IP Traffic Engineering
An introduction to
DiffServ, IntServ/RSVP, MPLS and VPN
A two day seminar

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Seminar Outline

1.- Routing protocols

1.1.- Definitions

1.2.- Interior Gateway Protocol (IGP)

1.3.- Exterior Gateway Protocol (EGP)

2.- Traffic Engineering

3.- Quality of Service (QoS)

3.1. - History

3.2. - QoS provisioning approaches

3.3. - QoS provisioning functionalities

4.- IP Differentiated Services (DiffServ)

4.1. - Concepts

4.2. - Basic operation

4.3. - Ingress agreements

4.4. - Ingress nodes architecture

- Classifier

- Traffic conditioner

- In-profile traffic

- Out-of-profile traffic

- Routing and forwarding

- Queue selector

4.5. - Core nodes architecture

4.6. - DS field

- IPv4 - TOS field

- IPv6 - TC field

- DS field

- Code points

4.7. - Per Hop Behavior (PHB) groups

- Class selector

- Expedite Forwarding (EF)

- Assured Forwarding (AF)

5.- IP Integrated Services (IntServ) and Resource Reservation Protocol (RSVP)

5.1. - Architecture elements

5.2. - Classes of service (IntServ)

- Guaranteed Service (GS)

- Controlled Load Service (CLS)

5.3. - Signaling protocol (RSVP)

- Overview

- Basic operation

- Resource reservation phase

- Unicast

- Multicast / multiparty

- reservation merging

- reservation sharing

- merging vs. sharing

- filtering

- Data transfer phase

- Packet / message formats

- RSVP objects

- PATH message

- RESV message

- Conclusions

6.- Admission control (Policy enabled networks)

6.1. - Architecture

6.2. - Basic Operation

6.3. - Management models

- LPDP

- Outsourcing model

- Provisioning model

7.- IntServ vs. DiffServ

8.- Routing vs. forwarding (in the IP world)

8.1. - Definitions

8.2. - Routers evolution

- Serial processing

- Parallel processing

- Processing along a route

- Label switching

- concept

- assumptions

- route calculation

- main initiatives

9.- Multi Protocol Label Switching (MPLS)

9.1. - Benefits

9.2. - Concepts

9.3. - Basic operation

- Definitions

- Ingress router tables

- Transit router tables

- Label stacking

- Typical applications

- simplifying IGP routes

- replacing BGP on interior routers

- VPN

9.4.- Label encoding

- Label format

- label stack entry

- label stack

- Identifying labeled packets

- Identifying layer 3 protocol

9.5.- LSP path determination and signaling

- Label Distribution Protocol (LDP)

- operation parameters

- distribution mode

- retention mode

- distribution control mode

- most used combinations

- peer to peer session

- Traffic engineering

- RSVP-TE and CR-LDP

- common features

- explicit routes

- QoS requests

- LSP preemption

- LSP modification

- RSVP-TE

- CR-LDP

- CSPF - Constrained Shortest Path First

- The problem

- The solution

- Service model

- IGP extensions

- Traffic Engineering Database (TED)

- User defined constraints

- CSPF algorithm

- Offline vs. online (CSPF) path calculation

10.- Virtual Private Networks (VPN)

10.1.- Introduction to VPN

- VPN types

10.2.- Layer 3, BGP/MPLS based VPN

- Terminology

- Route Distinguisher (RD)

- the problem

- the solution

- distribution

- Basic operation - routing information exchange

- Basic operation - data flow

10.3.- Layer 3, VR(Virtual Routers)/MPLS based VPN (overview)

10.4.- Layer 2 / MPLS based VPN (VPLS)

10.5.- Summary

10.6.- Layer 2 based VPN

- Point to Point Protocol (PPP)

- frame formats

- communications phases

- Tunneling

- the problem

- compulsory tunneling

- voluntary tunneling

- Tunneling protocols (list)

- PPTP

- L2F

- L2TP

10.7.- IP Sec based VPN

- IP Sec basics

- Authentication and integrity check principles

- AH - Authentication Header protocol

- ESP - Encapsulation Security Payload protocol

- IKE - Internet Key Exchange protocol