SDN

Traditional approaches

Software Defined Networks

Manual configuration
Routing protocols
Management protocols
MPLS

R

SDN controller

R

R

R

packet flow
control flow
Software Defined Networks

Motivation:
- many protocols, vendors, management platforms
- virtualization, cloud, … (fill the buzzword of a day)
- scale up in size and bandwidth

Goals:
- flexibility, agility, …
- central management, programatically configured (API)
- open and vendor-independent
Grossly simplified:

- **Application Plane**
  - Application
  - …………
  - Application

- **Control Plane**
  - Network Service
  - …………
  - Network Service

- **Data Plane**

**Interfaces**:

- **northbound interface**
- **southbound interface**
- **APIs**
- **Open Flow**
TCP Flow Control - review

- Receiver congestion
  - Window Size field - explicitly reported by the receiver
  - TCP Window Scale Option

- Network congestion
  - Retransmission timeout - based on observed RTT
  - Transmission window - based on detected packet loss
TCP Sliding Window

- **Initial sequence #**
- **Window size**
- **ACKs rec’d**
- **Moves as data is received and sent**
- **Moves as application reads data**
- **Moves with ACKs sent**
- **Moves as data is sent**
- **Receiver buffer size**
- **Receiver buffer available for data to be sent**
- **Sent but not yet received**
- **Received but not yet ack’d**
- **Ack’d data, delivered to the application**
- **Received and ack’d but not yet delivered to the application**

- **$2^{32} - 1$**

- **0**
TCP Congestion Control

- ACK self-clocking
- Retransmission timer management
- Additive Increase Multiplicative Decrease (AIMD)
- Slow start mechanism