

Cisco Service Node for Linksys One XA Series

The Cisco® Service Node for Linksys® One XA Series (XA for extensible architecture) products are part of the innovative, end-to-end Linksys One architecture from Linksys, a division of Cisco, for hosted services delivery for small businesses.

The next generation of the service node portfolio, the Cisco Service Node for Linksys One XA Series delivers improved hosted service provider (HSP) profitability by reducing initial costs and lowering overall service node capital expenditures. The design of the service node allows HSPs to grow their service node along with their business.

Instead of purchasing service node hardware and capacity licenses initially, HSPs can now spread out their expenditures through flexible right-to-use (RTU) licenses. This new model appreciably reduces break-even times, and significantly improves HSP return on investment (ROI).

Two models of the service node are available, each in AC and DC versions.

- Cisco Service Node for Linksys One XA Series Base units (part numbers L1-SN-XA1-BASE-AC and L1-SN-XA1-BASE-DC), which support 40,000 or more users
- Cisco Service Node for Linksys One XA Series Expansion units (part numbers L1-SN-XA1-EXP-AC and L1-SN-XA1-EXP-DC), which offer the same functions, but when combined with the base units, scale to 100,000 or more users

With Cisco Service Node Release 1.3, HSPs choose one of two available service node hardware configurations (refer to the “Ordering” section), and then build upon the service node hardware capabilities by purchasing RTU capacity licenses as their business requires.

Six versions of RTU licenses are available, in both per-seat and per-line versions:

- 100 users (part number L1-SN-XA1-RTU-100)
- 1,000 users (part number L1-SN-XA1-RTU-1000)
- 10,000 users (part number L1-SN-XA1-RTU-10K)
- 25 Lines (part number L1-SN-XA1RTU25L)
- 250 Lines (part number L1-SN-XA1RTU250L)
- 2,500 Lines (part number L1-SN-XA1RTU2500L)

Additionally, with Release 1.3, IP Security (IPsec) VPN for call-routing functions are optional, so now HSPs have the option to not purchase Cisco routers as part of the reference network design.

The service node provides the same basic functions as previous service nodes, and resides in the service provider network, where it acts as a system portal to the overall Linksys One solution and provides services to Linksys One customer endpoints.

The multitiered architecture of the service node allows it to serve as an aggregation point for call routing, customer provisioning, billing and management services, and the hosting and reselling of premium applications and services.

The service node also supports sales by providing value-added resellers (VARs) with secure, portioned branding services, account setup, customer premises equipment (CPE) ordering, service configuration, and partitioning of end-user services for small businesses.

Figure 1. Cisco Service Node for Linksys One SN-XA Series



The Cisco Service Node for Linksys One XA Series performs numerous functions that support Linksys One CPE:

- **CPE provisioning**—The service node provisioning engine provides automated configuration of CPE for simple and rapid deployment. When a new customer is created or a new service is added to a customer's account, the service node can make any updates on the network side as well as generate the network-side configuration required for CPE. Services for the customer site work immediately after the CPE downloads the configuration from the service node.
- **CPE configuration backup and restore**—The service node acts as a backup server where CPE can store a copy of the current configuration. If the CPE must be replaced for any reason (for example, a flood or a hardware failure), the existing configuration can be easily restored from the service node.
- **Call routing**—The service node call-routing function uses Session Initiation Protocol (SIP) proxy architecture. No per-user voice feature call processing is performed on the service node. A core SIP proxy handles SIP signaling and call routing from CPE to the public switched telephone network (PSTN), the PSTN to CPE, and CPE to CPE. Therefore, the service node provides a single point for passing calls between the Linksys One environment and the Internet telephony service provider (ITSP) providing PSTN connectivity. The service node uses IETF standards to define aspects of voice sessions, including ENUM for addressing, BIND Domain Name System 9 (BIND9) for service

location, and SIP for call routing. The service node call routing function is an optional component that is used in deployment models only where PSTN calls are transported as voice-over-IP (VoIP) calls across a customer's broadband Internet connection.

- **Branding services**—The hierarchical architecture of the service node supports a variety of flexible business models. Each service node can support multiple secure, discreet partitions that can be used to host a variety of brands. Each brand can control the logos and support contact information that is displayed on CPE belonging to a particular brand. Support for multiple brands can help a HSP take advantage of market opportunities with targeted offers, building on brand equity. Brands can also be other hosted providers, allowing the service node operator to support a wholesale service model. An agent level is also supported, allowing multiple agents per brand. Agents have a secure, brand-specific view of their own customers for provisioning and monitoring. Agents receive their own login point and can add and modify customer configurations without support from the HSP or brand. By securely allowing distributed account setup and support, HSPs can reduce their costs.
- **GUI**—The service node includes GUIs for managing resources and customers at the node, brand, agent, and consumer levels. The GUI functions provided at each level reflect the roles and responsibilities of the person operating at that level.
- **Database services**—The service node includes a PostgreSQL database that is used as the repository for all node, brand, agent, and consumer data.
- **CPE firmware services**—The service node provides the tools required to manage the firmware level used by the CPE and centrally distribute new firmware when required.
- **Cisco Service Node API**—The application programming interface (API) allows service providers to integrate the service node with their back-end operations support system (OSS) and business support system (BSS).
- **CPE and service node monitoring**—The service node provides tools for monitoring the service node itself and its associated CPE.
- **CPE security services**—To protect against fraud and denial-of-service (DoS) attacks on the services, the service node provides a VPN function to the CPE. The CPE at each customer site maintains an IP Security (IPsec) tunnel back to the service node. Any SIP signaling that leaves the customer site is tunneled across the IPsec tunnel back to the service node. Both the CPE and the service node are designed to accept only SIP packets that arrive through the tunnel, effectively preventing any unintentional SIP traffic from being processed.
- **Service node security services**—The service node is designed to be connected directly to the Internet. To protect against Internet threats, the service node is equipped with firewalls and security features that protect against DoS and other attacks.
- **Call details records (CDRs)**—When operating in run mode (a deployment model where PSTN calls are transported as VoIP calls across a customer's broadband Internet connection), the service node generates CDRs for PSTN calls and for calls between Linksys One customers. Intracustomer calls—that is, calls between two phones at the same site—do not generate a CDR.

Hardware Architecture Overview

The Cisco Service Node for Linksys One XA Series hardware is made up of base and expansion servers, as well as management and monitoring products for provisioning, database, call routing, application, and software services on this series.

Additional network hardware is required for successful service node deployments.

Cisco Service Node for Linksys One Xa Series Base Servers

The Cisco Service Node for Linksys One XA Series Base Server is the foundation of the product portfolio, and is needed for any Cisco Service Node for Linksys One XA Series deployment. The base server is a single server that includes the following:

- Two dual-core 3-GHz processors
- 4-GB DRAM
- Eight 146-GB hard drives
- Three Gigabit Ethernet interfaces
- Dual, hot-swap redundant power supplies (AC or DC)
- Remote management

With Cisco Service Node for Linksys One XA Series Release 1.3, two base servers are required for a service node deployment.

Cisco Service Node for Linksys One Xa Series Expansion Servers

The Cisco Service Node for Linksys One XA Series Expansion Server builds upon the capacity of the base server; it is used in conjunction with the base server for larger service node deployments. The expansion server is a single server that includes the following:

- Two dual-core 3-GHz processors
- 4-GB DRAM
- Three 146-GB hard drives
- Two Gigabit Ethernet interfaces
- Dual hot-swap redundant power supplies (AC or DC)
- Remote management

With Release 1.3, supported Cisco Service Node for Linksys One XA Series deployments may require two expansion servers.

Cisco Service Node for Linksys One Xa Series Management And Monitoring Products

The Cisco Service Node for Linksys One XA Series supports optional management and monitoring hardware (refer to "Ordering" section for more details). The service node management and monitoring products include:

- One 17-inch rack-mounted keyboard and monitor (RKM) unit
- One 8-port Keyboard, Video, Mouse (KVM) switch for connecting RKM and servers

Cisco Service Node for Linksys One Xa Series Network Products

The Cisco Service Node for Linksys One XA Series requires the use of Cisco Catalyst® 4948 Intelligent Ethernet Switches, in addition to offering the option of using Cisco 7301 Routers for call routing and network traffic encryption functions.

- Required Cisco Catalyst 4948 Switches connect the service node servers, monitoring and management equipment, and (optionally) VPN routers.
- Optional Cisco 7301 Routers with an Advanced Encryption Standard (AES) wide-key crypto card (part number SA-VAM2+) and Cisco IOS® Software IP/FW/IDS IPSEC 3DES image (part number S731CHK9-12408) provide IP connectivity between the service node and the Internet, allowing the service node to encrypt up to 280-Mbps Triple Data Encryption Standard (3DES) IPsec traffic and support up to 4000 simultaneous sites—and provide a firewall to protect service node components and customers from external and internally sourced attacks.

Table 1 provides the component specifications of the service node.

Table 1. Cisco Service Node for Linksys One XA Series Hardware Layout Specifications

| Product | Rack Units (RUs) | Quantity | Total RUs |
|--|------------------|----------|----------------|
| Service node base servers | 2 | 2 | 4 |
| Service node expansion servers | 2 | 0 or 2 | 0 or 4 |
| Service node management and monitoring equipment | 1 | 1 | 2 |
| Cisco Catalyst 4948 | 1 | 2 | 2 |
| Cisco 7301 | 1 | 0 or 2 | 0 or 2 |
| Total RUs | | | 6 or 13 |

Network equipment and server, storage, and software elements for the solution can be ordered separately.

Network Management

The Cisco Service Node for Linksys One XA Series provides a variety of tools to manage the extended environment that makes up the Linksys One solution. Different tools and capabilities are available at the node, brand, and agent levels.

Node-Level Network Management

Node-level network management tools are provided for managing the Cisco Service Node and extended Linksys One solution:

- Node-level GUI—Node operators can use the GUI to manage resources for the entire service node, including brands, CPE firmware releases, and ITSPs with associated phone numbers.
- Berkeley Software Distribution (BSD) shell—Node operators can access the OS using the Secure Shell (SSH) protocol, which is intended primarily for troubleshooting. Day-to-day operation and administration is performed through the node-level GUI.

Simple Network Management Protocol (SNMP)—The Cisco Service Node for Linksys One XA Series can be monitored by an external network management station through SNMP. Cisco routers running Cisco IOS Software support a vast number of MIBs. Consult the Cisco IOS Software documentation for a detailed list. Service node servers running FreeBSD also support SNMP. The following MIBs are supported:

- SNMPv2-MIB
- IF-MIB
- RFC1213-MIB
- IP-MIB
- TCP-MIB
- UDP-MIB
- SNMPv2-MIB
- HOST-RESOURCES-MIB
- IPV6-MIB
- UCD-SNMP-MIB
- UCD-DLMOD-MIB
- NET-SNMP-AGENT-MIB
- NET-SNMP-AGENT-MIB
- SNMPv2-MIB
- SNMP-FRAMEWORK-MIB
- SNMP-MPD-MIB
- SNMP-TARGET-MIB

Brand-Level Network Management

Brand-level network management tools are provided for management of the brand as well as agents and customers of that brand.

- Brand-level GUI—This interface allows brand administrators to manage resources, agents, and customers that belong to that brand.
- Service node API—This API provides a machine-to-machine interface by which a back-end OSS or BSS system can perform a subset of the functions available through the brand-level GUI. The functions that can be performed relate to provisioning customers and closely resemble the functions available through the agent-level GUI.
- Agent-level GUI—This interface is the only tool available to the agent. Agents can use it to add, modify, delete, and view customers. Agents can view or change data only for their own customers. As an option, a HSP can use the service node API to build a custom agent portal to replace the one that comes with the service node.

Software

The service node servers run a collection of open-source and Linksys One software:

- **FreeBSD**—This OS is the open-source operating system that runs on all Cisco Service Node for Linksys One XA Series servers. FreeBSD provides a mechanism that allows multiple virtual instances of the OS to be spawned and run on the same server, with each virtual OS completely isolated from all other instances. This partitioning mechanism is the one used to implement the brand-level services.
- **PostgreSQL**—This open-source package provides database services on the service nodes.
- **OpenSER**—This open-source package is used as the service node SIP proxy.
- **BIND**—This open-source package is used for Domain Name System (DNS) services. The Cisco Service Node for Linksys One XA Series runs its own DNS servers. DNS is used for several functions on the service nodes, including ENUM-based call routing of SIP calls and branding (each brand is known to the outside world as a separate DNS domain name).
- **BIND DLZ**—This open-source package allows BIND to use the PostgreSQL database to store its zone information. Dynamically loadable zones (DLZs) allow DNS updates to be reflected immediately when a change is made to zone data in the database. This feature is important because CPE that uses Dynamic Host Configuration Protocol (DHCP) can change its IP address at any time. When this happens, DNS must be updated immediately for the ENUM-based call routing to be able to successfully route calls to the CPE.
- **NET-SNMP**—This open-source SNMP package runs as an agent on the servers and implements several MIBs.

The Cisco 7301 Router and Cisco Catalyst 4948 Intelligent Ethernet Switch run standard Cisco IOS Software images. The versions used by the Cisco Service Node for Linksys One XA Series are shown in Table 2.

Table 2. Cisco IOS Software Versions Used by Service Node

| Product | Cisco IOS Software Version | Feature Set |
|---------------------|----------------------------|-------------------|
| Cisco 7301 | Release 12.4(11)T | Advanced Security |
| Cisco Catalyst 4948 | Release 12.2(31)SGA | IP Base SSH |

Power Specifications

Table 3 lists power specifications for the service node.

Table 3. Power Specifications

| Product | Power | Redundant Power |
|---------------------|----------------|-----------------|
| Base server | 3.6A | Yes |
| Expansion server | 3.6A | Yes |
| 17-inch RKM | < 30W | No |
| KVM switch | 0.5 to 0.25A | No |
| Cisco Catalyst 4948 | 4A AC or 8A DC | Yes |
| Cisco 7301 | 2A AC or 3A DC | Yes |

Physical Specifications

Table 4 lists physical specifications for the service node.

Table 4. Physical Specifications

| Product | RUs | Height (inches) | Width (inches) | Depth (inches) |
|---------------------|-----|-----------------|----------------|----------------|
| Base server | 2 | 3.38 | 17.54 | 26.01 |
| Expansion server | 2 | 3.38 | 17.54 | 26.01 |
| 17-inch RKM | 1 | 1.68 | 16.97 | 16.66 |
| KVM switch | 1 | 1.72 | 17.0 | 6.5 |
| Cisco Catalyst 4948 | 1 | 1.71 | 17.29 | 16.14 |
| Cisco 7301 | 1 | 1.73 | 17.3 | 13.87 |

Ordering

Table 5 lists ordering information for the Cisco Service Node for Linksys One XA Series.

Table 5. Ordering Information

| Part Number | Description |
|--------------------------|---|
| L1-SN-XA1-BASE-AC | <ul style="list-style-type: none"> • Cisco Service Node XA Series Base Server, AC Power <ul style="list-style-type: none"> ◦ Base server and software for Cisco Service Node XA Series, AC power ◦ Right To Use Licenses sold separately ◦ Network equipment sold separately ◦ Monitoring equipment sold separately |
| L1-SN-XA1-BASE-DC | <ul style="list-style-type: none"> • Cisco Service Node XA Series Base Server, DC power <ul style="list-style-type: none"> ◦ Base server and software for Cisco Service Node XA Series, DC power ◦ Right To Use Licenses sold separately ◦ Network equipment sold separately ◦ Monitoring equipment sold separately |
| L1-SN-XA1-EXP-AC | <ul style="list-style-type: none"> • Cisco Service Node XA Series Expansion Server, AC power <ul style="list-style-type: none"> ◦ Expansion server for Cisco Service Node XA Series, AC power ◦ Right To Use Licenses sold separately ◦ Network equipment sold separately ◦ Monitoring equipment sold separately |
| L1-SN-XA1-EXP-DC | <ul style="list-style-type: none"> • Cisco Service Node XA Series Expansion Server, DC power <ul style="list-style-type: none"> ◦ Expansion server for Cisco Service Node XA Series, DC power ◦ Right To Use Licenses sold separately ◦ Network equipment sold separately ◦ Monitoring equipment sold separately |
| L1-SN-XA1-MON | <ul style="list-style-type: none"> • Cisco Service Node XA Series monitor kit <ul style="list-style-type: none"> ◦ Keyboard, Video, Mouse (KVM switch – AC power) ◦ 17" Rackmount Keyboard (US version), Monitor – AC power |
| L1-SN-XA1-RTU-100 | Right to Use License – 100 Users |
| L1-SN-XA1-RTU-1K | Right to Use License – 1,000 Users |
| L1-SN-XA1-RTU-10K | Right to Use License – 10,000 Users |
| L1-SN-XA1RTU25L | Right to Use License – 25 Lines |
| L1-SN-XA1RTU250L | Right to Use License – 250 Lines |
| L1-SN-XA1RTU2500L | Right to Use License – 2,500 Lines |
| Spares | Description |
| L1-SN-XA-BASE-AC= | Base Server, SN-XA, AC Power, Spare, No SW |
| L1-SN-XA-BASE-DC= | Base Server, SN-XA, DC Power, Spare, No SW |
| L1-SN-XA1-EXP-AC= | Expansion Server, SN-XA, AC Power, Spare, No SW |
| L1-SN-XA1-EXP-DC= | Expansion Server, SN-XA, DC Power, Spare, No SW |
| L1-SN-XA1-RKM= | Rack mount Keyboard (US version) Video Monitor Mouse – Spare |
| CISCO-SN-KVM= | Spare keyboard, video, and mouse switch – Spare |

| | |
|---------------------------|--|
| L1-SN-XA1-DRIVE= | 146 GB hard drive - 2.5" – Spare |
| L1-SN-XA1-DVD= | DVD-ROM - 8x - IDE - internal – 5.25" – Spare |
| L1-SN-XA1-AC-PS= | Hot swap AC power supply for SN-XA1 Base and Expansion Servers – Spare |
| L1-SN-XA1-DC-PS= | Hot swap DC power supply for SN-XA1 Base and Expansion Servers – Spare |
| L1-SN-XA1-RTU-100= | Right to Use License – 100 Users |
| L1-SN-XA1-RTU-1K= | Right to Use License – 1,000 Users |
| L1-SN-XA1-RTU-10K= | Right to Use License – 10,000 Users |
| L1-SN-XA1RTU25L= | Right to Use License – 25 Lines |
| L1-SN-XA1RTU250L= | Right to Use License – 250 Lines |
| L1-SN-XA1RTU2500L= | Right to Use License – 2,500 Lines |

Cisco Service Node for Linksys One Xa Series Network Equipment Required

For the Cisco Service Node for Linksys One XA Series, the Cisco network equipment listed in Tables 6 and 7 is required, depending on whether an AC or DC power configuration is needed.

Table 6. Required Cisco Network Equipment—Cisco Service Node for Linksys One XA Series – AC Power Configurations

| Cisco Part Number | Description | Quantity |
|-------------------------|---|----------|
| WS-C4948 | Catalyst 4948, optional SW, 48-Port 10/100/1000+4 SFP, no p/s | 2 |
| CAB-7KAC | AC Power Cord North America | 4 |
| PWR-C49-300AC | Catalyst 4948 300-Watt AC Power Supply | 2 |
| PWR-C49-300AC/2 | Catalyst 4948 300-Watt AC Power Supply Redundant | 2 |
| S49IPBK9-12231SG | Cisco CAT4900 IOS IP BASE SSH | 2 |
| CON-OSP-WS-C4948 | ONSITE 24X7X4 C4948, Optional SW 48Pt SFP-no p s | 2 |

Table 7. Required Cisco Network Equipment—Cisco Service Node for Linksys One XA Series – DC Power Configurations

| Cisco Part Number | Description | Quantity |
|-------------------------|---|----------|
| WS-C4948 | Catalyst 4948, optional SW, 48-Port 10/100/1000+4 SFP, no p/s | 2 |
| PWR-C49-300DC | Catalyst 4900 300-Watt DC Power Supply | 4 |
| PWR-C49-300DC/2 | Catalyst 4900 300-Watt DC Power Supply Redundant | 2 |
| S49IPBK9-12231SG | Cisco CAT4900 IOS IP BASE SSH | 2 |
| CON-OSP-WS-C4948 | ONSITE 24X7X4 C4948, Optional SW 48Pt SFP-no p s | 2 |
| WS-C4948 | Catalyst 4948, optional SW, 48-Port 10/100/1000+4 SFP, no p/s | 2 |

Cisco Service Node for Linksys One Xa Series Network Equipment Options

For the Cisco Service Note for Linksys One XA Series, the Cisco network equipment listed in Tables 8 and 9 is optional, and varies, depending on whether an AC or DC power configuration is needed.

Table 8. Optional Cisco Network Equipment – Cisco Service Node for Linksys One XA Series – AC Power Configuration

| Cisco Part Number | Description | Quantity |
|--------------------------|--|----------|
| CISCO7301/2+VPNK9 | 7301, VAM2+, AC pwr, 512 sys mem, SDM | 2 |
| PWR-7301/2-AC | Cisco 7301 Dual AC Power Supply Option | 2 |
| CAB-AC | Power Cord, 110V | 4 |
| S731CHK9-12408 | Cisco 7301 Series IOS IP/FW/IDS IPSEC 3DES | 2 |
| MEM-7301-512MB | 512MB memory upgrade for 7301 | 2 |

| | | |
|-------------------------|---|---|
| MEM-7301-FLD64 | Compact Disk Flash for 7301,64MB option | 2 |
| SA-VAM2+ | AES wide key crypto card | 2 |
| ROUTER-SDM-NODOC | Device manager for routers (w/o hardcopy doc) | 2 |
| CON-OSP-73012 | ONSITE 24X7X4 7301, VAM2+, AC pwr, 512 sys mem, SDM | 2 |

Table 9. Optional Cisco Network Equipment – Cisco Service Node XA Series – DC Power Configuration

| Cisco Part Number | Description | Quantity |
|--------------------------|---|----------|
| CISCO7301/2+VPNK9 | 7301, VAM2+, AC pwr, 512 sys mem, SDM | 2 |
| PWR-7301/2-DC48 | Cisco 7301 Dual DC48 Power Supply Option | 2 |
| S731CHK9-12408 | Cisco 7301 Series IOS IP/FW/IDS IPSEC 3DES | 2 |
| MEM-7301-512MB | 512MB memory upgrade for 7301 | 2 |
| MEM-7301-FLD64 | Compact Disk Flash for 7301,64MB option | 2 |
| SA-VAM2+ | AES wide key crypto card | 2 |
| ROUTER-SDM-NODOC | Device manager for routers (w/o hardcopy doc) | 2 |
| CON-OSP-73012 | ONSITE 24X7X4 7301, VAM2+, AC pwr, 512 sys mem, SDM | 2 |

For More Information

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