WHITE PAPER

ENHANCED UNIFIED COMMUNICATION QOE THROUGH SOFTWARE-DEFINED NETWORKING (SDN)

Abstract

The concept of SDN (Software-defined Networking) originated from Stanford University in 2005 with their CleanState project to redefine the internet from a clean perspective with Control and Data plane separated and the former running on a general purpose server. While enterprises are adopting SDN to address their network routing inefficiencies, Unified Communication (UC) applications like Cisco Unified Communication Manager and Microsoft Lync could be enhanced to monetize their investments. In this paper, we are trying to address the limitation in the UC deployment through SDN which currently has static bandwidth allocation using Call Admission Control (CAC). We are proposing an implementation of a new Unified Communication Control Layer (UCCL) library which could be used by any application including UC core to dynamically allocate requisite bandwidth. This policy-controlled UCCL could be used in conjunction with CAC in UC deployment.

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Introduction

SDN enables programming the network from the application layer and enables users to dynamically manage network traffic based on the changing environment. This disruptive technology also paves the way to automate network provisioning, regulate traffic patterns without altering the existing physical networking infrastructure, while delivering Network and Security services in a much faster, efficient, and centralized manner and which is widely supported by many vendors like Ericsson, Juniper, Cisco, AT&T, etc. Because of its disruptive nature, there would be multiple thought processes which we need to deeply explore from various perspectives including applications like Cloud computing, UC, etc., which are currently deployed with or without any SDN concepts.

Figure 1 depicts a typical multisite UC deployment scenario without SDN. The UC clusters are interconnected to the network through IP WAN / PSTN where CAC will be used to set a static threshold for Audio/ Video (AV) packet flow for better QoS.

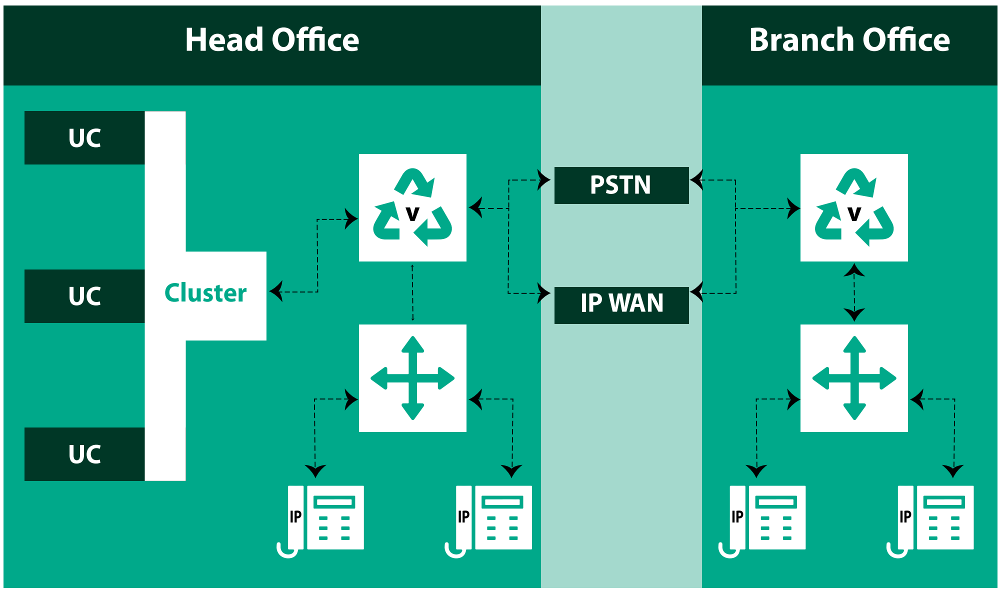

Figure 1. Typical Multisite UC deployment

Current limitations in UC Deployment

- **Static Configuration:** UC configuration needs to be manually changed every time to adapt to bandwidth changes or policy changes regarding video/audio access.
- **Scalability:** If webcast access is to be given to a greater number of viewers, then the existing bandwidth may not suffice even though there could be some unused bandwidth.
- **Cost:** Existing bandwidth must be increased to accommodate more users or to give more number of viewers video access which will result in additional costs.
- **Less efficient:** Dropped sessions will result in unused bandwidth leading to bandwidth wastage.
- **Admin Overhead:** UC configuration needs to be changed periodically for changes in the organization with increase or decrease in headcount.

Figure 2 below lists the tightly coupled interdependencies of Network and UC admin which are required for smooth operation. Less than adequate coordination will lead to poor QoE, which many enterprises are experiencing today.

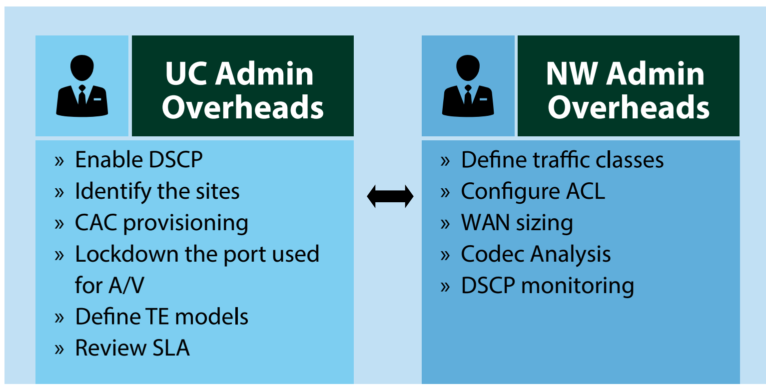

Figure 2. Comparison of Admin overheads

Proposed solution

We are proposing a UCCL layer, to enhance the QoS for UC (but not limited to UC), which will abstract the high number of complex NBI APIs to simplified APIs and can work across any SDN aware network solutions along with the existing CAC implementation.

Figure 3 depicts UC deployment scenario with SDN. Applications like UC core may use UCCL to abstract requisite information from NBI for dynamic bandwidth allocation. UCCL is a platform-independent layer which can communicate to any controller.

The below diagram (Figure 4) represents the high-level design of the proposed UCCL which interfaces the UC applications with SDN. (Note: The design given may not satisfy myriad application requirements).

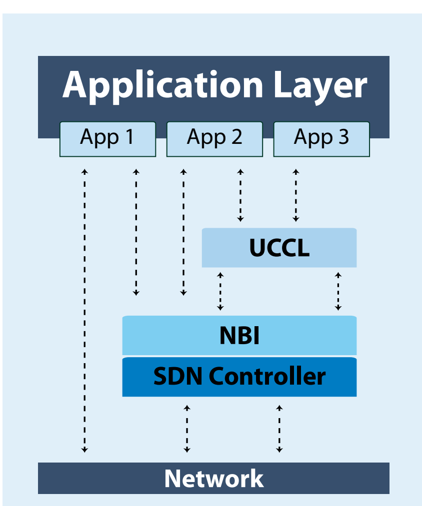

Figure 3. Network Access Layers

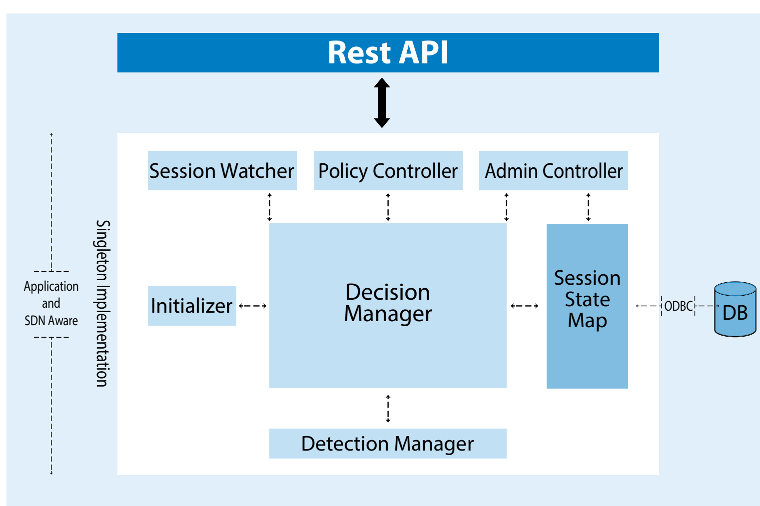

Figure 4. UCCL High level design

Session Watcher:
Monitor each session (voice, video, etc.) and keep track of them.

Policy Controller:
Define the local policies for the Apps.

Admin Controller:
Administrative interface (Queries, Status, etc.)

Decision Manager:
Core of the library which interacts with all other modules and apply changes as required.

Detection Manager:
Module which will monitor the updates from SDN

Session state Map:
Data structure to hold the library parameters (Media type, session-policy mapping, etc.)

The Detection Manager may implement the call procedure sequentially in the order listed below:

- Retrieve the NW topology list from SDN Controller
- Get the node properties from the topology list including resource availability
- Apply the UC and NW policies set by the admin and update corresponding application

Advantages of this approach

Without UCCL	With UCCL
Less efficient implementation since UC needs to make a high number of queries to the SDN API	Implementation efficiency is higher since the UC needs to make lesser number of queries
Multiple policies	Centralized policy
Slower deployment	Deployment can be faster due to lesser communication between NW and UC admin
Bandwidth over-provisioning	Accurate provisioning due to higher bandwidth utilization
Application has to be modified to call SDN API to make it an application-aware SDN	UCCL will provision to make the SDN, application-aware

Implementation View

Our proposed approach can be implemented in many ways. Two of the scenarios where it can be implemented are listed below.

Scenario 1: Bandwidth utilization

Here we are considering a large organization with three amongst their many branches, located at three different geographical locations with bandwidth of 500, 300, and 100 Mbps network WAN connectivity between these sites respectively. Each location has 250+ video endpoints. This will go up in the near future as the enterprise moves forward with more UC adoption through Mobile UC, Web Conference solutions, Cloud solutions, etc.

For each of the video endpoints, 2 Mbps of bandwidth needs to be reserved (to maintain QoS), so this requires ~500 Mbps of bandwidth. As in a typical enterprise scenario, the network admin would restrict the A/V call bandwidth to 1/5th of the total bandwidth (100 Mbps in this case).

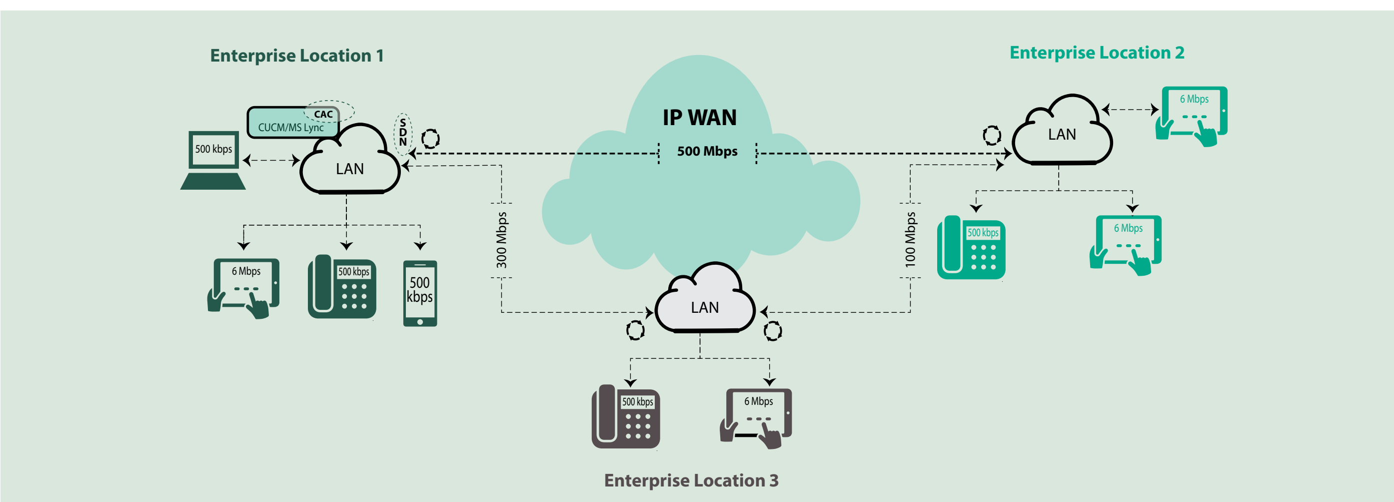

Figure 5. Dynamic Bandwidth Allocation in Enterprise Network

The bandwidth would be allocated by Cisco CM or Microsoft Lync through Call Admission Control (CAC) which would ensure that the bandwidth usage does not exceed 100 Mbps. This will restrict the maximum number of A/V calls to 50.

With SDN, this problem can be overcome by having UC application manage the bandwidth allocation using SDN updates through NBI. Here, the SDN would be aware of the topology and total bandwidth utilization and hence restriction need not be placed at the application layer. This will also eliminate the CAC limitations like excess calls being allowed due to race condition and the bandwidth reservation path calculated by UC application not accurately reflecting the network conditions during network failure. For example, if CAC is already configured for location 3 according to its bandwidth of 300 Mbps and if that network fails, then the service provider will reroute traffic through location 2, wherein the CAC reservation path would not suffice (since the line is only 100 Mbps from L2 to L3). Hence, using UCCL with SDN, bandwidth utilization will be optimum and will result in better QoE at lower cost (Estimated cost savings of using SDN over traditional UC deployment can be up to five times).

Scenario 2: Dynamic QoS

The other case is applicable for Automated QoS Network Service Application which is already published by ONF SDN WG.

Assumptions

The paper hereby assumes that:

- The requisite NBI APIs will be available across various SDN solutions for third party applications.
- The implementation of this approach could either be in the UC application itself or as a stand-alone, as may be deemed fit by the solution architect.
- The security aspects have not been considered.

Conclusive Summary

SDN is increasingly being adopted in Data centers and Enterprises. This paper is intended to provide an approach for dynamic bandwidth allocation using SDN by implementing an intermediate layer which can be utilized by UC for enhanced QoE. There could be many other dimensions explored using this layer for similar applications.

Glossary

- ACL – Access Control List
- CAC –Call Admission Control
- DSCP – Differentiated Services Code Point
- NBI – North Bound Interface
- QoS – Quality of Service
- QoE – Quality of Experience
- UCCL – Unified Communication Control Layer

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References

- Irwin Lazar. "Five unified communications trends that change the collaboration game".

  Internet: http://www.searchunifiedcommunications.techtarget.com/feature/Five-unified-communications-trends-that-change-the-collaboration-game Oct 2013 [Apr 2015]

- "SDN Architecture Overview". Internet: https://www.opennetworking.org/images/stories/downloads/sdn-resources/technical-reports/TR_SDN-ARCH-Overview-1.1-11112014.02.pdf Version 1.1, Nov 2014 [Apr 2015]

- Diana Gowen: "Bandwidth on Demand". Internet: http://www.centurylink.com/business/asset/channel/smart-solutions-bandwidth-on-demand-ethernet-services.pdf, Jun 2013 [May 2015]

- "Automating QoS". Internet: http://portal.imtc.org/DesktopModules/Inventures_Document/FileDownload.aspx?ContentID=21766, Version 1.2, Feb 2014 [May 2015]

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