

TELECOMMUNICATION TRANSMISSION AND SWITCHING SYSTEMS



Telecommunication Network



- A telecommunications network consists of
 - Transmission systems
 - Switching systems
 - Stations

Transmission Systems



- Transmission (abbreviation: *Tx*):
 - ▣ is the process of sending and propagating an analogue or digital information signal over a physical point-to-point or point-to-multipoint transmission medium, either wired, optical fiber or wireless.

- Transmission System:
 - ▣ is a system that transmits a signal from one place to another. The signal can be an electrical, optical or radio signal.
 - ▣ carries messages from an originating station to one or more distant stations.
 - ▣ is engineered and installed in sufficient quantity to provide a quality of service compatible with the cost and expected benefits.

Transmission Systems



- The source may be a simple telephone microphone, keyboard
- The destination may be a simple telephone speaker, monitor



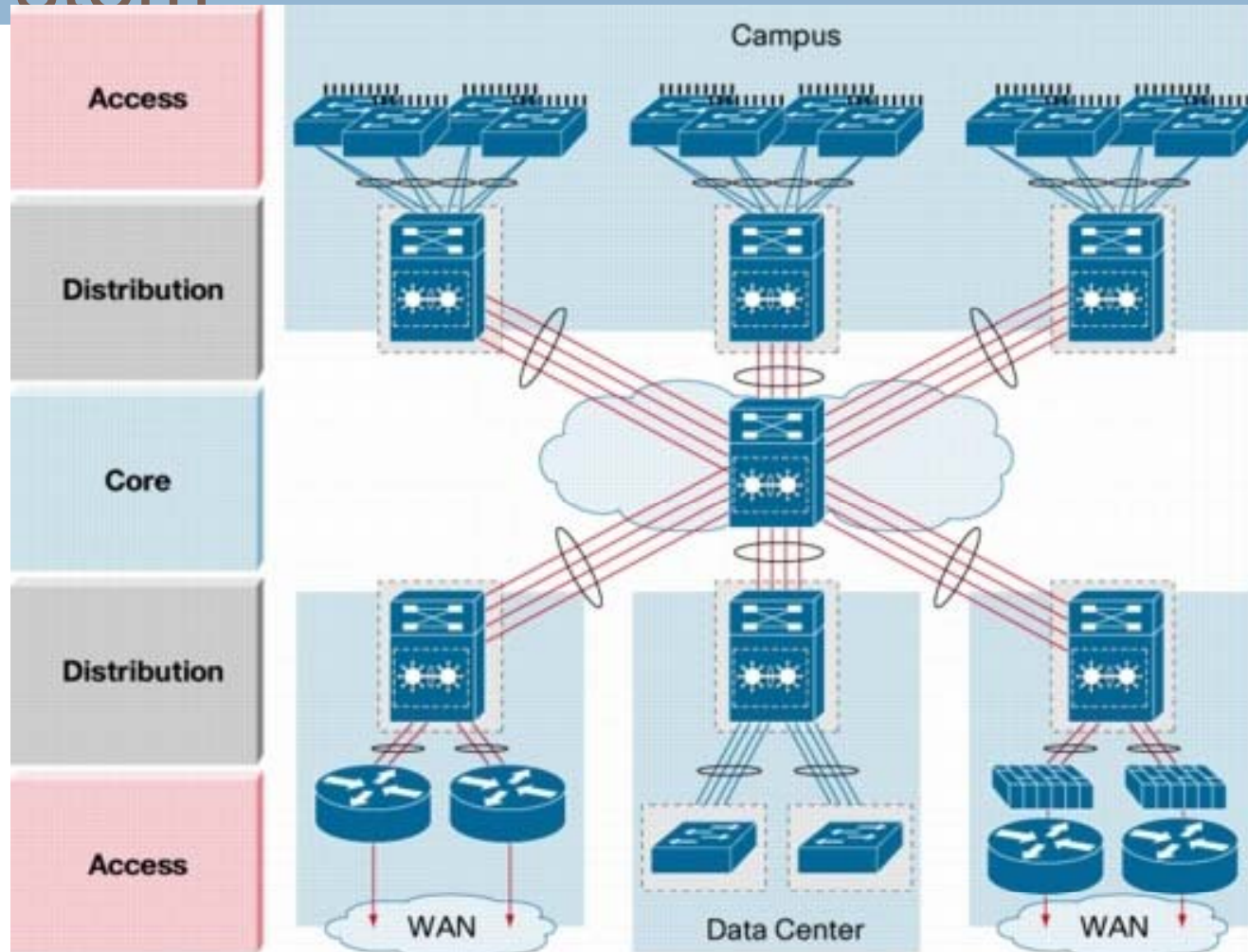
- It can be a single electrical medium, or a cascade of electrical media

Switching systems



- Switching systems are an assembly of switching and control devices provided so that any station in a communications system may be connected as desired with any other station.
- To enable the transmission facilities to be shared, stations are connected to and reached through switching system nodes that are part of most telecommunications networks.
- Switching Systems act under built-in control to direct messages toward their ultimate destination or address.

High Availability Network Design Simplified Using Virtual Switching System



http://www.cisco.com/en/US/prod/collateral/switches/ps5718/ps9336/images/prod_qas0900aecd806ed74b-2.jpg



Review of Telecommunications

Development of Telecommunications

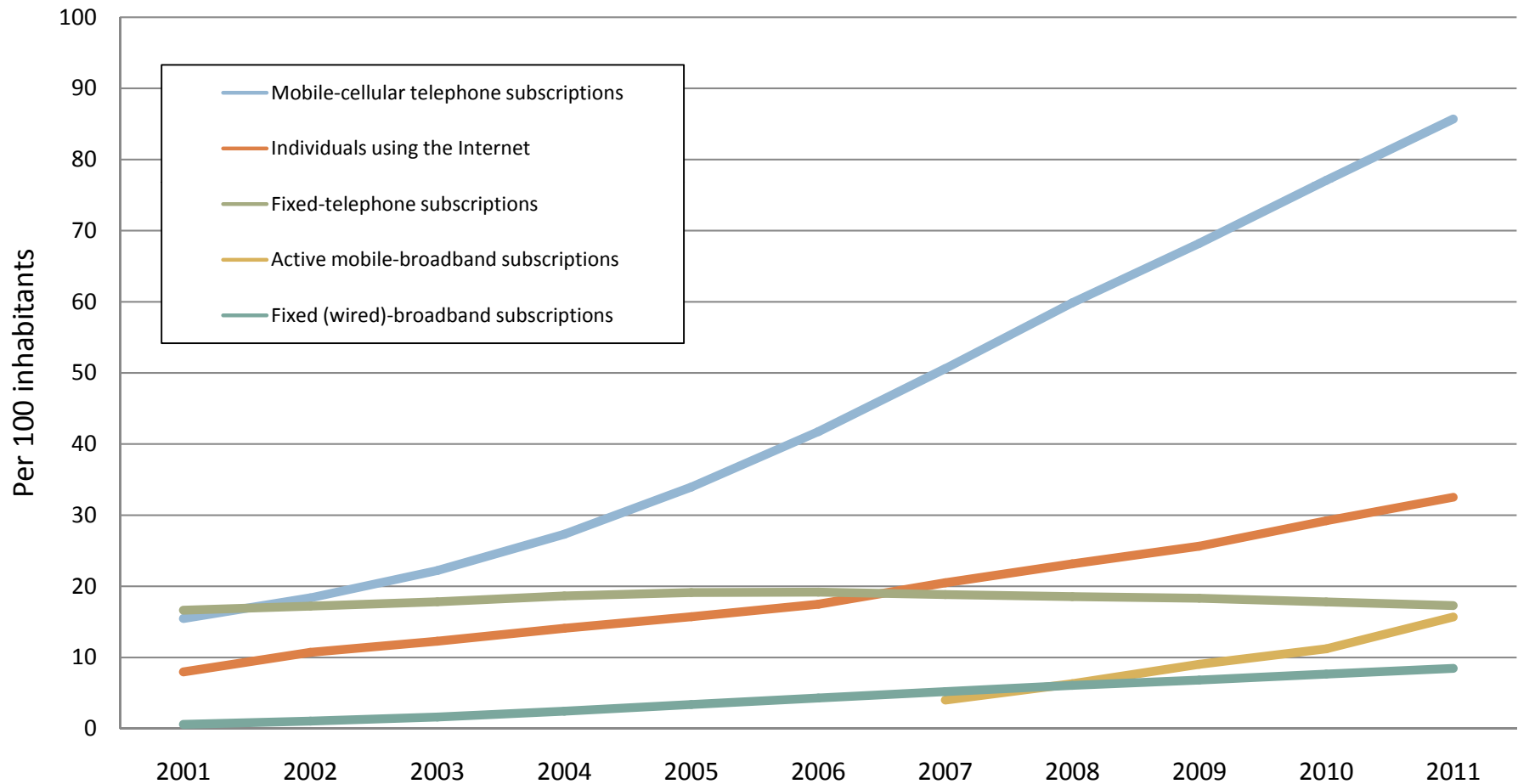
- 1837: Beginning of electrical communication, invention of Telegraph by Wheatstone and Morse
- 1876: Invention of Telephone by Alexander Graham Bell
- 1878: Opening of the first Telephone Exchange, at New Haven, Connecticut.

Global Telephony Trends

- 2008: 1.27 billion fixed line subscribers according to ITU
- At the end of 2011:
 - ▣ Total mobile-cellular subscriptions reached almost 6 billion corresponding to a global penetration of 86%.
 - ▣ more than 1 billion mobile-broadband subscriptions worldwide.
 - ▣ 590 million fixed (wired)-broadband subscriptions worldwide.
 - ▣ 2.3 billion people were online.

Global ICT developments 2001-2011

Global ICT developments, 2001-2011



Source: ITU World Telecommunication /ICT Indicators database

Business of Telecommunication

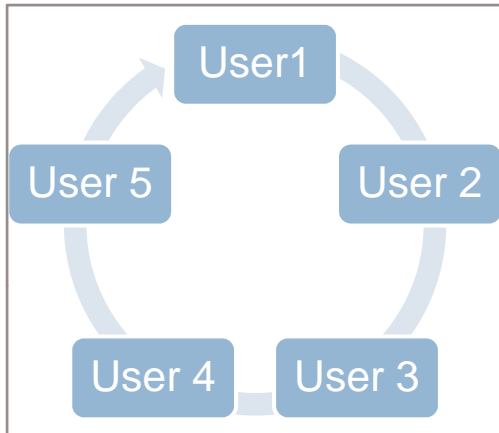
- Involves various participants. These include:
 - ▣ The public telecommunication Operators (PTO)
 - ▣ Providers of Services that involve telecommunications
 - ▣ Manufacturers of equipment and components
 - Both hardware and software
 - ▣ Financial investors
 - ▣ Governments
 - ▣ The users
 - who must pay charges to cover the cost of providing the network so they are referred to as *Subscribers or Customers*

Telephony in action

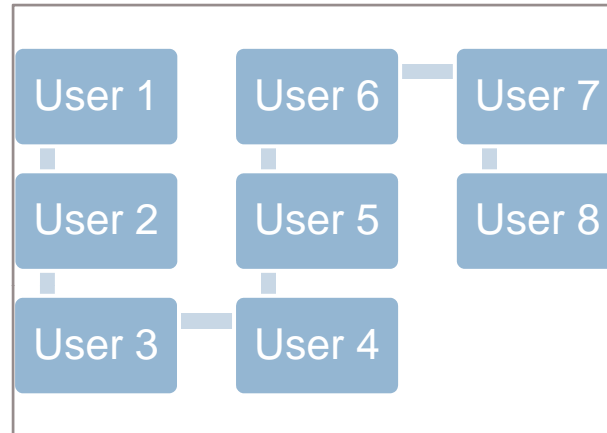


- Two-way communication is required, on demand, between any pair of stations
- It must be possible for many conversations to take place at the same time
- How?

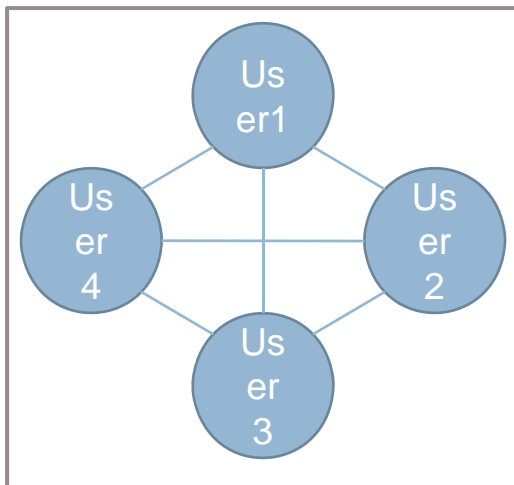
Network Structures



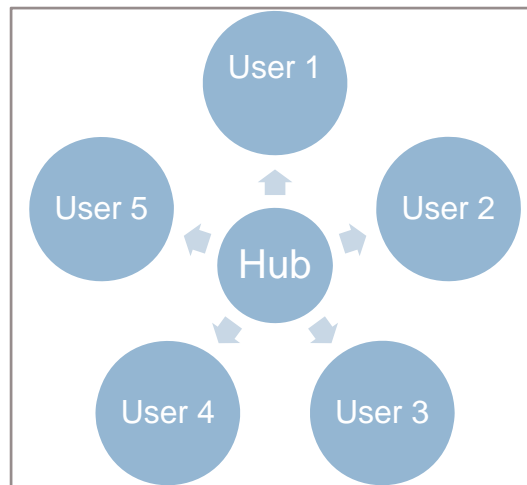
Ring Network $N=1$



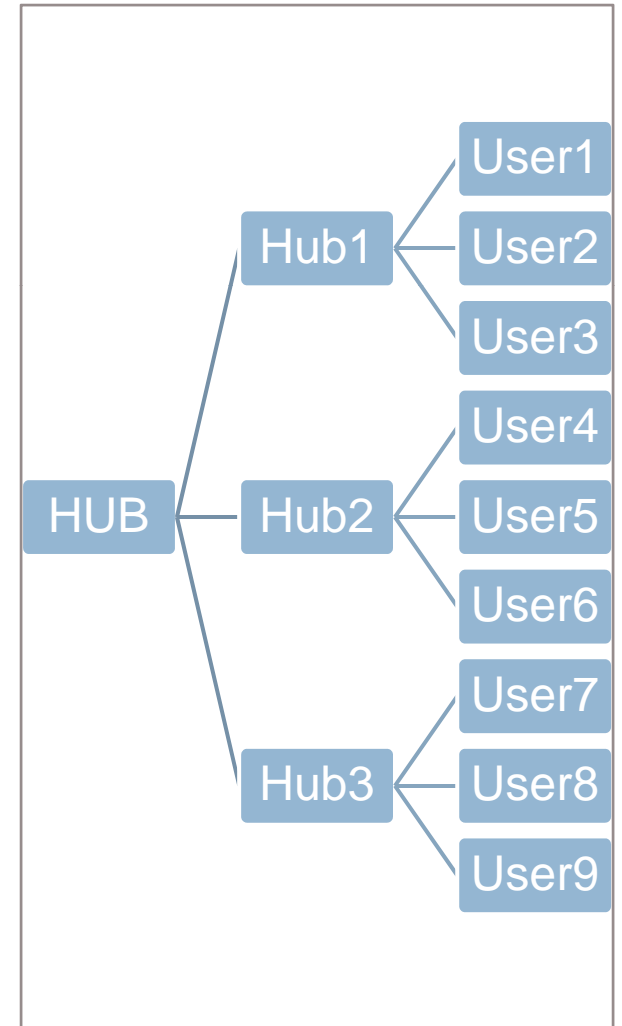
Bus Network $N=1$



Mesh Network $N=1/2n(n-1)$



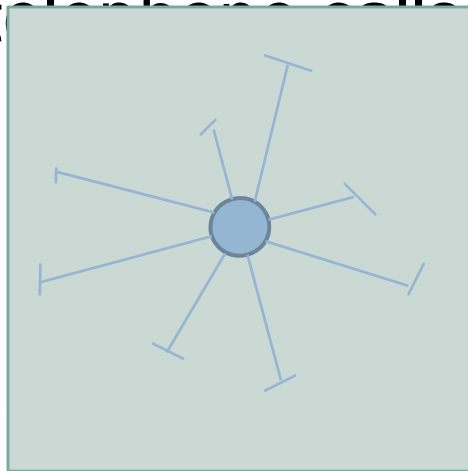
Star Network $N=n$



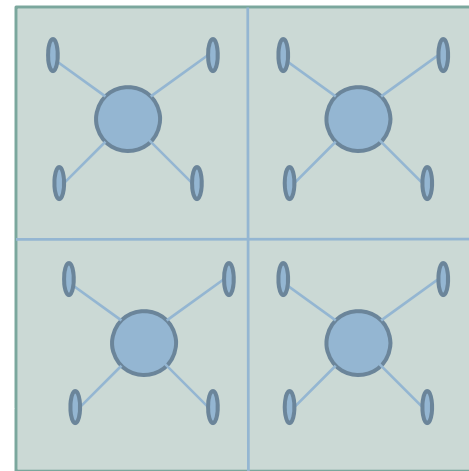
Tree Network

Exchange

- Solution can be provided by connecting a line from each user's station to the central switching center/telephone exchange
- a telephone exchange or telephone switch is a system of electronic components that connects telephone calls

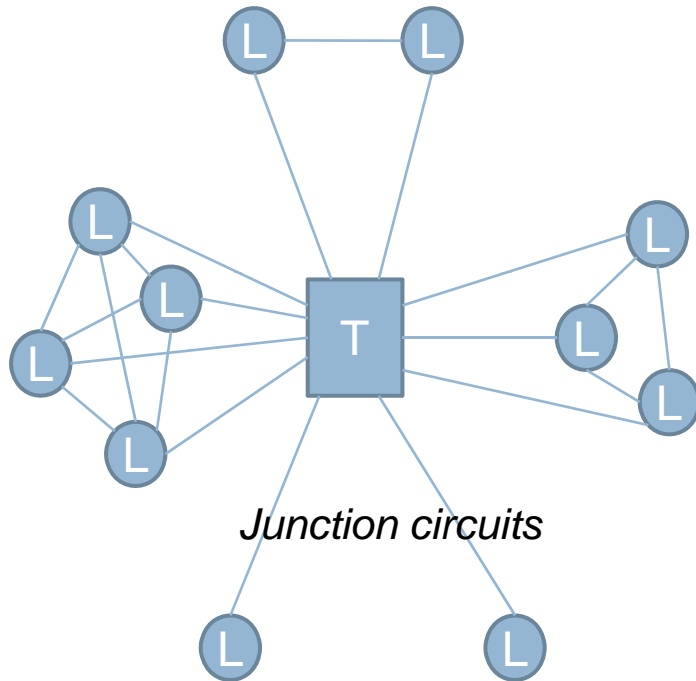


Area with a single
exchange



Area with several
exchanges

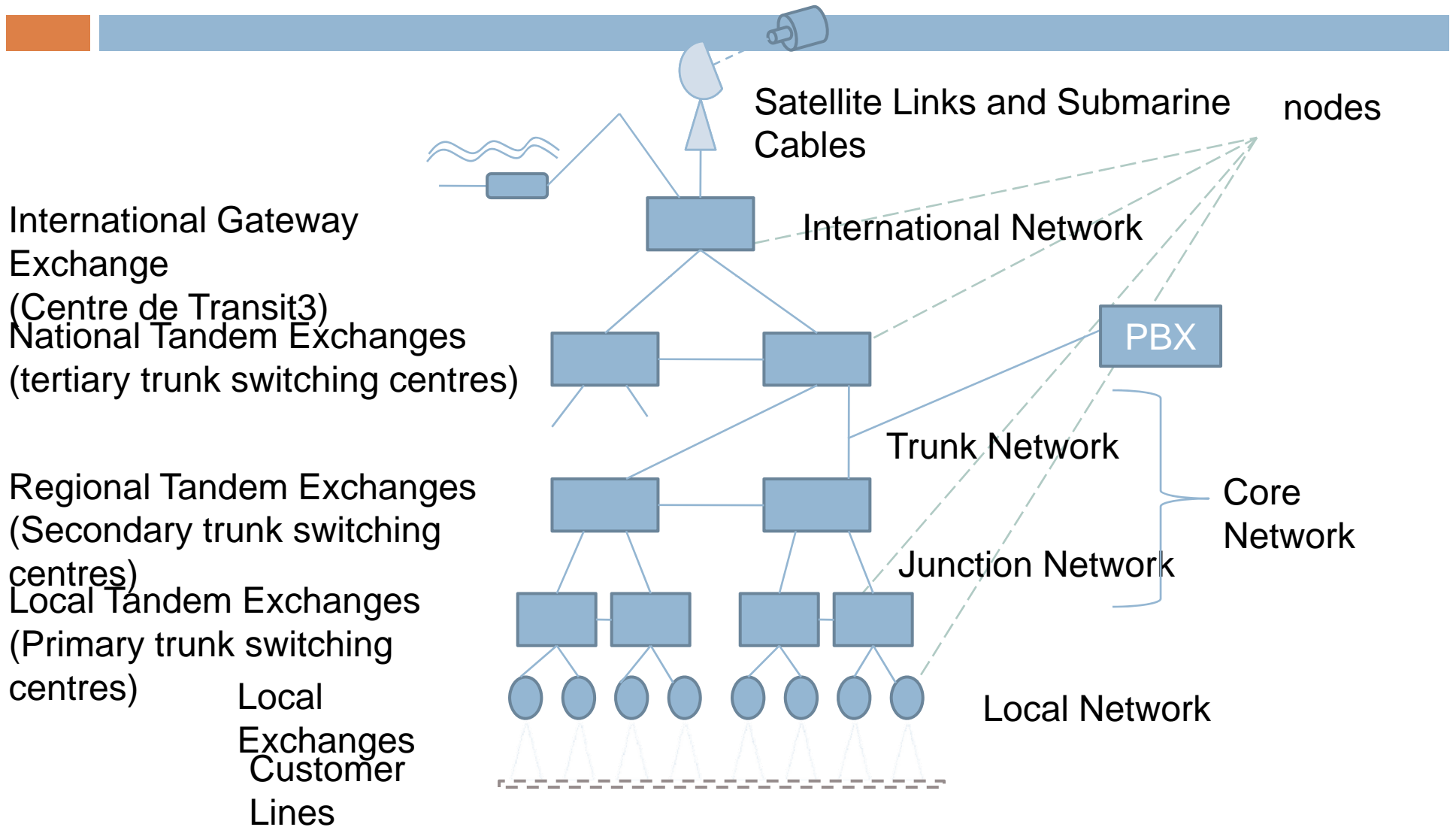
Telecommunication networks hierarchy



Junction Network
Multi exchange area.
L= Local Exchange
T=Tandem Exchange

- A National Public Switched Telecommunication Network (PSTN) consists of:
 - Local network
 - connects customers' station to their local exchanges.
 - These are also called subscribers' distribution networks, customer access networks or the customer loop.
 - Junction networks
 - interconnects a group of local exchanges serving as area and a tandem or trunk exchange.
 - The trunk network or toll network
 - which provides long-distance circuits between local areas throughout the country.

National Telecommunication Network



Elements of a Telecommunication Network



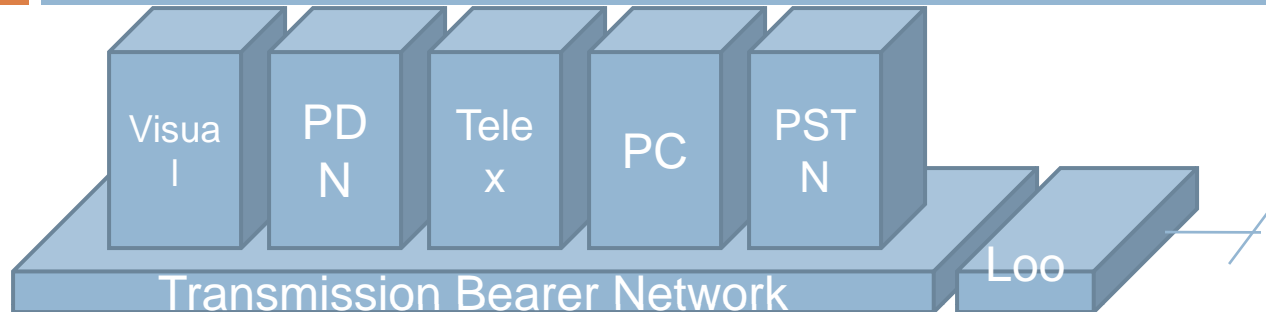
- Transmission System
- Switching System
- Signaling system
 - ▣ Responsible for interchange of information
- Which are made up by interconnecting
 - ▣ Customer nodes
 - ▣ Switching nodes
 - ▣ Transmission nodes
 - ▣ Service nodes

Network Services



- Customers of a PTO may require different services which appear to require different networks. Examples include:
 - ▣ Public Switched Telephone Network (PSTN)
 - ▣ The Public Switched Telegraph Network (Telex)
 - ▣ Private Networks for voice and data
 - ▣ Radio networks providing mobile communication
 - ▣ Public data networks (PDN)
 - ▣ Special Service Networks

Network Services Continued..



- Customers are connected to transmission bearer network at their local exchange via the local access network or local loop.
- The services provided over the telecommunication network can thus be divided into two categories:
 1. Teleservices
 - ▣ Provision of the service depends on particular terminal apparatus (e.g. telephone or tele-printer).
 2. Bearer Services
 - ▣ Present the customer with transmission capacity that can be used for any desired function (e.g. private circuits)

Terminology

North American	British
Customer's Loop	Local network
	Access Network
Central office	Exchange
End Office	Local Exchange
Class 5 Office	
Inter-office Trunk	Junction
Junctor	Trunk
Toll Office	Trunk Exchange
Toll network	Trunk Network