

Defining the Network
Environment:
A Taxonomy of Networks

by Frederick Scott

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A Taxonomy of Networks**

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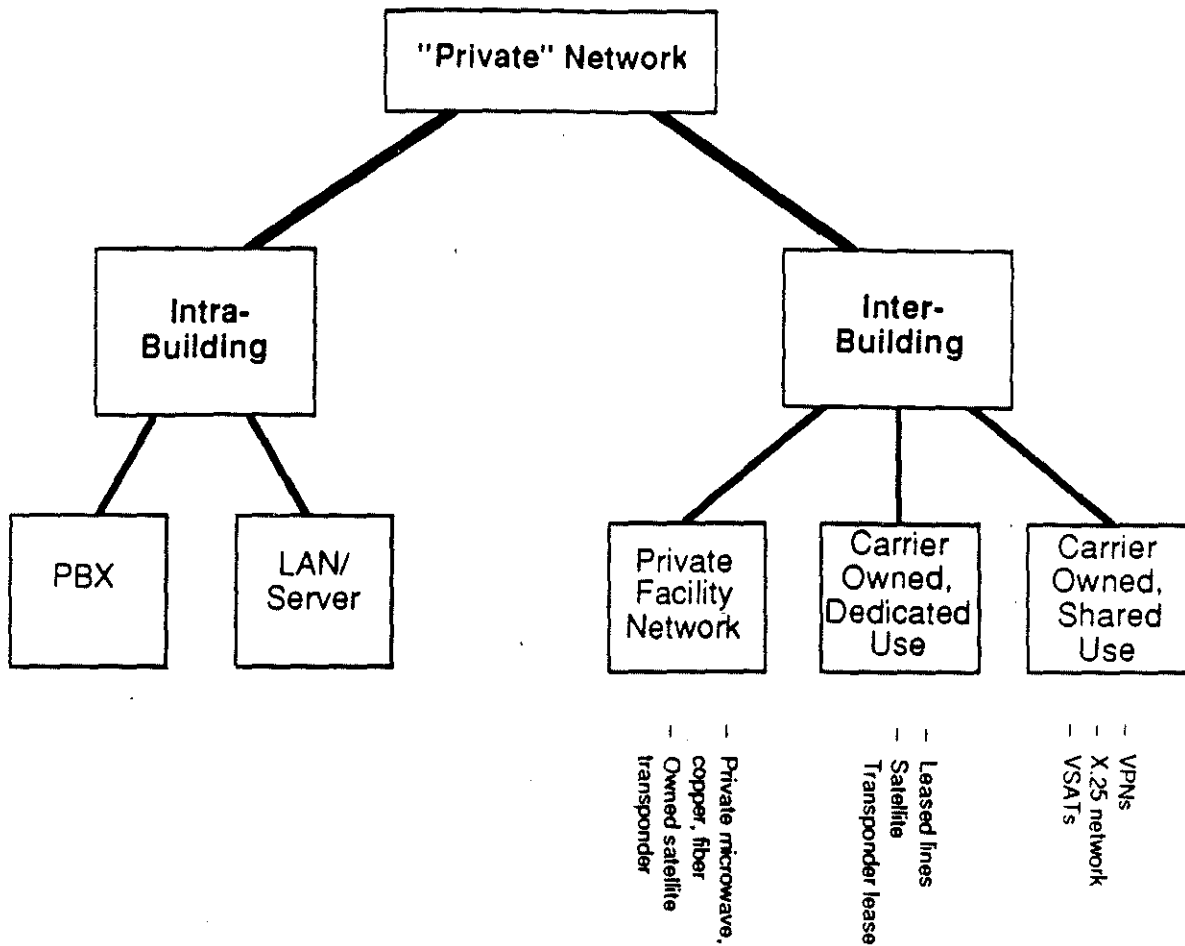
In the not too distant past, a telecommunications network manager of a large corporation could speak with pride of his company's "voice private network" and maybe even a "data private network" and everyone would probably know what he was talking about. The options for the network manager were limited, and his job was relatively uncomplicated

Today, the network manager's job is a tangled web of many different technologies, service offerings, architectures, and acronyms. A private network could be anything from privately owned fiber, microwave, or satellite facilities, to interconnected leased lines, to a virtual private network with customized dialing plan provided as part of the public switched phone network, or a combination of any or all of the above. The "voice" network is probably indistinguishable from the "data" network, with the two sharing the same facilities and both types of information being transmitted by an incredibly fast and highly accurate stream of 0s and 1s. Technology has advanced beyond the simple definitions implied by voice and data private networks. In order for the network manager of today to make those around him understand the characteristics of his network, a new set of definitions is required. Equally important, a common taxonomy of network elements is necessary to understand the shifting motivations which drive network manager decisions towards different telecommunications architectures and technologies.

Exhibit 1 below illustrates one possible beginning point for creating a new network taxonomy. It segments the concept of a "private" network initially into **Intra-building and Inter-building** classifications. This is useful to separate the most common types of "private" networks — those contained within a single building premises. **Because Private Branch Exchanges or Local Area Networks** are most commonly privately owned and operated, the PBX and LAN, along with their associated transmission lines, handsets and terminals could be thought of as a "private" network contained within a building. Separating out the intra-building networks allows us to concentrate on the more diverse category of inter-building networks.

EXHIBIT 1

PRIVATE NETWORK DEFINITIONS



Inter-building private networks are used to connect two or more intra-building networks to each other, and may take several different forms. A useful methodology to categorize these networks is to examine the ownership properties of the network facilities involved. By creating terms which describe whether the customer or a carrier is the owner of the facilities, we can create a framework for understanding the motivations of network managers as they formulate their network strategies.

As Exhibit 1 shows, the first category of Inter-building networks is the Private Facilities network, consisting of privately owned and operated telecommunications equipment. The Private Facilities network may utilize owned satellite, microwave,

fiber optic, or copper cable transmission facilities, and owned PBX or central office switching equipment. No traffic associated with other users is carried on these facilities, except to the extent that the company owner might "resell" some spare capacity to other subsidiaries or other companies.

The second category is the Carrier Owned, Dedicated Use network. This category of network ownership uses facilities owned by common carriers like AT&T, MCI, Comsat/Intelsat, or a Bell Operating Company, but dedicated for the usage of the single company customer. Typical examples are leased private lines, leases of satellite transponder capacity, or leases of multiplexing equipment.

The third and last category is the Carrier Owned, Shared Use network. This definition also employs facilities owned by common carriers, but these facilities are not dedicated to the customer. Rather, they are shared with other users of a public network, and the corporate customer's network traffic is mixed together and routed along with all other traffic. The private characteristics of the network are "virtual" and are created by software and network intelligence which offers customizable features, making the public network appear to the customer as a private network. While the Virtual Private Network (VPN) services offered by the large interexchange carriers are the most readily identifiable example, other Carrier Owned, Shared Use networks include X.25 packet switched networks, and VSAT satellite networks. Both X.25 and VSAT networks utilize common transmission and switching facilities which appear to the customer as a private network.

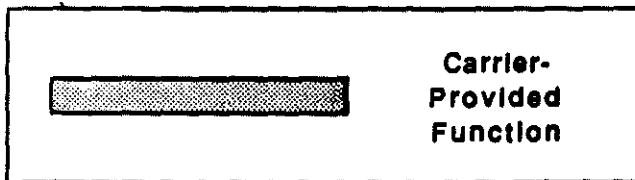
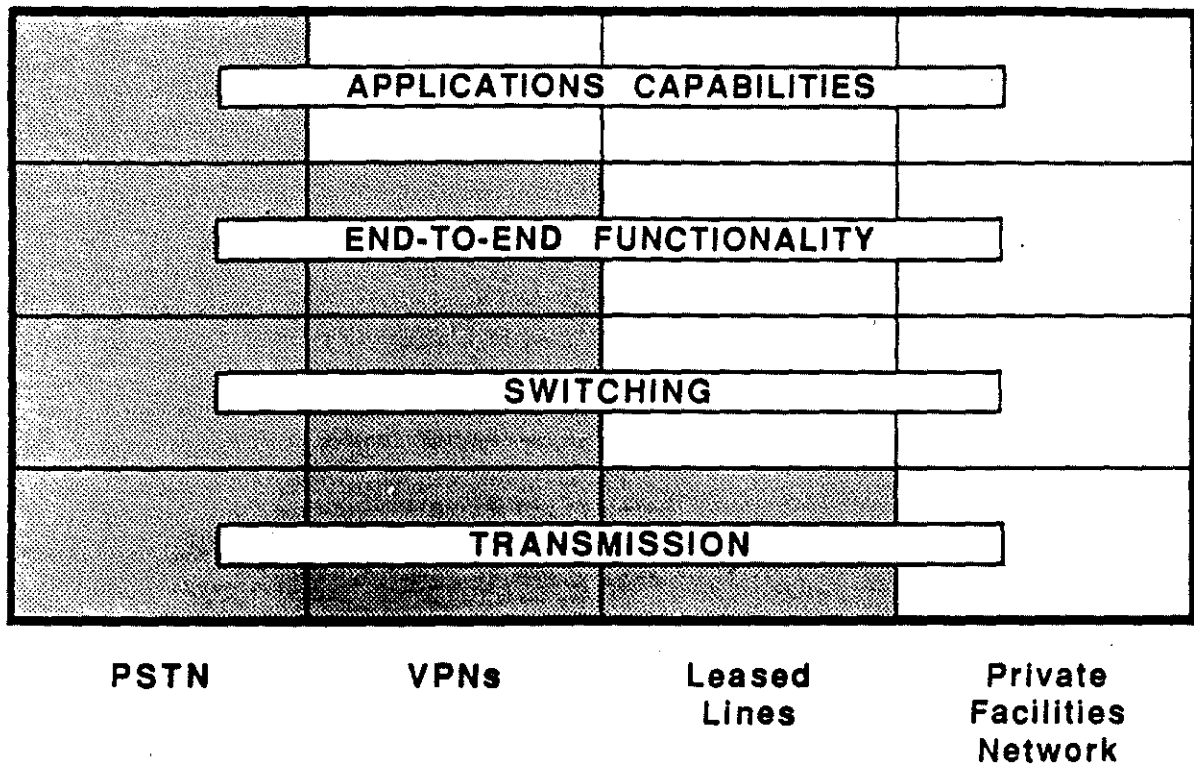
The classification of private networks by ownership characteristics is a useful starting point in defining network taxonomies, because the purchase/lease/share decision is one of the most challenging facing network managers. Over the past 20 years or so, the economies of network ownership versus common carrier dedicated service leases versus switched services have fluctuated with changing technologies. In the 1970s most traffic was carried on carrier owned, common use or leased facilities due to the relatively high cost of private facilities. In the 1980s, as private network costs dropped and technological advances led to ready availability of digital wideband high capacity transmission and digital switching, usage shifted towards private facilities to meet specific networking needs that could not be filled by the common carriers. Now, in the 1990s, the trends is returning to carrier owned common use technologies like VPNs or X.25 packet services as common carriers have deployed digital switching and transmission technologies, available at lower costs versus private facility equipment.

The purchase/lease/share decision can be thought to encompass four different layers or degrees of telecommunications functionality, beginning with basic Transmission, and increasing in complexity to Switching capabilities, End-to-

End Network Functionality (covering engineering, installation, testing, network fault identification and correction, etc.) and finally Applications Capabilities (covering numbering plans, routing decisions, network features, etc.). Network managers make purchase/lease/share decisions at each of these layers of functionality, and the various combinations of decisions create different types of telecommunications products. These combinations are illustrated by the figure in Exhibit 2, below.

EXHIBIT 2

PURCHASE/LEASE/SHARE CHARACTERISTICS OF TYPICAL TELECOMMUNICATIONS PRODUCT OFFERINGS



Whereas the Private Facilities network uses customer-owned and operated private equipment to provide all four layers of functionality, users of basic switched long distance or local services obtain all four layers from the major common carriers. Intermediate products, like VPNs, use carrier-provided functionality at all levels except applications, which are customizable and particular to each individual customer. A fourth example, leased line private networks, obtains only transmission from the common carrier, and uses their own private equipment for switching, end-to-end functionality, and applications.

Examining the ownership characteristics of networks in developing a network lexicon can therefore describe a large fraction of the private networking possibilities. Such a lexicon is also valuable as a framework to understand the changing purchase/lease/share decisions made at the various layers of functionality by network managers to assemble their networks. While additional standard terminology will no doubt be necessary to further define and categorize networks in greater detail, ownership offers a good starting point.