



Preferred Architecture for Cisco Webex Hybrid Services

Design Overview

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Preface

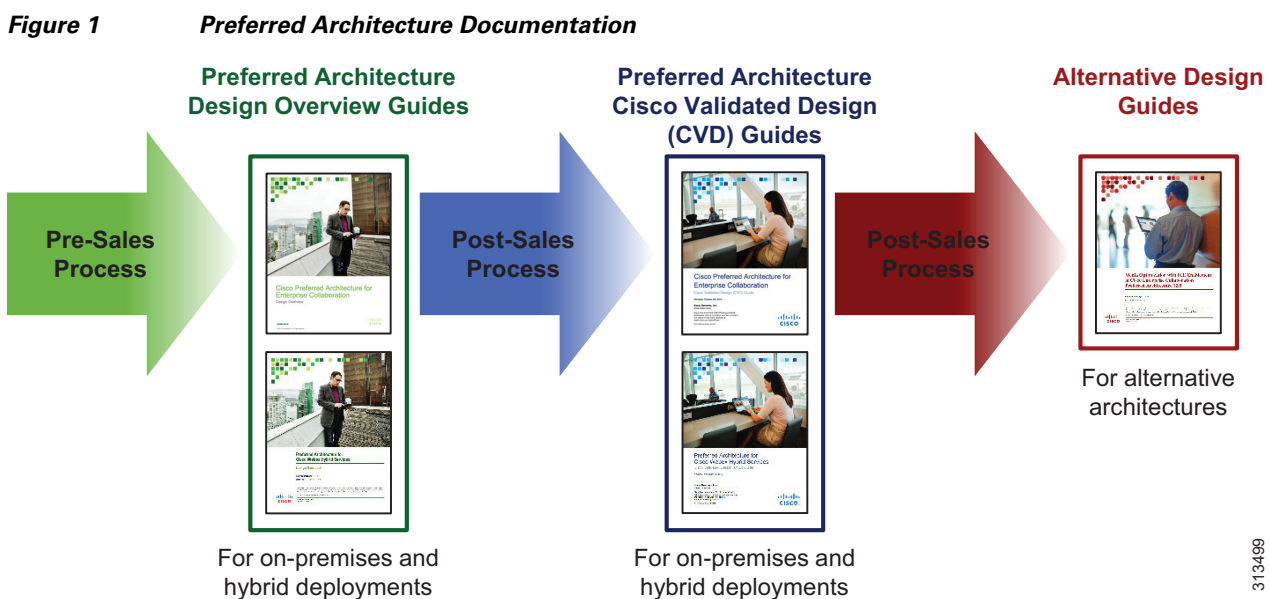
Cisco Preferred Architectures provide tested and recommended deployment models for specific market segments based on common use cases. They incorporate a subset of products from the Cisco Collaboration portfolio that is best suited for the targeted market segment and defined use cases. These deployment models are prescriptive, out-of-the-box, and built to scale with an organization as its business needs change. This prescriptive approach simplifies the integration of multiple system-level components and enables an organization to select the deployment model that best addresses its business needs.

Documentation for Preferred Architectures

The following types of Cisco documents describe and explain the Preferred Architectures:

- [Preferred Architecture \(PA\) Design Overview Guides](#) help customers and sales teams select the appropriate architecture based on an organization's business requirements; understand the products that are used within the architecture; and obtain general design best practices. These guides support pre-sales processes.
- [Preferred Architecture Cisco Validated Design \(CVD\) Guides](#) are post-sales documents that describe the Preferred Architectures in detail, provide design and deployment recommendations and best practices, and outline the PA deployment procedures and steps at a high level.
- [Alternative Design Guides](#) are post-sales documents that describe optional designs that can be deployed as alternatives to the Preferred Architectures described in the PA overview guides and CVDs. The alternative design always starts with the main PA as a foundation and builds upon it; therefore, each alternative design guide should be used in conjunction with its corresponding PA overview guide and CVD.

Figure 1 illustrates how to use the PA guides.



About This Guide

The Preferred Architecture for Cisco Webex Hybrid Services is for:

- Sales teams that design and sell collaboration solutions
- Customers and sales teams who want to understand the overall hybrid architecture, its components, and general design best practices

Readers of this guide should have a general knowledge of Cisco Collaboration products and services along with a basic understanding of how to deploy those products.

This guide simplifies the design and sales process by:

- Recommending products and services in the Cisco Collaboration portfolio that are built for the enterprise and that provide appropriate feature sets for this market
- Detailing a collaboration architecture and identifying general best practices for deploying in enterprise organizations

For detailed information about configuring, deploying, and implementing this architecture, consult the related CVD documents for the [Cisco Collaboration Preferred Architectures](#).

Introduction

More and more, organizations are choosing collaboration services from the cloud because cloud services:

- Are easier and faster to deploy
- Don't require the upfront capital investment of on-premises systems
- Provide predictable recurring expenditures through subscription-based user licensing
- Can free up IT staff to focus on other priorities

Many organizations, however, are unable or unwilling to move all their services to the cloud. Often, they are not ready to replace everything they have on-premises, or they simply want to augment their current collaboration tools with those from the cloud. But having tools from both the cloud and the premises can create inconsistent, disjointed user experiences.

Cisco solves this problem with Webex Hybrid Services. These services connect what you have on-premises with Webex Teams in the cloud to provide a single integrated experience. If you like the capabilities of Webex Teams, you can integrate those capabilities with what you currently have deployed for an even better end-user and administrator experience.

The Preferred Architecture (PA) for Webex Hybrid Services is a Cisco Validated Design (CVD) in the Preferred Architectures umbrella that was created as a supplement to the PA for Cisco Collaboration Enterprise on-premises deployments. It requires many of the same products and infrastructure as well as the architecture and planning incorporated in the PA for on-premises deployments. Therefore we expect you to follow and implement the latest version of the *Preferred Architecture for Cisco Collaboration Enterprise On-Premises Deployments*, available at <https://www.cisco.com/go/pa>, prior to deploying the PA for Webex Hybrid Services.

As part of implementing the PA for Webex Hybrid Services, there are a number of products and integrations covered in the latest version of the [Preferred Architecture for Cisco Collaboration Enterprise On-Premises Deployments](#) that overlap with, and thus are not part of, the PA for Webex Hybrid Services. The areas of overlap include Cisco Meeting Server, Cisco Unified Communications Manager IM and Presence Service, and Cisco Jabber. This does not mean that these products and services cannot be

deployed in an environment with Webex Hybrid Services, but that this PA for Webex Hybrid Services will not discuss or treat any design considerations around these on-premises products and services when they overlap with those included in the Webex Hybrid Services solution.

Technology Use Cases

Organizations want to streamline their business processes, optimize employee productivity, and enhance relationships with partners and customers. The Preferred Architecture (PA) for Cisco Webex Hybrid Services delivers capabilities that enable organizations to realize immediate gains in productivity and enhanced relationships. Additionally, the following technology use cases offer organizations opportunities to develop new, advanced business processes that deliver even more value in these areas:

- **Meetings** — Bring people together to create, communicate, and collaborate in one continuous work stream before, during, and after the meeting so that teams can be more effective while using any mobile or video device. Invite others to join meetings from their desk, a branch office, their homes, or the road with Webex Teams or on their Cisco on-premises endpoint or room device.
- **Messaging** — Exchange messages and share files with another person or a group of people. Message anyone; choose someone from your company directory or simply enter an email address and start messaging customers, partners, or anyone you need to work with.
- **Calling** — Webex Teams includes cloud-based calling. With Webex Teams, you can make calls to any other Webex Teams user in any company, as well as calls to any endpoint or room device deployed in your Cisco Enterprise on-premises solution. You can make and receive calls from a phone connected to the Webex Teams service in the office or from the Webex Teams application on your mobile phone or desktop. When integrated with Webex Hybrid Services, Webex Teams applications also support enterprise dialing habits such as numerical dialing to on-premises endpoints and the PSTN. (PSTN connectivity is provided through Cisco Unified Communications Manager deployed on the enterprise premises.)
- **Enhanced user experience** — The Webex Teams application is central to Webex Teams. The application gives the user the ability to access, use, and control the meetings, messaging, whiteboarding, and calling capabilities of Webex Teams, depending on the user's license entitlement. Users can also share content when in a meeting, when messaging, or while on a call. The Webex Teams application is how users access the service on their smartphones, via a browser, or via a dedicated application on their Mac or Windows PC.
- **Incorporate video, desktop sharing, and persistent messaging into meetings** — Improve communications, relationships, and productivity by making it easier to meet face-to-face over distance.
- **Extend telephony with video** — Facilitate face-to-face video communications directly from end-user phones or softphone applications.
- **Support teleworkers and branch offices** — Let employees work from multiple locations, whether satellite offices, home offices, or over the Internet when mobile.
- **Collaborate with external organizations** — Easily share information, interact in real time, and communicate using technologies beyond email and phones.
- **Create flexible work areas and office spaces** — Scale office space and create work areas that foster employee inclusiveness, collaboration, innovation, and teamwork.

The Benefits of Webex Hybrid Services

Cisco Webex Hybrid Services provide:

- **Consistent, unified user experience** — End users and IT administrators get the best of cloud and on-premises technology. Webex Hybrid Services combine the cloud and on-premises services for an integrated experience. Examples include the ability to share your desktop instantly, automatic directory synchronization, and simplified scheduling of meetings.
- **Easier transition to the cloud** — Webex Hybrid Services help your organization take advantage of Cisco Collaboration cloud-based services without discarding your existing on-premises investments. Instead, you can integrate them together for a better user experience, and move to cloud services as and when you like.
- **High level of security** — Security is integral to Webex Teams and its hybrid services. Cisco has used its extensive experience gained from securing the world's largest networks. Combining this knowledge with the hardware and the software elements of our market-leading communications and cloud services, we've built Webex Teams and its hybrid capabilities to be secure from the ground up.

Architectural Overview

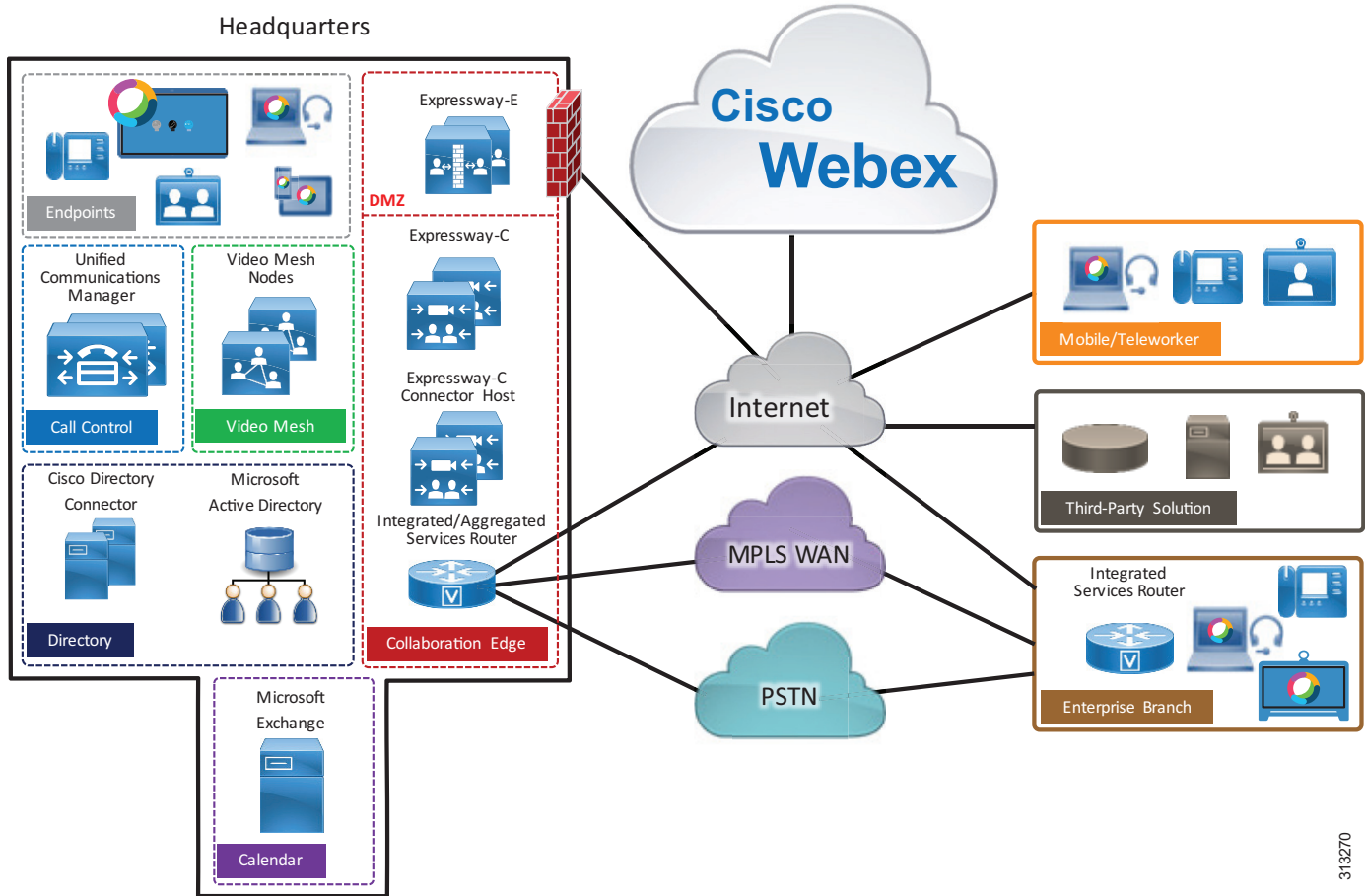
The Preferred Architecture (PA) for Cisco Webex Hybrid Services provides end-to-end collaboration targeted for deployments where a Cisco Collaboration solution based on Cisco Unified Communications Manager has been deployed. This architecture incorporates high availability for critical applications. The consistent user experience provided by the overall architecture facilitates quick user adoption. Additionally, the architecture supports an advanced set of collaboration services that extend to mobile workers, partners, and customers through the following key services:

- Voice and video communications
- Messaging
- Meetings that incorporate high-definition video, web conferencing, whiteboarding and content sharing capabilities
- Services for mobile and remote workers

Because of the adaptable nature of Cisco endpoints and their support for IP networks, this architecture enables an organization to use its current data network and the Internet to support both voice and video calls. The Preferred Architecture (PA) provides a holistic approach to bandwidth management, incorporating an end-to-end QoS architecture and video rate adaptation and resiliency mechanisms to ensure the best possible user experience for deploying pervasive video over managed and unmanaged networks.

The PA for Webex Hybrid Services, illustrated in [Figure 2](#), provides highly available and centralized on-premises and cloud services. These services extend easily to remote offices and mobile workers, providing availability of critical services even if communication to headquarters is lost. Centralized on-premises and cloud-based services also simplify management and administration of an organization's collaboration deployment.

Figure 2 Preferred Architecture for Cisco Webex Hybrid Services



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Table 1 lists the products in this architecture. For simplicity, products are grouped into modules to help categorize and define their roles. The content in this guide is organized in the same modules.

Table 1 *Components of the Preferred Architecture for Cisco Webex Hybrid Services*

Module	Component	Description
Endpoints	Cisco IP Phones, Cisco Video Endpoints and Room Devices, and Cisco Webex Teams	Enable real-time message, meet, and voice/video communications for users
Cisco Webex Core Services	Cisco Webex Control Hub	Web portal that enables provisioning and management of Webex Teams users and services, registration of the Expressway-C Connector Host to Webex, Expressway connector upgrades, and registration of Webex calling devices
	Cisco Webex Teams Messaging	Provides persistent messaging and content sharing
	Cisco Webex Meetings	Provides audio/video meetings, with content sharing and web conferencing capabilities for meetings
	Cisco Expressway-C Connector Host Management Connector	Enables connectors hosted on Expressway-C to be managed by the Webex Control Hub
Cisco Webex Hybrid Directory Service	Cisco Directory Connector	Provides user synchronization between Microsoft Active Directory and Webex
	Microsoft Active Directory	Provides the full list of corporate users and their attributes
Cisco Webex Hybrid Calendar Service	Cisco Expressway-C Connector Host Calendar Connector	Provides integration between the enterprise calendaring application and Webex
	Microsoft Exchange	Provides corporate calendaring services
Cisco Webex Video Mesh	Cisco Webex Video Mesh Node	Provides on-premises media processing capabilities for Webex. This includes voice, video, and desktop sharing.
Cisco Webex Hybrid Call Service	Cisco Unified Communications Manager (Unified CM)	Provides endpoint registration, call processing, and media resource management
	Cisco Webex Device Connector	Enables integration between on-premises call processing services and room systems registered as Webex Devices
	Cisco Expressway-C and Expressway-E	Enable interoperability and firewall traversal with Webex

High Availability

The PA for Webex Hybrid Services provides high availability for all deployed on-premises applications by means of the underlying clustering mechanism present in all Cisco Unified Communications applications. Clustering replicates the administration and configuration of deployed applications to backup instances of those applications. Likewise, cloud services are natively redundant by virtue of elastic computing and highly available service distribution within the cloud platform.

If an instance of an application or service fails, Cisco on-premises and cloud-based services (such as endpoint registration, call processing, messaging, and many others) continue to operate on the remaining instance(s) of the application or service. This failover process is transparent to the users. In addition to clustering, the PA for Webex Hybrid Services provides high availability through the use of redundant power, network connectivity, and elastic storage.

In the PA for Webex Hybrid Services, the following cloud services are deployed redundantly:

- Cisco Webex Control Hub
- Cisco Webex Teams Messaging
- Cisco Webex Meetings

Sizing Considerations

Sizing a deployment can become complex for large enterprises with sophisticated requirements. The [Preferred Architecture for Cisco Webex Hybrid Services, Cisco Validated Design \(CVD\) Guide](#), presents some examples that simplify the sizing process.

Licensing

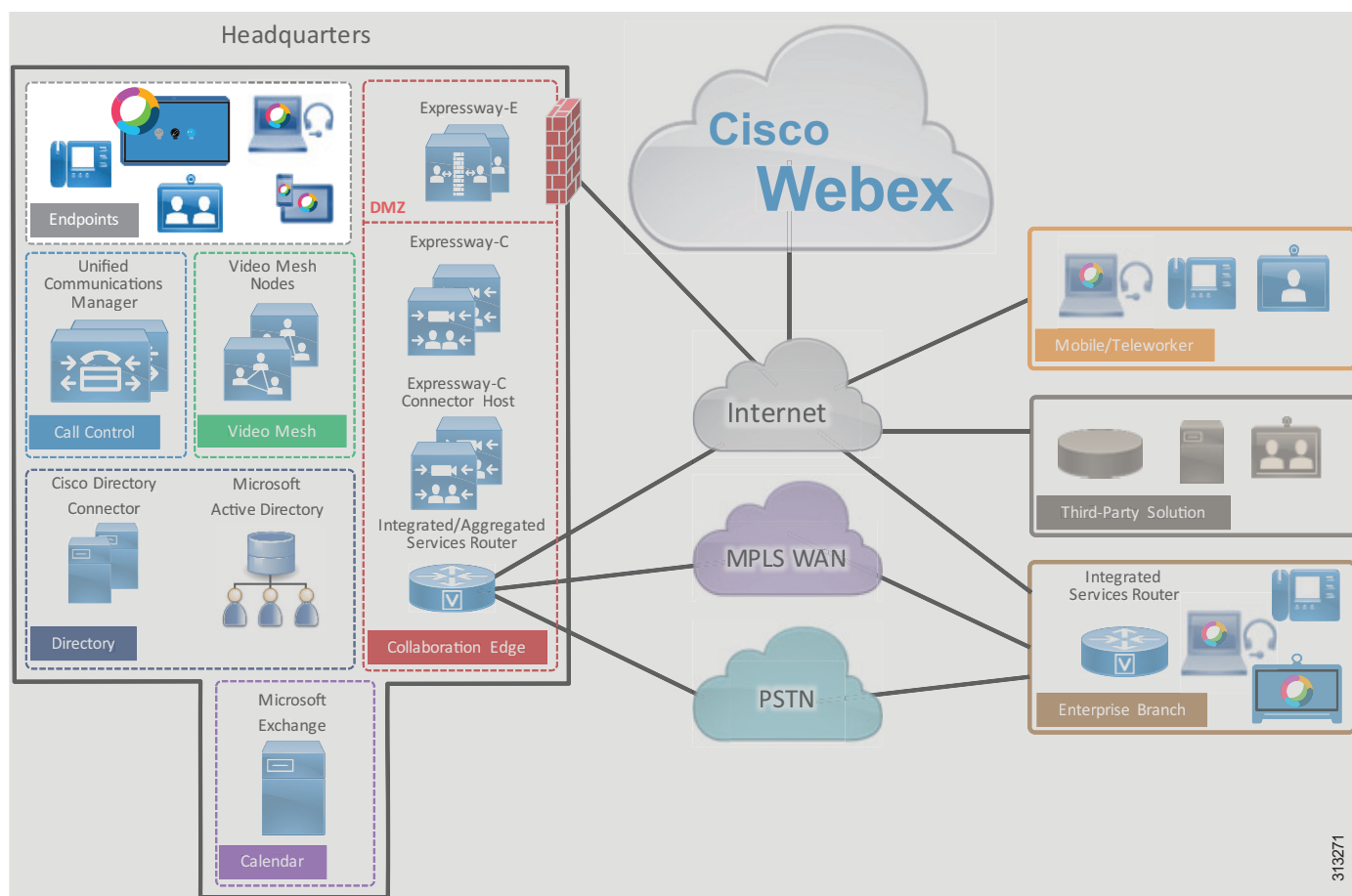
Details about the individual licenses for the endpoints and infrastructure components in the Preferred Architecture for Webex Hybrid Services are beyond the scope of this document. For information about licensing, see the [Cisco Collaboration Flex Plan](#).

Endpoints

Cisco Collaboration endpoints provide a wide range of features, functionality, and user experiences. Because Cisco endpoints range from low-cost, single-line phones and soft clients to presentation, whiteboard, and multi-screen Cisco TelePresence endpoints, an organization can deploy the right variety of endpoints to meet users' needs (Figure 3). Additionally, these devices enable users to access multiple communication services such as:

- Voice and video calling
- Meetings
- Messaging
- Desktop and content sharing
- Whiteboarding

Figure 3 Architecture for Endpoints



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Recommended Deployment

In the PA for Webex Hybrid Services, both Cisco Unified Communications Manager (Unified CM) on-premises call control and Cisco Webex provide endpoint registration and collaboration services.

We recommend the endpoints listed in the following tables because they provide optimal features for this design. Cisco has a range of [Collaboration Endpoints](#) with various features and functionality that an organization can also use to address its business needs.

Table 2 *Cisco IP Phones – Unified CM Only*

Product	Registration	Description
Cisco IP Phone 8800 Series	Unified CM	General office use, multiple-line phone
Cisco IP Phone 8832	Unified CM	On-premises IP conference phone

Table 3 *Cisco Video Endpoints and Room Systems – Unified CM or Cisco Webex Device*

Product	Registration	Description
Cisco Webex DX80 (CE Firmware)	Unified CM	Personal TelePresence endpoint for the desktop
Cisco Webex Room Kit Series	Unified CM or Webex Room Device	Integrator and multipurpose TelePresence endpoints
Cisco Webex Room Series	Unified CM or Webex Room Device	Integrator and multipurpose TelePresence endpoints with built-in single or dual screens
Cisco Webex Board	Unified CM or Webex Room Device	All-in-one presentation, whiteboard, and audio/video multipurpose room endpoint

Table 4 *Cisco Webex Teams Application*

Product	Description
Cisco Webex Teams application: <ul style="list-style-type: none"> • Mobile <ul style="list-style-type: none"> – Cisco Webex Teams for Android – Cisco Webex Teams for iPhone and iPad • Desktop <ul style="list-style-type: none"> – Cisco Webex Teams for Mac – Cisco Webex Teams for Windows • Web <ul style="list-style-type: none"> – Cisco Webex Teams web client 	Application with cloud-based integrated voice/video call, message, meeting, and content sharing services for mobile devices, personal computers, and web browsers. The mobile and desktop clients are also capable of registering to Unified CM for voice/video calling.

Table 5 **Comparison of Endpoint Features and Capabilities**

Product(s)	Audio	Video	Content Sharing	Cisco Unified CM Registration	Cisco Webex Registration	Whiteboarding
Cisco IP Phone 8800 Series	Yes	Yes ¹	No	Yes	Yes ²	No
Cisco IP Phone 8832	Yes	No	No	Yes	No	No
Cisco Webex DX80	Yes	Yes	Yes	Yes	Yes	No
Cisco Webex Room Kit Series	Yes	Yes ³	Yes	Yes	Yes	Yes ⁴
Cisco Webex Room Series	Yes	Yes ³	Yes	Yes	Yes	Yes ⁴
Cisco Webex Board	Yes	Yes	Yes	Yes	Yes	Yes
Cisco Webex Teams Mobile	Yes	Yes	Yes	Yes	Yes	Yes
Cisco Webex Teams Desktop	Yes	Yes	Yes	Yes	Yes	Yes ⁵
Cisco Webex Teams Web	Yes	Yes	Yes	No	Yes	Yes ⁵

1. Only the Cisco IP Phones 8845 and 8865 support video.
2. While cloud registration is supported with these endpoints, for the purposes of this PA these endpoints register to Cisco Unified CM.
3. Cisco Webex Room and Room Kit Series endpoints support 4K video resolution.
4. With Webex Board in companion mode, the Board and endpoint must be cloud-registered.
5. View capability only.

Cisco Webex Core Services

The PA for Cisco Webex Hybrid Services includes the following foundational functionality and services that underlie the entire Webex Hybrid Services solution:

- Cisco Webex Control Hub

The web-hosted online Webex Control Hub, available at <https://admin.webex.com/>, is used to administer and manage the organization's Webex Hybrid Services.

- Cisco Webex Teams Messaging

This basic feature of the Webex Teams application and the Webex platform provides one-to-one and group messaging with file sharing. This feature delivers persistent instant messaging with Webex Teams spaces, where users can message and share files.

- Cisco Webex Meetings

Webex Meetings provides audio and video conferencing with content sharing by leveraging the Webex conferencing service. Webex Meetings builds upon the messaging and file sharing capabilities of Webex Teams Messaging. Webex Meetings also enables advanced features such as meeting recording and permanent Personal Meeting Rooms (PMR) to provide users with personalized permanent voice and video meeting spaces. Users can join conferences using Webex Teams devices as well as Webex Teams and Webex Meetings applications.

- Cisco Expressway-C Connector Host Management Connector

The Cisco Expressway-C Connector Host is a standard Cisco Expressway-C server deployed within the customer's organization to provide an integration point between the on-premises and cloud collaboration services. The integration between the Cisco Expressway-C server and Cisco Webex is facilitated via micro-services installed and managed on the Expressway-C Connector Host by Webex. These micro-services enable hybrid services integration.

The Management Connector is included in the Expressway-C base software and is used by the administrator to register Expressway to Webex and to link the Expressway interface with the Webex management interfaces.

All of these services and components are relevant for the deployment of the PA for Webex Hybrid Services and will be referenced as appropriate in the remainder of this document.

Cisco Webex Hybrid Directory Service

Cisco Webex Hybrid Directory Service is the common identity component for any hybrid deployment. It provides a common directory shared between the enterprise and Webex through synchronization of the on-premises Microsoft Active Directory and Cisco Webex. This enables synchronization not only of users but also of resources such as enterprise room systems.

Cisco Directory Connectors are deployed on-premises. They communicate and synchronize over the enterprise network with Microsoft Active Directory, and they communicate over the Internet to Webex (Figure 4).

Figure 4 Architecture for Cisco Webex Hybrid Directory Service

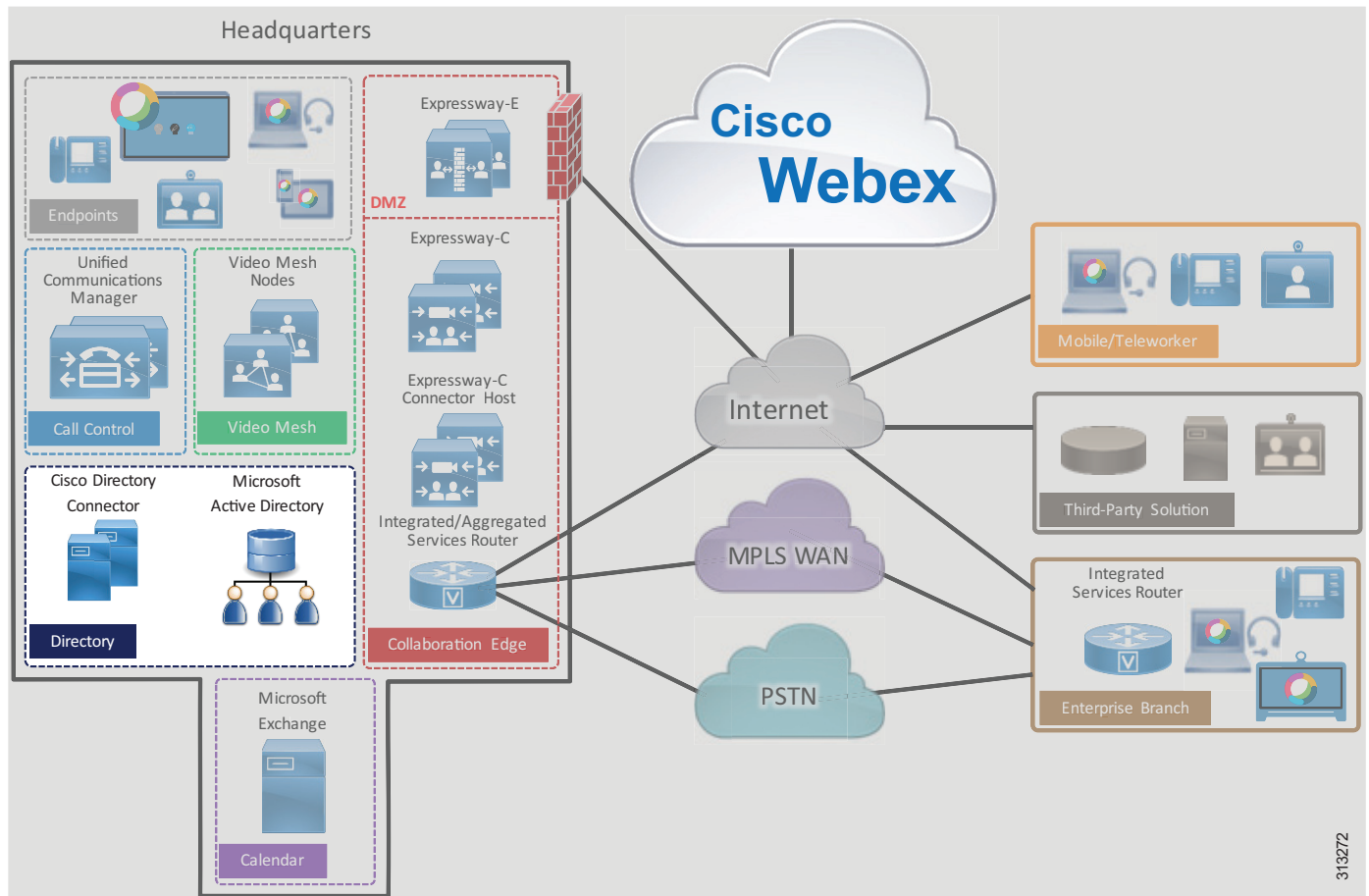


Table 6 lists the roles of the Cisco Webex Hybrid Directory Service components in this architecture and the services they provide.

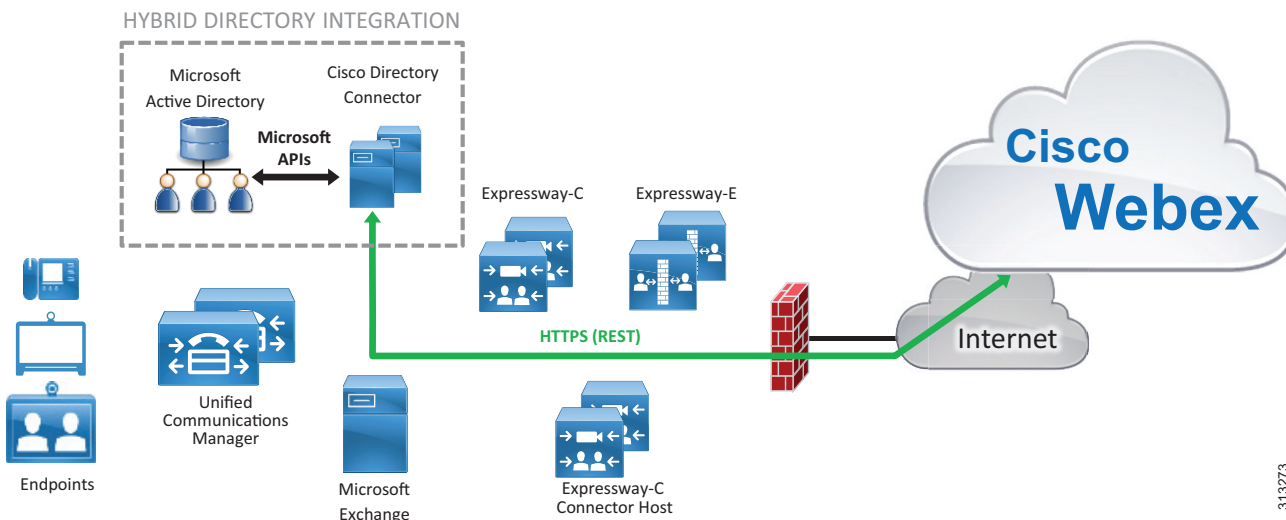
Table 6 *Components for Cisco Webex Hybrid Directory Service*

Module	Component	Description
Cisco Webex Hybrid Directory Service	Cisco Directory Connector	Provides user and resource synchronization between Microsoft Active Directory and Cisco Webex
	Microsoft Active Directory	Provides the full list of corporate resources and users and their attributes

Webex Hybrid Directory Service enables an administrator to populate the identity store of their company's Webex Teams organization with users and resources from their corporate Microsoft Active Directory. Once the cloud identity store for the company's organization has been populated, administrators can easily manage Webex Teams corporate user accounts. Administrators may configure user accounts, enable specific features, and provision users for collaboration services within the Webex Teams organization.

As shown in [Figure 5](#), Cisco Directory Connectors synchronize with Microsoft Active Directory using Microsoft application programming interfaces (APIs) over the on-premises network. At the same time, Cisco Directory Connectors push directory data and communicate over the Internet through the secure enterprise boundary and corporate firewall with the cloud identity service within Webex. HTTPS is used for communications between Cisco Directory Connectors and Cisco Webex.

Figure 5 *Hybrid Enterprise Directory Integration*



The Directory Connector servers run on Microsoft Windows Servers and must be actively joined to the Active Directory domain. (See the [Deployment Guide for Cisco Directory Connector](#) for the latest version support information.) A read-only administrator account is used to authenticate the Directory Connector to the Windows domain.

The customer organization administrator must log in to the Webex Control Hub and download the Directory Connector software to the Windows servers. Once Directory Connectors are installed and configured, synchronization takes place and users and resources are pushed to the Webex identity store for the customer's organization through HTTPS connections. Because these are outbound connections from the Cisco Directory Connectors to the Internet, they do not require any inbound ports to be opened on the internal or external firewall.

Directory Connectors are configured to pull information from the Microsoft Active Directory. (See the [Deployment Guide for Cisco Directory Connector](#) for the latest version support information.) Directory information can be pulled from the entire domain or from specific containers and organizational units. It is also possible to create LDAP filters if more granularity is needed.

Users log in to Webex Teams via their email address, which corresponds to the **mail** LDAP attribute.

Recommended Deployment

To deploy Webex Hybrid Directory Service in the PA for Webex Hybrid Services, we recommend the following:

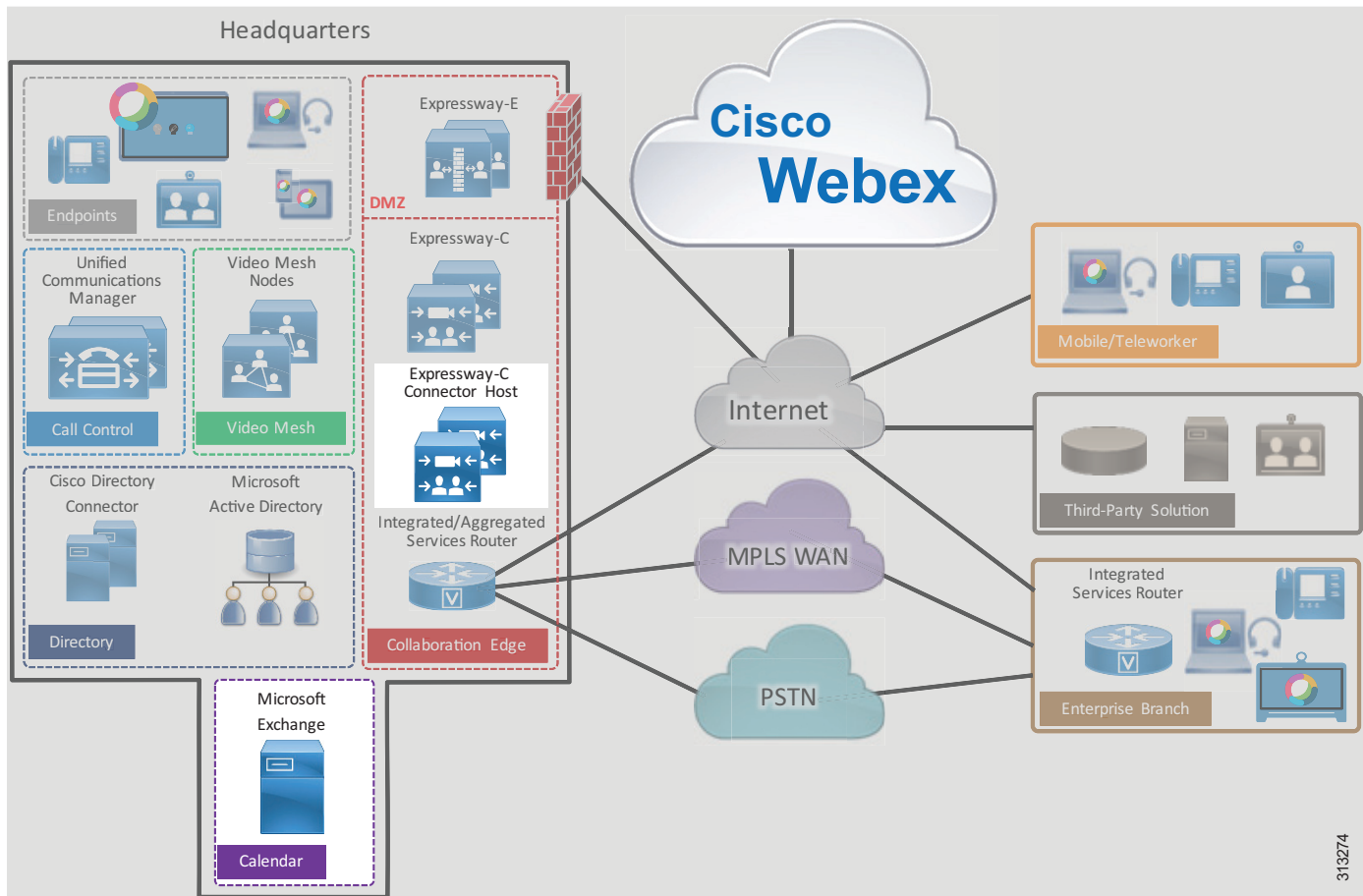
- Webex Teams users correlate to Cisco Unified CM end users by means of email addresses. For this reason, make sure that the end-user account mail ID field in the Unified CM End User database contains the user's email address. With LDAP directory integration, the mail ID field for Unified CM end users is typically mapped from the **mail** field of the LDAP directory during synchronization.
- When registering room systems as Webex devices, it is recommended to map an LDAP attribute (e.g. ipPhone) to the Webex attribute name **sipAddresses;type-enterprise**. Then, populate the mapped LDAP attribute with a unique full SIP URI (e.g. sip:conf_room01@ent-pa.com) for each device to ensure the Webex directory contains a dialable enterprise SIP URI for each room system.
- Install Directory Connectors and Active Directory Domain Service or Active Directory Lightweight Directory Services on separate Windows servers.
- After the Directory Connector installations finish, run a first synchronization. Then configure full synchronization and incremental synchronization schedules to keep the Directory Connectors (and in turn Webex) updated when user information changes (user update, deletion, or addition) within Microsoft Active Directory.

Cisco Webex Hybrid Calendar Service

Cisco Webex Hybrid Calendar Service enables enterprise calendar integration with Webex collaboration services. It provides calendar synchronization between on-premises Microsoft Exchange and Cisco Webex.

Cisco Calendar Connector is deployed on the Cisco Expressway-C Connector Host on-premises. It communicates and synchronizes over the enterprise network with Microsoft Exchange, and it communicates over the Internet to Webex (Figure 6).

Figure 6 Architecture for Cisco Webex Hybrid Calendar Service



Note

Although Webex Hybrid Calendar Service also supports integration to Microsoft Office 365 or G Suite by Google Cloud, these integrations are not discussed or covered in this PA for Webex Hybrid Services. For information about these integrations, refer to the latest version of the *Deployment Guide for Cisco Webex Hybrid Calendar Service*, available at <https://www.cisco.com/c/en/us/support/unified-communications/spark/products-installation-guides-list.html>.

Table 7 lists the roles of the Webex Hybrid Calendar Service components in this architecture and the services they provide.

Table 7 **Components for Cisco Webex Hybrid Calendar Service**

Module	Component	Description
Cisco Webex Hybrid Calendar Service	Cisco Expressway-C Connector Host Calendar Connector	Provides integration between the enterprise calendaring application and Webex
	Microsoft Exchange	Provides corporate calendaring services

Webex Hybrid Calendar Service enables a tight integration between the user's enterprise Microsoft Exchange calendar, Microsoft Outlook invitations, and Webex Teams Messaging. The Calendar Connector service provides two key features:

- **@meet**

When @meet is added to the location field of an Outlook calendar invitation, Calendar Connector and the cloud calendar service create a Webex Teams meeting and a new Webex Teams collaboration space with a name that matches the invitation subject. All users in the calendar invitation are added to the Webex Teams space and are invited to the meeting. This facilitates collaboration and allows the meeting organizer and attendees to communicate and share material prior to, during, and even after the meeting. If a calendar invitation includes a distribution list, users on the distribution list will not be added to the Webex Teams space automatically; however, they will receive the meeting invitation.

- **@webex**

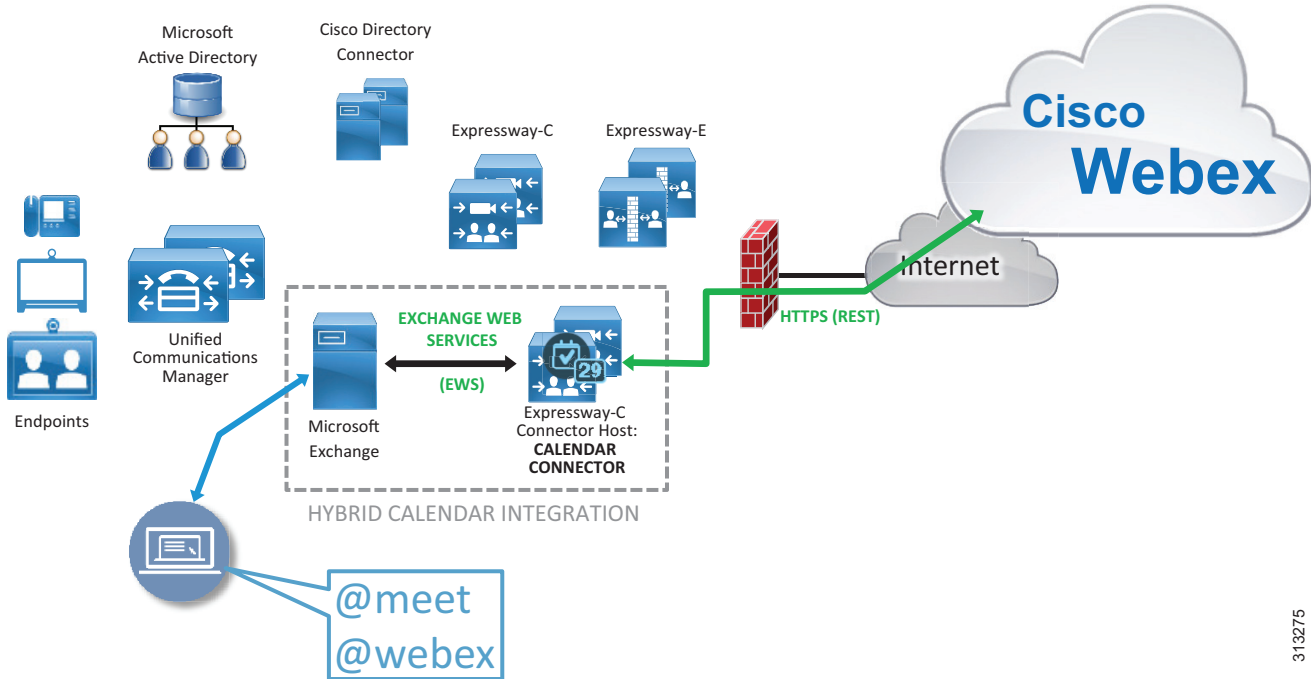
When @webex is added to the location field of an Outlook calendar invitation, Calendar Connector automatically populates the invitation with the user's Webex Personal Room information.

Hybrid calendar integration also enables:

- Synchronization of users' Microsoft Exchange enterprise calendar with their Webex Teams application calendar and meeting list
- Sharing of users' out-of-office status from Microsoft Outlook with Webex Teams

As shown in Figure 7, the Cisco Calendar Connector service running on the Expressway-C Connector Host synchronizes with Microsoft Exchange using Exchange Web Services (EWS) over the on-premises network. At the same time, Cisco Calendar Connector pushes calendar data and communicates over the Internet through the secure enterprise boundary and corporate firewall with the calendar service within Webex. Cisco Calendar Connector also integrates with Webex Personal Rooms for @webex functionality. HTTPS is used for communications between Cisco Calendar Connector on the Expressway-C Connector Host and Webex. Because this is an outbound connection from the Cisco Calendar Connector to the Internet, it does not require any inbound ports to be opened on the internal or external firewall.

Figure 7 Hybrid Enterprise Calendar Integration



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Note

As shown in [Figure 7](#), the Expressway-C Connector Host does not pair with the Expressway-E server and, in the case of hybrid calendar integration, does not rely on Expressway-C and Expressway-E firewall traversal capabilities to communicate with Webex.

Calendar Connector is configured to pull calendar and meeting information from Microsoft Exchange using an impersonation account. (For the latest version support information, see the [Deployment Guide for Cisco Webex Hybrid Calendar Service](#).) This meeting information is used to create the appropriate Webex Teams meeting and space with all invitees (@meet) and a Webex personal meeting room (@webex).

For more information about Webex Hybrid Calendar Service, consult the [Deployment Guide for Cisco Webex Hybrid Calendar Service](#).

Recommended Deployment

To deploy Webex Hybrid Calendar Service in the PA for Webex Hybrid Services, we recommend the following:

- Deploy a pair of dedicated Cisco Expressway-C hosts using the Expressway-C OVA. They will serve as your Cisco Expressway-C Connector Hosts. These Expressway-C servers do not pair with Expressway-E servers and, in the case of hybrid calendar integration, do not rely on Expressway-C and Expressway-E firewall traversal.
- The application impersonation role must be configured in Microsoft Exchange and is used in the Exchange Calendar Connector configuration on the Expressway-C interface. The application impersonation management role in Microsoft Exchange enables applications to impersonate users in an organization to perform tasks on behalf of the users. The impersonation account does not have to be an administrator, but it must have a mailbox.

Cisco Webex Video Mesh

Cisco Webex Video Mesh is a component of the PA for Cisco Webex Hybrid Services that enables organizations to deploy an instance of media processing on-premises. This means that Webex Teams room devices and clients, as well as Unified CM registered endpoints dialing into Webex meetings, can terminate media on-premises instead of sending all media to the cloud.

The benefits of Webex Video Mesh include:

- Improved call quality because media stays local, which reduces latency and packet loss
- Reduced consumption of Internet bandwidth
- Simplified on-premises deployment via Webex Control Hub
- Reduced utilization of Expressway for Unified CM registered endpoints connecting to Webex Meetings

The PA for Webex Hybrid Services addresses these needs with the Webex Video Mesh architecture shown in [Figure 8](#).

The central component of Webex Video Mesh is the Video Mesh Node. Webex Video Mesh can be deployed as a virtual machine on a Cisco Unified Computing System (UCS) server or on specifications-based hardware in the organization's data center(s). (See the [Cisco Webex Video Mesh Data Sheet](#) for more information.) The Video Mesh Node registers to Webex, and most management tasks are performed from the Webex Control Hub. The Webex Control Hub also provides automatic software updates and usage reports.

Figure 8 Architecture for Cisco Webex Video Mesh

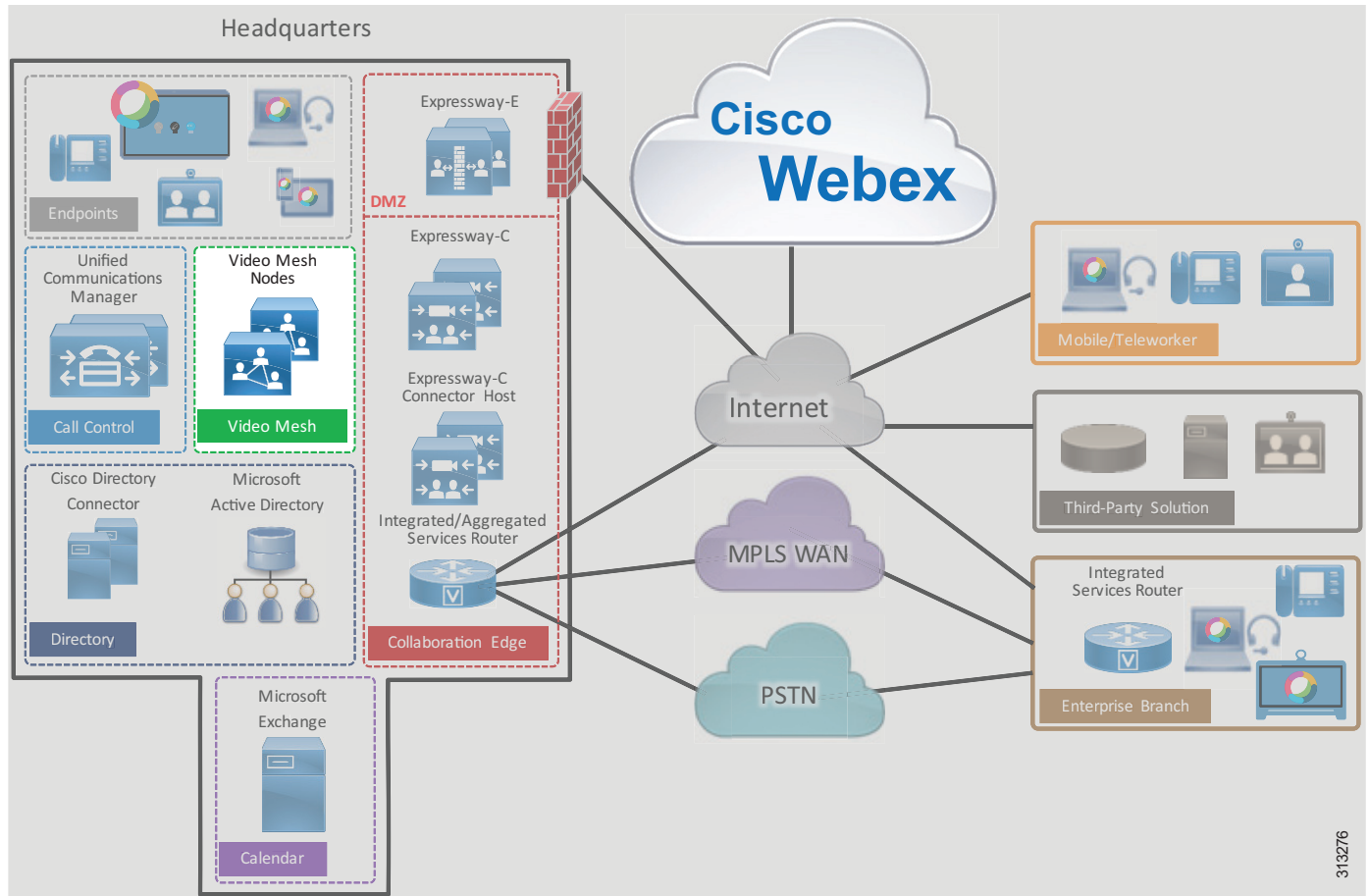


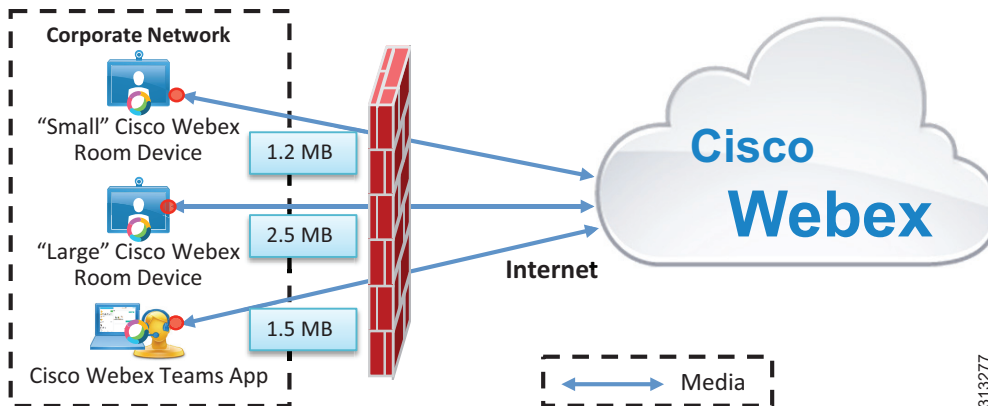
Table 8 lists the components and roles of Cisco Webex Video Mesh.

Table 8 Components for Cisco Webex Video Mesh

Module	Component	Description
Cisco Webex Video Mesh	Cisco Webex Video Mesh Node	Provides on-premises media processing capabilities for Webex Meetings. This includes voice, video, and desktop sharing.
	Cisco Webex Control Hub	Provides central administration for Webex Teams components.

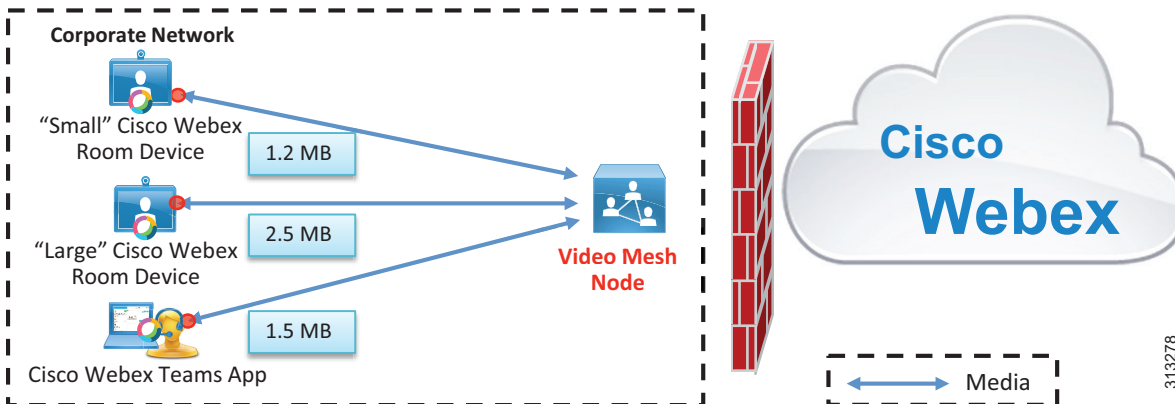
Every Webex Teams call is considered to be a meeting. In a Webex Teams meeting, signaling and media are sent to and from Webex. For example, Figure 9 shows a three-party Webex Teams meeting. Each party in the meeting sends and receives media to and from Webex via the Internet. As the number of concurrent calls increases, the organization's bandwidth usage to the Internet increases. The three-party Webex Teams call in Figure 9 uses up to 7 MB of the organization's Internet bandwidth (client bandwidth requirements shown in this example are average values).

Figure 9 Media Path of a Webex Teams Meeting



The Video Mesh Node bridges the media locally, resulting in network edge bandwidth savings as well as decreased overall latency. [Figure 10](#) shows the same three-party call with the media bridged locally on the Video Mesh Node within the enterprise, resulting in no bandwidth utilization for media over the Internet.

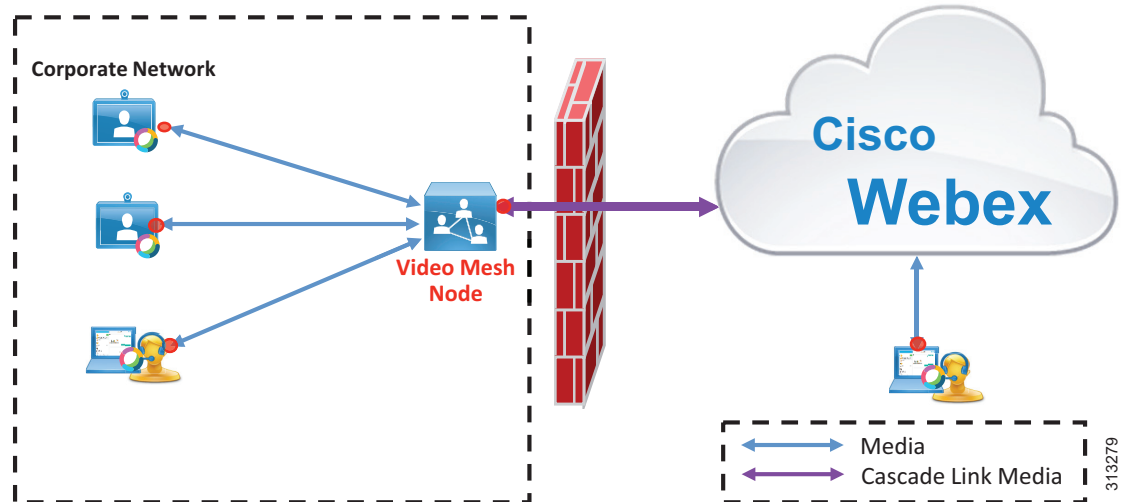
Figure 10 Media Path of a Webex Teams Meeting with Video Mesh Node



A single Video Mesh Node can accommodate up to 100 concurrent calls. Video can scale up to 1080p at 30 frames per second. If a Video Mesh cluster is full, the next Webex Teams endpoint in the organization that joins the meeting will send its media to Webex, and the Video Mesh Node will cascade the call to the cloud media services. The cascade link carries up to 6 HD streams, which allows picture-in-picture and layout controls on specific endpoints.

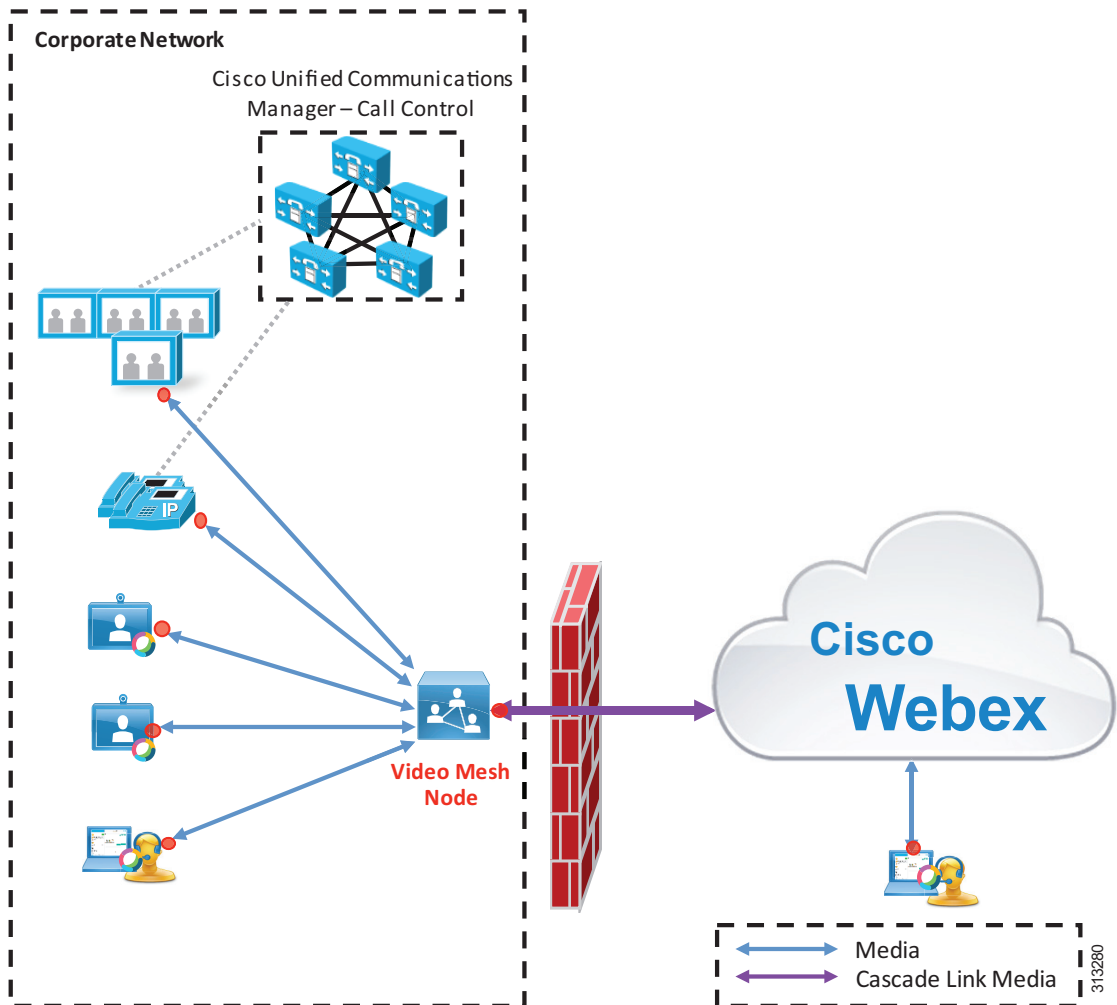
A cascade link is created when a remote participant joins the call and their Webex Teams endpoint may not be able to reach the Video Mesh Node. In this scenario, shown in [Figure 11](#), the remote Webex Teams endpoint sends media to the cloud media services, and a cascade link is created between that cloud media services and the Video Mesh Node hosting the call.

Figure 11 Cascading the Call to the Cloud for External Participants



The Video Mesh Node can host Webex meetings that include both Webex Teams endpoints and clients as well as Unified CM registered endpoints. Webex Video Mesh bridges on-premises Unified CM registered endpoints in meetings with Webex Teams endpoints and applications. Unified CM communicates to the Video Mesh Node via SIP trunking, thus allowing on-premises registered endpoints to join Webex Meetings with media termination at the Webex Video Mesh Node. (See [Figure 12.](#))

Figure 12 *Media Path of a Webex Teams Meeting with Video Mesh Node and Unified CM Registered Endpoints*



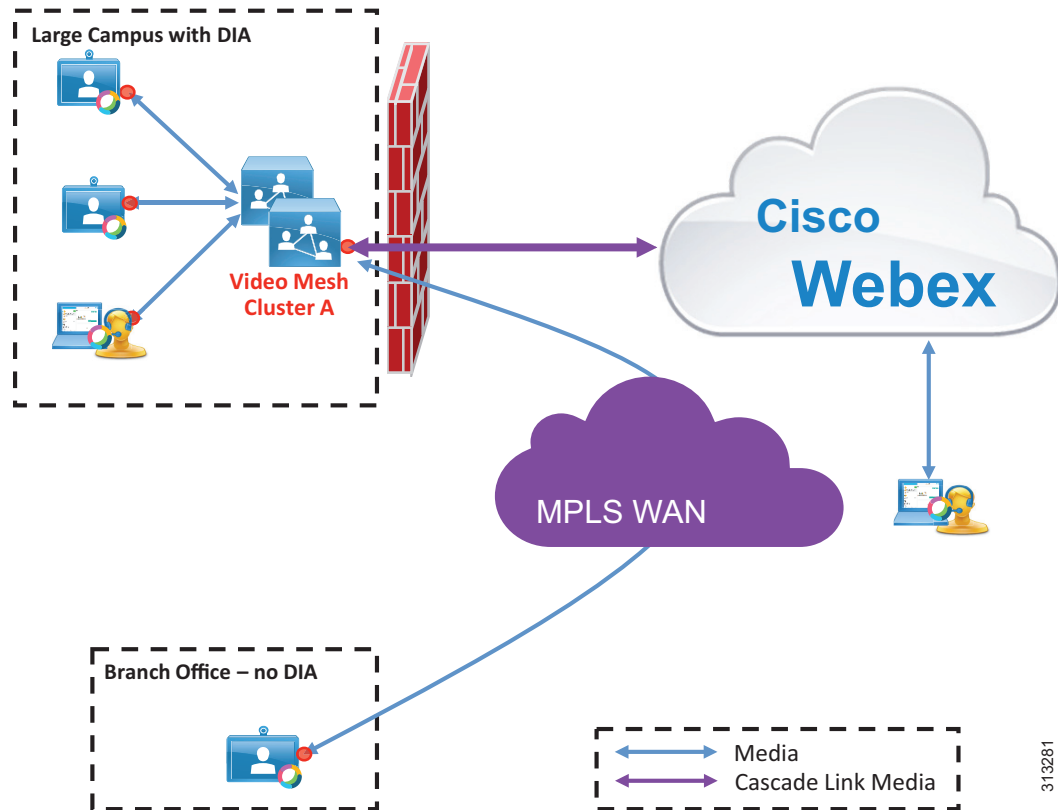
Recommended Deployment

The Video Mesh Node can be deployed on the corporate network or in the DMZ. We recommend deploying the Video Mesh Node on the corporate network. With this deployment model, internal Webex Teams endpoints will connect to available Video Mesh Nodes and external Webex Teams endpoints will connect to the cloud media services. Calls will be cascaded from Video Mesh Nodes to the cloud when Webex Teams endpoints from outside the organization's network connect to a call with internal participants.

Recommended deployment models are discussed in brief here. For further details and use cases, refer to the Cisco Validated Design (CVD) guide for the [Preferred Architecture for Cisco Webex Hybrid Services](#).

We recommend that you deploy Video Mesh Nodes only in large campus sites that have direct Internet access (DIA), as shown in [Figure 13](#). This will ensure that the Video Mesh Nodes are available for large user populations. It will also ensure that media will cascade from the Video Mesh Nodes directly to the cloud instead of traveling across a WAN to another site with direct Internet access.

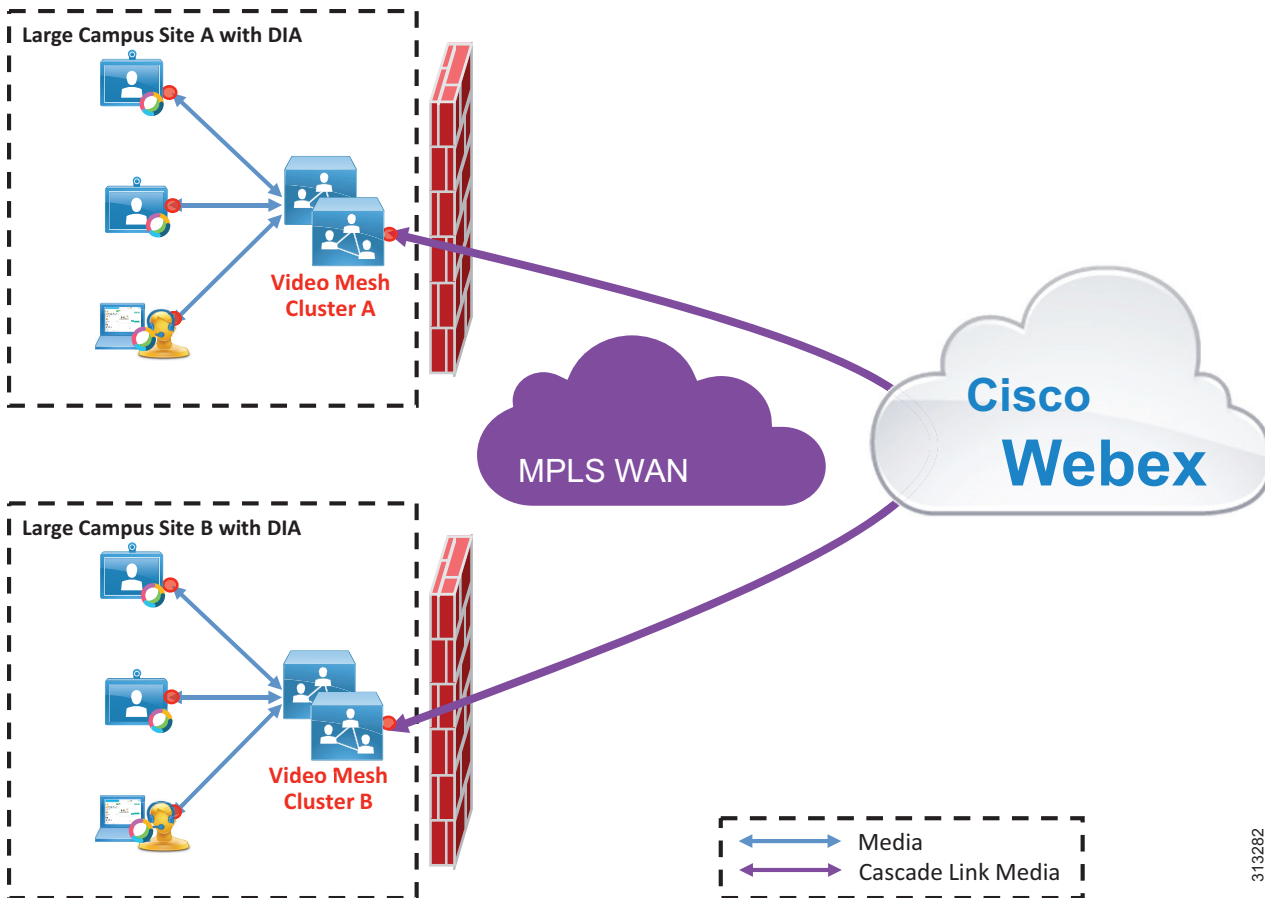
Figure 13 Video Mesh Nodes Deployed in a Large Site with Direct Internet Access (DIA)



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We recommend deploying Video Mesh Nodes in clusters. This provides high availability for internal users in case a single Video Mesh Node becomes unavailable. It also allows Webex Teams endpoints to overflow to a Video Mesh Node on the corporate network instead of overflowing to the cloud, thus saving bandwidth on the corporate network Internet edge (see [Figure 14](#)).

Figure 14 Multiple Video Mesh Clusters Cascading a Call to Webex



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We recommend sizing the Video Mesh cluster based on the number of calls expected for the organization's site. There is no maximum size for a Video Mesh cluster, and each Video Mesh Node can support up to 100 concurrent calls. Avoid clustering Video Mesh Nodes over the WAN. Clustering Video Mesh Nodes over the WAN could lead to excessive consumption of WAN bandwidth as call are cascaded between nodes over the WAN.

The Video Mesh Node requires a number of open firewall ports to enable cloud management, signaling, and media traffic flow. We recommend opening media ports for both TCP and UDP traffic flows. Ensure that media is marked with appropriate QoS markings to improve call quality on the corporate network. (See the [Bandwidth Management](#) section for details.)

Cisco Webex Hybrid Call Service

Cisco Webex Hybrid Call Service provides the integration of Cisco Unified Communications call services with Webex call services. The PA for Webex Hybrid Call Service includes Cisco Unified Communications Manager (Unified CM), Cisco Expressway-C and Expressway-E, and the Webex Device Connector (Figure 15).

The hybrid calling architecture consists of two main calling features:

- Hybrid Calling for Webex devices: enabling video room systems to make and receive calls using the same enterprise dialing used by endpoints directly registered with Unified CM.
- Hybrid Calling for Webex Teams (Unified CM): enabling Webex Teams users to make and receive calls using the Webex Teams application directly registered to Unified CM.

Figure 15 Architecture for Cisco Webex Hybrid Call Service

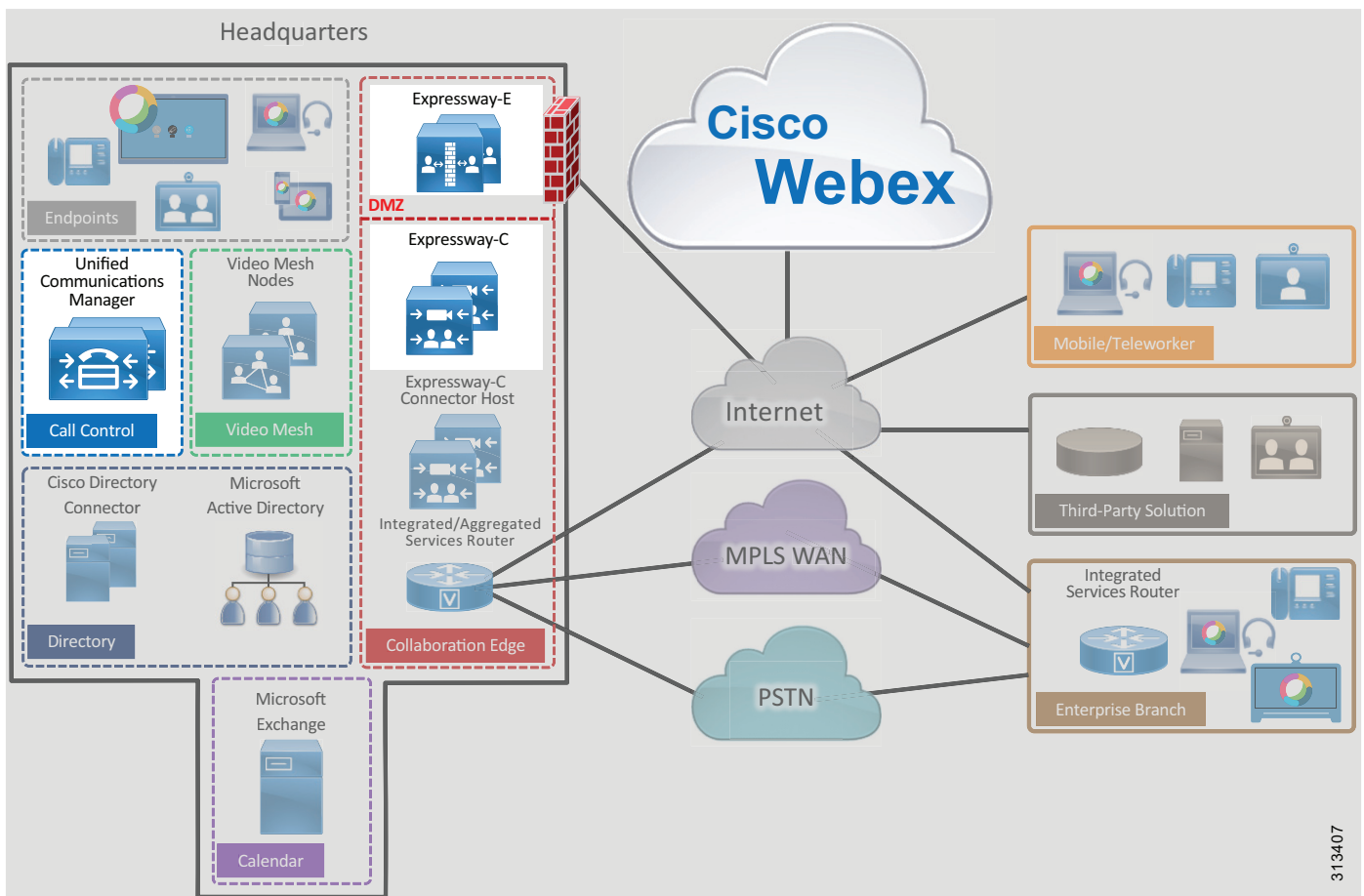


Table 9 lists the roles of the components in this architecture and the services they provide.

Table 9 **Components for Cisco Webex Hybrid Call Service**

Module	Component	Description
Cisco Webex Hybrid Call Service	Cisco Unified Communications Manager (Unified CM)	Provides endpoint registration, call processing, and media resource management
	Cisco Webex Device Connector	Provides integration between on-premises call processing services and room systems registered as Webex Devices (not shown in Figure 15)
	Cisco Expressway-C and Expressway-E	Enables firewall traversal for SIP signaling, media and mobile and remote access.

A key component of Webex Hybrid Call Service is the Webex Device Connector, hosted on a PC (Windows or Mac). Webex Device Connector provides hybrid calling configuration and provisioning for Cisco Webex Devices.

**Note**

Hybrid Calling support in the Webex Device Connector is new as of the publishing of this document and is currently only supporting Webex site deployments in the EMEA Data Center locations. The US based Data Center locations will soon have this support which is currently targeted for the July time-frame. As soon as this support is available for US based Webex sites this document will be updated and this notification removed.

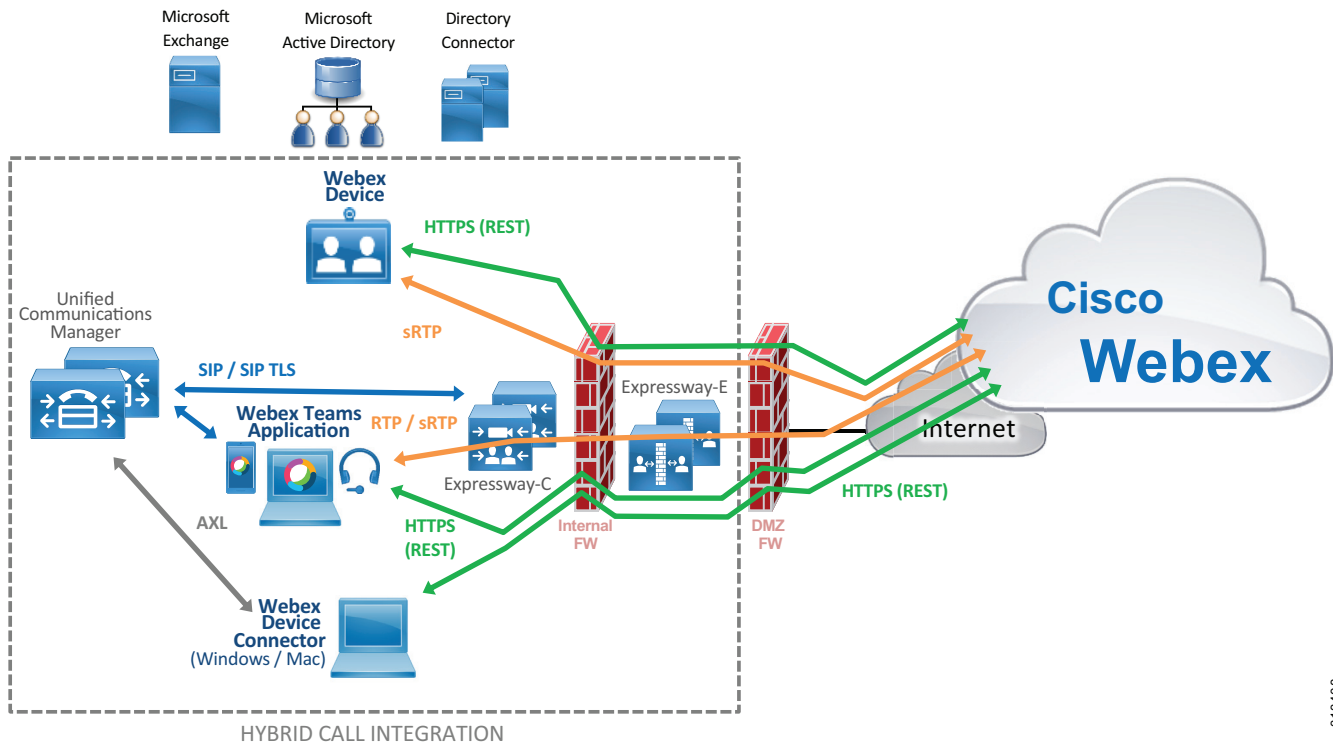
By deploying and provisioning Webex devices with the appropriate call routing configuration on Webex Control Hub, Unified CM, and Expressway, these cloud-registered room systems fully integrate with enterprise call control enabling enterprise calling to and from other enterprise users and the PSTN.

This architecture also introduces hybrid calling for Webex Teams with the application registering directly to Unified CM for enterprise calling capabilities. With hybrid calling for Webex Teams (Unified CM), the Webex Teams application fully integrates with enterprise call control enabling enterprise calling to reach other enterprise users and devices as well as the PSTN. Further, Webex Teams application users who are outside the enterprise are able to securely access these enterprise calling capabilities with Expressway mobile and remote access.

Recommended Deployment

Figure 16 illustrates the architecture for Webex Hybrid Call Service.

Figure 16 Architecture for Webex Hybrid Call Service



The following guidelines apply to the architecture shown in Figure 16:

- Webex devices and Webex Teams applications connect over the Internet to Cisco Webex services using HTTPS.
- Webex devices send media as sRTP over the Internet to Cisco Webex.
- Webex Teams applications register and route calls to Unified CM using SIP (or SIP TLS). Webex Teams applications send media (RTP or sRTP) directly to the far-end endpoint (or bridge or gateway).
- Webex Device Connector connects to Unified CM using AXL and to Cisco Webex over the Internet using HTTPS.
- Cisco Unified CM connects to Expressway-C and Expressway-E for firewall traversal using SIP.
- Redundant configurations of Cisco Unified CM, Expressway-C, and Expressway-E are recommended.

Webex Hybrid Calling Architecture

Webex Hybrid Calling enables integration of both Webex devices and Webex Teams applications with enterprise calling.

In the case of Webex devices, room systems register to Webex for call services and if hybrid calling integration is enabled, then the device can make and receive enterprise and PSTN calls (in addition to being able to call other Webex devices). Cisco Unified CM, Expressway, and Webex perform the following operations as shown in Figure 17:

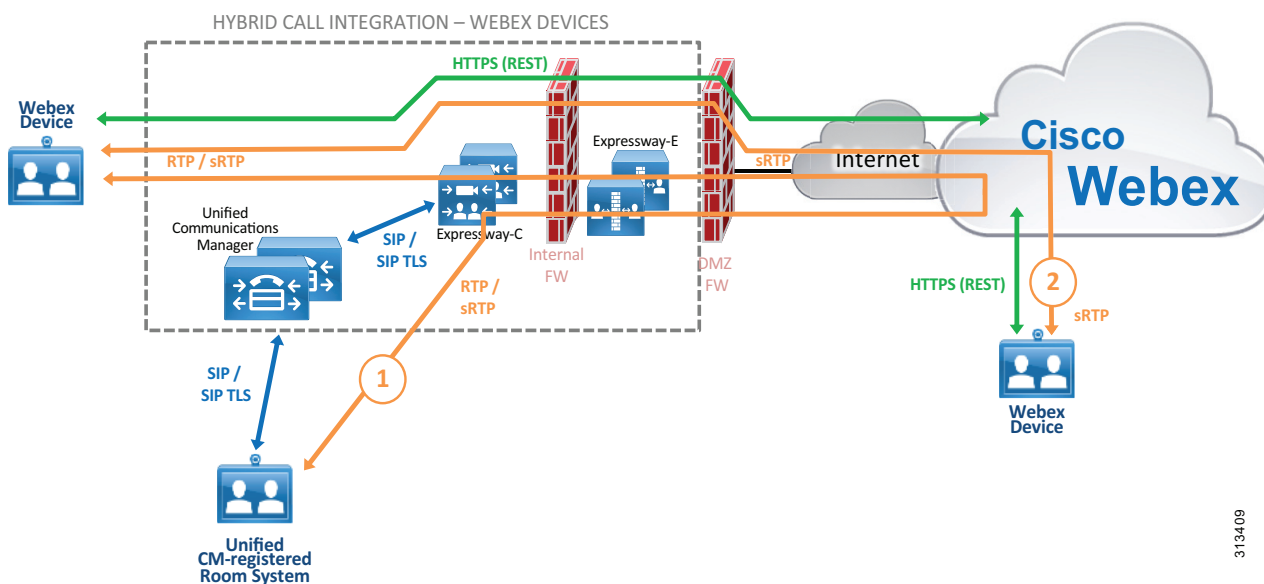
Receiving Calls

- Calls received on Cisco Unified CM for a hybrid calling-enabled Webex Device are routed to the corresponding Spark Remote Device and in turn extended to Webex through Expressway-C and Expressway-E to ring the room system. Once answered, the media will traverse the Expressway-C and Expressway-E and hairpin at the Webex cloud (See Figure 17, #1). The call to the Webex Device may originate from an enterprise registered endpoint, the PSTN, or even an edge or Business-to-Business (B2B) gateway (for example, Expressway).
- Calls received at Webex for a hybrid calling-enabled Webex Device are routed directly to the device. Once the call is answered, media hairpins in the Webex cloud and does not traverse the Expressway-C and Expressway-E (see Figure 17, #2).

Placing Calls

- Calls placed from a hybrid calling-enabled Webex Device destined for a specific enterprise or PSTN number are extended by Webex to the enterprise through Expressway to set up the call. Once answered, the media will traverse the Expressway-C and Expressway-E and hairpin at the Webex cloud (see Figure 17, #1).
- Calls placed from a Webex Device to another Webex Device or user will route directly within the cloud with media hairpinning in the Webex cloud (see Figure 17, #2).

Figure 17 Hybrid Calling Integration: Webex Devices



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In the case of Webex Teams, the application will register to Unified CM for call services. Note that Webex Teams continues to leverage Webex services from the cloud including messaging and meeting. Cisco Unified CM and Expressway perform the following operations as shown in [Figure 18](#):

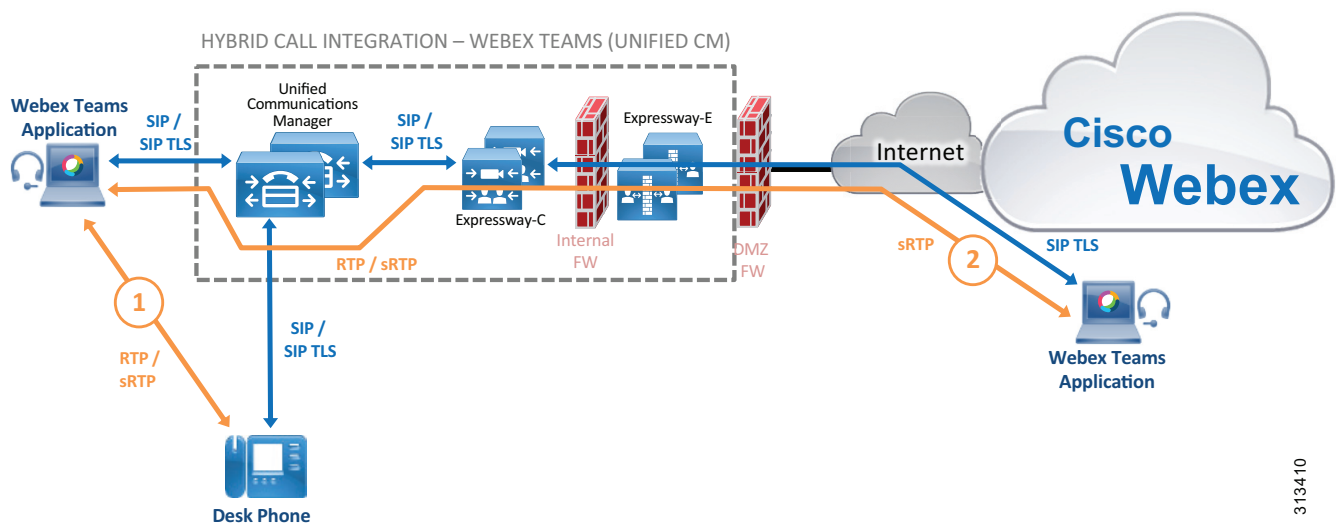
Receiving Calls

- Enterprise or PSTN originated calls to the Webex Teams application user's enterprise number will be extended via SIP (or SIP TLS). Once answered, the media will traverse directly between the Webex Teams application and the calling user/device. The calling device may be a desk phone registered to Unified CM (see #1) or another enterprise registered Webex Teams application and that application might be connected over Expressway mobile and remote access (see #2).

Placing Calls

- Calls placed from an enterprise-registered Webex Teams application destined for a specific enterprise or PSTN number are extended by Unified CM to the called device or user (just like any other registered endpoint). Once answered, the media will travel directly between the application and the called device or user (see #1).

Figure 18 Hybrid Calling Integration: Webex Teams (Unified CM)



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Media Encryption

Media is encrypted with Secure Real-time Transport Protocol (SRTP) between Cisco Webex and Cisco Expressway. Depending on the configuration, different scenarios can be achieved:

Endpoint-terminated encryption

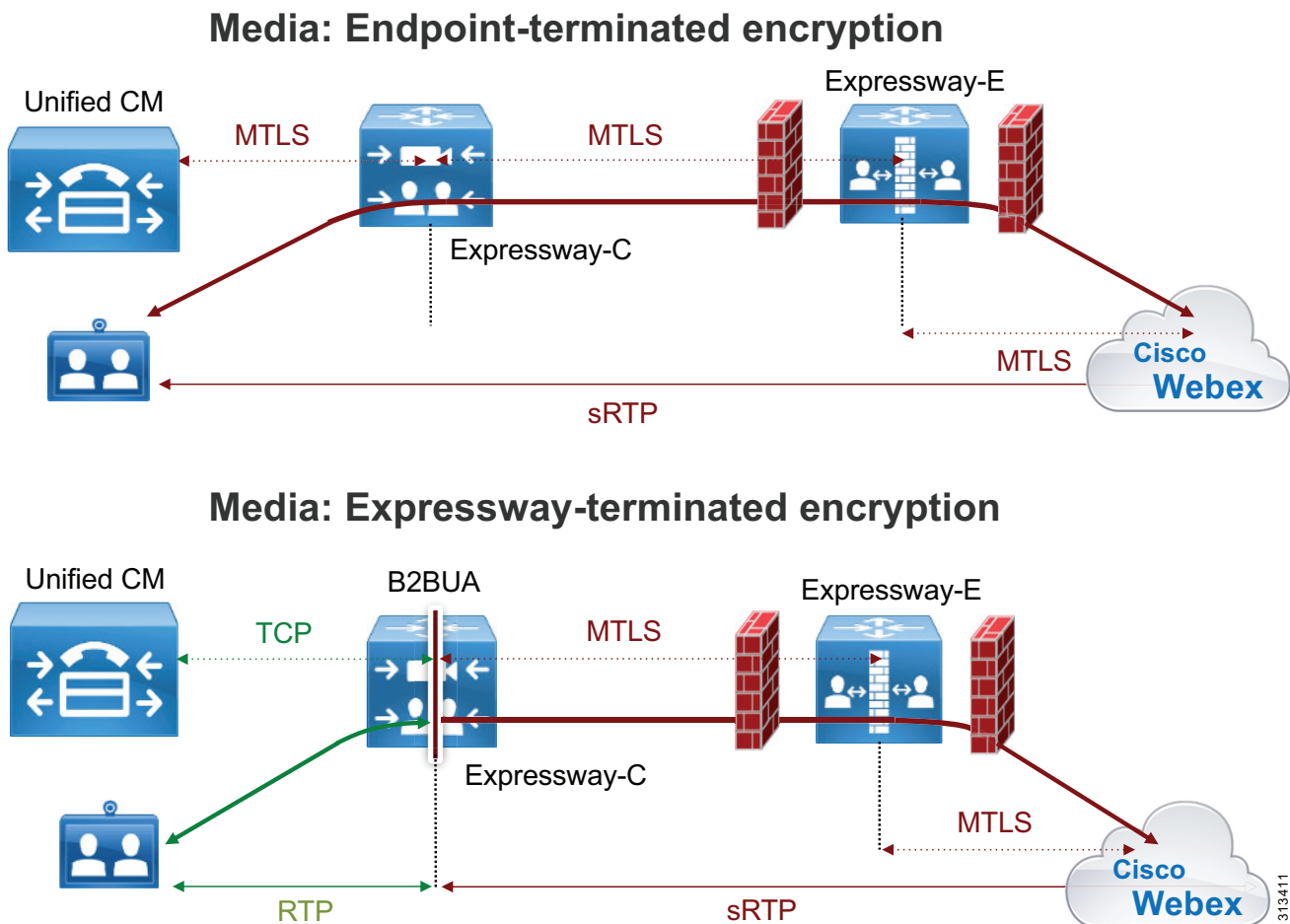
- This requires Unified CM to be in mixed mode to support both Webex Teams clients and Webex Devices. The endpoints and the SIP trunk to Expressway need to be provisioned for encryption.

Expressway-terminated encryption

- If Unified CM is not in mixed mode and uses non-encrypted RTP media traffic to send the call to Expressway-C, then Expressway-C can terminate the RTP connection from the Unified CM endpoint and open another call leg using sRTP to Webex. Any time Cisco Expressway performs RTP-to-sRTP conversion, it engages a back-to-back user agent (B2BUA). If Cisco Expressway performs RTP-to-sRTP conversion, we recommend enabling it on Expressway-C instead of Expressway-E so that the traffic in the DMZ will be encrypted.

Figure 19 illustrates these two encryption options.

Figure 19 Webex Hybrid Call Services: Expressway Media Encryption Options



Considerations for Deploying Multiple Unified CM Clusters

Webex Hybrid Call Service supports multiple Cisco Unified CM clusters. However, due to the call routing method used by Hybrid Call Services, enterprise calls to and from Webex devices and Webex Teams applications are always sent to the Unified CM cluster where the Spark Remote Device or Webex

Teams application is registered, before being sent to the destination. This is called *home cluster routing* and is necessary for the preservation of class of service (CoS) and calling ID. Likewise, Webex Teams applications registering to Unified CM in multi-cluster environments are automatically redirected to the home cluster configured for the associated user for access registration and calling services.

Bandwidth Management

Bandwidth management is about providing the best possible user experience end-to-end for all media capable endpoints, clients, and applications in the collaboration solution. The Preferred Architecture for Cisco Webex Hybrid Services incorporates a holistic approach to bandwidth management that includes an end-to-end Quality of Service (QoS) architecture with video rate adaptation and resiliency mechanisms to provide the best possible user experience for deploying pervasive video over managed and unmanaged networks.

Architecture for Webex Hybrid Services: QoS, Media Assure, and the Self-Regulating Video Network

The PA for Webex Hybrid Services applies the bandwidth management strategy of the [Preferred Architecture for Cisco Collaboration 12.x Enterprise On-Premises Deployments](#) to the Webex Teams endpoints, clients, and infrastructure components. This bandwidth management strategy starts with QoS.

QoS ensures reliable, high-quality voice and video by reducing delay, packet loss, and jitter for media endpoints and applications. QoS provides a foundational network infrastructure technology that is required to support the transparent convergence of voice, video, and data networks. The bandwidth management strategy for Webex Hybrid Services includes identifying and marking Webex Room Device and Webex Teams client signaling and media traffic as well as updating the QoS policies in the LAN, WAN, and Internet edge equipment in the on-premises solution.

Overview of Preferred Architecture On-Premises Bandwidth Management Solution Concepts and Strategy

With the increasing amount of interactive applications – particularly voice, video, and immersive applications – real-time services are often required from the network. Because these resources are finite, they must be managed efficiently and effectively. If the number of flows contending for such priority resources were not limited, then as those resources become oversubscribed, the quality of all real-time traffic flows would degrade, eventually to the point of becoming useless. The intelligent media techniques used for media resiliency and rate adaptation in all Cisco endpoints, clients, and conferencing architecture – referred to as Media Assure – coupled with QoS, ensure that real-time applications and their related media do not oversubscribe the network or the bandwidth provisioned for those applications, thus providing efficient use of bandwidth resources.

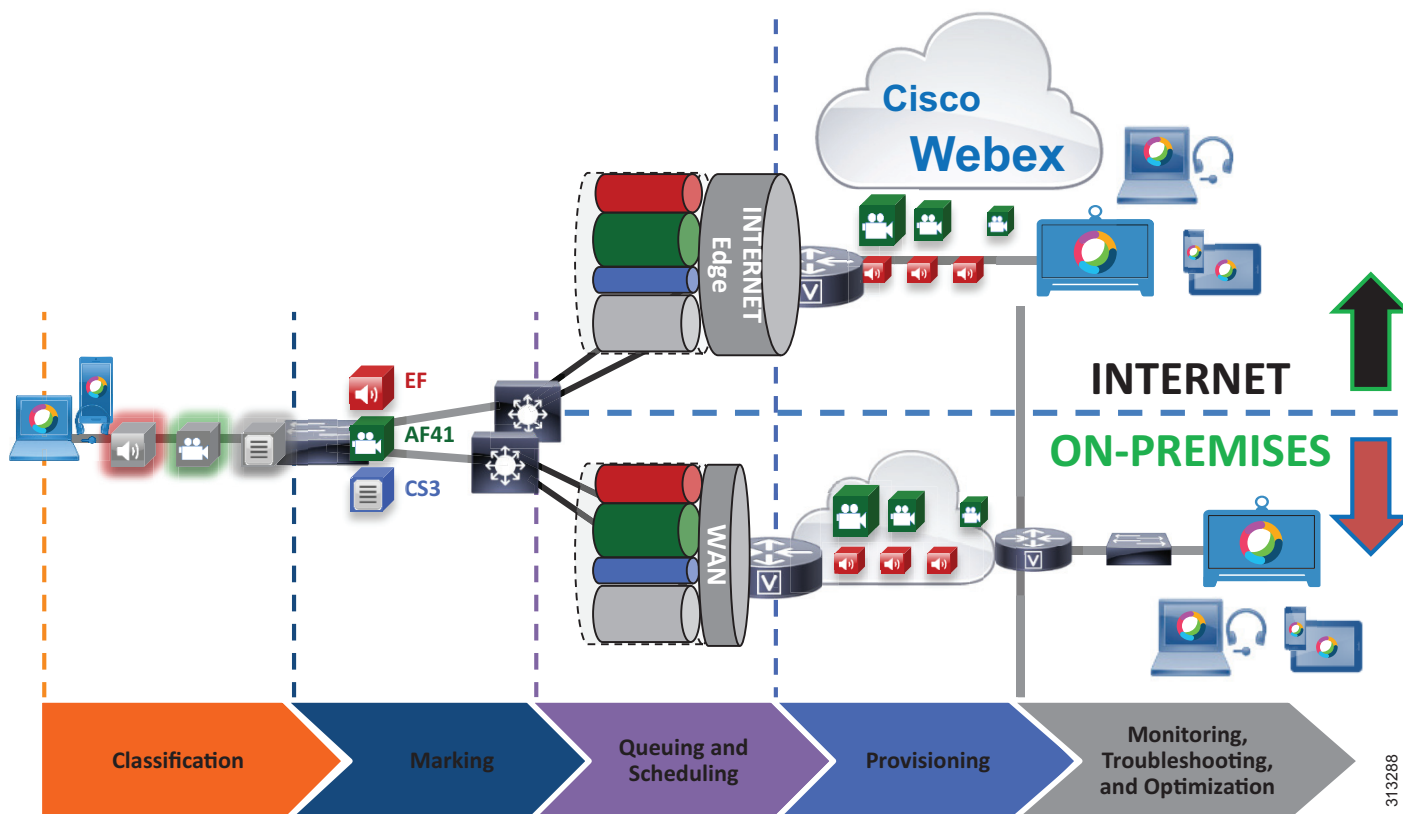
The self-regulating video network, prioritized audio, and opportunistic video are all bandwidth management concepts as well as a combined QoS strategy. A self-regulating video network consists of leveraging the intelligent media techniques and rate adaptation mentioned previously, along with proper provisioning and QoS to allow the video endpoints to maximize their video resolution during times when video bandwidth is not fully utilized in the network and to rate-adapt or throttle down their bit rate to accommodate more video flows during the busy hour of the day. Prioritized audio for both audio-only and audio of video calls ensures that all audio is prioritized in the network and is thus not impacted by any loss that can occur in the video queues. Prioritizing voice from all types of collaboration media ensures that, even during times of extreme congestion when video is experiencing packet loss and adjusting to that loss, the audio streams are not experiencing packet loss and are allowing the users to have an uninterrupted audio experience. In addition, opportunistic video allows for a group of video

endpoints to be strategically marked with a lower class of video, thus enabling them to use available bandwidth opportunistically for optimal video resolution during times when the network is less busy and more bandwidth is available, or conversely to down-speed their video more aggressively than the prioritized class of video during times of congestion when the network is in its busy hour. This concept of opportunistic video coupled with prioritized audio maintains an acceptable video experience while simultaneously ensuring that voice media for these opportunistic video calls is not compromised. This, of course, applies to the managed network, since an unmanaged network such as the Internet is not QoS-enabled and thus provides no guarantees with regard to packet loss. Nevertheless, the media resiliency and rate adaptation mechanisms also attempt to ensure that media over unmanaged networks such as the Internet has the best possible quality in the face of packet loss, delay, and jitter.

Figure 20 illustrates the approach to QoS used in the PA for the Cisco Collaboration Enterprise on-premises solution and that is followed in this Webex Hybrid Services solution:

- **Classification and marking** — Refers to concepts for identifying media and signaling for endpoints. It also includes the process of mapping the identified traffic to the correct DSCP to provide the media and signaling with the correct per-hop behavior end-to-end across the network.
- **Queuing and scheduling** — Consists of general WAN queuing and scheduling, the various types of queues, and recommendations for ensuring that collaboration media and signaling are correctly queued on egress to the WAN.
- **Provisioning and admission control** — Refers to provisioning the bandwidth in the network and determining the maximum bit rate that groups of endpoints will utilize.
- **Monitoring, troubleshooting, and optimization** — Ensures the proper operation and management of voice and video across the network.

Figure 20 Architecture for Bandwidth Management



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Recommended Deployment

To deploy bandwidth management in the PA for Webex Hybrid Services, we recommend the following:

- Identify Webex Teams traffic.
- Configure an on-premises LAN QoS policy for Webex Teams traffic classification and marking:
 - Mark all audio with Expedited Forwarding class EF. (This includes all audio of both voice-only and video calls.)
 - Mark all video from clients, desktop and room devices, as well as Expressway Edge components with an Assured Forwarding class of AF41 for prioritized video or AF42 for opportunistic video. (This will depend on the strategy taken in the on-premises solution configuration.)
- Update the WAN Edge policies for identifying, classifying, marking, and queuing Cisco Collaboration traffic with Webex Teams information:
 - WAN edge ingress re-marking policy
 - WAN edge egress queuing and scheduling policy

