QoS and QoE in the Next Generation Networks

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Quality of Service

- QoS for a network: different parameters such as bandwidth, latency, jitter, packet loss, packet delay
- for video applications: QoS is based on the bandwidth
- for VoIP: QoS is based on latency (end to end delay not larger than 200 ms)
- =>optimize delay, bandwidth, packet loss… but not all

- CoS (Classes of Service) classify the services in different classes.
- CoS manage each type of traffic with a particular way
- ETSI (European Telecommunications Standards Institute has introduced 4 CoS (Classe 1 : Best Effort, Classe 4: QoS guaranteed)
- QoE (Quality of Experience): subjective measure of a customer's for a supplied service
- Many SLA offers 3 CoS: Premium (max 15% of network resources), Olympic (max 80% of network resources) and BE

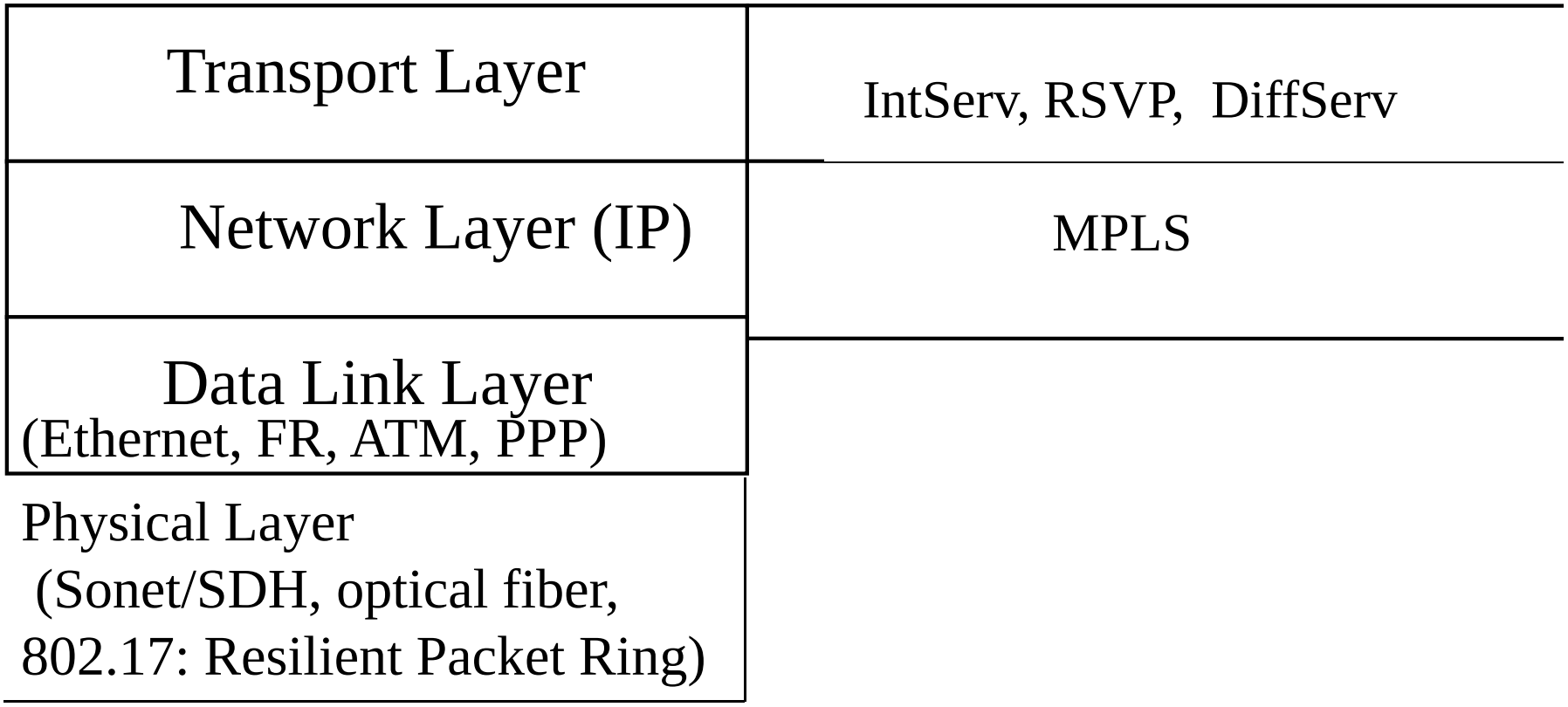
New Communication architecture

- Challenge : offer QoS in the Internet network
- Multimedia applications, VoD, IPTV for Internet will be developed and used when QoS mechanisms will exist
- New functions must be developed to guarantee performance, offer security, avoid jitter, allow the respect of time-constraints, ...

- Core of the network: architectures with signaling (SS7, X25/ATM, GSM, UMTS, NGN): QoS but expensive => UMTS 15000 $

- with no signaling (Arpanet, Internet 1st and 2nd generation, WiFi): no QoS, but cheap => Wi-Fi 100 $

- The control plane of ATM has been transferred to the IP layers
- IP: routing, signaling and the management of switching tables (20% traffic)
- ATM or Ethernet: only the fast forwarding at level 2 (80% traffic)


Transport Layer
IntServ, RSVP, DiffServ
Network Layer (IP)
MPLS
Data Link Layer
(Ethernet, FR, ATM, PPP)
Physical Layer
(Sonet/SDH, optical fiber,
802.17: Resilient Packet Ring)

MPLS (Multi Protocol Label Switching)

- Packet forwarding is based on labels
- Labels (4 octets) are assigned when the packets enter into the network
- The assignment of a packet to a FEC (Forwarding Equivalence Class) is done just once when the packet enters in the network at the ingress node, all packets with the same destination use a common route
- At the egress node, the label is removed
- The label is inserted between the layer 2 header and the IP header

IntServ

- Based on traffic control mechanisms
- Signaling protocol: RSVP
- Reservation at the router level
- Poor scalability: the amount of state increase proportionally with the number of flows
- Problems:
  - all routers must have RSVP
  - there is no policy for the reservation control
  - stations must support signaling

  => small networks

DiffServ

- DiffServ is a relative-priority scheme
- Signaling protocol: SLA
- Specify contracts for few traffic classes
- IP Packets are classified and marked at the network ingress routers to create several packet classes
- Type of service is marked inside each IP packet
- DiffServ scalability comes from the aggregation of the traffic
- Utilize aggregate classification state in the core of the network
- Share the bandwidth => hierarchy of the different flows

- Global Internet: GEO, MEO, LEO
- 3G: UMTS, CDMA2000, …
- 2G: GSM, GPRS, EDGE, PDC, …
- Hot Spots: WiFi
- PAN: Bluetooth, Ad Hoc, …
- Wired networks: ADSL, PSTN, …

- => Multimedia mobile applications will create an united common platform that incorporate different services.
- => QoS (time, bandwidth, reliability, …) and security problems within heterogeneous networks

QoS

- Terminals (batterie (hydrogen, supercondensator, …) , screen size, processor, ….)
- Blind spots
- Handover
- Each wireless networks offer different QoS

IEEE 802 wireless standards

- 802.15 WPAN, since 1999 (RFID, ZigBee, Bluetooth, UWB, Wimedia)
- 802.11 WLAN, since 1990 (WiFi)
- 802.16 WMAN, Wireless Local Loop, since 1999 (WiMax)
- 802.22 WRAN

- There is no single technology that can satisfy all needs . Family of complementary technologies and devices