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 \textit{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.