Integrated Service (IntServ)

versus

Differentiated Service (Diffserv)

Information taken from Kurose and Ross textbook " *Computer Networking – A Top-Down Approach Featuring the Internet*"

Integrated Service (IntServ)

- IntServ framework was developed within IETF to provide individualized QoS guarantees to individual sessions.
- provides services on a *per flow basis* where a flow is a packet stream with common source address, destination address and port number.
- IntServ routers must maintain per flow state information.

IntServ

- two key IntServ features:
  - Reserved Resources
    - the router must know the amount of its resources currently reserved for on-going sessions.
    - standard resources: link capacity, router buffers
  - Call Setup
    - A flow requiring QoS guarantees must be able to reserve sufficient resources at each router on path to ensure QoS requirements are met.

Call Setup details

- Call Setup *{also referred to call admission}* requires participation of each router on the path.
- steps in call setup process
  - Traffic characterization and specification of QoS
    - Rspec (R for reserved): defines the specific QoS being requested by a connection.
    - Tspec (T for traffic):characterizes the traffic the sender will be sending into the network or the traffic that the receiver will be receiving from the network.

Call Setup details

- Signaling for call setup
  - A session's Tspec and Rspec must be carried to the routers where resources will be reserved.
  - RSVP is the signaling protocol of choice.
- Per-element call admission
  - Once a router receives Rspec and Tspec for a session, it decides whether or not to admit the call.

IntServ traffic classes

1. Best Effort service
2. Controlled Load service
   - A flow receives a quality of service closely approximating QoS that flow would receive from an unloaded network element.
   - This is fine when the network is lightly loaded, but the service degrades quickly as network load increases.

Intserv traffic classes

3. Guaranteed Service [RFC2212]
   - Provides firm bounds on queueing delays that a packet will experience at a router.
   - A source's traffic characterization is given by a leaky bucket with parameters (r,b) and requested service is characterized by transmission rate, R. This characterization is requiring a forwarding rate R at each router and a bound on maximum queuing via the leaky bucket parameters.

Differential Service (DiffServ)

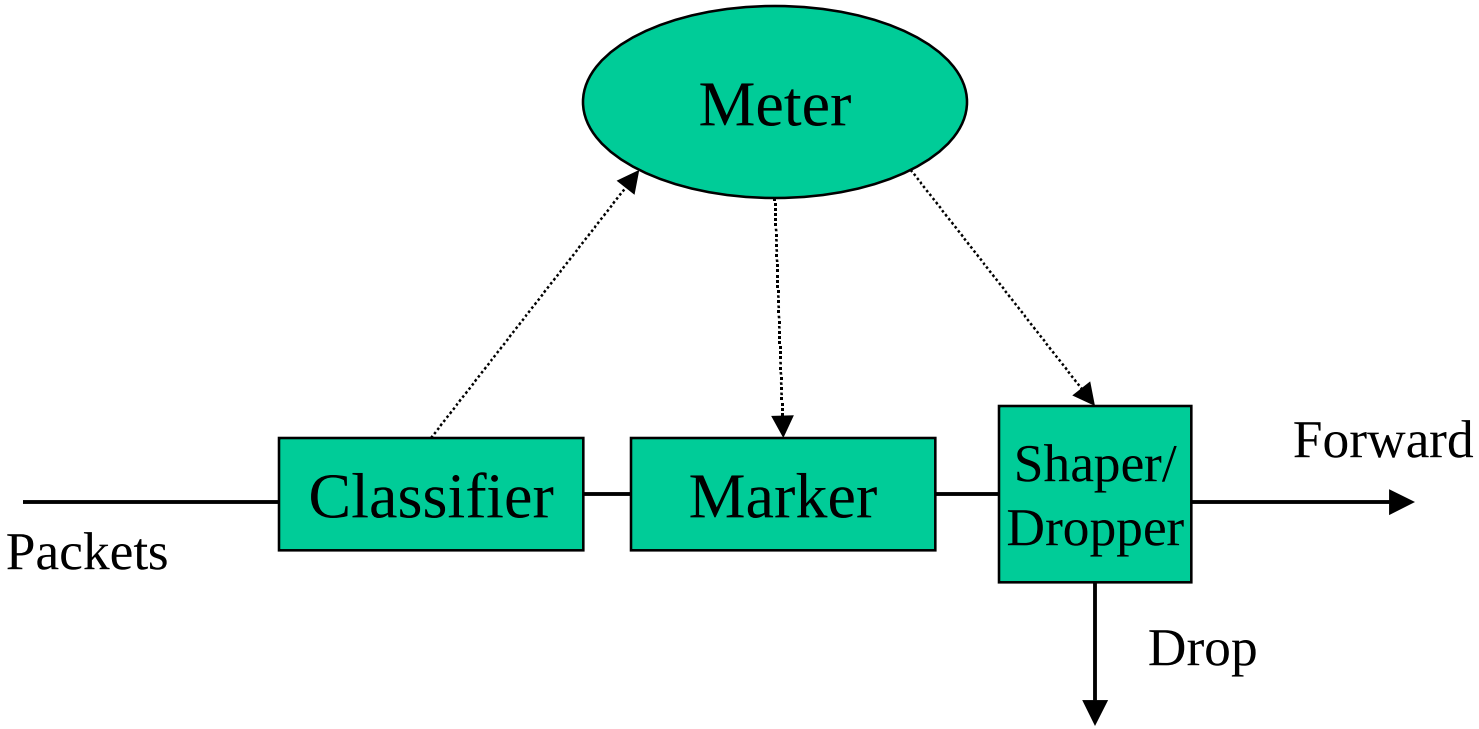
- In DiffServ, flows are aggregated into classes that receive “treatment” by class.
- More complex operations are pushed out to edge routers and simpler operations done by core routers.
- motivated by:
  - scalability, flexibility, and *better-than-best-effort service* without RSVP signaling.

DiffServ functional elements

- edge functions:
  - packet classification
  - packet marking
  - traffic conditioning
- core functions:
  - forwarding based on *per-hop behavior* (PHB) associated with packet's class

DiffServ edge functions

- packet classification
  - classifier selects packets based on values in packet header fields and steers packet to appropriate marking function
  - how classifier obtains the rules for classification not yet addressed [RFC 2475 uses term *behavior aggregate* rather than class of traffic.]
    - administrator could load table of source addresses
    - done under control of TBA signaling protocol



Logical view of packet classification and traffic conditioning at the edge router

DiffServ edge functions

- packet marking
  - DS field value set accordingly at the marker.
- may wish to limit injection rate of specifically marked packets into network, i.e., user promises to keep sending rate within a **traffic profile.**
- **metering function** compares the incoming packet flow with negotiated traffic profile.
  - This implies a **traffic shaper/dropper** function.

DiffServ core routers

- Routers define packet classes and separate incoming packets into classes.
- Treatment is done per class.
- Per-hop behavior (PHB) defines differences in performance among classes.
  - externally observable performance criteria that do ***not*** specify internal implementation mechanisms at router.

per-hop behavior (PHB)

- examples:
  - A given class receives at least 10% of outgoing link bandwidth over time interval.
  - Class A packets have strict priority over class B packets.
- current proposals for PHB:
  - Expedited Forwarding (EF) PHB
  - Assured Forwarding (AF) PHB

Expedited Forwarding (EF) PHB

- EF specifies that the departure rate of class of traffic from router must equal or exceed a configured rate *independently* of the traffic intensity of any other classes.
- This implies some form of isolation among traffic classes.

{EF abstraction: a link with a minimum guaranteed link capacity}

Assured Forwarding (AF) PHB

- Assured Forwarding divides traffic into four classes where each AF class is *guaranteed* some minimum resources (capacity, buffering).
- Within each class, packets are further partitioned into one of three “drop preference” categories. Congested routers then drop/mark based on their preference values.

Assured Forwarding (AF) PHB

- Determining resource allocation per class of service must be done with knowledge about traffic demands for the various traffic classes.