needed something to take notes for this particular meeting. Unfortunately, under previous circumstances, it took hours or an entire day to image a new machine and obtain the files off of a bad hard drive. The VIP needed a quick and easy way to access the files he needed for the meeting, as well as a device to use in the meantime while a machine was being provisioned. Along with the broken laptop, the VIP accidently deleted a file that was needed before it crashed. There needed to be an easy way to recover those files.

AFit wanted a product that would create a more centralized desktop environment where the administrators have control of desktop images, applications, and user data (2). AFit was also looking for a way to easily install and upgrade machines to ensure employees are up to policy and have access to the correct software (2). Users would have a more streamlined experience as they go about their day and would require little to no interruption of service. Users have the habit of installing their own applications which leads to problems accessing other applications or getting viruses, so there needed to be a way to enforce a policy as well. AFit was also looking for an easy way to migrate their Windows XP users over to Windows 7. This is due to the fact that on April 8\textsuperscript{th}, 2014, Microsoft no longer supports Windows XP (2).
Solution

We spoke to Craig Stoelting, an IT Analyst in AFit, about a solution to these issues. Craig believed that VMware Horizon Mirage would be the answer to many of AFit’s desktop support problems. Craig though that VMware Horizon Mirage could be implemented into their existing VMware View environment. Also, the University of Cincinnati gets VMware products at a discount due to a partnership (13). For the purpose of this project, we used a couple of 60 trial licenses. This project is a proof of concept and an evaluation of the software to determine if it would be beneficial to the Admin and Finance department.

Figure 1: Previous network diagram of backup solution
VMware Mirage has several key features that will help AFit manage its desktop environment securely and efficiently. The main features include base and application layering, backup and recovery, and Windows XP to 7 migrations. The project deliverables are a best practices and overview guide of the software for AFit, setup of the Mirage Management server with a SQL database, Mirage server, webserver with file portal and helpdesk dashboard sites. Several users from both the AFit department and the UCit Helpdesk have centralized desktops administrated by Mirage. All of the users’ data is backed up by the Mirage service as a disaster recovery solution. Figure 2 below shows a network diagram with VMware Mirage 4.3 implemented into AFit’s existing infrastructure.

Figure 2: Current network diagram after Mirage implementation
Layering

VMware Mirage utilizes an application-layering technology that takes a desktop image and divides it into a set of logical layers that the local administrators control. These layers can be updated and pushed out by a user’s local IT support. If a desktop is malfunctioning, IT can update the system layers without overwriting user data or user installed applications (1). Reference machines are used to create these layers and Mirage captures an image of the desktop creates a CVD, or Centralized Virtual Desktop (10). The two types of layers that Mirage uses are base layers and application layers. Figure 3 shows the breakdown of layers in VMware Horizon Mirage (18).

![Mirage layering breakdown](https://www.example.com/mirage-layering-breakdown.png)

**Figure 3: Mirage layering breakdown. “Horizon Mirage Layers explained” Horizon Flux. 2013. Web. 21 Mar. 2013.**

Base Layers

Base layers contain the main operating system and core programs. These are defined by the local administrators through a reference machine which is used to create the layers. Base layers contain the operating system, such as Windows 7 in our case, plus core applications like Microsoft Office, McAfee antivirus, Windows Updates and more. Base layers should only contain applications that all users in an org unit need and the more specific programs are on the
application layers (10). VMware does state in the administration guide that any applications included in the base layers (as well as the app layers) should be “suitable for mass distribution and uses a volume license that does not require machine-specific identification or individual manual activation” (4). These layers can be updated as well and pushed out to all users connected to Mirage. In Figure 4 below, you can see the capture sequence for a base layer. First, prepare a Windows machine as the reference machine, then install the applications, centralize the machine with Mirage (creating a backup), and then capturing a snapshot of reference machine. After capturing the snapshot, Mirage lets you name and give a description of the base layer (18).

![Base Layer Capture](image)

*Figure 4: Mirage base layer capture sequence.*

We have discovered in our environment that in-house applications and any application that does not install do not get captured in the application layer. In this scenario, we recommend that when creating a base layer for a specific organizational unit that these applications be included in the base layer so they can be easily distributed to the unit.

The base layer will also capture any related drivers on the machine that is used as the reference machine. If the business has the same hardware then utilizing the service is a lot easier since different base layers or driver profiles do not have to be created. Driver profiles can be created as needed for different hardware models as in our case with AFit. We had to download drivers for a few different models and create rules with the Mirage Management Console to push
them to the correct hardware. We have acquired and successfully deployed drivers to the following models: Dell OptiPlex 755, OptiPlex 760, OptiPlex 780, and Dell XPS One,

We experienced problems when deploying to a Dell Latitude E6410. Almost none of the drivers were pushed to the machine. The admins we tested this on spent multiple hours trying to obtain the drivers for their machines themselves. The biggest driver of concern was the wireless driver. If an end user was to take the machine home, they would not be able to connect to any Wi-Fi network and would be giving the help desk a call to figure out how to get his or her internet to work.

The problem we ran into while layering to machines was that the drivers were not being pushed based on the roles we set up. After investigation, we discovered that the driver profiles are only utilized when performing certain tasks. This included hardware migration, base layer provisioning, and migration (4). We determined the best approach for a base layer is to create it in a virtual machine. This limits the number of drivers on the base layer which effectively makes it smaller and can be deployed across different hardware platforms faster. The lighter base layer allows for faster deployment across the enterprise as well. After the base layer is assigned, the application layers can be assigned.

**Application Layers**

Application layers contain the rest of the programs that users need, although the applications can vary based on the user or department. Administrators can create multiple application layers for different departments or users, depending on their needs (10). For example, administrators can create an application layer for the Finance department, where they need the programs SAP and SPSS. The Marketing department has different needs and need
access to Adobe CQ5. Both departments, do not need access to all those programs, so two app layers can be created, one for Finance and one for Marketing. Just like with base layers, these can be consistently updated by the administrators and pushed out to Mirage users at their discretion. When the user reboots his or her machine, all updates will be installed during the reboot.

AFit requested a few specific applications which included SQL Server Management Studio, VMware View, VMware vSphere, PuTTY, and AD admin pack. The VMware products and admin pack were not a problem. They were captured and layered appropriately. However PuTTY and SQL Server Management Studio were not as easy to deploy.

As mentioned earlier, any files that do not install to the hard drive are not recorded by the application recording process. In order to get PuTTY to download, we had to obtain a Windows installation package for it to be captured by the application layer. Mirage reported during the application recording process that SQL server was not compatible with the software. VMware is aware of this issue, but as of the 4.4 release notes it is still not compatible (17).

Application layers are captured in a specific sequence that is a bit different from base layers. First, Mirage needs a reference machine to capture the app layer. It is suggested to not use the same machine used for the base layer. Next, Mirage scans the reference machine to capture the current system state. After the scan, install the application(s) for the app layer. Finally, Mirage then scans the reference machine again and captures a snapshot of the programs that were installed after the first scan. The app layer is now create and can be given a name and description. Figure 5 shows the sequence below (19).
Application layers can be used across different organizational units. In our scenario, we utilized the AFit application to the help desk as well since they also utilize the same software for troubleshooting. This made it easier to centrally manage applications across the organization and enforced as well. Enforcing layers means that the user is required to have them on the machine. Administrators also have the option to remove any unwanted software from the machine as well through the management console. We experienced users who have several tool bars installed along with countless outdated programs that were no longer being utilized. After we enforced the layers, all of the user installed applications were removed and the machine experienced a performance boost as a result.

We determined it was better to make different application layers for different programs. This again saves on space on the base layer and when individual application layers need to be pushed, administrators don’t have to push out large amounts of data to a machine to fix or update one application. In our environment we made separate application layers for the Adobe products, Acrobat Pro, Java, Network Connect, SAP, and the web browsers along with their required updates. We found this to be easier since most of these applications update every couple of months. Users still have the ability to update the software themselves, but administrators can update the layers and push them as needed when software requirements and security demanded it.
Java was our biggest concern because of the legacy applications at UC. Some legacy applications require Java 6 update 32 to run, while we were not concerned with this particular version, we did have to consider the difference between Java 7 update 45 and Java 7 update 51. The added security feature in update 51 broke many applications in use at UC, therefore it had to be rolled back to update 45. This was determined before system administrators discovered what had to be changed in Java’s security settings to allow the applications to run. We could then resume pushing Java 7 update 51 back to the users.

AFit also utilizes VMware ThinApp to distribute some applications to their users. Mirage is able to capture these ThinApp packages as app layers as well and this provides an easier way to distribute ThinApp packages to multiple users (18).

**Backup and Recovery**

A client program is installed on a user’s machine to capture a snapshot of the system. The Mirage system synchronizes when a user is logged in and snapshots will run in the background at set periods of time without interference of productivity (1). The Mirage server retains a set amount of snapshots, which is set by the administrator. These snapshots contain any user data that can be used for backup and recovery of files. Mirage users are given access to a File Portal that can be accessed through the web. If a user loses a file or a file is corrupted, they can use the File Portal to browse snapshots and recover files directly to their desktop. They can also right-click on any file or folder in Windows explorer and recover the files this way (1). This is a self-service file recovery system that takes the pressure off of desktop support and lets the user save time and be stress free (1).
Mirage is also very useful for disaster recovery. Mirage lets desktop support and users recover files and folders with ease, but it also allows for full system recovery (5). For example, let’s go back to the VIP with a broken hard drive. If the hard drive is replaced, then a base operating system needs to be installed with the Mirage client software. The base layers and app layers can be pushed onto the laptop and the VIP’s data can be recovered by pushing the CVD with the last snapshot data that is available (4). This reduced the time it took to provision a new computer from a few hours to less than an hour. While the new machine is being imaged, the desktop support team can turn the CVD into a virtual machine. The VIP can then use a borrowed machine and get into their desktop temporarily with the VMware View client for their meeting. Or if it is just a certain file they need, they can go to the File Portal and download the file to another computer or a personal device like a tablet or smartphone.

When a machine is already to go, the administrator simply needs to assign a physical machine to a CVD and tell the wizard to migrate user data only. This will push the user data and settings to the new machine or hard drive so the machine is exactly the way they had it before their original crashed. This is an easy way to push all of the data back to the machine without having to worry about redoing the base or application layers.

We set our own retention policies for backup and recovery so only certain amounts of data can be recovered. Our retention policy is set for two days in a week, two weeks, and one month. This means that there is five snapshots at any given time after centralizing the desktop. Once a snapshot falls out of this range, it is removed and replaced by a more recent version. We chose this retention policy due to storage constraints. Before layering was enforced, the amount of space initially consumed by the CVD’s was more than expected. One snapshot was consuming approximately 80 Gigabytes. Once layering was pushed, the process of deduplication
allowed for files that were common across all CVD’s to only be created once. The files were then accessed by different machines via reference points set up by the software. Mirage does this automatically to reduce the amount of storage needed to perform backups. We then saw that each new machine that was added was consuming less than 2 Gigabytes of additional storage when centralized. We believe it was this much initially since we were running the CVDs across multiple hardware models and the difference comes from the various drivers on different platforms.

Administrators have the ability to restore a machine to a snapshot. They have to select the device and click on revert to snapshot and choose the date that was last working for the user. This will start the process of reverting it back to the date that was selected so system files and user data can be restored to a previous working point. This operates differently than windows backup as it is all stored centrally within the datacenter. This is beneficial as it provides security and enterprise backups and can be pushed to different devices if needed. Windows backups do not allow this functionality as they can only be restored to the same machine. Inside the datacenter, there is redundancy so chances of losing the information are reduced significantly.

**Migration**

Effective April 8\textsuperscript{th}, 2014, Windows XP will no longer be officially supported by Microsoft. It is essential for desktop support to get Windows XP users migrated to Windows 7 to stay up to date. VMware recognized this need and have developed a Windows 7 migration tool within Mirage (3). Mirage streamlines the process by upgrading an existing Windows XP device to Windows 7, or migrating a user’s profile and files in a hardware-refresh process from
an older XP device to a new 7 device (16). This can greatly reduce the time it takes to migrate users from Windows XP to 7. VMware estimated that if a business needed to migrate 1000 desktops and 1000 laptops, it would roughly take 1,100 hours for the desktops and 2,850 hours for the laptops without using Mirage. With Mirage, VMware estimates it would take 600 hours to migrate 1000 desktops and 600 hours to migrate 1000 laptops. The estimated labor cost savings in this scenario was 69.6% (16).

Currently, AFIT has many users on a Windows XP machine. They have around 213 Windows XP users, most are virtualized in persistent VMware Horizon View environment. The biggest problem AFIT faces is a lack of a seamless transition between Windows XP and 7. AFit was looking into another VMware product, called Persona Management, which will allow migration of the files from one environment to another in VMware View (14). VMware Mirage does support a persistent VMware Horizon View environment in a limited capacity, but does not support a non-persistent virtual environment. Even in a persistent View setup, Mirage cannot use all of its features with it. For example, Mirage can only use base and app layer assignment, enforce layers, and apply driver libraries to View virtual machine pools. Mirage cannot centralize View desktops, which means no use of the backup and recovery tools, file portal, Windows 7 migrations and more (4). AFit was also discussing of moving to a non-persistent View environment and using VMware Personal Management to house user profile data on their servers. If AFit decides to go this route, then Mirage will be completely useless in their current virtual environment. This doesn’t mean that VMware won’t add functionality for non-persistent virtual desktops in the future, but as of the latest version 4.4 (released in March 2014) there is still no compatibility (17).
User Profile

There are three types of users in AFit’s environment: the end user, the helpdesk technician, and the Mirage system administrator. The helpdesk technicians will have some of the same roles as the system administrator in Mirage.

End Users

End users will be able to their current machines that they are used to. With Mirage installed, they should notice no difference in how their system runs. They will be able to request new applications or request system administrators to update the software they use. They request it by contacting the AFIT helpdesk technicians (3). They can also opt in or opt out of the service based on the needs of the job and if the department is willing to pay for the service. The end user will also be able to retrieve their own files through the file portal or through their desktop explorer (4).

Helpdesk Technicians

Helpdesk technicians will take trouble calls when a computer crashes or files get lost or corrupted. They will put in the request to update or add additional software to an application layer (3). They will have the ability to access a virtualized version of the desktop if one exists and to provision both a physical and virtual machine based off of the user’s CVD (3).

System Administrators

System administrators will manage the CVDs, application and base layers of the system. They will update each layer to keep all software up to date and monitor system vitals. As users request additional software, the admins will test compatibility with current systems to ensure ease of use for end users. They will also be monitoring the system to see who is up to date on
backups and layers and push out layers as required (3). This will keep users on the same hardware and software configurations. They will monitor the storage LUN to ensure that enough free disk space available to add users and keep existing users on the retention policy (3).

**Software and Interface Experience**

IT employees should have experience in systems administration, SQL administration, and knowledge of client operating systems, especially Windows 7. Employees should also have knowledge of Windows Server 2008 R2 or higher and SQL Server 2008 R2 or higher. Also, a familiarity with networking protocols and administration is needed to troubleshoot connection problems between different servers, storage, and clients.

**Experience with Similar Applications**

Administrators need similar experiences with Windows Deployment Services (WDS), Windows Automated Installation Kit (WAIK), System Center Configuration Manager (SCCM), VMware vSphere, vCenter, Horizon View, Fusion and Workstation.

**Frequency of Use**

Depending on department’s needs and resource constraint, this could be used daily or weekly. If the department already uses and is familiar with VMware products, then it is an easy learning curve and will be utilized easily. This is something that will be used every day at a varied capacity.
Timeline

The best way to approach this project was to first setup a test environment before putting Mirage into AFit’s environment. This way the products could be tested first so the implementation for AFit would go smoother. UC’s College of Education, Criminal Justice, and Human Service’s
resources were used to create the test environment. The IT program in the college has a virtual sandbox that is used by students to create VMware virtual machines and networks. This was perfect for creating a test environment to try out Mirage. After the work in the test environment, the project was moved to AFit’s environment. Taking what was learned from the test environment, the installation and setup for AFit was much smoother. Figure 7 shows the gannt chart of the project.

![Gannt Chart](image)

Figure 7: Horizon Mirage Evaluation Project Timeline.
Budget

This section will be divided between the project budget and the production budget. The project budget being what was spent on the project and the production budget being what AFit would have to spend to put into production.

Project Budget

AFit has generously supplied server space and network resources for this project. The only costs to this project would be the amount of named licenses that are needed to create CVD snapshots of employee computers. Evaluation licenses were obtained until the end of the year so no cost was incurred initially (2). A VMware sales representative provided extended evaluation licenses for this project (13).

The cost of the licenses depends on the amount of users that sign up for the service and by the amount of users determined by AFit who is required to have the service. The licenses only come in increments of 10 (8). The goal was to gain long term support from VMware and purchasing three years of basic support. Basic support is during VMware’s published business hours Monday through Friday. For the initial pilot, the project utilized a trial license to get a couple people in AFit along with several people from the UCit Helpdesk on this service.

Production Budget

The hardware is not being purchased as it is using available hardware resources from the department. However, the minimum requirements are: a server running Windows Server 2008 R2 with an Intel equivalent 2.26 GHz Quad-Core Processor with 16 GB of RAM (10). Mirage requires a minimum 146 GB system drive which includes a 100 GB Horizon Mirage network cache (10). The estimated cost of the server would be $2,554.08 (15).
According to Table 1 the project would cost $13,449.47 if all hardware and software had to be purchased. Since UC has a license agreement with Microsoft, the cost of the server and SQL database are already covered (3). The project ran on existing hardware in UCit’s datacenter so a server was not required to be purchased. The only cost to the project would have been the licenses for Horizon Mirage, which would have cost $9,326.40 if the group increased to 40 users.

<table>
<thead>
<tr>
<th>Item</th>
<th>Qty</th>
<th>Price</th>
<th>AFit Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizon Mirage 3 year basic support (10 users)</td>
<td>4</td>
<td>$2,331.60</td>
<td>$9,326.40</td>
</tr>
<tr>
<td>Windows Server 2008 R2</td>
<td>0</td>
<td>$669.99</td>
<td>$0.00</td>
</tr>
<tr>
<td>Microsoft SQL Database</td>
<td>0</td>
<td>$899.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>PowerEdge R620</td>
<td>0</td>
<td>$2,554.08</td>
<td>$0.00</td>
</tr>
<tr>
<td><strong>Potential Cost vs Actual Cost</strong></td>
<td></td>
<td><strong>$13,449.47</strong></td>
<td><strong>$9,326.40</strong></td>
</tr>
</tbody>
</table>

Table 1: Cost for minimal implementation.

Storage is an important aspect to consider when evaluating this product. Storage varies by the amount of users utilizing the service along with how many different layers are required to keep the business operational and in compliance with its needs. VMware recommends an average of 15GB per user for the backup aspect of the product (4). At UC, storage is charged at a rate of 23 cents per Gigabyte a month on ATA drives and 40 cents per Gigabyte a month for Fiber Channel drives. The cost of the storage for our project if deployed to production would be $4,968 over a three year period on ATA drives. Since the project was in a development environment and AFit has its own storage, we were not required to pay for storage.

Table 2 shows the differences between the different packages that VMware offers for the Horizon Mirage software. There are four different packages as shown below. The difference between them is how long the support term lasts and if basic or production support is needed. The difference between basic and production support is service level agreements and hours of operation. With basic support, the business will get support for 12 hours a day during VMware’s
published business hours. The SLA is different based on severity. As an example, critical problems will be addressed within 4 hours. With production support, the business will get 24/7 support and faster response times. For critical problems, it will be addressed within 30 minutes of being reported.

<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizon Mirage 3 year production support</td>
<td>$2,490.00</td>
</tr>
<tr>
<td>Horizon Mirage 3 year basic support</td>
<td>$2,331.60</td>
</tr>
<tr>
<td>Horizon Mirage 1 year production support</td>
<td>$1,875.00</td>
</tr>
<tr>
<td>Horizon Mirage 1 year basic support</td>
<td>$1,815.00</td>
</tr>
</tbody>
</table>

Table 2: Cost of different packages for VMware Mirage.

**Compatibility Issues & Setbacks**

- Windows XP x64 is not compatible with the Mirage Client, requires XP x86 SP2 or higher.
- Driver Profiles were not pushing to laptops, had to create separate base layer and driver profile.
- Domain joining needs to be done by a domain admin account to allow same named machines back on the domain.
- Database generates lots of logs and needs to be truncated or shrunk on a schedule time period otherwise database will crash and management server will stop functioning.
- System drive needs to be larger than 146GB, continuously ran out of space. This is also due to all server components except the database are installed on one virtual machine. Current state, we recommend a 200GB system drive.
- Ports 135, 445, 8000, 8001, 8443, and 8444 need to be opened on the server firewall if the install does not do this automatically.
- SQL Management Studio cannot be included in a layer. It is not currently compatible.
- Web browsers may need to allow third-party cookies to use the File Portal and Web Manager sites. Not enabling third-party cookies may log users out of the Mirage sites frequently.
AFit Presentation

The project was presented to AFit on April 7th to discuss the findings. The software service was presented to the group to gauge interest in the software and to see if it would be beneficial to their needs and improve the service they provide to their users. We introduced those that were not already familiar with the project.

They were interested in the product, but at this time in their current configuration it will not benefit them. It does not save them time given how they currently run the environment. The data in the desktop and documents folder is rerouted to a network share. This is considered backed up in their situation as all data is stored in a centrally managed environment. They compared Horizon Mirage to their current desktop deployment system, System Center Configuration Manager (SCCM). It came to the conclusion that Mirage does not save enough time to justify the cost. We estimated about one to one and a half hours to deploy an image on site and approximately three hours to deploy over the VPN if the internet bandwidth is above average. SCCM can deploy an image in just slightly more time and provides the same deployment features as Mirage. Considering Mirage also uses Microsoft’s User State Migration Tool (USMT), it requires time to install and import the tool into the Mirage server to do the same thing as a free tool. They did, however, agree that the added benefit of having an all in one solution to deploy and backup machines was nice.

We also discussed their future plans for a VDI environment and it moving to a non-persistent environment. VMware acknowledges that the product is not capable of any use of Mirage’s features to a non-persistent machine. The entire product would be of no use in this scenario until VMware provides support to a non-persistent environment. Their current environment is also heavily vested into a VDI and Mirage, once again, does not fully support the
VDI infrastructure as it is advertised. VMware just added layering support to a VDI in Mirage version 4.3 (20).

The final conclusion is that the software is not beneficial in their environment. They do believe that it is greatly beneficial for others outside of their area and would like to see it offered as a service in the future. This would be used for the higher ups in the rest of the organization to ensure that they have their machines backed up and can easily deploy a nearly identical machine if a problem arises. Once VMware has added support for VDI, AFit can see the benefit of the product. IT would allow for easy deployment of vCenter pools.

**Conclusion**

“Fighting Fires” is not something any IT person wants to deal with. It takes time and resources away to keep maintaining an environment that is not currently up to date. The solution we are proposing will help alleviate most of that problem. It gives time for IT personnel to innovate and make use of additional resources. Projects at UC such as migration and better backup and recovery have been put on hold, which has led to backup date being two months or more out of date. This service allows for a seamless user experience that will perform backups while the machine is in use (1).

The amount of time saved from implementing this solution would allow AFit to further innovate the environment and also allow for the users to have important data backed up. This ensures business continuity after a loss, for a backup of the data will be present. If a physical machine goes down, AFit can virtualize the desktop while they are getting another machine ready and retrieve files the user needs to continue on with their day. Mirage saves time and
money for both IT and end users by having a self-service backup and recovery solution and a simple desktop migration tool (1).
References


2 Stoelting, Craig. "Initial Project Discussion." Personal interview. 6 Sept. 2013.


