Goliath Customer P.C. XenDesktop Assessment Findings and Recommendations





a. <u>Virtual Infrastructure</u>	
b. <u>Network Infrastructure</u>	
c. <u>Citrix XenDesktop Configuration</u>	
d. <u>XenServer Configuration</u>	
e. Provisioning Services Configuration	
f. VMware vSphere Configuration	
g. <u>Citrix and Group Policy Configuration</u> Performance and User Experience Findings	
g. <u>Citrix and Group Policy Configuration</u> Performance and User Experience Findings Recommendations	
g. <u>Citrix and Group Policy Configuration</u> Performance and User Experience Findings Recommendations a. <u>XenDesktop Architecture</u>	
g. <u>Citrix and Group Policy Configuration</u> Performance and User Experience Findings Recommendations a. <u>XenDesktop Architecture</u> b. <u>XenServer Hosts</u>	
 <u>citrix and Group Policy Configuration</u> <u>Performance and User Experience Findings</u> <u>Recommendations</u> <u>XenDesktop Architecture</u> <u>XenServer Hosts</u> <u>Provisioning Services Recommendations</u> 	
 <u>Citrix and Group Policy Configuration</u> <u>Performance and User Experience Findings</u> <u>Recommendations</u> <u>XenDesktop Architecture</u> <u>XenServer Hosts</u> <u>Provisioning Services Recommendations</u> <u>Logon Recommendations</u> 	



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.



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.



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



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.

Details Applications Desktops Machine Catalogs Usage Tags Administrators	
Delivery Group	State
Name: Development Description: 2.8 (or newer) Users: 7.8 (or newer) Scope: All StoreFronts: https://	Enabled: Yes Maintenance Mode: Off Registered Machines: 0 Unregistered Machines: 0 Powerd off Machines: 2 Total Machines: 2 Installed VDA version: 7.110.86 Operating System: Windows 7 Service Pack 1

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.

Details - IT								
Details Applications	s Desktops Machine Catalogs (1) Usage Tags Administrators							
Delivery Group State								
Name: Description: Set to VDA version: Users: Scopes: StoreFronts:	IT 7. 7. 8. (or newer) All https:///////////////////////////////////	Enabled: Yes Maintenance Mode: Off Registered Machines: 4 Unregistered Machines: 0 Powered off Machines: 4 Total Machines: 4 Total Machines: 4 Operating System: Windows 7 Service Pack 1						



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.

Details - Production							
octato populacional acontrativa	as order to a second of a						
Delivery Group		State					
Name: Production Description: - Set to VDA version: 7.8 (or newer) Users: Scopes: All StoreFronts: https:// https://		Enabled: Maintenance Mode: Registered Machines: Umregistered Machines: Powered off Machines: Total Machines: Installed VDA version: Operating System:	Ves Off 114 0 0 114 7.110.86 Windows 7 Service Pack 1				

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.

Details - Testing Details - Applications Desktops Machine Catalogs Usage Tags Administrators						
Delivery Group		State				
Name: Description: Set to VDA version: Users: Scopes: StoreFronts:	Testing 7.8 (or newer) All https://	Enabled: Maintenance Mode: Registered Machines: Unregistered Machines: Powered off Machines: Total Machines: Installed VDA version: Operating System:	Yes Off 8 machines are in maintenance mode 0 8 7.11.0.86 Windows 7 Service Pack 1			

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.

Machine type	No. of machines	Allocated machines
Desktop OS (Virtual)		
User data: Discard	Provisioning method: Citrix provisioning ser	
Desktop OS (Virtual)	4	4
User data: Discard	Provisioning method: Citrix provisioning ser	rvices
Desktop OS (Virtual)	114	114
User data: Discard	Provisioning method: Citrix provisioning ser	rvices
Desktop OS (Virtual)	8	8
User data: Discard	Provisioning method: Citrix provisioning ser	rvices
	Machine type Desktop OS (Virtual) User data: Discard	Machine type No. of machines Desktop OS (Virtual) 2 User data: Discard Provisioning method: Citrix provisioning se Desktop OS (Virtual) 4 User data: Discard Provisioning method: Citrix provisioning se Desktop OS (Virtual) 114 User data: Discard Provisioning method: Citrix provisioning se Desktop OS (Virtual) 114 User data: Discard Provisioning method: Citrix provisioning se Desktop OS (Virtual) 8 User data: Discard Provisioning method: Citrix provisioning se



XenServer Configuration

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

0	
File View Pool Server VM Storag	e Templates Tools Help
🕒 Back - 🔘 Forward - 1 🌄 Add New	Server 📅 New Pool 🛅 New Storage 📜 New VM 🍥 Shut Down 🛞 Reboot 🕕 Suspend
Search	
I the XenCenter	General Memory Storage Networking GPU HA WLB Users Search
	Pool Networks
*	
-	Networks
6	Name Description NIC + VLAN Auto Link Status MAC MTU
6	Bond 0+1 Bond 0+1 - No Connected 1500
0	Bend 2-3 Bond 2-3 No Connected 1500
8	Bond ++ > No Connected 1500
lõ = m	
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	Add Network Properties Remove
	IB Address Configuration
	IP Address Comparation
	Server Interface Network NIC IP-Setup IP-Address Subnet-mask Gateway DNS
	The second secon
	Management Bond (0.1) Bond (0.1) Static
	1 8C9 Rend 4-5 Rend 4-5 Rend 4-
	Management Bond 0-1 Bond 0-1 Static
	LiSCSI Bond 4+5 Bond 4+5 Static
T Intrastructure	
Dbjects	

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.



Name	Description	Tune	Shared	Urane	Size	Virtual allocation
	Description	IVM over iS	Ver	78% (234.6 GR used)	300 GR	216.7 GR
	have been been seen to a stand	LVM over iS	Ver	70% (234.6 CD used)	300 GB	242 CB
	the side of the line side the	LVW OVER IS	Tes	70% (234.0 GB used)	300 GB	245 06
A Designed to the second se	the second	LVM over iS	Yes	72% (210.0 GB used)	300 66	207.0 GB
No. and a subscript on the local division of	Contraction of the second second second	LVM	No	0% (20 MB used)	237.9 68	8 MB
Tel a selle for any ser	"These was not been allowed by	udev	No	0% (0 B used)	0 B	0 8
i inni ini	AND DESCRIPTION OF THE OWNER.	LVM over iS	Yes	75% (225.6 GB used)	300 GB	216.6 GB
And a state of the state of the	"These strength and the strength in-	udev	No	0% (0 B used)	0 B	08
And income provide a little of the	Paper a Did to be and highly	udev	No	0% (0 B used)	0 B	0 B
THE REAL PROPERTY.	Plana Plana and Barris	udev	No	0% (0 B used)	08	0 B
hand all a second s	ACCERT OF MELLINE AND ADDRESS.	LVM over iS	Yes	75% (225.6 GB used)	300 GB	216.6 GB
the state in some or	There is not set if it is not the	udev	No	0% (0 B used)	0 B	0 B
All some or All States	Physical Diff. Subman (1998).	udev	No	0% (0 B used)	0 B	08
and Annual or March	- Longitude and an USE Participation	Ext3	No	0% (187.3 MB used)	234.1 GB	0 B
and design or the life	. Local design on Middlewich .	LVM	No	0% (4 MB used)	237.9 GB	0 B

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





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 ultilization.









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.

Farm Properties	Farm Properties	
General Security Groups Licensing Options vDisk Version Status Alert if number of versions from base image exceeds: 5	General Security Groups Licensing Options vDisk Version Status Auto-Add Enable auto-add Add own devices to this site:	Offline database support
Merge after automated vDisk update, if over alert threshold Default access mode for new merge versions: Maintenance V	VIO(en7 v) Note: A collection with a template target device must be specified for the site where the auto-add will take place.	
	Audting Chine database support Chine database support Chine database support	
OK Cancel Help	OK Cancel Help	



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

Connections	Description
58	
60	
	Connections 58 60

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.

lame	Store	Connections	Size	Mode	Class	Description	
	Development	0	57,342 MB	Private		IT Gold Image	
•	Development	0	51,198 MB	Private		Production Gold Image	
- 100 IN	π	4	57,342 MB	Cache in Device RAM with Overflow on Hard Disk: 1024 MB		IT image	
	Production	114	51,198 MB	Cache in Device RAM with Overflow on Hard Disk: 1024 MB		Production Image	
0	Testing	0	51,198 MB	Cache in Device RAM with Overflow on Hard Disk: 1024 MB		Production Image	
0	Testing	0	51,198 MB	Cache in Device RAM with Overflow on Hard Disk: 1024 MB		Production Image	

XenServer pool connection is configured for automated image updates.

Name		Connection	Туре	Description
	and the second designed	Mp Intradical T1 val type formig: (on	Citrix XenServer	
	10.0000700	caracteristication and a second according a second	Citrix XenServer	

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.

Organize	 Disable this network device 	Diagnose this connection Rename this connection View status of this connection Change settings of this connection	E	
N	NIC1-Production Enabled Intel(R) I350 Gigabit Network Con	NIC2-Production Enabled Intel(R) 1350 Gigabit Network Con NIC3-Stream Enabled Intel(R) 1350 Gigabit Network Con		
N.	NICS-Stream Enabled Intel(R) 1350 Gigabit Network Con	NIC6-Stream Enabled Intel(R) 1350 Gigabit Network Con Microsoft Network Adapter Multi		



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.



The production network adapter is configured the same as XenStream

Advanced Settings
Adapters and Bindings Provider Order
Connections are listed in the order in which they are accessed by network services.
→ Production → NIC1-Production → NIC2-Production ↓ NIC2-Production ↓ Remote Access connections]
Bindings for XenStream: ✓ ● ✓ ● Internet Protocol Version 4 (TCP/IPv4) ● Internet Protocol Version 6 (TCP/IPv6) ● Internet Protocol Version 4 (TCP/IPv4) ● Internet Protocol Version 6 (TCP/IPv4) ● Internet Protocol Version 6 (TCP/IPv6)
OK Cancel



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.

dapters and Bindings	Provider Order	
Connections are listed network services. Connections:	in the order in which they are acc	cessed by
XenStream		t
Local Area Conn	ection 5	
Internet Internet Internet Internet Internet Internet Internet I	Protocol Version 4 (TCP/IPv4) Protocol Version 6 (TCP/IPv6) rosoft Networks	3
I - Internet i	Protocol Version 6 (TCP/IPv6)	



The Production connection is configured with the default settings.

Advanced Settings
Adapters and Bindings Provider Order
Connections are listed in the order in which they are accessed by network services.
Le Production Le Production Le NIC1-Production Le NIC2-Production Le Remote Access connections]
Bindings for XenStream:
OK Cancel

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.

General		vSphere HA
vSphere DRS: vSphere HA: VMware EVC Mode:	On On Intel⊛ "Merom" Generation	Admission Control: Enabled Current Failover Capacity: 2 hosts Configured Failover Capacity: 1 host
Total CPU Resources: Total Memory: Total Storage:	124 GHz 767.62 GB 7.69 TB	Host Monitoring: Enabled VM Monitoring: Disabled Application Monitoring: Disabled
Number of Hosts: Total Processors:	3 48	Advanced Runtime Info Cluster Status Configuration Issues
Number of Datastore Clusters: Total Datastores:	0 22	vSphere DRS
Virtual Machines and Templates: Total Migrations using vMotion:	69 171	Migration Automation Level: Fully Automated Power Management Automation Level: Off DRS Recommendations: 0 DRS Faults: 0 Migration Threshold: Apply priority 1, priority 2, priority 3,
Commands		Target host load standard deviation: - 0.081 Current host load standard deviation: 0.017 (😴 Load balanced)
Add Host	🐨 New Datastore Cluster 🏟 Edit Settings	View Resource Distribution Chart
Steven Resource Pool		Storage
		Storage resources A Status Drive Type Capa A
		Normal Non-SSD 349.75 Normal Non-SSD 29.75
		Normal Non-SSD 2.50
		Normal Non-SSD 269.25 Normal Non-SSD 250
		Normal Non-SSD 269.25
		Normal Non-SSD 2.50 Normal Non-SSD 269 75



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

Cluster Features	Name
(sphere HA (virtual Machine Options VM Monitoring DatastoreHeartbeating (Sphere DRS DRS Groups Manager Rules Virtual Machine Options Power Management HostOptions Mware EVC wapfile Location	Pestures For the second seco
	Visioner DRS and Milware EVC should be enabled in the cluster in order to permit placing and migrating Wes with Fault Tolerance turned on, during load balancing.

Luster Features Sphere HA Virtual Machine Options VM Monitoring DatastoreHeartbeating Sphere DRS DRS Groups Manager Sules	Host Monitoring Status ESX hosts in this cluster exchange network performing network maintenance that may IF Enable Host Monitoring	heartbeats. Disable this feature when cause isolation responses.
Virtual Machine Options Power Management HostOptions Wware EVC Wapfile Location	Admission Control The vSphere HA Admission control policy di reserved for VM falovers. Reserving more toleratebut reduces the number of Web C Enable: Disallow VM power on operation C Disable: Allow VM power on operations	etermines the amount of cluster capacity that is fallover capacity allows more failures to be had can be run. hs that violate availability constraints that violate availability constraints
	Admission Control Policy	ontrol should enforce.
	 Percentage of cluster resources reserved as failover spare capacity: 	25 🛨 % CPU 25 🛨 % Memory
	C Specify failover hosts:	0 hosts specified. Click to edit.
		Advanced Options



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DatastoreHeartbeating Sphere DRS DRS Groups Manager Rules Virtual Machine Options Power Management HostOptions Mware EVC wapfile Location	 Partially automated Witual machines will be automatically placed onto hosts at power on and vCenter will suggest migradem recommendations for vitual machines. Pully automated Witual machines will be automatically placed onto hosts when powered on, and will be automatically migrated from one host to another to optimize resource usage. Migration threshold: Conservative Aggressive Aggressive Apply priority 1, priority 2, priority 3, and priority 4 recommendations. vCenter will apply recommendations that promise even a moderate improvement to the cluster's load balance.
	Advanced Options

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.

Cluster Features vSphere HA Virtual Machine Options	Use this pag virtual mach virtual mach	e to create rules for virtual mac ines only while they are deploye ines are moved out of the cluste	hines within this cluster . Rules id to this cluster and will not be ir.	will apply to retained if the
DatastoreHeartbeating	Name		Туре	Defined by
vSphere DRS DPS Groups Manager Rules Virtual Management HostOptions Wware EVC Swapfile Location		Xen StoreFront Separation Xen DDC Separation Exchange Separation Xen DDC 5.5 Separation Xen DDC 5.5 Separation DC Separation DC Separation NetScaler Separation	Separate Virtual Machi Separate Virtual Machi Separate Virtual Machi Separate Virtual Machi Separate Virtual Machi Separate Virtual Machi	User User User User User User
	K	Battove	Edt	



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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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Preferred color depth for simple graphics User setting - CAUVatal Display 24 bits per pixel Debuint 24 bits per pixel 24 bits per pixel Debuint 24 bits per pixel
 Target frame rate User setting - KAtWatal Display 30 dps (Detaulti 30 tps)
Target mikimum frame rate User setting - KAVisual Display/Moving Images 10 for (Defution 10 fop)
Universal print driver usage User setting - CAI/Printing(Drives User setting - CAI/Printing(Drives Use universal printing only if requested driver is unavailable(Default: Use universal printing only if requested driver is unavailable)
Universal printing optimization defaults Universetting - f.ChröningUniversal Finning ImageCompressions BestQualityLiteapyweightCompressions False,ImageCaching = True; FloreXlowNonAdminsToModify=False (Default: ImageCompressions StandriQualityLiteapyweightCompressions False,ImageCaching = True, FloreXaching = True, AllowNonAdminsToModify=False (Default: ImageCompressions StandriQualityLiteapyweightCompressions False,ImageCaching = True, FloreXaching = True, AllowNonAdminsToModify=False (Default:
Universal printing print quality limit User setting - CAR/Initing/Universal Printing No Limit (Default No Limit)
Use asynchronous writes User setting - CA/File Redirection Exabled (Default: Disabled)
Use video codec for compression User setting - CA(Graphics Use video code when available(Defaulti Use video code when available) Use video code when available(Defaulti Use video code when available)
View window contents while dragging User setting - CALDesktop UI Allored (Delsuit: Allored)
Visual quality User setting - ICALVaual Display High (Default: Medium)
Windows media fallback prevention User setting - CAlMultimedia Not Configured Delatik Not Configured

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.





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	0.0000	ICA Latency	Avg. ICA Latency	Group Name	Client Address	Client Version	Broker Name	Start Time	State Change Time
T management	InUse	Concession in the local distance of the loca	23.4 %	12.9 %	28.5 %	108.6 secs			Production	A DESCRIPTION OF THE	14.2.0.10	and the second second	2017-07-14 10:27:40	
R contract on the	InUse .	100	30.3 %	92%	82.7 %	181.1 secs.	2 ms.	2.2 mt.	Production	10000	14.6.0.12010	- No. of Concession, Name	2017-07-14 07:16:26	
÷	InUse	Contraction (Contraction)	38.9 %	25.2 %	91.5 %	146.3 secs.	2 ms.	3.4 ms.	Production	the second second	14.7.0.13011	No. of Concession, Name	2017-07-10 08:28:51	
Emmonie	InUse	1000	37.1%	18.0 %	80.7 1	107.7 secs.	1 mi	1.5 mt.	Production	Providence of	14.1.0.0	and and a second second	2017-07-54 08:26:55	
N and a state of the state of t	InUse	A DECK	41.0%	13.7 %	80.0	106.8 secs.	1 ms.	1.4 ms.	Production	the second second	14.1.0.0	and the second second	2017-07-14 08:49:36	
E management	InUse	10000	83.4 %	7.2 %	27.3 6	92.7 secs.	1.05.	1.0 ms.	Production	1000	14.1.0.0	and the second s	2017-07-14 14:31:25	
X	InUse	1000	25.7 %	15.3 9	76.5%	92.5 secs.	1 ms.	2.8 ms.	Production	Longer and	14.7.0.13011	and the second second	2017-07-14 09:50:07	
X managements	InUse	1.000	31.0 %	16.3 %	05 6 %	74.2 secs.	. 13 ms.	1.7 ms.	Production	1000	14.1.0.0	And the owner of the owner owner.	2017-07-14 12:36:28	
E	InUse	1 March 1	75.0%	7.3 %	70.5 %	72.3 secs.	54 mL	57.3 mi.	Production		14.3.0.5014	and the second second	2017-07-14 08:08:55	
X management	InUse	10000	23.1%	9.8 %	05.1 %	71.6 secs.	2 ma	1.7 ms.	Production	1000	14.1.0.0	And and a second se	2017-07-14 08:25:07	
¥.	InUse	Contract of Contra	23.2 %	10.8 %	64.6%	GE.1 secs.	1 //15.	1.1 ms.	Production	THE R. LEWIS CO.	14.1.0.0	1.000	2017-07-14 07.42.48	
X second as a	InUse	CONTRACTOR OF CONT	23.2 %	12.4 %	79.3 %	87.7 secs.	1.012	5.2 ms.	Production	1000	14.1.0.0	ALC: NOT THE OWNER.	2017-07-14 08:54:46	
×	InUse	- Common	12.2 %	20.7 %	84.5	65.6 secs.	1 ms.	1.3 mt.	Production	10.00	141.0.0	A DAY OF THE OWNER	2017-07-14 08:30:15	
X and a	Disconnected	1.00001000000	24.5 %	14.9 %	76.0	65.2 secs.	2 ms.	2.9 ms.	π	1000001001	14.6.0.12010	and the second s	2017-07-14 08:48:37	2017-07-14 12:33:50
2	InUse	1000	33%	12.7 %	55.6 1	64.9 secs.	1.01	1.3 mc.	Production	100	14.1.0.0	All second as	2017-07-14 08:24:31	
X month and	InUse	Longer (26.4%	10.5 %	897 %	64.5 secs.	1 ma.	1.1 ms.	Production	1000	14.1.0.0	and the second s	2017-07-14 12:50:02	
3	inUse	The second se	36.7 %	15.9 %	68.4 %	00 secs	0 195	0.9 ms.	Production		14.1.0.0	and the second s	2017-07-14 08:25:04	
X	InUse	100001	99.2 %	12.5 %	91.5 %	59.8 884	1 ma.	1.3 ms.	Production	1000	14.1.0.0	and the second s	2017-07-14 00:56:11	
X come of the	InUse	1 Marcola Ma	21.4 %	12.6 %	01.0 %	Lesta.	1.00.	1.2 ms.	Production		14.1.0.0	10.000 million 40	2017-07-14 08:52:06	
R management	InUse	Contraction of Contra	29.2%	6.5 %	09.6%	57.8 secs.	1 ms.	\$.7 mc.	Production	1000	14.1.0.0	and the second s	2017-07-14 09:07:08	
X	InUte	100	90.6 %	7.2 %	80.1 %	. 57.2 secs.	0 ma.	1.9 ma.	Production		14.1.0.0	the second se	2017-07-14 08:53:26	
× management	InUse	10001	82,4 %	531	52.7 %	58.4 secs.	1 ms.	1.1 ms.	Production	1000	14.1.0.0	and some of the local division of the local	2017-07-14 09:06:54	
E completent	InUse	a contract of the second se	3.8%	16.3 %	723%	56 secs.	19 mil.	60.5 mil.	Production		14.3.100.10	and the second second	2017-07-14 07:16:39	
H annual and	inUse	1000	5.4%	13.2 %	72.5%	55.6 secs.	2 ms	1.6 ms.	Production	100.00	14.1.0.0	and the second se	2017-07-14 08:45:16	
E company and	InUse	Contract of Contra	56%	14.4 %	01.4 %	52.9 secs.	26 ms.	27.5 ms.	Production	10.00110	14.6.0.12010	and the second s	2017-07-14 05:29:53	
X annual and	InUse	10000	29.6 %	13.0 %	57.0 %	52.6 secs.	1 ma.	1.5 mt.	Production	COLUMN TWO	14.1.0.0	ALC: NAME OF TAXABLE	2017-07-14 08:58:04	
¥ management	InUse	1000	17.3 %	14.8 %	57.5%	51.3 secs.	1 ms.	1.0 ms.	Production	100.00	14.1.0.0	and the second s	2017-07-14 09 16:20	
X	InUse	COMPANY 1	83%	9.7 %	27.6 %	50.6 secs.			Production	internal and	14.1.0.0	An Avenue of Con-	2017-07-14 09:03:23	1
W appropriate state	InLite	1. March 1	89%	123 9	26.9 %	ALL SECS.			Production	Contraction of the local division of the loc	14100	And and a second se	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.



Logon Duration Details for: Deskto, Connect D/T Client Address Reconnect Logon Brokering VM Start Client Valid Server Vaid HDX Auth GPO Scripts Profile Load 2017-07-10 08:57:44 No 63.33 secs. 0.23 secs. 7.6 secs. 7.0 secs. 0.27 secs. 15.96 secs. 8.1 secs. 0.76 secs. 36.9 s Constraint Logon Duration Brokering Stages for:
Connect D/T Client Address Reconnect Logon Brokering VM Start Client Valid Server Valid Server Valid Address Reconnect Logon Darabon of sages U Controller Client Valid Server Valid Server Valid Address Reconnect Logon Duration Brokering Stages for:
2017-07-10 08:57:44 No 63.33 secs. 0.23 secs. 7.6 secs. 7.0 secs. 0.27 secs. 0.27 secs. 15.96 secs. 8.1 secs. 0.76 secs. 36.9 s ⊖ Lógon Duration Brokering Stages for: Citrix Delivery Controller Start-up Stages
Citrix Delivery Controller Start-up Stages
Citrix Delivery Controller Start-up Stages
C140 C0100 0100
CASU CUISU CUISU CUISU DIMSU CUISU PCSU PCSU PCSU PCSU SSSD 0.27 secs. 133 secs. 55.71 secs.
AECD BUCC CFDCD COCD IFDCD LPWD NRCD NRCD REVD SCCD SCD SCD TRWD 0.84 secs. 0.81 secs. 3.26 secs. 0.001 secs.
E Logon Duration Session Launch
Action Time Duration Details
Indexing & Client Validation 2017-07-10 08:58:05 7.8 secs. ZDC / DDC Broker
Account Data 06 58:11.103871100 0 secs. Account Daman Ration Control Domain Ration Domain Ration Do Domain Name - Domain Cardingter Galart
Jomain Controller Data 08:58:11:103871100 0.52 secs. Domain Controller Name Domain Controller P Adverse. In Jone A
DAP Calls 06.58:11.634349300 Uit of appleade Group Policy objects: LESD — Time Spec
Registry Extensions 08 58:12:554885000 8:22 secs. Window 7 Demonalization Microsoft Office
Chrix Group Policy Extensions 08:58:12:960544800 0.56 sec: Local Group Policy Extension Processing.
avian Devirantion Evidencione 06:58-13 577777600 0 16 cover Starting Folder Redirection Extension Processing
Connect D/T Client Address Reconnect Logon Brokering VM Start Client Valid Server Valid HDX Auth GPO Scripts Profile Log
2017/0/-10 05:46:00 NO 149:19 SECS. 0.03 SECS. 8:34 SECS. 7:78 SECS. 0.24 SECS. 14:55 SECS. 3:68 SECS. 0:06 SECS. 20:28
B Logon Duration Brokering Stages for:
Citrix Delivery Controller States
CASD CONSD COSD DMSD D5 secs. PCSD PCSD PCSD 126 secs. 150.15 secs
CASD CONSD COSD DMSD CESD PLSD PLSD PLSD 126 secs 150.15 secs 0.39 secs 0.5 secs 120 19 secs 120 19 secs 126 secs 150.15 secs 126 secs 150.15 secs Citrix Receiver Startup Stages AECD BUCC CFDCD LPWD NRWD RECD SCCD SCD TRWD 0.71 secs 0.68 secs 0.98 secs 1.2 secs 0.001 secs 0.001 secs
CASD CONSD COSD DMSD CESD PLSD PLSD PLSD 126 secs 150.15 secs 0.39 secs 0.5 secs 120 39 secs 0.5 secs 120 39 secs 126 secs 150.15 secs AECD BUCC CFDCD COCD IFDCD LPWD NRVD RECD REWD SCCD SCD SLCD TRWD 0.71 secs 0.68 secs 0.98 secs 1.2 secs 0.001 secs 0.001 secs

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.



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



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.











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





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.

Monitor > Memory										Sign Out Settings Help
Groups Ser	rers									
Server, Worksteioe and Virtual Machine Memory Status										
Gph OS VM	Server Name	Total Phys(KB) Av	ail Phys(KB) %	Avail Phys	Total Page(KB) A	vall Page(K8) %	Avail Pa	e Avail Phys	Avail Page	
4 6 5		5,242,872	680,060	13	10,478,716	4,617,324	44			
400		5,242,872	489,124	9	10,478,716	5,024,272	48			
a 8 6		5,242,872	346,032	7	10,478,716	5,053,752	48	-		
400		5,242,872	399,724	8	10,478,716	5,153,488	49	-		
405		5,242,872	652,532	11	10,478,716	5,487,792	52			
4 6 6		5,242,872	586,140	11	10,478,716	5,662,080	54			
a 6 6		5,242,872	823,252	16	10,478,716	5,670,196	54			
4 6 6		5,242,872	632,824	12	10,478,716	5,626,668	54			
400		5,242,872	1,047,152	20	10,478,716	5,664,076	54			
405		5,242,872	823,356	16	10,478,716	5,703,856	54			
a 🛛 🖓		5,242,872	710,628	14	10,478,716	5,723,836	55			
400		5,242,872	739,857	14	10,478,716	5,805,872	55			
405		5,242,872	728,508	14	10,478,716	5,877,468	56			
400		5,242,872	1,216,044	23	10,478,716	5,822,844	56			
405		5,242,872	1,033,640	20	10,478,716	6,025,096	57			
4 6 6		5,242,872	874,428	17	10,478,716	6,012,088	57			
405		5,242,872	820,556	16	10,478,716	5,954,432	57			
4 6 6		5,242,872	985,001	19	10,478,716	5,980,208	57			
a 0 6		5,242,872	1,023,876	20	10,478,716	6,067,144	58			
405		5,242,872	978,568	19	10,478,716	6,051,320	58			
40 %		5,242,872	1,132,840	22	10,478,716	6,089,464	58			
400		5,242,872	859,264	16	10,478,716	6,047,264	58		R	
a 🕲 🗟		5,242,872	926,008	18	10,478,716	6,123,096	58			
400		5,242,872	1,015,964	19	10,478,716	6,160,892	59			
405		5,242,872	1,063,400	20	10,478,716	6,155,564	59			
305		5.242.822	1.005.512	24	65.478.746	6 110 112	40			



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.





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



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



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.



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.



- 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.
- 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.