C4000 Series
Site Survey Guide

BOGEN®
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Site Survey Guide

This document provides prerequisites and initial setup instructions for the C4000 system, an Internet Protocol (IP) based solution for commercial paging and audio distribution applications that allows site personnel to:

- Control facility event schedules, announcements, and tones.
- Create and manage paging, time, and audio zones.
- Manage station types, configuration, and Class of Service (CoS).
- Manage users, roles, and permissions.

C4000 can be implemented as a new system installation or as an upgrade to a third-party intercom and paging system.

Before installing and configuring C4000, ensure that:

- Required services are enabled on your network. Examples of required services include multicast and Session Initiation Protocol (SIP).
- Required multicast IP addresses and ports are known and available.
- Required IP addresses are known and available.
- Required port numbers are open.

1.1 Understanding System Requirements

The C4000 web-based UI requires a secure Hypertext Transfer Protocol Secure (https) type network connection to the C4000 System Server. Users can log in to the C4000 system using a Google Chrome web browser from a computer or tablet running either a Windows 8.1 (or later) or a Mac OS X 10.12.x (or later) operating system (OS). The UI can also be accessed via a Chrome browser enabled Android-

based tablet or mobile device. To access the server, type your C4000 System Server's IP address (for example, 10.10.20.12).

1.1.1 Whitelisted Web Addresses

C4000 requires access to specific Uniform Resource Locators (URLs), commonly referred to as web addresses. Access to many of these web addresses is required during installation; access to other web addresses, such as the address for the Network Time Server (NTS) is required during runtime. The Information Technology (IT) department for the site must whitelist the web addresses so that they can be easily accessed as needed.

The following table lists the URLs that must be whitelisted.

Table 1, Whitelisted Web Sites

URL	Description
http://hostedactivation.com (specifically, http://hostedactivation.com/bogen)	Required for C4000 License support
http://downloads.digium.com	Required for updates from Digium
http://downloads.asterisk.org/ (specifically, http://downloads.asterisk.org/pub/telephony/sounds/releases)	Required for Asterisk updates
http://www.pjsip.org/	Required for PJSIP updates
http://ftp.us.debian.org (specifically: http://ftp.us.debian.org/debian/)	Required during Linux package updates
http://security.debian.org (specifically: http://security.debian.org/)	Required during Linux package updates
stun01.sipphone.com	Required for STUN based IP address resolution (This is used by the C4000 Web UI and should be enabled on the computer that runs the web UI.)
https://raw.githubusercontent.com/	Serves unprocessed versions of files stored in the GitHub repositories.
http://2431612419.airable.io https://2431612419.airable.io	airable URL
http://api.sound-machine.com https://api.sound-machine.com	SoundMachine URL
http://api.bogenedu.com/api/customers	Required for C4000 Warranty Support

Table 1, Whitelisted Web Sites (Continued)

URL	Description
http://bogen-ssu.bogen.com/	Bogen System Software Update server – Required for automatic Nyquist server software and Nyquist firmware software update notifications and downloads.
https://www.weather.gov/alerts	Required for displaying weather alerts.
https://ipapi.co	Required for automatically finding county code for alerts.
https://api.weather.gov	Required for obtaining alerts from the National Weather Service.
ns1.google.com resolver1.opendns.com	Required for obtaining the Nyquist server's public IP address for Audio Distribution streams and for automatically finding the county code for alerts.

URLs that are entered on the C4000 System Parameters page are used during runtime and include the URLs for the NTS, the Session Traversal Utilities for (Network Address Translation (NAT) (STUN) server, and the Traversal Using Relays around NAT (TURN) server.

The default URLs for the STUN and TURN servers are not set. The default URL for NTS is pool.ntp.org.

1.1.2 Nyquist System Server Requirements

The following are the minimum requirements for the C4000 System Server if you elect to not use the Nyquist System Controller (NQ-SYSCTRL):

Table 2, Nyquist System Server Minimum Requirements

OS	Debian Linux OS (AMD 64-bit version) release 8.xx.x *Note:* Refer to the most up to date release notes on the website (www.bogen-ip.com) for details about which Linux OS versions have been tested for use with the Nyquist system.
CPU	Quad-core Intel-based processor running at 3.0 GHz or higher
Hardware	Sound card with microphone port

Table 2, Nyquist System Server Minimum Requirements (Continued)

Memory	8 GB RAM (Error Correcting Code (ECC) RAM is recommended for increase performance and reliability.)
Disk Storage	One 250 GB disk drive Some form of hardware-based RAID is recommended for redundancy and high availability. Consider using a larger drive if large amounts of audio (for example, voice mail, announcements, recordings, and music) are being stored on the system. Note that music, tones, and announcements created or stored as .wav files will be larger than if created or stored as MP3 files. Other factors that should be considered are: • How often will backups be performed? • Will the system be backed up locally or remotely on a detachable drive, Storage Area Network (SAN)/Network Attached Storage (NAS), or Network File System (NFS)? • How many users will have voicemail ability? • How long will voicemail messages be stored? • Will voicemail messages be part of the local system backups?
NIC	10/100/1000 MB Ethernet port (NIC is an acronyn for Network Interface Card)
PCI Expansion Slots	One or more Peripheral Component Interconnect (PCI)/PCI Express (PCIe) slot if telephony network connectivity other than, or in addition to, SIP trunking is required; contact your Bogen Distributor for assistance in determining these telephony hardware needs.
Telephony Interfaces	One or more PCI/PCIe type third-party telephony interface cards (for example, Foreign Exchange Office (FXO), Foreign Exchange Subscriber (FXS), etc.) if telephony network connectivity other than, or in addition to, Session Initiation Protocol (SIP) trunking is required; contact your Bogen Distributor for assistance in determining these telephony hardware needs.

1.1.3 Network Application Services

Required application services will be installed automatically on the C4000 system server as part of the C4000 installation. All other listed network services must be already present or installed manually on the associated network. The following table lists the services and their locations:

Table 3, Network Application Services

Service	Description	Required	Location
Apache	Used as the web server to drive the C4000 web interface.	Mandatory	C4000 System Controller
DHCP	Supplies dynamic IP addresses to the C4000 System Controller and associated devices. (DHCP is the acronym for Dynamic Host Configuration Protocol.) It also supplies the Trivial File Transfer Protocol (TFTP) server IP address or host name to devices on the network via option_66.	Optional	Network
DNS	Resolves host names to IP addresses. DNS is an acronym for Domain Name System, a hierarchical naming system for computers, servers, or other resources connected to either the Internet or to a private network.	Optional	Network
ICE STUN TURN	Resolves IP addresses behind Network Address Translation (NAT)/ firewall. - Interactive Connectivity Establishment - Session Traversal Utilities for NAT - Traversal Using Relays around NAT	Optional	C4000 System Controller/ Network

Table 3, Network Application Services (Continued)

Service	Description	Required	Location
NTP	Provides date/time synchronization for the C4000 System Controller and the associated devices (IP Phones, appliances). (NTP is an acronym for Network Time Protocol.)	Mandatory	Network
SNMP	Provides the C4000 Linux server statistics via Simple Network Management Protocol (SNMP) v1 through Port 161.	Optional	C4000 System Controller
TFTP	TFTP is used by IP phone and C4000 device provisioning. A TFTP server runs on the C4000 System Controller on port 69 (the standard TFTP port #). Device provisioning files are stored on the C4000 System Controller in directory: `/srv/tftp`. This is the only directory exposed by the TFTP server.	Mandatory	C4000 System Controller

1.1.4 Network Ports

The following table lists the network ports required by the C4000 system controller and the associated devices.

Table 4, Network Ports Used by C4000

Service	Description	Port
DHCP	Dynamic Host Configuration Protocol (Optional)	67, 68
DNS	Domain Name System (Optional)	53
DUNDI	Distributed Universal Number Discovery	4520
HTTP	Phone provisioning (HTTP is an acronym for Hypertext Transfer Protocol)	8088
HTTPS	Secure HTTP	8089

Table 4, Network Ports Used by C4000 (Continued)

Service	Description	Port
HTTPS	Secure HTTP (HTTP over TLS/SSL); used during DPMA license registration.	443
IAX	C4000 Inter-Facility Communications	4569
MGCP	Media Gateway Control Protocol (Optional)	2727
NTP	Network Time Protocol	123
ODBC	Database connection (ODBC is an acronym for Open Database Connectivity.)	3306
RTP	Audio Streams (RTP is an acronym for Real-Time Transport Protocol.)	10000-20000
Server Management	Local port used for server management DO NOT allow outside access to this port. During C4000 system controller installation, an IP filter rule is installed to block outside access to this port.	5038
SIP	Session Initiation Protocol (SIP) Transfer Control Protocol (TCP)/User Datagram Protocol (UDP) connections	5060
SIP over Web Services	SIP WS/WSS connections	8088
SNMP	Simple Network Management Protocol (Optional)	161
TFTP	TFTP connections	69

1.1.5 Multicast IP Addresses

A minimum of three multicast IP Addresses are required for an C4000 system:

- Emergency-All-Call Multicast RTP IP Address
- All-Call Multicast RTP IP Address
- Audio Distribution Multicast IP Address

These multicast RTP IP Addresses are entered when setting System Parameters.

If you want to use multicasting for zones, a multicast IP Address is needed for each multicast zone.

A zone is a collection of stations. C4000 stations consist of any Web interface device (personal computer (PC), tablet, smart phone), Voice over Internet Protocol (VoIP) speaker, VoIP phone, or Nyquist appliance (NQ-A2060, NQ-GA10P, NY-P0100, etc.) connected to the system and assigned an extension. No limit exists for number of stations that can exist in a multicast zone.

Multicast IP Addresses for zones are set through the Zones menu and are added when creating a zone or when editing a zone.

1.1.6 Multicast Ports

Multicast ports must be set for each multicast IP address. When setting Multicast ports for zones, the port number must start with an even number and a range of four is needed between port numbers. For example, if Zone 1 uses Multicast Port Number 6010, then Zone 2 *cannot* use port 6011, 6012, or 6013.

1.1.7 IP Addresses

IP addresses (static or dynamic) are needed for each of the following items:

- C4000 System Controller
- Each Nyquist VoIP phone or speaker
- Each Nyquist appliance
- Each device used to access the Web UI (PC, Mac, tablet, or mobile)

For information about the Nyquist appliances applicable to the C4000, refer to the Bogen web site (http://www.bogen-ip.com/).

1.1.8 Bandwidth Requirements

Bandwidth requirements are as follows:

- Background Traffic:
  - SIP registration (unicast every 60 seconds between each SIP endpoint and the Server): 0.001 Mbps
  - Inter-facility connection (unicast every 60 seconds between local and remote nodes): 0.141 Mbps
  - Ambient Noise Sensor (multicast every 500 msec): 480 bps

- Feature Specific Traffic:
  - Audio distribution (multicast) local media (MP3 file): 0.070 Mbps
  - Audio distribution (multicast) Internet media (SOUNDMA-CHINE/airable): 0.071 Mbps
  - Announcement (multicast): 0.087 Mbps
  - Intercom call (unicast between two SIP endpoints): 0.171 Mbps
  - Zone page (multicast): 0.086 Mbps
  - All Call page (multicast): 0.086 Mbps
  - Emergency All Call page (multicast): 0.086 Mbps
  - Facility page (unicast between local and remote nodes): 0.147 Mbps
  - District All Call page (unicast between local and remote nodes): 0.143 Mbps
  - District Emergency All Call page (unicast between local and remote nodes): 0.141 Mbps
  - District intercom call (unicast between local and remote nodes): 0.151 Mbps

1.1.9 C4000 Cabling and Wiring Requirements

The following table describes C4000 cabling and wiring requirements:

Table 5, Cabling and Wiring Requirements

Server and C4000 Devices	Cat5 or better cabling for network connection.
Digital Call Switches	Cat5 or equivalent cabling (The CAN 2.0 BUS connection on these devices allows them to be daisy-chained.)
I/O Controller	Cat5 or any other 2-wirer (or denser) cable with a 500mA or better current rating.

Table 5, Cabling and Wiring Requirements (Continued)

Matrix Mixer Pre Amp	Audio connections by input type (for example, XLR, pluggable screw terminal connectors); use 2-conductor or 3-conductor shielded cable (as needed for balanced or unbalanced) to reduce electromagnetic interference (EMI) or radio frequency (RF) interference to the Line or MIC inputs.
VoIP Intercom Module	Cat5 or equivalent cabling for the CAN Bus Port 2-conductor or 3-conductor shielded cable (as needed for balanced or unbalanced) to reduce electromagnetic interference (EMI) or radio frequency (RF) interference on the Line Level outputs for Ambient Mic Input, Push-to-Talk Mic Connection, and Relay Contact HDMI 1.3 cable or better for HDMI output West Penn 357 cable or equivalent for call switch input and analog speaker connection *Note:* While the system is entirely CAT5 or better cable compatible, it is not advisable to use category wiring for two-way intercom stations in installations where Electromagnetic Field (EMF) interference is a possible concern. In such environments, it is recommended to use West Penn #357, Belden #8724, or equivalent cabling to protect against cross talk and noise induced by EMF interference.
Networked Audio Power Amplifier	Cat5 or equivalent cabling for the network connection; shielded pair of appropriate gauge for connection to speaker. 2-conductor shielded cable (as needed for balanced or unbalanced) to reduce EMI.

1.1.10 Telephony Environment

The Nyquist C4000 can interface with a customer's telephony system in the following ways:

- Network-based SIP trunks to PSTN or Cloud-based VoIP provider
- Network-based SIP Tie-Lines to the premises-based IP-PBX
- FXS ATA to the premises-based PBX or IP-PBX

Use of FXS ATA requires purchase/use of a third-party FXS VoIP Gateway device (for example, Cisco SPA112 Two Port Phone Adapter)

Using SIP trunks allows full bi-directional calling between any C4000 station and the IP-PBX/PBX/PSTN and supports features such as E-911 calling, remote call transfer, and off-premise calling. The FXS ATA option only allows a station on the PBX to dial through" to the Nyquist system where it will receives a second dial tone to initiate DTMF controlled paging, intercom calls, etc.

Set up an appointment with both Bogen Technical Support (800-995-2809) and the PBX vendor or customer (if the customer maintains the telephony system) to assist during integration of the C4000 and telephony systems.

1.2 Additional Information

Additional information about C4000 appliances' specifications and installation instructions can be obtained via the Bogen C4000 web site (http://www.bogen-ip.com/).

1.3 Installation Checklist

The following checklist is provided to aid in obtaining information needed for C4000 system installation and initial configuration. You can print the checklist and use the Notes column to write required information, such as multicast IP addresses. In some cases, such as recording IP addresses for stations or VoIP phones, additional pages may need to be copied to accommodate the total number of devices being installed.

Done	Item	Information
☐	**C7000 System Controller/ Server** Permanently allocated IP Address Will the server be a Nyquist System Controller (NQ-SYSCTRL)?	_____ ☐ Yes ☐ No
☐	**Network Time Server** IP Address	_____
☐	**TFTP Server (Optional)** IP Address	_____
☐	**Emergency-All-Call** Multicast RTP IP Address RTP Port Number	_____ _____
☐	**All-Call** Multicast RTP IP Address RTP Port Number	_____ _____
☐	**Audio Distribution** Multicast IP Address RTP Port Number	_____ _____

Done	Item	Information
☐	**Telephony Environment (Analog PBX/IP-PBX/ Hosted VoIP)** PBX/IP-PBX Make/Model Preferred Connectivity/ Integration	_____ _____ _____
☐	**Facility** Name Page Number Host/IP Address Password	_____ _____ _____ _____
☐	**Facility** Name Page Number Host/IP Address Password	_____ _____ _____ _____
☐	**Facility** Name Page Number Host/IP Address Password	_____ _____ _____ _____

Done	Item	Information
☐	**Facility** Name Page Number Host/IP Address Password	 _____ _____ _____ _____
☐	**Multicast Zone** Zone (Name or Number) Zone Type (Paging, Time, and so on) Multicast IP Address Port Number	 _____ _____ _____ _____
☐	**Multicast Zone** Zone (Name or Number) Zone Type (Paging, Time, and so on) Multicast IP Address Port Number	 _____ _____ _____ _____

Done	Item	Information
☐	**NQ-P0100 Matrix Mixer Pre-Amp** IP Address (if static) MAC Address	 ____________________ ____________________
☐	**NQ-P0100 Matrix Mixer Pre-Amp** IP Address (if static) MAC Address	 ____________________ ____________________
☐	**NQ-P0100 Matrix Mixer Pre-Amp** IP Address (if static) MAC Address	 ____________________ ____________________
☐	**NQ-P0100 Matrix Mixer Pre-Amp** IP Address (if static) MAC Address	 ____________________ ____________________
☐	**NQ-P0100 Matrix Mixer Pre-Amp** IP Address (if static) MAC Address	 ____________________ ____________________
☐	**NQ-P0100 Matrix Mixer Pre-Amp** IP Address (if static) MAC Address	 ____________________ ____________________

Done	Item	Information
☐	**NQ-E7010 I/O Controller**	
	IP Address (if static)	_____
	MAC Address	_____
	Input Contact 1	_____
	Input Contact 2	_____
	Input Contact 3	_____
	Input Contact 4	_____
	Input Contact 5	_____
	Input Contact 6	_____
	Input Contact 7	_____
	Input Contact 8	_____
	Output Contact 1	_____
	Output Contact 2	_____
	Output Contact 3	_____
	Output Contact 4	_____
	Output Contact 5	_____
	Output Contact 6	_____
	Output Contact 7	_____
	Output Contact 8	_____

Done	Item	Information
☐	**NQ-S1810CT, NQ-S1810WT, NQ-S1810CT-G2, or NQ-S1810WT-G2 VoIP Speaker**	
	Model and Name	____________________
	IP Address (if static)	____________________
	Station/Architectural Number	____________________
	Physical Location	____________________
	MAC Address	____________________
☐	**NQ-S1810CT, NQ-S1810WT, NQ-S1810CT-G2, or NQ-S1810WT-G2 VoIP Speaker**	
	Model and Name	____________________
	IP Address (if static)	____________________
	Station/Architectural Number	____________________
	Physical Location	____________________
	MAC Address	____________________
☐	**NQ-S1810CT, NQ-S1810WT, NQ-S1810CT-G2, or NQ-S1810WT-G2 VoIP Speaker**	
	Model and Name	____________________
	IP Address (if static)	____________________
	Station/Architectural Number	____________________
	Physical Location	____________________
	MAC Address	____________________

Done	Item	Information
☐	**NQ-S1810CT, NQ-S1810WT, NQ-S1810CT-G2, or NQ-S1810WT-G2 VoIP Speaker** Model and Name IP Address (if static) Station/Architectural Number Physical Location MAC Address	 ____________________ ____________________ ____________________ ____________________ ____________________
☐	**NQ-S1810CT, NQ-S1810WT, NQ-S1810CT-G2, or NQ-S1810WT-G2 VoIP Speaker** Model and Name IP Address (if static) Station/Architectural Number Physical Location MAC Address	 ____________________ ____________________ ____________________ ____________________ ____________________
☐	**NQ-S1810CT, NQ-S1810WT, NQ-S1810CT-G2, or NQ-S1810WT-G2 VoIP Speaker** Model and Name IP Address (if static) Station/Architectural Number Physical Location MAC Address	 ____________________ ____________________ ____________________ ____________________ ____________________

Done	Item	Information
☐	**NQ-T1000 VoIP Phone** IP Address (if static) Station/Architectural Number Physical Location MAC Address	 ____________________ ____________________ ____________________ ____________________
☐	**NQ-T1000 VoIP Phone** IP Address (if static) Station/Architectural Number Physical Location MAC Address	 ____________________ ____________________ ____________________ ____________________
☐	**NQ-T1000 VoIP Phone** IP Address (if static) Station/Architectural Number Physical Location MAC Address	 ____________________ ____________________ ____________________ ____________________
☐	**NQ-T1000 VoIP Phone** IP Address (if static) Station/Architectural Number Physical Location MAC Address	 ____________________ ____________________ ____________________ ____________________

Done	Item	Information
☐	**NQ-GA10P/NQ-GA10PV VoIP Intercom Module** Model and Name Device Type IP Address (if static) MAC Address Station/Architectural Number Location of Ambient Noise Sensor(s) Attached (if applicable) Location of Push-to-Talk Microphone Attached (if applicable)	 _____ _____ _____ _____ _____ _____ _____
☐	**NQ-GA10P/NQ-GA10PV VoIP Intercom Module** Model and Name Device Type IP Address (if static) MAC Address Station/Architectural Number Location of Ambient Noise Sensor(s) Attached (if applicable) Location of Push-to-Talk Microphone Attached (if applicable)	 _____ _____ _____ _____ _____ _____ _____

Done	Item	Information
☐	**NQ-A4060/NQ-A4120/ NQ-A4300 Networked Audio Power Amplifier** Model and Name Device Type IP Address (if static) MAC Address Line Input-1 Source (if used) Line Input-2 Source (if used)	 _____ _____ _____ _____ _____ _____
	Amplifier Output - A Station/Architectural Number	 _____
	Amplifier Output -B Station/Architectural Number	 _____
	Amplifier Output - C Station/Architectural Number	 _____
	Amplifier Output - D Station/Architectural Number	 _____

Done	Item	Information
☐	**NQ-A2060/NQ-A2120/ NQ-A2300 Networked Audio Power Amplifier** Model and Name Device Type IP Address (if static) MAC Address Line Input Source (if used)	 _____ _____ _____ _____ _____
	Amplifier Output - A Station/Architectural Number	 _____
	Amplifier Output - B Station/Architectural Number	 _____

Done	Item	Information
☐	**NQ-PA120/NQ-PA240/ NQ-PA600 Public Address Amplifier** Model and Name Device Type IP Address (if needed) MAC Address	 _____ _____ _____ _____
	Amplifier Output Station/Architectural Number	 _____
	Line/Mic Channel 1 source:	_____
	Line/Mic Channel 2 source:	_____
	Line/Mic Channel 3 source:	_____
	Line/Mic Channel 4 source:	_____

Glossary

The following terms are used by the C4000 system and the C4000 UI.

All-Call	A simultaneous page to all facility stations, unless the station has been excluded from pages, which has a higher priority than normal paging
Appliance	A purpose-built Nyquist device that contains configurable and upgradeable firmware.
Central Processing Unit (CPU)	The electronic circuitry within a computer that performs the basic arithmetic, logical, control, and input/output (I/O) operations specified by computer program instructions
Class of Service (CoS)	A term used to define the permissions, such as zone paging, that a station or extension has
Coder-decoder (Codec)	A device or computer program for encoding or decoding a digital data stream or signal
Controller Area Network (CAN) Bus	A specialized serial communications network standard designed to allow microcontrollers and devices to communicate with each other in applications without a host computer; a message-based protocol, it was designed originally for multiplex electrical wiring within automobiles.
Domain Name System (DNS)	One of the protocols that comprise the TCP/IP suite, it converts Internet domain and host names, like those in URLs from a web browser, into IP addresses.
Dynamic Host Configuration Protocol (DHCP)	A standardized network protocol that is used on Internet Protocol (IP) networks and is controlled by a DHCP server that dynamically distributes network configuration parameters, such as IP addresses, for interfaces and services

Emergency-All-Call	A top priority all-call page to all stations, even those that have been set up for page exclusion
Hypertext Transfer Protocol (HTTP)	An application protocol that runs on top of the TCP/IP suite of protocols, HTTP is the set of rules for transferring files on the World Wide Web.
Hypertext Transfer Protocol Secure (HTTPS)	A secure HTTP connection that is used frequently when sensitive information is being passed to a server
Input/Output (I/O)	Any operation, program, or device that transfers data to or from a computer
Interactive Connectivity Establishment (ICE)	A technique used to allow two computers to communicate with each other as directly as possible. It is used for interactive media such as Voice over Internet Protocol (VoIP), peer-to-peer communications, video, and instant messaging to avoid communicating through a central server.
Internet Protocol (IP)	The method, or protocol, by which data is sent from one computer to another on the Internet
Media Gateway Control Protocol (MGCP)	A signaling and call control communications protocol used in VoIP telecommunication systems that uses decomposed multimedia gateways for transmitting telephone calls between an IP network and traditional analog facilities of the public switched telephone network (PSTN)
Multicast	Communication between a single sender and multiple receivers
Network Address Translator (NAT)	A method of remapping one IP address space into another by modifying network address information in IP datagram packet headers while they are in transit across a traffic routing device
Network Interface Controller (NIC)	A computer circuit board or card that is installed in a computer so that it can be connected to a network
Network Time Protocol (NTP)	A protocol that is used to synchronize the time of a computer client or server to another serve or reference time source
Operating System (OS)	The system software that manages computer hardware and software resources and provides common services for computer programs

Peripheral Component Interconnect (PCI)	An interconnection system between a microprocessor and attached devices in which expansion slots are spaced closely for high speed operation
Peripheral Component Interconnect Express (PCIe)	A serial expansion bus standard for connecting a computer to one or more peripheral devices
Protocol	The special set of rules that end points in a telecommunication connection use when they communicate
Redundant Array of Independent Disks (RAID)	A data storage virtualization technology that combines multiple physical disk drive components into a single logical unit to provide data redundancy, performance improvement, or both
Real-time Transport Protocol (RTP)	An Internet Protocol (IP) standard that specifies a way for programs to manage the real-time transmission of multimedia data over either unicast or multicast network services
Session Initiation Protocol (SIP)	A standard protocol for initiating an interactive user session that involves multimedia elements such as video, voice, chat, gaming, and virtual reality
Session Initiation Protocol (SIP) Trunk	A direct connection to an ITSP that allows you to use VoIP telephony beyond the facility's firewall without a PSTN
Simple Network Management Protocol (SNMP)	A protocol for network management that is used for collecting information from and configuring network devices, such as servers, printers, hubs, switches, and routers, on an IP network
Session Traversal Utilities for Network Address Translation (NAT) (STUN)	A protocol for assisting devices behind a NAT firewall or router with their packet routing
Station	A speaker, phone, device used to access the C4000 web interface, or an C4000 appliance, such as an I/O Controller
Transport Control Protocol (TCP)	A protocol developed for the Internet to get data from one network device to another
Trivial File Transfer Protocol (TFTP)	A simple version of FTP that allows a client to get a file from or put a file onto a remote host

Traversal Using Relays around Network Address Translation (NAT) (TURN)	A protocol that assists in traversal of NATs or firewalls for multimedia applications
User Data Protocol (UDP)	An alternative to TCP that sends datagrams over an IP
User	Personnel who are authorized to use C4000; also, one of the default roles provided by C4000
Voice over IP (VoIP) Phone	Also known as an IP phone, a VoIP phone uses VoIP technologies to transmit calls over an IP network, such as the Internet, rather than over a traditional public switched telephone network (PSTN).
Zone	A collection of stations that is used to control paging and audio activities or features