ITU Regional Standardization Forum for Africa

Livingstone, Zambia 16-18 March 2016

Quality of Service (QoS) Provisioning in Interconnected Packed-based Networks

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1956 2016
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SUMMARY

- This presentation focuses on the ITU-T Recommendation Y.1545, mainly on the following:
  - QoS classes and related performance objectives for packet-based networks
  - Packet marking and
  - Packet handling mechanisms
- It focuses also on QoS in WiMAX Access Networks

INTRODUCTION

- Traditional IP networks have been built under the unguaranteed best-effort packet delivery;

- Best-effort delivery principle does not provide a reliable QoS in interactive voice telephony and other demanding real-time applications when network bandwidth limitations increase delay, jitter and packet loss.

INTRODUCTION (Cont.…)

- For QoS provision of Internet, two main architectures were developed:
  - Integrated Service (IntServ) and
  - Differentiated Service (DiffServ)

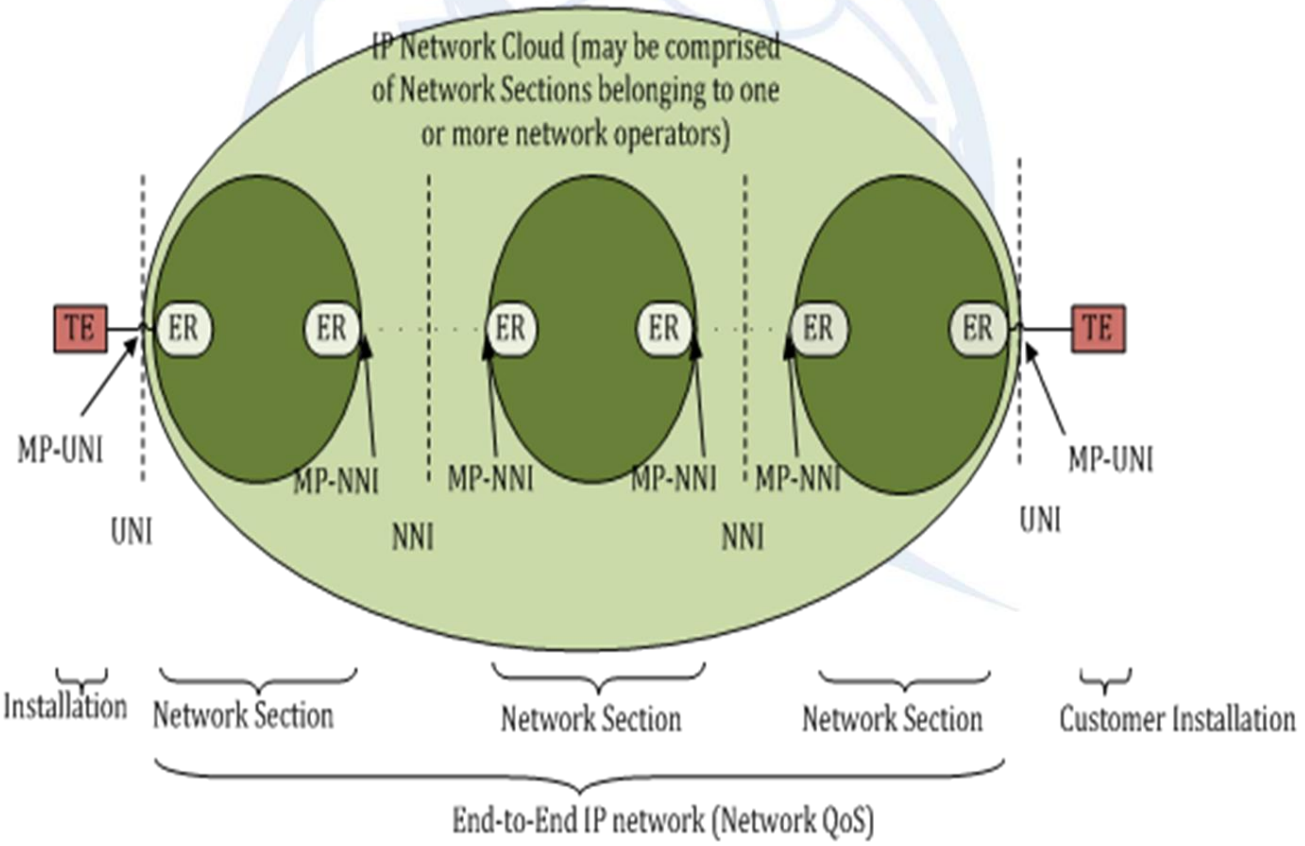
- This presentation focusses on DiffServ;

- DiffServ is a service model able to offer several levels of service by assuring different QoS needs;

- DiffServ divides the traffic into a small number of classes and treats each class differently

REFERENCE ARCHITECTURE

The performance objectives are measured over packets in a population of interest that enter a source UNI and exit through a destination UNI. Ref. ITU-T Rec. Y.1545.



QOS CLASSES AND NETWORK PERFORMANCE OBJECTIVES

Guidance on QoS classes and related performance objectives for packet-based networks is highlighted in this table Ref. [ITU-T Rec.Y.1541]

QoS Class	Service/Application	Network Performance Parameters		
		IP TD	IPDV	IPLR
Class 0	Voice over IP (VoIP) Video Teleconference (VTC) **Note 1:** PSTN Voice quality	≤100 ms	≤50 ms	≤10–3
Class 1	Voice over IP (VoIP) Video Teleconference (VTC) **Note 2:** Satellite Voice quality	≤400 ms	≤50 ms	≤ 10–3
Class 2	Transaction data **Note 3:** Highly Interactive data (Signalling)	≤100 ms	U	≤10–3
Class 3	Transaction data **Note 4:** Interactive data (Business data)	≤400 ms	U	≤10–3
Class 4	Video streaming	≤1 s	U	≤10–3
Class 5	Traditional applications of Default IP networks	U	U	U

MAPPING OF DIFFERENT INTERCONNECTED NETWORKS

Mapping between DiffServ, MPLS and Ethernet [ITU-T Y.1545]

Packet network QoS class	Description	Layer 3 packet marking: DSCP (Diffserv Code Point)	Layer 2 packet marking		Applications
			MPLS (class of service)	Ethernet (priority code point)	
Classes 0, 1	Jitter sensitive	EF (Expedited forward)	5	5 (default) or 6	Telephony
Classes 2, 3, 4	Low latency	AF (Assured forward)	4, 3 or 2	4, 3 or 2	Signalling, interactive Data
Class 5	Best efforts	DF (Default forward)	0	0	Web browsing, Email

PACKET MARKING

- A single NNI or UNI carries traffic from several applications, intended for multiple packet network QoS classes.

- for the receiving network to apply the appropriate treatment to each packet in accordance with the desired packet network QoS class, packets are marked in an appropriate way by the sender.

- A specific QoS class is associated with its appropriate packet marking (e.g: diffserv code point) for QoS mapping purposes

PACKET HANDLING

- When a packet is received by an ISP/NSP (or carrier) for a supported packet network QoS class, the receiving network provider transports it according to the service level agreement it has established with the sender network provider.

- When multiple network sections are present in a UNI-to-UNI path, the transfer capacities available for each QoS class at the point of NNI should be considered and agreed upon between all network providers in the path.

PACKET HANDLING (Cont….)

- When a received packet is marked for a packet network QoS class that is not supported within the sender's service agreement with the receiving network service provider, then the receiving network provider should carry the received packet in another agreed class but with the sender's marking preserved.

- To avoid packet re-ordering, the packets belonging to the same flow are allocated to the same packet network QoS class and given the same treatment in network queues.

QUALITY OF SERVICE IN WIMAX NETWORKS

- WiMAX (IEEE 802.16) standards are designed and created as QoS support for internet in radio link connection,
- the traffic (packets) going inside the network are classified into different QoS classes

WiMAX QUALITY OF SERVICE CLASSES

Class of Priority	Application	WiMAX QoS Classes
0	VoIP & Streaming media with CBR traffic	UGS (Unsolicited Grant Service)
1	VoIP with variable bit rate	ertPS (Extended Real-Time Polling Service)
2	Streaming Media with VBR	rtPS (Real-Time Polling Service)
3	Non-real time application (file download)	nrtPS (Non-Real-Time Polling Service)
4	HTTP (Web browsing)	Best Effort

GUARANTEED END-TO-END QOS NETWORK

What is the need of providing end-to-end quality of service over a given wireless access network (e.g: WiMAX)?

QUALITY OF SERVICE METRICS

What are the QoS metrics in order to measure the QoS experienced by end users?:

- Throughput
- Delay
- Jitter
- Packet loss

Thank you for your attention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