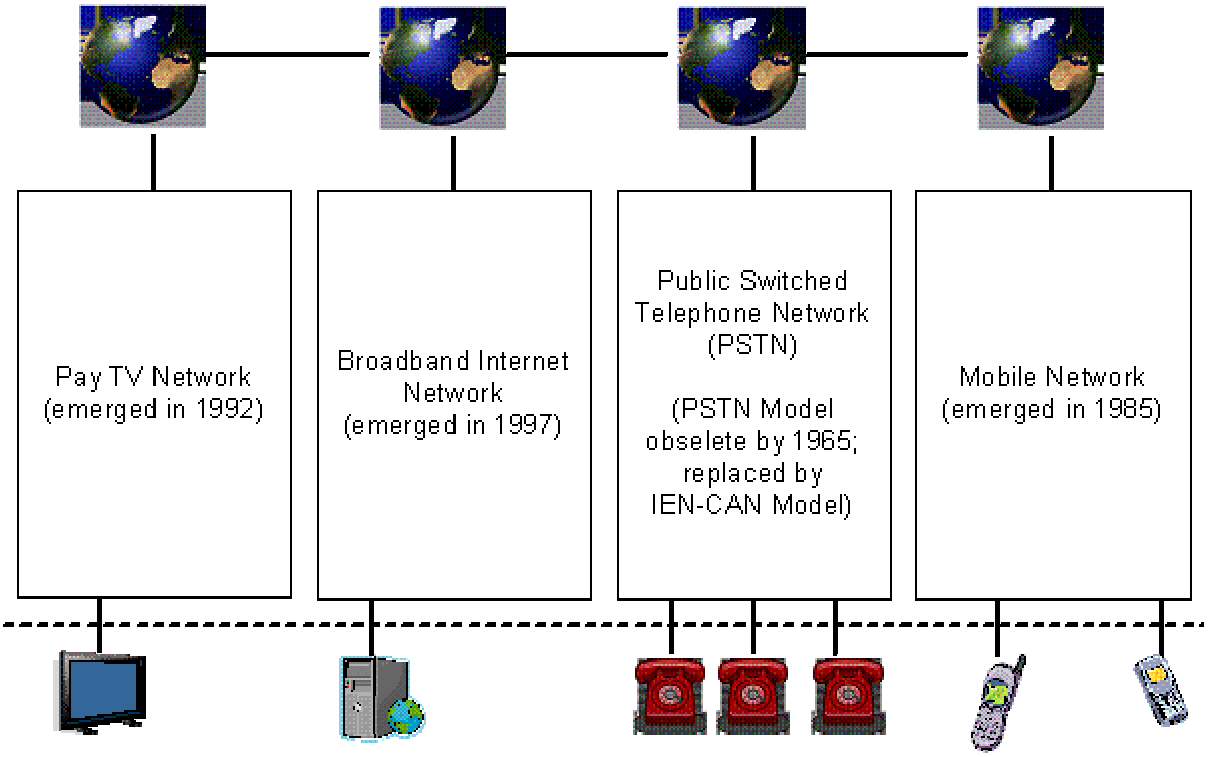
Creation of the IEN Connectivity Model

© Malcolm Moore
02-Nov-2005

Introduction

The figure below shows the PSTN model as understood by telecomms Engineers of that era in the mid 1950's, where the phone has a wire into the wall to the PSTN and it just 'magically' connects to the 'world'.

In line with this very primitive thinking, equivalent models for the Mobile Network, Broadband Internet and Pay (Cable) TV are shown alongside. The approximate emergence dates for Australia are included in these connectivity models.



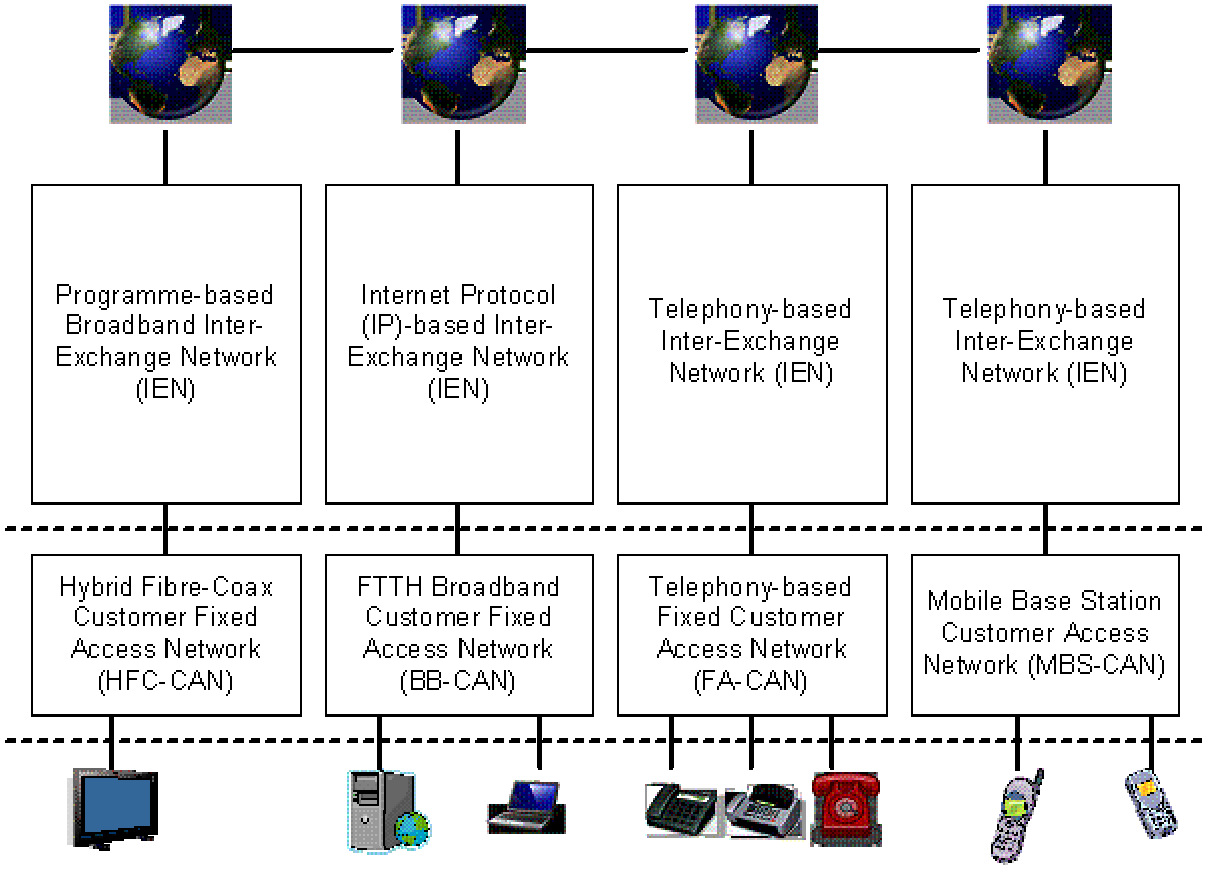
Before 1960, almost all telephone calls were either Operator connected through a point-to-point transit network, in all major capital cities; switched with step-by-step technology switches - so there was a rather blurred demarcation between the Customer Access Network (CAN) and the Inter-Exchange Network (IEN).

In 1960 a new switching technology called Crossbar provided automated alternate path routing and this revolutionised the switched network providing massive efficiencies in network path routing.

By 1965, this complex switching technology change became effective nationally. It became obvious to those working in the Engineering Division of the then Post Master General's Department, that the CAN was a simple non-switched network topology and the IEN was a very complex switched mesh transmission network topology.

These diametrically different network topologies grew a different range of expertise requirements, and even though management made structural changes to reflect appropriate expertise, external business analysts stuck firmly to the now outdated PSTN connectivity model.

To reflect this change in thinking from the PSTN connectivity model to the IEN connectivity model it is an easy step to include a demarcation line between the Customer Access Network (CAN) and the Inter-Exchange Network (IEN) to isolate and show these CAN structures.



This above figure shows the CAN separate from the IEN, (and the dates have been removed for simplicity).

The CAN now relates somewhat to products that are switched through the IEN structure, and many business analysts have stumbled this far but still couldn't let go of the now very outdated and simplistic PSTN connectivity model.

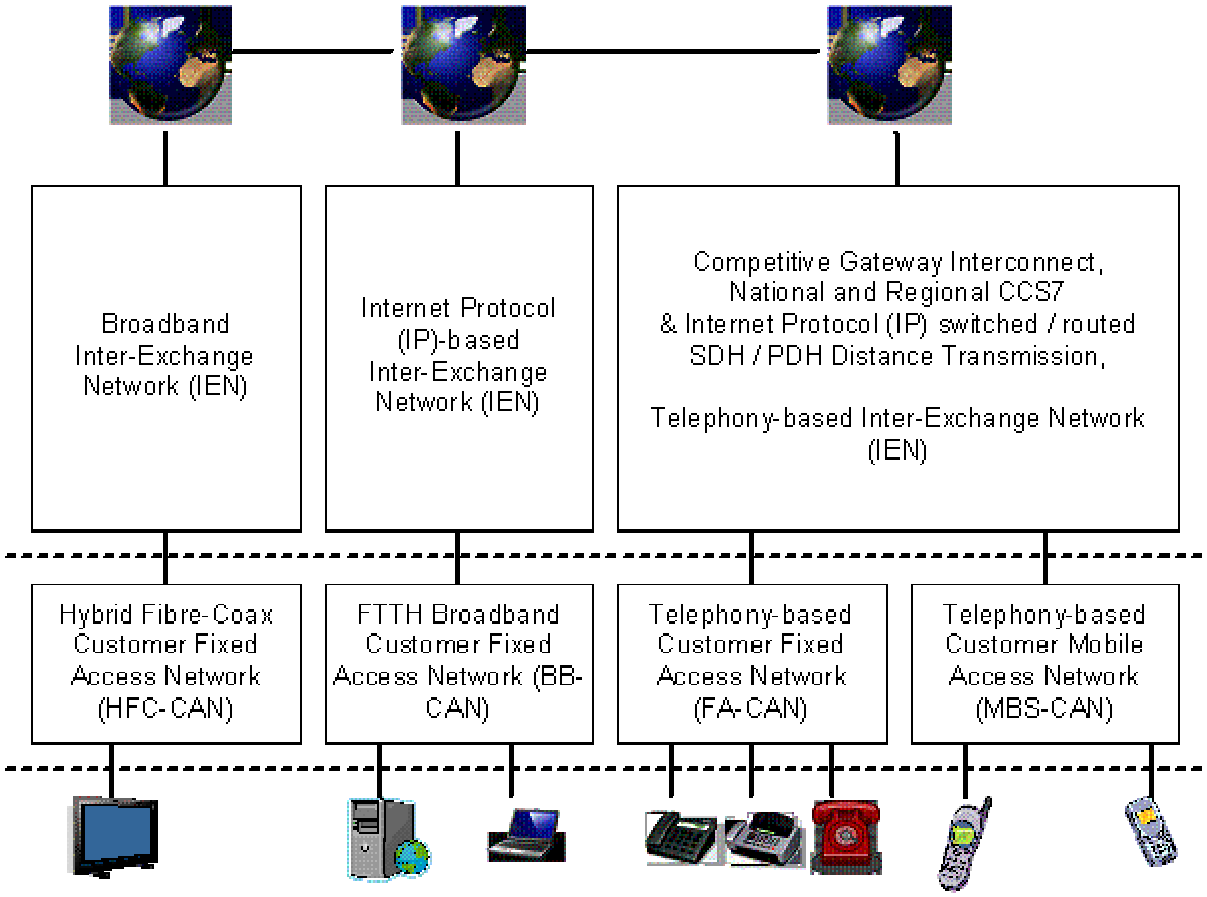
Consequently, these rather inept analysts have (incorrectly) stuck with four non-connected product lines (still using the homogenous PSTN type modelling)!

This is a prime reason why so many reports to the Australian Federal Government Departments are totally at odds with reality, as their reports have totally failed to recognise the massive Inter-Exchange Network (IEN) infrastructure that connects the various CAN structures and wide range of commercial product lines.

By about 1985 both the Mobile [Phone, Radio] Base Station CAN and the Fixed Access CAN both had a common telephony-based Inter-Exchange Network Structure based on a combination of mechanical and digital switching, with analogue and digital transmission.

These adjacent equipment infrastructures were merged as one Inter-Exchange Network Structure, consisting of four layers/ levels of switching and four levels of transmission (District, Regional, National and Competitive Gateway Interconnect).

For simplicity, these layers have not yet been shown.



In combining these two telephony-based (mobile and fixed access) Inter-Exchange Network Structures into one, it now also becomes obvious that this complex switched matrix in the IEN is the common connectivity for both types of the telephone-based customer access networks.

This fundamental realisation has enormous implications for business analysts who are still using the simplistic PSTN type model because it makes the Mobile Access Network a realistic subset of the telephony-based IEN structure, and not a separate network structure as it was in the PSTN (fixed access) model.

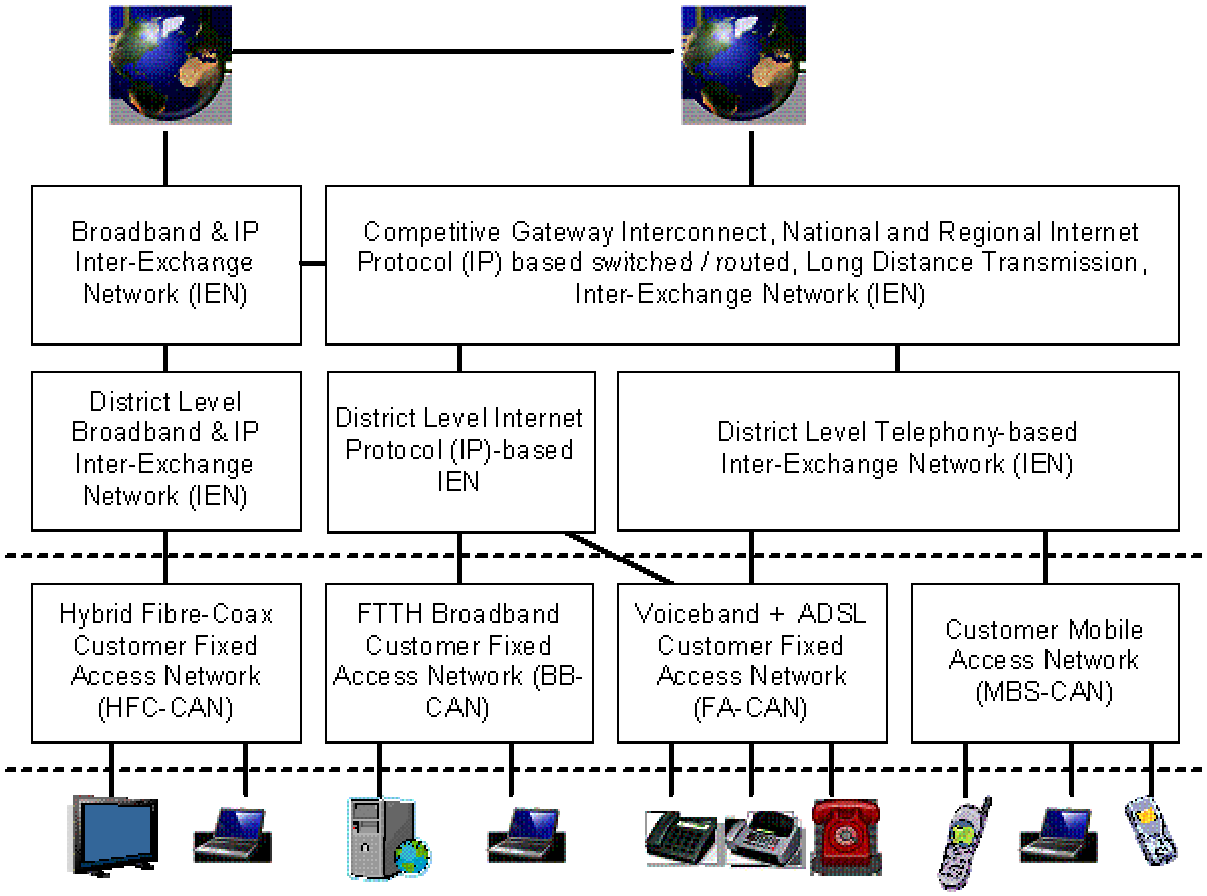
A classic example of this farcical situation are the Yearly Reports on Telecommunications in Australia, commissioned by the Australian Consumer and Competition Commission (ACCC) - which it then provides to the Department of Communications IT and the Arts.

The above figure also shows that the Hybrid-Fibre Access Network for Pay TV has a considerable Inter-Exchange Network (IEN) component (which is Broadband, Radio and TV programme distribution networks).

Businesses that have FTTH connecting to them for Internet also have a substantial Internet Protocol IEN mesh associated with it (which highly emulated the four levels of switching/routing and transmission like that used in the telephony based IEN.

With the emergence of ADSL on fixed access copper pair CAN that is primarily used for telephony, this makes for an awkward modelling structure (as shown below)

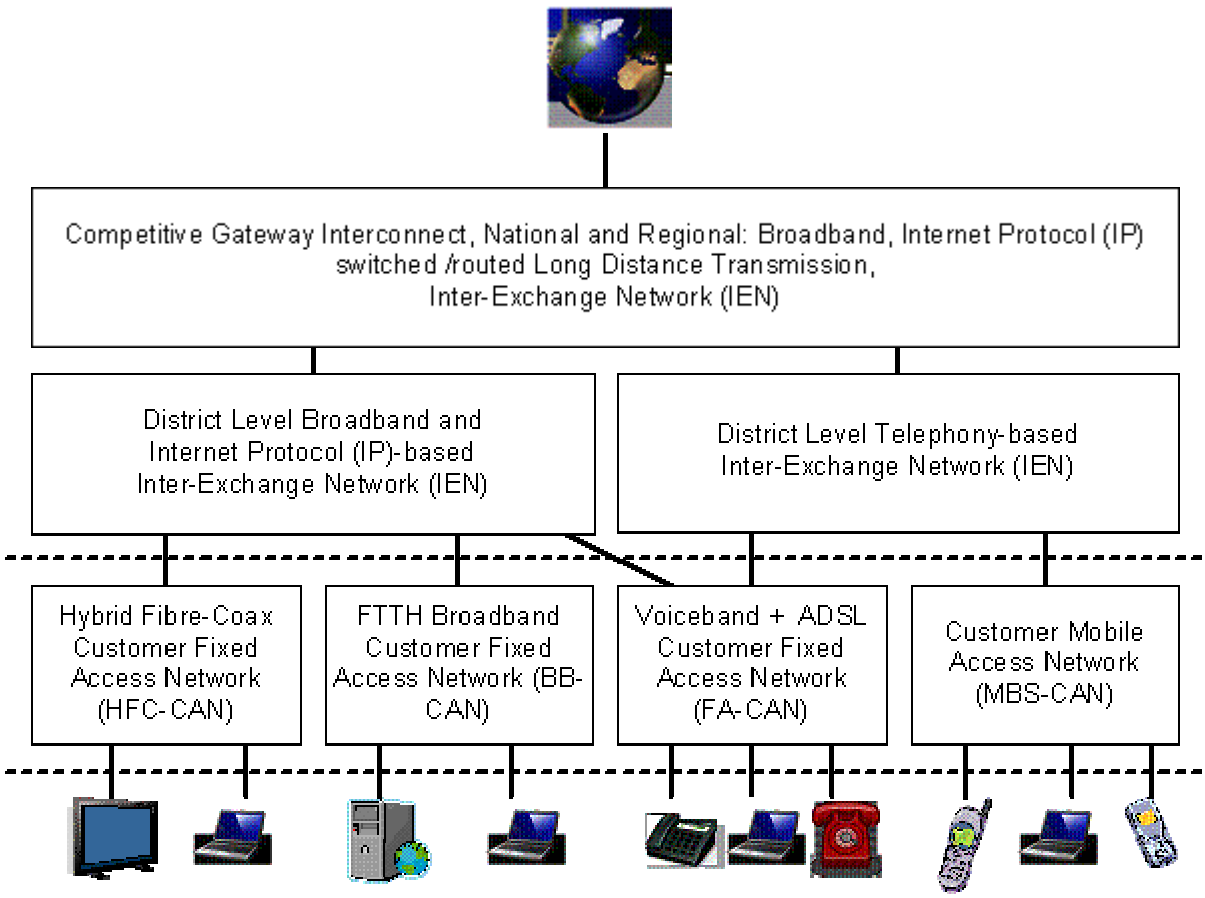
because some of the IPN Internet Protocol Network) is physically connected as Data Over Voice in the fixed access CAN.



This figure reflects the telecommunications structure at about 2000, with Broadband and IP IEN structures being shown here as geographic and network topology parallels to each other.

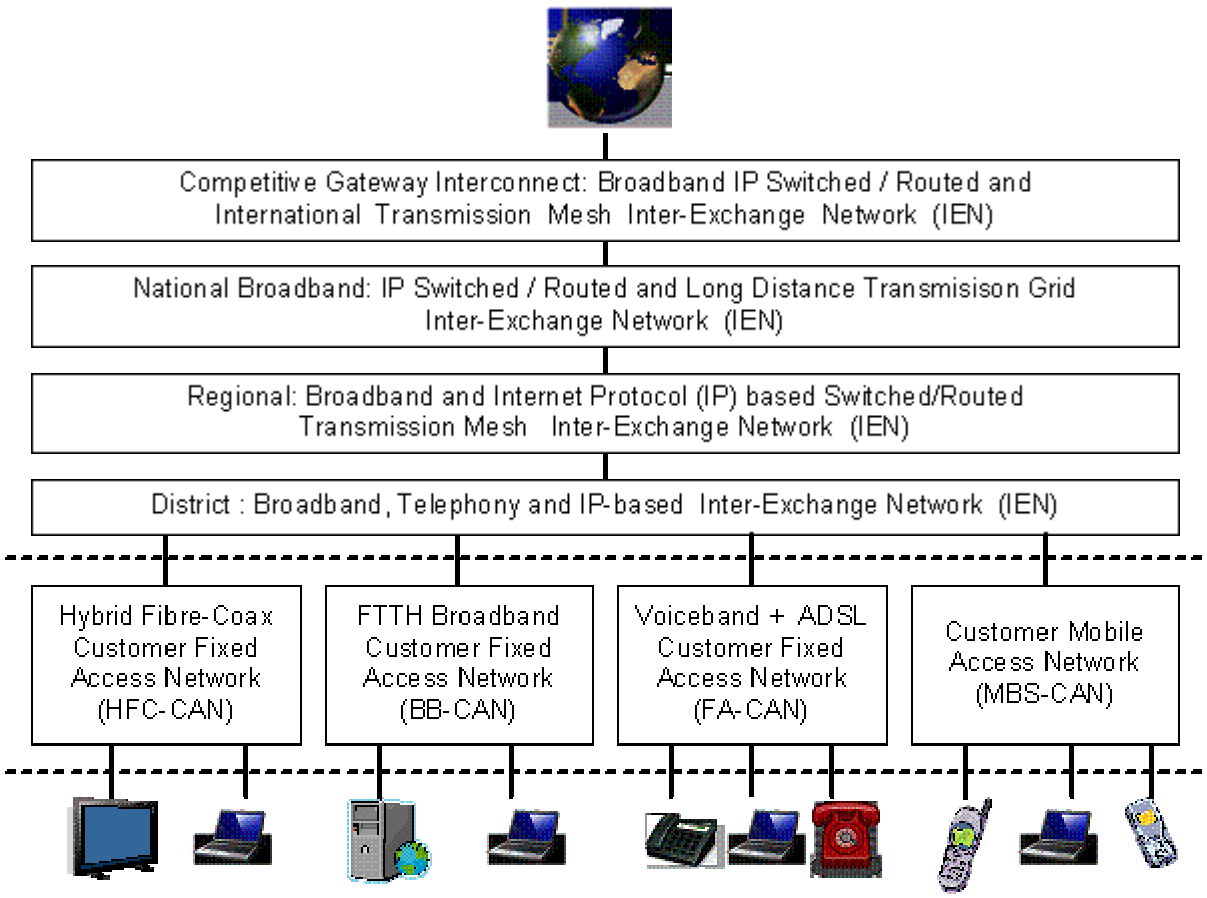
Compare this model with the earlier models and there are more products being provided at the customer level, and Internet is being made available through the fixed access copper pair CAN, and through the HFC CAN (which was exclusively used for Pay TV).

The Competitive Gateway Interconnect, National, Regional and District levels have been identified more clearly in this model with the District switching and transmission level now spanning across the telephony-based and Internet switched IEN.



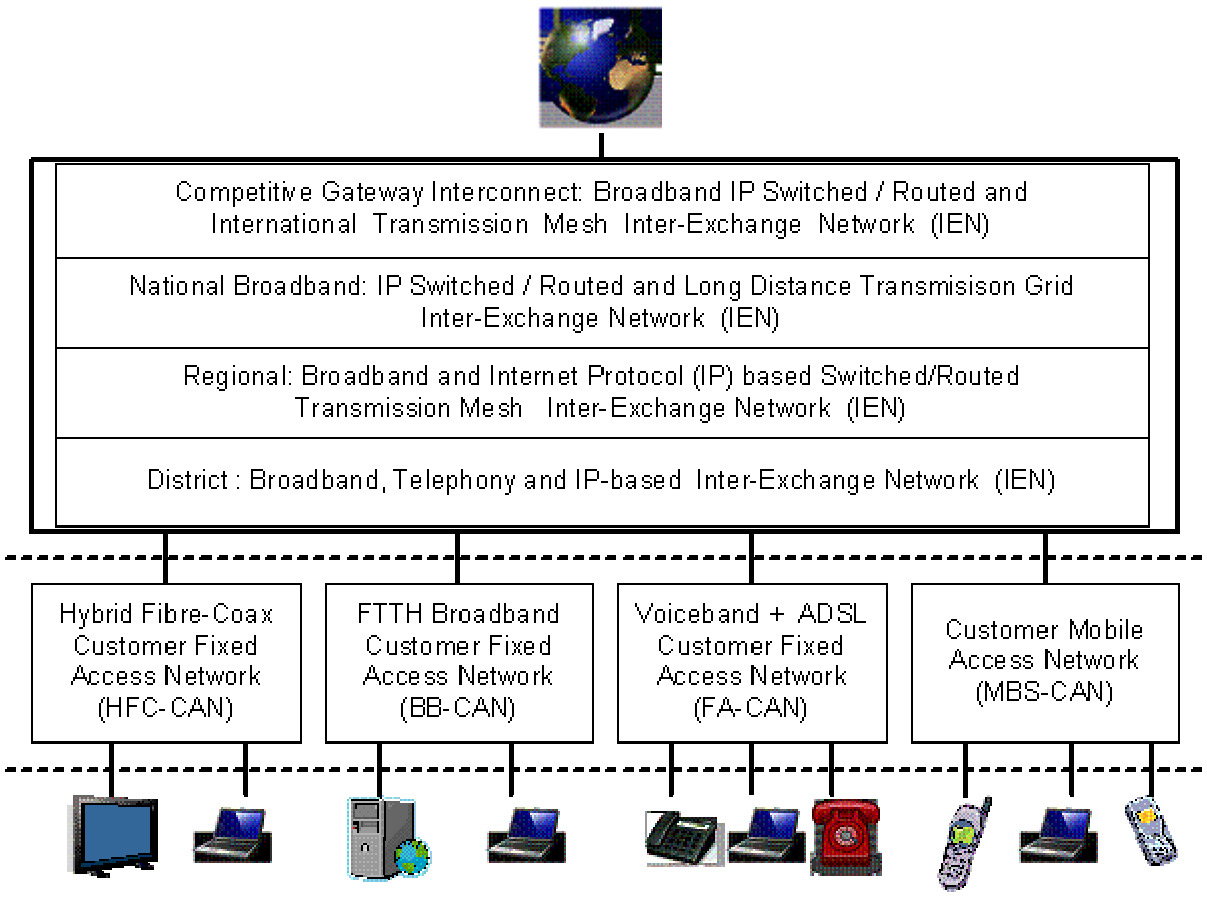
This above figure is showing that the whole IEN is now taking on a distance-dependent layered mesh structure with common switching and transmission technologies, which is in stark contrast to the CAN which has taken a vertical non-mesh non-switched transmission-based infrastructure where commercial products ride on this and are commercially competitive because they all utilise the associated IEN infrastructure to connect efficiently through high economies of scale.

This realisation introduced the notion that commercial products ride on the back of infrastructures, and that it is the products that are commercially competitive - not the infrastructures themselves; but most business analysts really struggle to realise that duplicate infrastructures are inherently extremely cost-expensive and commercially are disasters waiting to crash.



This figure shows five of the six telecommunication network layers (the customer premises network is not shown here), and this figure sets the scene for the IEN Connectivity Model.

As shown above the four IEN layers are effectively homogenous with a common Competitive Gateway Interconnect at the top and a range of Customer Access Network interfaces at the bottom.



So here we have it: The Inter-Exchange Network (IEN) which is an homogenous complex switched transmission network that has a variety of different technology interfacing Customer Access Networks (CAN) hanging off it that connects to the Customer Premises Network (CPN) that includes Customer Equipment.

Some of the networks that form the IEN includes the Internet Protocol Network (IPN), Digital Data Network (DDN), Common Channel Signalling (CCS7) Network.

There is also the Radio and Television Programme Network, (Digital Video/Broadcast Network), Network Management Network (Out Of Band Network, SDH Control Network), and several other networks that together combine to provide the Speech / Data/ Video/ IP/ switching, management and metering functions.

In IT terms, the high level switching is part of the IEN is the Core Network and the perimeter switches at the District/Local levels are termed the Edge Network.

Rest In Peace: PSTN

It should be very obvious that the Public Switched Telephone Network (PSTN) was a term that was used in an era that has long gone; when almost all long distance calls were operator connected or by direct route switching, and business analysts incorrectly assumed that the telecommunications network was homogenous.

People that those that still use the PSTN connectivity model in relation today's telecommunications industry are several decades out of date with reality, and are seriously lacking the basics about today's telecommunication network functionalities.

The concept of the PSTN connectivity model was replaced by about 1965 with two diametrically different network structures:

- ***The Customer Access Network (CAN), which is not switched, has many hundreds of small footprint very simple star structures.***
- ***The Inter-Exchange Network (IEN) which are very complex switched multi-level meshes, with very large footprints.***

These two networks structures connect in several different ways to form an IEN Connectivity Model that very closely aligns with the telecommunications infrastructure in Australia and provides very rational basis for modelling network based reporting and policies to support the Australian Telecommunications industry.

Comments and Corrections are welcome