TSN: Lecture 1
Switch and Router Architectures

Topics Covered

- Types of Switching elements
- Routing and Switching
- Equipment Characteristics
- A generic switch

Types of switching elements

- Telephone switches
  - switch samples (8 bits)
- Datagram routers
  - route datagrams (variable length 64 bytes minimum)
- ATM (Asynchronous Transfer Mode) switches
  - switch ATM cells (constant length packets = 53 bytes = 5 bytes header + 48 bytes payload)
- MPLS switches
  - switch MPLS packets (variable length)
  - embedded routers or ATM switches

What's the difference between routing and switching??

Routing and Switching

- Routing
  - Packet forwarding based on routing tables (established through routing protocols)
  - Longest Prefix Match lookup
  - datagram switching (no circuit setup)

- Switching
  - Pre-establish a circuit (physical or virtual) for communication
  - Packet forwarding is based on cross-connect tables (established through call setup procedures)
  - Uses physical or logical (virtual) circuit identifier (VCI)

Equipment Characteristics

- Switching Fabric Capacity
  - e.g., 1Gb, 10Gb, 320G, 5T
- Number of Interfaces (or ports)
  - 2, 4, 8, 16, 32, 64, 128
- Types of Interfaces (or ports)
  - Ethernet, T1, DS3, OC3, OC48, OC192
- Redundancy
  - Fabric, Port and Power Supply redundancy
- Control Plane (in-band or out-of-band)
  - Protocols supported
  - Management (Command Line Interface CLI, Web based, SNMP)

Classification

- Packet vs. Circuit switches
  - packets have headers (self-routing info) and samples don't
- Connectionless vs. connection oriented
  - connection oriented switches need a call setup
  - setup is handled in *control plane* by *switch controller* using *signaling protocols*
  - connectionless switches deal with *self-contained* datagrams

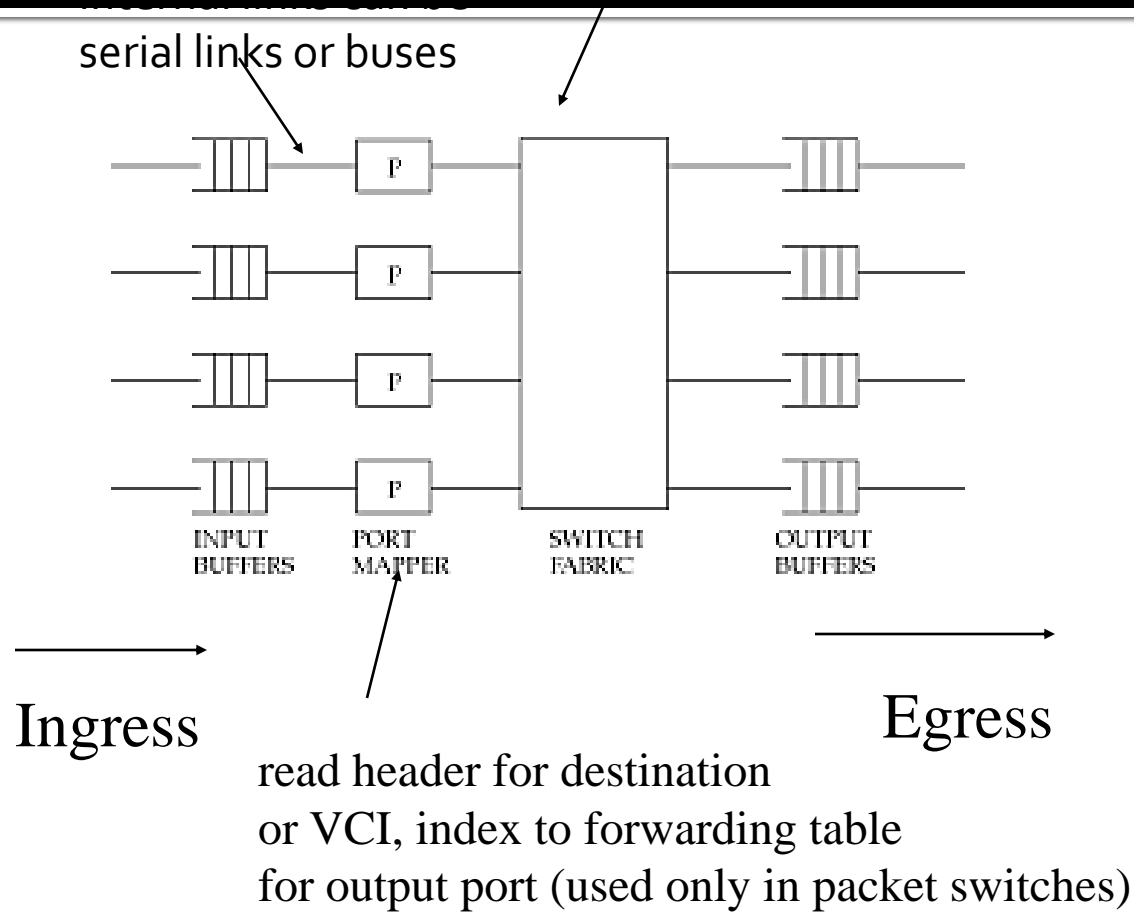|	Connectionless (router)	Connection-oriented (switching system)
Packet switch	Internet router	ATM switching system MPLS Switch
Circuit switch		Telephone switching system

Other switching element functions

- Participate in routing algorithms
  - to build routing tables
- Resolve contention for output trunks
  - scheduling
- Admission control
  - to guarantee resources to certain streams
- We'll discuss these later
- Here we focus on pure data movement (data path)

Requirements

- Capacity of switch is the maximum rate at which it can move information, *assuming all data paths are simultaneously active (e.g, 32 ports each at 10G=320G)*
- Primary goal: maximize capacity
  - subject to cost and reliability constraints
- Circuit switch must reject calls if it can't find a path for samples from input to output
  - goal: minimize call blocking
- Packet switch must reject a packet if it can't find a buffer to store it awaiting access to output trunk
  - goal: minimize packet loss
- Don't reorder packets (why??)

A generic switch

internal links can be
serial links or buses

INPUT BUFFERS	PORT MAPPER	SWITCH FABRIC	OUTPUT BUFFERS

Ingress

Egress

read header for destination
or VCI, index to forwarding table
for output port (used only in packet switches)

Ingress, Egress Linecards will host Framing, Traffic Management
functions; Not all switches may have all components

Generic Switch – Folded Diagram

- Ports and links are generally bi-directional

Switch Card

Switch Core

Line Cards

| I | E | ······ | I | E | ······ | I | E |

I = Ingress
E = Egress

Port *0* Port *1* Port *N*