DVS Enterprise Test Results for Microsoft Lync 2013 and Citrix XenDesktop 7

Dell Client Cloud Computing Engineering

Revision: 1.0

11/6/13

Contents

Preface 1
1 Introduction 1
2 Test Environment 2
3 Test Infrastructure Setup 5
3.1 RAID Configuration 5
3.2 VMware vSphere Networking 5
3.2.1 Network Architecture 5
3.2.2 Network Characteristics 5
3.2.3 vSwitch and VLAN Configuration 6
3.2.4 VDI Network 6
4 Test Methodology 7
4.1 Test Objectives 7
The testing focuses on the all CPU, memory, Disk IOPs, and networking aspects of VDI compute hosts and detailed statistics and metrics are captured. 7
4.2 Test Approach 7
4.3 Load Generation 7
4.4 Test Criteria 7
5 Lync 2013 VDI Plug-in Testing/Characterization results 8
5.1 Messaging (chat) Performance 8
5.2 Audio Performance 11
5.3 Video Performance 14
5.4 Desktop Sharing Performance 17
5.5 Summary of Resource Utilization for Lync Use Cases 20
6 Conclusions 21
About the Authors 23

Preface

This document describes the test efforts for Microsoft Lync 2013 and Citrix XenDesktop 7 virtual desktops for DVS Enterprise. The document provides information on the test objectives, test infrastructure setup used for the testing, test methodology, and the test results.

1 Introduction

The purpose of this test activity is to determine the performance impact of running Microsoft Lync 2013 with XenDesktop 7 virtual desktops on DVS Enterprise. The goal is to understand the impact of Microsoft Lync point-to-point connectivity between Lync 2013 connections using Citrix HDX technologies and determine the impact on performance of the VDI compute host, and ultimately on the session density numbers.

This test effort uses one DVS Enterprise compute host and two XenDesktop 7 virtual desktops with Windows 8 guest operating system and Microsoft Lync 2013 clients installed on them. To test the connectivity using Citrix HDX technologies, two Windows clients are used as the end-point devices to run virtual desktop sessions. Microsoft Lync 2013 VDI Plug-in is installed on the Windows clients for optimized performance.

The Lync 2013 VDI Plugin is an optimization component built by Microsoft for Lync 2013 in VDI. It installs on a Windows client end-point and provides pairing capabilities with Citrix Receiver for Windows in order to optimize the resource utilization and user experience. The Lync 2013 VDI plug-in provides "point to point" connectivity for functions such as desktop sharing, audio and video calls. With this functionality, it offloads the connection through the VDI compute host thus reducing CPU, memory, IOPS, and network consumption from the VDI compute host.

This test effort attempts to understand the impact of four different use cases with Microsoft Lync 2013 on the compute host resource utilization. The four use cases are:

a. Messaging (chat)

b. Audio call

c. Video call

d. Desktop Sharing

At the end, an attempt has been made to understand the impact of the incremental resource utilization at the compute host level due to Microsoft Lync 2013 and how that impacts the virtual desktop session density numbers for DVS Enterprise.

2 Test Environment

2The test infrastructure will include:

- VMware vSphere 5.1 U1 Hypervisor
- Citrix XenDesktop 7 virtual desktops with Windows 8 Enterprise guest system
- 1 x Dell R720 rack servers (Compute Host to support two desktop sessions for Lync 2013 test)
- 1 x Dell R710 rack servers (Management Host)
- 1 x Dell R710 rack servers (Lync Server 2013 and Infrastructure Services)
- Dell PowerConnect 6248 switch
- 1x Windows client end-point with Windows 8 Enterprise
- 1x Windows client end-point with Windows 7 SP1
- Microsoft Lync 2013 VDI Plug-in

Overview of the core infrastructure components:

- The Citrix XenDesktop Connection server will be a virtual server hosted on a single management server (VMware ESXi).
- VMware vCenter Server will be used for managing the Management and Compute hosts.
- The Master virtual machine will be stored on local storage of Compute host.
- Desktops will be created using Citrix Machine Creation Services (MCS).
- Virtual desktops will be stored on local storage on Compute host.
- Microsoft Lync 2013 VDI Plug-in will be installed on the Windows client end-points.

The core infrastructure components are listed below.

Citrix XenDesktop Infrastructure	
Component	**Description**
Active Directory	Common namespace and secured access to all the servers and VMs in the environment.
DHCP	Used to provide IP address for virtual desktops
DNS	IP address and host name resolution for the entire VMware environment
Microsoft SQL Server	Microsoft SQL server database was used to create databases for VMware vCenter server
Citrix XenDesktop Delivery Controller	Creates and provisions virtual desktops from a master virtual machine.
Citrix StoreFront	Manages the virtual desktop requirements of the user. Authenticates users by interacting with Active Directory. Manages the connectivity between users and their virtual desktops.
Citrix License Server	Manages licenses for Citrix XenDesktop environment.
Citrix XenDesktop Virtual Desktop Agent (VDA)	Installed on virtual desktops. Manages the direct connection between virtual desktops and client devices.
HDX Technologies	Used for communication between client devices and virtual desktops.
Virtual desktop storage configuration	

Component	Description
Master vDisk	The master virtual machine disk image used as the base to create the virtual desktops. The master image is stored on the Compute Host Tier-1 storage.
Hypervisor	
Component	**Description**
VMware vSphere 5.1 U1	The full vSphere version of ESXi 5.1 U1
VMware vCenter 5.1	Centralized management interface for the VMware vSphere environment.
Lync 2013 Server	
Component	**Description**
AD	Supports Lync 2013 Server
Lync 2013 Server	A Virtualized OS (Windows 2013) will host the Lync 2013 Server

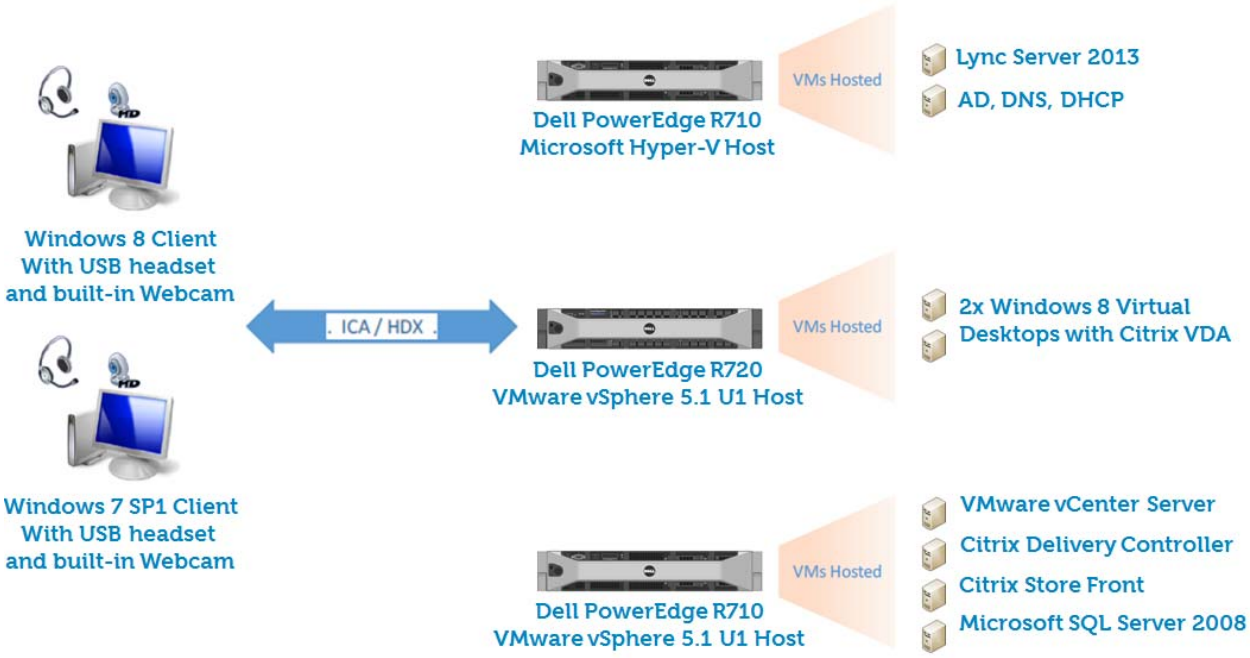
Refer to Appendix A for more detailed information about the hardware and software components to be used for evaluating this solution.

Solution Configuration - Hardware Components:		Description
Compute Host	• 1 x Dell PowerEdge R720 Server: o VMware ESXi 5.1 Update 1 (Installed on SD cards) o Intel-(R)-Xeon- (R) CPU E5 – 2690 v2 3.0 GHz CPU o 256 GB @ 1600 MHZ o 12 x 146GB 15K SAS internal disk drives o Broadcom BCM5720 1 GbE NIC o PERC H710P RAID Controller	For ESXi Environment, 12 x 146 GB drives are configured on RAID 10 This host supports the Windows 8 XenDesktop 7 desktops.
Management Host	• 1 x Dell PowerEdge R710 Server: o VMware ESXi 5.1 Update 1 (Installed on SD cards) o 2 x HexCore Intel® Xeon® X5670 2.9 Ghz Processors o 96 GB RAM @ 1333 MHZ o 2 x 146GB 15K SAS internal disk drives o 1 x Broadcom 5709 1GbE NIC,	The management VMs is hosted on Tier-2 storage (EqualLogic SAN). This host will host the following VMs, all running Windows server 2008 R2 SP1: • VMware vCenter • Citrix XenDesktop Controller • Citrix StoreFront Server • Microsoft SQL server

	Quad-Port	(VMware vCenter Database)
Test Lync 2013 Server Infrastructure	• 1x Dell PowerEdge R710 servers: o Microsoft Hyper-V o Intel-(R)-Xeon- (R) CPU X5670 @ 2.9 GHz o 96 GB RAM @ 1333 MHZ o 8 x 146GB 15K SAS internal disk drives o Broadcom 5709 1GbE NIC o Lync 2013 Server	Windows 2012 and Hyper V will be installed on the Test R710 server. Lync 2013 is installed in a VM running here. AD is installed on another VM running here. The infrastructure used here is only to test Microsoft Lync 2013 with XenDesktop7. The Lync infrastructure should be sized to meet customer requirements.
Network	• 1 x Dell PowerConnect 6248 1Gb Ethernet Switch	Deployment Stack and Test Stacks configured on same physical switch.
Performance Monitoring	• VMware Virtual Center 5.1 • Perf Mon stats on Desktop session	• Performance data will be captured from VSphere client. • Local desktop session Perf Mon stats will be captured

Solution Configuration – Software Components	Description/Version
VMware vCenter	Version 5.1 U1
Citrix XenDesktop	Version 7.0
Hypervisor	VMware ESXi 5.1 U1
Microsoft SQL Server	Version 2008 R2
Windows 8 Enterprise (32 bit)	VDI Clients for characterization tests Login VSI launchers
Windows Server 2012	VMs for hosting Citrix XenDesktop, vCenter Server, MSSQL server and other infrastructure VMs.
Microsoft Lync 2013 VDI Plug-in	Version 15.0.4420.1017

3 Test Infrastructure Setup



3.1 RAID Configuration

For Management Host 8 x 146 GB 15k SAS drives will be configured on RAID 10 for OS deployment as well as management VMs storage.

For Compute Host 10 x 146 GB SAS drives will be configured on RAID 10 for compute resources (VDI Desktops). VMware ESXi 5.1 will be installed on internal SD card.

3.2 VMware vSphere Networking

All VMware vSphere management components will be hosted on a single R720 server for the purposes of testing outlined in this document. All virtual desktops will be hosted on a single R720 Server. Since testing will be limited to single server performance validation, there will be 2 servers required and networked as the Management and Compute Hosts.

3.2.1 Network Architecture

The network connectivity between the Management and Compute host servers will be managed by a PC 6248 switch. Both of these servers will communicate via the VDI Network VLAN.

3.2.2 Network Characteristics

Type of Network	Description
VDI network	This will represent the VDI network traffic for VDI virtual desktop to infrastructure communication. The virtual desktops contact the Active Directory server and DHCP server also using the same network.
Management network	Represents the network traffic due to the communication between different infrastructure components such as the Citrix XenDesktop Connection server, Active directory, Microsoft SQL server, and VMware vCenter. The management network of all servers is configured on this network.

3.2.3 vSwitch and VLAN Configuration

The infrastructure network is divided into two VLANs to segment network traffic into different classes. The two VLANs to be used in the test configuration are:

- VDI VLAN
- Management VLAN

3.2.4 VDI Network

The servers listed below are part of the VDI network:

- The PowerEdge R720 hosting the virtual desktops
- The PowerEdge R710 hosting the VMware vSphere management virtual servers
- The Test Mgmt server used for hosting the Active Directory server

4 Test Methodology

4.1 Test Objectives

The primary objective of the testing are:

- Determine the CPU, Memory, Disk IOPS, and Network impact on the Citrix XenDesktop Compute host for using the Lync 2013 clients for chat, audio, video, and desktop sharing sessions on each virtual desktop.

The testing focuses on the all CPU, memory, Disk IOPs, and networking aspects of VDI compute hosts and detailed statistics and metrics are captured.

4.2 Test Approach

- 2 Enhanced workload sized VMs to test sessions to each other via manual Lync initialization.
- One Windows 8 client end-point running Microsoft Lync 2013 VDI Plug-in and one Windows 7 SP1 client end-point running Microsoft Lync 2013 VDI Plug-in will be used for creating the two VDI sessions.
- Measure above mentioned compute items during messaging (chat), voice, video and desktop sharing.
- Measure per VM overhead associated with running Lync 2013 clients in VDI sessions.
- Provide guidance on a per VDI host scaling measurement.

4.3 Load Generation

Two desktops in the XenDesktop 7 infrastructure will manually connect to each other and test a regular IM session, desktop sharing, and audio and video call. In each of these four types of Lync activities, all data described above (4 areas) will be captured with the Microsoft Lync 2013 VDI Plug-in.

4.3.1 Monitoring Tools

The system resource utilization and performance metrics at the VMware ESXi hypervisor layer will be monitored using VMware vCenter. The Windows client end-points will be monitored through Perf Mon metric captures to ensure that they themselves are not a bottleneck.

4.4 Test Criteria

What is the per VM session density change with Lync 2013 on XenDesktop 7?

4.3.1 Storage Capacity and I/O Latency

All virtual desktops will be stored on local Tier 1 storage on the Compute Host. The storage disk I/O latency will be measured to not exceed 20 ms, which is industry standard for good performance. Maintaining this limit will ensure good user application response times when there are no other bottlenecks at the infrastructure layer

4.3.2 System Resource Utilization on the Hypervisor Host Infrastructure

The primary focus of our testing is to test the impact of Lync 2013 client with plugin for VDI on Compute host local Tier 1 IOPs. Using the following metrics at the hypervisor infrastructure layer will ensure solution consistency:

Average CPU utilization on the compute host to remain below 85%, with occasional peaks up to 90%. Total network bandwidth utilization not to exceed 85%.

5 Lync 2013 VDI Plug-in Testing/Characterization results

In order to test out the functionality and provide VDI compute server overhead we manually initiated two VDI sessions that were enabled with Lync 2013 on each desktop. The sessions used independent Windows clients that were enabled with USB headsets and integrated video devices. The tests were run with the Lync 2013 VDI Plug-in installed on the Windows clients. The data on the VDI compute host should be interpreted as a divisible of 2 since there were two sessions running concurrently. The per VM resource utilization is converted to per VM incremental resource utilization due to Lync by subtracting the resources used by applications other than Lync. This method also allows the observed incremental resource utilization due to Lync to be VM profile agnostic.

5.1 Messaging (chat) Performance

Lync usage simulation: This test simulates a chat (text based messaging) session between two users, each using one virtual desktop on a Windows client device. Both of the users simulate typing and sending messages.

Lync incremental resource utilization: CPU utilization, active memory usage, network bandwidth utilization, and disk I/O data points were collected for the compute host – the VMware ESXi host server running the virtual desktops. The data for the compute host should be interpreted as a divisible of 2 since there were two sessions running concurrently. This data will provide the resource utilization for one VM running Microsoft Lync and performing messaging activity.

In addition, CPU utilization, active memory usage, network bandwidth utilization, and disk I/O data points were separately collected for the compute host running the same two VMs – but this time without running Lync or any other application. This data for the compute host should also be interpreted as a divisible of 2 since there were two sessions running concurrently. This data will provide the resource utilization for one VM in idle state.

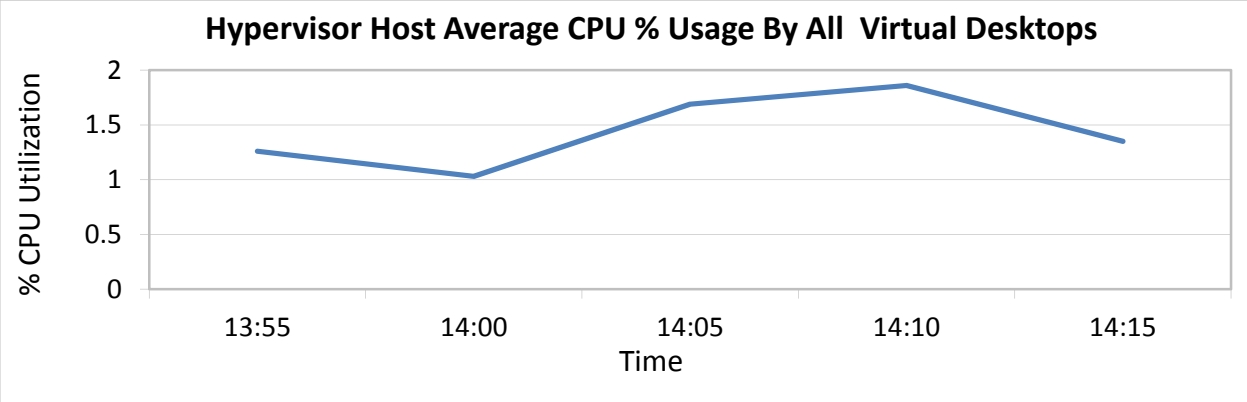
The peak incremental resource utilization due to Microsoft Lync was calculated by subtracting the "average resource utilization when the VM is in idle condition" from the "peak resource utilization when the VM was running Lync messaging".

The per VM average resource utilization in idle state is:

Hypervisor Host Resource	Utilization
CPU Utilization	0.1%
Memory (Active) Utilization	0.3 GB
Disk IOPS (Read & Write)	1 IOPS
Network Utilization	0.2 Mbps

Each of the following plots provides the resource utilization for two VMs running Microsoft Lync and performing messaging (chat).

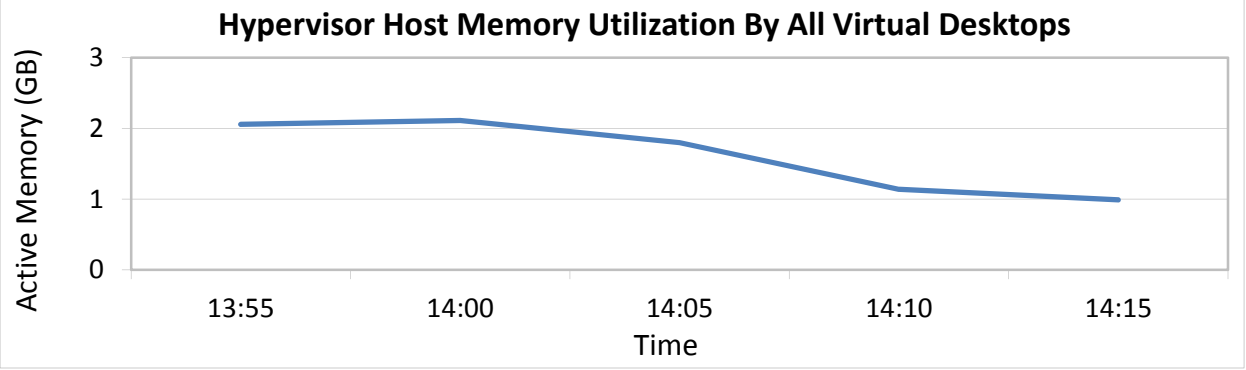
5.1.1 Messaging (Chat), CPU Performance



The CPU utilization peaked around 1.86% (for two sessions). Based on these results, it can be concluded that CPU utilization for **each** session with active messaging (chat) session would account for an ~ 0.93% CPU increase.

Incremental utilization due to Lync:
0.93% peak utilization with Lync messaging - 0.1% average utilization in idle state = 0.83% peak incremental utilization due to Microsoft Lync messaging (chat).

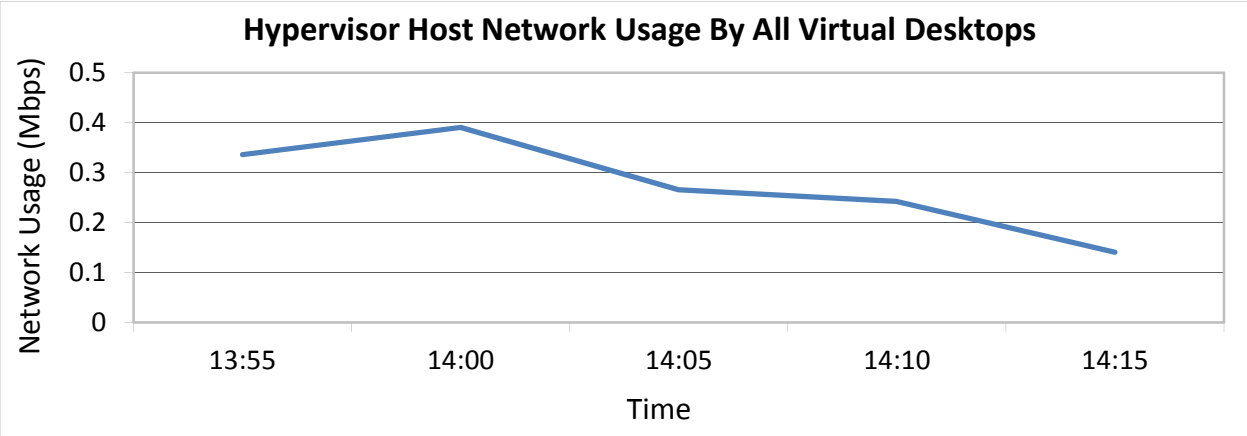
5.1.2 Messaging (Chat), Memory Performance



The peak memory consumption was around 2.1 GB of RAM (for two sessions). Based on these results, it can be concluded that memory consumption for **each** session with active messaging (chat) session would account for an ~ 1.05 GB RAM increase.

Incremental utilization due to Lync:
1.05 GB peak utilization with Lync messaging - 0.3 GB average utilization in idle state = 0.75 GB peak incremental utilization due to Microsoft Lync messaging (chat).

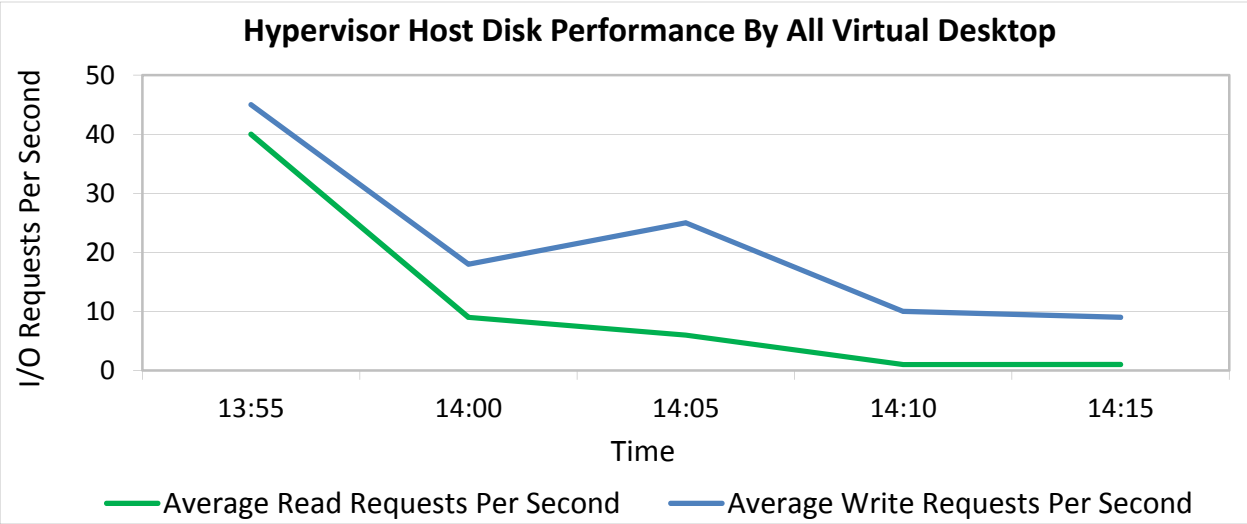
5.1.3 Messaging (Chat), Network Performance



The peak network consumption was around 0.4 Mbps (for two sessions). Based on these results, it can be concluded that network consumption for **each** session with active messaging (chat) session would account for an 0.2 Mbps network increase.

Incremental utilization due to Lync:
0.2 Mbps peak utilization with Lync messaging - 0.02 Mbps average utilization in idle state = 0.18 Mbps peak incremental utilization due to Microsoft Lync messaging (chat).

5.1.4 Messaging (Chat), Disk Performance



The peak disk resource consumption was around 12 requests per seconds combined R/W (for two sessions). Based on these results, it can be concluded that disk resource consumption for **each** session with active messaging (chat) session would account for an average of ~ 6 requests per second combined R/W increase.

Incremental utilization due to Lync:
6 IOPS peak with Lync messaging - 1 IOPS average in idle state = 5 IOPS peak incremental utilization due to Microsoft Lync messaging (chat).

5.2 Audio Performance

Lync usage simulation: This test simulates an audio call occurring between two users, each using one virtual desktop on a Windows client device. For the audio call simulation, a song was played near the headphone attached to the first Windows client with a session to one of the virtual desktops. On the other side, at the second Windows client with a session to the other virtual desktop, a paragraph was read repetitively to the headphone attached to it.

Lync incremental resource utilization: CPU utilization, active memory usage, network bandwidth utilization, and disk I/O data points were collected for the compute host – the VMware ESXi host server running the virtual desktops. The data for the compute host should be interpreted as a divisible of 2 since there were two sessions running concurrently. This data will provide the resource utilization for one VM running Microsoft Lync and performing an audio call.

In addition, CPU utilization, active memory usage, network bandwidth utilization, and disk I/O data points were separately collected for the compute host running the same two VMs – but this time without running Lync or any other application. This data for the compute host should also be interpreted as a divisible of 2 since there were two sessions running concurrently. This data will provide the resource utilization for one VM in idle state.

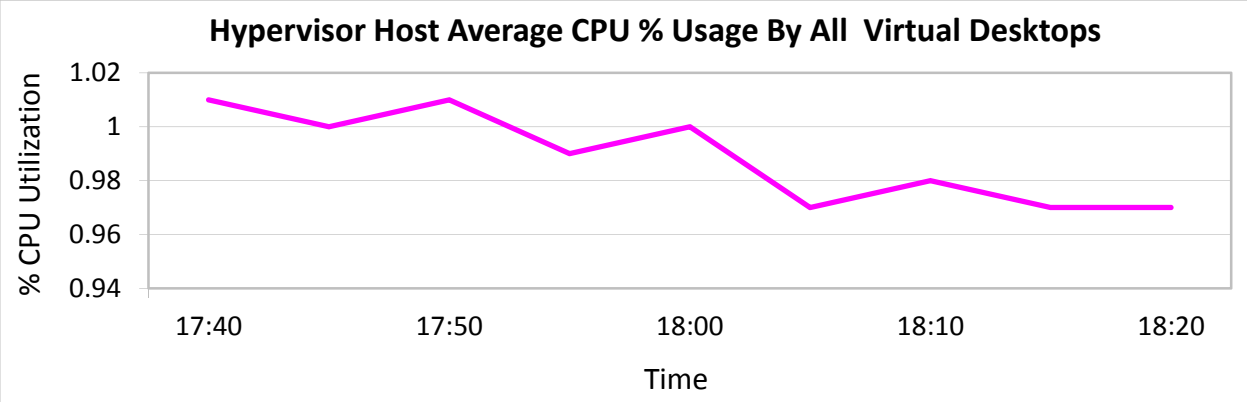
The peak incremental resource utilization due to Microsoft Lync was calculated by subtracting the "average resource utilization when the VM is in idle condition" from the "peak resource utilization when the VM was running audio call".

The per VM average resource utilization in idle state is:

Hypervisor Host Resource	Utilization
CPU Utilization	0.1%
Memory (Active) Utilization	0.3 GB
Disk IOPS (Read & Write)	1 IOPS
Network Utilization	0.2 Mbps

Each of the following plots provides the resource utilization for two VMs running Microsoft Lync and performing an audio call.

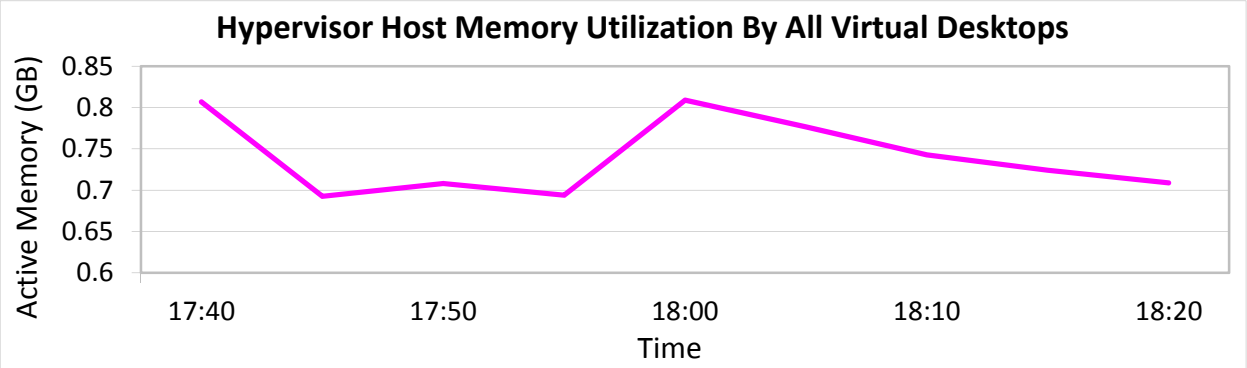
5.2.1 Audio, CPU Performance



The graph above shows the CPU utilization for the compute host by two virtual desktops. The CPU utilization peaked around 1.01% (for two sessions). Based on these results, it can be concluded that CPU utilization for **each** session with active Audio Lync calling would account for an ~ 0.5% CPU increase.

Incremental utilization due to Lync:
0.5% peak utilization with Lync audio call - 0.1% average utilization in idle state = 0.4% peak incremental utilization due to Microsoft Lync audio call.

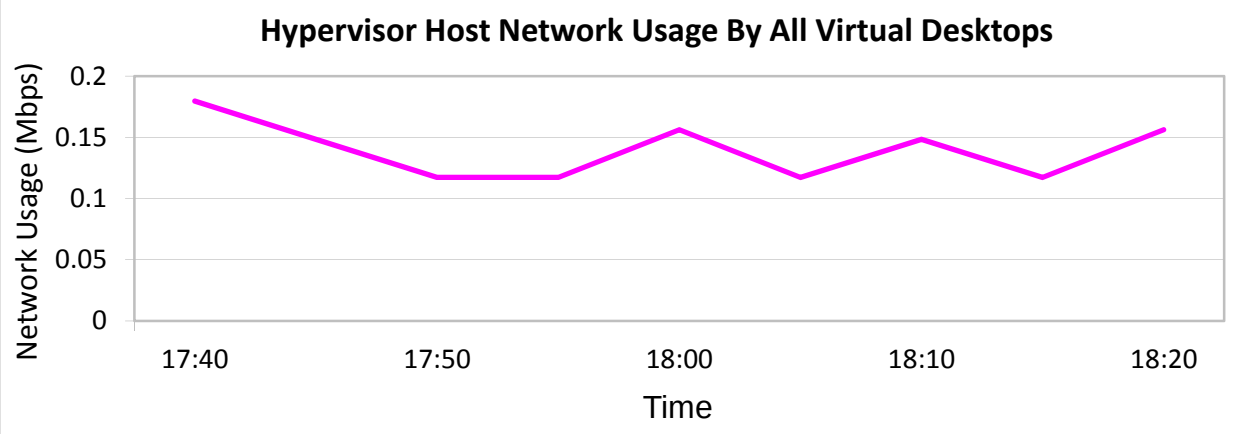
5.2.2 Audio, Memory Performance



The peak memory consumption was around 0.81 GB of RAM (for two sessions). Based on these results, it can be concluded that memory consumption for **each** session with active Audio Lync calling would account for an ~ 0.4 GB RAM increase.

Incremental utilization due to Lync:
0.4 GB peak utilization with Lync audio call - 0.3 GB average utilization in idle state = 0.1 GB peak incremental utilization due to Microsoft Lync audio call.

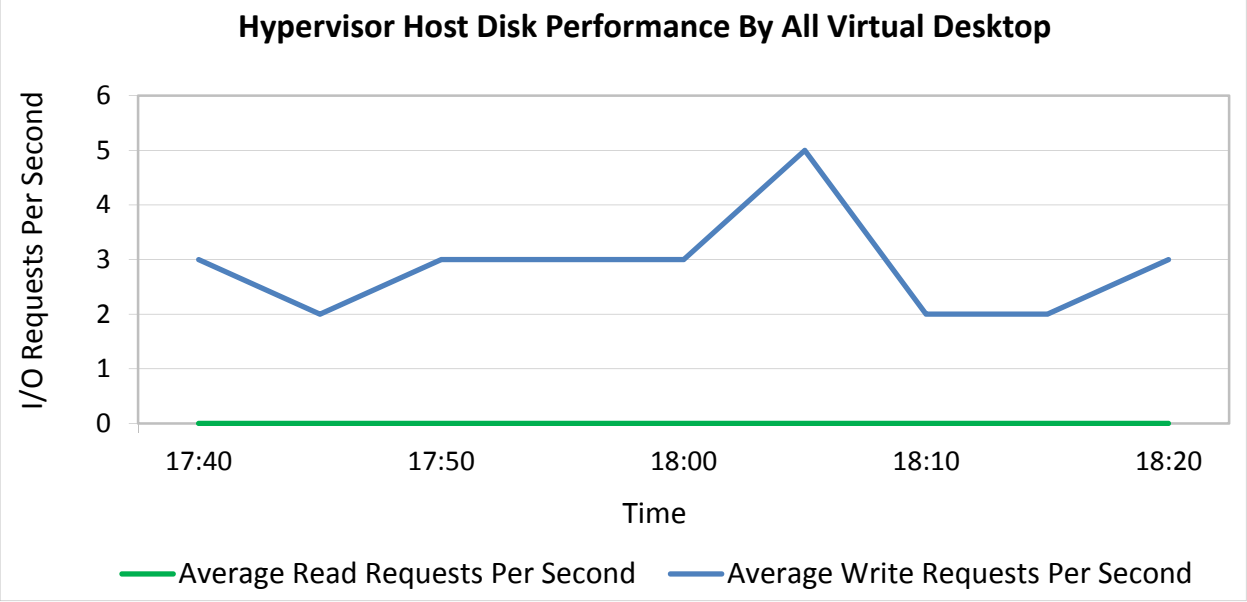
5.2.3 Audio, Network Performance



The peak network consumption was around 0.18 Mbps (for two sessions). Based on these results, it can be concluded that network consumption for **each** session with active Audio Lync calling would account for an 0.09 Mbps network increase.

Incremental utilization due to Lync:
0.09 Mbps peak utilization with Lync audio call - 0.02 Mbps average utilization in idle state = 0.07 Mbps peak incremental utilization due to Microsoft Lync audio call.

5.2.4 Audio, Disk Performance



The peak disk resource consumption was around 5 requests per seconds combined R/W (for two sessions). Based on these results, it can be concluded that disk resource consumption for **each** session with active Audio Lync calling would account for an average of ~ 3 requests per second combined R/W increase.

Incremental utilization due to Lync:
3 IOPS peak with Lync audio call - 1 IOPS average in idle state = 2 IOPS peak incremental utilization due to Microsoft Lync audio call.

5.3 Video Performance

Lync usage simulation: This test simulates a video call (with active audio) occurring between two users, each using one virtual desktop on a Windows client device. For the video simulation, the webcams on both of the Windows clients, which were running sessions to the virtual desktops, were used. Along with that, for audio simulation, a recorded speech was played near the headphone attached to one of the first Windows clients with a session to one of the virtual desktops. On the other side, at the second Windows client with a session to the other virtual desktop, a paragraph was read repetitively to the headphone attached to it.

Lync incremental resource utilization: CPU utilization, active memory usage, network bandwidth utilization, and disk I/O data points were collected for the compute host – the VMware ESXi host server running the virtual desktops. The data for the compute host should be interpreted as a divisible of 2 since there were two sessions running concurrently. This data will provide the resource utilization for one VM running Microsoft Lync and performing a video call with active audio.

In addition, CPU utilization, active memory usage, network bandwidth utilization, and disk I/O data points were separately collected for the compute host running the same two VMs – but this time without running Lync or any other application. This data for the compute host should also be interpreted as a divisible of 2 since there were two sessions running concurrently. This data will provide the resource utilization for one VM in idle state.

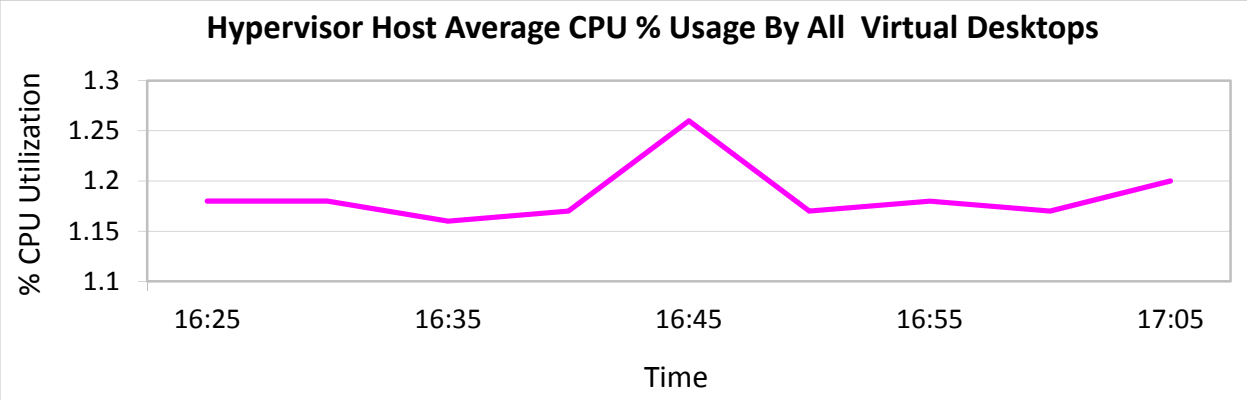
The peak incremental resource utilization due to Microsoft Lync was calculated by subtracting the "average resource utilization when the VM is in idle condition" from the "peak resource utilization when the VM was running a video call with active audio.

The per VM average resource utilization in idle state is:

Hypervisor Host Resource	Utilization
CPU Utilization	0.1%
Memory (Active) Utilization	0.3 GB
Disk IOPS (Read & Write)	1 IOPS
Network Utilization	0.2 Mbps

Each of the following plots provides the resource utilization for two VMs running Microsoft Lync and performing a video call with active audio.

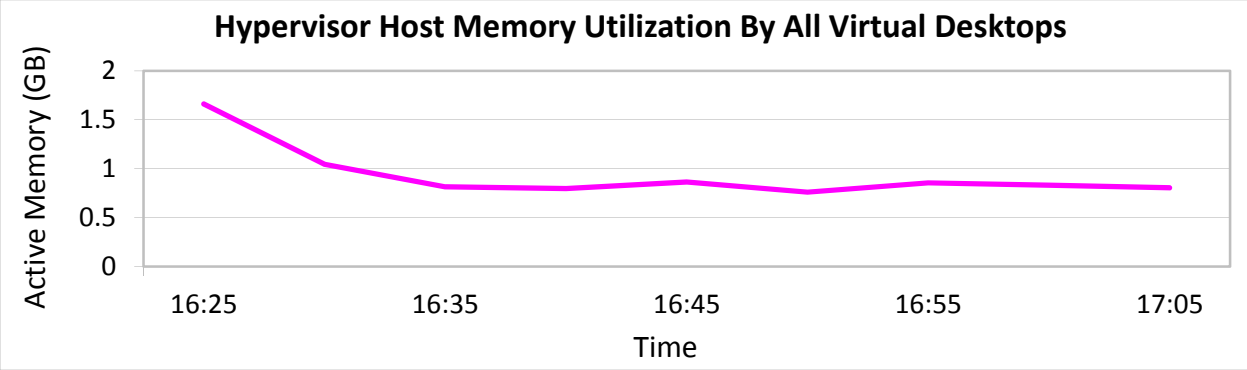
5.3.1 Video with Active Audio, CPU Performance



The CPU utilization peaked around 1.26% (for two sessions). Based on these results, it can be concluded that CPU utilization for **each** session with active Video Lync calling would account for an ~ 0.63% CPU increase.

Incremental utilization due to Lync:
0.63% peak utilization with Lync video call with active audio - 0.1% average utilization in idle state = 0.53% peak incremental utilization due to Microsoft Lync video call with active audio.

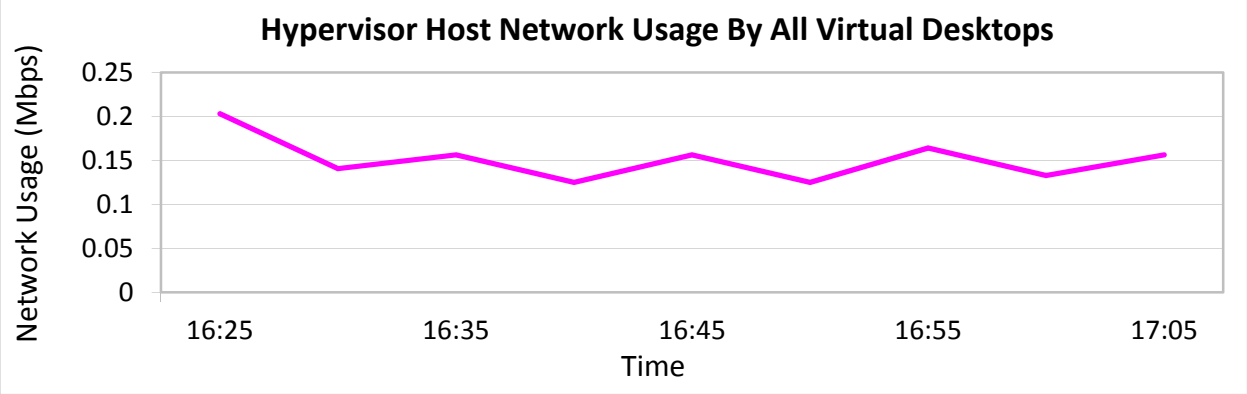
5.3.2 Video with Active Audio, Memory Performance



The peak memory consumption was around 1.66 GB of RAM (for two sessions). Based on these results, it can be concluded that memory consumption for **each** session with active Audio Lync calling would account for an ~ 0.83 GB RAM increase.

Incremental utilization due to Lync:
0.83 GB peak utilization with Lync video call with active audio - 0.3 GB average utilization in idle state = 0.53 GB peak incremental utilization due to Microsoft Lync video call with active audio.

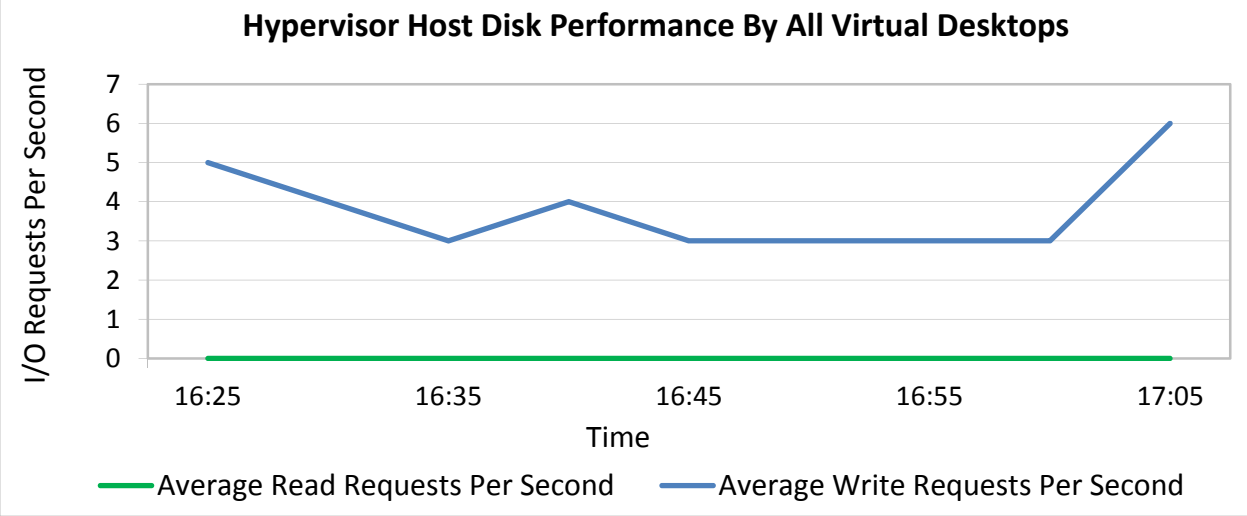
5.3.3 Video with Active Audio, Network Performance



The peak network consumption was around 0.2 Mbps (for two sessions). Based on these results, it can be concluded that network consumption for **each** session with active Audio Lync calling would account for an ~ 0.1 Mbps network increase.

Incremental utilization due to Lync:
0.1 Mbps peak utilization with Lync video call with active audio - 0.02 Mbps average utilization in idle state = 0.08 Mbps peak incremental utilization due to Microsoft Lync video call with active audio.

5.3.4 Video with Active Audio, Disk Performance



The peak disk resource consumption was around 6 requests per seconds combined R/W (for two sessions). Based on these results, it can be concluded that disk resource consumption for **each** session with active Audio Lync calling would account for an ~ 3 requests per second combined R/W increase.

Incremental utilization due to Lync:
3 IOPS peak with Lync video call with active audio - 1 IOPS average in idle state = 2 IOPS peak incremental utilization due to Microsoft Lync video call with active audio.

5.4 Desktop Sharing Performance

Lync usage simulation: This test simulates a desktop sharing session between two users, each using one virtual desktop on a Windows client device. One user shares the desktop with the other user. The user sharing the desktop performs several tasks while the desktop is being shared. Some of the tasks are:

- Open and review a Microsoft PowerPoint presentation with a lot of graphics content
- Open a graphics file in Microsoft Paint and edits it
- Open some folders to look for a few files.

Lync incremental resource utilization: CPU utilization, active memory usage, network bandwidth utilization, and disk I/O data points were collected for the compute host – the VMware ESXi host server running the virtual desktops. The data for the compute host should be interpreted as a divisible of 2 since there were two sessions running concurrently. This data will provide the resource utilization for one VM running Microsoft Lync and sharing desktop with the other user through Lync.

In addition, CPU utilization, active memory usage, network bandwidth utilization, and disk I/O data points were separately collected for the compute host running the same two VMs – but this time without running Lync. In this case, the same tasks, which were performed while sharing the desktop, were performed by one of the users (but in this case. Lync was not running and desktop wasn't being shared). This data for the compute host should also be interpreted as a divisible of 2 since there were two sessions running concurrently. This data will provide the resource utilization for one VM for the same set of tasks but without running Lync.

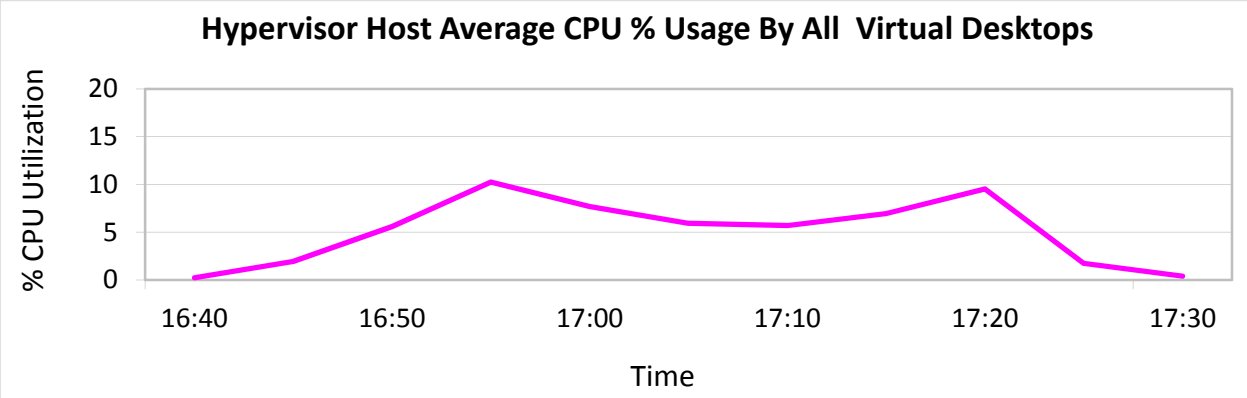
The peak incremental resource utilization due to Microsoft Lync was calculated by subtracting the "peak resource utilization while performing different tasks without sharing the desktop" from the "peak resource utilization while performing the same tasks but with active desktop sharing through Lync".

The per VM peak resource utilization while running the set of tasks, as mentioned above, but without running Lync was observed to be:

Hypervisor Host Resource	Utilization
CPU Utilization	4%
Memory (Active) Utilization	0.71 GB
Disk IOPS (Read & Write)	13 IOPS
Network Utilization	2 Mbps

Each of the following plots provides the resource utilization for two VMs running Microsoft Lync and performing a desktop sharing.

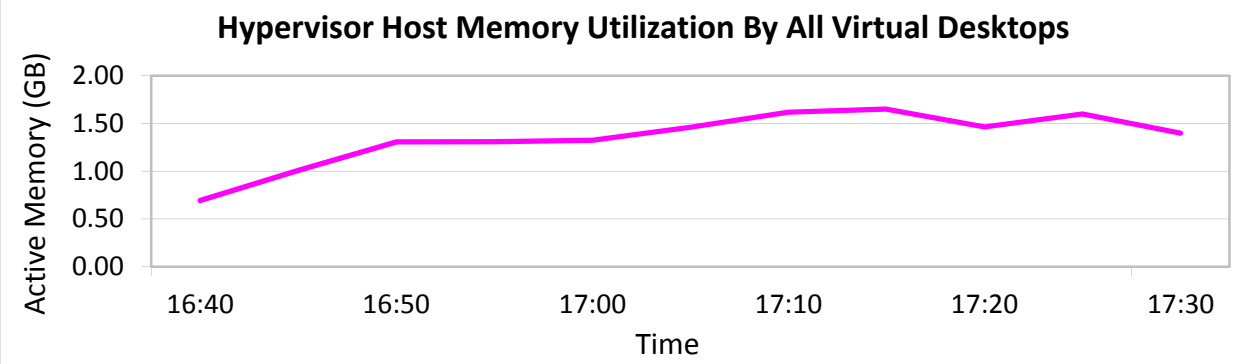
5.4.1 Desktop Sharing, CPU Performance



The CPU utilization peaked around 10% (for two sessions). Based on these results, it can be concluded that CPU utilization for **each** session with an active Lync Desktop Sharing session would account for an ~ 5% CPU increase.

Incremental utilization due to Lync:
5% peak utilization with Lync desktop sharing while performing different tasks - 4% peak utilization with running the same tasks without running Lync = 1% peak incremental utilization due to Microsoft Lync desktop sharing.

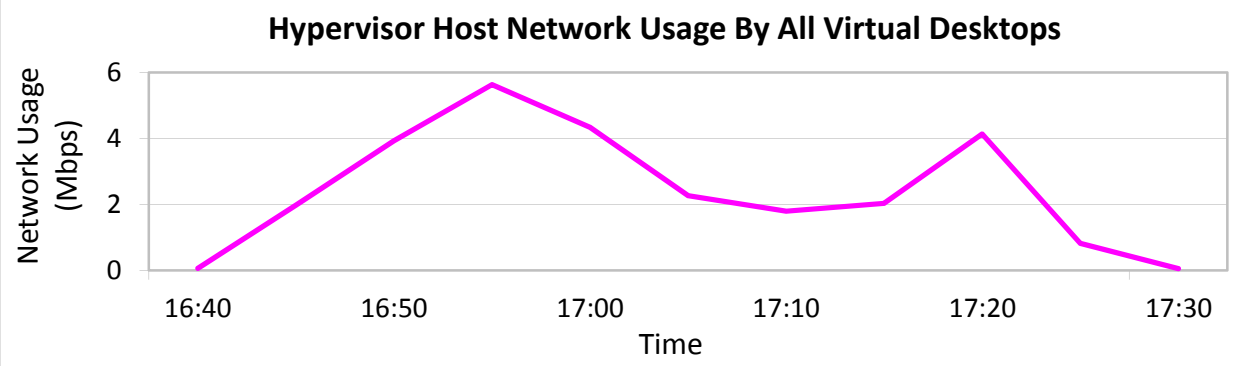
5.4.2 Desktop Sharing, Memory Performance



The peak memory consumption was around 1.65 GB of RAM (for two sessions). Based on these results, it can be concluded that memory consumption for **each** session with an Lync Desktop Sharing session would account for an ~ 0.83 GB RAM increase.

Incremental utilization due to Lync:
0.83 GB peak utilization with Lync desktop sharing while performing different tasks - 0.71 GB peak utilization with running the same tasks without running Lync = 0.12 GB peak incremental utilization due to Microsoft Lync desktop sharing.

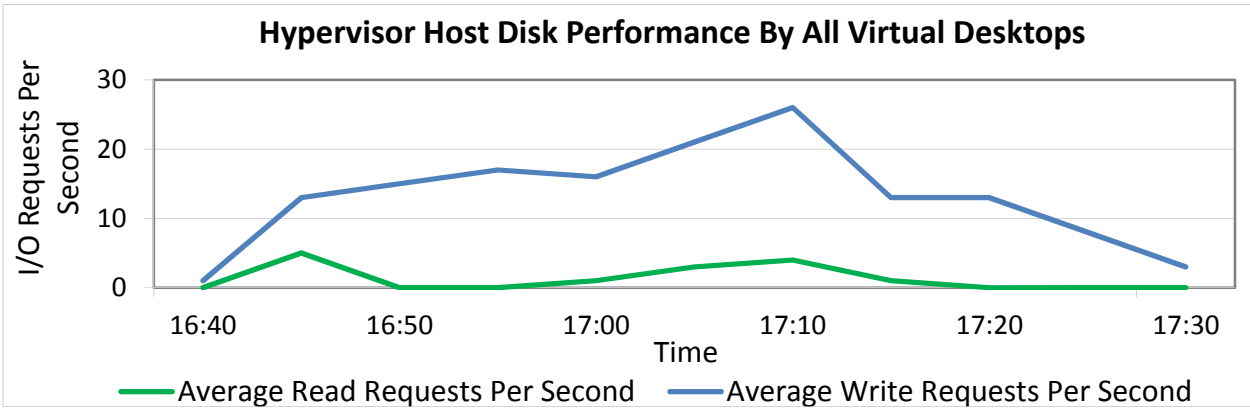
5.4.3 Desktop Sharing, Network Performance



The peak network consumption was around 5.6 Mbps (for two sessions). Based on these results, it can be concluded that network consumption for **each** session in a Lync Desktop Sharing session would account for an ~ 2.8 Mbps network increase.

Incremental utilization due to Lync:
2.8 Mbps peak utilization with Lync desktop sharing while performing different tasks - 2 Mbps peak utilization with running the same tasks without running Lync = 0.8 Mbps peak incremental utilization due to Microsoft Lync desktop sharing.

5.4.4 Desktop Sharing, Disk Performance



The peak disk resource consumption was around 30 requests per seconds combined R/W (for two sessions). Based on these results, it can be concluded that disk resource consumption for **each** session in a Lync Desktop Sharing session would account for an ~ 15 requests per second combined R/W increase.

Incremental utilization due to Lync:
15 IOPS peak with Lync desktop sharing while performing different tasks - 13 IOPS peak utilization with running the same tasks without running Lync = 2 IOPS peak incremental utilization due to Microsoft Lync desktop sharing.

5.5 Summary of Resource Utilization for Lync Use Cases

Lync Messaging (Chat)	
Hypervisor Host Resource	Incremental Utilization Due to Lync Per Virtual Desktop
CPU	0.83 %
Memory	0.75 GB Active Memory
Disk	5 IOPS (R + W)
Network	0.18 Mbps

Lync Audio Call	
Hypervisor Host Resource	Incremental Utilization Due to Lync Per Virtual Desktop
CPU	0.4 %
Memory	0.2 GB Active Memory
Disk	2 IOPS (R + W)
Network	0.07 Mbps

Lync Video Call with Active Audio	
Hypervisor Host Resource	Incremental Utilization Due to Lync Per Virtual Desktop
CPU	0.53 %
Memory	0.53 GB Active Memory
Disk	2 IOPS (R + W)
Network	0.08 Mbps

Lync Desktop Sharing	
Hypervisor Host Resource	Incremental Utilization Due to Lync Per Virtual Desktop
CPU	1 %
Memory	0.12 GB Active Memory
Disk	2 IOPS (R + W)
Network	0.8 Mbps

As mentioned earlier, these resource utilization numbers represent incremental resource utilization for Microsoft Lync, so they are agnostic to the size of the desktop. In other words, by observing the incremental resource utilization for Microsoft Lync, the data presented above can be applied any VM profile.

6 Conclusions

The overall results showed that running Microsoft Lync 2013 and using it for different purposes, like messaging, audio call, video call, and desktop sharing, results in significant additional resource utilization for the hypervisor host server running the virtual desktops. The resource utilization on the hypervisor host server was monitored for four different parameters: CPU usage, active memory, network utilization, and disk IOPS. Of these four measured categories, the mitigating resource was CPU usage.

Assumptions

For understanding the impact of the incremental resource utilization due to Microsoft Lync 2013 on the VDI session density (total number of virtual desktops that can be supported on the compute host), we consider the incremental host CPU utilization per VM due to Microsoft Lync 2013 to be the average of the incremental host CPU utilization per VM due to messaging, audio, video, and desktop sharing. This means that:

The average incremental compute host CPU utilization per VM due to Lync 2013
= (0.83% for messaging + 0.4% for audio + 0.53% for video + 1% for desktop sharing) / 4
= 0.69%

Scenario-1: 50% Lync Usage Concurrency

In this scenario, it is assumed that only 50% of the total users will be engaged in using Microsoft Lync at any given point. This means that:

The average incremental compute host CPU utilization per VM due to Lync 2013 with 50% usage concurrency
= 0.69% x 0.5
= 0.345%

Impact on Density:

Based on the test results described in the document, for all of the three major workloads (basic, standard, and premium) considered for DVS Enterprise, the use of Microsoft Lync 2013 for all sessions on top of these workloads would result in the following guidance:

Workload	Total Desktops with Lync	# of Desktops Reduced Due to Lync	Percentage Reduction
Basic – 180 Win8 users per PE R720	106	74	41%
Standard – 115 Win8 users per PE R720	79	36	31%
Premium – 100 Win8 users per PE R720	72	28	28%

Scenario-2: 100% Lync Usage Concurrency

In this scenario, it is assumed that 100% of the total users will be engaged in using Microsoft Lync at any given point. This means that:

The average incremental compute host CPU utilization per VM due to Lync 2013 with 100% usage concurrency
= 0.69% x 1.0
= 0.69%

Impact on Density:
Based on the test results described in the document, for all of the three major workloads (basic, standard, and premium) considered for DVS Enterprise, the use of Microsoft Lync 2013 for all sessions on top of these workloads would result in the following guidance:

Workload	Total Desktops with Lync	# of Desktops Reduced Due to Lync	Percentage Reduction
Basic – 180 Win8 users per PE R720	75	105	58%
Standard – 115 Win8 users per PE R720	61	54	47%
Premium – 100 Win8 users per PE R720	56	44	44%

About the Authors

Pranav Parekh is a Sr. Solutions Engineer at Dell Client Cloud Computing group. Pranav has extensive experience designing desktop virtualization solutions, IaaS private cloud solutions, virtualization solutions, and enterprise class blade servers. Pranav has a master's degree in Electrical & Computer Engineering from the University of Texas at Austin.

Peter Fine is the Sr. Principal Engineering Architect for Citrix-based solutions at Dell. Peter has extensive experience and expertise on the broader Microsoft, Citrix and VMware solutions software stacks as well as in enterprise virtualization, storage, networking and enterprise datacenter design.

Rick Biedler is the Solutions Development Manager for Citrix solutions at Dell, managing the development and delivery of Enterprise class Desktop virtualization solutions based on Dell Datacenter components and core virtualization platforms.