

Verizon LTE Mobile Private Network Cisco Jabber

Mobile Device Deployment Guide for
Private Network Traffic Management (LTE QoS)
on Verizon Wireless MPN

Revision 1.0

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Introduction

Verizon offers Private Network Traffic Management (PNTM) for the Verizon 4G LTE Mobile Private Network service (MPN). MPN provides private two key services:

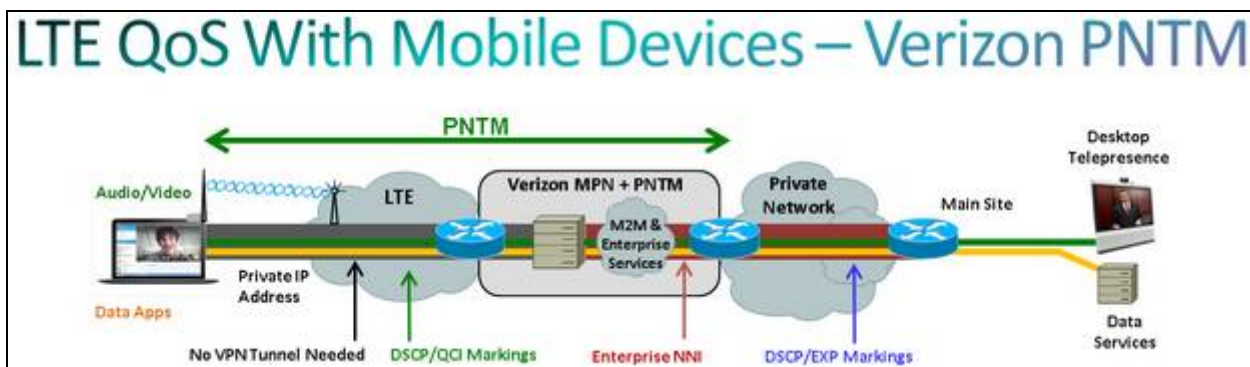
Last-mile access to an organization's internal network via 4G LTE or 3G: With MPN, enterprise traffic over Verizon LTE is not exposed to the public Internet. The ISR LTE IP address and LAN addresses are part of the organization's private address space allowing native routing and static IP device addressing.

A mobile device's (phone, tablet, laptop, etc.) LTE connection directly to an organization's private network: With MPN, enterprise or IoT traffic over Verizon LTE is not exposed to the public Internet. The mobile device's LTE IP address is part of the organization's private address space. This guide focuses on the mobile device use case.

With Verizon Private Network Traffic Management (PNTM) option for a mobile device, applications such as Jabber can leverage differentiated service (availability and priority) over LTE. This can provide an improved experience for users making voice and/or video calls, and instant messaging with mobile devices.

Mobile data applications receive best effort service currently. If the mobile device and important applications are able to appropriately mark packets, they can leverage the PNTM differentiated service. The guide will address data applications, however the focus is with the Cisco Jabber application.

Below is a figure depicting a mobile device with Verizon MPN and Private Network Traffic Management (PNTM).



Due to the flexibility of Verizon's PNTM service (DSCP-based QoS), any mobile application that can mark DSCP can be leveraged. As an example, Cisco's Jabber client can set DSCP in packets. The benefits are available to an organization leveraging either premises-base UC, or Verizon's cloud-based UC offering (Unified Communications and Collaboration as a Service, UCCaaS). Verizon offers PNTM and UCCaaS together: Verizon UCCaaS Mobile First.

With UCCaaS Mobile First, mobile voice and video calls using the Cisco Jabber client can be prioritized by Verizon 4G LTE Private Network Traffic Management. Additional functions of the service for mobile devices include an integrated dial plan, single number reach, enterprise caller ID, seamless handoff between devices, native Message Waiting Indicator, integrated voice & video calling/IM/Presence/screen sharing/file transfer, click to Webex, music on hold, call park/transfer, etc. The mobile device becomes a full enterprise unified communications endpoint, with mobility and security.

LTE QoS is based on a traffic flow template pushed to the end device's LTE modem from the network. Historically, the flow template was based on a 5-tuple (source and destination IP addresses, protocol, source and destination port numbers). A use case is streaming of pay-per-view video. This method of classification is limiting for enterprise LTE QoS usage.

Verizon and Cisco have partnered to leverage LTE technology for mobile device connectivity with Private Network Traffic Management. The efforts include deployment options, network enhancements, and testing, which meet today's LTE open 3GPP standards. Below are the key characteristics:

- Verizon offers two bearer channels across an LTE Private Network connection. Both bearers are part of a single logical connection. The service rate options are 0.5Mbps or 2Mbps for the bearer supporting Mission Critical Class-of-Service (CoS).
- Traffic is classified and placed onto the appropriate LTE bearer based on the ToS byte of an IP packet (e.g. DSCP value). This allows integration with an organization's existing QoS model per generally accepted practices (mark DSCP close to the source and treat traffic across the network based on DSCP in each packet). Multiple applications can map to the bearer offering enhanced QoS.
- The PNTM bearers include the dedicated bearer (supports all packets marked DSCP CS3, AF3x, CS4, AF4x, CS5, EF), and the default bearer (supports all other packet markings). The default bearer provides best effort service, while the dedicated bearer provides preferential treatment (Mission Critical CoS) up to the service rate. Traffic above the service rate in the dedicated bearer is dropped.

This document provide the following:

- Phone, Tablet and Laptop models supported by Verizon PNTM
- Applications found to properly mark traffic over LTE
- Guidelines for choosing the appropriate PNTM service rate
- Design considerations for Cisco UC and LTE-connected Jabber clients
- Examples of call statistics and bandwidth with different UC settings
- Configuration links and considerations

Phone, Tablet and Laptop models supported by Verizon PNTM

The following devices have been validated to support PNTM (support for multiple LTE bearers and send packets with appropriate DSCP marking to the correct bearer). For devices not on the list, please contact your Verizon Wireless representative.

Device	Details
Samsung SM-G900V (Galaxy S5)	Android Version 5.0 Baseband Version G900VVRU1BOC4 Kernel Version 3.4.0 (3/18/2015) Build SEPF_SM-G900V_5_0_0002 Hardware Version G900V.05
Samsung SM-T337V (Galaxy Tab)	Android Version 4.4.2 Baseband Version T337VVRU1ANE1 Kernel Version 3.4.0 (5/8/2014) Build KOT49H.T33VVRU1ANE1 Hardware Version T337V.03
Apple iPad 4	Version 8.1.3 (12B466) Modem Firmware 7.03.00
Apple iPhone 5	Version 8.3 (12F70) Modem Firmware 8.01.00
Pantech UML295 (Windows Laptop)	Hardware Revision REV_03 Firmware Version L0295VWD500F.B4

Applications Found to Properly Mark Traffic Over LTE

Currently, Cisco Jabber release 11.0 has been tested and found to support PNTM. Information can be found here:

www.cisco.com/c/en/us/products/collateral/unified-communications/cius/data_sheet_c78-658146.html

www.cisco.com/c/en/us/products/collateral/unified-communications/jabber-android/data_sheet_c78-649887.html

Guidelines for choosing the appropriate PNTM service rate

The two options for the PNTM differentiated service rate are 0.5Mbps and 2Mbps. The rate applies to each individual LTE subscription (each mobile device). Choosing the appropriate rate per device can be done by determining which mobile applications need preferential treatment, determining the bandwidth desired for each, and totaling the bandwidth.

For Cisco Jabber, determining the desired bandwidth is based on audio and video quality desired. Details are available at

www.cisco.com/c/en/us/td/docs/voice_ip_comm/jabber/11_0/CJAB_BK_C04C09E7_00_cisco-jabber-110-planning-guide.html

The maximum video and audio codecs and resolution vary for different mobile devices. Generally, obtaining the highest quality video and audio will lead to selecting the 2Mbps service rate, as more than 0.5Mbps would be required. Also, if screen sharing is desired, that will require additional bandwidth. The planning guide link above provides the detail for audio, video and screen sharing/presentation sharing. Below are examples from the planning guide for iPad and Android tables.

Bandwidth Performance Expectations for Cisco Jabber for Android

Note that VPN increases the size of the payload, which increases the bandwidth consumption.

Upload speed	Audio	Audio + Interactive Video (Main Video)
125 kbps under VPN	At bandwidth threshold for g.711. Insufficient bandwidth for video. Sufficient bandwidth for g.729a and g.722.1.	Insufficient bandwidth for video.
256 kbps	Sufficient bandwidth for any audio codec.	Transmission rate (Tx) — 256 x 144 at 15 fps Reception rate (Rx) — 256 x 144 at 30 fps
384 kbps under VPN	Sufficient bandwidth for any audio codec.	Tx — 640 x 360 at 15 fps Rx — 640 x 360 at 30 fps
384 kbps in an enterprise network	Sufficient bandwidth for any audio codec.	Tx — 640 x 360 at 15 fps Rx — 640 x 360 at 30 fps

Bandwidth Performance Expectations for Cisco Jabber for iPhone and iPad

The client separates the bit rate for audio and then divides the remaining bandwidth equally between interactive video and presentation video. The following table provides information to help you understand what performance you should be able to achieve per bandwidth.

Note that VPN increases the size of the payload, which increases the bandwidth consumption. VPN is commonly used for LTE on the public network. Traffic across a private LTE network (such as Verizon MPN) is separated from the public Internet.

Upload speed	Audio	Audio + Interactive Video (Main Video)
125 kbps under VPN	At bandwidth threshold for g.711. Insufficient bandwidth for video. Sufficient bandwidth for g.729a and g.722.1.	Insufficient bandwidth for video.
290 kbps	Sufficient bandwidth for any audio codec.	256 x 144 at 20 fps
415 kbps	Sufficient bandwidth for any audio codec.	640 x 360 at 20 fps
1024 kbps	Sufficient bandwidth for any audio codec.	1280 x 720 at 20 fps

If applications in addition to Cisco Jabber will benefit from preferential treatment by PNTM, the 2Mbps option may be beneficial. Although the maximum bit rate used for Jabber calling can be configured, other data application may not be controlled. In addition, the mobile device may not have the ability to closely control prioritization of voice/video traffic over data traffic within the device itself.

Design considerations for CUCM and LTE-connected Jabber clients

If the PNTM service rate chosen is 0.5Mbps, it is feasible for the bandwidth used by a Mobile client with Cisco Jabber to exceed it. This is not desirable, as the traffic above the service rate will be dropped, affecting audio and video call quality. Cisco Unified Communications can be configured to limit the maximum bandwidth used by a particular mobile client for voice and video calling. This ability exists whether the device part of a premises-based call control system, or leverages a cloud-based unified communications service such as Verizon's Unified Communications and Collaboration as a Service offering. www.verizonenterprise.com/products/advanced-communications/unified-communications-collaboration

Two Cisco Unified Communications functions that work together are Locations (call admission control, the maximum number of simultaneous calls from a location based on bandwidth) and Regions (defining the maximum per-call audio and video bandwidth from an endpoint). As each LTE mobile device has its own network connection, Locations would not be used as a call admission control technique. In other words, including an organization's LTE mobile devices in one UC "Location" and then limiting the maximum # of calls would not be beneficial.

Regions are useful as a method to determine the maximum bandwidth per user on a call. An LTE mobile device can be defined in a Cisco UC Region that can limit the maximum bandwidth per call for both audio and video communications. Based on those limitations, the endpoint will use the best audio and video codec that it can support, and that will yield a bit rate within the defined limits. An example would be to create two Regions for mobile video devices, one for devices leveraging 2Mbps PNTM and one for device using 0.5Mbps PNTM service rate.

Examples of Device Pools and Regions in Cisco Unified Callmanager (CUCM)

The CUCM Region a device would be configured with is one of a number of policies associated with an endpoint definition. The CUCM links in this document provide information regarding these policies. The association of a Region to an endpoint such as a phone or Jabber mobile device can be accomplished in a few ways. As an example, an endpoint can have policies applied based on which Device Pool it is placed in. The Region is defined within a Device Pool.

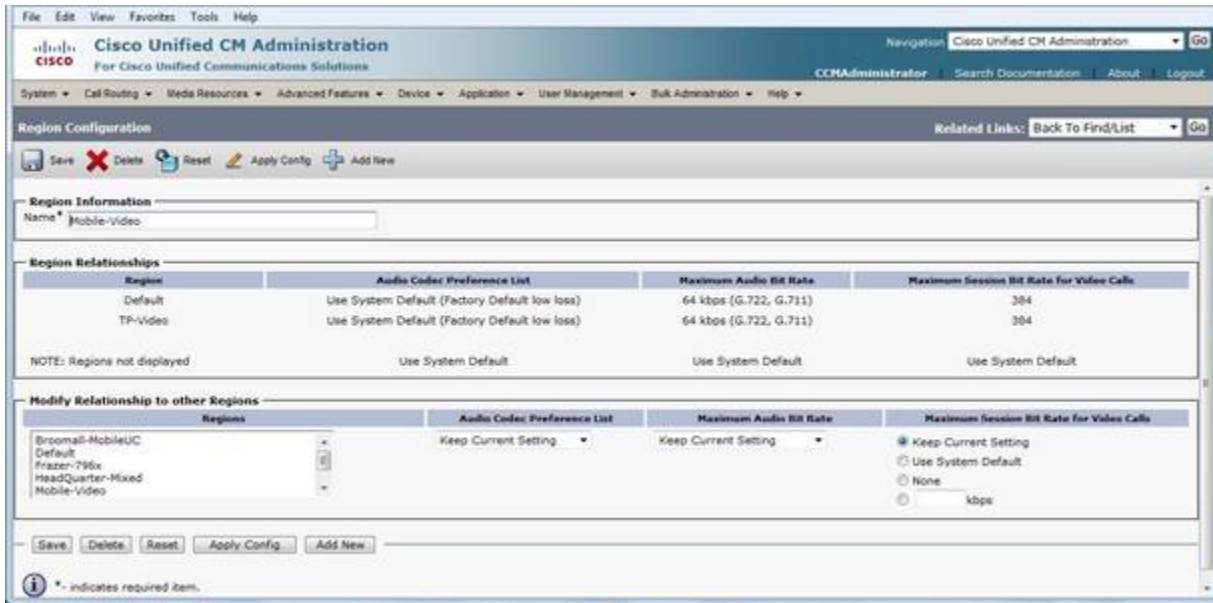
To continue the example, a mobile Jabber client can be defined and associated with a Device Pool named "Mobile-Video". The "Mobile-Video" device pool can be associated to a Region named "Mobile-Video". Below are snapshots of these CUCM definitions. The first snapshot is of a Device Pool setting, which would be associated via the CUCM endpoint definition.

The screenshot shows the 'Device Pool Details' configuration page in a web browser. The browser address bar shows the URL: <https://10.20.80.9/ccmadmin/devicePoolDetail.do?setToken=0&key=8b2d703b-6c36-2e2a-3c54-eed3f09b>. The page title is 'Device Pool Details'. The configuration is divided into two main sections:

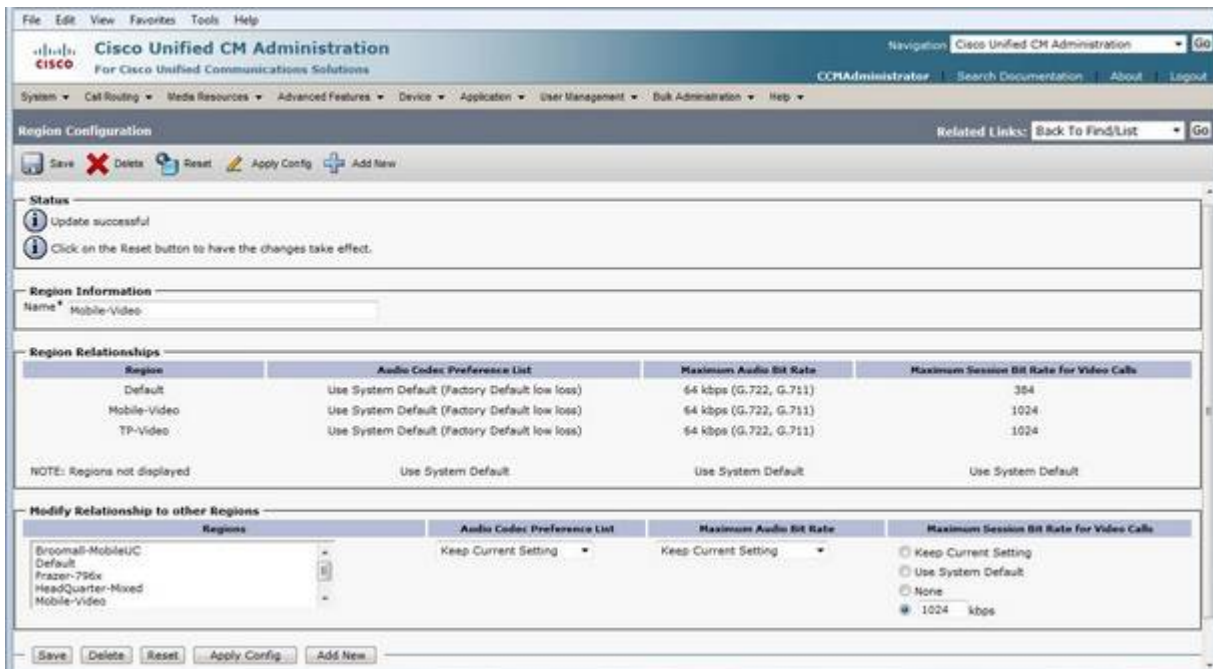
- Device Pool Settings:**
 - Device Pool Name*: Mobile-Video
 - Cisco Unified Communications Manager Group*: Default
 - Calling Search Space for Auto-registration: < None >
 - Adjunct CSS: < None >
 - Reverted Call Focus Priority: Default
 - Local Route Group: < None >
 - Intercompany Media Services Enrolled Group: < None >
- Roaming Sensitive Settings:**
 - Date/Time Group*: CNLocal
 - Region*: Mobile-Video
 - Media Resource Group List: Default_MRGL
 - Location: < None >
 - Network Locale: < None >
 - SRST Reference*: Disable
 - Connection Monitor Duration***: (empty field)
 - Single Button Barge*: Default
 - Join Across Lines*: Default
 - Physical Location: < None >
 - Device Mobility Group: < None >

The browser window also shows a 'Certificate error' message in the top right corner. The zoom level is set to 100%.

The following snapshot is of the Regions with only “TP-Video”, set with a maximum video bandwidth of 384Kbps.

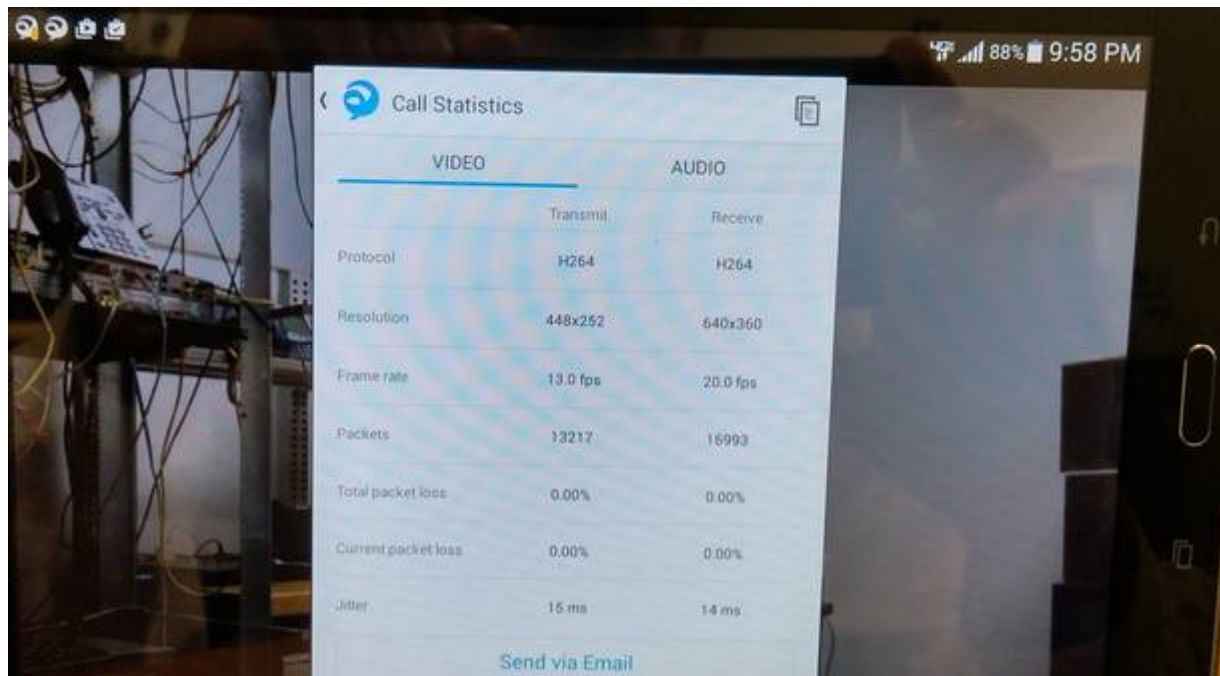
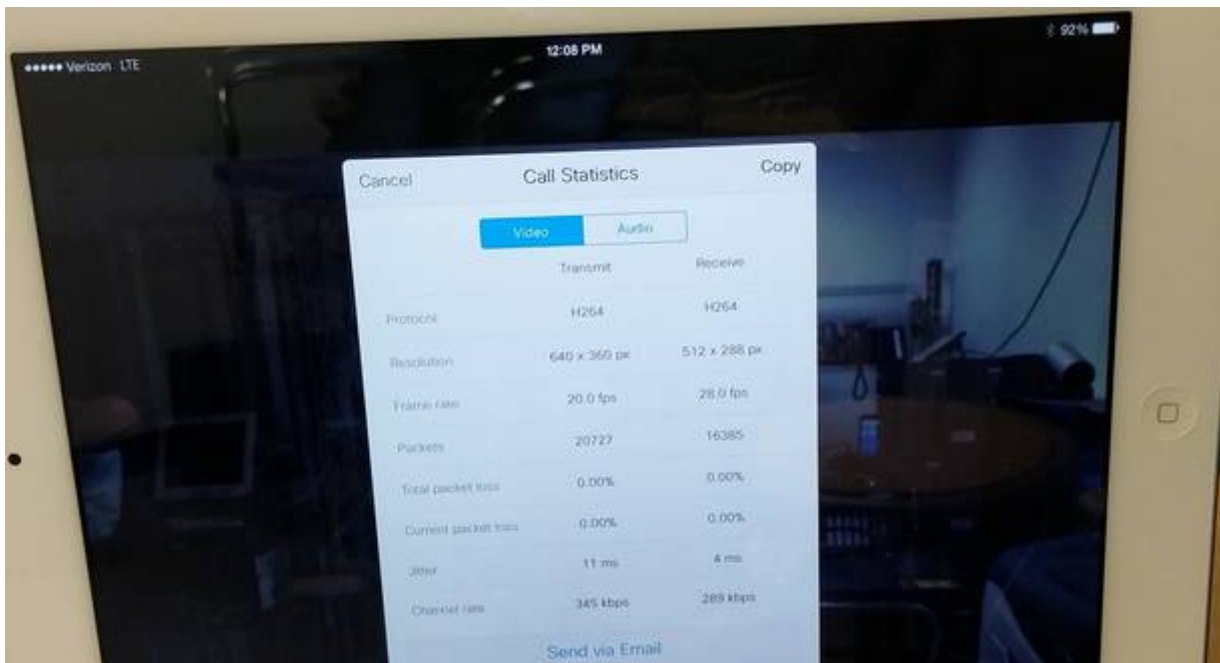


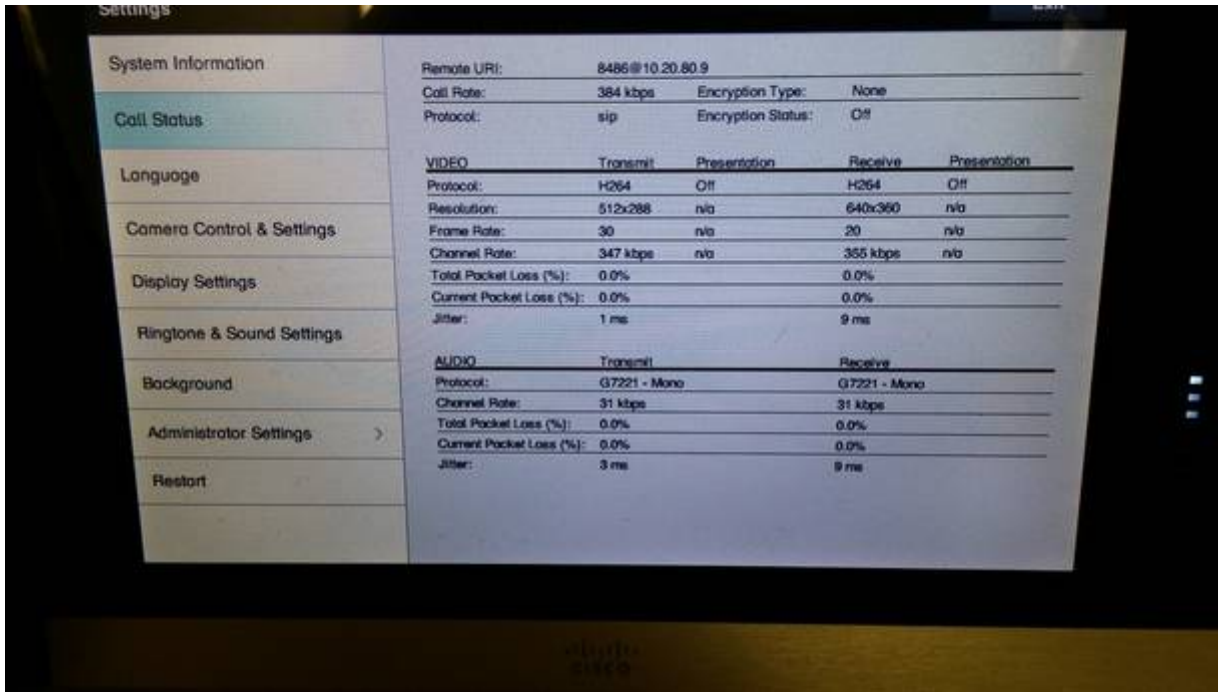
The following snapshot is of the Regions with “Mobile-Video” and “TP-Video”, both set with a maximum video session bandwidth of 1024Kbps.



Examples of Call Statistics With UC Region Settings of 384Kbps and 1024Kbps

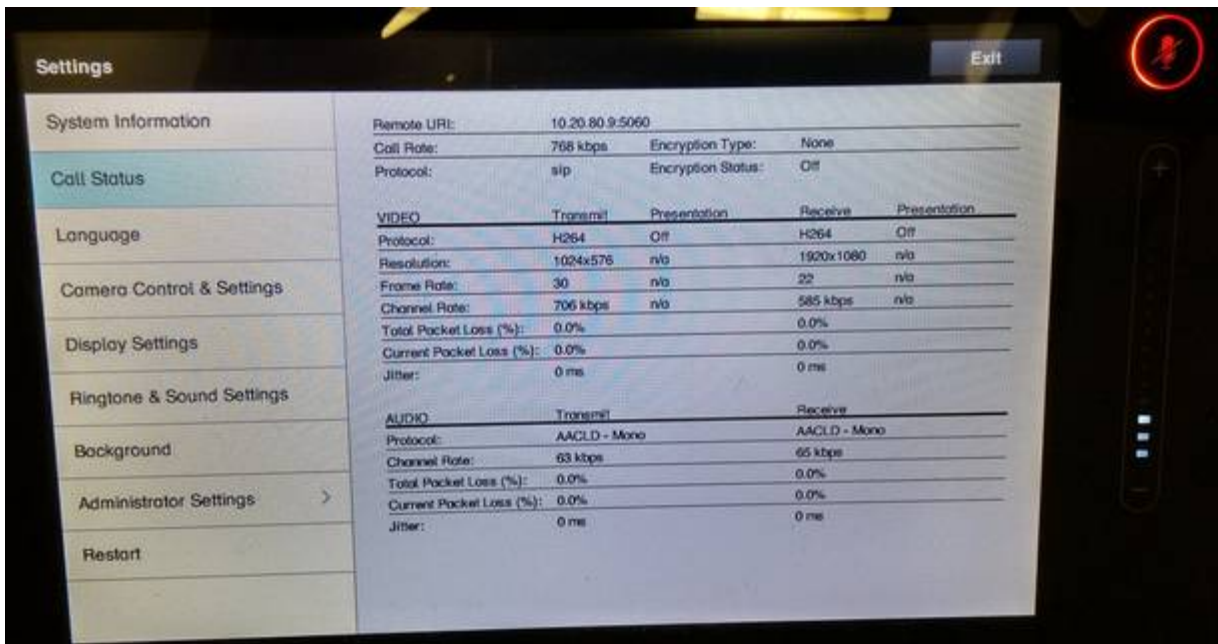
Below are examples of using a region setting of 384Kbps for video and 1Mbps for video. The audio setting is 100Kbps. The images include statistics for point-to-point calls between an LTE mobile Jabber device and an EX60 within the enterprise landline network, where all devices are in a region that limit video to 384Kbps. The first image is of the iPad, followed by the galaxy tablet, followed by the Cisco EX60 endpoint (the latter's statistics were similar with both tablets).





The following images include statistics for point-to-point calls between an LTE mobile Jabber device and an EX60 within the enterprise landline network, where all devices are in a region that limit video to 1024Kbps. The first image is of the iPad, followed by the galaxy tablet, followed by the Cisco EX60 endpoint (the latter's statistics were similar with both tablets, also shown is a snapshot of EX60 statistics in a 3-way multipoint MCU call with the 2 LTE Jabber clients abd 1024Kbps region).





Configuration Considerations and Links

Considerations:

- Verizon PNTM is an option for Verizon Mobile Private Network. An MPN is a prerequisite for PNTM
- Leverage Verizon PNTM validated mobile devices if feasible. For other devices, contact your Verizon representative.
- Testing of other applications for their ability to mark DSCP would be performed by an organization. One method may be to test the mobile device over WiFi and capture the packets sent by the WiFi Access Point over the Ethernet infrastructure. This assumes QoS over the LAN has been configured.
- Testing of the mobile device running multiple applications concurrently would be performed by an organization, to ensure that the device itself does not cause delay, jitter or loss of mission critical packets.
- Ensure that UC provisioning (e.g. region settings) for the Jabber mobile client match the PNTM service rate for the client

Links:

Information regarding Cisco Unified Communications bandwidth management and Call Admission Control:
www.cisco.com/c/en/us/td/docs/voice_ip_comm/cucm/srnd/collab11/collab11/cac.html

Information regarding bandwidth consumption with varying Cisco Jabber audio and video codecs:
www.cisco.com/c/en/us/td/docs/voice_ip_comm/jabber/11_0/CJAB_BK_C04C09E7_00_cisco-jabber-110-planning-guide/CJAB_BK_C04C09E7_00_cisco-jabber-110-planning-guide_chapter_010.html#CJAB_RF_SAB7C6B3_00

Cisco Jabber 11 release notes:
www.cisco.com/c/en/us/td/docs/voice_ip_comm/jabber/Windows/11_0/RN/JABW_BK_C5E7828C_00_cisco-jabber-windows-11-release-notes.html

Cisco Jabber installation and configuration guide:
www.cisco.com/c/en/us/td/docs/voice_ip_comm/jabber/11_0/CJAB_BK_D657A25F_00_deployment-installation-guide-jabber-110.html

Cisco Communications Manager feature guide:
www.cisco.com/c/en/us/td/docs/voice_ip_comm/cucm/admin/11_0_1/featureConfig/CUCM_BK_FE5123E0_00_cucm-feature-configuration-guide_1101.html

Compatibility matrix for Cisco UC, including CUCM and Jabber releases:
www.cisco.com/c/en/us/td/docs/voice_ip_comm/uc_system/unified/communications/system/Compatibility/CSR-Compatibility-Matrix.html

Verizon Unified Communications and Collaboration as a Service fact sheet:
www.verizonenterprise.com/resources/factsheet/fs_unified-communications-and-collaboration-services_en_xg.pdf

QoS information page for Microsoft Windows: <https://technet.microsoft.com/en-us/network/bb530836.aspx>

Frequently Asked Questions

Q) What other mobile applications can mark the DSCP bits?

A) Currently Cisco Jabber is the only application tested to do so. The guide will be updated as additional applications are validated.

Q) I have a Windows laptop with an LTE interface. Can it support QoS (sending of traffic with DSCP set by an application)?

A) Assuming the application is capable of marking packets, the following guide provides for how to enable QoS on Microsoft Windows: <https://technet.microsoft.com/library/dd919203.aspx>




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