IPv6
Quality of Service

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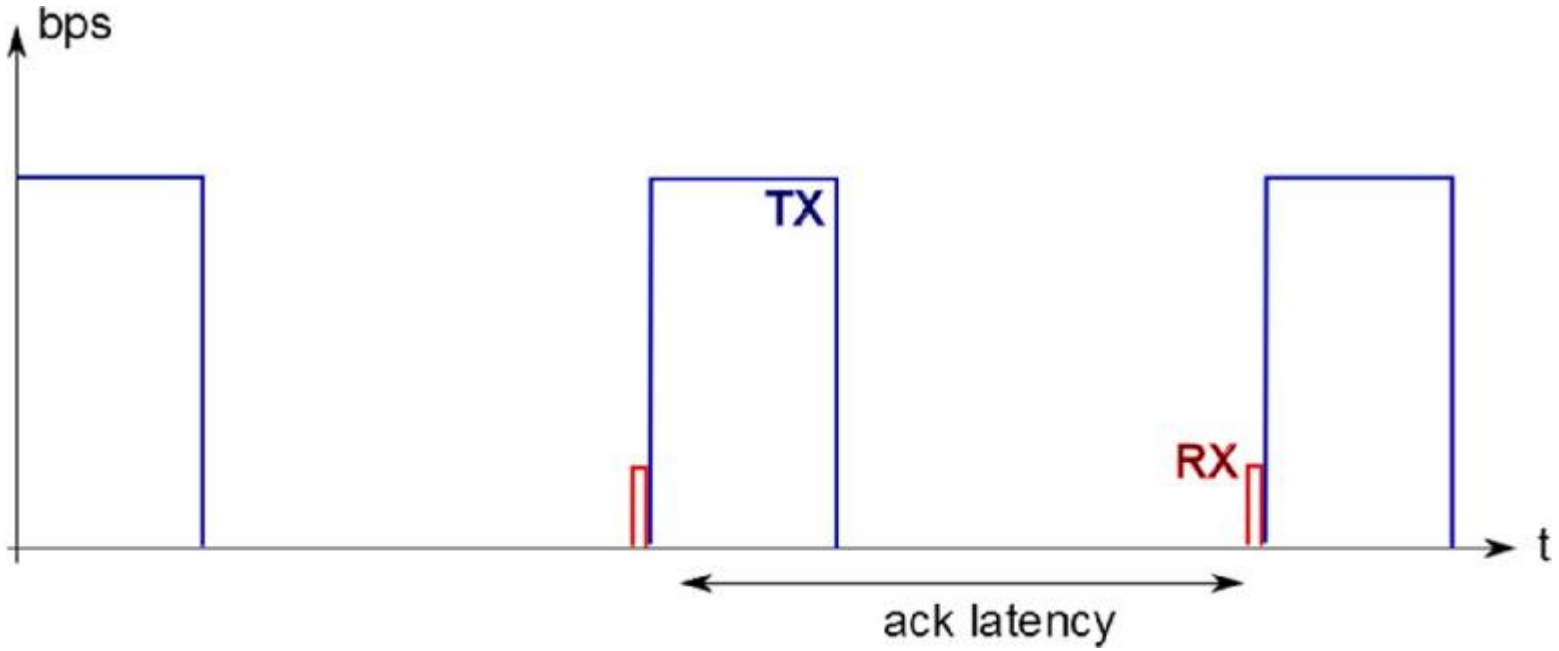
Quality of Service?

Quality of Service

- Wikipedia
  QoS = “Overall performance of a network”
  - Bandwidth
  - Latency
  - Jitter
  - Availability
  - Dropped packets
  - Out-of-order
- Concern of all network layers!
- Fairness!

Bandwidth example

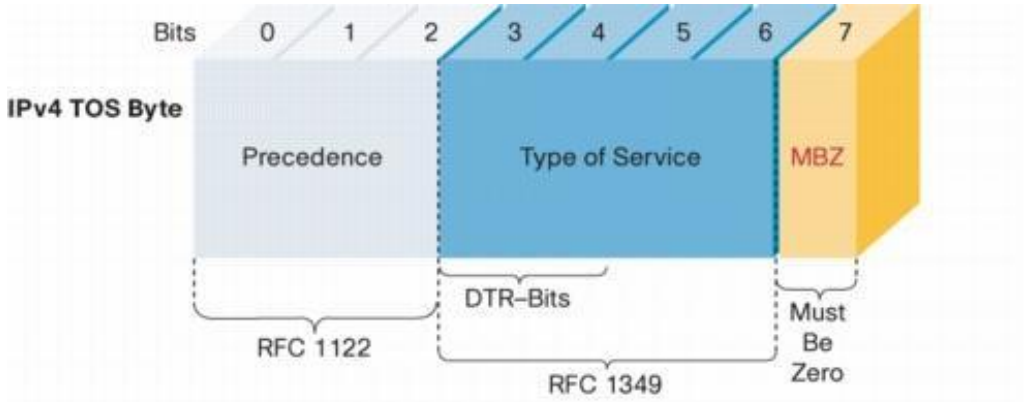


- TCP Ack latency -> bandwidth limiting
  - TCP window scaling support

IPv4 QoS

- 1980/81 (rfc791)
  - Type of Service (TOS)
  - Time of Live (avoid network starvation)
  - Options
    - DARPA: Top secret packets!!!
    - ...

IPv4 rfc791 TOS



Bits (0–2): IP-Precedence Defined
111 – Network Control
110 – Internetwork Control
101 – CRITIC/ECP
100 – Flash Override
011 – Flash
101 – Immediate
001 – Priority
000 – Routine

Bits (3–6): The Type of Service Defined
0000 – [all normal]
1000 – [minimize delay]
0100 – [maximize throughput]
0010 – [maximize reliability]
0001 – [minimize monetary cost]

- How to link with application requirements?
- How mapped to lower layers?

IPv6 Traffic Classes

- 1995/98 (rfc2460) Cisco/Nokia
- Traffic Classes (8-bit)
  - NOT Specified yet how
    - Default zero
    - Some way should be foreseen towards upper layer to fill this in.
    - Can be changed underway

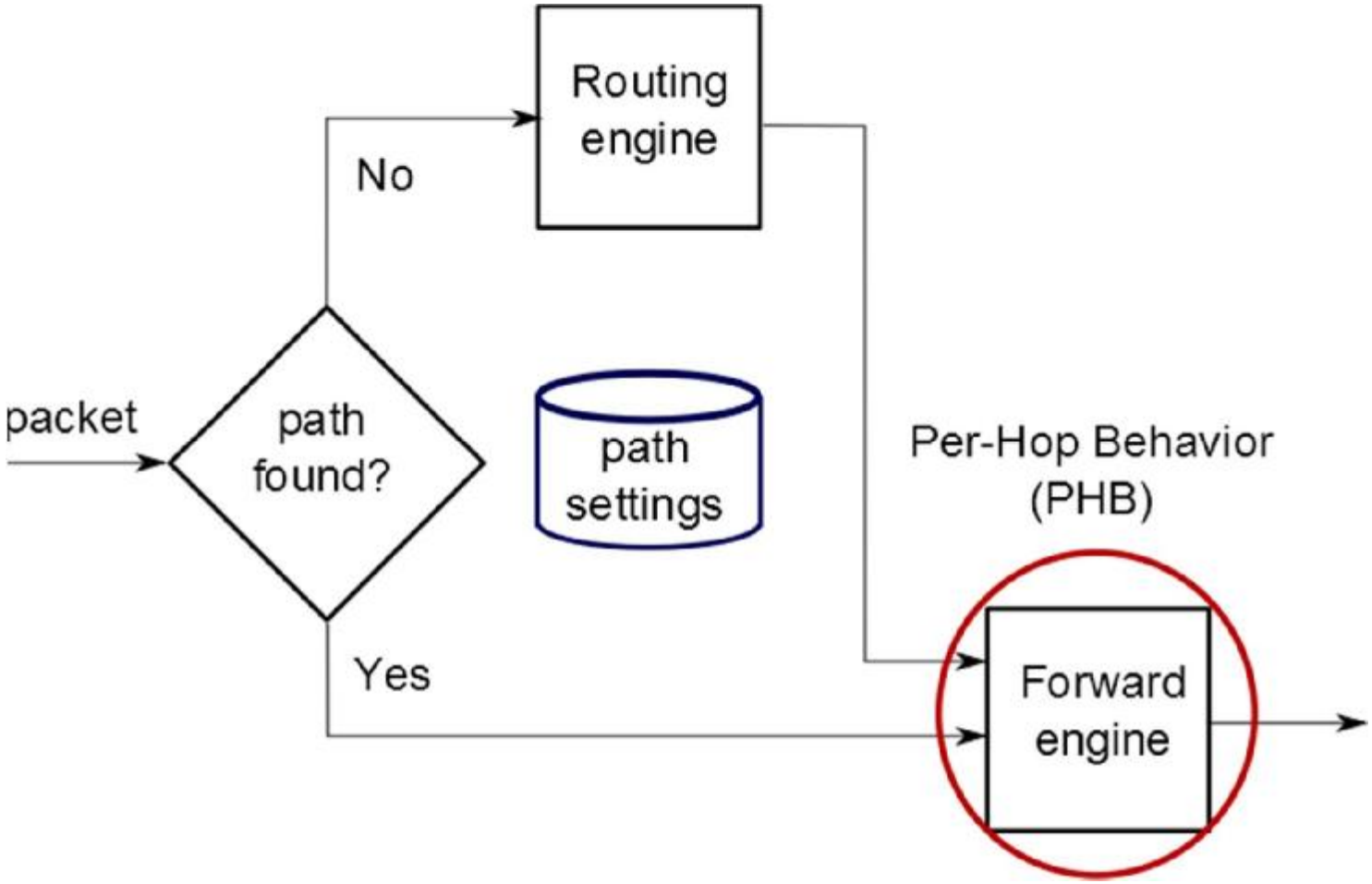
IPv6 Flow labels

- 20-bit
- Meant for IPv6 Routers
  - To request “Special Handling”
  - Experimental...
- Different proposed rfc on how to handle
  - Still propose phase...
  - Contradicting rfc’s
  - Only main difference IPv6 QoS compared with IPv4

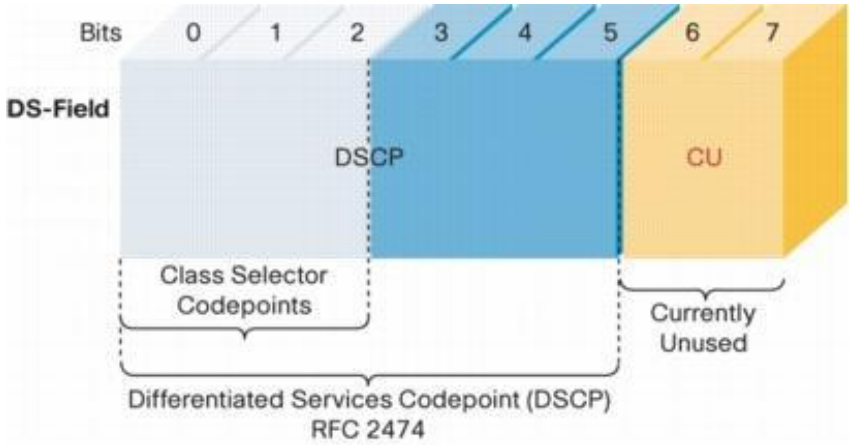
DS Field (rfc2474)

- **Differentiated Services Field (DiffServ)**
- 1998 both for IPv4 and IPv6!
- For IPv4: redefines TOS field
- For IPv6: defines Traffic Classes
- Start to define behaviour!
  - Per-hop Behavior: PHB

Per-Hop Behavior

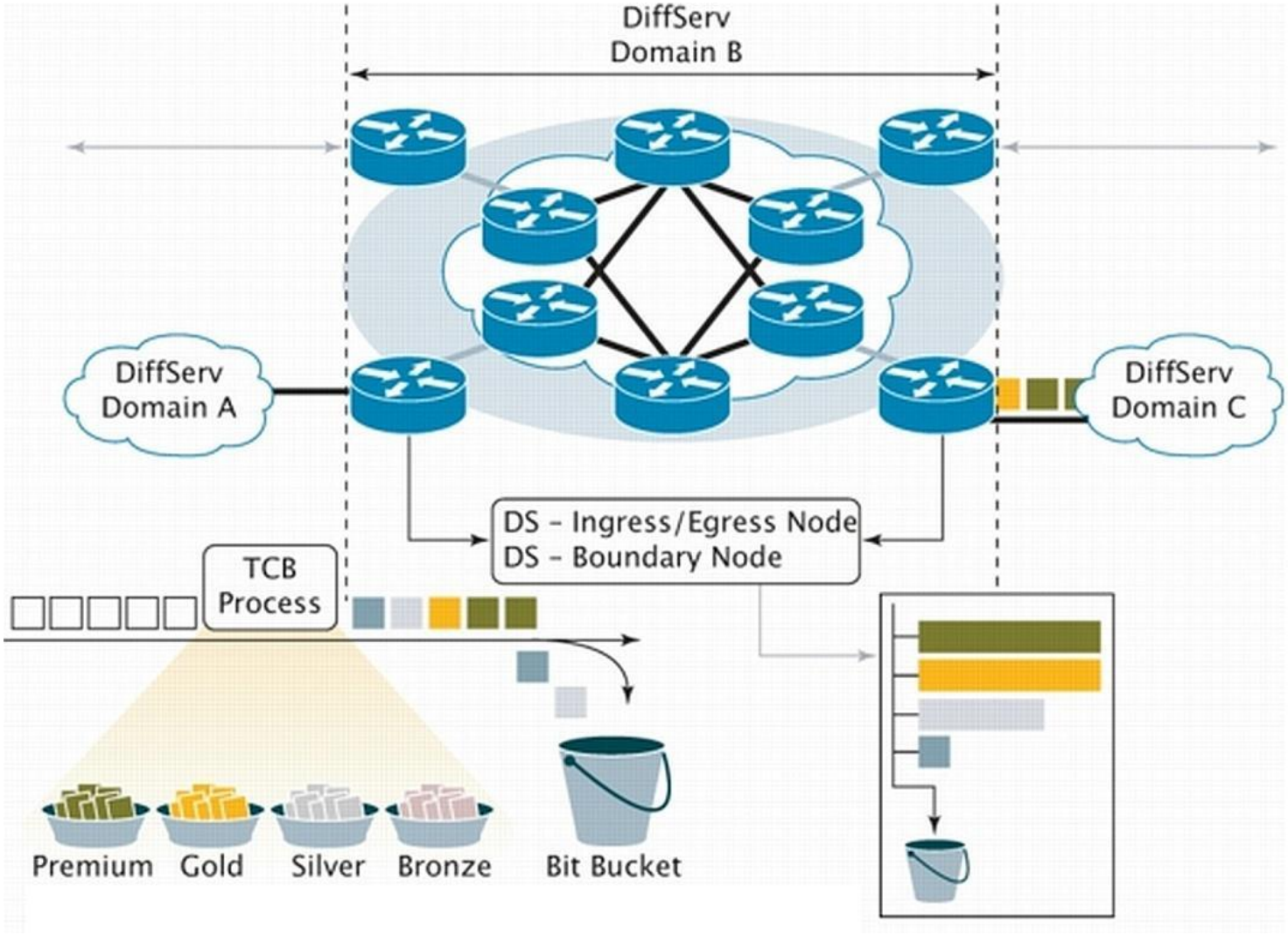


DS-Field



- Re-use of precedence bits of TOS (backwards compatible, except type of services bits): all zero == IPv4 TOS

DiffServ: at network level!



DiffServ PHB

- Default PHB (000 000), best effort
- Class-Selector PHB (xxx000), = TOS prec.
- Expedited Forwarding (EF) PHB = Low latency low jitter, low drop... (example VOIP)
  rfc2598 -> rfc3246
  - Formal, but parameterized and highest prio!
- Assured Forwarding PHB (rfc2597)

AF PHB

Bandwidth parititioning

	class1	class2	class3	class4
Low Drop Prec	001010	010010	011010	111010
Medium Drop Prec	001100	010100	011100	111100
High Drop Prec	001110	010110	011110	111110

Drop probability

Integrated Services

- Point-to-point QoS (!= network QoS)
  - IntServ versus DiffServ
- resource ReSerVation Protocol (RSVP)
  - Receiver oriented and unidirectional
  - Traffic specification: characteristics of data flow
  - Request specification: QoS requested.
- All routers in between have to co-operate
  - QoS on path...

Ethernet QoS => CoS

- Class of service: IEEE 802.1Q
  - VLAN and CoS: extra 32-bit in ethernet header:
    - 16-bit to differentiate VLAN packets
    - 16-bit for CoS and VLAN
      - 3-bit PCP: same as IP TOS (or class in DiffServ)

That's all Folks!

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