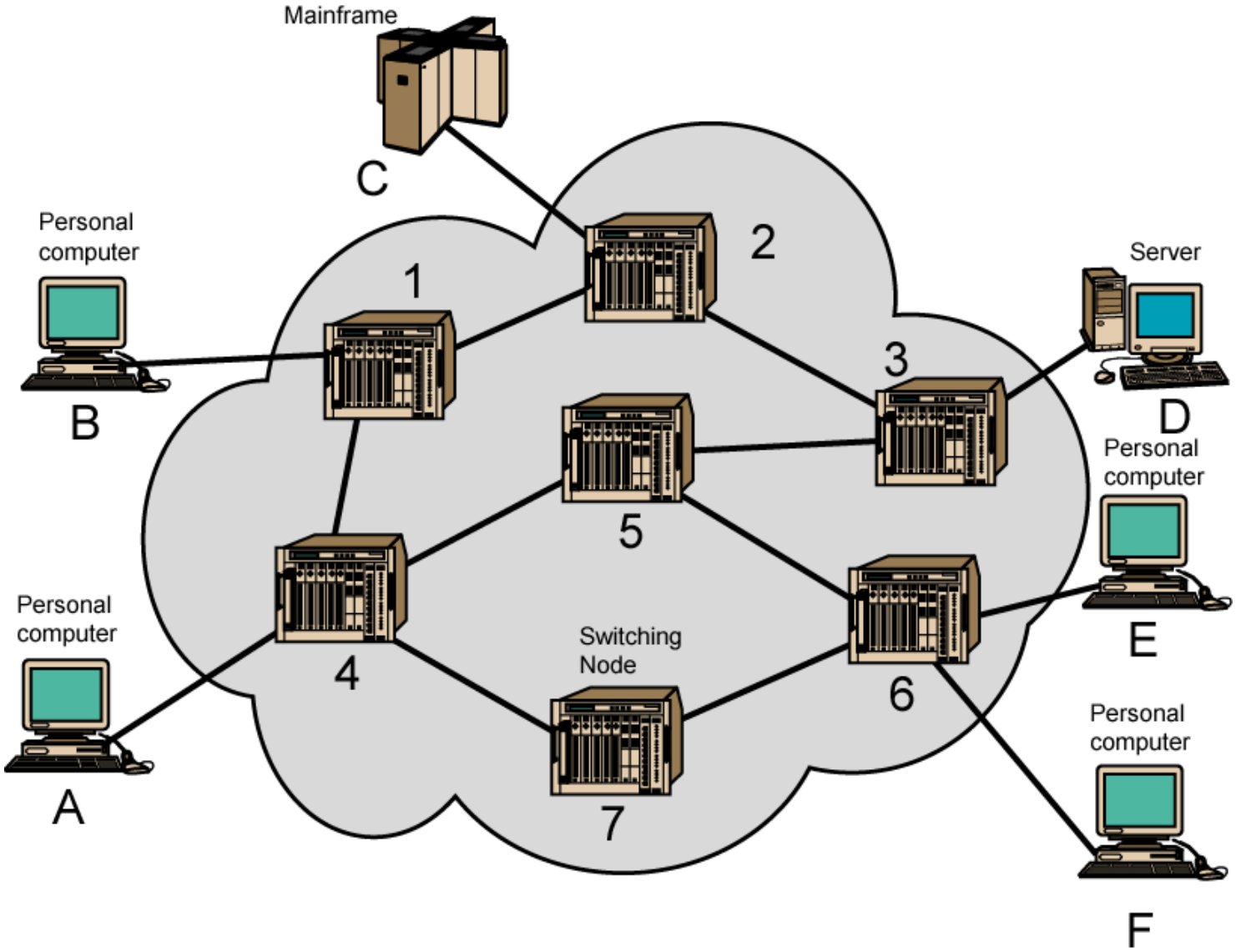
Common Channel signaling

Switching Networks

- Long distance transmission is typically done over a network of switched nodes
- Nodes not concerned with content of data
- End devices are stations
  - —Computer, terminal, phone, etc.
- A collection of nodes and connections is a communications network
- Data routed by being switched from node to node

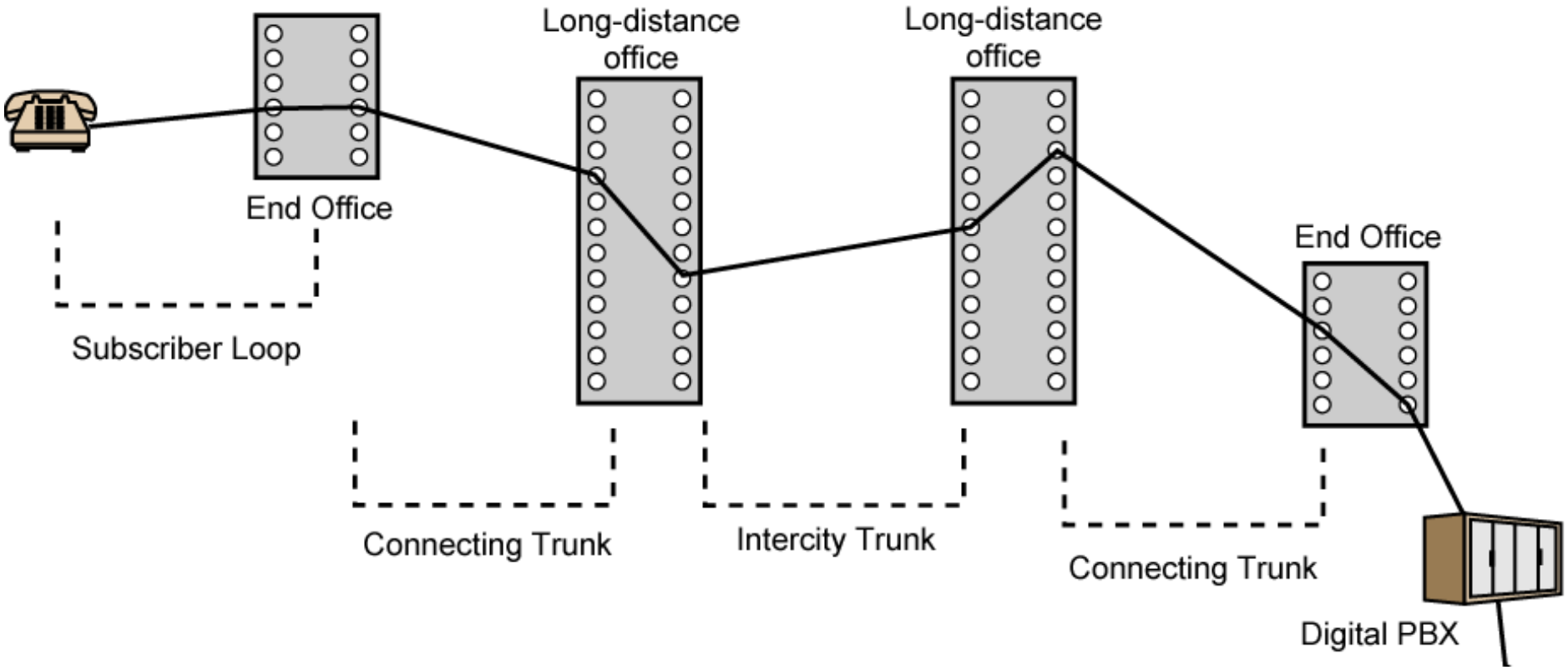
Simple Switched Network



Circuit Switching

- Dedicated communication path between two stations
- Three phases
  - —Establish
  - —Transfer
  - —Disconnect
- Must have switching capacity and channel capacity to establish connection
- Must have intelligence to work out routing

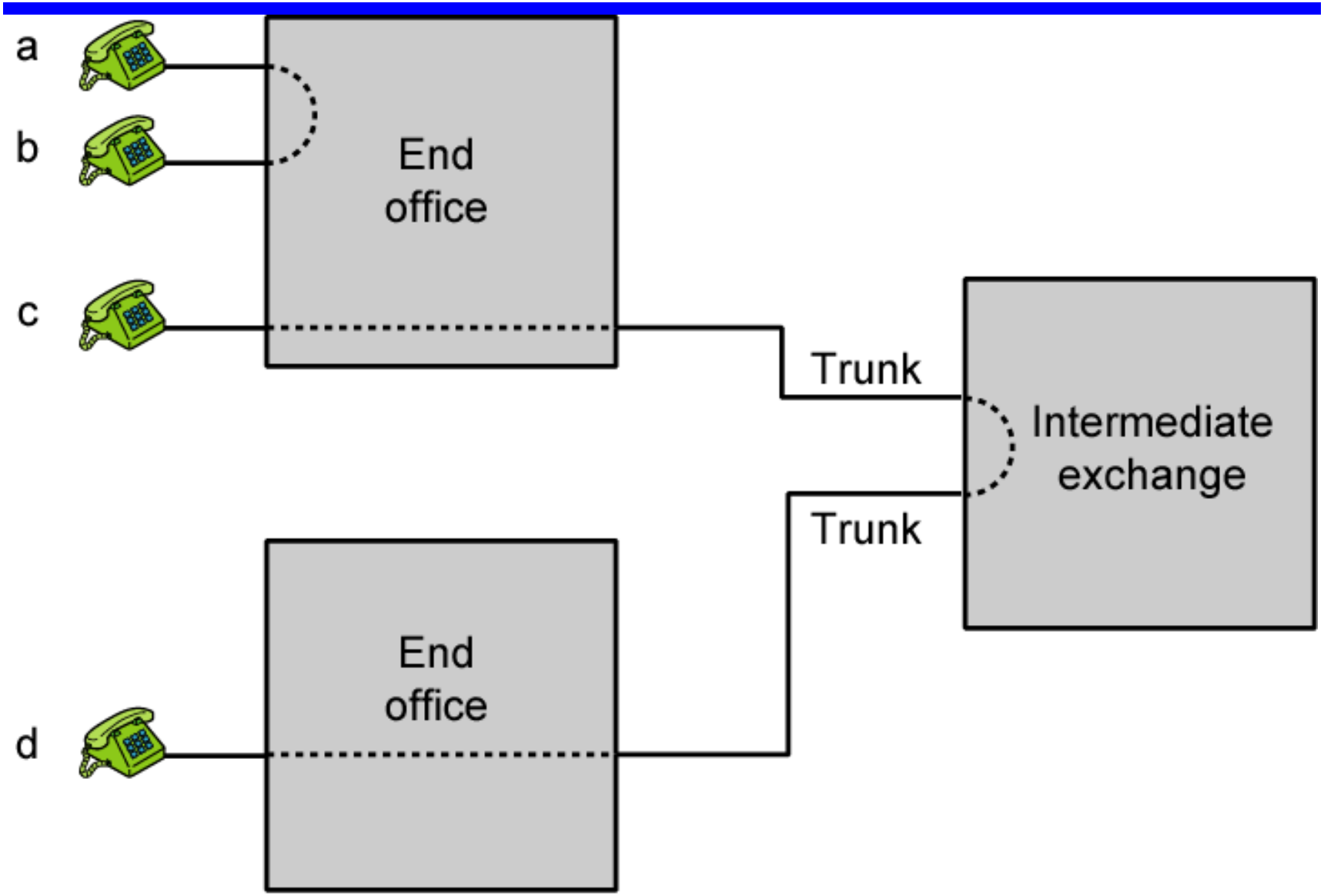
Public Circuit Switched Network



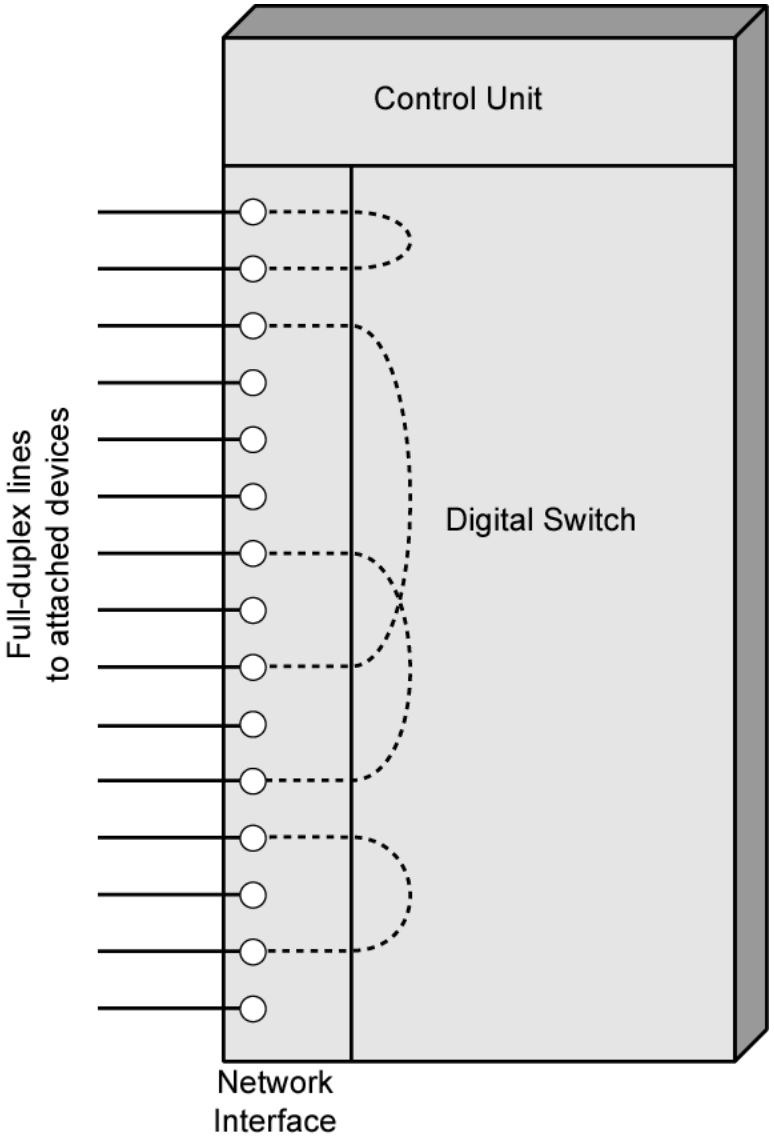
Telecomms Components

- Subscriber
  - Devices attached to network
- Subscriber line
  - Local Loop
  - Subscriber loop
  - Connection to network
  - Few km up to few tens of km
- Exchange
  - Switching centers
  - End office - supports subscribers
- Trunks
  - Branches between exchanges
  - Multiplexed

Circuit Establishment



Circuit Switch Elements



Circuit Switching Concepts

- Digital Switch
  - —Provide transparent signal path between devices
- Network Interface
- Control Unit
  - —Establish connections
    - Generally on demand
    - Handle and acknowledge requests
    - Determine if destination is free
    - construct path
  - —Maintain connection
  - —Disconnect

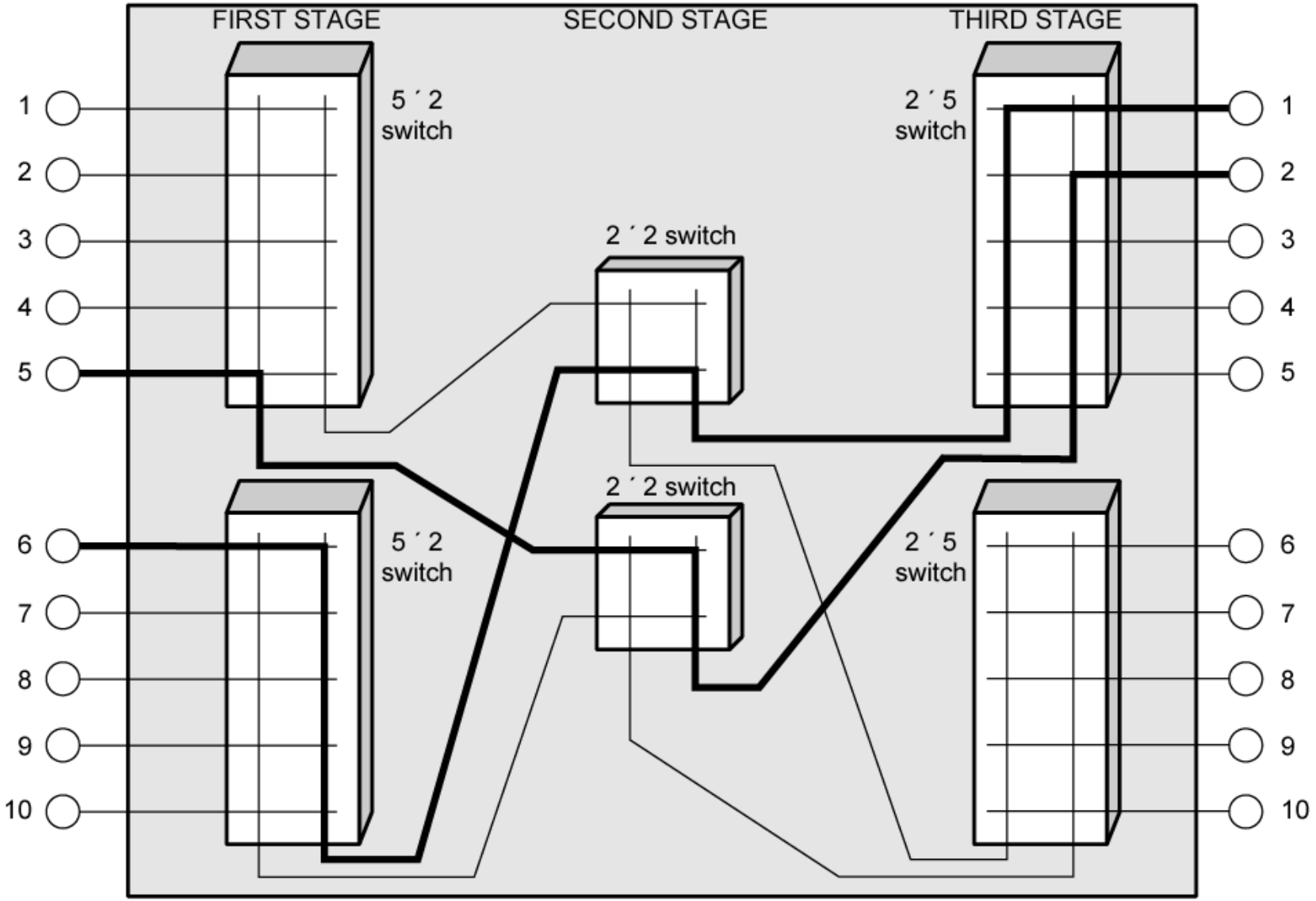
Blocking or Non-blocking

- Blocking
  - —A network is unable to connect stations because all paths are in use
  - —A blocking network allows this
  - —Used on voice systems
    - Short duration calls
- Non-blocking
  - —Permits all stations to connect (in pairs) at once
  - —Used for some data connections

Multistage Switch

- Reduced number of crosspoints
- More than one path through network
  - Increased reliability
- More complex control
- May be blocking

Three Stage Space Division Switch



Time Division Switching

- Modern digital systems rely on intelligent control of space and time division elements
- Use digital time division techniques to set up and maintain virtual circuits
- Partition low speed bit stream into pieces that share higher speed stream

Control Signaling Functions

- Audible communication with subscriber
- Transmission of dialed number
- Call can not be completed indication
- Call ended indication
- Signal to ring phone
- Billing info
- Equipment and trunk status info
- Diagnostic info
- Control of specialist equipment

Control Signal Sequence

- Both phones on hook
- Subscriber lifts receiver (off hook)
- End office switch signaled
- Switch responds with dial tone
- Caller dials number
- If target not busy, send ringer signal to target subscriber
- Feedback to caller
  - Ringing tone, engaged tone, unobtainable
- Target accepts call by lifting receiver
- Switch terminates ringing signal and ringing tone
- Switch establishes connection
- Connection release when Source subscriber hangs up

Switch to Switch Signaling

- Subscribers connected to different switches
- Originating switch seizes interswitch trunk
- Send off hook signal on trunk, requesting digit register at target switch (for address)
- Terminating switch sends off hook followed by on hook (wink) to show register ready
- Originating switch sends address

Location of Signaling

- Subscriber to network
  - —Depends on subscriber device and switch
- Within network
  - —Management of subscriber calls and network
  - —ore complex

In Channel Signaling

- Use same channel for signaling and call
  - Requires no additional transmission facilities
- Inband
  - Uses same frequencies as voice signal
  - Can go anywhere a voice signal can
  - Impossible to set up a call on a faulty speech path
- Out of band
  - Voice signals do not use full 4kHz bandwidth
  - Narrow signal band within 4kHz used for control
  - Can be sent whether or not voice signals are present
  - Need extra electronics
  - Slower signal rate (narrow bandwidth)

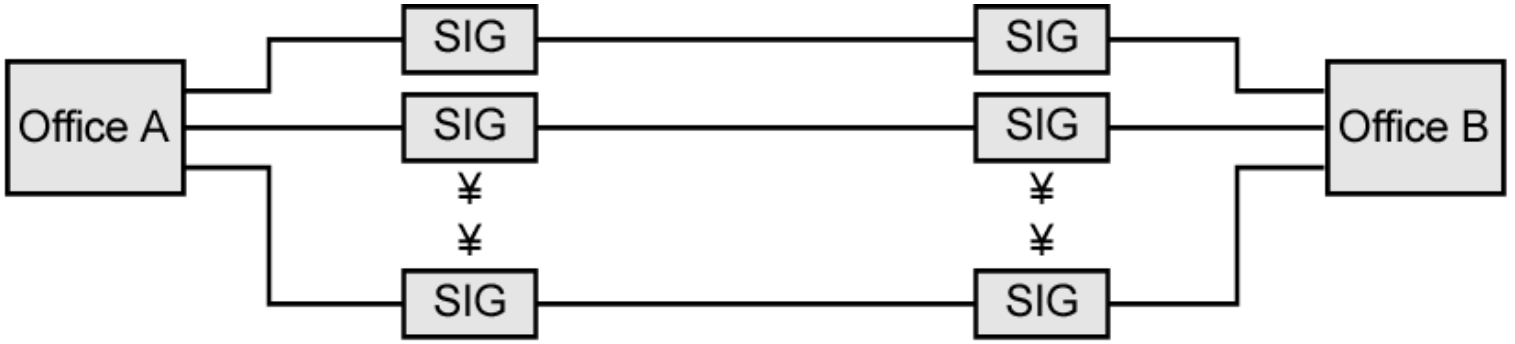
Drawbacks of In Channel Signaling

- Limited transfer rate
- Delay between entering address (dialing) and connection
- Overcome by use of common channel signaling

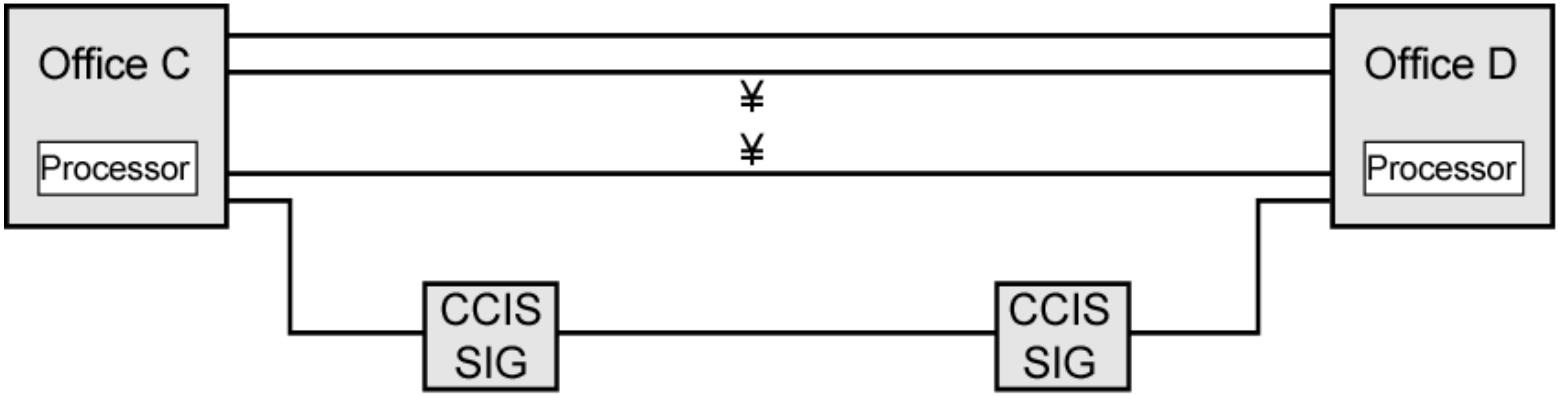
Common Channel Signaling

- Control signals carried over paths independent of voice channel
- One control signal channel can carry signals for a number of subscriber channels
- Common control channel for these subscriber lines
- Associated Mode
  - Common channel closely tracks interswitch trunks
- Disassociated Mode
  - Additional nodes (signal transfer points)
  - Effectively two separate networks

Common v. In Channel Signaling



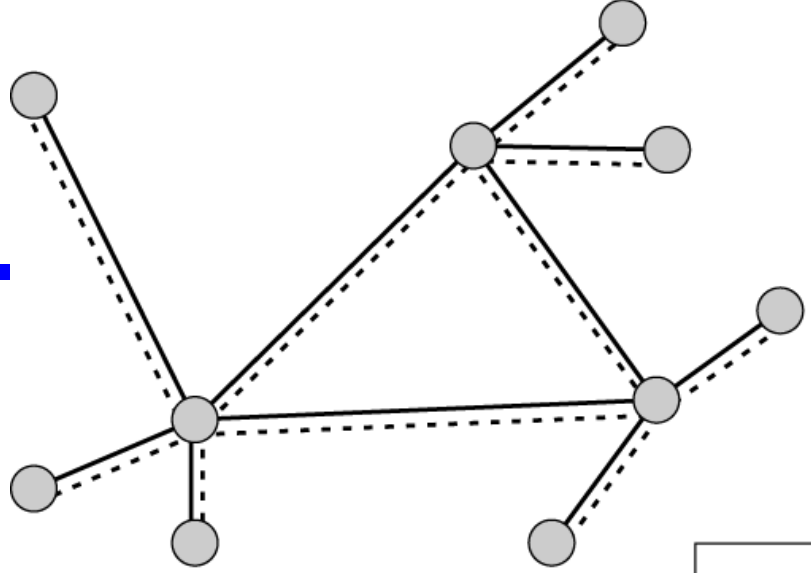
(a) Inchannel



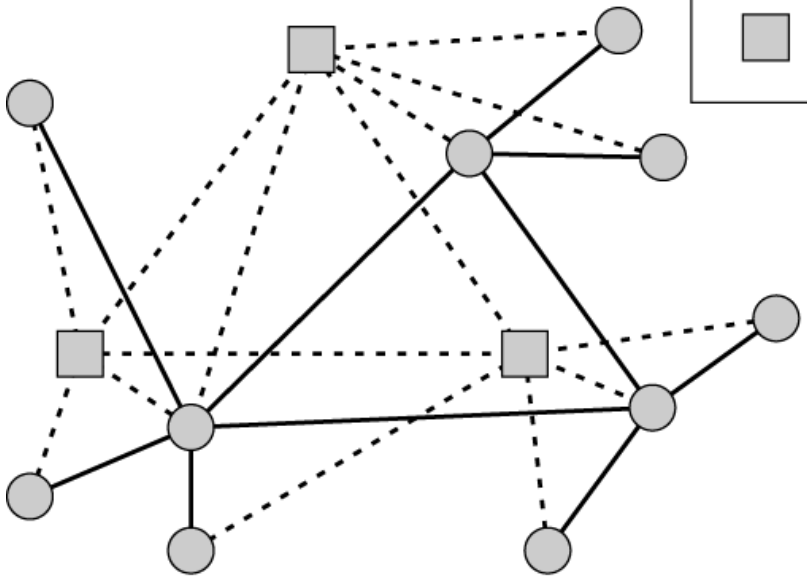
(b) Common channel

CCIS SIG: Common-channel interoffice signaling equipment
SIG: Per-trunk signaling equipment

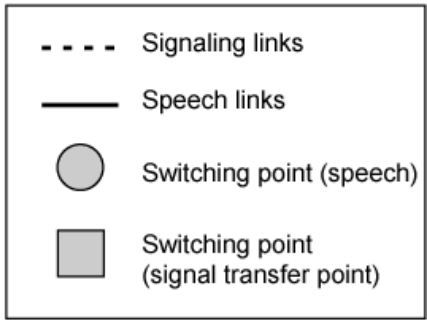
Common Channel Signaling Modes



(a) Associated



(b) Disassociated



Signaling System Number 7

- SS7
- Common channel signaling scheme
- ISDN
- Optimized for 64k digital channel network
- Call control, remote control, management and maintenance
- Reliable means of transfer of info in sequence
- Will operate over analog and below 64k
- Point to point terrestrial and satellite links

SS7
Signaling Network Elements

- Signaling point (SP)
  - —Any point in the network capable of handling SS7 control message
- Signal transfer point (STP)
  - —A signaling point capable of routing control messages
- Control plane
  - —Responsible for establishing and managing connections
- Information plane
  - —Once a connection is set up, info is transferred in the information plane

Signaling Network Structures

- STP capacities
  - —Number of signaling links that can be handled
  - —Message transfer time
  - —Throughput capacity
- Network performance
  - —Number of SPs
  - —Signaling delays
- Availability and reliability
  - —Ability of network to provide services in the face of STP failures