



# Direct Routing for Microsoft Phone System with Cisco Unified Communications Manager (UCM) via Cisco Unified Border Element (CUBE)

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## Introduction

Customers using Microsoft Phone System have the option of not only connecting to the public switched telephone network (PSTN) using a certified Session Border Controller (SBC), such as the Cisco Unified Border Element (CUBE) but also to an internal phone system such as Cisco Unified Communications Manager.

This document describes deployment scenarios, supported features, and recommendations for successful interworking between Cisco Unified Communications Manager (UCM) release 12.5.1 and Direct Routing for Microsoft Phone System using Cisco Unified Border Element (CUBE) 12.8. This document should be used in conjunction with the following resources:

- [Direct Routing for Microsoft Phone System with CUBE Application Note](#)
- [CUBE PSTN interoperability documentation](#)
- [Cisco UCM design guides](#)
- [Cisco UCM administration/configuration guides](#)

This document assumes that the reader is knowledgeable with the terminology and configuration of Direct Routing for Microsoft Phone System with CUBE described in the application note above. Only those details specific to interworking with Cisco UCM are addressed in this document.

Testing was performed in accordance with Direct Routing for Microsoft Phone System test methodology with Media Bypass disabled in a lab environment.

## Network Topology

### Direct Routing deployment with On-Premises Cisco UCM

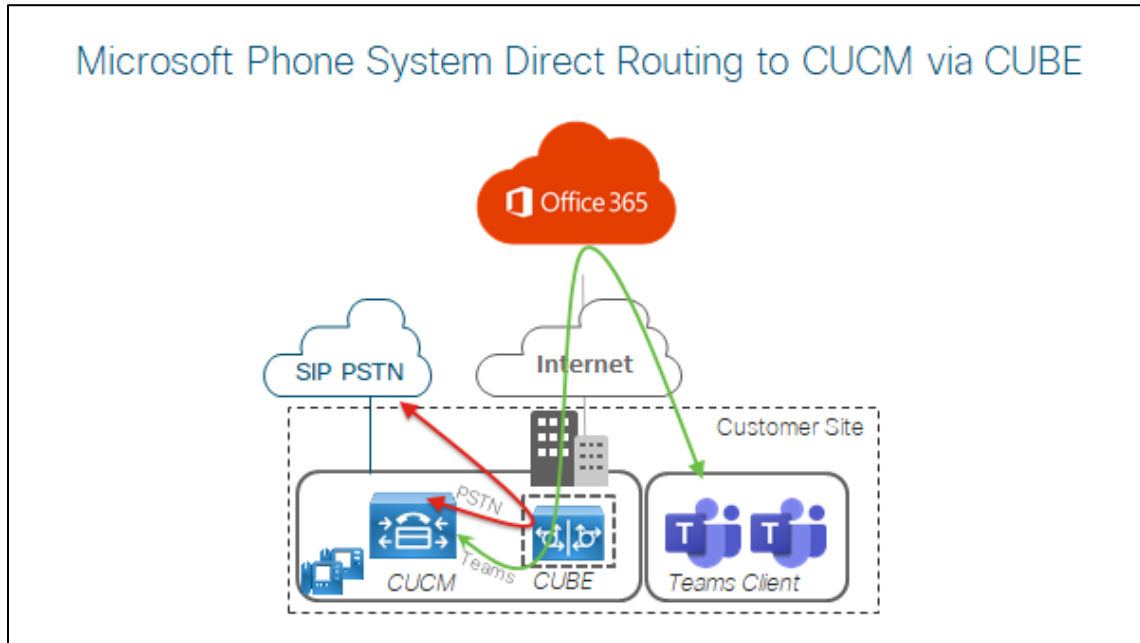


Figure 1: Network Topology

- The network topology includes the Microsoft Phone System, Microsoft Teams client, CUBE, Cisco UCM, IP Phones, and the PSTN
- Microsoft 365 Admin Center is used to configure a gateway trunk associated with the CUBE public FQDN
- The trunk between CUBE and Microsoft Phone System uses TLS/SRTP
- The trunk between CUBE and Cisco UCM uses UDP/RTP
- Cisco UCM has a PSTN connection that may use the same CUBE or a dedicated PSTN GW. The configuration of that is out of the scope of this documentation
- This solution allows calling between Microsoft Phone System clients and Cisco UCM clients or the PSTN via CUBE

## Deployment & Call Routing Options

### Deployment

**Coresident Direct Routing SBC** – Where a common CUBE instance is used to connect Microsoft Phone System to both Cisco UCM and the PSTN.

### Call Routing

There are two principal ways in which call routing can be configured with a coresident SBC deployment.

**Call routing with Cisco UCM** – This is where all calls, regardless of destination are routed via Cisco UCM. This centralizes dial plan management and is a recommended solution. When a coresident PSTN GW is used, a call from Microsoft Phone System will route through CUBE to Cisco UCM and then back to CUBE to the PSTN trunk.

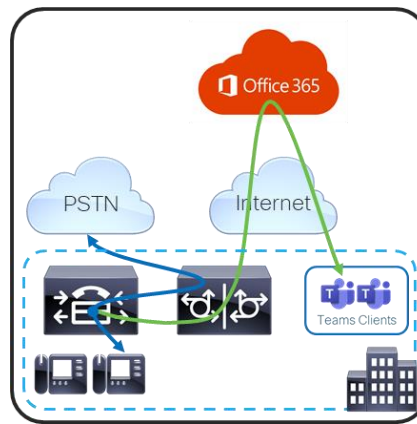


Figure 2: Coresident Direct Routing SBC and PSTN GW with UCM Call Routing

**Call routing with CUBE** – This is where calls between Microsoft Phone System and the PSTN are routed directly by CUBE. This solution may be chosen in a coresident PSTN gateway deployment to reduce the number of call legs. Routing calls from the PSTN towards Cisco UCM or Microsoft Phone System may require the management of a more detailed CUBE dial plan.

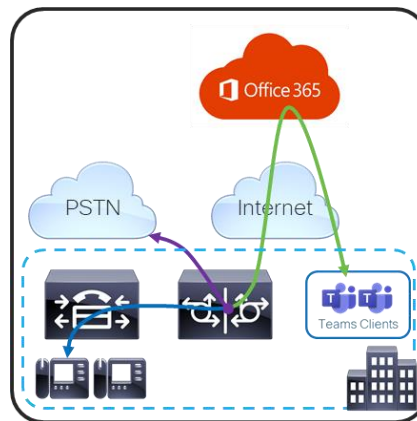


Figure 3: Coresident Direct Routing SBC and PSTN GW with CUBE Call Routing

## Deployment

**Dedicated Direct Routing SBC** – Where there is a dedicated CUBE instance for Direct Routing and an additional gateway used for connection to the PSTN.

## Call Routing

There is one principal way in which call routing can be configured with a dedicated SBC deployment.

**Call routing with Cisco UCM** – This is where all calls, regardless of destination are routed via Cisco UCM. This centralizes dial plan management and is a recommended solution. A call from Microsoft Phone System will route through CUBE to Cisco UCM and then to the PSTN GW.

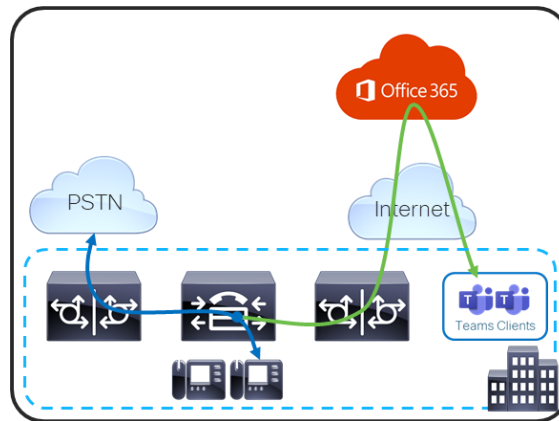


Figure 4: Dedicated Direct Routing SBC with UCM Call Routing

The PSTN connection in any of these scenarios could be an ITSP SIP Trunk or an Analogue/TDM connection. An ITSP SIP Trunk was used for Cisco testing & validation.

## Tested Topology and System Components

The following components were used in the validation of this solution. Please refer to product specific documentation for further details.

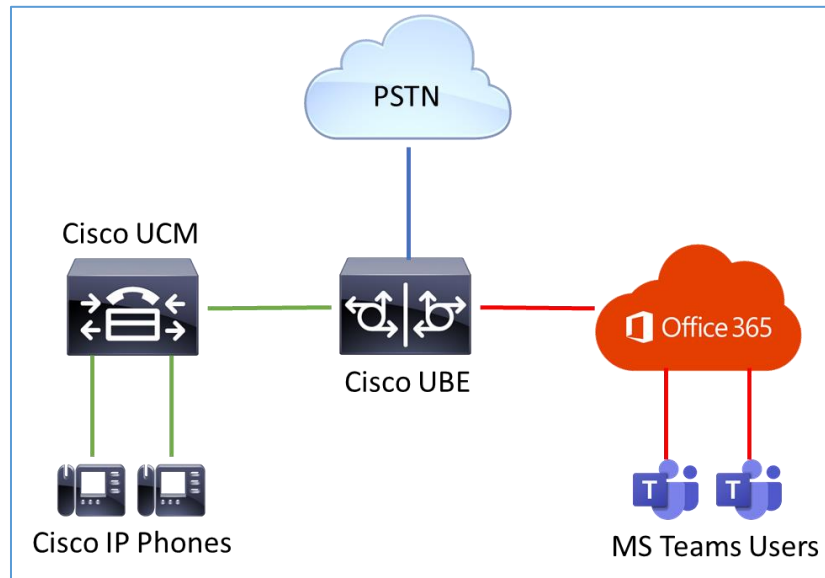


Figure 5: Tested Network Topology

### Cisco UCM

- Cisco Unified Communications Manager release 12.5.1 [Any currently supported version may be used]

### CUBE

- Cisco ISR 4000 series router [Any certified platform may be used]
- CUBE-Version: 12.8.0 (IOS-XE 17.2.1r) [Later releases may be used]

### Cloud Infrastructure

- Microsoft Office 365 Tenant with Phone System license
- Media Bypass Off/Disabled (Media Bypass On has not yet been tested with Cisco UCM interoperability)

### End Points

- Microsoft Teams client for Windows or Mac [Any client supported by Microsoft may be used, features may vary]
- Cisco IP Phones running enterprise SCCP or SIP software registered to Cisco UCM

## Features

The following details how Cisco UCM features work when interconnecting with Microsoft Phone System using Direct Routing with CUBE.

For features independent of Cisco UCM please refer to the “Direct Routing for Microsoft Phone System with CUBE” application note.

### Summary of Features/Scenarios Validated

- Basic call between the two systems and verification of voice path, using both SIP and legacy (SCCP) phones registered to Cisco UCM, and Teams clients registered to Microsoft Phone System<sup>1</sup>
- CLIP/CLIR/CNIP/CNIR features: Calling party Name and Number delivery (allowed and restricted)<sup>1</sup>
- COLP/CONP/COLR/CONR features: Connected Name and Number delivery (allowed and restricted)<sup>1</sup>
- Call Transfer: Attended and Early attended<sup>1</sup>
- Alerting Name Identification<sup>1</sup>
- Call forwarding: Call Forward Unconditional (CFU), Call Forward Busy (CFB), and Call Forward No Answer (CFNA)
- Hold and Resume with Music on Hold
- Three-way conferencing<sup>1</sup>
- Voice messaging and MWI activation-deactivation<sup>1</sup>
- Call Park<sup>1</sup>
- Extend and Connect<sup>1</sup>
- Single Number Reach (SNR) provides Cisco UCM users with the ability to be reached via a single enterprise phone number that rings on both their Cisco IP desk phone and their Microsoft Teams client (Remote Destination) simultaneously. Users can pick up an incoming call on either their Cisco IP Phone or Microsoft Teams client and at any point can use the Cisco IP Phone to transfer the call between devices without interruption.
- Centralized voicemail, using Unity Connection integrated with Cisco UCM via SIP. This voicemail solution can provide centralized voicemail services, supporting both Microsoft Phone System and Cisco end-users.

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<sup>1</sup> Refer to

Limitations section for further details.



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## Limitations

The following limitations should be considered when interworking Cisco UCM with Microsoft Phone System using CUBE for Direct Routing:

- To ensure that mid-call features, such as hold and transfer work correctly, the Cisco UCM SIP trunk to CUBE must be configured to use a Media Termination Point (MTP). When using a Cisco UCM software MTP, calls between Cisco UCM and CUBE use G.711 u-law encoding by default.
- Microsoft Phone System does not support overlap dialing.
- Microsoft Phone System does not support alerting name updates.
- Microsoft Phone System does not support Privacy ID sent by Cisco UCM in 180 Ringing or 200 OK when Connected Name/ID is restricted by Cisco UCM. Subsequently, Microsoft Phone System does not support updating Connected Party details as Private on the Teams client.
- Microsoft Phone System does not update the CLID in transfer/conference scenarios. After the transfer/conference is completed, Cisco UCM sends mid-call INVITE and UPDATE messages that contain P-asserted-id (PAI) and Remote-party-id (RPI). This information is not processed by Microsoft Phone System or presented on the Teams client.
- When using the Cisco Remote Destination feature, +E164 route patterns should be configured as required to direct extended calls to Microsoft Phone System.
- Microsoft Phone System does not support Message Waiting Indication (MWI) notifications from Cisco Unity Connection.
- When a call from a Microsoft Phone System client is transferred by Cisco UCM to another Microsoft Phone System client, the originating client does not display the Caller ID of the transferee.
- Direct routing for Microsoft Phone System does not support video codecs, therefore only audio calls can be established between Cisco UCM and Microsoft Phone System clients using this solution.
- A call parked in Cisco UCM can be retrieved by either Cisco UCM or Microsoft Phone System clients. A call parked in Microsoft Phone System can only be retrieved by Microsoft Phone System clients.
- Lines cannot be shared between Cisco UCM and Microsoft Phone System clients.
- Microsoft Phone System clients do not display alerting name or number when called from a UCM client.
- Connected party information restriction is not supported by Microsoft Phone System, either to or from UCM.
- Call completion (callback, automatic callback) is not possible when calling a Microsoft Phone System number from Cisco UCM.
- All calls between Microsoft Phone System registered numbers will take place in the cloud and not route through Direct Routing. This is expected and default behavior.

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## Solution Configuration Guidance

Cisco UCM is a feature-rich and highly configurable product that allows customers to closely align their solution with business and operational processes. As configurations vary greatly between customer installations, it would not be practical to include a step-by-step configuration guide that aligns with every use case in this document. Design processes used for customer systems should instead be extended to interconnect with Microsoft Phone System. The following paragraphs provide general guidance on how to configure the three principal components of this solution.

### Configuring Microsoft Phone System

In general, Microsoft Phone System should be configured as described in the “Direct Routing for Microsoft Phone System with CUBE” Application Note.

Where Cisco UCM is used for all call routing and Cisco Unity Connection is being used for centralized voicemail, Microsoft Phone System clients should be configured with a Calling Policy that responds with busy when on a call. To do this, set “Busy on busy is available when on a call” to On in a custom calling policy.

Microsoft Phone System may be configured to allow users to withhold their caller ID when calling via the Direct Routing SBC. If this feature is used, CUBE SIP profiles may be used to recover the caller ID from the privacy header when sending the call to Cisco UCM if required.

### Configuring Cisco UCM

Cisco UCM should be configured to interwork with Microsoft Phone System via CUBE using a SIP trunk. A dial plan should be constructed to suit the needs of both call control platforms and the PSTN.

When creating a non-secured SIP trunk between Cisco UCM and CUBE, the following parameters should be configured:

- SIP Trunk Security Profile
  - Accept unsolicited notifications
  - Replaces headers should be accepted
- SIP Trunk Profile
  - Media Termination Point required
  - Best Effort for Early Offer support for voice and video
  - Enable inbound Redirecting Diversion Header Delivery
  - Send PRACK for all 1XX messages
  - Enable Options Ping

### Configuring CUBE

The “Direct Routing for Microsoft Phone System with CUBE” Application Note provides details on how to configure CUBE for both Microsoft Phone System and PSTN trunks. Cisco UCM trunk configuration follows a similar approach to that detailed for non-secure PSTN trunks.

It is recommended that Cisco UCM, Microsoft Phone System and PSTN trunks are configured using separate voice-class tenant instances.

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To simplify dial plan configuration, consider using source [URI to classify inbound calls](#) and [dial-peer groups](#) to filter outbound route options. [E164 pattern-maps](#) may be used to limit the number of dial-peers required within each dial-peer group.

[Server groups](#) should be configured for multi-node Cisco UCM clusters.

[Options Ping](#) may be used to monitor the availability of Cisco UCM services.

## End-to-End TLS Topology

End-to-end TLS interoperability testing between Microsoft Phone System and Cisco UCM v14.0.1 via CUBE v14.4 [IOS-XE 17.6.3a] was also performed.

The following features are supported for an end-to-end TLS setup:

- Incoming and outgoing calls using G711ulaw and G729.
- Ad-hoc Conference
- Call hold & Resume
- Blind and Consultative Call transfer
- Call forward (all and no answer)
- DTMF (RFC2833)
- Microsoft Teams Calling number privacy (Anonymous Calling)

The following features are not supported in an end-to-end TLS setup:

- Legacy SCCP phones do not support secure calls as SCCP phones do not support the 80-bit crypto required by Microsoft Teams.
- Shared Line Appearance is not supported by Microsoft Teams clients.
- Blind Transfer is not supported by Cisco SIP Phones.
- Video calling scenarios were not tested.

The following caveats should be noted for an end-to-end TLS setup:

- Testing has been executed with Media bypass disabled in Microsoft Phone System Direct Routing Trunk.
- There is no ringback when a Microsoft Teams user performs a blind transfer.
- CUCM sends AVP instead of SAVP towards CUBE when the conference is initiated at CUCM. CUBE disconnects the call by sending a "BYE" as soon as receiving AVP/RTP from Cisco UCM
- A one-way audio issue was observed as Microsoft Teams sends "recvonly" in SDP response for the call resume INVITE though CUCM sends "sendrecv". A SIP profile was added to always send "sendrecv" from CUBE to Microsoft Phone System to ensure Microsoft Phone System responds with "sendrecv" always which resolved the one-way audio issue.
- Microsoft Phone System does not support receiving external notifications. Ex – NOTIFY sent by CUCM for message waiting indication (MWI).
- CUBE does not forward the PAI on 18x responses from CUCM to Microsoft Teams, though "asserted-id pai" is configured in CUBE. Hence, Alerting name is not updated for Microsoft Teams user.

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- When the call is initiated from Microsoft Teams to CUCM and the call is transferred from Teams to another CUCM phone, CUBE sends “491 Request Pending” continuously as CUBE receives REFER before the HOLD transaction gets completed.
  - When the call is initiated from CUCM to Microsoft Teams with a delayed offer, Microsoft Teams responds with a “400 Bad Request” for INVITE without SDP.