



Let's begin with another module called 'PSTN Switching'...

Objectives



- At the end of this session, you will be able to:
 - Understand the need of switching and definition of switching
 - Understand the notion of circuit switching and the role of switch in PSTN network
 - Draw classification of switching and historical evolution in telecom switching
 - Understand block schematic of a typical digital exchange
 - Understand notion of time and space switching
 - Understand steps followed in end-to-end telephone call
 - Understand types of PSTN nodes and their interconnectivity

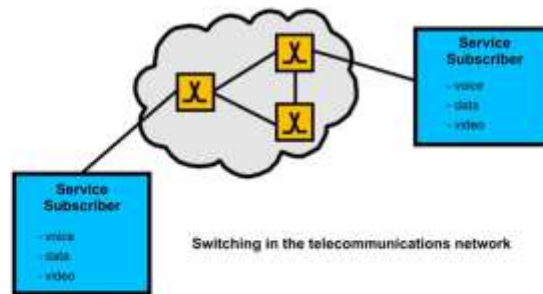
Agenda



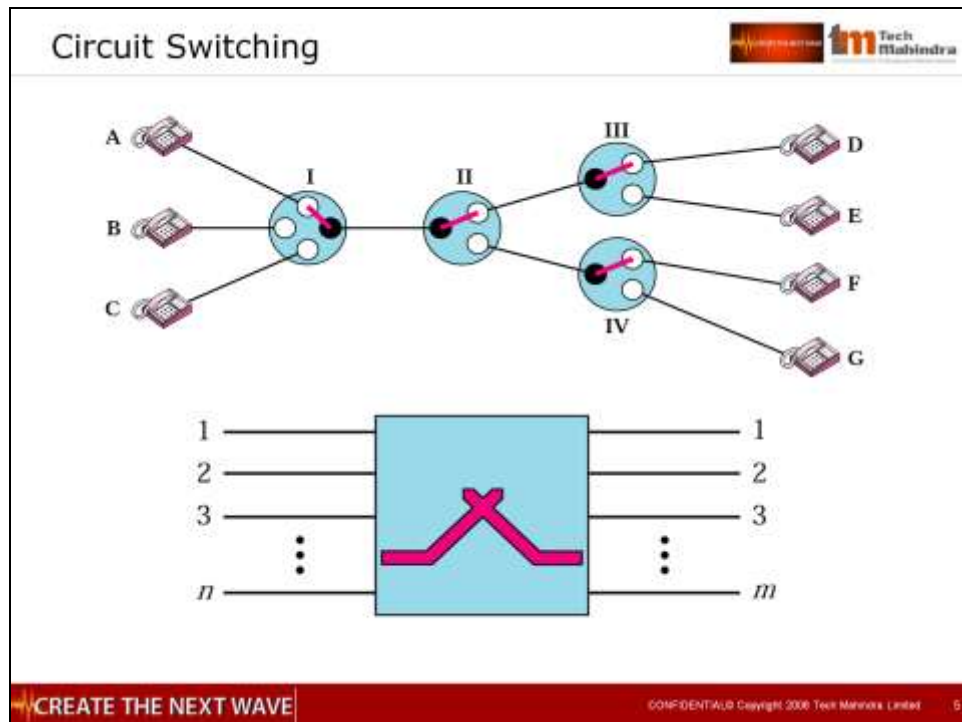
- Switching and Switch
- Classification of telecom switches
- Digital exchange
- Telephony: A typical end-to-end call flow
- PSTN nodes and interconnectivity

ITU-T Definition of Switching

- The ITU-T defines switching as:
"The establishing, on demand, of an individual connection from a desired inlet to a desired outlet within a set of inlets and outlets for as long as is required for the transfer of information".



Here is a classical ITU-T definition of switching...



PSTN uses circuit switching whereas computer network uses packet switching. Let's understand, What is meant by circuit switching.

Circuit switching creates a direct physical connection between two devices. By moving the lever of the switches, any telephone on the left side can be connected to any telephone on the right side. To be very specific and perfect, circuit switching reserves resources between end-to-end entities. Resource in PSTN context is a time slot.

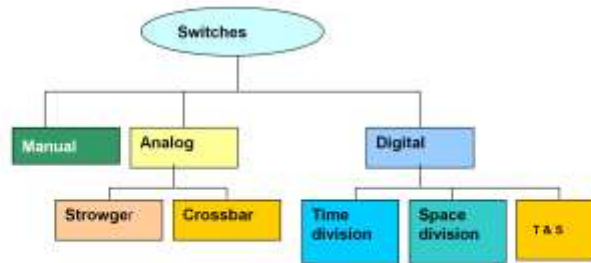
Circuit switch is a device with n inputs and m outputs that creates a temporary connection between input link and output link. The number of inputs does not have to match with number of outputs.

Circuit switching today either uses either of two technologies: Space division switches OR time division switches.

Switching



- Switch
 - Device that sets up a communication path on demand and tears it down when it is no longer needed
- Switching
 - Routing information between different parties



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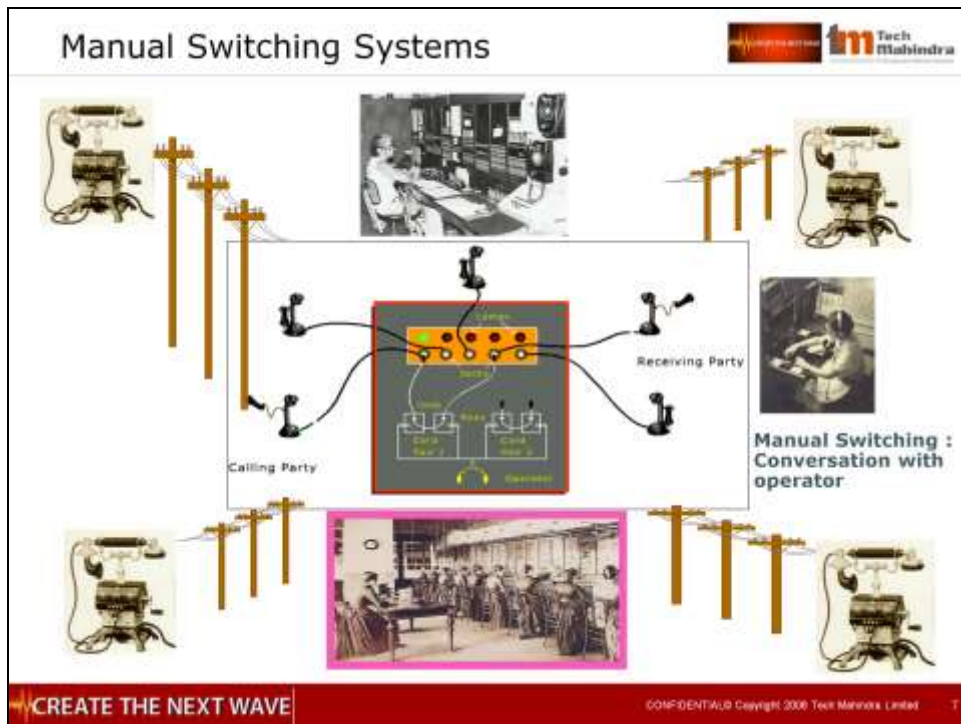
Switch ...Device that sets up a communication path on demand and tears it down when it is no longer needed

The switching systems can be classified into three categories;

Manual - where all operation was manual

Analog - where operation was automatic but information transfer was analog

Digital switches where operation was automatic and information transfer was digital.

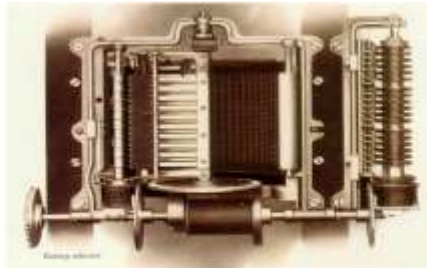
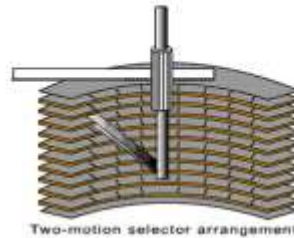
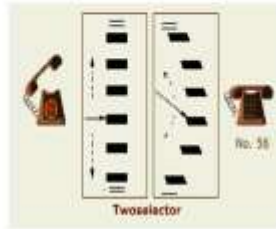


Exchanges have undergone revolutionary change starting from Manual till today's automatic electronic exchange/switch.

Beginning of this revolution started with Manual exchange wherein all operations carried out manually by human operators sitting in front of switch board especially dominated by women as seen in the figure.

But as the subscriber densities increased the need for automatic exchange was felt and strowger was the one who invented first ever automatic exchange which replaced human operators.

Strowger Switching System



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The construction of strowger exchange involved two-motion selector as shown in the figure.

Selectors used are constructed using electromechanical rotary switches.

Exchange transmitted sound in the form of analog signals.

Since Strowger eliminated the operator, the calling customer must provide the pulses to drive the selector. **The number of pulses in a train is equal to the digit value it represents except in the case of zero, which is represented by 10 pulses.**

Operation :

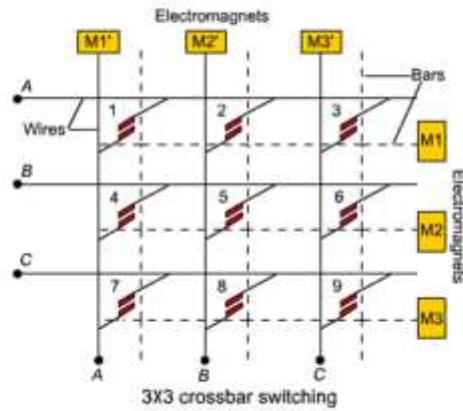
When the digit 5 is dialed, five pulses are generated by the subscriber's handset and transmitted to the strowger switch.

The switch then steps to level 5. and then subscriber dialed 6 wherein switch steps horizontally for the second digit dialled which in this case is 6 and connection is established.

Crossbar Switching



Crossbar Switches by G. A. Betulander - designed using Common Control Concept

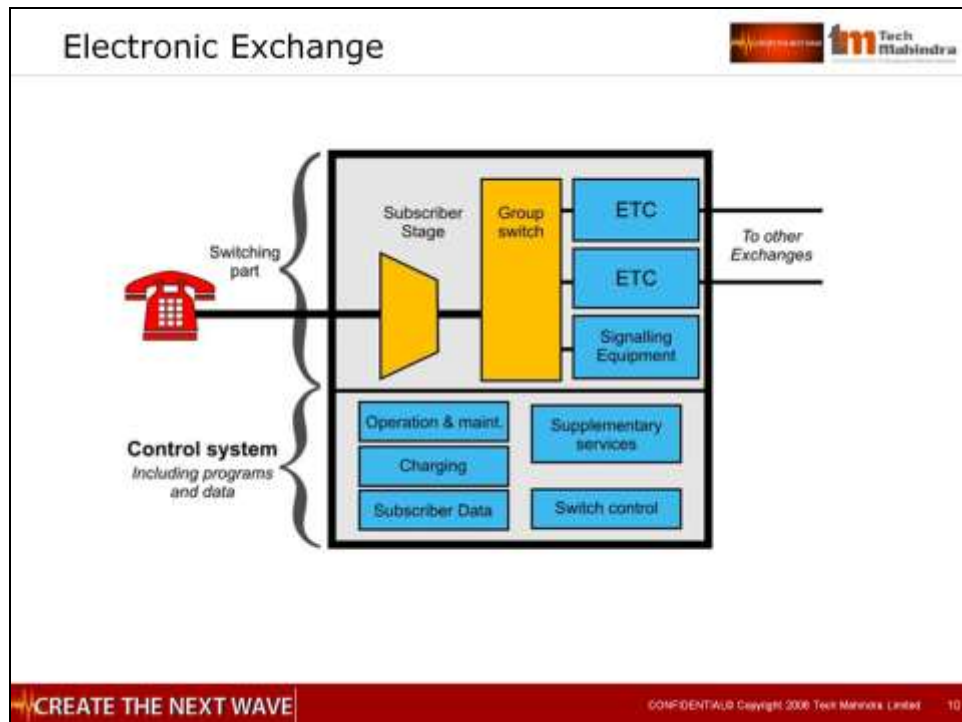


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Disadvantages

- Expensive relays
- Noise due to chattering of delays
- Limited capacity due to grid

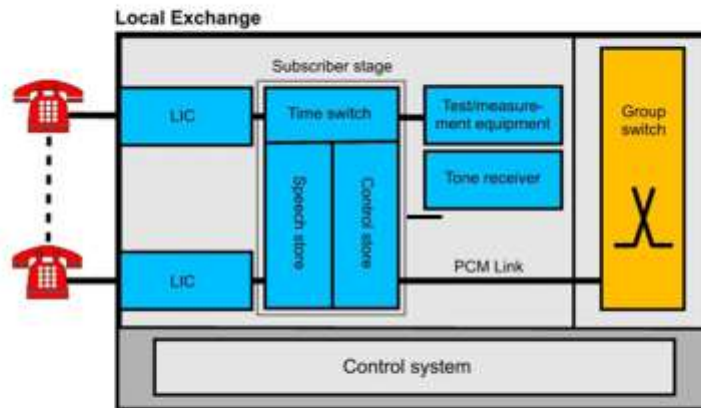


Electronic Exchange or Digital switches are the one where operation are automatic and information transfer was digital.

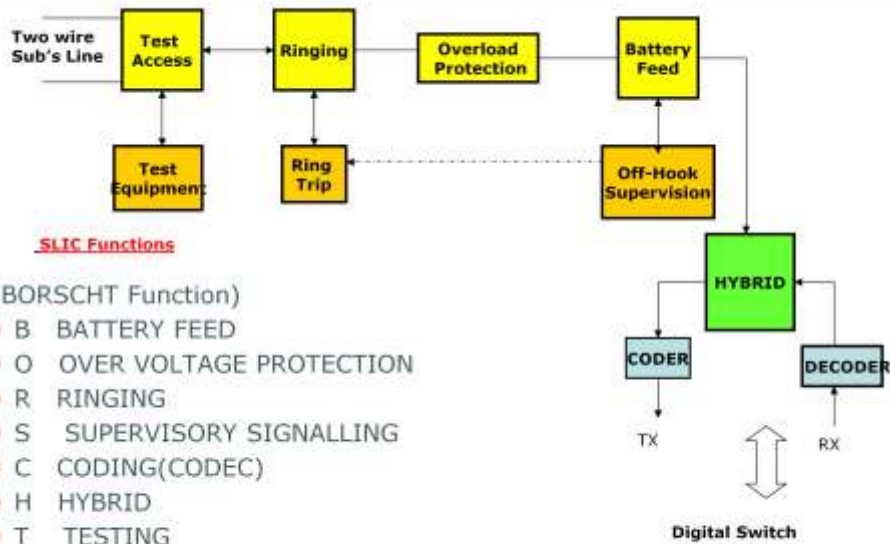
Conversion of analog to digital and vice-versa happens here. Information traversal between such exchanges in digital in nature.

Typical advantages of these type of changes are :1) Faster call setup and tear down, 2) Optimum utilization of resources , 3) better quality and error control

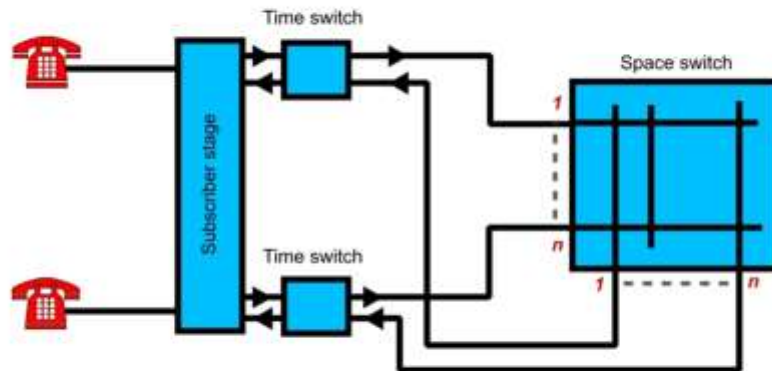
The Subscriber Stage



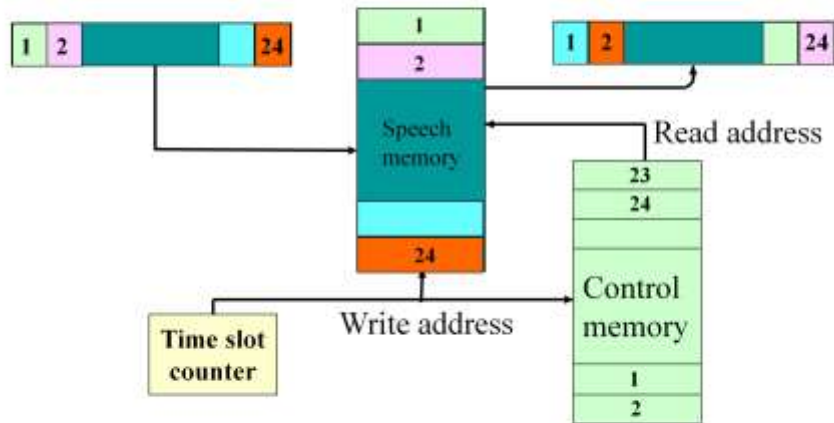
Block Diagram of SLIC for a Digital Exchange



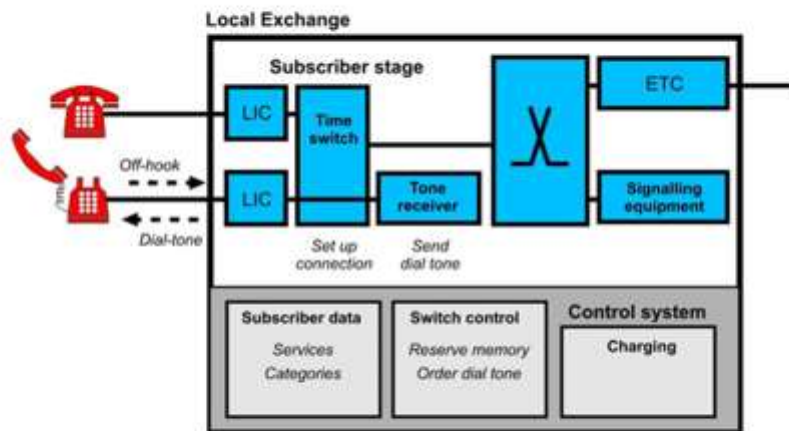
Time and Space Switch



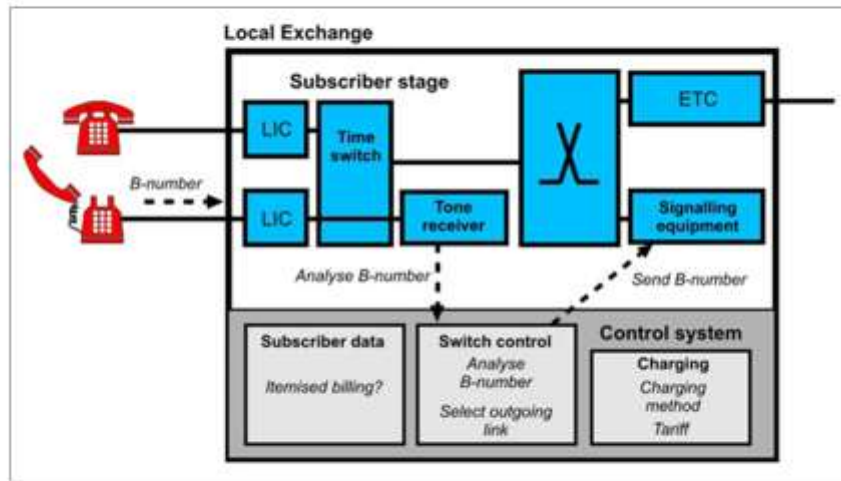
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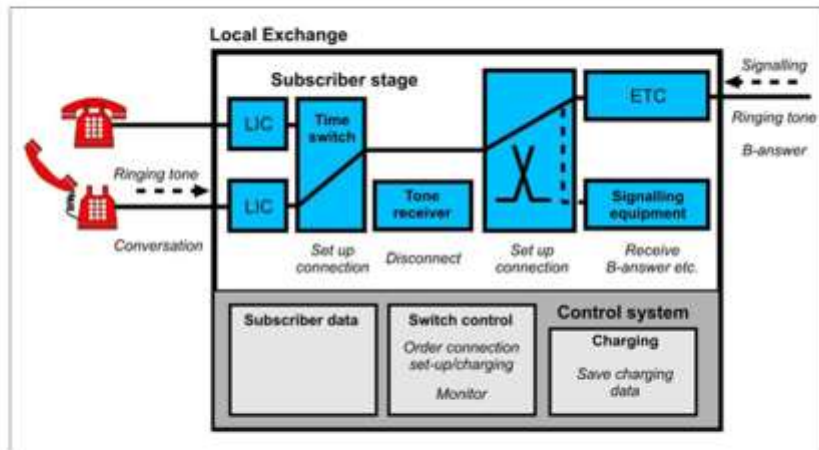
Phase 1: The A-subscriber lifts the handset



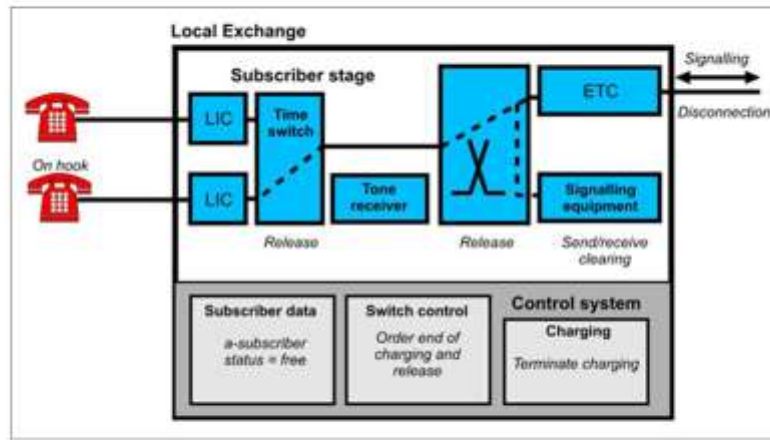
Phase 2: The exchange receives the B-subscriber number



Phase 3: The exchange sets up the outgoing calls



Phase 4: The subscribers conclude their conversation



PSTN Nodes



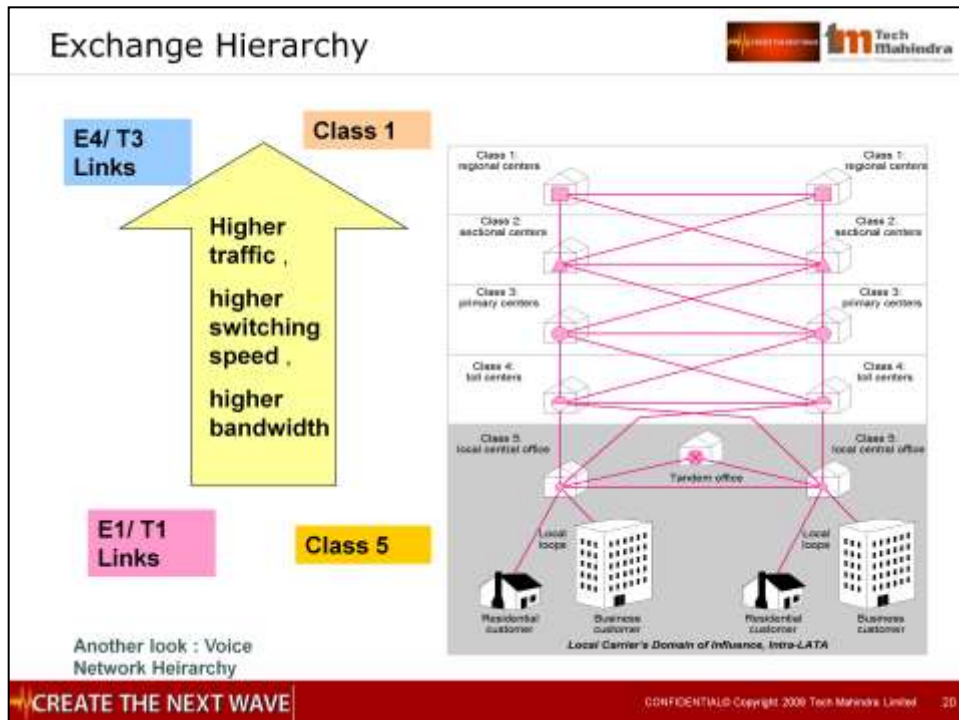
- PSTN nodes can be subdivided into three main categories:
 - Local exchanges
 - Transit exchanges
 - International exchanges

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PSTN nodes

PSTN nodes can be subdivided into three main categories: local exchanges, transit exchanges and international exchanges. Local exchanges are used for the connection of subscribers. Transit exchanges switch traffic within and between different geographical areas. International exchanges, and other gateway-type exchanges, switch traffic to telecommunications networks that belong to other operators.

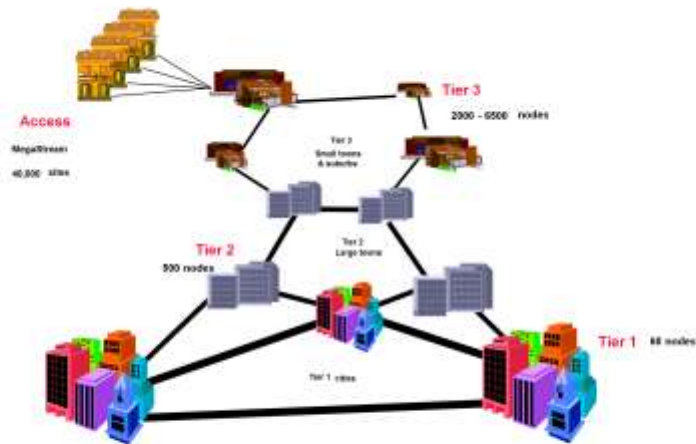


This is another classification of exchange hierarchy. The same names are changed.

Basic Principle remains same.

Higher is the level, higher is the load so is switching speed so is bandwidth requirement.

PSTN Network Architecture



Summary



- In this session, we have learned:
 - Need of switching and definition of switching
 - Notion of circuit switching and the role of switch in PSTN network
 - Classification of switching
 - Historical evolution in telecom switching
 - Block schematic of a typical electronic exchange
 - Time and space switching concept
 - End-to-end telephone call: Step by step
 - Types of PSTN nodes and their interconnectivity to form PSTN network architecture



Thank You