A private branch exchange (PBX) is a telephone exchange or switching system that serves a private organization and performs concentration of central office lines or trunks and provides intercommunication between a large number of telephone stations in the organization. The central office lines provide connections to the public switched telephone network and the concentration aspect of a PBX permits the shared use of these lines between all stations in the organization. The intercommunication aspect allows two or more stations to directly connect while not using the public switched telephone network. Each PBX-connected station, such as a telephone set, a fax machine, or a computer modem, is often referred to as an extension and has a designated extension telephone number that may or may not be mapped automatically to the numbering plan of the central office and the telephone number block allocated to the PBX.

Initially, PBX systems offered the primary advantage of cost savings for internal phone calls: handling the circuit switching locally reduced charges for telephone service via central-office lines. As PBX systems gained popularity, they began to feature services not available in the public network, such as hunting groups, call forwarding, and extension dialing. From the 1960s a simulated PBX known as Centrex provided similar features from the central telephone exchange.

A PBX differs from a key telephone system (KTS) in that users of a key system manually select their own outgoing lines on special telephone sets that control buttons for this purpose, while PBXs select the outgoing line automatically, or formerly, by an operator. The telephone sets connected to a PBX do not normally have special keys for central-office line control, but it is not uncommon for key systems to be connected to a PBX to extend its services.

A PBX, in contrast to a key system, employs an organizational numbering plan for its stations. In addition, a dial plan determines whether additional digit sequences must be prefixed when dialing to obtain access to a central-office trunk. Modern number-analysis systems permit users to dial internal and external telephone numbers without special codes to distinguish the intended destination.

Current trends

Since the advent of Internet telephony (Voice over IP) technologies, PBX development has tended toward the IP PBX, which uses the Internet Protocol to carry calls. Most modern PBXs support VoIP. ISDN PBX systems also replaced some traditional PBXs in the 1990s, as ISDN offers features such as conferencing, call forwarding, and programmable caller ID. As of 2015 ISDN is being phased out by most major telecommunication carriers throughout Europe in favour of all-IP networks, with some expecting complete migration by 2025. Originally having started as an organization’s manual switchboard or attendant console operated by a telephone operator or just simply the operator, PBXs have evolved into VoIP centers that are hosted by the operators or even manufacturers.

Even though VoIP is considered by many people as the future of telephony, the circuit switched network remains the core of communications, and the existing PBX systems are competitive in services with modern IP systems. Five distinct scenarios exist:

• Hosted/virtual PBX (hosted and circuit-switched) or traditional Centrex
• IP Centrex or hosted/virtual IP (hosted and packet-switched)
• IP PBX (private and packet-switched)
• Mobile PBX solution (mobile phones replacing or used in combination with fixed phones)
• PBX (private and circuit-switched)

For the option to call from IP network to the circuit-switched PSTN (SS7/ISUP), the hosted solutions include interconnecting media gateways

PBX functions

Functionally, the PBX performs four main call processing duties:

• Establishing connections (circuits) between the telephone sets of two users (e.g. mapping a dialed number to a physical phone, ensuring the phone isn’t already busy)
• Maintaining such connections as long as the users require them (i.e. channelling voice signals between the users)
• Disconnecting those connections as per the user’s requirement
• Providing information for accounting purposes (e.g. metering calls)

In addition to these basic functions, PBXs offer many other calling features and capabilities, with different manufacturers providing different features in an effort to differentiate their products. Common capabilities include (manufacturers may have a different name for each capability):

• Auto attendant
• Auto dialing
• Automated directory services (where callers can be routed to a given employee by keying or speaking the letters of the employee’s name)
• Automatic call distributor
• Automatic ring back
• Busy override
• Call blocking
• Call forwarding on busy or absence
• Call logging
• Call park
• Call pick-up
• Call transfer
• Call waiting
• Camp-on
• Conference call
• Custom greetings
• Customized abbreviated dialing (speed dialing)
• Direct inward dialing (DID)
• Direct inward system access (DISA) (the ability to access internal features from an outside telephone line)
• Do not disturb (DND)
• Follow-me, also known as find-me: Determines the routing of incoming calls. The exchange is configured with a list of numbers for a person. When a call is received for that person, the exchange routes it to each number on the list in turn until either the call is answered or the list is exhausted (at which point the call may be routed to a voice mail system).

*Interactive voice response*

• Local connection: Another useful attribute of a hosted PBX is the ability to have a local number in cities in which you are not physically present. This service essentially lets you create a virtual office presence anywhere in the world.
• Music on hold
• Night service
• Public address voice paging
• Shared message boxes (where a department can have a shared voicemail box)
• Voice mail
• Voice message broadcasting
• Welcome message

**Interface standards**

**Interfaces for connecting extensions to a PBX include:**

- **DECT** – a standard for connecting cordless phones.
- **Internet Protocol** – For example, H.323 and SIP.
- **POTS** (plain old telephone service) – the common two-wire interface used in most homes. This is cheap and effective, and allows almost any standard phone to be used as an extension.
- **Proprietary** – the manufacturer has defined a protocol. One can only connect the manufacturer’s sets to their PBX, but the benefit is more visible information displayed and/or specific function buttons.

**Interfaces for connecting PBXs to each other include:**

- **DPNSS** – for connecting PBXs to trunk lines. Standardized by British Telecom, this usually runs over E1 (E-carrier) physical circuits.
- **Internet Protocol** – H.323 and the Session Initiation Protocol (SIP) are IP-based solutions for multimedia sessions.
- **Primary rate interface** (ISDN) – Provided over T1 (23 bearer channels and 1 signaling channel) or E1 carriers.
- **Proprietary protocols** – if equipment from several manufacturers is on site, the use of a standard protocol is required.
- **QSIG** – for connecting PBXs to each other, usually runs over T1 (T-carrier) or E1 (E-carrier) physical circuits.

**Interfaces for connecting PBXs to trunk lines include:**

- **Internet Protocol** – H.323, SIP, MGCP, and Inter-Asterisk eXchange protocols operate over IP and are supported by some network providers.
- **ISDN** – the most common digital standard for fixed telephony devices. This can be supplied in either Basic (2-circuit capacity) or Primary (24- or 30-circuit capacity) versions. Most medium to large companies would use Primary ISDN circuits carried on T1 or E1 physical connections.
- **RBS** (robbed bit signaling) – delivers 24 digital circuits over a four-wire (T1) interface
- **standard POTS** (plain old telephone service) lines – the common two-wire interface used in most domestic homes. This is adequate only for smaller systems, and can suffer from not being able to detect incoming calls when trying to make an outbound call (commonly called glare).

**Interfaces for collecting data from the PBX:**

- **File** – the PBX generates a file containing the call records from the PBX.
- **Network port** (listen mode) – an external application connects to the TCP or UDP port. The PBX streams information to the application.
- **Network port** (server mode) – the PBX connects to another application or buffer.
- **Serial interface** – historically used to print every call record to a serial printer. In modern systems a software application connects via serial cable to this port.

A data record from a PBX or other telecommunication system that provides the statistics for a telephone call is usually termed a call detail record (CDR) or a Station Messaging Detail Record (SMDR).

**Hosted PBX systems**

Virtual PBX systems or hosted PBX systems deliver PBX functionality as a service, available over the public switched telephone network (PSTN) or the Internet. Hosted PBXs are typically provided by a telephone company or service provider, using equipment located in the premises of a telephone exchange or the provider’s data center. This means the customer does not need to buy or install PBX equipment. Generally the service is provided by a lease agreement and the provider can, in some configurations, use the same switching equipment to service multiple hosted PBX customers.

The first hosted PBX services were feature-rich compared to most premises-based systems of the time. Some PBX functions, such as follow-me calling, appeared in a hosted service before they became available in hardware PBX equipment. Since introduction, updates and new offerings have moved feature sets in both directions. It is possible to get hosted PBX services that include feature sets from minimal functionality to advanced feature combinations.

**In addition to the features available from premises-based PBX systems, hosted-PBX:**

- allows a single number to be presented for the entire company, despite its being geographically distributed. A company could even choose to have no premises, with workers connected from home using their domestic telephones but receiving the same features as any PBX user.
- allows multimodal access, where employees access the network via a variety of telecommunications systems, including POTS, ISDN, cellular phones, and VOIP. This allows one extension to ring in multiple locations (either concurrently or sequentially).
- allows scalability so that a larger system is not needed if new employees are hired, and so that resources are not wasted if the number of employees is reduced.
- eliminates the need for companies to manage or pay for on-site hardware maintenance.
- supports integration with custom toll plans (that allow intra company calls, even from private premises, to be dialed at a cheaper rate) and integrated billing and accounting (where calls made on a private line but on the company’s behalf are billed centrally to the company).
Hosted PBX providers

The ongoing migration of most major telecommunication carriers to IP-based networks, coupled with the rise in Cloud Communications has resulted in a significant rise in the uptake of hosted PBX solutions.

Mobile PBX

A mobile PBX is a hosted PBX service that extends fixed-line PBX functionality to mobile devices such as cellular handsets, smartphones and PDA phones by provisioning them as extensions. Mobile PBX services also can include fixed-line phones. Mobile PBX systems are different from other hosted PBX systems that simply forward data or calls to mobile phones by allowing the mobile phone itself, through the use of buttons, keys and other input devices, to control PBX phone functions and to manage communications without having to call into the system first.

A mobile PBX may exploit the functionality available in smartphones to run custom applications to implement the PBX specific functionality.

In addition, a mobile PBX may create extension identifiers for each handset that allow to dial other cell phones in the PBX via their extension shortcut, instead of a PSTN number.

IP-PBX

An IP-PBX handles voice signals over Internet protocol, bringing benefits for computer telephony integration (CTI). An IP-PBX can exist as physical hardware, or can carry out its functions virtually, performing the call-routing activities of the traditional PBX or key system as a software system. The virtual version is also called a "Soft PBX".

Source: https://en.wikipedia.org/wiki/Business_telephone_system#Private_branch_exchange

Related Links:

- How to configure Asterisk to trigger intercom at call receiving side
- How to configure our PBX so that the feature Record Missed Calls is active but not counting the current missed call?
- IP-PBX
- IVR - Interactive Voice Response
- PBX - Private Branch Exchange
- PBX Partner
- PBX Partner - 3CX
- PBX Partner - Antilo i-PBX
- PBX Partner - Astimax
- PBX Partner - Broadsoft
- PBX Partner - Crown
- PBX Partner - Deutsche Telefon
- PBX Partner - Easybell
- PBX Partner - FreePBX
- PBX Partner - Metaswitch