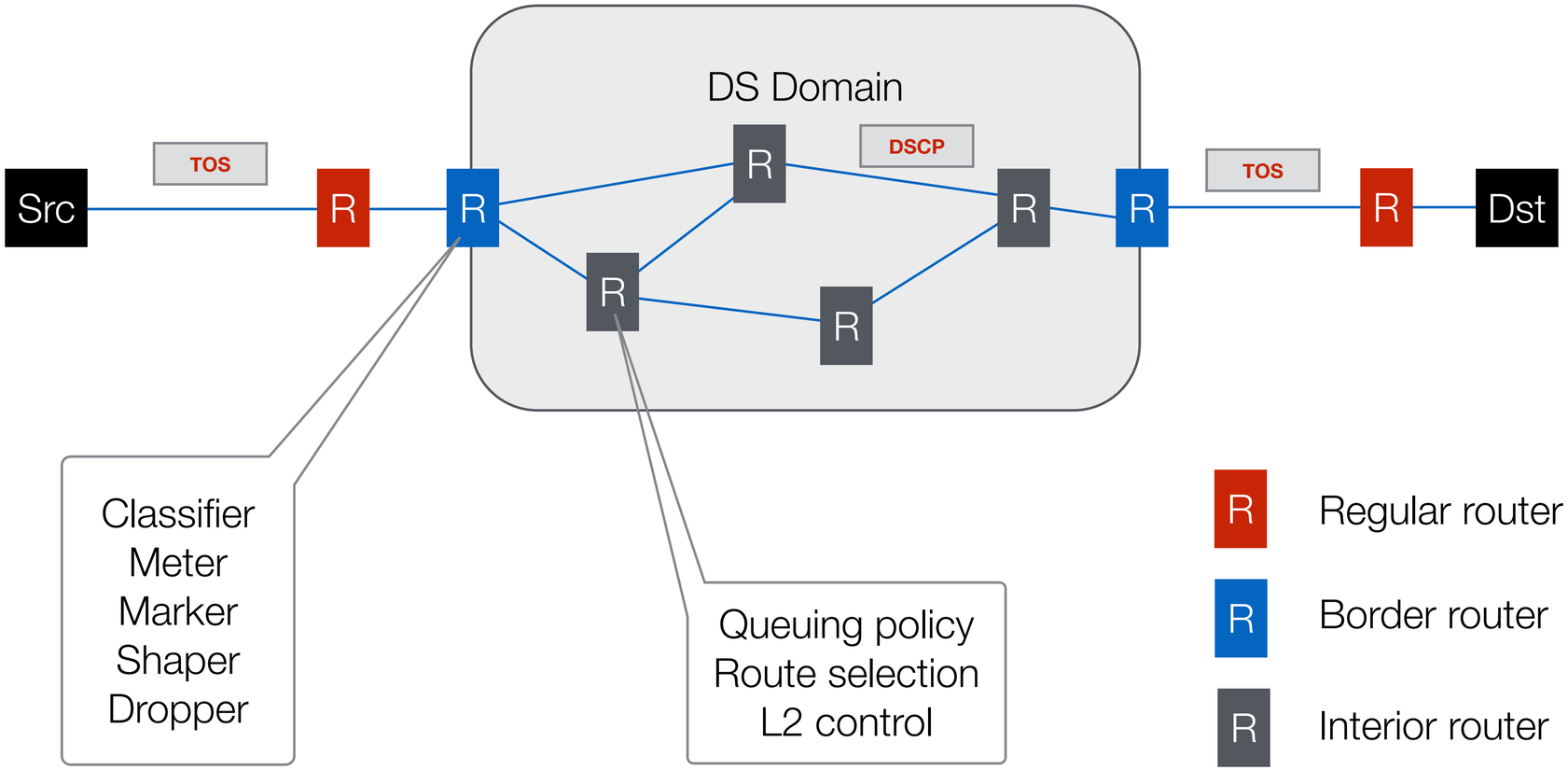
CS 725/825 & IT 725

Lecture 21

Network Layer

November 19, 2025

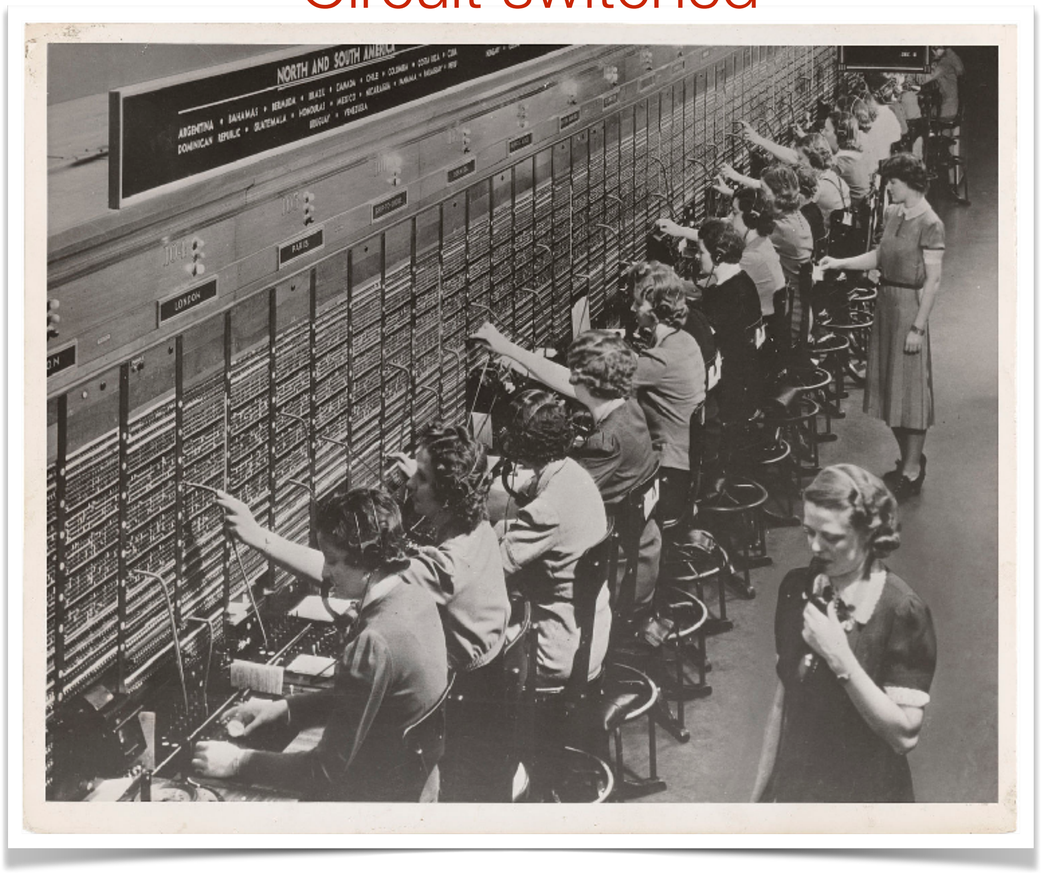
Differentiated Services



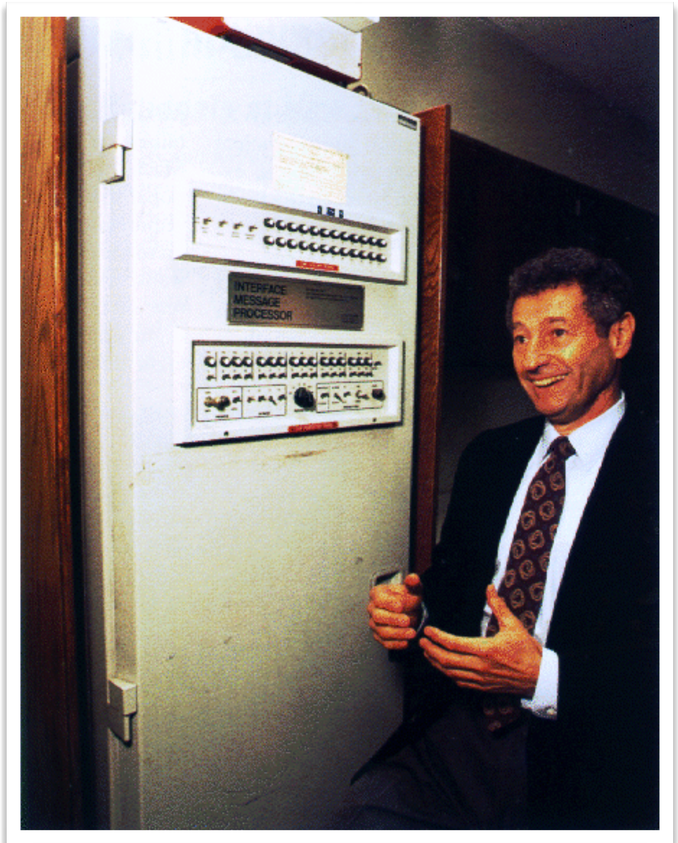
Categories of Networks

- Compromise: virtual packet switched

Circuit switched



Packet switched



Images from Wikimedia Commons

Virtual Circuits

- Problems with packet-switched networks:
  - no connection between packets
  - difficult to provide QoS
  - difficult to provision resources
  - difficult to control routes the packets take
  - reactive fault-tolerance
- All these problems can be addressed in circuit-switched networks

Circuits vs Virtual Circuits

- Virtual Circuit Switched Networks
  - an overlay on top of a packet switched network that provides a circuit-based service
  - “most of the benefits at a fraction of the cost”
  - trading ability to control for loss of simplicity
- Always the next big thing
  - OSI - Open System Interconnect (R.I.P.)
  - ATM - Asynchronous Transfer Mode (R.I.P.)
  - MPLS - MultiProtocol Label Switching (alive and well)

Virtual Circuit Switching

- Virtual Circuit (VC)
  - separation of routing and forwarding
- Circuit Switching Table
  - state-full forwarding
- Virtual Circuit Identifier (VC id)
  - global circuit vs locally significant circuit identifier

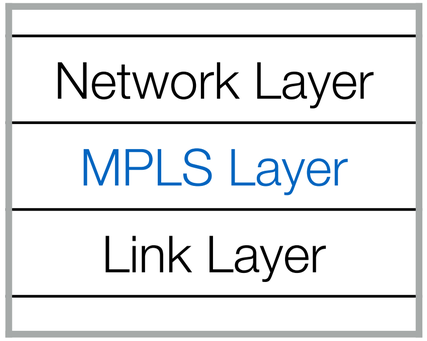
MPLS

- MultiProtocol Label Switching
  - a protocol providing virtual circuit service
  - designed to coexist and complement existing protocols, not to replace them
- One protocol, many uses:
  - simplification of forwarding
  - traffic engineering
  - protection and restoration
  - support for legacy services
  - VPNs, ...

MPLS Terminology

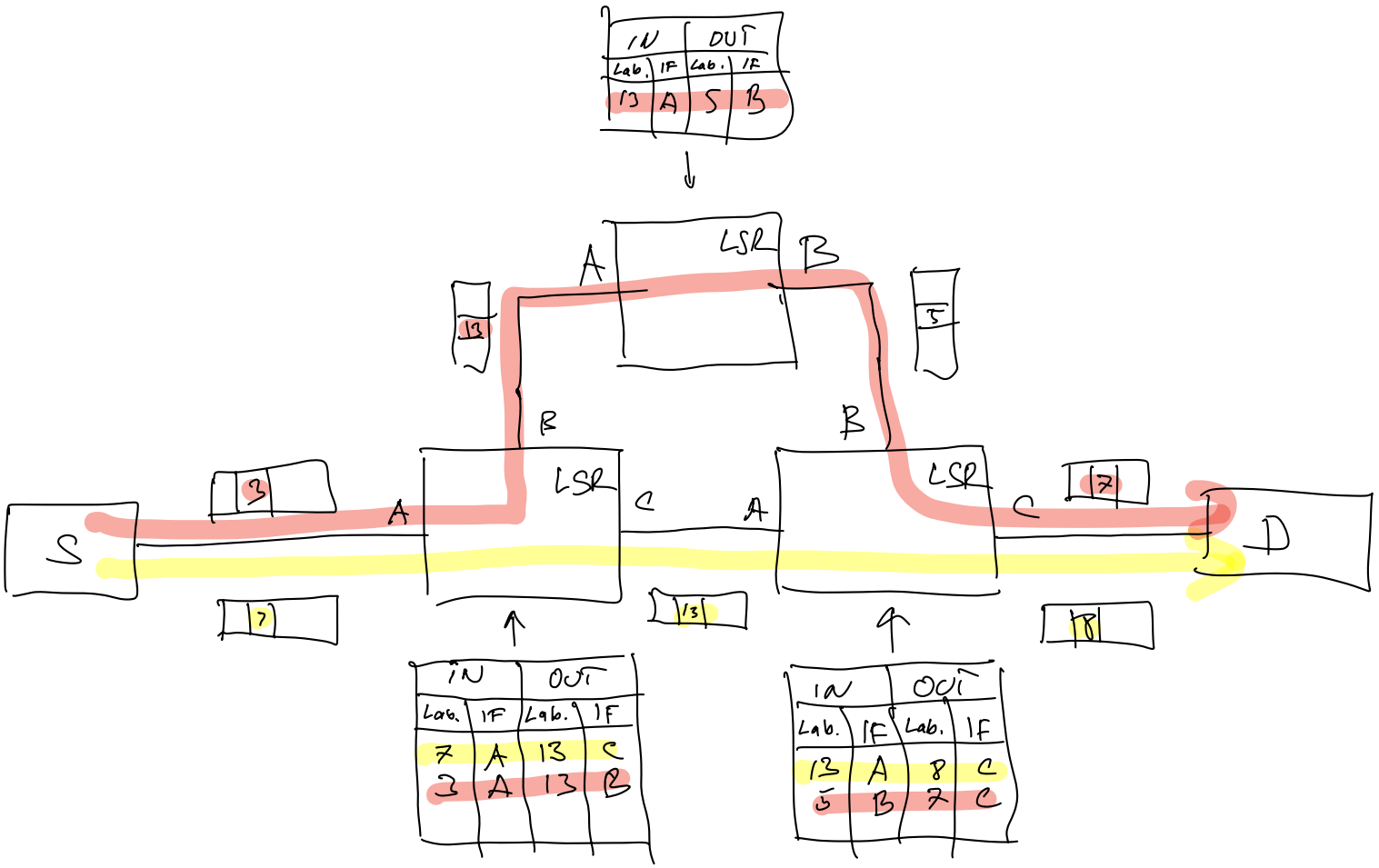
- Label Switched Path (LSP): a VC
- Label: VC id
- Label Switch Router (LSR): a switch
- Forwarding Equivalence Class (FEC)

Typically:



MPLS packet

MPLS (VIRTUAL CIRCUIT) SWITCHING



LSP (VC) 1

LSP (VC) 2