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## Outline

- Introduction to QoS
- Metrics
- QoS Architectures
- IPv6 header & QoS
- Configuration Examples
- Conclusions

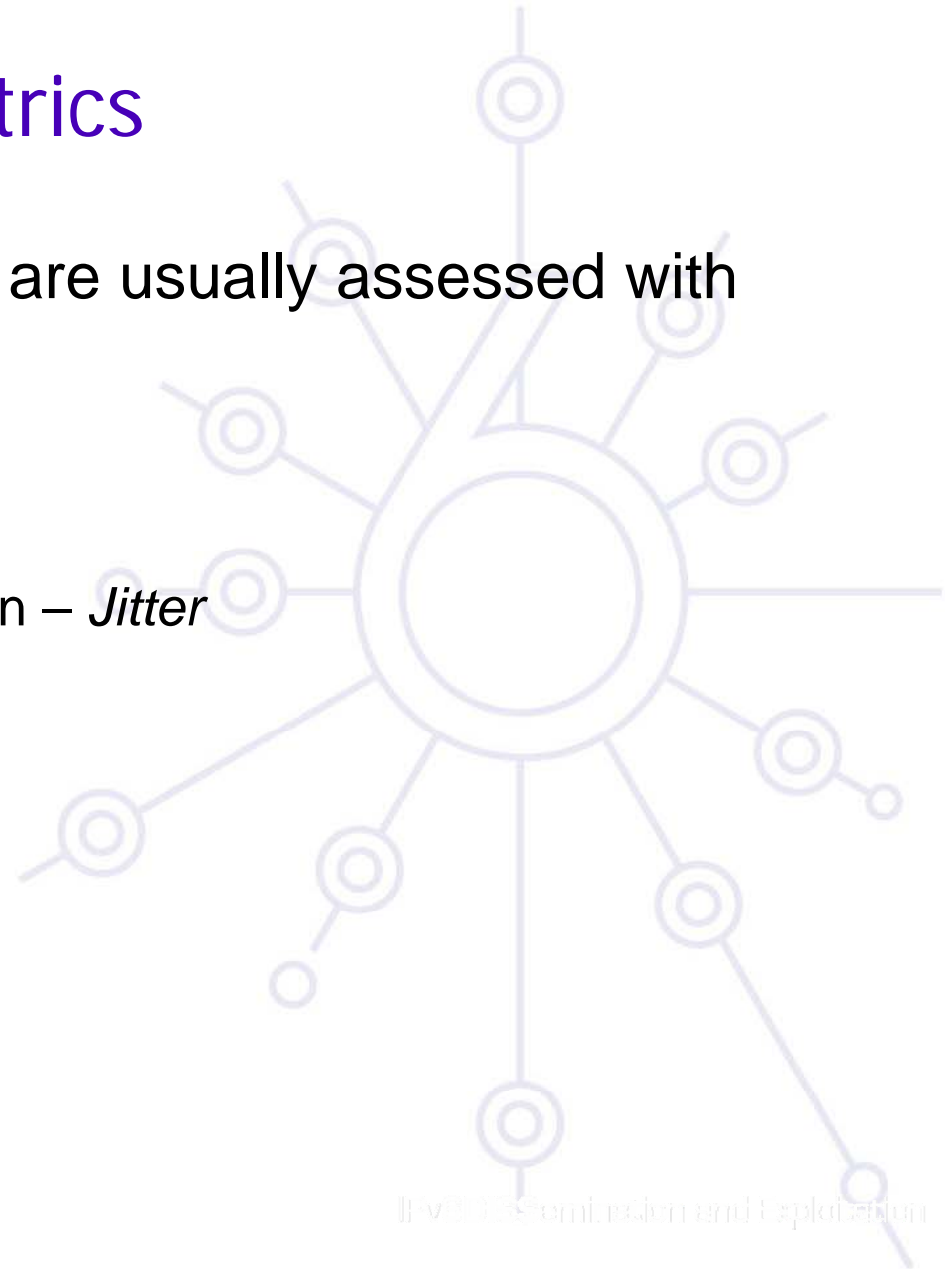


## Introduction to QoS

- QoS developments in IP networks is inspired by new types of applications:
  - VoIP, audio/video streaming, networked virtual environments, interactive gaming, videoconferencing, video distribution, e-commerce, GRIDs & collaborative environments, etc.
- **Quality-of-Service (QoS)** is a set of service requirements (performance guarantees) to be met by the network while transporting a flow.

# Metrics

- Performance guarantees are usually assessed with the next metrics:
  - Bandwidth
  - Delay
  - Inter-packet Delay Variation – *Jitter*
  - Packet loss

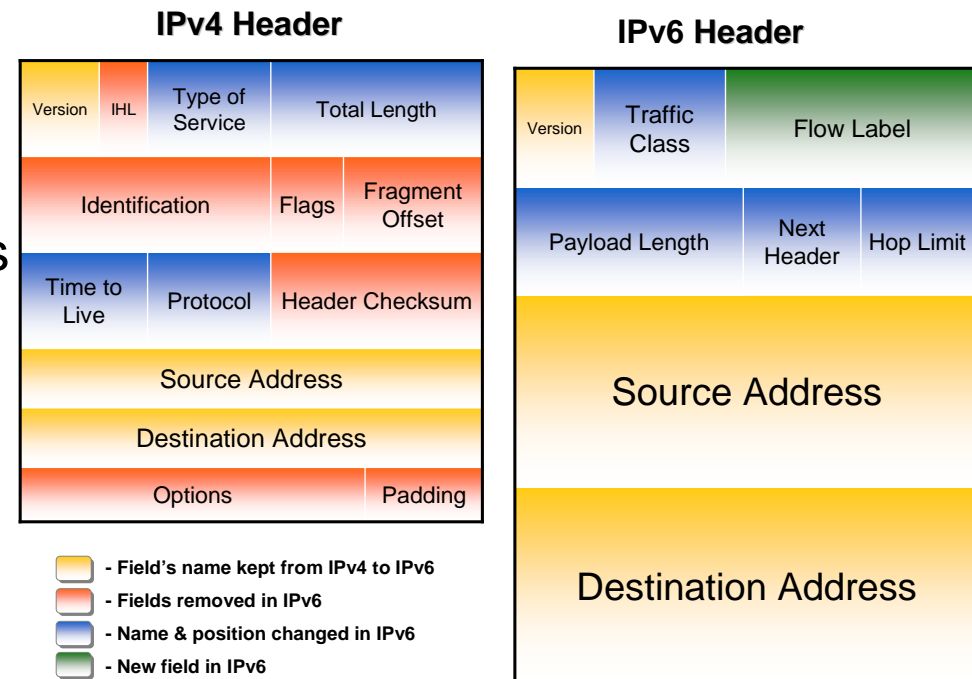


# QoS Architectures

- Best Effort Internet
- Integrated Services
  - Performance guarantees to traffic and resource reservations are provided on **per-flow** basis.
  - Guaranteed & Controlled Load Service
  - Scaling issues (per flow state information)
- Differentiated Services
  - Performance guarantees are provided to **traffic aggregates** rather than to flows.
  - Per-Hop Behaviours (PHB): EF & AF
  - Lack of any signalling protocol for resource allocation (admission control) and QoS mechanisms control.
  - Example of services: Premium, “Silver”, LBE

# IPv6 & IPv4 Header Comparison

- The IPv6 header is redesigned.
  - Minimize header overhead and reduce the header process for the majority of the packets.
  - Less essential and optional fields are moved to extension headers



IPv6 and IPv4 headers are not *interoperable*.



## QoS fields in IPv6 Header

- Traffic Class
  - An *8-bit* field used to distinguish packets from *different classes or priorities*.
  - Provides the *same* functionality as the ***type of service*** field in the IPv4 header.
- Flow label
  - A *20-bit* field defining the packets of the flow.
  - Selected by the source and never modified in the network.
  - Fragmentation or encryption is not anymore problem, as in IPv4.



## Configuration steps in MQC

- Define **Class Map**

- Separate traffic into classes based on access lists (ACLs), DSCP/ToS, MPLS EXP, protocol, etc. or combinations of those criteria

```
class-map [match-any | match-all] class-name
```

- Define **Policy Map (Service Policy)**

- Associate a class map with one or more QoS policies, e.g. bandwidth allocation, queue management, (re)-marking

```
policy-map policy-map-name
```

## Configuration steps in MQC

- Apply a **Service Policy** to an interface
  - Associate a policy map to an physical or logical interface at input or output.

```
service-policy {input | output} policy-map-name
```

## Configuration examples

```
class-map match-any ip_premium_out
  match ip dscp 46
  match ip dscp 47
  match ip dscp 40
  match mpls experimental 5
```

IP Premium  
classification  
*class-map*

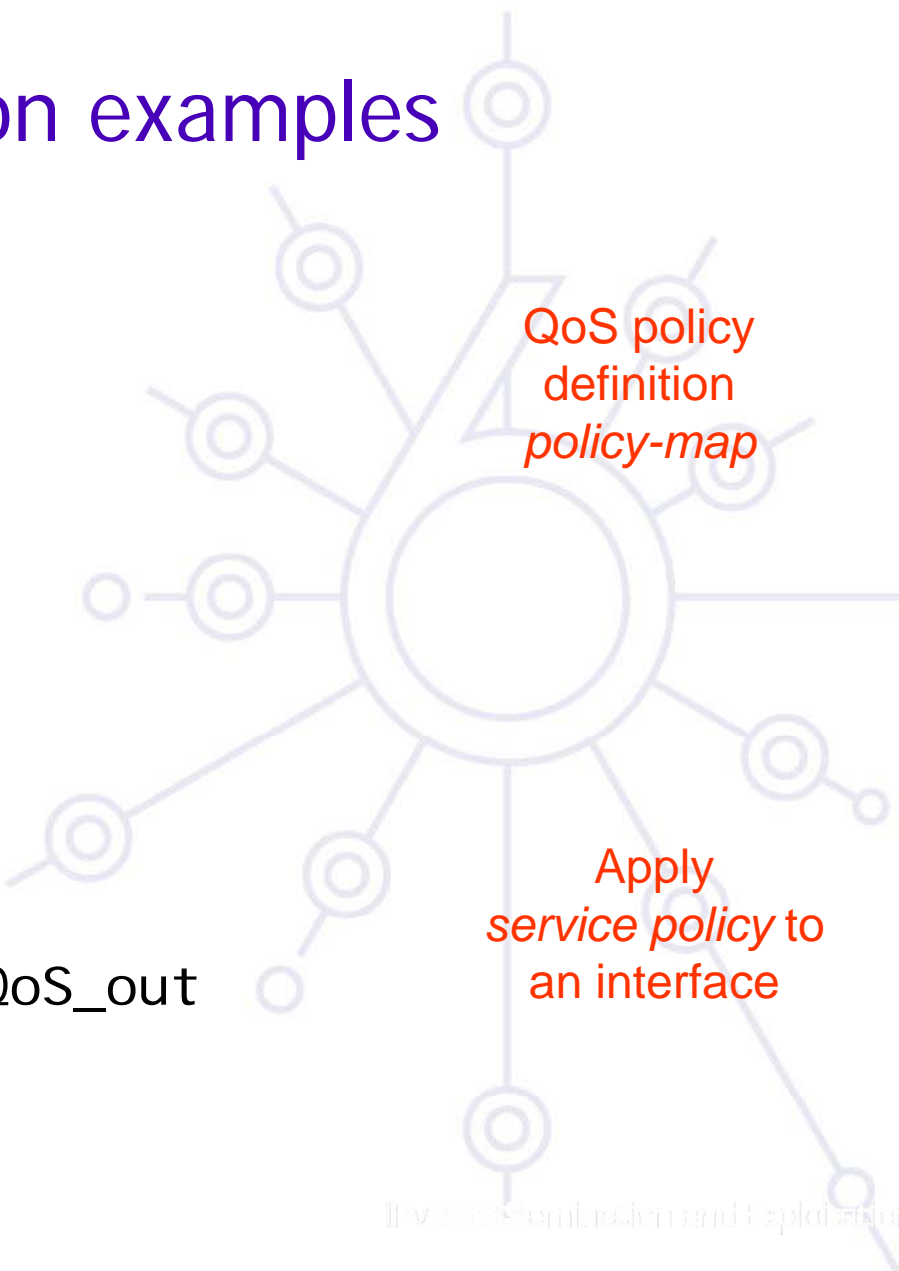
```
class-map match-any lbe_out
  match ip dscp 8
  match mpls experimental 1
```

LBE  
classification  
*class-map*

## Configuration examples

```
policy-map QoS_out
  class ip_premium_out
    priority
  class lbe_out
    bandwidth percent 1
  class class-default
    exit
  exit

interface POS 0/1
  service-policy output QoS_out
```



QoS policy  
definition  
*policy-map*

Apply  
*service policy* to  
an interface

## Conclusions

- The IPv6 protocol, in terms of QoS support, is **neither superior nor inferior** to IPv4 counterpart.
- The *flow label* field in the IPv6 header may ease provision of services in the future.
- There is no difference in the QoS configuration among IPv6 and IPv4 traffic.

## Revision Questions!

- What are the difference related to QoS between the IPv6 and IPv4 headers? Is there any improvement in the IPv6 and why?
- Shall we expect different performance guarantees for IPv6 and IPv4 traffic? Under which conditions?