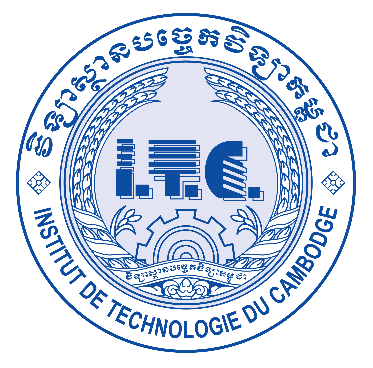
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| Report Network  Institute of Technology Cambodia  Department of Information and Communication Engineering |
| **Group A (2)**  Voice Over Internet Protocol |
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## CentOs

### What is the CentOS?

CentOS is a Linux distribution that provides a free, community-supported computing platform functionally compatible with its upstream source, Red Hat enterprise Linux.

### Installation CentOS?

As you saw in section “CentOS 6” there are many types of installations to choose. And we did previously when installing CentOS 6, we’ll also install CentOS 7 from the installation DVD. At the time of writing of this book, this could be downloaded from the official site. After downloading the ISO file, we can burn it onto DVD. After that, we are ready to boot a server with the installation DVD inserted, as long as the computer is configured to boot from a DVD.

🡺And then, we select the first option: Install CentOS 7, the computer now will start the graphical installer, and we’ll be asked about the language we want to use during the install

🡺After we click the continue button, we can see a brief summary of the installation.

🡺After that we can set the time zone or change the keyboard layout.

🡺We can also select the software packages we want to install. By default, a minimum install is selected, but there are many other collections of packages available, such as basic web server or virtualization host. We will keep the default selection: Minimal Install

🡺Before beginning the actual installation, we must choose the installation choose the installation destination.

🡺In the most cases, we selected the local hard disk, but we could also select other devices, such as SAN disks.

At this point, we could also set up the network, but we prefer to do it after the installation, we can omit this step and click the **Begin Installation** button. While the system is copying files, we can set the root password and create additional users.

### Why use CentOS?

There are 5 reasons that we should choose CentOS 7 and the strengths of the platform:

* + **Security:** it is the primary concern that comes to mind and CentOS has multiple security features built-in.
  + **Extended Support:** CentOS, Major versions are supported for 10 years and will receive security updates as needed.
  + **Package Manager:** CentOS uses the YUM (Yellodog Update Modified) package manager to keep your system up to date.
  + **A wealth of Documentation:** CentOS is a widely used platform throughout the web hosting world, it has become the de facto industry standard.
  + **Management Panel Support:** CentOS can support multiple management platforms including cPanel, InterWorx, WebMin, DirectAdmin, Spacewalk, CWP, Plesk, ISPConfig, Virtualmin, Vesta CP, and multiple other platforms.

## What is VoIP?

VoIP (Voice over Internet Protocol) is a digital telephone system that lets users make and receive phone calls over the Internet as opposed to over the traditional wired Public Switched Telephone (PSTN)

## How Does VoIP work

VoIP technology works by breaking up the voice audio from a phone conversation into digital voice data packets, then sending these data packets to the recipient over the internet. On the other hand, more complicated with VoIP, codecs compress and disassemble these voice data packets so they can travel over IP network (a local area network or a wide area network). Once, this voice transformed back into words and phrases instead of just digital signals in transit. And VoIP users can make calls via VoIP softphone, VoIP phones or by connecting traditional analog phones to a VoIP system via an analog telephone adaptor.

## Key VoIP Feature

**Calling Routing**

Call routing is a call management strategy that distributes incoming calls to agents according to pre-set criteria. There are different routing techniques to choose:

* List-Based Routing: Routes calls according to a pre-set, linear list that starts at the top again after each call.
* Round Robin Routing: Ideal for commission-based sales teams and to prevent overburdening specific customer service agents.
* Skills-Based Routing: Routes inbound calls according to agent strengths, areas of expertise, and skill sets.
* Time-Based Routing: Routes calls according to specific agent schedules and/or time zones, especially helpful for geographically diverse times
* Relationship-Based Routing: Routes calls to agents according to previously established working relationships, such as a client’s preferred agent or VIP caller status

**Interactive Voice Response (IVR)**

IVR is a VoIP feature that uses pre-recorded voice prompts, speech recognition, and/or customer interactions via dial pad to direct calls to the proper departments or individual agents. When a customer places an outbound call to a business phone system with IVR, recorded messages collect essential information such as customer contact information, the reason for the call, desired department or representative and payment Information. IVR is designed to automate business processes that either completely negate the need for the caller to speak to a live agent or drastically reduce call times.

**Auto Dealers**

Automated outbound dialers (auto-dialers) expedite lead list penetration and increase overall talk times by eliminating the need for agents to physically enter in phone numbers and ensuring that agents connect to calls only when a prospect is on the other line and ready to talk. This feature automatically filters out busy signals, disconnected numbers, and voicemail machines. There are several dialing modes to choose from, outlined below:

* Predictive Dialer: Makes simultaneous outbound calls, filtering out voicemail, fax machines, busy signals, and disconnected numbers. Uses an algorithm to “predict” agent availability, and transfers live leads to agents accordingly.
* Progressive Dialer: Makes one call at a time per agent to maintain a consistent outbound dialing pace that can be adjusted according to agent availability and preference. Agents must end their current calls completely before the next phone number is automatically dialed.
* Power Dialer: Uses a pre-set call: agent ratio to automatically dial prospect phone numbers as soon as an agent becomes available. Only connects agents to a live lead.

**Call Recording**

Call recording is a form of call monitoring that either automatically records calls between agents and callers, or records them on an on-demand basis. Call recordings are then automatically stored in the cloud for later review. In many cases, call recordings are automatically transcribed and transcriptions can be searched/organized by keywords or phrases. These recordings allow for agent and department evaluation and quality assurance, more in-depth customer insight, evaluation of current training materials, infallible records of what was or was not said on a call.

**Visual Voicemail**

Visual voicemail is a VoIP feature that transcribes voicemail messages left for agents via voicemail-to-text and/or voicemail-to-email. This means agents do not have to take the time to listen to each individual voicemail, and that they can easily prioritize callbacks according to voice-message content. Visual voicemail also allows agents to listen to recorded messages if needed.

**Call Forwarding**

Call forwarding is a call distribution strategy that automatically sends (forwards) incoming calls to different telephone numbers associated with the same agent or department in a pre-set order. Forwarding calls allows for greater team flexibility and is especially ideal for remote or blended agents, because it eliminates the need for agents to be physically tied to a single location to take calls. It also prevents callers from having to hang up and dial multiple phone numbers in the hopes of reaching the desired agent.

## Pros and Cons of VoIP

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| --- | --- |
| **VoIP Pros** | **VoIP Cons** |
| Cheaper and more scalable than landline phone service | May require users to upgrade current Internet speed |
| More advanced features than standard business phones | Access to advanced features may require users to scale up to a higher plan tier |
| Increased portability and flexibility | Has a higher learning curve than traditional phones |
| Better overall voice and call quality | Dependent on a strong, uninterrupted Internet connection to avoid jitter and latency |

VoIP software packages can be categorized into Free VoIP Phones, Free VoIP Gateways, Free VoIP Gatekeepers, Free VoIP Proxies, Free VoIP Software Development Libraries, and Free VoIP PBX.

Some of the most popular VoIP tools are listed below:

**Ooma**

**Features:**

* Ooma has features for video conferencing.
* Its virtual receptionist functionality helps with automating the management of incoming calls.
* It has enhanced call blocking capabilities.
* It contains many more functionalities like call recording.

**CloudTalk:**

**Features:**

* VoIP
* Power dialer with scripts and surveys, Smart dialer, and Click-to-Call.
* Interactive Voice Response (IVR) with Drag and Drop builder.
* Inbound call distribution and outbound dialing.
* SMS/Text messaging with templates.
* 50+ Integrations with CRMs (Salesforce, Hubspot, Pipedrive & more) as well as Helpdesks (Zendesk, Freshdesk, Zoho, ..) and Zapier + API.
* It has functionalities for agent scripting, voice mail, call conferencing, and toll-free numbers.
* CloudTalk offers local phone numbers from 140+ countries (toll-free as well).

**Asterisk:**

**Features:**

* Conference calling
* Call Recording
* Call Monitoring
* Distributed Universal Number Discovery
* Caller ID on Call Waiting
* Direct Inward System Access
* Call Parking
* SMS Messaging
* Trunking
* Transcoding
* Voicemail
* Call Queues and many other features

## Install VoIP software on CentOS

Before you start running Asterisk on CentOS 7, you have to make sure all the package son the system is up to date:

**# sudo yum -y update**

Set hostname type:

**# sudo hostnamectl set-hostname pbx.ex.com**

Add EPEL repository:

**# sudo yum -y install epel-release**

Set SELinux in Permissive Mode by running the commands below:

**# sudo setenforce 0**

**# sudo sed -i 's/\(^SELINUX=\). \*/\SELINUX=permissive/' /etc/selinux/config**

**Step 1: Install Asterisk 16 PBX dependencies**

The initial step when setting up Asterisk is to install all required dependencies.

**# sudo yum -y install wget vim net-tools**

You also need to install Development Tools group packages.

**# sudo yum -y groupinstall "Development Tools"**

The other packages that you need to install are:

# **sudo yum -y install libedit-devel sqlite-devel psmisc gmime-devel   ncurses-devel libtermcap-devel sox newt-devel libxml2-devel libtiff-devel  audiofile-devel gtk2-devel uuid-devel libtool libuuid-devel subversion kernel-devel kernel-devel-$(uname -r) git subversion kernel-devel crontabs cronie cronie-anacron wget vim**

**Step 2: Download and Install Jansson**

Jansson is a C library for encoding, decoding and manipulating JSON data. Download and install it on CentOS 7 server by running the commands below:

**# cd /usr/src/**

**# git clone https://github.com/akheron/jansson.git**

**# cd jansson**

**# autoreconf  -i**

**# ./configure --prefix=/usr/**

**# make && make install**

**Step 3: Download and Install PJSIP**

PJSIP is a free and open source multimedia communication library written in C language implementing standard based protocols such as SIP, SDP, RTP, STUN, TURN, and ICE. Clone the project from Github, then compile and install.

**# cd /usr/src/**

**# git clone https://github.com/pjsip/pjproject.git**

**# cd pjproject**

**# ./configure CFLAGS="-DNDEBUG -DPJ\_HAS\_IPV6=1" --prefix=/usr --libdir=/usr/lib64 --enable-shared --disable-video --disable-sound --disable-opencore-amr**

**# make dep**

**# make**

**# make install**

**# ldconfig**

**Step 4: Download and Install Asterisk**

Now that we have all dependency packages installed, we should be ready to download and install Asterisk 16 on CentOS 7.

**# cd /usr/src/**

**# wget http://downloads.asterisk.org/pub/telephony/asterisk/asterisk-16-current.tar.gz**

**# tar xvfz asterisk-16-current.tar.gz**

**# rm -f asterisk-16-current.tar.gz**

**# cd asterisk-\***

**# ./configure --libdir=/usr/lib64**

## How much Does VoIP Cost?

VoIP is only as good as your internet connection. If your network bandwidth is low, the service is bound to suffer.

VoIP doesn't use as much bandwidth as you might expect. It's essential that VoIP devices receive low latency on your network. Each device should have at least 100 kbps upload speed available. A good connection has less than 70ms ping and jitter, which measures the latency and stability of your internet connection.

The bandwidth your business needs will depend on the number of concurrent calls you plan on making.The best way to determine this is to run a bandwidth test on your current network.

## VoIP Equipment and Hardware

Though VoIP BYOD compatibility eliminates much of the need for expensive equipment, a few basic hardware options are still required. We’ll cover those, as well as popular optional VoIP hardware.

**Essential Equipment and Hardware**

The equipment below is required for getting VoIP phone system up and running. And Internet Connection and Router is the most important thing you’ll need to operate a VoIP system is a high-speed broadband Internet connection and router. In general, VoIP systems need a minimum bandwidth of 90-156 kbps to function properly-meaning you may need to upgrade your internet service. Note that sufficient bandwidth is the responsibility of the user, not of the VoIP provider. A router connects VoIP devices to the Internet and keeps those VoIP calls connected.

**Compatible Device:** Once you have working Internet, you need to determine the specific devices you’ll use to make and receive VoIP calls.

Popular VoIP compatible devices include:

* + Standard desk phones (via ATA or VoIP phones)
  + Smartphones
  + Desktop computers
  + Laptop computers
  + Tablets

**Ethernet Cable:** An ethernet cable provides your VoIP system with a powerful, consistent internet connection. Though VoIP calls are possible over WiFi, an Ethernet Internet connection is much more reliable than a wireless one.

**PoE Adapter:** A PoE adapter is connected to the Ethernet cable, then plugged directly into a wall outlet to ensure the cable has sufficient power.

**Analog Telephone Adaper** (ATA): An Analog Telephone Adapter (ATA) allows users to connect existing desk phones, (analog phones) fax machines, or other on-premise devices to their VoIP network. In short? It’s what enables standard phones to make and receive VoIP calls.

**VoIP Gateway:** A VoIP gateway converts analog phone signals to virtual SIP, (Session Initiation Protocol) creating a link between the traditional phone system setup and the network.

**Optional Equipment and Hardware:** Though you don’t *need* to have this equipment, having it elevates your VoIP experience.

**VoIP Desk Phones:** Even if users primarily rely on desktop computers and cell phones to communicate via VoIP voice, many also choose to invest in a traditional desk phone (also called a hard phone or an IP phone.)

Key features to look for in VoIP phones include:

* LCD color touchscreen
* Programmable keys and shortcuts
* Built-in video calling screen
* Built-in USB ports
* Busy light indicator

**Headsets:**VoIP headsets provide a better overall sound quality, have noise-cancellation features, and make it is easier for employees to hear and stay focused on current conversations. Both wired and wireless headsets are available, though the latter is more popular and allows for greater flexibility.

Look for headsets with:

* A Bluetooth range of at least 5 feet
* Basic call control functions on the headset itself
* Adjustable microphone
* Compatible smartphone app

**Conference Speakers:** headsets make one-on-one conversations clearer, but speakers can make conference calls a much better experience for everyone involved.

Look for speakers with:

* Built-in microphones
* Background noise suppression
* An audio pickup radius of 7-10 feet at a minimum
* User controls like mute, remove from speakerphone, intercom, volume controls
* Bluetooth connectivity/USB ports