Goliath Customer P.C.
XenDesktop Assessment
Findings and Recommendations

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Introduction

Goliath Customer P.C. is an intellectual property law firm located in Pittsburgh PA. The law firm has approximately 300 employees and uses Citrix XenDesktop to deliver desktop computing and application access to employees. Since the recent upgrade to XenDesktop 7.11 there have been performance issues that have been plaguing users. These user's issues have primarily revolved around slow session performance and long logon times.

On Wednesday, July 5th, 2017 the IT team at Goliath Customer engaged Goliath Technologies to assess and review the environment. There were two key goals for the project. The first was to review the environment from an architecture and configuration perspective. The goal of this phase was to ensure that the architecture and components are configured following best practices. The second phase was to review the user issues that have been chronic in the environment and identify the root cause.

This report details the architecture and configuration of the environment, it also includes the specifics related to the analysis of the slow logons and session performance issues. Contained within the following content are the detailed findings and recommendations going forward for Goliath Customer.

Section 1 – Enterprise Infrastructure Configuration Findings

The following section details the overall design of the components that the environment is comprised of. This includes the physical hardware components, the network, dependency services and the Citrix role server components.

Virtual Infrastructure

The infrastructure is comprised of two environments. VMware vSphere 6 is the hosting platform for the primary infrastructure. All services including Active Directory, DHCP, DNS, SQL, File Server and Citrix role services are hosted on vSphere ESXi servers. There is a separate XenServer 7 server pool comprised of three physical host servers that the VDI guest VMs reside on.

Network Infrastructure

Users mostly connect to the environment locally on the LAN. Users also access resources remote from home and other locations outside the office. There are also some permanent remote users that access the environment from Canada.

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Remote users access the environment via NetScaler Gateway SSL proxied ICA session. RSA soft tokens are integrated into the NetScaler Gateway remote access portal for multi-factor authentication.

All connections from the LAN are interconnected via Cisco core 4505 switch. The core switch routes layer three traffic for the internal network. The Citrix environment and storage networks are hosted on 2 Cisco 3750 switches. Each 3750 connects to the core via 10Gbps fiber uplinks. The switches are not stacked, but rather configured in a mesh configuration. vMotion traffic is not on a dedicated VLAN, and currently uses the production LAN network. Storage Traffic traverses a dedicated non-routable VLAN. There is no DMZ configured in the environment, all externally facing resources are located on the internal trusted network. This Firewall is a Cisco ASA 5110.

Storage is hosted on a Dell EqualLogic SAN comprised on 10K spindles, this applies to all storage across the infrastructure except for the write cache data for PVS. The cache data is stored on an array with 15K spindles. The physical servers are HPE DL380s that connect to the network via bonded 1Gbps pairs.

Users connect to Citrix from either HP T510 thin clients or from Asus USX32a laptops. In the office, thin clients and docked laptops access the network via hardwired gigabit connections. Roaming laptop users access the network via Wi-Fi connections.

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Citrix XenDesktop Configuration

Goliath Customer currently has XenDesktop 7.11 deployed as their virtual desktop platform. There are 130 licenses available and the concurrent user count at any given time is 100. Citrix role servers are deployed as follows.

- Two NetScaler version 11
- Two StoreFront Servers
- Two XenDesktop 7.11 Delivery Controllers
- Two Provisioning Services 7.8 servers (physical servers)
- Licensing Server
- SQL Database, single server no high availability
- XenServer 6.6 (two host servers)
- Citrix Role Servers, SQL server and Domain Controllers are deployed as virtual machines on a VMware vSphere 6 cluster

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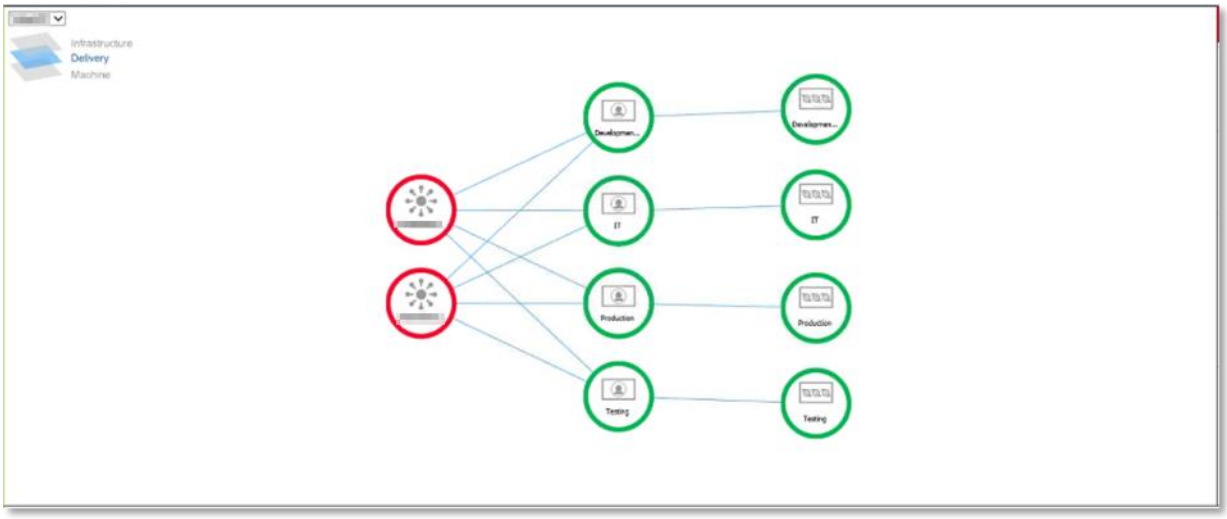
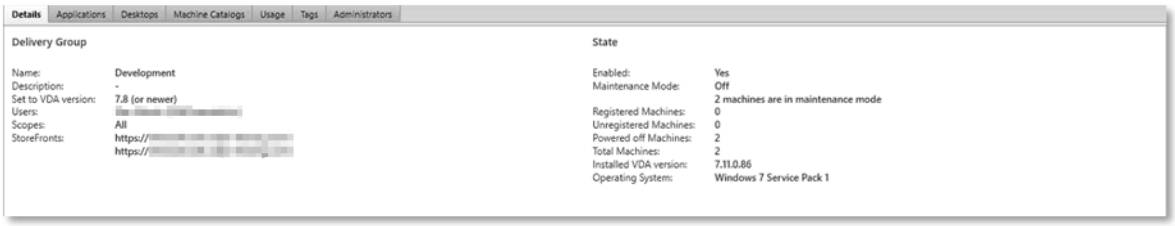
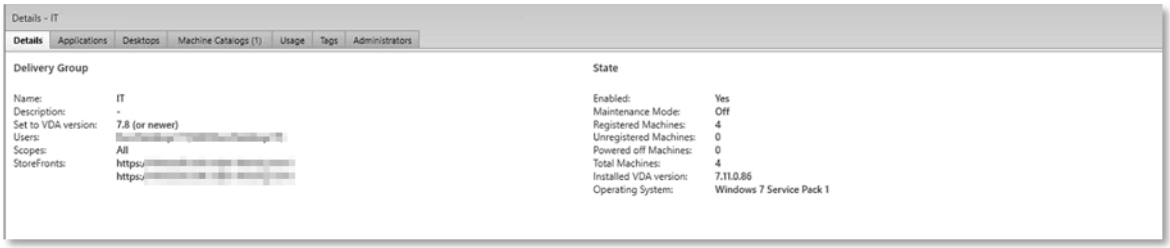
The XenDesktop environment is comprised of four delivery groups and four machine catalogs. The delivery groups are configured as follows.



The development delivery group is configured for staging and testing image updates, and is comprised of two desktops. This delivery group is connected to a corresponding machine catalog delivered from PVS with the vDisks configured in private mode.



The IT delivery group is configured for the IT group. IT is comprised of 4 virtual desktops contained in a corresponding machine catalog. These desktop images are used for IT day to day operations and have applicable software and tools installed in the image.



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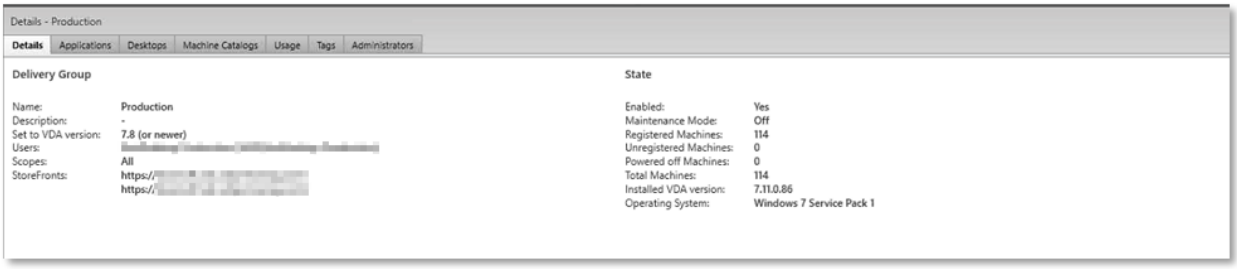
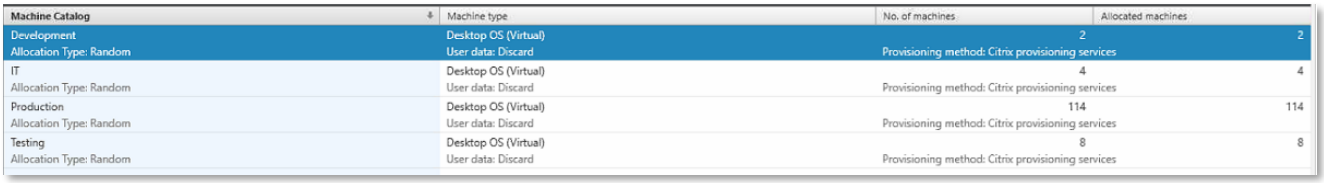
The production delivery group is the primary production delivery group for the law firm's users. It is comprised of 114 virtual desktop computers contained in a corresponding machine catalog.



The testing delivery group, also configured from a corresponding machine catalog and is used for testing updated vDisks before they are put into production. There are 8 virtual desktops in this delivery group.

All four virtual machine catalogs, depicted below are configured to be pooled, random desktops. All machines in each delivery group discard user data and reboot upon logoff.



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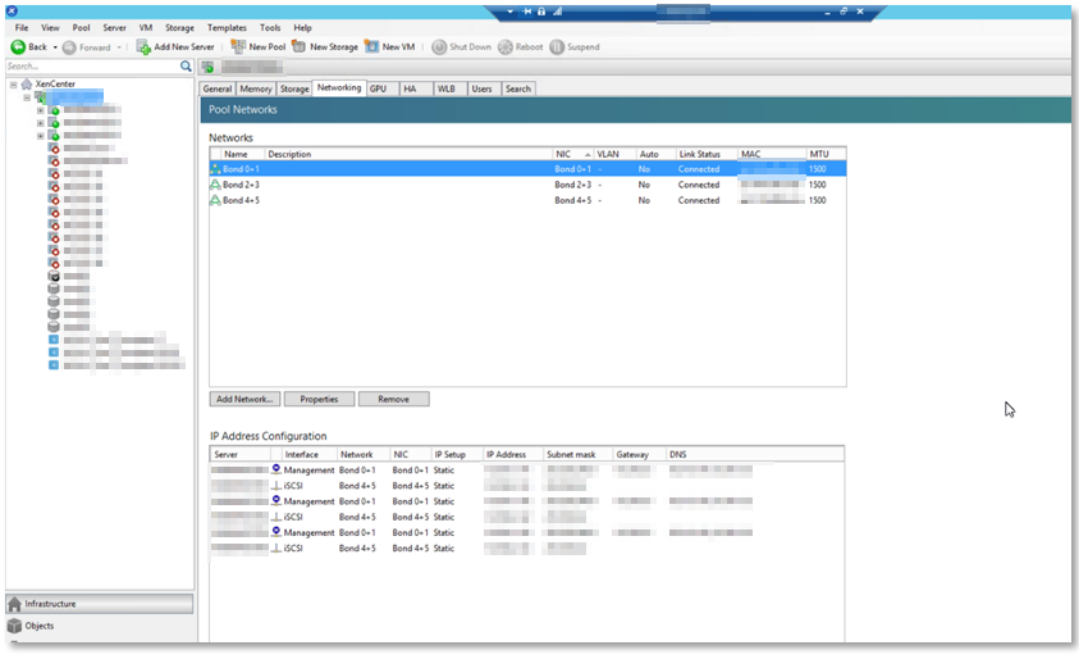
XenServer Configuration

The VDI infrastructure is hosted on three XenServer host servers. The XenServer cluster configuration is as follows.



Each server is configured with a management and iSCSI virtual network. The connections are comprised of bonded 1 Gbps pairs. The storage network is non-routable iSCSI. Shared storage is hosted on an EqualLogic SAN, the primary array is 10K SAS. Cache data is stored on a 15K SAS shelf for high IOPS performance.

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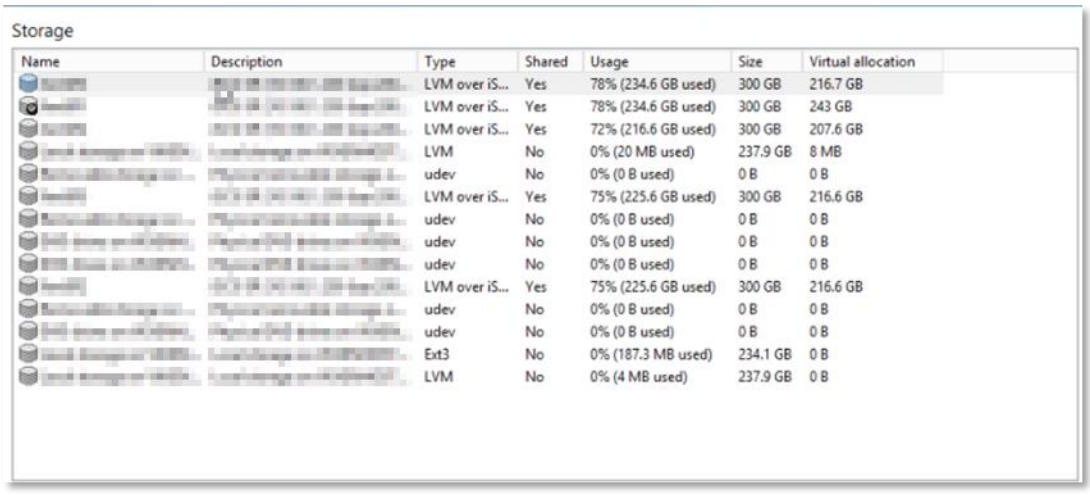
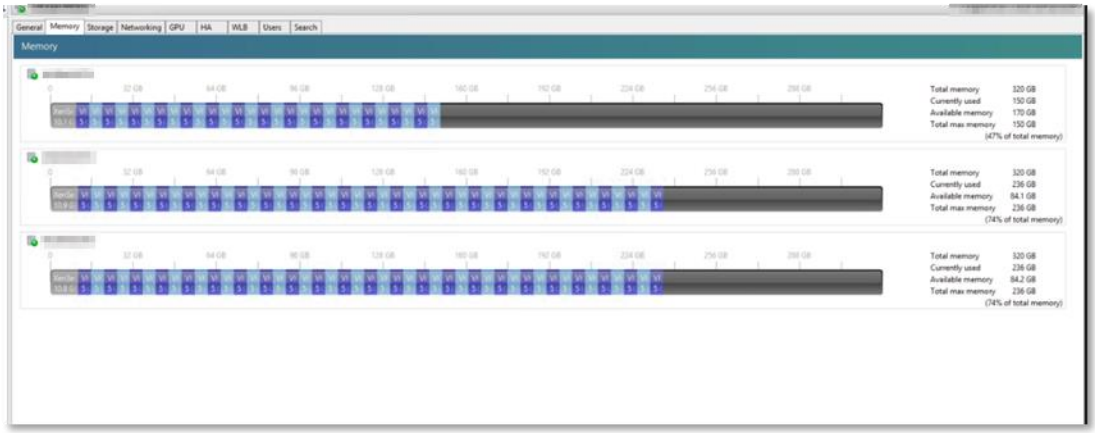


Each server has 320 GB of RAM allocated, two of three host servers are at approximately 75% memory utilization on a consistent basis.



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Total utilization metris per host is demonstrated bleow. Two of the three host servers are above 55% processor utilization and as stated above, at 75% memory consuption. One host server is under 35% CPU and 50% memory ultilzation.

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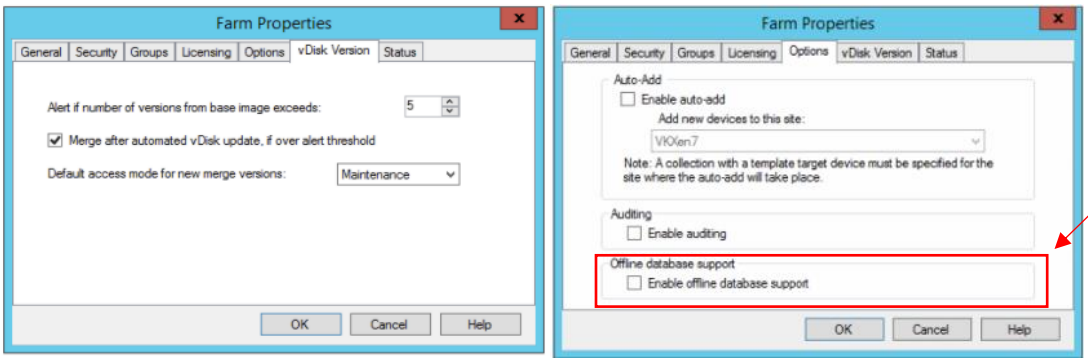
Provisioning Services Configuration

Provisioning Services are configured on two bare metal Windows 2012 R2 servers. Each server is configured with 32 GB of RAM. The PVS farm configuration is as follows.

The farm is configured to merge images after automated vDisk update. Default farm configurations are in place. Offline database support is not enabled for the PVS farm.



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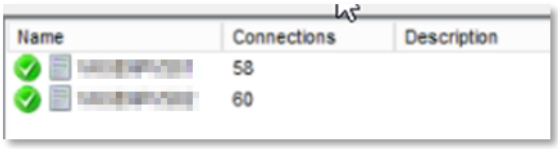
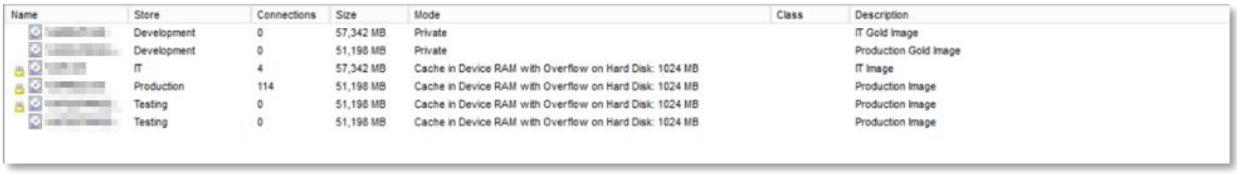
The farm is comprised of two servers with connections evenly load balanced.

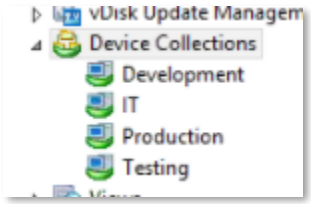


Development vDisk images are configured in private mode for IT and Production images. All other images are configured in standard mode with Cache on RAM configured for 1GB of RAM. Disk offload is also configured for write cache data.

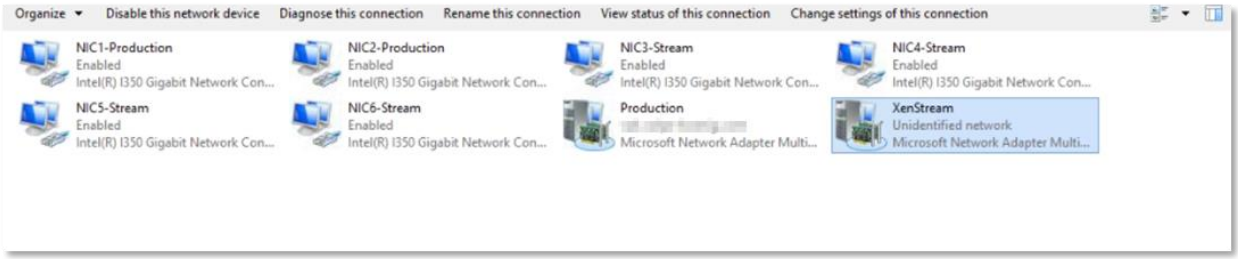


XenServer pool connection is configured for automated image updates.

There are four device collections, each corresponds with the machine catalogs and delivery groups configured in the XenDesktop site.



Two aggregated network connections are configured on each PVS server. The Production connection is comprised of two adapters and is configured for management/general network access. The XenStream connections are configured for streaming images to target devices. The XenStream network is non-routable.



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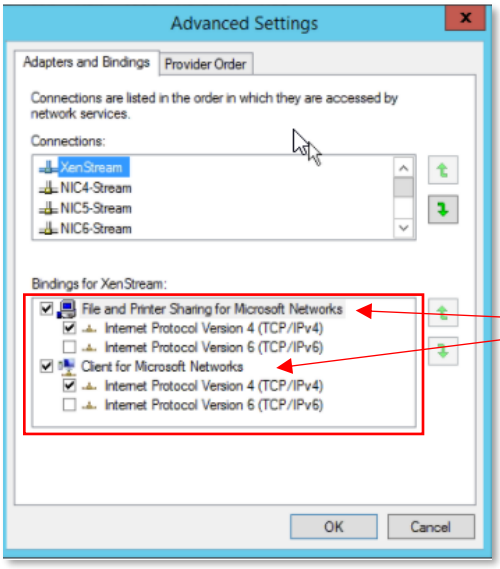
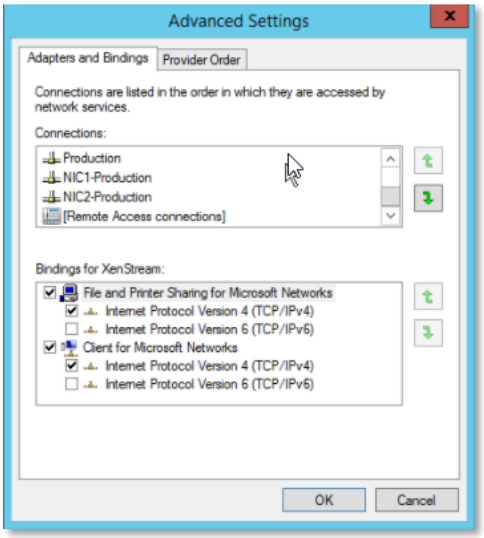
The XenStream adapter is configured as follows, both File and Printer Sharing for Microsoft networks and client for Microsoft networks is enabled on the adapter.



File & Printer Sharing and Client for MS networks enabled on the streaming servcies NIC

The production network adapter is configured the same as XenStream



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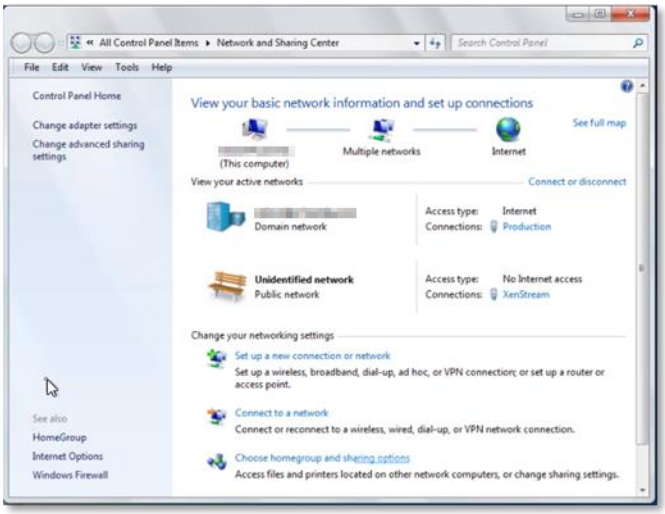
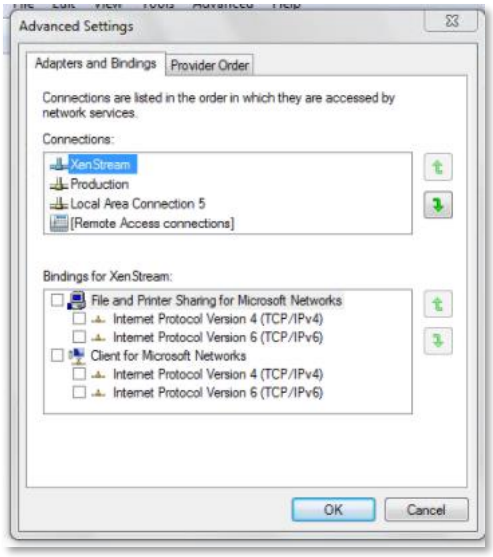
Target device network connections are also configured with both a production and XenStream connection.



XenStream is configured as the primary connection. File and Printer sharing for MS Networks and Client for Microsoft Networks is disabled.



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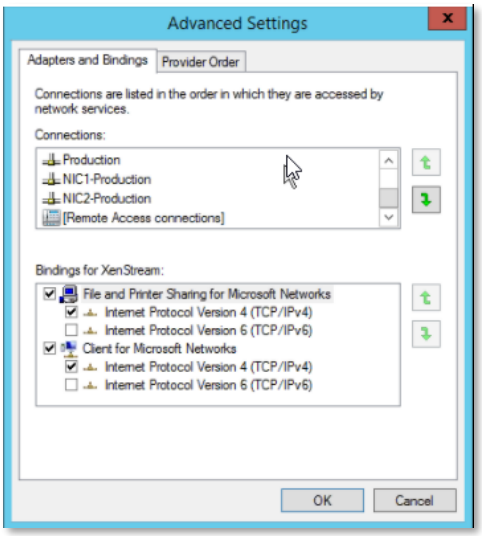
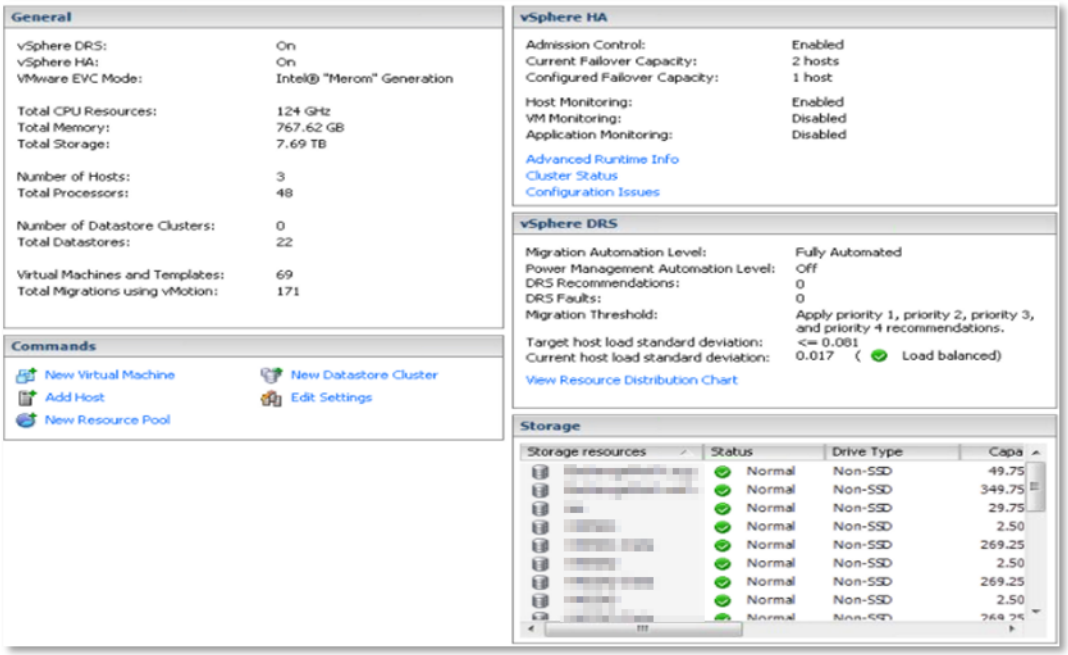
The Production connection is configured with the default settings.



VMware vSphere Configuration

XenDesktop role services are stored on a VMware vSphere cluster. The cluster contains all server resources for the environment in addition to Citrix management resources. The cluster configuration is detailed below.



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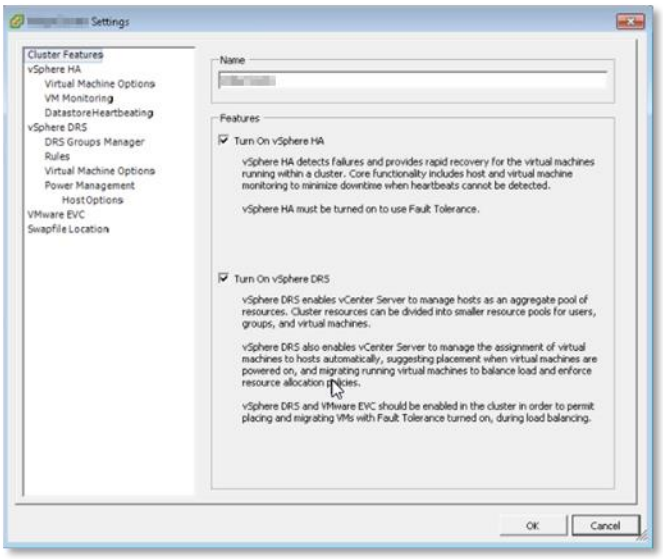
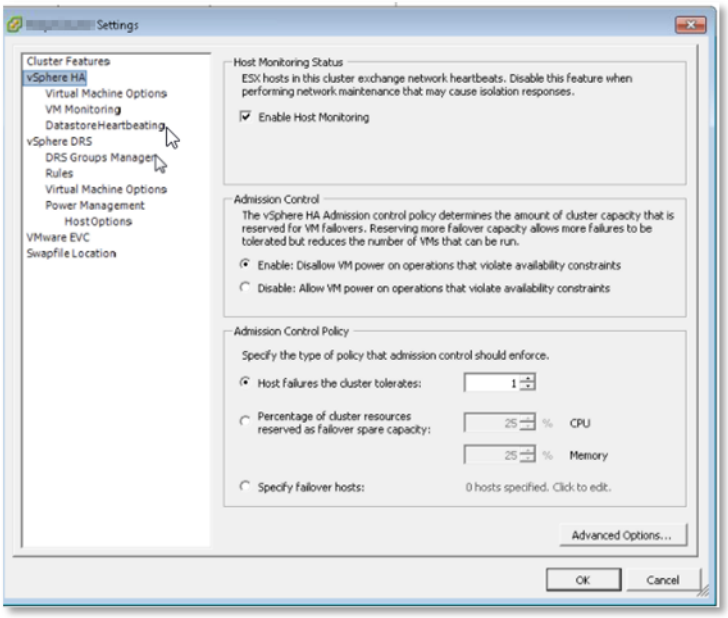
Both High Availability (HA) and Distributed Resource Scheduler (DRS) are enabled on the cluster.





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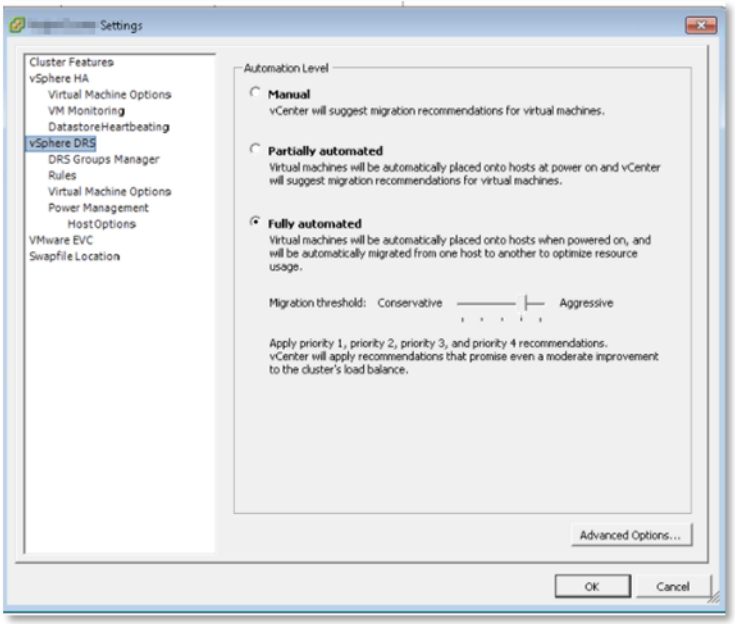
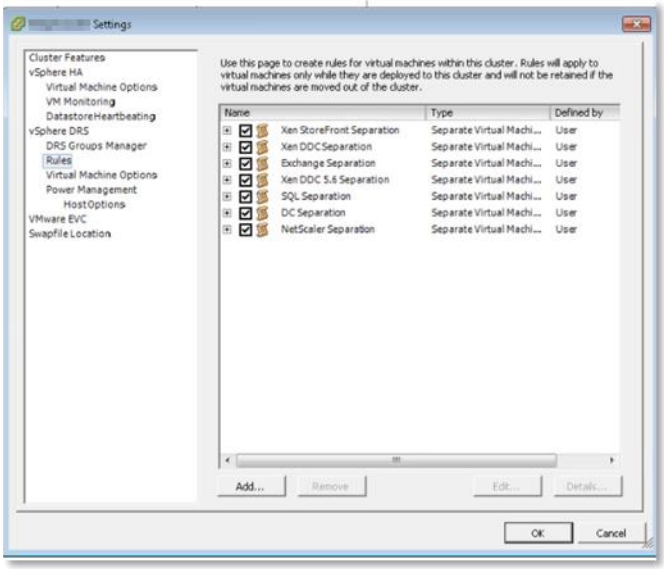


DRS Affinity Settings are configured for all redundant services. These services include StoreFront, Delivery Controllers, Microsoft SQL servers, Domain Controllers, NetScaler VPXs and Microsoft Exchange servers.



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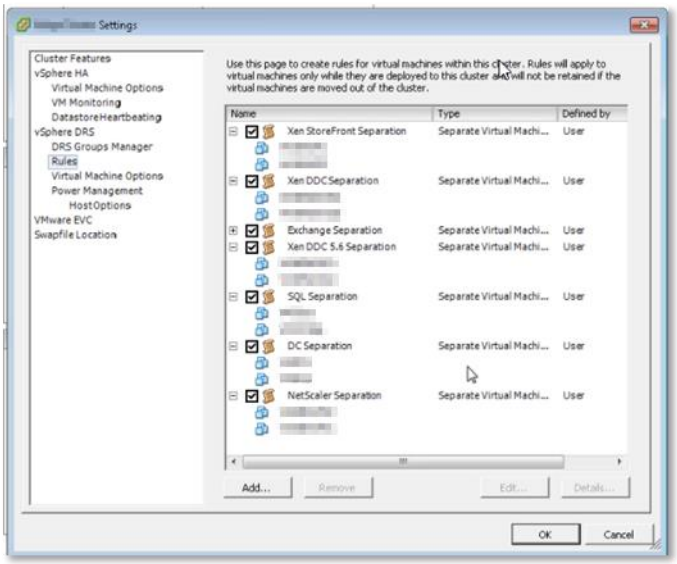
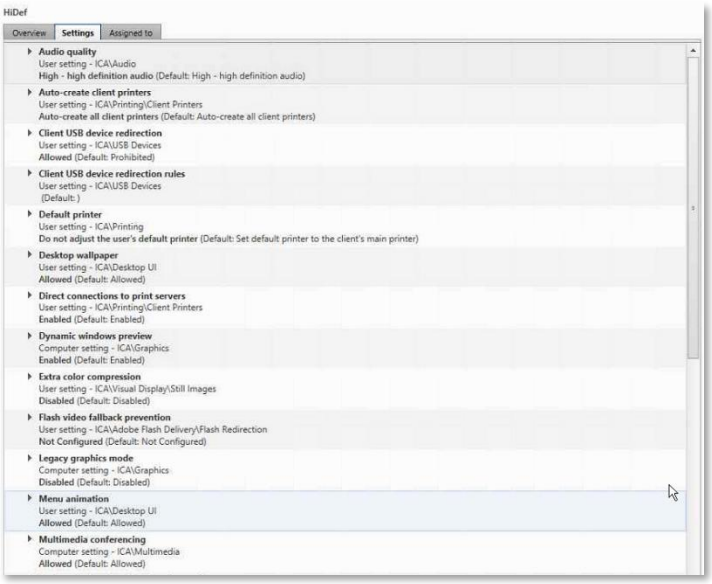


Citrix and Group Policy configuration

The Citrix HiDef policy template is applied to the production users in the environment. The policy is configured with default settings and has not been modified.



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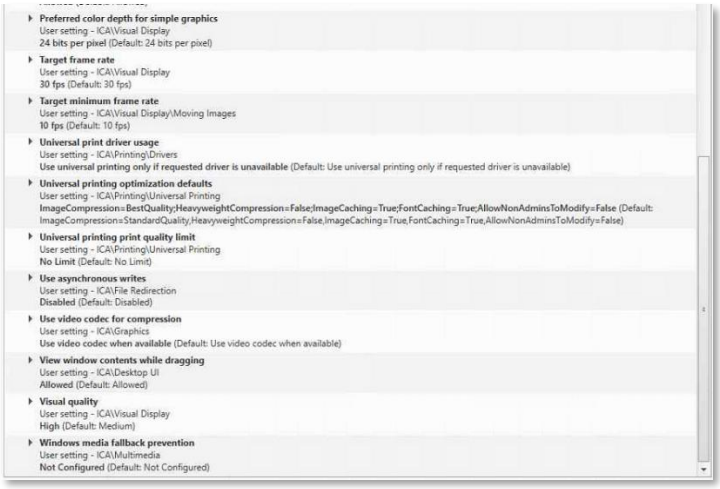
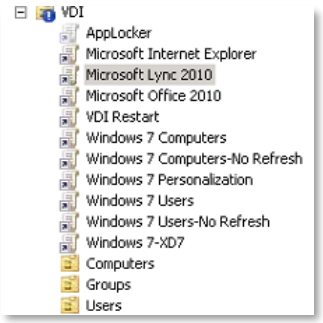


Several Group Policies have been configured at the Active Directory level for profile management, security and for application configuration.

Citrix Profile Management is leveraged for managing roaming profiles. CPM is combined with folder redirection to manage profile size and stability.



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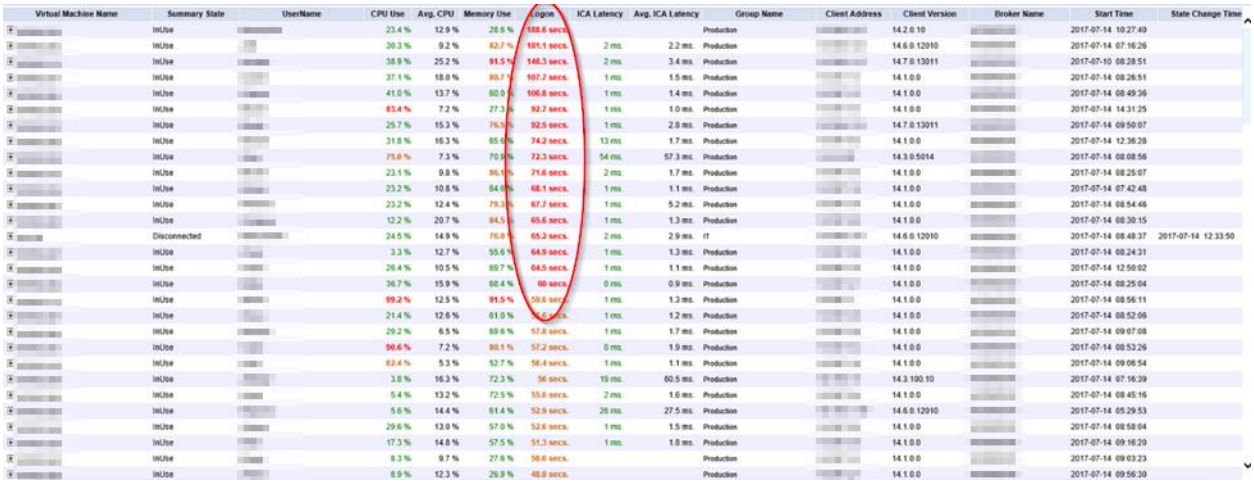
Section 2 – Performance and User Experience Findings

Virtual desktops are configured with 1 vCPU and 5 GB of RAM. 1GB of RAM is used for PVS write cache data. Each VDI is configured with a dedicated vDisk hosted on a 15K SAS array. This disk is for write cache spillover if more that 1GB is required for write cache. All VDI virtual machines are PVS target devices and boot to one of the four PVS vDisks detailed in the previous section.

During the engagement, there were two key issues that stood out, slow logons and session performance issues, manifesting as sluggish desktop and application performance. The slow logon issues occurred randomly to different users at different times. The session performance issues consistently impact the same subset of users who are power users in the environment.

An example of the logon duration issues is depicted below. The long logons occur during different times of the day and to different users.



Virtual Machine Name	Summary State	UserName	CPU Use	Avg. CPU	Memory Use	Logon	ICA Latency	Avg. ICA Latency	Group Name	Client Address	Client Version	Broker Name	Start Time	State Change Time
	InUse		23.4 %	12.9 %	28.6 %	108.6 secs.			Production		14.2.0.10		2017-07-14 10:27:49	
	InUse		30.3 %	9.2 %	82.7 %	101.1 secs.	2 ms.	2.2 ms.	Production		14.6.0.12010		2017-07-14 07:16:26	
	InUse		38.9 %	25.2 %	91.5 %	146.3 secs.	2 ms.	3.4 ms.	Production		14.7.0.13011		2017-07-10 08:28:51	
	InUse		37.1 %	18.0 %	89.7 %	107.7 secs.	1 ms.	1.5 ms.	Production		14.1.0.0		2017-07-14 08:26:51	
	InUse		41.0 %	13.7 %	80.0 %	106.8 secs.	1 ms.	1.4 ms.	Production		14.1.0.0		2017-07-14 08:49:36	
	InUse		83.4 %	7.2 %	27.3 %	92.7 secs.	1 ms.	1.0 ms.	Production		14.1.0.0		2017-07-14 14:31:25	
	InUse		25.7 %	15.3 %	76.5 %	92.5 secs.	1 ms.	2.8 ms.	Production		14.7.0.13011		2017-07-14 09:50:07	
	InUse		31.8 %	16.3 %	85.6 %	74.2 secs.	13 ms.	1.7 ms.	Production		14.1.0.0		2017-07-14 12:36:28	
	InUse		75.0 %	7.3 %	70.8 %	72.3 secs.	54 ms.	57.3 ms.	Production		14.3.0.5014		2017-07-14 08:08:56	
	InUse		23.1 %	9.8 %	86.1 %	71.6 secs.	2 ms.	1.7 ms.	Production		14.1.0.0		2017-07-14 08:25:07	
	InUse		23.2 %	10.8 %	84.8 %	68.1 secs.	1 ms.	1.1 ms.	Production		14.1.0.0		2017-07-14 07:42:48	
	InUse		23.2 %	12.4 %	79.3 %	67.7 secs.	1 ms.	5.2 ms.	Production		14.1.0.0		2017-07-14 08:54:46	
	InUse		12.2 %	20.7 %	84.5 %	65.6 secs.	1 ms.	1.3 ms.	Production		14.1.0.0		2017-07-14 08:30:15	
	Disconnected		24.5 %	14.9 %	76.8 %	65.2 secs.	2 ms.	2.9 ms.	IT		14.6.0.12010		2017-07-14 08:48:37	2017-07-14 12:33:50
	InUse		3.3 %	12.7 %	55.6 %	64.9 secs.	1 ms.	1.3 ms.	Production		14.1.0.0		2017-07-14 08:24:31	
	InUse		26.4 %	10.5 %	89.7 %	64.5 secs.	1 ms.	1.1 ms.	Production		14.1.0.0		2017-07-14 12:50:02	
	InUse		36.7 %	15.9 %	68.4 %	60 secs.	0 ms.	0.9 ms.	Production		14.1.0.0		2017-07-14 08:25:04	
	InUse		99.2 %	12.5 %	91.5 %	59.6 secs.	1 ms.	1.3 ms.	Production		14.1.0.0		2017-07-14 08:56:11	
	InUse		21.4 %	12.6 %	61.0 %	57.8 secs.	1 ms.	1.2 ms.	Production		14.1.0.0		2017-07-14 08:52:06	
	InUse		29.2 %	6.5 %	69.6 %	57.8 secs.	1 ms.	1.7 ms.	Production		14.1.0.0		2017-07-14 09:07:08	
	InUse		90.6 %	7.2 %	80.1 %	57.2 secs.	0 ms.	1.9 ms.	Production		14.1.0.0		2017-07-14 08:53:26	
	InUse		62.4 %	5.3 %	52.7 %	56.4 secs.	1 ms.	1.1 ms.	Production		14.1.0.0		2017-07-14 09:06:54	
	InUse		3.8 %	16.3 %	72.3 %	56 secs.	19 ms.	60.5 ms.	Production		14.3.100.10		2017-07-14 07:16:39	
	InUse		5.4 %	13.2 %	72.5 %	55.6 secs.	2 ms.	1.6 ms.	Production		14.1.0.0		2017-07-14 08:45:16	
	InUse		5.6 %	14.4 %	61.4 %	52.9 secs.	26 ms.	27.5 ms.	Production		14.6.0.12010		2017-07-14 05:29:53	
	InUse		29.6 %	13.0 %	57.0 %	52.6 secs.	1 ms.	1.5 ms.	Production		14.1.0.0		2017-07-14 08:58:04	
	InUse		17.3 %	14.8 %	57.5 %	51.3 secs.	1 ms.	1.8 ms.	Production		14.1.0.0		2017-07-14 09:16:20	
	InUse		8.3 %	9.7 %	27.6 %	50.6 secs.			Production		14.1.0.0		2017-07-14 09:03:23	
	InUse		8.9 %	12.3 %	26.9 %	48.8 secs.			Production		14.1.0.0		2017-07-14 09:56:30	

There were two key common denominators when assessing the logon duration breakdown of the users. In every instance logon script execution and profile load time were identical in duration, and generally where most of the time was consumed, this is shown in the examples below.

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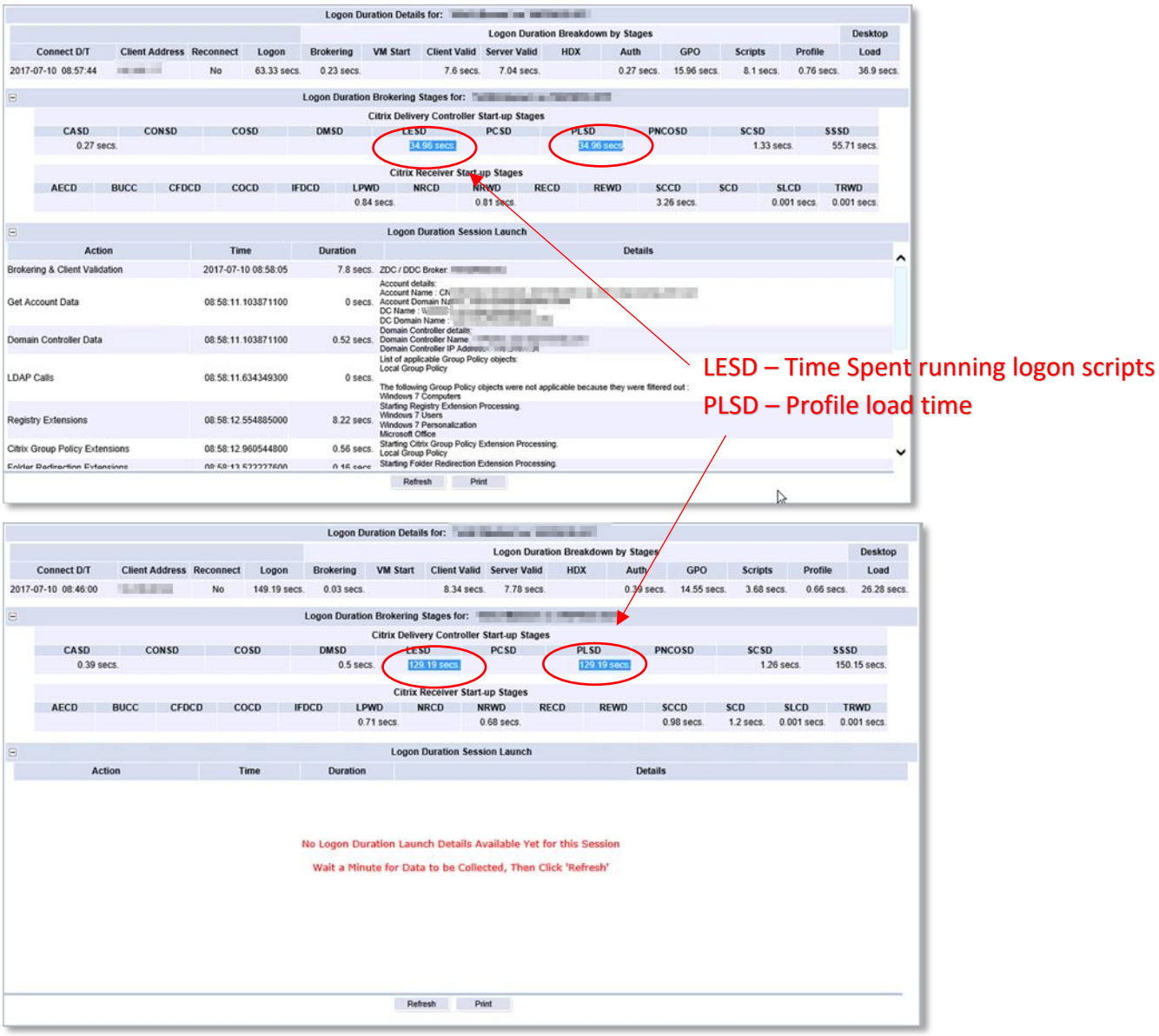

The net result of the slow logon issue points directly to the profile load time. In every session slow to logon, the profile load and script execution times are identical and the largest contributor to the overall logon duration. It is typical and expected to see both LESD and PLSD times match when the root cause of logon duration slowness is the result of Citrix UPM profiles loading slowly.

The session performance issues were the more critical of the issues that users were experiencing. As previously stated, these issues manifested in sluggish performance related to graphic presentation and application operation. The commonality with these issues is that the same subset of power users were impacted on a reoccurring basis.

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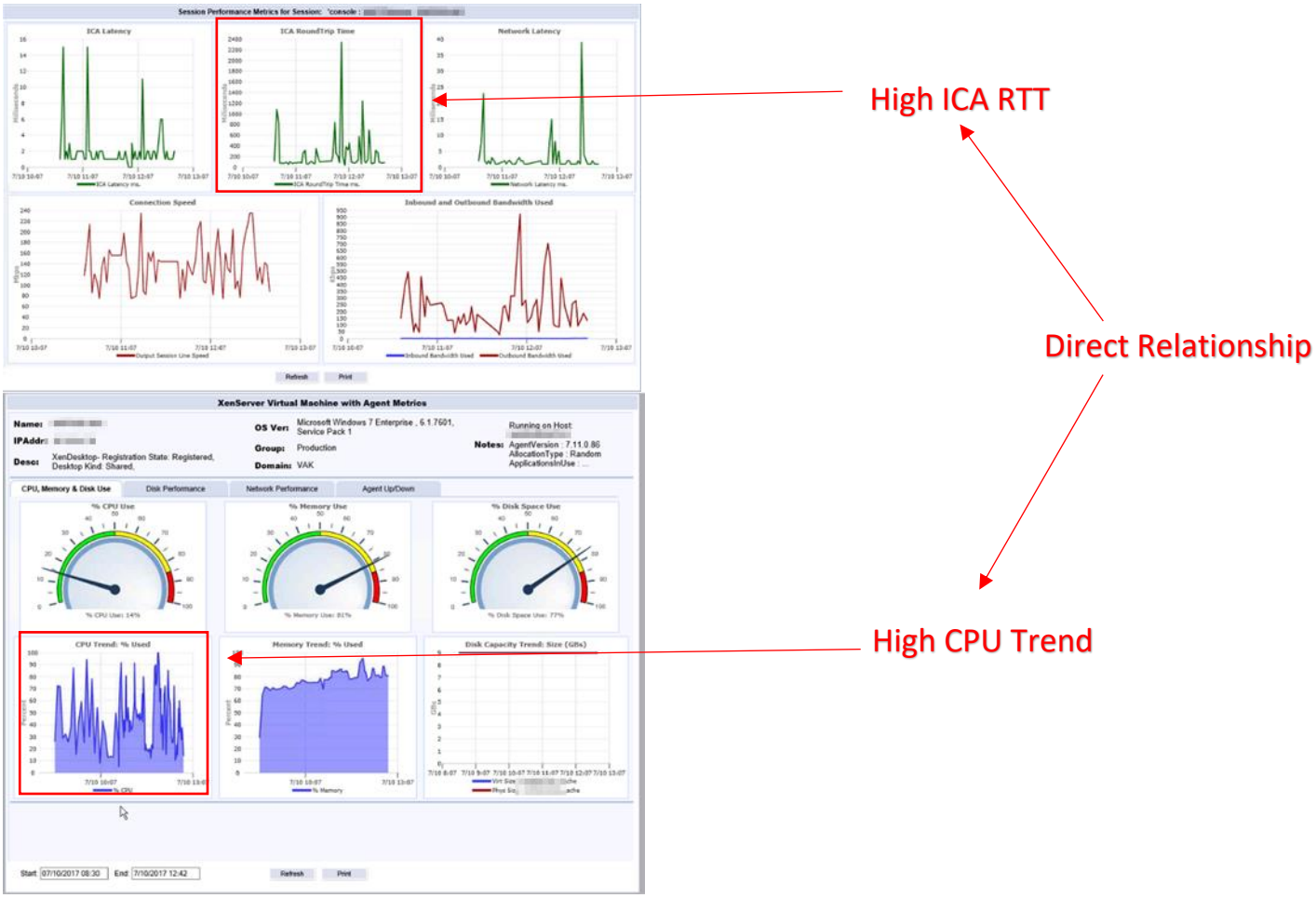
Over a period of two weeks data was gathered related to user session data and analyzed on two separate occasions. The results detailed below detail the findings related to user sessions experiencing slowness and overall poor user experience.

Virtually all the poor performing sessions during this assessment manifested in the following manor; high round trip times coupled with very high CPU utilization. Some sessions also had high ICA latency and RAM usage as well, but RTT and CPU were the consistent sources of concern. From a network performance standpoint, connection speeds and network latency were at optimal levels for all user sessions throughout the duration of the assessment.



When round trip time is high, and other latency metrics (ICA latency and network latency) are low, it is indicative of a system level performance problem. This is reflected in the data samples above, and in the following examples below. There is a direct correlation between RTT and processor utilization on each analyzed session. The possibility of this being VM or hardware

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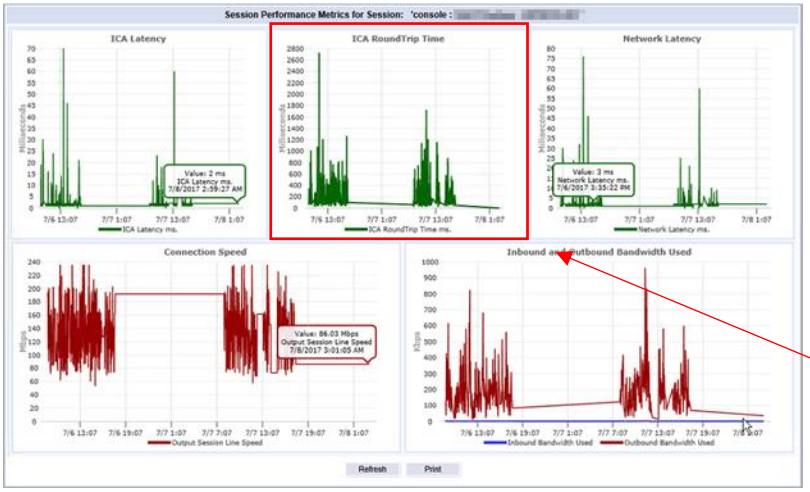
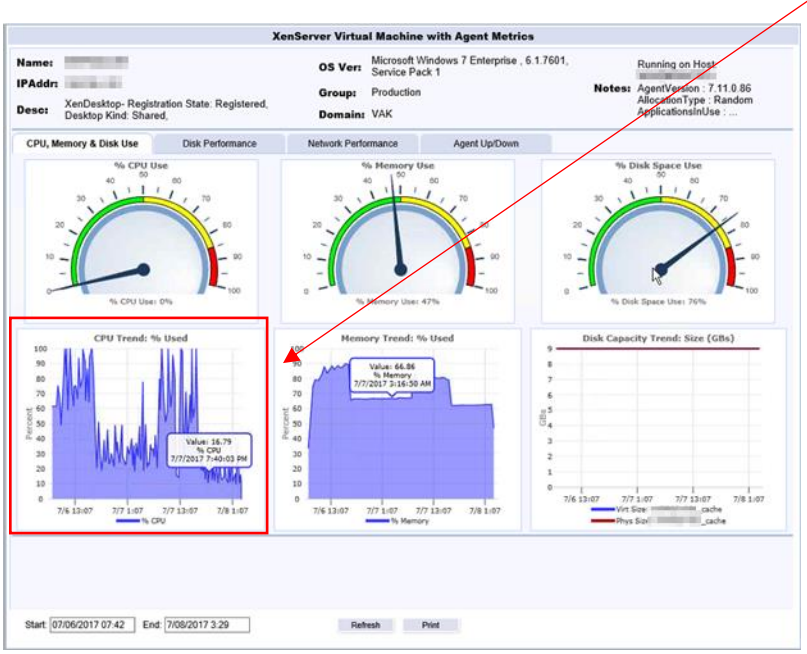
specific was also ruled out as some users were observed on multiple different virtual desktops. In every case the process/RTT condition followed the user and not the virtual machine.





RTT and CPU Trend have cooresponding patterns

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250 – 500 ms RTT on average.

CPU pegged at 100%,

RAM only 60%

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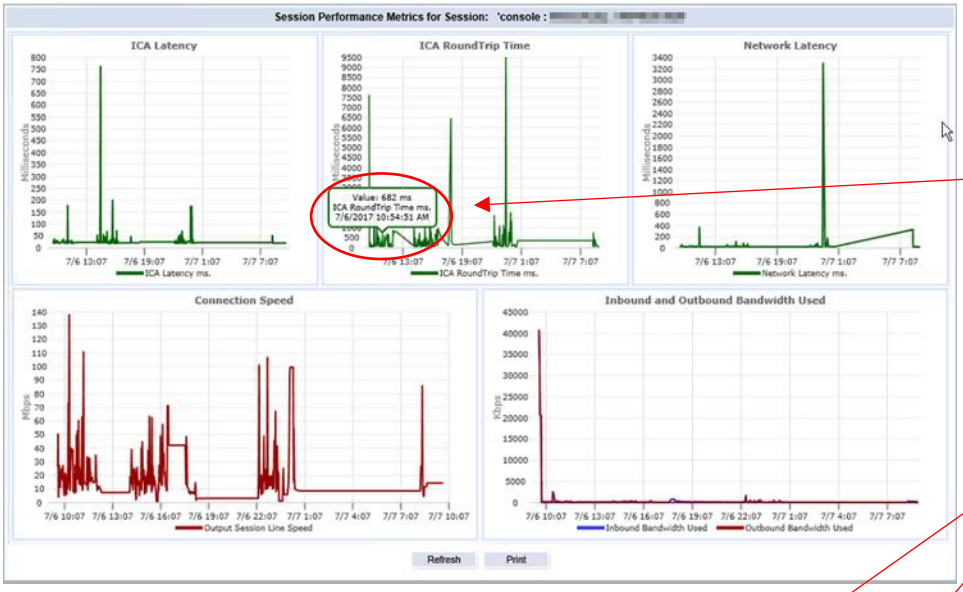
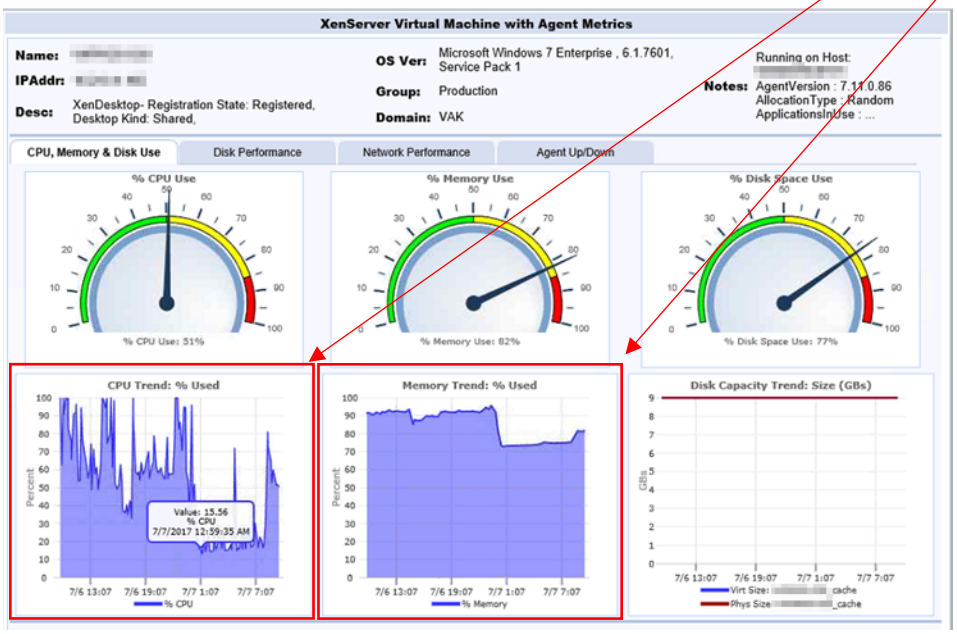


682 ms is at a level where user experience is unacceptable. This coorelates to both high CPU and RAM utililzaiton.



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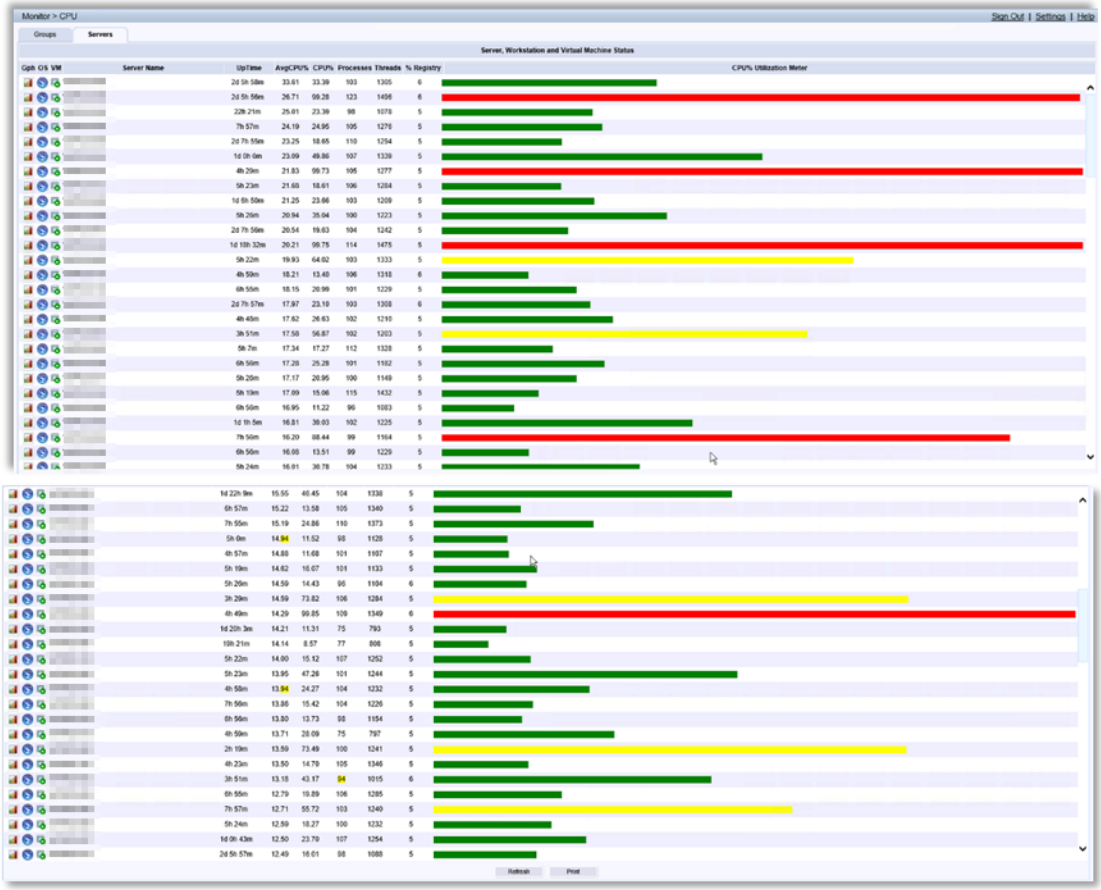
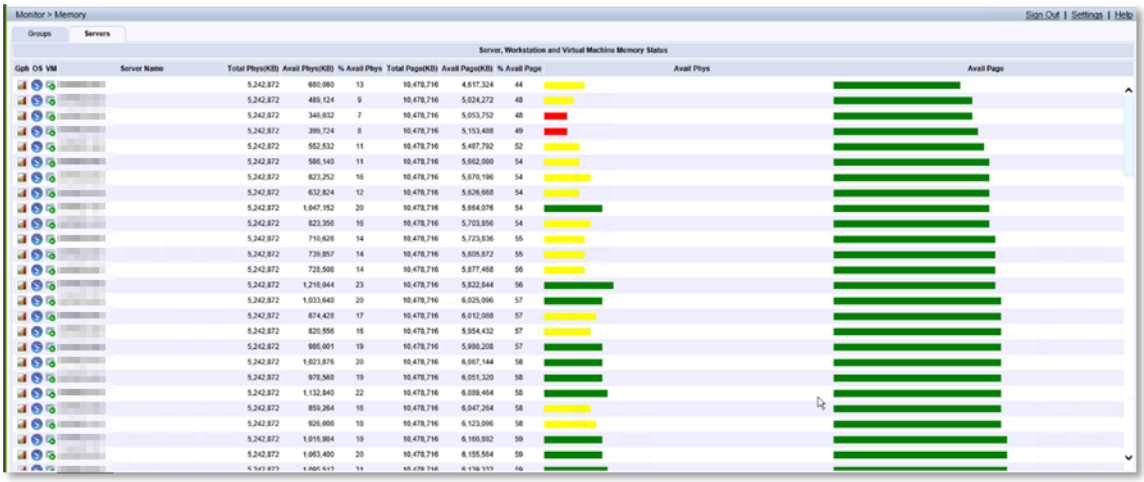
A CPU consumption analysis was performed for all the VDI to determine how widespread the CPU utilization condition was. For the point in time that the data was analyzed, six users/VMs were over 99% processor utilization, and five were over 55%.



RAM consumption was also analyzed and 26 machines had 20% or less available RAM.



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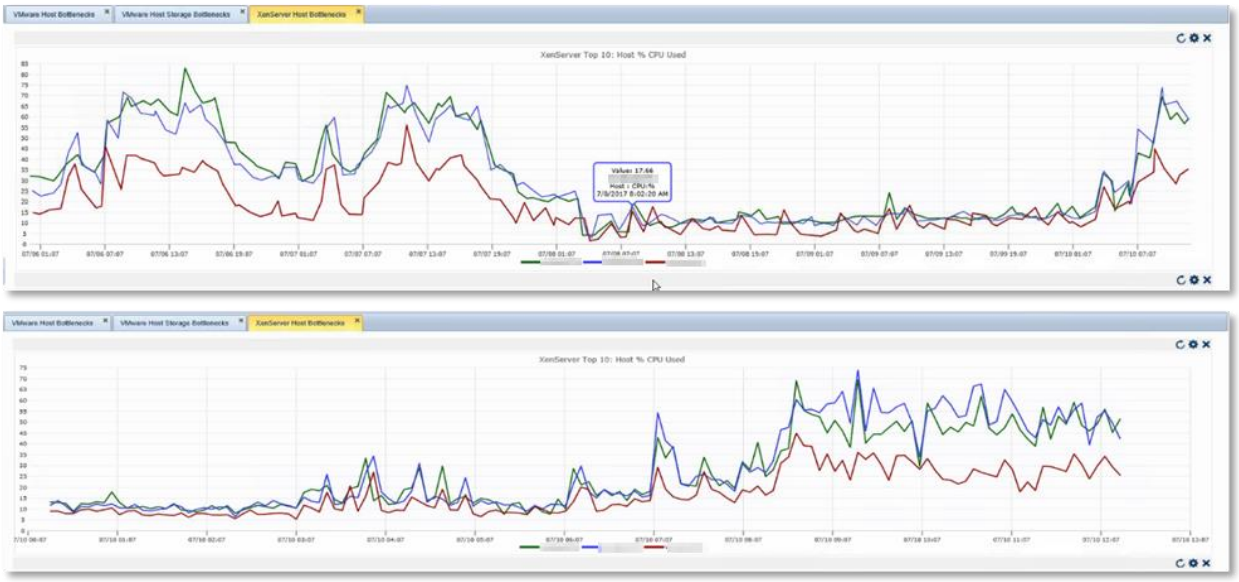
Performance Graphs were configured to trend CPU utilization over time. Both XenServer host and VM performance were charted over a four-day period. During business hours CPU utilization was between 65% and 85% for two XenServer hosts. During off hours CPU utilization dropped to 25% or less on all three host servers.



The same analysis was performed at the VM level resulting in trends that mirrored the host CPU consumption data points shown above.

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In summary, the analysis determined that users experiencing poor session performance are experiencing high ICA round trip time. The same users also experiencing high resource utilization while ICA RTT is high.

Section 3 – Recommendations

XenDesktop Architecture

From an overall design and architecture perspective the Citrix XenDesktop environment is configured to recommended practices. From a management server perspective, there are redundant NetScalers configured as an HA pair, two StoreFront servers and two Delivery Controllers. The VMware Cluster is configured with DRS and HA, and affinity rules are configured ensuring that redundant components remain separated on different physical host servers. This is also consistent with their Domain Controllers and redundant application servers.

The XenDesktop database is not in a redundant configuration and resides on a stand-alone SQL server. VMware HA is configured, but would still result in down time should a database issue occur. If there was a significant issue such as database corruption, the downtime could be significant. To address this potential issue, it is recommended that the XenDesktop infrastructure is upgraded to 7.12 to enable local host cache. While the in-place version of XenDesktop has connection leasing available for providing availability to application resources in the event of a DB loss, connection leasing does not support the pooled random desktops delivered in your environment. Leveraging local host cache enables a read-only SQL express database on the delivery controller. This database is a replica of the production database and ensures desktop brokering availability in the event of database downtime, regardless of the root-cause.

XenServer Hosts

It is recommended that the virtual desktops are rebalanced on the XenServer Hosts. Two of three host servers are at levels of concern for both CPU and RAM utilization throughout the day. One host is running constantly at a low level of overall resource utilization. Rebalancing will reduce the strain on the server pool and will leave available capacity for increasing VM level resources as needed.

The number of virtual machines available is 114 for production users. There are about 100 concurrent connections at any one time. This factor, combined with the current imbalance of VMs across hosts increases the risk of user downtime should one of the XenServer host servers become unavailable. To remediate this risk, it is suggested that the number of VDI available in the Production Delivery Group is increased to 134. The additional VMs should be spread evenly across all the XenServer hosts in the pool. The additional VDI machines will create an N+1

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availability model, allowing for users to seamlessly establish new sessions should a physical host go offline for any reason. This remediation should be performed after the desktops are rebalanced across the VMs. Should additional delivery groups or VMs be added in the future, the same formula should apply, unless there isn't a need for high availability of the newly added resources. Should an additional XenServer physical host server be added, the N+1 model should remain but the formula for distribution will be adjusted accordingly.

Provisioning Services Recommendations

The PVS environment is configured to best practice and does not have significant issues that require attention. Physical servers ensure that there is enough resource capacity to satisfy the demands of the existing target devices and there is room for significant expansion in target device count over time. vDisk and streaming load balancing is configured and running optimally.

It was observed that offline database support was not enabled for the PVS farm. Without offline database support, there is risk of downtime should the database or the database server go offline. It is recommended that offline database support is enabled to add an additional layer or resilience to the PVS deployment.

The networking configuration of the PVS servers follows best practice by having one aggregated link dedicated to management and standard operations, and one aggregated link dedicated to target device streaming traffic. The PVS streaming network is non-routable and dedicated only to operating system streaming. On PVS server the streaming link has Client for Microsoft Networks and File and Printer sharing for Microsoft networks enabled. To better optimize the streaming connection for the Provisioning Server it is recommended that those services are disabled on the streaming network connections, matching the configuration of the target device images.

For further optimization of PVS network traffic ensure that spanning-tree portfast or SFP fastlink is enabled on all switch ports connecting to the PVS environment. On the server side disable large send offload to reduce latency timeouts of streaming traffic. Additionally, ensure that all port speeds are configured for the appropriate speed with auto-negotiate disabled. For more information regarding network optimization following the link below.
https://support.citrix.com/article/CTX117374

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Logon Recommendations

Long profile load and logon script execution stand out as the primary consistency with long logons occurring in the environment. When these metrics match, it is indicative of Citrix UPM and is not in and of itself an abnormality. Upon review of the user profile configuration it is apparent that profile and policy configurations are complex for users in this environment. It also has been determined that there are sound drivers and a need for this complexity. Additionally, while folder redirection has been configured as part of the profile configuration, there are applications that will not function with redirected application data folders. As a result, those folders require data roaming which also could be contributing to extended logon times.

The steps listed below are recommended for tuning the environment to improve logon performance times.

1. Review all user profile configurations and ensure that roaming data is minimized. Inherently roaming data requires time to upload and download, resulting in longer logon/logoff times.
2. Review CPM configuration and ensure applicable optimizations such as caching and profile streaming are enabled.
3. Review performance of File Servers during the times of long logons, performance issues can cause delays with downloading and uploading profile data, resulting in logon times.
4. Review the performance of domain controllers and delivery controllers during the times of long logons. As with file servers, delays in processing profile and policy data can also result in long logons.
5. Analyze and identify if there are resource constrains on the VDI for sessions with long logons. Many of the problematic logons observed during the assessment had either high memory consumption, high CPU consumption or both on the virtual desktop machines the users were logging on to. High resource constrains at the VDI level also would contribute to long login times.

Based on the configuration complexity of user profiles and policies combined with the possible resource constraints it is likely that the slow profile processing in the environment is manifesting from a combination of several different variables. Following the recommendations above should help to pinpoint areas that tuning can occur and should produce positive improvements with logon duration.

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Session Experience Recommendations

User session performance issues are the most visible and critical in the environment. Beyond the fact that slowness occurs to the same subset of users, there is not pattern or predictability as to when or how these issues occur. As a result, identifying root cause has been troublesome at best. By analyzing metrics as all layers from the user down to the hypervisor over a period of two weeks several conditions have been identified, and analyzed. The following list reiterates each finding and its relevance to the session performance issues.

- High connection speed and low network/ICA latency. All sessions reviewed reflected a high quality, fast low latency connection for all sessions. High quality sessions, such as the ones identified in this assessment rule out the network infrastructure as a potential contributor to session related performance issues.
- High ICA Round Trip Times (RTT). As detailed in the findings above, all users reporting poor user experience were also showing high ICA RTT. Experiencing high ICA RTT despite a quality network connection is a clear indicator that system level performance issues are the root cause.
- High resource utilization at the XenServer host level. Although two of three XenServer host servers were showing high RAM and CPU utilization during business hours, it is not likely that host level performance is the genesis of the session slowness. Many users on heavily utilized host servers are not reporting performance issues. As a result it is not probable that host level utilization is impacting performance or it would be more wide spread.
- High RAM at the VM guest level. Some sessions reporting sluggish session performance have high memory utilization. It is also not likely that guest level RAM utilization is the root-cause either because some sessions reporting slowness are not reflecting high RAM consumption. However, it should still be considered as a secondary contributing factor for users at critical RAM levels.
- High guest machine CPU consumption. All users' sessions experiencing performance issues also reflect high CPU consumption over the duration of their session. In each case there are periods of high and periods of low consumption demonstrating why the issue would be experienced in an intermittent manner. Furthermore, as detailed in the findings section, ICA RTT metrics directly coincide with CPU trending statistics. This correlation draws a direct line from CPU utilization to perceived user experience and therefore identifies guest GPU utilization as the root cause of the issue.

Overall, based on the findings, users having session related slowness are also consuming high amounts of guest CPU resources, resulting in an overall poor user experience. The following list details recommended next steps for resolving the issue.

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1. Create a new desktop delivery group and machine catalog for power users. Creating a new delivery group will allow CPU (and possibly RAM long term) to be increased for only the users that require it, without having to add additional resources to all guest VDI. This process will allow for the issue to be addressed without having to over allocate system resources across the board.
2. Increase CPU cores from one core to two cores on all guest VDI in the new "power users" delivery group. Increasing CPU should provide additional overhead to accommodate the demands of these users. CPU performance should be observed after new allocation to ensure performance has improved. RAM utilization should also be observed for these users, in many cases memory consumption was also high and could result in some users having performance issues beyond what CPU utilization caused. If necessary increase the RAM allocation to the delivery group/machine catalog as needed.
3. Rebalance XenServer hosts to accommodate new resource demands. Although this was recommended in the previous section of the document, it is important to note again. Adding additional CPU to guest VDI will place greater demand on the hypervisor host servers. If the additional vCPU is assigned to the guest machines without rebalancing, the overhead could result in performance related issues for all users on the over taxed host machines.

Conclusion

In conclusion, the two key issues found in the environment were sporadic long logons and sessions performance issues for power users. Logon issues are, at least, resulting from the need to have complex user profile and group policy configuration. They should be resolved through tuning and assessing each of the logon components.

User session performance was found to be a result of high CPU demands placed on guest VDI machines. Increasing processor in an efficient manner by leveraging a new delivery group and machine catalog should alleviate poor user experience.

Overall the design and configuration of the Citrix XenDesktop environment at Goliath Customer is sound and to best practice. With the exception of minor tuning and administrative maintenance, the environment should remain stable and scalable well into the future.