Computer Networks

Differentiated Services (§5.4.6)

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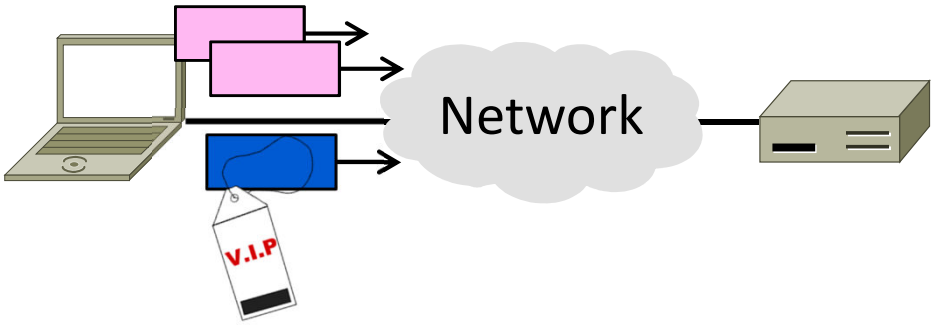
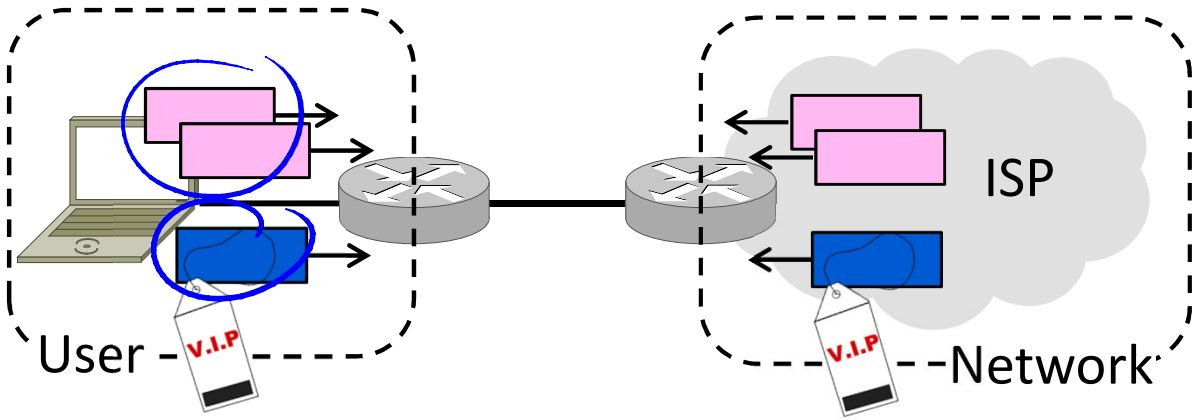
Topic

- Treating different traffic flows differently in the network
  - Coarse QOS (grades of service)
  - Gradually being deployed



Motivation

- User runs Skype and BitTorrent
  - Or remote desktop, gaming, web, etc.
  - How can we give preference to flows?

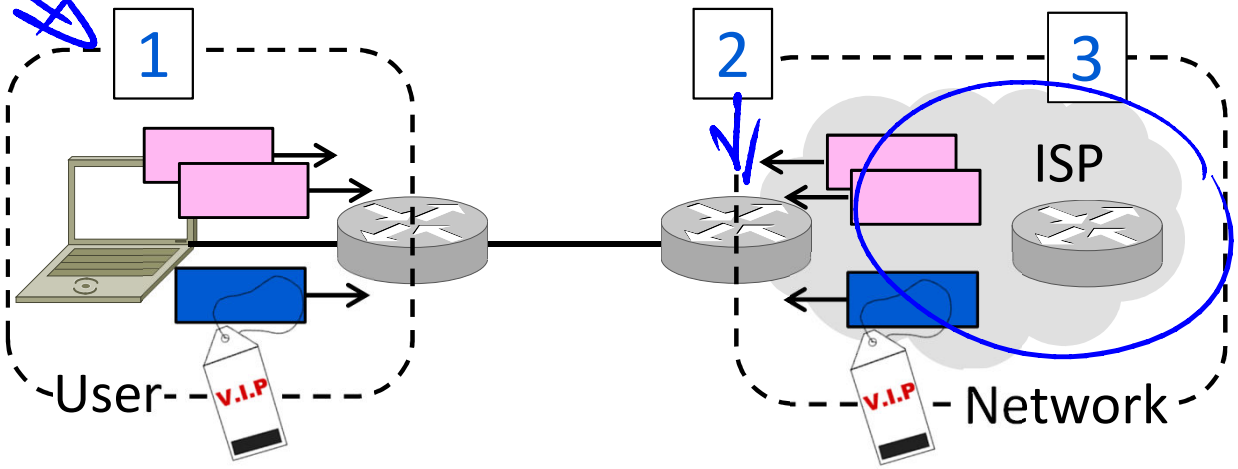


Differentiated Services

- Idea is to treat different kinds of traffic differently in the network
  - Have a few kinds of network service (GOLD, SILVER, BRONZE)
  - Different kinds get better or worse treatment in the network
  - Map apps to the right kind of service

Differentiated Services (2)

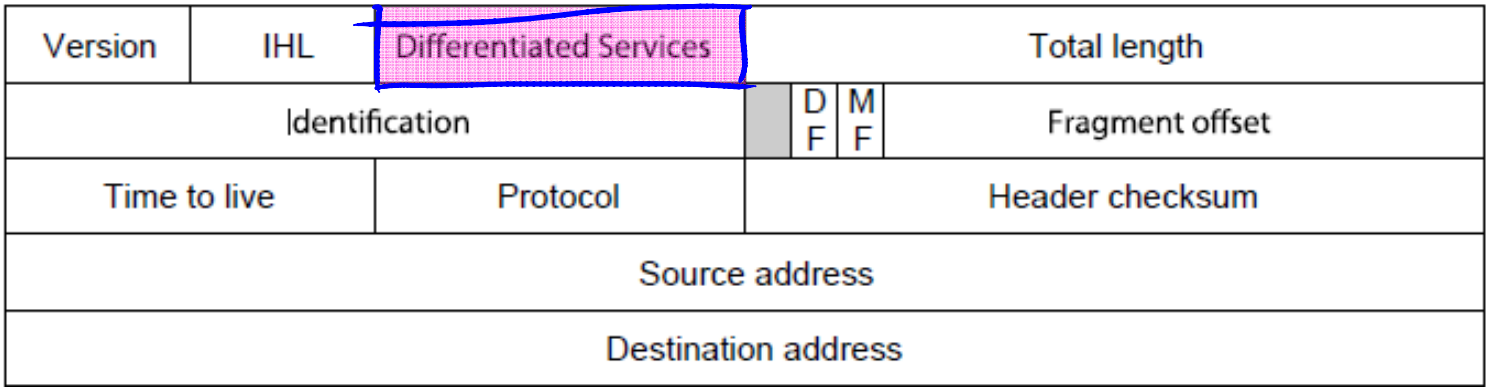
- Architecture:
  1. User marks packet with desired service (e.g., Skype=GOLD)
  2. Network polices traffic levels at boundary (token bucket)
  3. Network provides different forwarding (WFQ at routers)



1. Marking Packets

- Use bits in IPv4/IPv6 header to mark the kind of service
  - 6-bit DSCP (Differentiated Services Code Point)

IPv4 Header



Marking Packets (2)

- Many possible DSCP markings for different service/apps
  - Supported services depend on configuration of network

Service Name / Meaning	DSCP Value	Traffic Need (App example)
Default forwarding / Best effort	0	Elastic (BitTorrent)
Assured forwarding / Enhanced effort	10-38	Average rate (streaming video)
Expedited forwarding / Real-time	46	Low loss/delay (VoIP, gaming)
Precedence / e.g., Network control	48	High priority (Routing protocol)

Marking Packets (3)

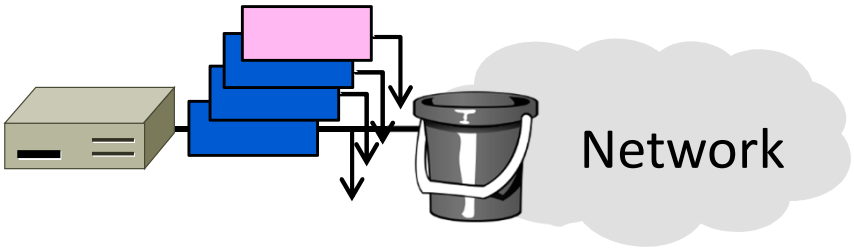
- Traffic is marked by user
  - Depends on local policies, e.g., gaming = expedited?
- May be done as part of host
  - Let OS or app classify their traffic
- May be done inside the network
  - Using heuristics, such as ports

2. Policing Packets

- Network (ISP) checks incoming traffic meets service contract
  - Not more expedited traffic than agreed (and paid for!)
  - Only allowed markings, e.g., no network control from users

Policing Packets (2)

- Policing is done with token bucket
  - Can demote "out of profile" traffic by re-marking (e.g., to default / best effort) or prioritizing for loss

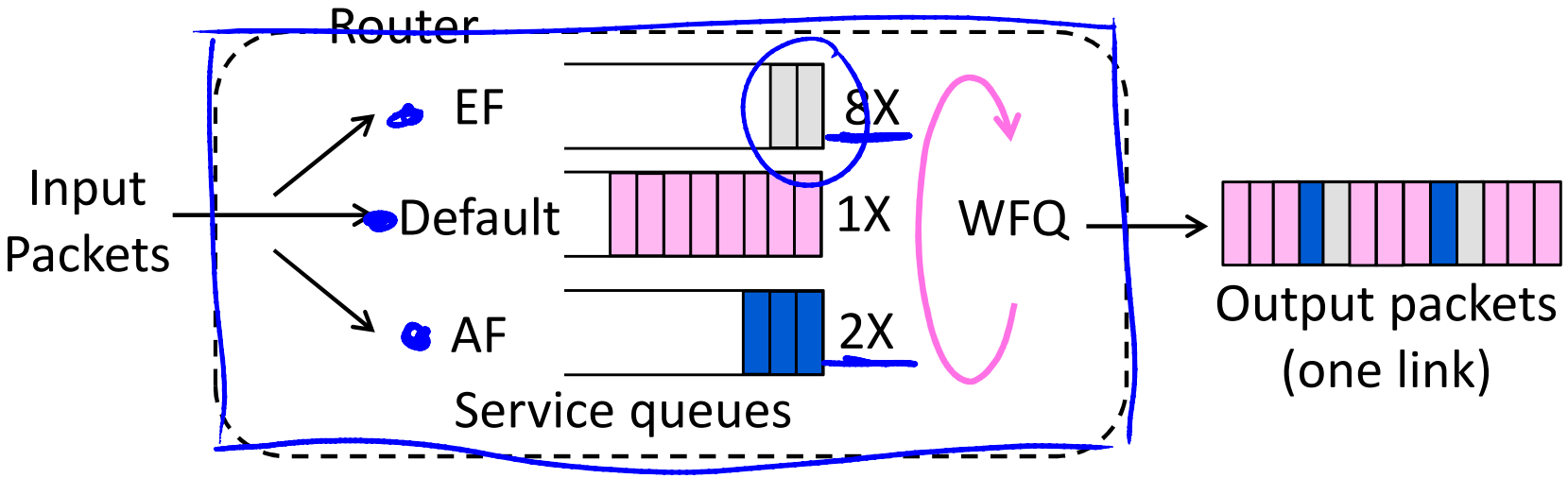


3. Forwarding Packets

- Network (ISP) routers use WFQ (and more) instead of FIFO
- The different kinds of service are the different flows/queues
- DSCP values are used to map packet to the right flow/queue

Forwarding Packets (2)

- Services are defined as “per hop behaviors”
  - No guarantee for end-to-end service through a network
  - Need small amounts of high priority traffic for good service



Deployment

- QOS provides value when it is deployed across the network
  - Not much use if only your ISP!
- QOS is tightly tied to pricing
  - "All my packets are high priority"
- Makes deployment slow/difficult …

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