

Deployment Experience With Differentiated Services

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Questions?

Agenda

- **Introduction**
- **Facts about Diffserv deployment**
- **Inhibiting factors**
- **Catalysts for further deployment**
- **Discussion**

Introduction

- **Definitions of QoS**

Application-based (e.g. can I get required latency with acceptable probability)

Mechanism-based – the use of policers, non-FIFO queues etc. to provide differentiation among classes

- **Mechanisms are of interest here**

If overprovisioning alone meets needs of applications, present and future, QoS R&D should be abandoned

Traffic engineering mechanisms not defined as QoS

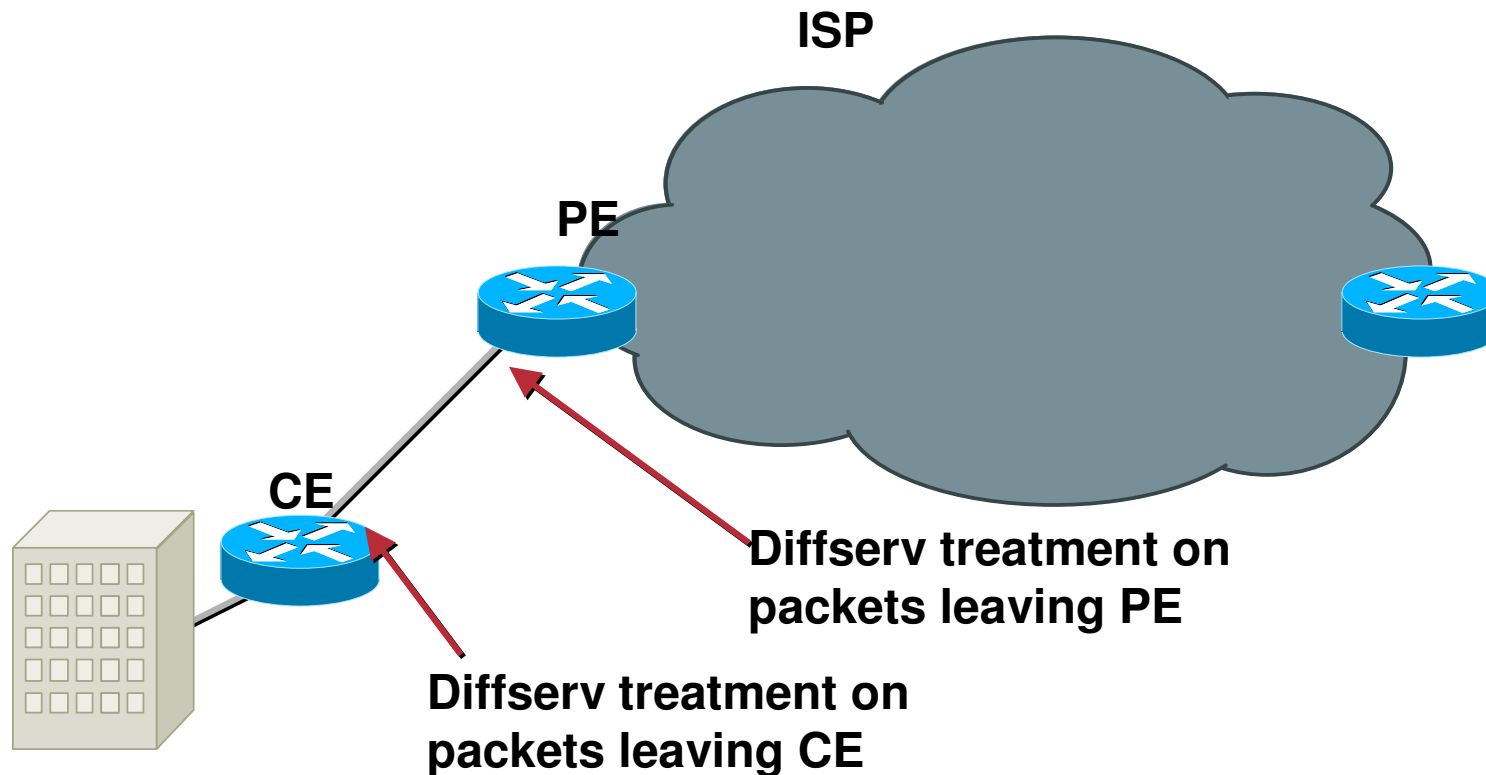
Diffserv deployment

- **In the Internet core, essentially none**
- **There are a lot of IP networks besides the public Internet!**
- **IP-based VPNs**
 - RFC2547 (MPLS/BGP)**
 - IPSEC-based**
- **Enterprise networks**
- **Public VOIP networks**

Diffserv deployment – IP VPNs

- **RFC2547-style and IPSEC-based VPNs**
- **Edge bandwidth is expensive enough to warrant complexity of diffserv – don't want to buy enough BW to provide voice-like QoS to all traffic**
 - No need to run bulk data at 30% utilization**
 - Relative burstiness of data makes matters worse**
- **Service often competes with/replaces Frame Relay (w/ CIR), so QoS expected**
- **About 200 providers running 2547 – a few dozen doing diffserv (but they are big)**

Diffserv on the edge



Observation: easier to get packets marked correctly for CE→PE than for PE→CE

Diffserv deployment – Public VOIP

- **Telecom Italia the most notable provider publicly announcing use of VOIP for consumer telephony**
 - **Most of the public telephony in Italy now on the same IP network as IP-VPNs**
- **Consistent policy is easy – VOIP gateways set DSCP, police at the edges**
- **No interprovider issue (today)**

Diffserv deployment – Enterprise

- **VOIP in enterprise is very cost effective when sites are interconnected by expensive links (leased lines, FR, etc.)**
- **Relatively easy to get packet marking right**
phones, gateways set DSCP
police edges at “first hop”
- **Less reason to deploy QOS within the campus, but cost is low too (given that marking & policing was already needed)**

Diffserv (non-)deployment – ISP edge

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- **BW scarcity just as in VPN case, but many important differences too**

Not the same customer expectation of QoS – just starting to see single class SLAs (e.g. jitter guarantees)

Interprovider the norm

Unable to predict the set of communicating sites – thus hard to get consistent policy on inbound traffic

Inhibiting factors

- **Bandwidth glut**

Hard to justify any extra complexity when delay is minimal

Hard to sell multiclass QOS when the default class is excellent (especially when **competitors' default is sufficient for VOIP)**

- **Configuration/provisioning complexity**

e.g., how much BW should I allocate to an AF queue?

- **Possible mismatch between customer needs (e2e service) and what Diffserv does (PHBs)**

Less compelling argument if edge is where the congestion is

Why interprovider QoS is hard

- **For ISPs with global reach, interprovider QoS opens door to competition**
- **Customers can't easily predict which ISPs their traffic will traverse**
 - With whom do I negotiate my SLA?**
 - What speed of light delay will I see?**
- **No uniform service definition**
 - Prevents comparison shopping**
 - Unable to concatenate services from multiple ISPs**

Catalysts for further deployment

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- **BW glut subsides**
- **Development of customer demand**
- **Regional ISPs collaborate**
- **Standard service definitions**

Diffserv report card

- **Perfectly fine as far as it goes**
 - Well matched to enterprise and SP edge applications**
- **Admission control (e.g. RFC 2998) could increase its reach**
- **Provisioning remains a challenge**
 - “magic numbers” for utilization target**
 - Unpredictability of traffic matrix (cf. Frame Relay)**

Summary

- **Diffserv deployment more widespread than widely acknowledged**
 - Don't assume that the public Internet is representative
- **Biggest challenges for global QoS:**
 - Interprovider issues
 - Consistent application of QoS policy
 - Provisioning
 - Adoption of admission control where needed
- **Future research should focus on deployment hurdles, not new QoS mechanisms**