Microsoft Lync Qualification for Dell Networking Switches

Dell Engineering
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A Dell EMC Deployment and Configuration Guide

Revisions

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1 Introduction

This guide details the methodology of Quality of Service (QoS) configuration and testing on Dell Networking switches for the Microsoft Unified Communications Open Interoperability Program (UCOIP).

Organizations are increasingly turning to Microsoft Lync to drive down costs and drive up worker productivity through an integrated solution for Unified Communications and Collaboration (UC&C). Microsoft Lync deployments are increasing dramatically as business leaders realize the value of deploying an integrated platform for voice, video, Web conferencing, instant messaging, collaboration, presence and private branch exchange (PBX) replacement

Organizations must deliver business-grade voice communications to both wired and mobile users so that users can access a rich set of communications and collaboration tools that are accessible at their desks or on the move. Without a solid network infrastructure, the quality of experience, user adoption and, ultimately, return on investment will suffer.

Dell EMC teams with Microsoft to provide comprehensive UC&C solutions that support high-quality service delivery. In addition to the Dell EMC solutions being optimized to deliver an exemplary user experience, these solutions also undergo testing for Microsoft Lync certification. The solutions are validated based on Microsoft recommended best practices as well as our own real world experience. For example, Dell EMC has designed reference architectures to serve as starting points for full Microsoft Lync implementation. Dell EMC solutions include storage, networking and servers as well as endpoint devices on the desktops and in the hands of users around the world.

The Microsoft UCOIP test plan includes voice and video quality tests with simulated WAN impairment. To validate QoS configurations and show Microsoft Lync performance improvement, background traffic is supplied to each PC and switch in the test topology. This guide shows how QoS was configured and presents the Microsoft Lync quality and performance metrics that were achieved.

2 Test Overview

The test setup is comprised of four sites (Figure 1), which simulates a main campus and three remote offices. Each site includes both PCs and phones, with communication within and across each of the sites.

Microsoft Lync voice and video calls were established and maintained on each PC and phone. Call quality was monitored by both a test technician and the Microsoft Lync Monitoring Server. The latter provided unbiased Degradation Mean Opinion Scoring (MOS), packet loss, jitter, and other metrics. The Degradation-MOS number provided by the Microsoft Lync Monitoring Server was used as the primary Microsoft Lync quality measurement.

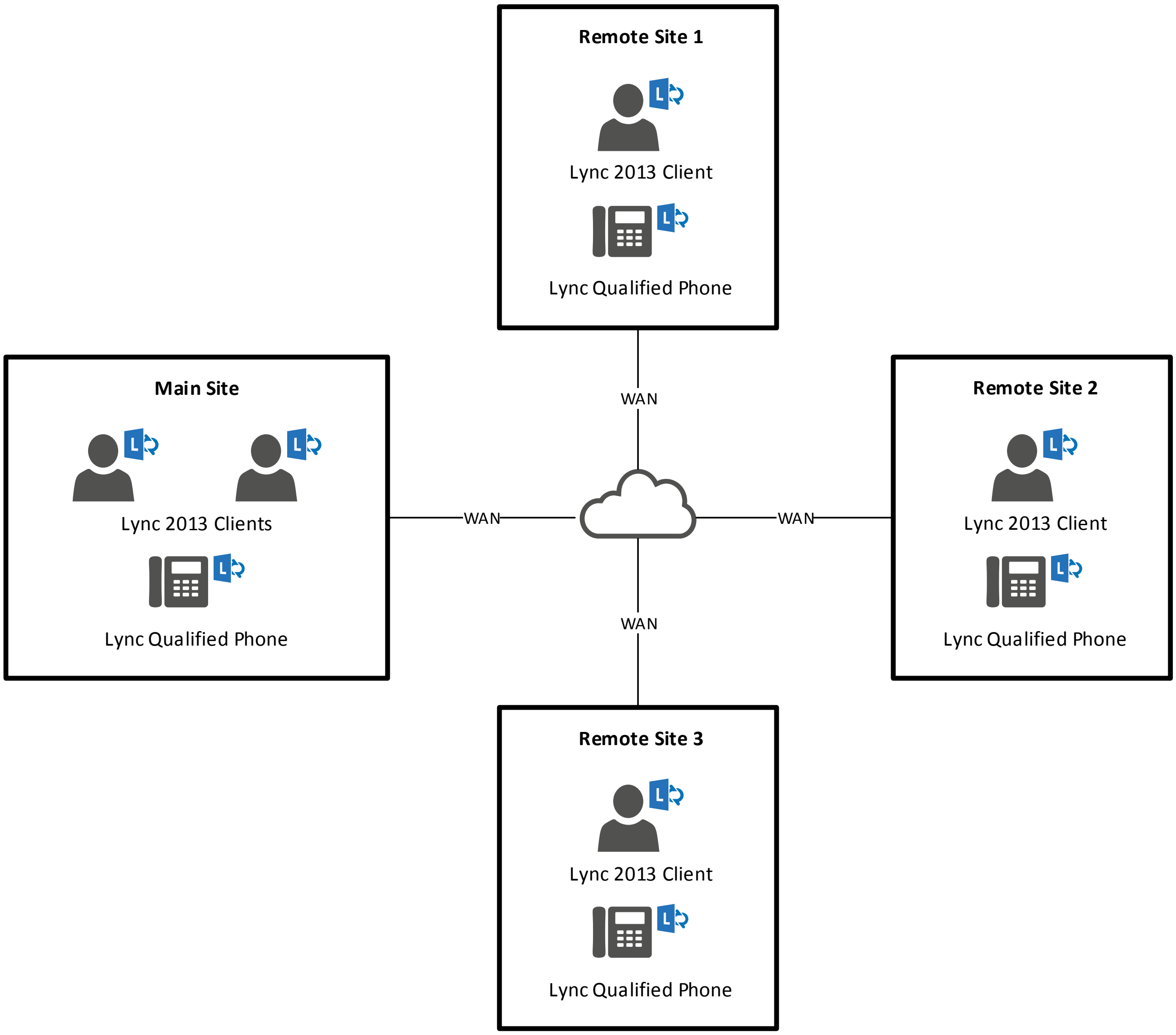

Figure 1 Microsoft Reference Test Topology

3 Test Equipment

The following tables (Table 1 - Table 5) list components used in the test setup.

Table 1 Switches

Switch	Description/Firmware Version
Dell Networking S4810	9.5.0.0
Dell Networking N3048P	6.1.0.1
Dell Networking N3024P	6.1.0.1
Dell Networking N2048P	6.1.0.1
Dell Networking N2024	6.1.0.1

Table 2 Servers

Sever	Version
Dell R710	Microsoft Server 2012R2 – Microsoft Lync Server 2013
Dell R610 – VMware ESXi 5.1	Microsoft Server 2012R2

Table 3 Microsoft Lync Clients and Microsoft Lync Phones

Microsoft Lync Client	Version
Dell XPS 13	Windows 8.1 Pro – Microsoft Lync 2013
Dell Precision M3800	Windows 8.1 Pro – Microsoft Lync 2013
Dell Latitude E6420	Windows 7 Pro – Microsoft Lync 2013
Dell XPS 14	Windows 7 Ultimate N – Microsoft Lync 2013
Dell Latitude 6040u	Windows 7 Ultimate N – Microsoft Lync 2013
Polycom VVX 500 (4 qty.)	UCS 5.1.1

Table 4 Impairment Server- WAN Emulator

Impairment Server - WAN Emulator	Version
WANem - TATA	V2.0

Table 5 Background Traffic Generator

Background Traffic Generator	Version
IXIA – IxExplorer	6.70.1050.14 EA-Patch2

4 Network Topology and Test Methodology

The following network diagram (Figure 2) shows the equipment used during the writing of this guide.

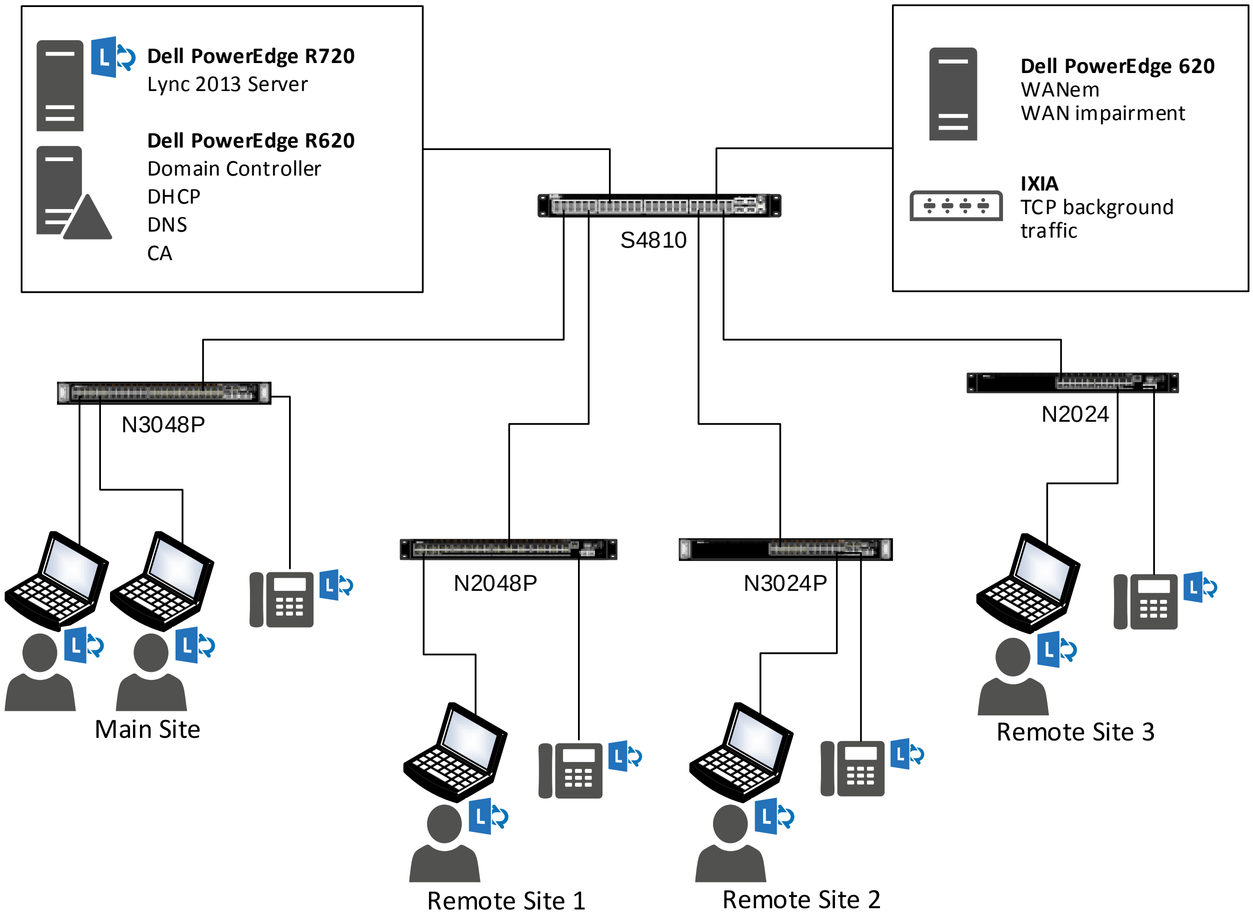

Figure 2 Microsoft Lync Qualification Test Topology

> **Note:** Omitted from the diagram are the connections from the IXIA traffic generating appliance to each switch. In the actual setup, each switch had an individual connection with IXIA traffic to simulate a full capacity network.

The UCOIP test plan requires calls between each PC and phone for every combination between the Main Site and Remote Sites. To inject packet loss and latency, each call between sites was routed through the WAN impairment server. Calls within the Main site were not routed through the WAN impairment server.

Several test iterations were done with and without QoS settings applied. Test iterations with and without the background traffic were performed. Low-priority background traffic was simulated by the IXIA network test system. All references to low priority or background traffic represent simulated traffic for the purpose of network congestion.

Test results were gathered through reporting from the Microsoft Lync Monitoring Server, which on Microsoft Lync Server 2013, is collocated on the Microsoft Lync Server.

5 Quality of Service (QoS) configuration

Differentiated Services (DiffServ) is the mechanism used for traffic classification of Microsoft Lync traffic. DiffServ can be used throughout the network including Layer 3. Within all the Dell Networking switches, the Differentiated Services Code Point (DSCP) values were mapped to cos-queue values where a Weighted Random Early Detection (WRED) profile was used to prioritize traffic classes.

In this configuration, all Microsoft Lync packets were tagged with a DSCP value of 46. All DSCP values of 46 were mapped to a cos-queue of value 3. Similarly, all background traffic was tagged with a DSCP value of zero, and mapped to a cos-queue of zero. The particular values used in this example are for demonstration purposes only. The administrator may use any DSCP or cos-queue value structure that fits their network requirements.

NOTE: cos-queue and service-queue are used interchangeably, depending on the switch OS version and model. Both terms refer to the IEEE 802.1q PCP field.

Microsoft Lync Client Configuration

Clients used in this example had Windows operating systems installed with Microsoft Lync 2013 software. Through group policy, all packets originating from “lync.exe” were tagged with a DSCP value of 46 at the client.

For more information, see Policy-Based Quality of Service (QoS) at http://technet.microsoft.com/en-us/library/dd919203%28v=ws.10%29.aspx

Polycom VVX 500 Configuration

All the Microsoft Lync certified phones in this example were configured to tag voice packets originating from the phone with a DSCP value of 46. See the Polycom user manual for configuration instructions.

Dell Networking S4810 v9.5.0.0 Configuration

Configuring DSCP, cos-queue, and WRED on Dell Networking OS 9.5.0.0 is a several step process that involves both global and interface commands. The steps below are provided as a general outline of the configuration process and methodology.

1. Create two named class-maps to map a class to each respective DSCP value.
2. Create a named wred-profile and designate the threshold limits for traffic to be dropped.
3. Create a named qos-policy to map a policy to the WRED profile.
4. Create two named policy-maps to map a service-queue to a class.
5. Apply the policy maps to a service policy within the designated interfaces.
6. Set the service-queue for Lync traffic to strict-priority.

NOTE: The Dell Networking S4810 was used for test purposes to certify Dell Networking OS v9.5.0.0. Dell Networking has a large family of high performance switches that are Microsoft Lync Certified. See Appendix A for a list of Dell Networking Microsoft Lync Certified switches.

Figure 3 provides the QoS portion of the running configuration from the switch. A single interface is shown with accompanying global configuration settings. Admins will need to apply the service-policy command to each interface requiring QoS settings.

```
interface TenGigabitEthernet 0/1
 no ip address
 switchport
 service-policy input pmap_lync
 service-policy output pmap_background
 no shutdown

class-map match-any class_background
 match ip dscp 0

class-map match-any class_lync
 match ip dscp 46

policy-map-input pmap_lync
 service-queue 0 class-map class_background
 service-queue 3 class-map class_lync

policy-map-output pmap_background
 service-queue 0 qos-policy qpol_background
 service-queue 1 qos-policy qpol_background

qos-policy-output qpol_background
 wred green WRED_G

strict-priority unicast 3

wred-profile WRED_G
 threshold min 10 max 20 max-drop-rate 100
```

Figure 3 S4810 Switch QoS Configuration

Dell Networking N-Series Switches v6.1.0.1 Configuration

Configuration of the N-Series switches can be accomplished under global configuration mode. The steps below are provided as a general outline of the configuration process and methodology.

1. Set the *classofservice* to trust DSCP.
2. Map DSCP values to cos-queues using *classofservice ip-dscp-mapping.*
3. Designate the cos-queue values to be randomly detected using *cos-queue random-detect.*
4. Designate the cos-queue value for strict priority Lync traffic.
5. Use *exponential-weighting-constant*, to smooth instantaneous changes to queue sizes (optional).
6. Set the thresholds and drop probability for the non-Lync traffic using *random-detect queue-parms.*

NOTE: Several models within the Dell Networking N-Series were used for test purposes to certify Dell Networking OS v6.1.0.1. Dell Networking has large family of high performance and advanced switches that are Microsoft Lync Certified. See Appendix A for a list of Dell Networking Microsoft Lync Certified switches.

Figure 4 provides the QoS portion of the N-Series Switch Configuration. All QoS settings in this example are global; no interface settings are shown.

```
classofservice trust ip-dscp

classofservice ip-dscp-mapping 0 0

classofservice ip-dscp-mapping 46 3

cos-queue random-detect 0 1

cos-queue strict 3

random-detect exponential-weighting-constant 5

random-detect queue-parms 0 1 min-thresh 5 10 15 50 max-thresh 15 25 50 98 drop-prob-scale  1 2 3 25
```

Figure 4 N-Series Switch QoS Configuration

6 Test Results

The test results confirm the QoS configuration had the desired effect on call quality and optimizing Microsoft Lync traffic flows. In each test case, the quality increased significantly when compared to the results without the QoS configuration being applied. With the QoS enabled, all effects from the low priority traffic were kept to acceptable low levels or had no adverse effects.

The data shows packet loss to be the main driver of call quality, which is the QoS configuration's objective of limiting the impact of low priority traffic. In all cases, the background traffic applied was 90% of the line rate of the corresponding port's bandwidth. In the case of the N-Series switches, 1GbE ports were utilized. In the case of S4810, 10GbE ports were utilized.

For those test iterations with a WAN impairment of 10% packet loss across the WAN, the call quality corresponded with the additional loss. In many deployments, the administrator does not have the ability to control the QoS capability for the WAN connections. In these situations, it is important to know that even in the presence of WAN impairment Dell EMC switches can provide excellent Microsoft Lync experience. If the administrator can utilize QoS across the WAN link, the DSCP tagging could enable further quality improvement.

The following tables (Table 6 - Table 9) present the data from the Microsoft Lync Quality Summary Reports. Microsoft refers to all data within their reports as Quality of Experience (QoE) metrics. MOS values represent a combination of subjective scoring and translation from the degradation MOS values in the Quality Summary Report.

Table 6 Microsoft Lync QoE Metric Results - Microsoft Lync Voice Call

Call From	Call To	WAN Impairment	Background Traffic Applied	QoS Applied	Average Packet Loss	Average Jitter (ms)	MOS
Main Site	Main Site	None	No	Yes	0.00%	0.00	5.0
		None	Yes	No	59.79%	0.00	1.8
All Sites	All Sites	None	Yes	Yes	0.05%	1.17	4.0
		Latency: 40 ms Packet Loss: 0%	Yes	Yes	0.01%	1.00	4.9
		Latency: 40 ms Packet Loss: **~10%**	Yes	Yes	10.21%	1.67	3.5
		Latency: 80 ms Packet Loss: 0%	Yes	Yes	0.10%	1.50	4.9
		Latency: 80 ms Packet Loss: **~10%**	Yes	Yes	10.15%	0.83	3.8
		Latency: 80 ms Packet Loss: **~10%**	Yes	No	13.81%	1.67	2.6
		Latency: 80 ms Packet Loss: **~10%**	No	No	10.14%	1.60	3.3

Table 7 Microsoft Lync QoE Metric Results - Microsoft Lync Voice Conference Call

Call From	Call To	WAN Impairment	Background Traffic Applied	QoS Applied	Average Packet Loss	Average Jitter (ms)	MOS
All Sites	All Sites	None	No	Yes	0.00%	1.00	5.0
		None	Yes	Yes	0.00%	1.4	5.0
		Latency: 40 ms Packet Loss: 0%	Yes	Yes	0.00%	1.4	5.0
		Latency: 40 ms Packet Loss: **~10%**	Yes	Yes	9.86%	2.0	4.4
		Latency: 80 ms Packet Loss: 0%	Yes	Yes	0.00%	1.0	5.0
		Latency: 80 ms Packet Loss: **~10%**	Yes	Yes	9.88%	1.2	4.5
		Latency: 80 ms Packet Loss: **~10%**	No	No	9.95%	1.0	4.4
		Latency: 80 ms Packet Loss: **~10%**	Yes	No	Could not establish call without QoS enabled		

Table 8 Microsoft Lync QoE Metric Results - Microsoft Lync Video Call

Call From	Call To	WAN Impairment	Background Traffic Applied	QoS Applied	Average Frozen Frame %	MOS
Main Site	Main Site	None	Yes	Yes	0.0%	5
		None	No	Yes	0.48%	4.9
All Sites	All Sites	None	Yes	Yes	1.01%	4.7
		None	No	Yes	0.24%	4.9
		Latency: 80 ms Packet Loss: **~10%**	Yes	Yes	22.83%	3.0
		Latency: 80 ms Packet Loss: **~10%**	Yes	No	28.83%	2.0

Table 9 Microsoft Lync QoE Metric Results - Microsoft Lync Video Conference Call

Call From	Call To	WAN Impairment	Background Traffic Applied	QoS Applied	Average Frozen Frame %	MOS
All Sites	All Sites	None	Yes	Yes	0.05%	5
		None	No	Yes	0.05%	5
		Latency: 80 ms Packet Loss: **~10%**	Yes	Yes	18.38%	3.1
		Latency: 80 ms Packet Loss: **~10%**	Yes	No	43.46%	1.8

Note: Test results on the phones that were not available through the Lync Monitoring Server are not included.

7 Conclusion

As the adoption and migration continues towards unified communications, the Microsoft Lync Server platform is an ideal platform through which users can stay connected with the enterprise and one another. Dell EMC's networking infrastructure is the ideal platform for Microsoft Lync; by identifying and prioritizing traffic, it enables the Microsoft Lync Server to be deployed anywhere within the enterprise. The combination of Microsoft Lync Server and Dell Networking allows employees to communicate more reliably, securely and effectively over voice, video, IM, or conferencing than was ever before possible.

A Compatible Switches

The test plan presented in this document was conducted on Dell Networking Switches running the Dell Networking OS versions 9.5.0.0 and 6.1.0.1. The Dell EMC switches running these OS versions are listed below.

Dell Networking Data Center Switches running Dell Networking OS version 9.5.0.0:

M I/0 aggregator	S5000
MXL 10/40 GbE	S6000
S4810	Z9500
S4820T	Z9000

Dell Networking Campus Switches running Dell Network OS version 6.1.0.1:

8164	N3024F
8164F	N3024P
8132	N3048
8132F	N3048P
N2024	N4032
N2024P	N4032F
N2048	N4064
N2048P	N4064F
N3024	

B Reference

Manuals and documentation for the Force 10 S4810 Switch

http://www.dell.com/support/home/us/en/04/product-support/product/force10-s4810/manuals

Manuals and documentation for Dell Networking N-Series Switches

http://www.dell.com/support/home/us/en/04/product-support/product/networking-n2000-series/manuals

http://www.dell.com/support/home/us/en/04/product-support/product/networking-n3000-series/manuals

http://www.dell.com/support/home/us/en/04/product-support/product/networking-n4000-series/manuals