

Telecommunications 101

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Background

Before the advent of digital transmission, digital switching, fax machines, mobile/cellular phones and Data/Internet services that we have these days, the total network that switched calls between customers/subscribers fixed access telephones was called the **Public Switched Telephone Network (PSTN)**.

In that same era, in most countries globally, telecommunications networks were Government owned and operated under the respective Post Offices. As a direct consequence, telephone services were known as the Post Office Telephone Service, or (more affectionately in the USA) the Plain Old Telephone Service (POTS). That era has long gone and these terms (PSTN and POTS) have been dead since about 1965, and here is why:

The [1970's USA/global push for the privatisation](#) of telecommunications out of Government hands incidentally identified that the PSTN connectivity model had within it two structural networks that were fundamentally different, yet were co-dependent.

One of these networks is the **Customer Access Network (CAN)** that connects the Customer Premises Equipment (CPE) to the Local or District Exchange.

The other network is the **Inter-Exchange Network (IEN)** that switches connections through long distance transmission systems to switches at Local and District Exchanges (and several other functions including metering).

These two networks structures are physically connected to each other in Local Exchanges at the Main Distribution Frame (MDF), or a Digital Distribution Frame (DDF) or an Optical Distribution Frame (ODF), depending on the technologies.

Since about 1960, a large range of technological advances in telecommunications engineering has enabled Fax / Modems and Data / Internet to operate over the same Customer Access Networks and Inter-Exchange Networks that were exclusively used by fixed access telephones.

Further technology advances in Mobile/Cellular telephone access networks have widened the functionality to include Mobile/Cellular switching in the Inter-Exchange Network and Broadband Internet access in the Customer Access Network and Internet Switching in the Inter-Exchange Network.

Today, the IEN has a much wider functionality that it did in the 1970's and the IEN now switches with long distance transmission to then switch to a wide range of Customer Access Networks that provide connections for at least:

- Fixed Access Telephones,
- Mobile/Cellular Telephones,
- Mobile/Cellular Internet, IP Phones
- Dial-Up Data/Internet,

- Cable Broadband Internet, Pay TV,
- ADSL Broadband Internet, IP Phones, Personal Devices
- ISDN, MegaLinks, Frame Relay,
- Broadcast Program Distribution.

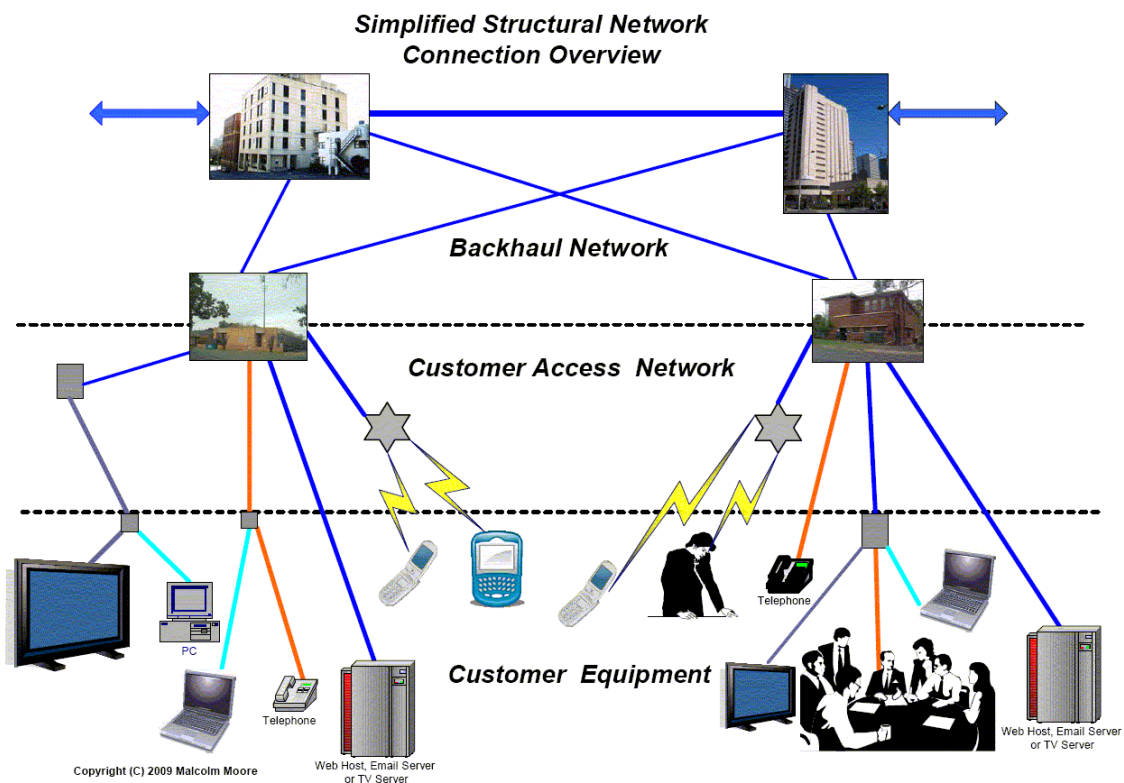
One Picture Explains So Much

To get a simple understanding of the current Telecommunications Infrastructure, all that is needed is to think through making a call to somebody else, using the Internet, and/or using Pay TV.

With a Landline based phone: Pick up the Handset (Customer Equipment) and check for Dial Tone from the Local Switch (Inter-Exchange Network), and this tone comes through an insulated twisted pair cable (Customer Access Network) that is the transmission and signalling path between the customer premises and the local switch.

In the case of a Mobile Phone (Customer Equipment), check for sufficient radio field strength (which comes from a Mobile Base Station and its feed which are all Customer Access Network (CAN) connecting to the Node or District Switch - which is part of the Inter-Exchange Network (IEN).

Dial in the number and wait for the network signalling to connect network switches and their associated optical fibre transmission systems, which are all parts of the Inter-Exchange Network (IEN) to connect you to your called persons phone (through the part of the CAN that connects to them) - who in this case is using a mobile phone (Customer Equipment).



The network signalling switches and optical fibre/radio based transmission systems connect you to a Node / District switch, which again is part of the Inter-Exchange Network (IEN) that has an optical fibre feeding to a mobile base station and radio

transceiver connecting (all Customer Access Network) to their mobile phone (Customer Equipment). This can be confusing and a picture is worth 1000 words!

This picture above visually defines with a high degree of accuracy the three fundamentally different network structures that all join in cascade to effect connections between customers/subscribers. These structures are the:

- **Inter-Exchange Network (IEN)** and associated equipment,
- **Customer Access Network (CAN)**, and its associated equipment, and
- **Customer Premises Network (CPN)** and associated equipment.

All IT/telecommunications equipment at ***each customer premises and/ or with any customer is termed "Customer Equipment". The network and associated equipment is termed the Customer Premises Network (CPN).***

A non-exhaustive list of customer equipment includes: Land-Line/Mobile/IP Phones, Dial-Up Fax and Data Modems, PABXs/Extension Phones, Cable Modems/Set Top Boxes, Routers/Switches, Pagers, Personal/Laptop Computers, Website/Email Servers, Televisions/VDUs, Printers/Scanners. Customer Premises Networks can be complex.

To create a connection to another customer / subscriber beyond the immediate CPN, ***the connection has to pass through the (non-switched) Customer Access Network (CAN) into the Inter-Exchange Network (IEN)***, and it is only in the IEN where the call is switched and connected through (long distance) transmission paths to the distant (local) end of the IEN, where the connection then passed through the CAN to the CPN.

The Customer Access Network (CAN) is all the transmission plant/equipment/cable/radio, pair gain systems (PGS) / line conditioning equipment and associated signalling structures that connect from the Customer Premises Network (CPN) into the ***Inter-Exchange Network (IEN)***.

To connect two or more customers; Irrespective of the transmission content, calling nature, or service provided, ***the switched connection has to pass through the Inter-Exchange Network (IEN)***, to connect via individual Customer Access Networks (CANs) the two customers / computers / fax / mobiles / phones / CATV etc. The above picture shows these connections very clearly.

The Inter-Exchange Network (IEN) is a complex network with two major sub-set components:

- Switching Hierarchy (the highway intersections)
- Transmission Network (the transmission highways)

These two subsets have a range of switches, routers, transmission systems, signalling and control networks and systems that together form the infrastructure to transport call connections from CAN to CAN.

All transmission, signalling and switching/routing equipment, power, buildings, and network management that sits between the two or more sets of Customer Access Networks is the Inter-Exchange Network (IEN), which is covered later.

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Comments and Corrections are welcome