Cisco Unified Border Element

Product overview

Cisco® Unified Border Element (CUBE), Cisco's Session Border Controller (SBC), allows control of SIP services with registered external entities, most commonly service providers that offer VoIP services based on the SIP or H.323 protocols. CUBE is a software product available for licensing on the Cisco IOS® and Cisco IOS XE Software. It runs on many of our enterprise routers but is also available for licensing as a software load for a virtual container. This document lists the specific routers on which CUBE is supported, including the Cisco ASR 1000, 4000 Series ISRs, ISR G2, and several models of the 800 Series fixed-configuration routers. The virtualized CUBE, or vCUBE, runs in an ESXi virtual container as part of the Cisco Cloud Services Router (CSR) 1000V.

Part of the Cisco Collaboration Edge Architecture, CUBE is an enterprise-class SBC that connects large, midsize, and small business unified communications networks to the IP Public Switched Telephone Network (PSTN). In addition to session border control, CUBE has many other capabilities, including simple and cost-efficient collaboration beyond the enterprise firewall. Collectively these functions give you unprecedented flexibility for architecting your network.

CUBE use cases include:

- IP PSTN connectivity with Session Initiation Protocol (SIP) trunking (with or without time-division multiplexing [TDM] or ISDN backup)
- Cisco WebEx® Cloud Connected Audio (CCA and CCA-SP)
- Voice recording solutions (including either Real-Time Protocol [RTP] or Secure RTP [SRTP])
- Call-center Interactive-Voice-Response (IVR) solutions
- Call-center outbound call progress analysis solutions
- Voice security policy to identify malicious inbound calling patterns
- Cloud connectivity solutions for Cisco and third-party hosted call control
- VPN-less SIP phone proxy registration to hosted SIP-based call control (such as BroadSoft)
- Business-to-business telepresence, voice, and video interconnect

Each of these use cases is described in more detail in the following sections.

IP PSTN connectivity with SIP trunking

The benefits of unified communications and collaboration services will continue to grow as voice, video, and mobile services become more pervasive elements of integrated collaboration solutions. However, these enhancements will be available only if you deploy end-to-end real-time IP communications for both inter- and intracompany voice services based on SIP. This deployment requires transitioning your service provider network interconnect from TDM circuits to SIP trunking.

The SBC has become a critical network component for scaling and securing unified communications networks. The SBC makes it possible to expand end-to-end IP connectivity for real-time voice and video through service provider SIP trunks or through a secure SIP session over the Internet to directly connect two enterprise networks.

CUBE supports the transition to SIP trunking by enabling Cisco or third-party IP call and session control to connect to and interoperate with service provider SIP trunk services. It terminates and reoriginates both signaling (H.323 and SIP) and media streams (RTP and Real-Time Control Protocol [RTCP]) to provide secure border interconnection services between IP networks. Using this solution, Cisco customers can save on their current network services, simplify their network architectures, and position their networks for ongoing enhancements in collaboration services.

You can deploy CUBE virtually on Cisco Unified Computing System™ (Cisco UCS®) servers, or as an integrated Cisco IOS or IOS XE Software application. It runs on a broad range of Cisco router platforms. These routers include the Cisco 800, 2900, 3900, and 4000 Series Integrated Services Routers (ISRs) as well as the Cisco ASR 1000 Series Aggregation Services Routers. The breadth of Cisco router platforms that support the CUBE feature license means that it provides unsurpassed price and performance scalability compared to other enterprise SBCs. This scalability translates into network design flexibility for enterprise, midsize, and small businesses. It also means operational efficiencies and a broader serviceable market for service providers that include CUBE as part of their SIP trunk managed or hosted services.

CUBE performs the following functions between the enterprise and service provider networks:

- Session control: The capability to offer flexible trunk routing, Call Admission Control (Quality of Service [QoS]), and resiliency and call accounting for the SIP sessions processed by the SBC
- Interworking: The capability to interconnect different signaling methods and media encoding variants for both voice and video sessions
- Demarcation: The capability to act as a distinct demarcation point between two networks for address and port translation and to facilitate troubleshooting
- Security: The capability to intelligently allow or disallow real-time traffic between networks, and to encrypt the real-time traffic as appropriate for the application

Flexible SIP interconnect: As a Cisco IOS and IOS XE Software feature set that runs on a broad range of Cisco routers (see Table 2 for a complete list), CUBE enables great flexibility in how you design your SIP trunk network. Of course, this means you can now use existing Cisco routers as a CUBE platform. As a result you can deploy CUBE in centralized, distributed, or hybrid (combination of centralized and distributed) SIP architectures. This flexibility is invaluable as collaboration use cases, such as conferencing, video, and mobility, evolve and place increased demands on the enterprise network. Many service providers have recognized their customers' need to adapt and now offer multilocation SIP trunk pooling services. You can take advantage of these service offerings because of the unsurpassed SBC price and performance flexibility that CUBE provides.

For SIP network deployments that require a centralized architecture, you can deploy a CUBE cluster: a highly scalable, highly available configuration that is created when CUBE is used with Cisco Unified SIP Proxy (Cisco USP), which can support up to 64,000 concurrent sessions in a single cluster.

Simplified TDM-to-SIP migration: For most enterprises, the transition from TDM trunk services to SIP trunk services requires careful planning because this transition must be achieved while maintaining a functional voice network. This planning involves, among other things, addressing the service provider requirement for number portability and the IT requirement for dial-plan revisions. CUBE can simplify this transition, particularly for Cisco customers who already use the Cisco TDM Gateway on the Cisco 2900, 3900, and 4000 Series ISRs. You can easily upgrade these gateway platforms without requiring any additional hardware to support the CUBE feature license. Because they can concurrently support SIP trunking and TDM trunking, you can transition your voice network to SIP trunking while retaining the existing TDM gateway functions. Furthermore, you can achieve this without making any changes to the centralized dial plan of your organization. As you become familiar and confident with SIP trunking, you can phase out the TDM Gateway function, or retain it as a high-availability redundant network strategy.

Cisco Cloud Services: HCS and WebEx Cloud Connected Audio

CUBE is solution tested with Cisco Cloud Services: HCS and Webex CCA-SP.

CUBE supports multi-tenancy SBC functionality, which is tested as part of the HCS solution architecture. The CUBE multi-tenancy allows each configured sub-tenant to have its own SIP user agent definition, thereby enabling registration of each sub-tenant to the Service Provider IMS environment for improved accounting and serviceability.

CUBE also provides value for the Cisco WebEx Cloud Connected Audio (CCA) by providing a tested peering connection from the Cisco WEBEX cloud to the Service Provider SIP service architecture. This allows WEBEX audio sessions to be transmitted to the SIP trunk customers of the Service Provider over their existing provisioned SIP trunk connections. CUBE can also be used on the SP customers premise to enable SIP normalization between the customer's on-prem IP-PBX and the Webex services. Overall, CUBE supports the high-capacity SIP media connectivity to the Cisco WebEx® cloud to replace the customer's more expensive TDM audio connection.

Voice and video recording

CUBE supports voice-recording solutions by providing various mechanisms to invoke media forking on a per-call basis. One method, based on SIPREC standards, sends a forked SIP invite to the target recording application server, which can either accept or reject the call.

An alternative method is an HTTP-based API that allows Cisco Unified Communications Manager starting with version 10.0, to instruct CUBE to perform the media forking for each specific call session, and can toggle the media forking through the duration of an active call.

Call-center and IVR solutions

CUBE provides numerous features to improve the performance of your enterprise call center. For example, it supports midcall codec renegotiation, with either internal transcoding or external endpoints, to allow different codec support for IVR versus live agent communication. CUBE also supports SIP-based call progress analysis for outbound call-center solutions, thereby enabling an entirely SIP-based call center environment for both inbound and outbound customer contact functions. CUBE, as a gateway function, is also closely integrated with IVR functions, because it runs concurrently on the Integrated Services Routers Generation 2 (ISR G2) router with the Cisco IOS and IOS XE Software-based VoiceXML.

Voice policy

CUBE, as part of its complete SBC security function, supports policy-led evaluation of phone calls. This capability is becoming increasingly critical as incidents of Telephony Denial-of-Service (TDoS) attacks are more prevalent, as evidenced by the formal public warnings of such attacks being given by the U.S. Federal Bureau of Investigation (FBI) and Department of Homeland Security (DHS). CUBE enables highly flexible and granular voice-policy solutions to identify specific patterns of calling activity from either internal users (employees) or external callers and to take appropriate action when those patterns occur, including call termination, call redirection, and call recording. This call pattern recognition helps ensure that the enterprise voice network is not disrupted by external callers with malicious intentions, but rather is used to support the strategic communications activities of the business, as intended.

Cloud connectivity solutions for third-party hosted call control

Many service providers offer hosted call-control services to their small customers based on cloud-based Private-Branch-Exchange (PBX) software such as BroadSoft. Using the NanoCUBE licensing (refer to the "CUBE Licensing Options" section later in this document), Cisco 800 Series ISRs, part of the Cisco Integrated Services Routers Generation 2 (ISR-G2) portfolio, can be included as part of these hosted call-control services to perform gateway functions at the customer premises, such as registration pass-through, voice quality metrics, and 911 preemption.

CUBE licensing options

CUBE licensing is, in all cases, a per-session license, where a "session" is defined as a two-way call transiting CUBE, either for signaling, media or both, regardless of the number of media sessions involved in that call. As such, there is no additional licensing needed for calls with media forking for call recording.

CUBE can be licensed according to the following three different licensing options:

- CUBE Legacy licensing: Since the first release of CUBE in 2004, CUBE licensing has been treated as an option for the hardware platform on which it will be deployed. This licensing model is still available, and is now referred to as CUBE Legacy licensing. There are two versions of the CUBE Legacy licensing, Standard and Redundant. The CUBE Redundant Legacy licensing is used to support CUBE high availability deployments, with either active/standby redundant pairs to support call preservation, or active/active redundant pairs without call preservation. CUBE Standard Legacy licensing is used for CUBE licensing with all modular Cisco ISR and ASR 1000 Series platforms to deliver the full range of CUBE functions, but without redundancy for high availability. In both cases, the CUBE Legacy license is nontransferable, except between redundantly paired Cisco IOS and IOS XE platforms in the event of a redundancy failover. If the user wants to deploy CUBE on a new Cisco IOS or IOS XE platform, they must buy additional CUBE Legacy licensing to be associated with a new Cisco IOS or IOS XE platform.

- CUBE Cisco ONE™ Licensing: Since February, 2015, CUBE session licenses have been included in the Cisco ONE UC WAN bundle. Beginning in January 2017, CUBE add-on session licensing has been available in the Cisco ONE ordering structure. In addition, CUBE upgrade licenses are available in Cisco ONE to allow upgrades of CUBE Legacy licensing to CUBE Cisco ONE licensing. The CUBE Cisco ONE licensing offers all the benefits, as well as having all the obligations, of Cisco ONE licensing. For example, CUBE Cisco ONE licensing is transferable within the constraints defined by the Cisco ONE tiering rules, as set forth at the following document: https://www.cisco.com/c/en/us/products/collateral/software/one-software/tiering-guide-cisco-one.html?cachemode=refresh. However, the rights to transfer the CUBE Cisco ONE licenses require that the user have a current and SWSS contract.

- NanoCUBE licensing: NanoCUBE licensing is used for the Cisco 800 Series ISR and Cisco Service Provider Integrated Access Device (SP-IAD) platforms, typically as part of a third-party cloud-hosted call-control

solution, such as BroadSoft. This licensing option also supports other CUBE features, except to the extent that such features require additional hardware platform support, such as Digital Signal Processors (DSPs) for transcoding. The primary difference for NanoCUBE licensing, as compared to the other two CUBE licensing options, is that NanoCUBE is not session based. Instead, NanoCUBE is platform based and allows usage of the total maximum number of CUBE sessions that can be supported by the platform. The maximum number of sessions for the Cisco 800 Series ISR is shown in Table 2 of this document.

Table 1 provides a summary of CUBE licensing options:

Table 1.   CUBE licensing options

License type	Standard		Redundant
Session type	Trunk sessions	Line sessions (proxy registrar)	Trunk sessions with media failover HA
Legacy	All CUBE features supported except redundancy for high availability. However, session license is tied to a specific serial number platform.	Not applicable	Allows dual redundancy to support active/standby pairs in the same data center, to support active/active across data centers, or both simultaneously.
Cisco ONE	All CUBE features supported except redundancy for high availability. License transferability allowed within terms of Cisco ONE platform transfer rules.	Not applicable	Allows active/standby pairs in the same data center. Active/active is automatically included under terms of Cisco ONE transferability (see the Cisco ONE ordering guide, as referenced above).
NanoCUBE	Most CUBE features, but with exceptions, including transcoding, media forking, SRTP-RTP, active/standby HA. However, it adds PSTN FXO survivability	Line-side proxy registration (10 endpoints per registration event) with PSTN and local survivability	Not applicable

For more details on CUBE ordering, please see the Ordering Information section, where the specific product IDs for the different types of CUBE licensing, as described above, are presented, as well as product IDs for license upgrades from Legacy to Cisco ONE licensing and for license upgrades from Standard to Redundant licensing.

CUBE feature support

CUBE supports a comprehensive list of SBC features, which can be categorized into one of the following: Session Control, Security, Interworking, Demarcation. Table 2 provides a detailed (though not complete) list of the SBC features supported.

Table 2.   Cisco Unified Border Element features (CUBE versions include 9.5.1 or later)

Feature	Support details
Protocols	• H.323 and SIP
Protocol and signal interworking	• H.323 to H.323 (including Cisco Unified Communications Manager) • H.323 to SIP (including Cisco Unified Communications Manager) • SIP to SIP (including Cisco Unified Communications Manager) • SIP to SIP (including Cisco TelePresence® calls)
Media support	• RTP, RTCP, and Binary Flow Control Protocol (BFCP) • Sub-RTCP for media statistics
Media interworking	• SIP delayed-offer to SIP early-offer interworking for audio or video calls • H.323 Slow Start to H.323 Fast Start for audio calls
Media modes	• Media flow-through • Media flow-around
Signaling transport mode	• Transport Control Protocol (TCP) • User Datagram Protocol (UDP) • TCP-to-UDP interworking

Feature	Support details
Fax support	• T.38 fax relay • Fax pass-through • Fax over G711
Modem support	• Modem pass-through • Modem over G711

Dual-tone multifrequency (DTMF)	• H.245 alphanumeric
	• H.245 signal
	• RFC 2833
	• SIP notify
	• Key Press Markup Language (KPML)
	• Interworking capabilities include:
	  ◦ H.323 to SIP
	  ◦ RFC 2833 to G.711 in-band DTMF[*]
	  ◦ Various SIP-to-H.323 DTMF interworking options
	  ◦ RFC 2833 to KPML

Supplementary services	• Call hold, call transfer, and call forwarding for H.323 networks using H.450 and transparent passing of Empty Capability Set (ECS) • SIP-to-SIP supplementary services (holds and transfers) support using REFER • SIP-to-SIP supplementary services (holds and transfers) support using REINVITE • H.323-to-SIP supplementary services for Cisco Unified Communications Manager with Media Termination Point (MTP) on the H.323 trunk • Multicast Music on Hold (MMoH) to Unicast MoH conversion • Call Progress Analysis (CPA) to analyze far-end media (live vs. recorded media) for outbound call center
Internetworking	• Configurable SIP profiles to manipulate SIP message content, including header fields and Session Descriptor Protocol (SDP) attributes • P-Asserted-Identity (PAI), P-Preferred-Identity (PPI), and Remote-Part-ID (RPID) internetworking** • Unsupported Multipurpose Internet Mail Extensions (MIME)-type attachment pass-through** • Unsupported SIP header pass-through** • Dial-peer bind (allows Cisco Unified Border Element to connect to multiple different service providers) • Incoming dial-peer match based on remote IP address • Assisted RTCP for Microsoft Lync Interoperability • Conditional SIP profiles, performing header modification dependent on header content
Call routing and dialing options	• E164-based dialing • Uniform Resource Identifier (URI)-based dialing • Routing based on nonsequential lists (either E164 or URI or both) • Destination-based or source-based routing • Dial Peer Groups (Trunk Groups) (outbound routing determined by inbound dial pattern) • Server Groups to define order of selection of alternative or backup routing paths for outbound routing • Routing based on duple header variables (both AND OR logic) • Refer consumption and refer pass-through
Multitenancy, multi-VRF, and trunk realms	• Support for dial plan scenarios requiring either or both inter- and intra- IP VRF routing tables. • Per VRF-domain SIP user agent for multi-tenancy support. • Realm commonality of multiple trunks, even with different user agent definitions per trunk
Cisco Call Admission Control (CAC)	• CAC based on maximum number of calls per trunk (maximum number of calls) • CAC based on IP circuits • CAC based on total calls, CPU use, or memory use threshold • CAC based on bandwidth availability and call-spike detection • Resource Reservation Protocol (RSVP)
OPTIONS SIP message support	• Support for response to OPTIONS-PING messages with OPTION- PING groups based on session target • Support for generation of in-dialog OPTIONS-PING messages • Support for generation of out-of-dialog OPTIONS-PING messages to control dial-peer status**
Media recording	• Media forking features for both voice and video to integrate with Cisco TelePresence Media Recording Servers • API-based mechanisms for invoking media forking • Support for standard SIPREC media forking

Feature	Support details
IP routing feature	• Support for Cisco IOS and IOS XE Software-based routing features, including Border Gateway Protocol (BGP), Enhanced IGRP (EIGRP), and Multiprotocol Label Switching (MPLS) • Support for Cisco IOS and IOS XE Software-based policy routing features • Support for Cisco IOS and IOS XE Software-based Access-Control-List (ACL) features • Integration with Cisco Intelligent WAN (IWAN) functionality. IWAN is Cisco's version of SD-WAN features
Voice-quality statistics	• Packet loss, jitter, and Round-Trip Time (RTT) • Per-call leg call-quality statistics • Flexible NetFlow call-quality statistics and information • Sub-RTCP statistics collection
QoS	• IP Precedence and Differentiated-Services-Code-Point (DSCP) marking • Per-call QoS packet marking
Network Address Translation (NAT) traversal	• NAT traversal support for SIP phones deployed behind non-Application Line Gateway (ALG) data routers • Stateful NAT traversal • IPv4-to-IPv6 translation
Network hiding	• IP network privacy and topology hiding • IP network security boundary • Intelligent IP address translation for call media and signaling • Back-to-back user agent, replacing all SIP-embedded IP addressing • History information-based topology hiding and call routing
Number translation	• Number translation rules for Voice-over-IP (VoIP) numbers • URI-based dialing translations
Codecs	• G.711 mu-law and a-law • G.722 and G.722.2 • G.723ar53, G.723ar63, G.723r53, and G.723r63 • G.726r16, G.726r24, and G.726r32 • G.728 • G.729, G.729A, G.729B, and G.729AB • Internet Low Bitrate Codec (iLBC) • Mid-call codec renegotiation • Adaptive Multi-rate (AMR) wideband • AAC-LD

Transcoding**	• Transcoding between any two different families of codecs from the following list:
	  ◦ G.711 a-law and mu-law
	  ◦ G.729, G.729A, G.729B, and G.729AB
	  ◦ iLBC
	  ◦ G.722
	• Mid-call transcoder insert and drop

Security	• Rogue SIP invite and rogue RTP packet detection • Alerts for rogue packet activity • Configurable RTP port range • IP Security (IPsec) • SRTP flow-through • Transport Layer Security (TLS) version 1.2, with exclusivity • SRTP-to-RTP interworking with SHA 384 key format • Configurable SIP listening port • Configurable closing of unused transport mechanisms • SIP registration and digest authentication support • Various mechanisms for control of RTP and UDP packet flooding • Voice security policy application integration (via API)

Feature	Support details
Authentication, authorization, and accounting (AAA)	• AAA with RADIUS
Voice media applications	• Tool Command Language (Tcl) scripts support for application customization • Web-based API to monitor and control signaling and media traffic (for external policy control)
API	• Web-based API compatible with Web Service Description Language (WSDL) development tools to support call monitoring and control, Call-Detail Records (CDRs), and serviceability attribute interaction with external application; specifically designed for voice-policy applications

Billing	• Standard CDRs for accurate billing available through:
	  ◦ AAA records
	  ◦ Syslog
	  ◦ Simple Network Management Protocol (SNMP)

Lawful intercept[**]	• Provision of replicated packets to third-party mediation device
Line-side proxy user agent NanoCUBE sessions	• Proxy registration of endpoints using standard SIP registration process (including third-party SIP endpoints) for connecting with third-party hosted call-control services (e.g. BroadSoft). • Local and PSTN survivability in the event of loss of WAN connectivity to hosted call control • Call preemption • Proxy endpoint registration with 10 endpoints per SIP registration event
Inter-Cluster Lookup Service (ILS) routing	• Support for ILS routing to complement ILS dial-plan exchange between Cisco Unified Communications Manager clusters or to simplify call-routing complexity between multiple clusters
Video	
Protocols	• H.323 and SIP
Cisco endpoints supported	• Cisco Unified Video Advantage (UVA) and Cisco TelePresence endpoints
Rich media	• Simultaneous support for data, audio, and video
Signaling interworking	• SIP delayed-offer to SIP early-offer calls
Media	• Support for multiplex RTP calls (for Cisco TelePresence solution) • Simple Traversal of UDP through NAT (STUN)/Datagram TLS (DTLS) pass-through for telepresence
H.323-enhanced features	• H.235 pass-through for secure calls • H.239 pass-through for picture-in-picture feature
QoS	• DSCP markings to prioritize video streams as they traverse the network
Data support	• T.120 data collaboration flow-around only
Camera control	• Far-End Camera Control (FECC)
Video suppression	• Terminate video media session for connection to audio-only sessions
Video codecs	• H.261 • H.263 • H.264
Network management	
Manageability, serviceability, and troubleshooting	• Resource usage monitoring over SIP trunk • Sortable dial peers • SNMP per-call quality traps • SNMP and syslog SIP trunk status messages • DEBUG commands allowing user-selectable levels of debug information, from critical to verbose • DEBUG commands allowing user-selectable information for specific call characteristics

Feature	Support details
High availability	
High availability	• Inbox redundancy on Cisco ASR 1006 • Box-to-box redundancy on Cisco ASR 1000 (based on RG Infrastructure) • Box-to-box redundancy on Cisco ISRs (Hot Standby Router Protocol [HSRP]-based) • Use of port channels to allow connection to redundant switches **Note:** Media is preserved for active calls at time of failover in each redundancy configuration listed.

** Requires DSPs and is available only on the Cisco 2900, 3900, 3900E, and 4000 Series Integrated Services Routers and Cisco ASR 1000 Series Aggregation Services Routers.

Router platform support

CUBE is developed as a component within Cisco IOS and IOS XE Software and runs on the following platforms:

- Cisco 800 Series ISRs (Cisco 880 Series and Cisco 892F and 897 models)
- Cisco Integrated Access Device (SP-IAD) (EOL has been announced)
- Cisco 2900 Series ISRs (Cisco 2901, 2911, 2921, and 2951) (EOL has been announced)
- Cisco 3900 Series ISRs (Cisco 3925 and 3945) (EOL has been announced)
- Cisco 3900E Series ISRs (Cisco 3925E and 3945E)
- Cisco 2900 Series ISRs (Cisco 2901, 2911, 2921, and 2951)
- Cisco 4000 Series ISRs (Cisco 4321, 4331, 4351, 4431, and 4451)
- Cisco ASR 1000 Series Routers (Cisco ASR 1001-X, 1002-X, 1004, and 1006 (RP2) models)
- Cisco CSR 1000V virtualized router platform (see section on virtual CUBE below)

A minimum of 64 MB of flash memory and 256 MB of DRAM and a minimum of one Fast Ethernet port for an external interface are required.

CUBE may require additional hardware for connectivity to the PSTN and WAN and for transcoding capabilities. If connected to the IP network through a WAN connection, CUBE supports all the WAN connectivity methods and interface cards that the underlying router platform supports.

Note: For transcoding, additional DSPs are required.

More information about transcoding is available at:
https://www.cisco.com/en/US/products/ps5854/products_qanda_item0900aecd8016c2c7.shtml.

Product specifications and session capacities

Table 3 shows platform memory specifications to support CUBE. In this table, the maximum capacities for each CUBE platform are shown, which is intended for the purpose of platform comparison only. Actual session capacities achieved by the user will depend on various factors, including CPS rate, call type (for example, call center vs. standard IP telephony), transcoding, and session type. CUBE supports two session types, as follows:

- SIP trunk session: SIP trunk registration and connectivity to service provider
- NanoCUBE session: Allows for SIP endpoint access to hosted third-party call control

Table 3. Platform support, product specifications, and session capacity and session types

Router platform with latest CUBE versions	Flash memory	DRAM	Maximum SIP trunk sessions**	Maximum NanoCUBE sessions**	Calls per second: Sustainable / maximum
C881V ISR[*] **C886V ISR**[*] **C887V ISR**[*]	Fixed configuration	Fixed configuration	15	15	4 / 8
C888E ISR[*]	Fixed configuration	Fixed configuration	25	25	5 / 10
C892FSP ISR[*]	Fixed configuration	Fixed configuration	50	50	6 / 12
C897VA ISR	Fixed configuration	512 MB upgradable to 1024 MB	80	80	6 / 12
Cisco 2901 ISR	256 MB	2.5 GB	100	–	6 / 12
Cisco 2911 ISR	256 MB	2.5 GB	200	–	7 / 14
Cisco 2921 ISR	256 MB	2.5 GB	400	–	7 / 14
Cisco 2951 ISR	256 MB	2.5 GB	600	–	7 / 14
Cisco 3925 ISR	256 MB	2.5 GB	800	–	10 / 20
Cisco 3945 ISR	256 MB	2.5 GB	950	–	10 / 20
Cisco 3925E ISR	256 MB	2.5 GB	2,100	–	12 / 24
Cisco 3945E ISR	256 MB	2.5 GB	2,500	–	14 / 28
Cisco 4321 ISR	256 MB	4 GB	150	–	15 / 30
Cisco 4331 ISR	256 MB	4 GB	500	–	16 / 32
Cisco 4351 ISR	256 MB	4 GB	1,000	–	17 / 34
Cisco 4431 ISR	256 MB	8 GB	3,000	–	22 / 44
Cisco 4451 ISR	Refer to data sheet	8 GB	6,000	–	28 / 56
Cisco ASR 1001	Refer to data sheet	16 GB	10,000	–	35 / 70
Cisco ASR 1001-X	Refer to data sheet	16 GB	12,000	–	40 / 80
Cisco ASR 1002-X	Refer to data sheet	16 GB	14,000	–	75 / 150
Cisco ASR 1004 and ASR 1006 (RP2)	Refer to data sheet	16 GB	16,000	–	75 / 150
Cisco CSR 1000V	Refer to data sheet	Refer to section below "More About Virtualized CUBE "	Refer to section below "More About Virtualized CUBE "	–	Refer to section below "More about Virtualized CUBE"

[*] These router platforms support NanoCUBE licensing (refer to section "CUBE Licensing Options").
** Maximum trunk sessions mentioned are for simple trunk calls (seven messages per leg) and may vary depending on call and or message rate.
** Maximum sessions assumes that only the specified session is configured. Simultaneous use of other CUBE session types will reduce session maximums one for one.

More about virtualized CUBE (vCUBE)

To facilitate the IT trend toward virtualization, CUBE is also available in a virtualized form factor. Virtual CUBE is integrated into the Cisco Cloud Services Router 1000V (CSR 1000V), which is based on the Cisco IOS XE operating system used on the 4000 Series ISRs and ASR 1000 Series, but which has been adapted to run on a hypervisor on the Cisco UCS servers. This section provides more details about this virtual CUBE (or, for short, vCUBE).

Hardware

Virtual CUBE has been tested with the same ESXi hypervisors supported by the Cisco CSR 1000V. Although the CSR 1000V has been tested with a broader range of hypervisors than vCUBE, until further announced, vCUBE will be supported only on ESXi. Furthermore, both vCUBE and CSR 1000V can be deployed on third-party "spec-based" servers. However, vCUBE has been performance tested only on the Cisco UCS servers. Table 4 provides the Cisco UCS server configurations that support vCUBE.

Table 4.   Virtual CUBE hardware and hypervisor support

Cisco UCS	Hypervisor	Virtual CUBE form factor	
		vCPU per vCUBE instance	Memory (GB) per vCUBE instance
Cisco UCS-E, UCS-C Series	ESXi	1	4
Cisco UCS-E, UCS-C Series	ESXi	4	4
Cisco UCS-E, UCS-C Series	ESXi	4	8

Software

Proper configuration of vCUBE on the CSR 1000V requires a thorough understanding of the CSR 1000V. To obtain this understanding, the following documents are recommended for your review:

- Understand the overall CSR 1000V product offering. For details about this, please refer to the following document: https://www.cisco.com/c/en/us/products/collateral/routers/cloud-services-router-1000v-series/datasheet-c78-733443.html

- Understand the CSR 1000V basic platform and configuration requirements. For details about this, please refer to the following document: https://www.cisco.com/c/en/us/td/docs/routers/csr1000/software/configuration/b_CSR1000v_Configuration_Guide/b_CSR1000v_Configuration_Guide_chapter_00.html?dtid=osscdc000283

- Understand the relevant CSR 1000V license parameters. For details about the licensing package support and hardware requirements, please refer to the Cisco CSR 1000V Series Cloud Services Router Configuration Guide.

- Install the appropriate Cisco IOS or IOS XE Software image as part of Cisco CSR 1000V installation, which supports vCUBE. For details about installation, please visit Installation.

Licensing package support

Virtual CUBE is enabled with the APPX and AX feature license packages available as options with the CSR 1000V. The AX license package provides access to all features supported in vCUBE. When the license is installed, the vCUBE-related Command-Line Interface (CLI), including voice and dial-peer configurations, is visible. Also, relevant CUBE processes are instantiated.

Table 5 details the license package support for a virtual CUBE.

Table 5.   License package support for Virtual CUBE

vCUBE session license quantity	CSR 1000v feature license option	CUBE feature support	Performance
10 concurrent sessions	APPX	All CUBE features except TLS, SRTP, and transcoding	See Table 6 below
10 concurrent sessions	AX	All CUBE features except transcoding	See Table 6 below

At this time, neither vCUBE nor CSR 1000V are orderable under the Cisco ONE licensing structure. As such, until Cisco ONE licensing is available for these products, add-on vCUBE licenses should be ordered using the following product IDs, which are described in more detail in Table 8:

- FLASR1-CUBE-100P=
- FLASR1-CUBE-100R=

When both vCUBE and CSR 1000V are included in Cisco ONE licensing, add-on licenses for vCUBE purchased under the Legacy licensing model will be upgradable to Cisco ONE licensing terms.

For detailed information about CSR 1000V licensing, refer to the Cisco CSR 1000V Series Cloud Services Router Configuration Guide.

Performance

Table 6 gives performance information about virtual CUBE. This performance information is based on CUBE flow-through sessions with 14 SIP messages per call and with a call hold time of 180 seconds.

Table 6.   Performance information for virtual CUBE

vCPU required per vCUBE instance	Memory (GB)	Sustainable calls per second (CPS)	Maximum SIP trunk sessions
1	4	5	900
4	4	16	2900
4	8	18	3250

Ordering Information

This section details the various options for ordering the CUBE product.

This product is orderable by following three simple steps:

1. Select a Cisco router based on performance requirements (refer to Table 3).
2. Select a Cisco IOS or IOS XE Software image with CUBE feature support (all IP Voice and later images support some components of CUBE). On the Cisco 2900, 3900, 3900E, and 4000 Series platforms that use a universal software image, select the Unified Communications package.
3. Select the appropriate Cisco IOS or IOS XE Software feature license.

To order CUBE Legacy Bundles, refer to the product IDs in Table 7.

To order CUBE Cisco ONE Bundles, refer to Tables 9 and 10.

To order CUBE software licenses as an add-on to a previously ordered CUBE hardware platform (such as a 4000 Series ISR or ASR 1000 Series), follow steps 2 and 3 and refer to either Table 8 (for CUBE Legacy licenses) or Table 9 (for Cisco ONE licenses) when selecting feature license part numbers.

To upgrade CUBE Legacy licenses to CUBE Cisco ONE licenses, refer to Table 9.

To order CUBE software for the CSR 1000V, use the same part numbers as for CUBE on the ASR 1000.

To order CUBE clustering, refer to the data sheet for Cisco Unified SIP Proxy (Cisco USP) v9.0.

Table 7.   CUBE Legacy platform bundles

Part number (SKU)	Product description	Technology option required	License category	Flash/D RAM
C2901-VSEC-CUBE/K9	Cisco 2901 Voice Sec and CUBE Bundle, PVDM3-16, UC and SEC License P, FL-CUBEE-10	SL-29-UC-K9 and SL-29-SEC-K9	**Legacy**	256 MB 512 MB
C2911-VSEC-CUBE/K9	Cisco 2911 Voice Sec and CUBE Bundle, PVDM3-16, UC and SEC License P, FL-CUBEE-10	SL-29-UC-K9 and SL-29-SEC-K9	**Legacy**	256 MB 512 MB
C2921-VSEC-CUBE/K9	Cisco 2921 Voice Sec and CUBE Bundle, PVDM3-32, UC and SEC License P, FL-CUBEE-10	SL-29-UC-K9 and SL-29-SEC-K9	**Legacy**	256 MB 512 MB
C2951-VSEC-CUBE/K9	Cisco 2951 Voice Sec and CUBE Bundle, PVDM3-32, UC and SEC License P, FL-CUBEE-10	SL-29-UC-K9 and SL-29-SEC-K9	**Legacy**	256 MB 512 MB
C3925-VSEC-CUBE/K9	Cisco 3925 Voice Sec and CUBE Bundle, PVDM3-64, UC and SEC License P, FL-CUBEE-10	SL-39-UC-K9 and SL-39-SEC-K9	**Legacy**	256 MB 1 GB
C3945-VSEC-CUBE/K9	Cisco 3945 Voice Sec and CUBE Bundle, PVDM3-64, UC and SEC License P, FL-CUBEE-10	SL-39-UC-K9 and SL-39-SEC-K9	**Legacy**	256 MB 1 GB
C3925E-VSEC-CUBEK9	Cisco 3925E Voice Sec and CUBE Bundle, PVDM3-64, UC and SEC License P, FL-CUBEE-10	SL-39-UC-K9 and SL-39-SEC-K9	**Legacy**	256 MB 1 GB
C3945E-VSEC-CUBEK9	Cisco 3945E Voice Sec and CUBE Bundle, PVDM3-64, UC and SEC License P, FL-CUBEE-10	SL-39-UC-K9 and SL-39-SEC-K9	**Legacy**	256 MB 1 GB
ISR4321-V/K9	Cisco ISR 4321 Bundle, w/UC License, CUBE-10	No additional	**Legacy**	
ISR4331-V/K9	Cisco ISR 4331 Bundle, w/UC license, CUBE-10	No additional	**Legacy**	
ISR4351-V/K9	Cisco ISR 4351 Bundle, w/UC license, CUBE-10	No additional	**Legacy**	
ISR4431-V/K9	Cisco ISR 4431 Bundle, w/UC license, CUBE-10	No additional	**Legacy**	
ISR4451-V/K9	Cisco ISR 4451 Bundle, w/UC license, CUBE-10	No additional	**Legacy**	

Table 8.   Ordering information for add-on CUBE Legacy feature licenses

Part number (SKU)	Description
FL-CUBEE-5(=)	Feature license applicable to the Cisco 2900, 3900, and 4000 Series platforms for 5 simultaneous IP-to-IP Gateway sessions
FL-CUBEE-5-RED(=)	Feature license applicable to the Cisco 2900, 3900, and 4000 Series platforms for 5 simultaneous IP-to-IP Gateway sessions with dual redundancy option
FL-CUBEE-25(=)	Feature license applicable to the Cisco 2900, 3900, and 4000 Series platforms for 25 simultaneous IP-to-IP Gateway sessions
FL-CUBEE-25-RED(=)	Feature license applicable to the Cisco 2900, 3900, and 4000 Series platforms for 25 simultaneous IP-to-IP Gateway sessions with dual redundancy option
FL-CUBEE-100(=)	Feature license applicable to the Cisco 2900, 3900, and 4000 Series platforms for 100 simultaneous IP-to-IP Gateway sessions
FL-CUBEE-100-RED(=)	Feature license applicable to the Cisco 2900, 3900, and 4000 Series platforms for 100 simultaneous IP-to-IP Gateway sessions with dual redundancy option
FLASR1-CUBE-100P=	Cisco Unified Border Element 100 Sessions for ASR1000 Series sold as spare (add-on) license
FLASR1-CUBE-100R=	Cisco Unified Border Element 100 Sessions for ASR1000 Series with dual redundancy option sold as spare (add-on) license
FLSASR1-CUBEE-4KP=	Cisco Unified Border Element 4000 Sessions for ASR 1000 Series sold as spare (add-on) license
FLSASR1-CUBEE-4K-R=	Cisco Unified Border Element 4000 Sessions for ASR 1000 Series with dual redundancy option sold as spare (add-on) license
FLSASR1-CUBEE-16K=	Cisco Unified Border Element 16,000 Sessions for ASR 1000 Series sold as spare (add-on) license
FLSASR1-CUBEE-16R=	Cisco Unified Border Element 16,000 Sessions for ASR 1000 Series with dual redundancy option sold as spare (add-on) license

Part number (SKU)	Description
FLASR1-CE-100R	Cisco Unified Border Element 100 Sessions – ordered as option under ASR 1000 Series with dual redundancy.
FLASR1-CE-500R	Cisco Unified Border Element 500 Sessions – ordered as option under ASR 1000 Series with dual redundancy
FLASR1-CE-1KR	Cisco Unified Border Element 1000 Sessions – ordered as option under ASR 1000 Series with dual redundancy
FLASR1-CE-4KR	Cisco Unified Border Element 4000 Sessions – ordered as option under ASR 1000 Series with dual redundancy
FLASR1-CE-16KR	Cisco Unified Border Element 16,000 Sessions – ordered as option under ASR 1000 Series with dual redundancy
FL-NANOCUBE=	NANOCUBE license available only for 800 Series ISRs and SP-IAD 2900 routers
FL-SL-IPV-POL-100=	Voice Policy/Voice Security feature license for 100 sessions (additional Cisco UCS-E or UCS-C server required)
FL-SL-IPV-POL-1K=	Voice Policy/Voice Security feature license for 1,000 sessions (additional Cisco UCS-E or UCS-C server required)
FL-SL-IPV-POL-10K=	Voice Policy/Voice Security feature license for 10,000 sessions (additional Cisco UCS-E or UCS-C server blade required)
L-SP-MEADV-A-100=	Provisioning and monitoring for up to10 CUBE platforms

Table 9.　Ordering information for CUBE Cisco ONE feature licenses (see Cisco ONE ordering guide for more information)

CUBE Cisco ONE SKU	Top-level part number	Description
C1-CUBEE-STD	Depends on	Cisco ONE license for CUBE Standard Single Session
C1-CUBEE-RED	the ISR / ASR	Cisco ONE license for CUBE Redundant Single Session
C1-CUBEE-STD-RED-UP	Cisco ONE top-level part number (see list below)	License upgrade from Cisco ONE CUBE Standard to Cisco ONE CUBE Redundant
C1-CUBEE-STD	C1-ISR-ADD	Cisco ONE license for CUBE Standard Single Session
C1-CUBEE-RED	or	Cisco ONE license for CUBE Redundant Single Session
C1-CUBEE-STD-RED-UP	C1-ASR1K-ADD	License upgrade from Cisco ONE CUBE Standard to Cisco ONE CUBE Redundant
C1-CUBEE-UP-STD	C1-ISR-UPG or	Upgrade to CUBE Cisco ONE for CUBE Standard **Legacy license**
C1-CUBEE-UP-RED	C1-ASR1K-UPG	Upgrade to CUBE Cisco ONE for CUBE Redundant **Legacy license**

Table 10.　List of top-level Cisco ONE partner numbers

C1AUPISR4320SK9	C1AUPISR4330SK9	C1AUPISR4350SK9
C1AUPISR4400SK9	C1AUPISR2900SK9	C1AUPISR3900SK9
	C1AUPASR1SK9	

Downloading the software

After ordering a feature license, visit the Cisco Software Center to download the Cisco IOS and IOS XE Software. Table 12 provides the software image name and software feature set available with each platform.

Table 11.　CUBE software feature set and software file

Platform	Software image name	Software feature set
Cisco 880 and 890 router platforms	C880voice-universalk9-mz C890-UNIVERSALK9-M	Universal Image
Cisco 2901, 2911, and 2921 router platforms	c2900-universalk9-mz	Universal Image
Cisco 2951 router platforms	c2951-universalk9-mz	Universal Image
Cisco 3925 and 3945 router platforms	c3900-universalk9-mz	Universal Image
Cisco 4321, 4331, and 4351 router platforms	ISR4300-universalk	Universal Image
Cisco 4432 and 4451 router platforms	isr4400-universalk	Universal Image
Cisco ASR 1000 Series router platforms	SASR1R1-AESK9-21SR	Cisco ASR Advanced Enterprise Services

Platform	Software image name	Software feature set
Cisco CSR1000V Virtual router platform	csr1000v-universalk9.03.15.01.S-ext.ova	Cisco CSR Advanced Enterprise Services

Note: Cisco 2800 and 3800 Series ISRs can support CUBE with Cisco IOS or IOS XE Software Release 15.1(4)M and earlier. The end-of-life notice for these platforms can be found at the following link: https://www.cisco.com/en/US/prod/collateral/routers/ps5853/qa_c67-631674_ps5854_Products_End-of-Life_Notice.html.

Summary

Organizations large and small are realizing the value of SIP-based communication. The Cisco session border controller, CUBE, is helping these organizations take advantage of service providers' SIP services by providing voice and video connectivity for both trunk and line-side service offerings. As such, CUBE is ideal for businesses of all sizes; it cost-effectively supports a variety of SIP services, whether with premises-based call control or hosted call control, with the added benefit that CUBE uses the customer's existing investment in Cisco routers.

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For more information

For more information about the Cisco Unified Border Element (CUBE), visit https://www.cisco.com/go/cube or contact your local Cisco account representative.

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