



LAN-Telephone System versus PSTN

Summary

A LAN-Telephone System as a packet-based technology has structural advantages over the alternative technology, circuit based or switched networks traditionally used in telephone systems. These advantages are lower cost and better service.

What are "circuit based or switched networks"?

Over a hundred years ago, the first telephone was connected to a public network with a copper cable. This cable only had to transfer voice that was spoken between the public network and the telephone.

According to the requested number, the operator connected the parties that wanted to communicate. Later, these jobs were rationalised by conveying the dialled number thru pulses on the line and having the public network automatically switching the lines. Using tone dialling again speeded up the process but it is essentially the same thing, i.e. the calling telephone is effectively directly connected to the called telephone. The next forty years that picture did not change too much. Instead of using dedicated lines between the post offices, engineers started to multiplex these expensive lines to use one cable for several connections. Digital standards like ISDN, T1 and E1 transferred the voice digitally, but the paradigm of transporting voice over a switched line, i.e. reserved or set-up path did not change.

What are "packet oriented networks"?

Meanwhile, the computer industry developed at an incredible speed. With increasing processing power, the need arose to input more data to the computer and to deliver the results to the user. Many I/O and storage devices were conceived. The communication systems in the beginning only connected peripheral devices like terminals but soon were also used to connect computers. In comparison to computers, the communication paths were very unreliable. Thus, the computers were programmed to put data into frames, i.e. packets with a checksum to ensure the data was transferred correctly. If an error was detected the packet was simply rejected and retransmitted. It was not important to do this with a stringent timing restriction (which voice has) but to ensure that the data arrived correctly.

After a while, there were many "standards" to choose from, since each computer vendor (who also sold the operating system, communication stacks, printers, terminals, applications, etc) thought it was best not to be interoperable with the competition. The first step to break this monopoly was done by a group of researches who wanted to connect different kind of computer networks. By defining a protocol that Inter (connected) Net (works) regardless of their physical attributes the Internet Protocol (IP) was born.

In contrast to a switched network, a packet based network such as the Internet or an Intranet splits a data stream up into several packets that are sent through the network. All of these packets have their own

destination address and in theory (and sometimes in practice) these packets travel different ways to their destination. That implies several benefits and problems:

- The underlying network resources are used only when data has to be transported. This allows a much more efficient usage of the resources.
- That in turn makes data compression economically feasible. The worst-case bandwidth can be allocated, but statistically only a fraction of that bandwidth is used. The rest of the allocated bandwidth can be used for other services like email and file transfer.
- The big problem with this technology is that it is hard to guarantee that a packet will be delivered reliably within a predefined, short period and in the correct sequence. The network elements (routers and switches) that determine which way a packet will travel have to decide this very fast for many packets. For this problem, special protocols have been introduced which negotiate the routes before data is actually transmitted.
- The voice can be sent simultaneously with other services. This makes cost sharing with other applications possible.

The required network technology has become available in the last few years.

Total Cost of Ownership

Operators are interested in the "bottom line" of the cost for their infrastructure for a given period of time. These costs can be divided into

- Investment (network infrastructure, software and cables),
- Maintenance (cost for running service teams including training),
- Operation (connection fees).

Investment costs for computer network technologies are much lower than the respective telecommunications technology. Analysis found a factor of 10 and more. In many cases, there is no need for any extra investment in the computer communication infrastructure because it is there or will be anyway.

The same applies for the maintenance costs in a computer network. The service team for the computer network also maintains the telecommunication network. Computer network management tools have become sophisticated enough to enforce service level agreements.

In sum, the total cost of ownership for a LAN-Telephone System is significantly lower than a comparable switched network, especially when the network is used for other services than voice.

Media integration

Media integration is free when the network that is used is an Intranet. There is no communication barrier for a telephone device to talk to a web server or to a database. That makes it simple (and cheap) to integrate services.