
Chapter 1 – Introduction

Asterisk is revolutionary, reliable, scalable, open source, free software that makes possible powerful enterprise telephone systems. Asterisk systems are in use world-wide, reliably supporting small and large enterprises, with thousands, even tens of thousands, of users.

An Asterisk system is far less expensive than any proprietary telephone system you might consider, and Asterisk does much more than legacy telephone systems. With Asterisk, you can:

- place calls to and from the telephone company, as if you had an ordinary land line.
- easily connect standard analog telephones to your Asterisk system, with inexpensive adaptors or gateways. Handsets from many legacy PBX systems, for example Nortel, can be reused.
- place voice calls over a local area network, or over the Internet. Calls on a LAN or the Internet use IP, the Internet Protocol. This is VoIP, Voice over IP.
- place calls between different offices, different floors, different buildings, different cities, or different countries. Any authorized user can place calls through your Asterisk system.

Asterisk is a PBX, a soft switch, and a lot more. Asterisk is also an open source toolkit for telephony applications, and a full-featured, open architecture, call-processing and computerized telephony integration platform. Among Asterisk's many features are the following:

- VoiceMail Server with Directory
- Conferencing Server
- Packet Voice Server
- Encryption of Telephone Calls
- Heterogeneous Voice over IP gateway (H.323, SIP, MGCP, IAX)
- Custom Interactive Voice Response (IVR) system
- Number Translation
- Calling Card Server
- Predictive Dialing
- Call Queuing with Remote Agents
- Gateway and Aggregation for Legacy PBX systems
- Remote Office or User Telephone Services
- PBX long distance Gateway

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- Telemarketing Block
- Standalone VoiceMail System

Asterisk not only lowers the costs of running a PBX, it will increase the size of the VoIP market. Just like FedEx and parcels, Asterisk will transform the VoIP market, and make it a lot more attractive to a lot more people.

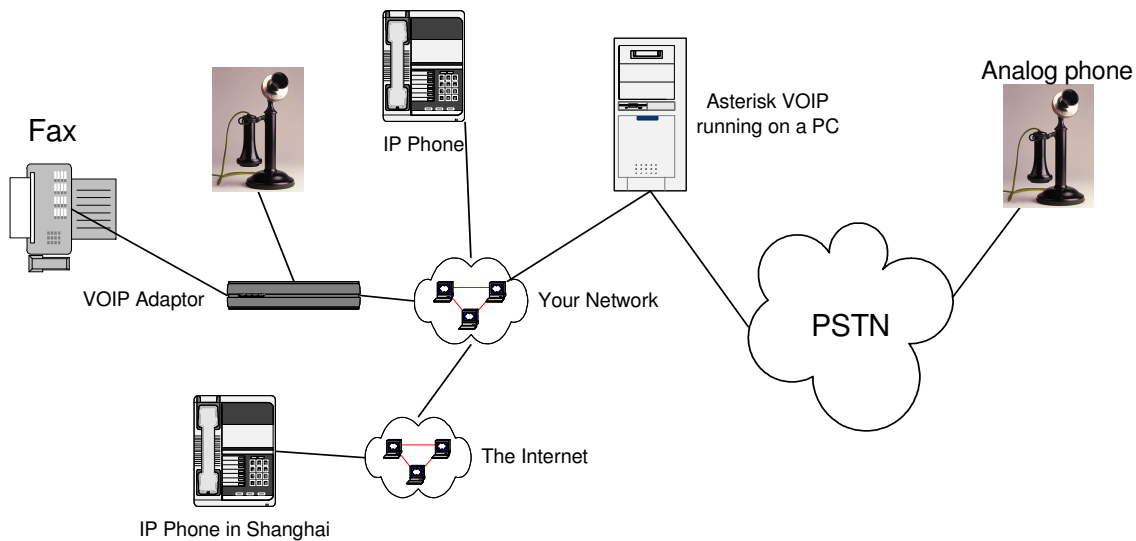
Connecting to the PSTN

Asterisk users should be able to place calls to telephones connected to the PSTN. This means your Asterisk system must be connected to the PSTN. This is easy to do.

If calls are to be accepted from the public telephone network (PSTN), Asterisk users need a telephone number. These telephone numbers have to be rented from your local telephone company. You can also rent a connection to your telephone company; this connection is usually some wires buried in the ground, or wires hung from poles.

Boards you add to the server running Asterisk, or a separate gateway device, connect the server to the connection you rent from the phone company. When someone dials your telephone number from the PSTN, your desk phone rings.

FIGURE 1. - Connecting to the Public Telephone Network

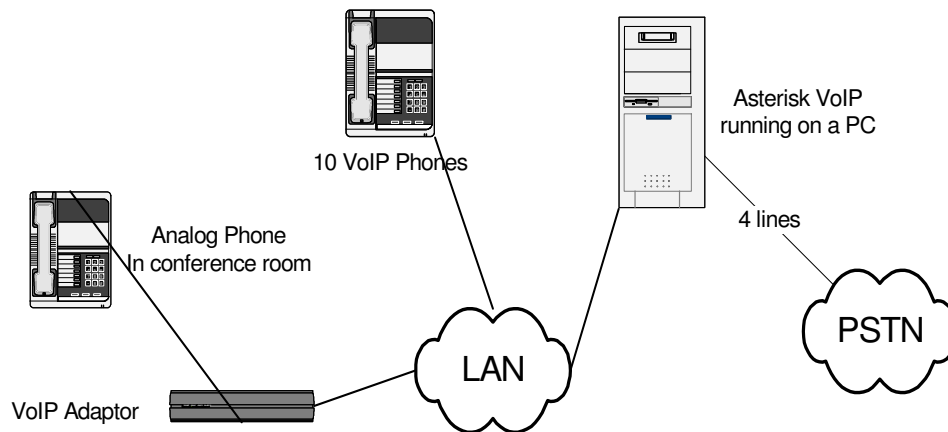


How Asterisk Can Benefit Specific Business Configurations

Scenario One - A Small Office

In this scenario, a small office has four lines from the telephone company, each with its own telephone number. The office has ten users, and a conference room. The ten users each have a VoIP telephone. There is an analog telephone in the conference room connected to a VoIP adaptor. The small business can easily afford the inexpensive Asterisk server. The Asterisk server manages calls for the four lines, and for all of the phones in the office.

FIGURE 2. Small Office



- An incoming caller hears a voice menu, with options for accessing a company directory, calling the operator, contacting sales, or dialing an extension directly. The caller wants to speak to someone in sales. They listen to the instructions, and then press 1.
- Three phones are in the sales department. All three phones ring. A distinctive ring lets the sales staff know this is an incoming call from a potential customer.
- Anyone can answer the incoming call from any phone. If no phone is answered by the fourth ring, the caller is given the choice of leaving a message or contacting the operator. If the user leaves a message, it is stored in a separate voice mail box for the sales department. Each of the three users in sales is sent an email message letting them know that there is a new sales call.

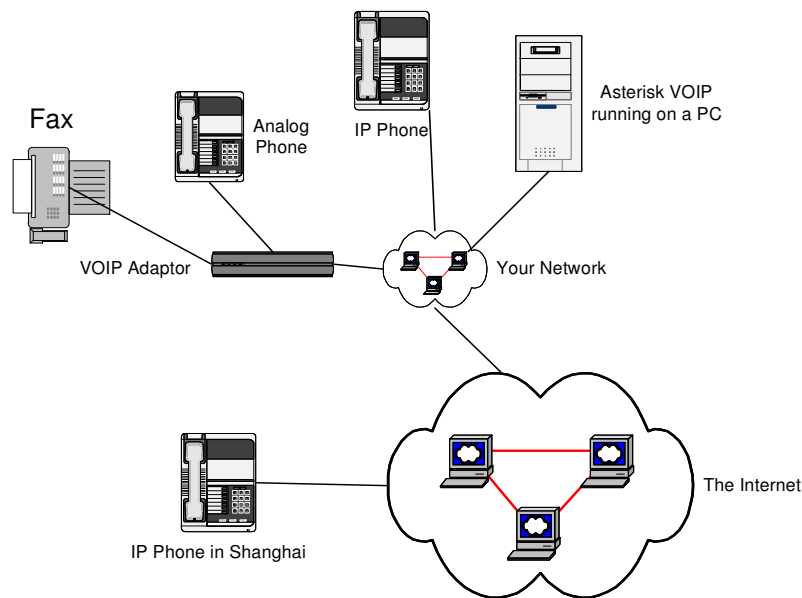
All the users in the office have all the functionality of the most sophisticated PBX. They have VoiceMail, least cost phone call routing, and many other features.

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Scenario Two - Offices in New York and Shanghai

As shown in the illustration below, this Asterisk system, in New York, is connected to the Internet. With a VoIP phone, or an inexpensive VoIP adaptor, this company can install a phone in its Shanghai office, and attach it to the Internet over a broadband connection. The Shanghai phone is controlled by the office Asterisk system in New York. Calls between Shanghai and New York go over the Internet.

FIGURE 3. Small Office With an Internet Connection



Using the remote phone in Shanghai is *exactly* like using a phone in the New York office. Incoming callers and local users will be not able to tell where the phone is! In fact, the phone could be attached to any Internet connection, anywhere on Earth, and it would work *exactly* as if it were in the New York office.

VoIP telephone calls sent over a local data network or the Internet never have a long distance charge or a toll charge associated with them. The charge for these telephone calls is included in the price paid for the Internet connection.

Scenario Three - A Large Business With Several Offices

This scenario stars a business with 1500 employees. The main office is in New York. District offices are in Chicago and Los Angeles. World wide support is done from the Manila office.

Asterisk servers in New York and Chicago communicate with each other over a high speed Internet connection. The Asterisk servers communicate with the two branch offices over a high speed Internet connection. The hosted facilities are hardened, and geographically separate from each other and the company offices.

- With shared Asterisk servers, if one fails another takes over. This is much safer for the company, since there is no single point of failure. Even in the event of an outage at one of the main offices, telephone communications won't be disrupted.
- If there is a problem in the office, employees can take their phones off their desks, and move them to their homes or another office. If there is a problem at the Chicago office, key employees can relocate to the New York office, taking their desk phones with them, or using phones already at the New York office. Business goes on.
- Users seeking support can call local numbers in any of the regions. These calls are routed to the support center in Manila. The calls are sent over the Internet, so there is no long distance charge to the company. The user has called a local number, and also pays no long distance charge. This is called "toll bypass."

Scenario Four - A Busy Traveler

Asterisk can benefit a busy user who travels frequently.

- Someone calls an Asterisk user. Asterisk answers the phone, and prompts the caller for their name. The caller says their name. Asterisk then plays a message asking them to wait for a moment while their called party is located.
- The Asterisk server rings the office telephone at the user's business' headquarters, and at a branch office, and rings the home telephone and cell phone of the user, all at the same time. If the user doesn't answer any of the phones after six rings, the caller is prompted to leave a voice mail message.
- When the user answers any of the phones, the Asterisk server announces the telephone number of the calling party, if caller ID is available. Then the Asterisk server plays back the name the calling party has just recorded. The user presses 1 on the keypad of their phone to accept the call, or 3 to refuse the call. If the user refuses the call, the caller is directed to VoiceMail. The Asterisk server sends a text message to the user's cell phone indicating there is new voice mail.

Scenario Five - An International Business

Asterisk can benefit a business that would otherwise have substantial long-distance telephone costs.

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- An electronics manufacturer has its main offices in San Jose, California, with international offices in London, Tokyo, Hong Kong, and Munich. Asterisk servers are in hosted facilities in San Jose and Tokyo. Asterisk servers are also in the Hong Kong, Munich, and London offices.
- All the Asterisk servers have high speed connections to the Internet. All the servers also have connections to their local public telephone systems.
- Because the Asterisk servers are connected over the Internet, there are no long distance charges for calls between the offices. Any user in any office can call any user in any other office. These calls are routed over the Internet, that is, they are toll bypass calls.
- The support staff for this company is all at the San Jose headquarters. Instead of having support staff at the London office, management has decided to perform all English language support from San Jose. Users in London can call the London telephone number for the company. If they wish to contact support, their call is routed to the San Jose office over the company's VPN. This is a toll bypass call.

Asterisk Compared to Proprietary Telephone Systems

A wide range of proprietary telephone systems, from small to large, are available from corporate vendors. All the components of a proprietary system come from a single manufacturer. The single company designs and builds all the hardware and software for their telephone system. They manufacture the system themselves. None of their equipment will work with systems from other companies. This is how they control their price.

Legacy manufacturers usually sell the largest systems themselves, through a dedicated sales force. A dedicated sales force is, of course, expensive. The cost of this sales force, and all the support behind the sales force, is included in the price you pay for your telephone system.

The price you pay for a proprietary telephone system includes all the costs of manufacturing and distribution. The price has to be high enough to provide a profit for everyone in the distribution chain: the proprietary manufacturer, distributor, representative, retailer, etc. The cost of designing and manufacturing is spread over a relatively few number of systems from a single manufacturer. This makes proprietary systems very expensive.

Even the most sophisticated, largest, Signate Asterisk server is far less expensive than any traditional PBX. Asterisk systems are open. Interface boards or gateways are inexpensive, and are available from a variety of competing vendors.

Manufacturers of proprietary systems classify them by their features. Do you want VoiceMail? That's more hardware and more money. Do you need a system that supports more users? That's a larger more expensive system. A proprietary system will cost more for every feature you want. Features like VoiceMail and an Internet connection will be expensive.

Each proprietary system in a manufacturer's product range is limited to a certain number of users. Adding more users requires adding more expensive cards to the system, or buying a more expensive system. Manufacturers demand much more money for their more capable systems.

Do you need an Asterisk system to support more users? Just use a more powerful server or another server.

You won't be able to get the features available with an expensive proprietary system if you purchase an inexpensive proprietary system. Manufacturers do not put all the features they support into all the products they sell. There may be a feature you need or want that is only available with a more expensive system.

Asterisk provides many features. Features only available in a proprietary phone system costing tens or hundreds of thousands of dollars are now available in your free Asterisk software. Asterisk has most of the features found on any high end proprietary telephone system.

Asterisk is an open source effort. It is not proprietary software. A user community has grown up around Asterisk. When a developer from any organization adds a new feature, you get that feature too. Unlike proprietary systems, you can easily add your own features.

Asterisk has facilities proprietary telephone systems cannot provide. For example, Asterisk has a scripting system. This scripting system makes it easy to make Asterisk do amazing things. For example, you can write a script to have Asterisk call you in the morning to wake you up, and even to have Asterisk read a weather or traffic report. The following chapters describe how to design, install, configure, build, and maintain an Asterisk system for your enterprise.

Who Made Asterisk?

Asterisk was originally created by Mark Spencer. Code has been contributed by open source programmers from around the world. Improvements, testing, and bug-fixes from the community have proven invaluable in developing and improving Asterisk. Asterisk is now a very popular and extremely successful team effort from the open source community.

A Partial Feature List

When this book was written, Asterisk already provided the following features. New features are regularly added.

- Telephony services
 - VoiceMail system
 - Password protected
 - Separate *away* and *unavailable* messages
 - Default or custom messages
 - Multiple mail Folders
 - Web interface for voice mail checking
 - E-mail notification of voice mail
 - Voice mail forwarding
 - Visual message waiting indicator

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- Message waiting stutter dialtone
- Auto attendant
- Interactive voice response
- Overhead paging
- Flexible extension logic
 - Multiple line extensions
 - Multi-layered access control
 - Direct inward system access
- Directory listing
- Conference bridging
 - Unlimited conference rooms
 - Access control
- Call queuing
- ADSI menu system
 - Support for advanced telephony features
 - PBX driven visual menu systems
 - Visual notification of voice mail
- Call detail records
- Local call agents
- Remote call agents
- Protocol bridging
 - Provides seamless integration of technologies
 - Offers a unified set of services to users regardless of connection type
 - Allows interoperability of VoIP systems
- Call features
 - Music on hold
 - Music on transfer
 - Flexible mp3 based system
 - Volume control
 - Random play
 - Linear play
 - Call waiting
 - CallerID
 - Caller ID blocking

- Caller ID on call waiting
- Call forward on busy
- Call forward on no answer
- Call forward variable
- Call transfer
- Call parking
- Call retrieval
- Remote call pickup
- Do not disturb
- Scalability
 - TDMoE
 - Allows direct connection of Asterisk PBX
 - Offers zero latency
 - Uses commodity Ethernet hardware
- Voice over IP
 - Allows for integration of physically separate installations
 - Uses commonly deployed data connections
 - Allows a unified dialplan across multiple offices
- Voice over IP Interoperability
 - Inter-Asterisk Exchange (IAX)
 - H.323
 - Session Initiation Protocol (SIP)
 - Media Gateway Control Protocol (MGCP)
- Traditional telephony interoperability
 - Robbed bit signaling types
 - FXS and FXO
 - Loopstart
 - Groundstart
 - Kewlstart
 - E&M
 - E&M Wink
 - Feature Group D
- PRI Protocols
 - 4ESS

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- Lucent 5E
- DMS100
- National ISDN2
- EuroISDN
- BRI (ISDN4Linux)
- Codec Support
 - GSM
 - G.729 (available through purchase of commercial license(s))
 - G.723.1 (pass through)
 - Linear
 - G.711 Mu-Law
 - G.711 A-Law
 - ADPCM
 - ILBC
 - LPC-10
 - MP3 (decode only)

Licensing

Asterisk is generally distributed under the terms of the GNU General Public License, or GPL. This license permits you to freely distribute Asterisk in source and binary forms, with or without modifications, provided that, when it is distributed to anyone at all, it is distributed with source code (including any changes you make), and without any further restrictions on their ability to use or distribute the code. For more information, refer to the GNU General Public License

The GPL does not extend to the hardware or software that Asterisk talks to. For example, if you are using a SIP soft phone as a client for Asterisk, it is not a requirement that program be distributed under GPL. For those applications in which the GNU GPL is not appropriate (because of some sort of proprietary linkage, for example), commercial licensing is available.