

# Packet Switching Technologies

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# Contents (Short Version)

- Virtual Circuit Packet Switching
  - X.25
  - Frame Relay
  - Asynchronous Transfer Mode (ATM)
  
- Datagram Packet Switching
  - Internet Protocol (IP)
    - Covered in detail in later lectures

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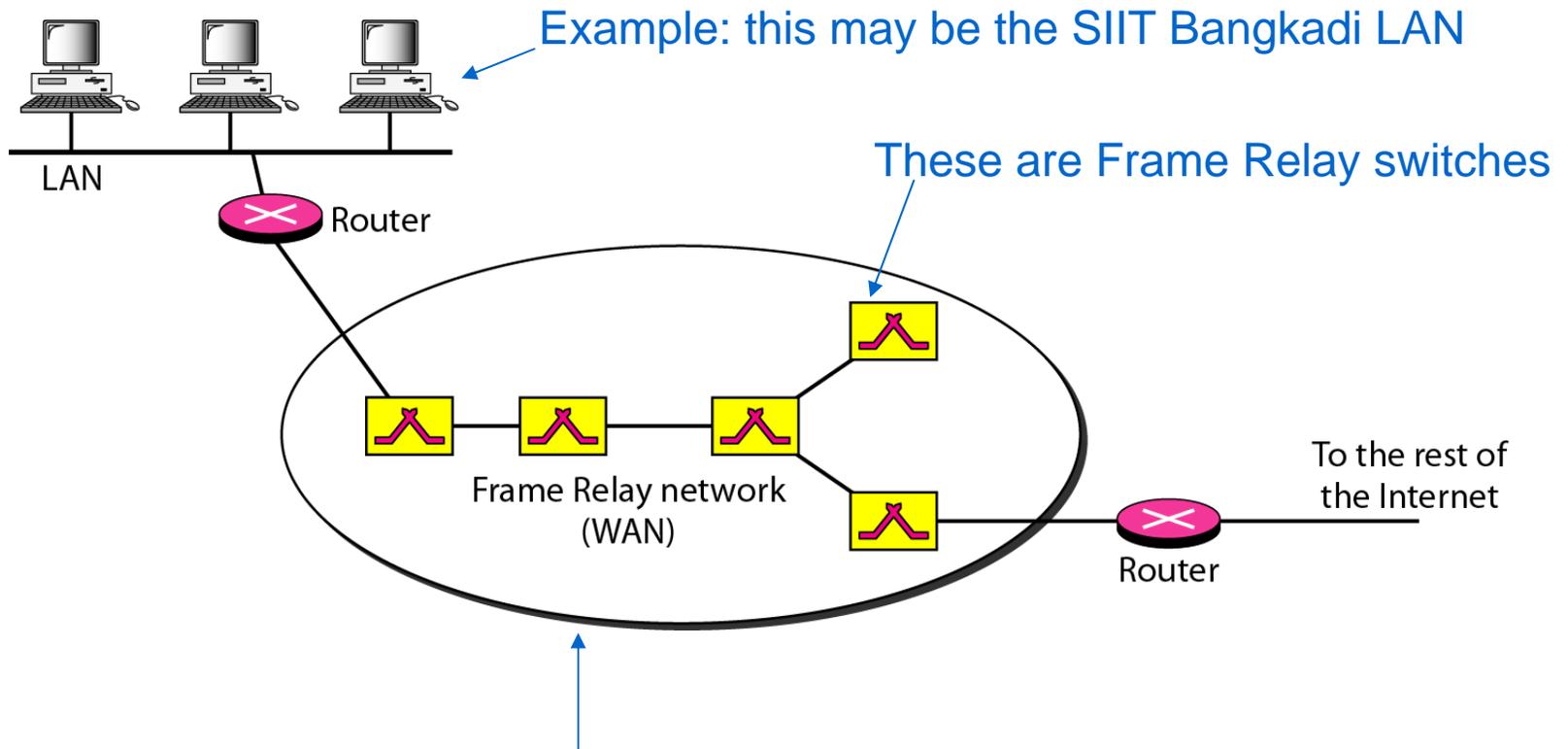
# X.25

- ITU-T standard for interface between host and packet switched network
  - Developed in 1970's; initiated by telephone carriers – there was a need to provide WAN connectivity over public data networks
  - Designed to transmit over error-prone analog links
  - Today, largely replaced by other technologies (frame relay, IP over SONET, ...)
    - Legacy networks mainly support transaction-oriented application (e.g. financial)
    - Still used in developing countries
- Defines three layers
  - Physical
  - Link
  - Packet (like Network layer)
- Typical speed is 64kb/s; up to 2Mb/s

# Frame Relay

- Developed in late 1980's, early 1990's
- Designed to eliminate most X.25 overhead
  - Key differences from X.25:
    - call control carried in separate logical connection
    - multiplexing and switching at layer 2 (not layer 3)
    - no hop by hop error or flow control
    - hence end to end flow and error control (if used) are done by higher layer (that is, Frame Relay does not do this)
- A single user data frame is sent from source to destination
  - There are no Acknowledgements for hop-by-hop (Layer 2) flow control or error control
    - But since many communication links are very reliable now, this is not a big issue
  - Fewer overheads than X.25. **Frame Relay is more efficient**
- Provides data rate of 1.5Mb/s, extended to 44Mb/s

# Frame Relay Network



Example: this may be a network owned and operated by an ISP. SIIT pays the ISP to carry traffic to other networks (e.g. Rangsit, other Uni's, the Internet)

# Asynchronous Transfer Mode

- In 1980's, as Internet grew, people wanted faster methods than IP datagram switching (and routing)
  - Routers performing forwarding/routing in software were slow for large networks
- Developed ATM, with the intention that it could be used as a fast WAN and LAN technology
  - Virtual circuit based packet switching
    - Use fixed size (53 byte) packets, or ATM cells: 48 bytes of data and 5 bytes of header
  - Better support for voice, video and data: Quality of Service control (wasn't available in IP at the time)
  - Support data rates from 25Mbs up to 622Mb/s (now even faster)
- Current status:
  - ATM WANs are today used by telecommunication companies to connect their networks (e.g. within ISPs, across cities, between cities)
    - In the future, may be replaced with IP over optical networks (SDH/SONET)
  - ATM LANs were not successful: Ethernet is the dominant LAN standard

# Layers in Switching Technologies

