

# Proven IP Network Services: from End-User to Router and vice versa

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# Outline

## ■ Applications: the Centre of the QoS Offer

- end-user perception
- application modelling

## ■ Network Services: the Network Operator's Offer

- service level specification
- graphical user interface

## ■ Traffic Classes: the Engineering of IP Quality of Service

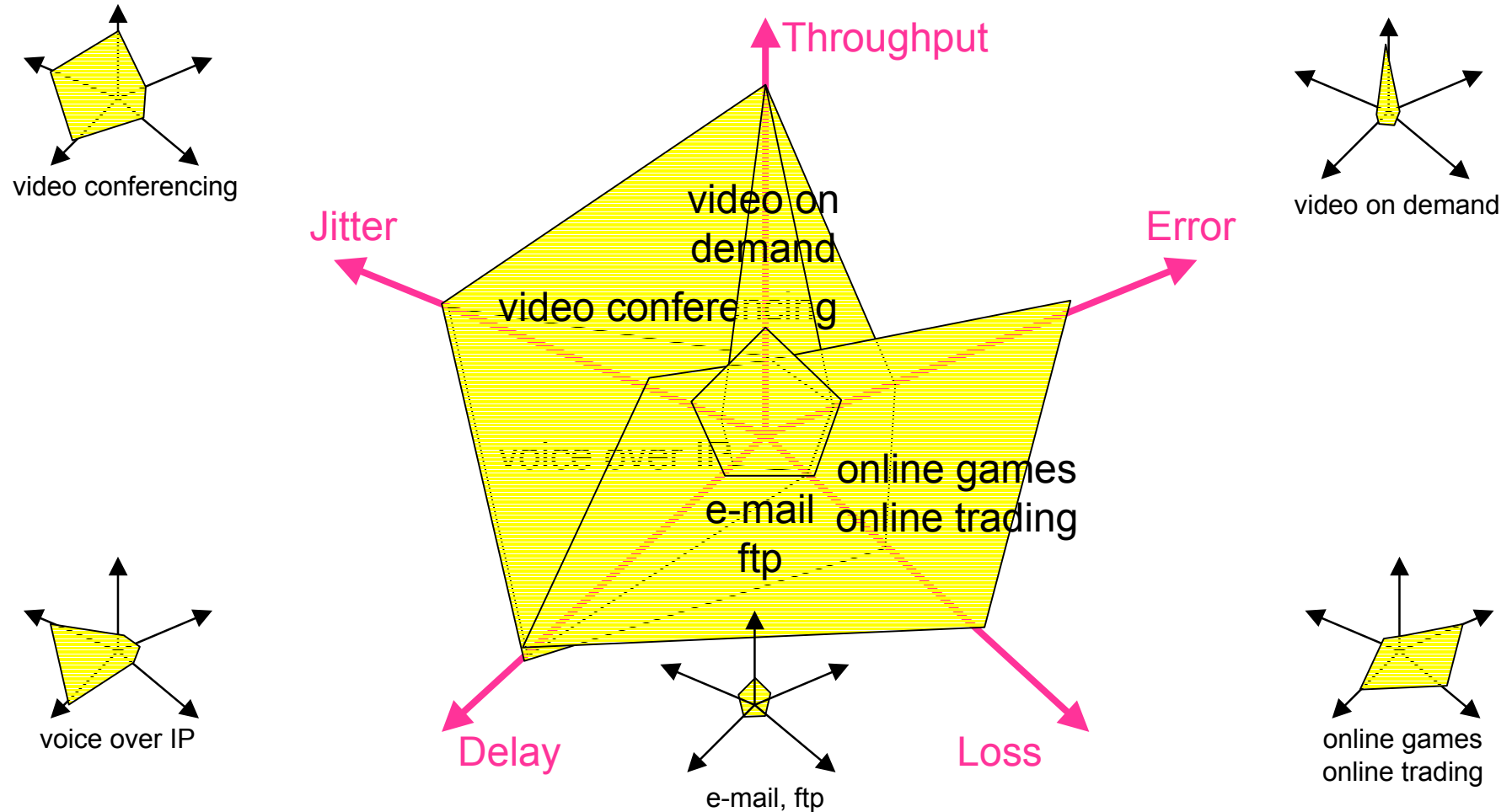
- router configuration
- network QoS parameters

## ■ Measurements: the Proof Technique at Network Level

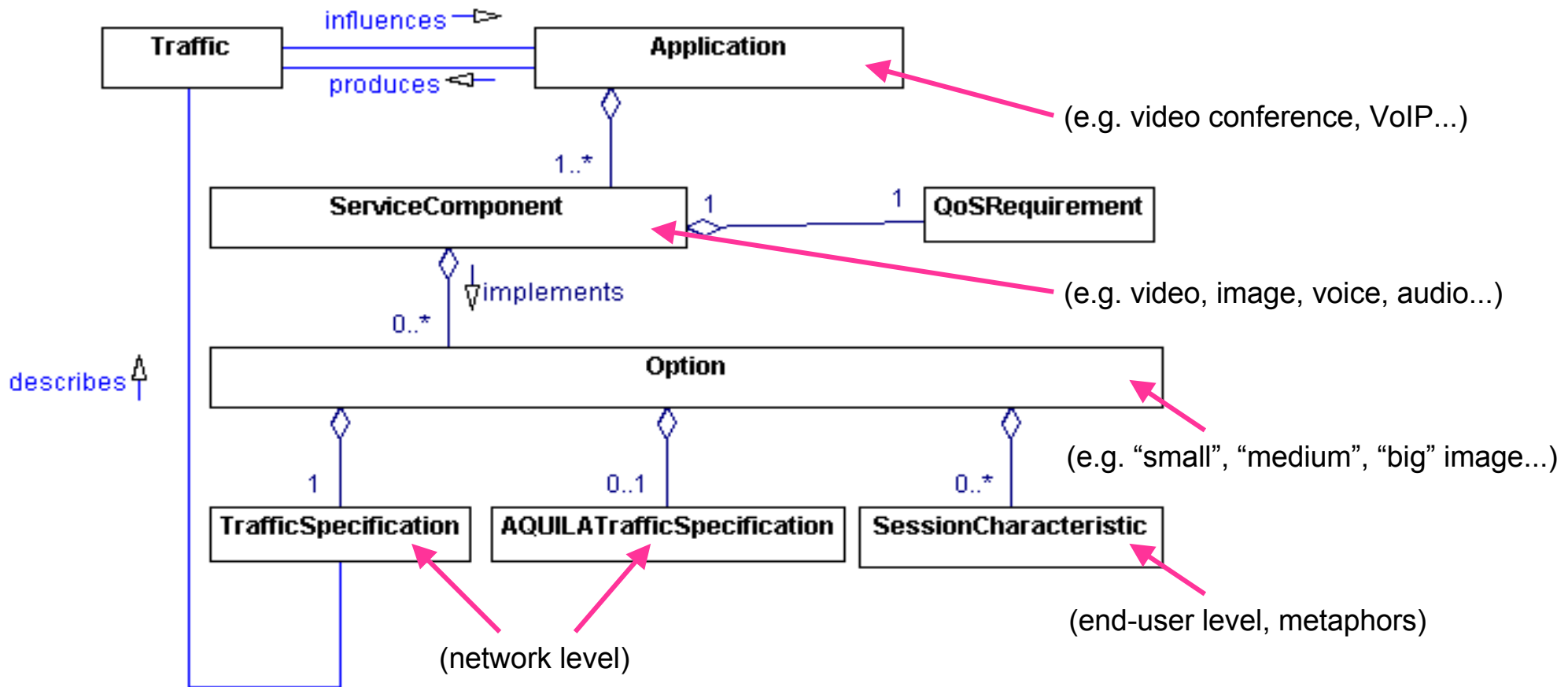
- distributed measurement architecture

## ■ Outlook and Summary

# QoS Parameter affecting Application Perception



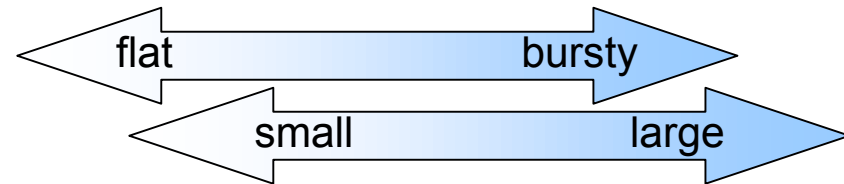
# Application Modelling



# Traffic Characterisation Alternatives

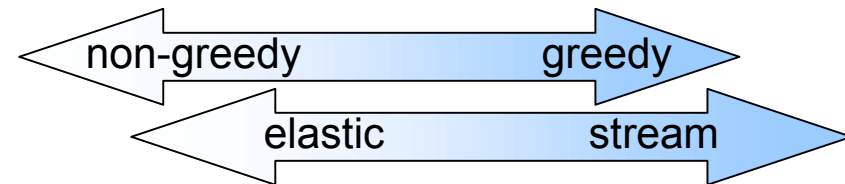
## ■ Traffic Packet Characteristics

- burstiness
- packet size



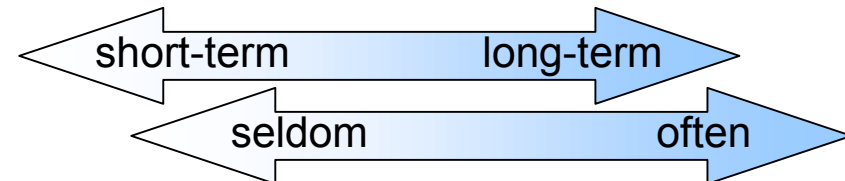
## ■ Traffic Flow Characteristics

- greediness
- elasticity

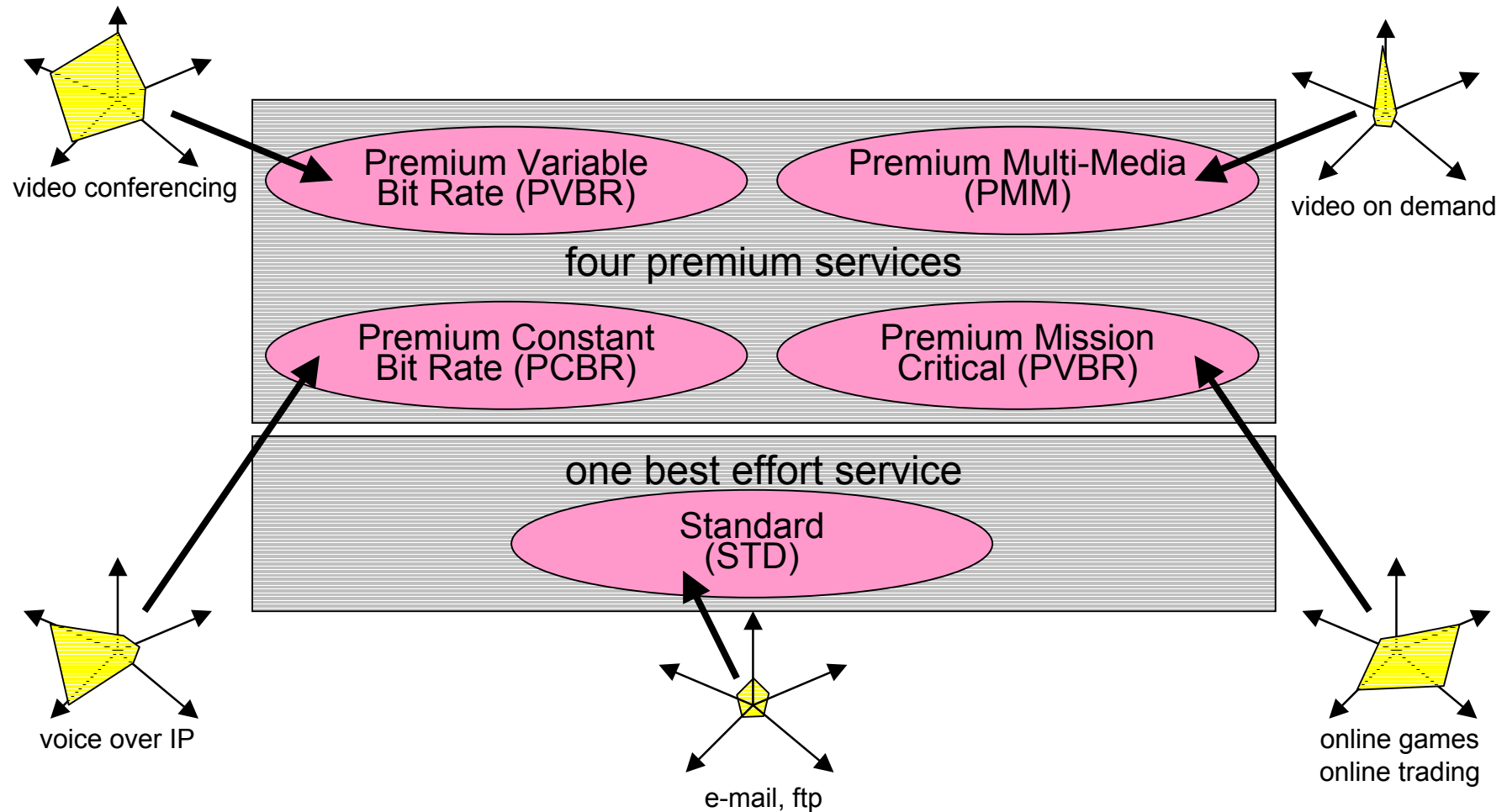


## ■ Schedule Constraints

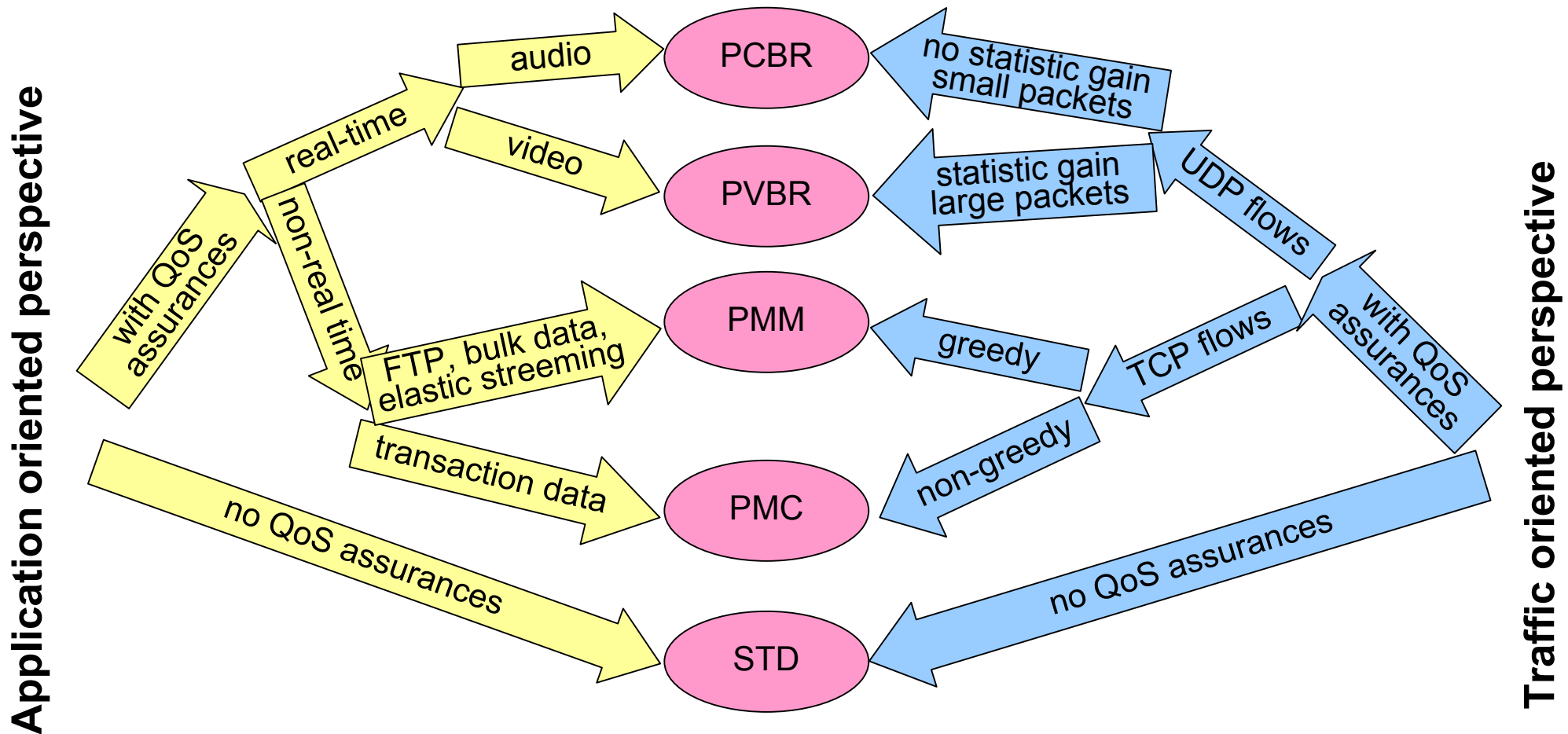
- life time
- frequency



# Limited Set of Network Services



# Network Services Landscape



# Service Level Specification for Reservation

## ■ Scope

- indicates the topology of ongoing reservation with reference to end-points of the traffic flow

## ■ Flow Indication

- focuses on the association between packet level and application level

## ■ Traffic Description/Conformance Testing

- describes the traffic relevant for the reservation

## ■ Performance Guarantees


- summarises the commitment of the network operator to fulfil the customer requirements


## ■ Service Schedule

- provides information regarding the start time and the service duration



# Reservation GUI: Application Selection

Address  http://141.76.72.202:8080/aquila2/jsp/ReservationGUI.jsp Go Links

*Welcome to the*  *Portal*

LOGGED IN

<b>NEW RESERVATION</b>		<b>CURRENT RESERVATIONS</b>	<b>RESERVATION HISTORY</b>	<b>LOGOUT</b>
<b>REGULAR</b>	<b>ADVANCED</b>			

**Application Identifiers**

Application Name:

Service Component:

**Network Service**

- ☒ Premium CBR
- ☐ Premium VBR
- ☐ Premium Multimedia
- ☐ Premium Mission Critical

# Reservation GUI: Service Level Specification

## Service Level Specification (SLS):

### Scope\*

- ☒ Point-to-Point
 ☐ bidirectional
   
☐ Point-to-Any
   
☐ Point-to-Many
   
☐ Any-to-Point

### Flow Identifiers: Source

IP Address	1.2.3.4
NetMask	255.255.255
Lower Port	0
Upper Port	0

### Destination

IP Address	2.3.4.5
NetMask	255.255.255
Lower Port	21
Upper Port	21

Protocol ID	DON'T CARE
DiffServ Code Point	0

OR Proxy: NONE

# Reservation GUI: Traffic Specification

## Traffic Specification

Peak Rate (bit/s)	<input type="text" value="0"/>
Bucket Size for PR (bytes)	<input type="text" value="0"/>
Sustainable Rate (bit/s)	<input type="text" value="0"/>
Bucket Size for SR (bytes)	<input type="text" value="0"/>
Min. Policed Unit (bytes)	<input type="text" value="0"/>
Max. (allowed) Packet Size (bytes)	<input type="text" value="0"/>
Max. Latency (ms)	<input type="text" value="0.0"/>
Max. Variation (% of delay)	<input type="text" value="0.0"/>
Max. Packet Loss Probability (%)	<input type="text" value="0.0"/>
Degree of Bandwidth Guarantee (%)	<input type="text" value="0.0"/>
Packetordering	<input type="checkbox"/>

Submit

Reset

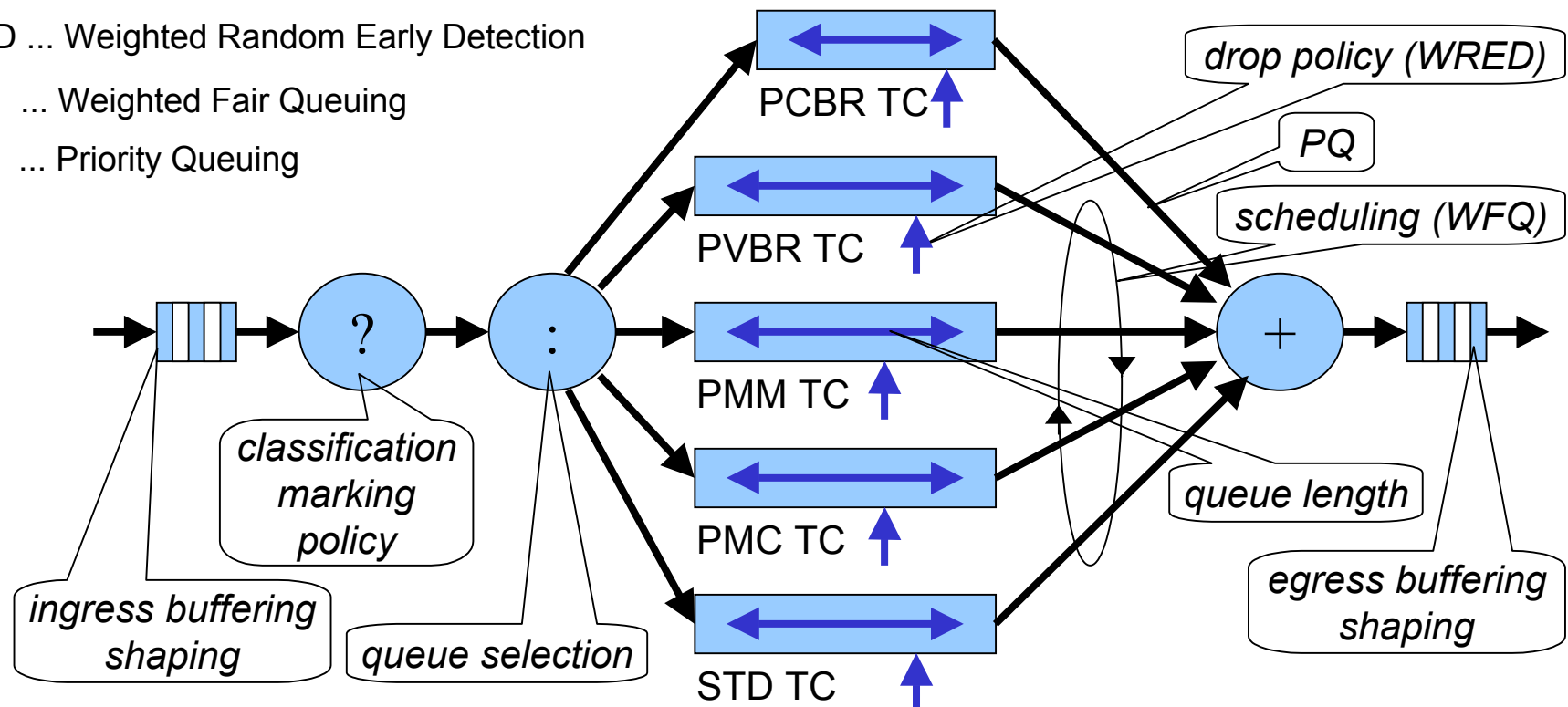
# Router Capability Exploitation

TC ... Traffic Class

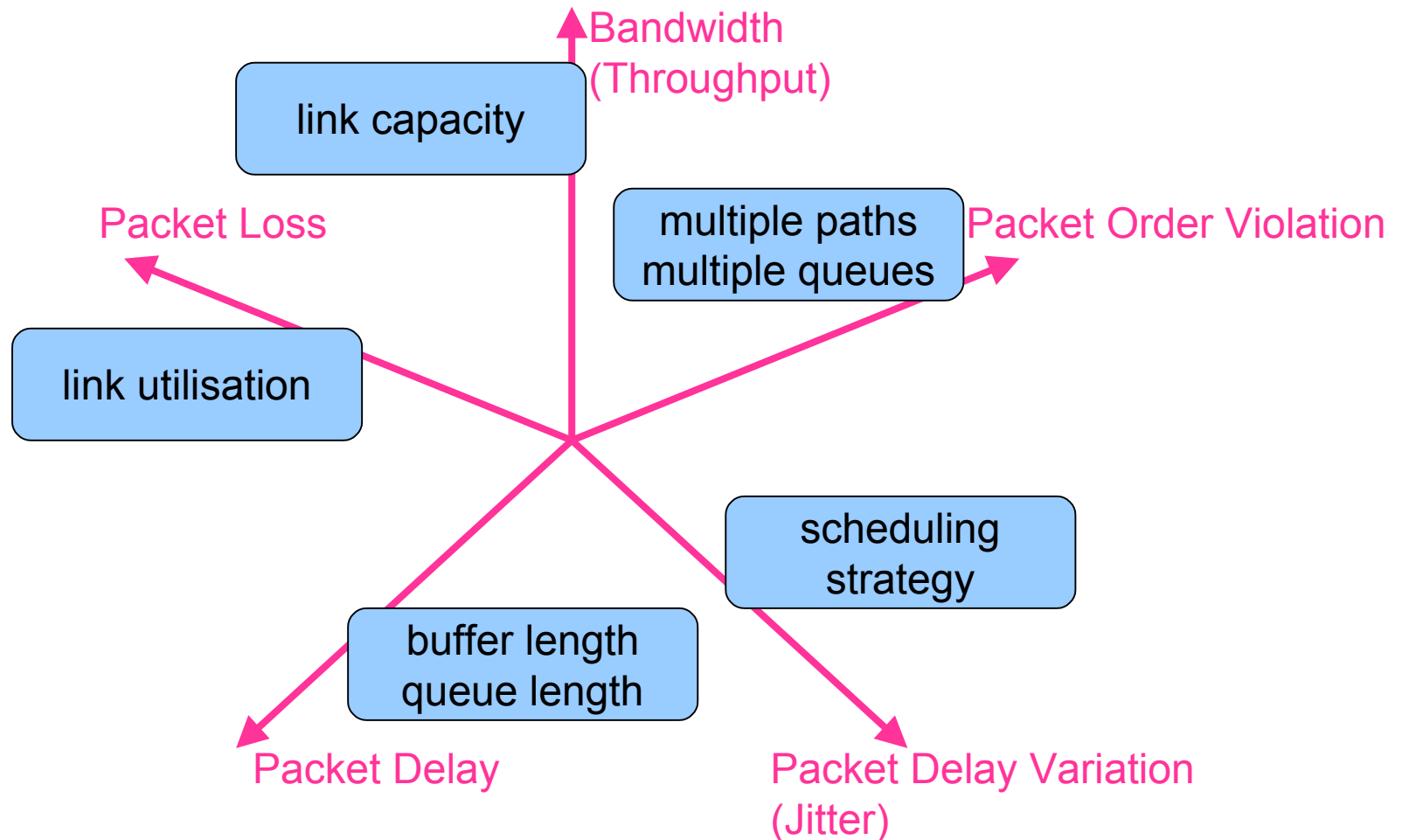
WRED ... Weighted Random Early Detection

WFQ ... Weighted Fair Queuing

PQ ... Priority Queuing



# Influence Factors on Network QoS Parameters



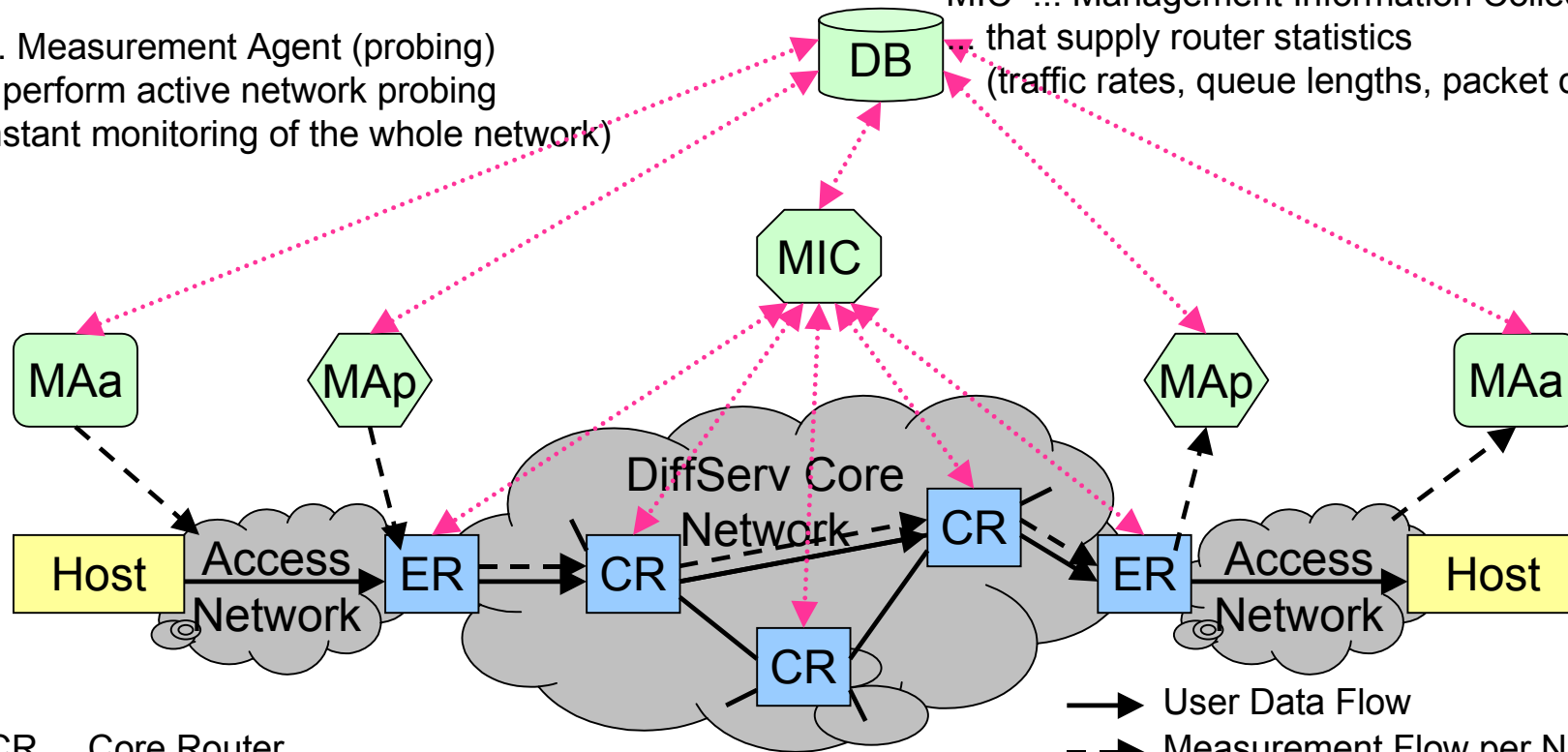
# Distributed Measurement Architecture

**MAa** ... Measurement Agent (application-like)  
... with traffic generators that produce application-like flows  
(reproducible experiments as opposed to real applications)

**MAp** ... Measurement Agent (probing)  
... that perform active network probing  
(constant monitoring of the whole network)

**DB** ... Database  
... stores configuration data and measurement results

**MIC** ... Management Information Collector  
that supply router statistics  
(traffic rates, queue lengths, packet drop counters)



**CR** ... Core Router  
**ER** ... Edge Router

→ User Data Flow  
--> Measurement Flow per Network Service  
..... Data Collection

# Outlook

## ■ Under Common Development

- support of “Globally Well-Known Services” for inter-domain QoS
- definition and support of “Application Profiles”
- selection of a QoS definition language
- development of enhanced measurement tools

## ■ Within the AQUILA Project

- pan-European trial with multiple domains
- verification of the enhanced architecture
- adaptation of Network Services

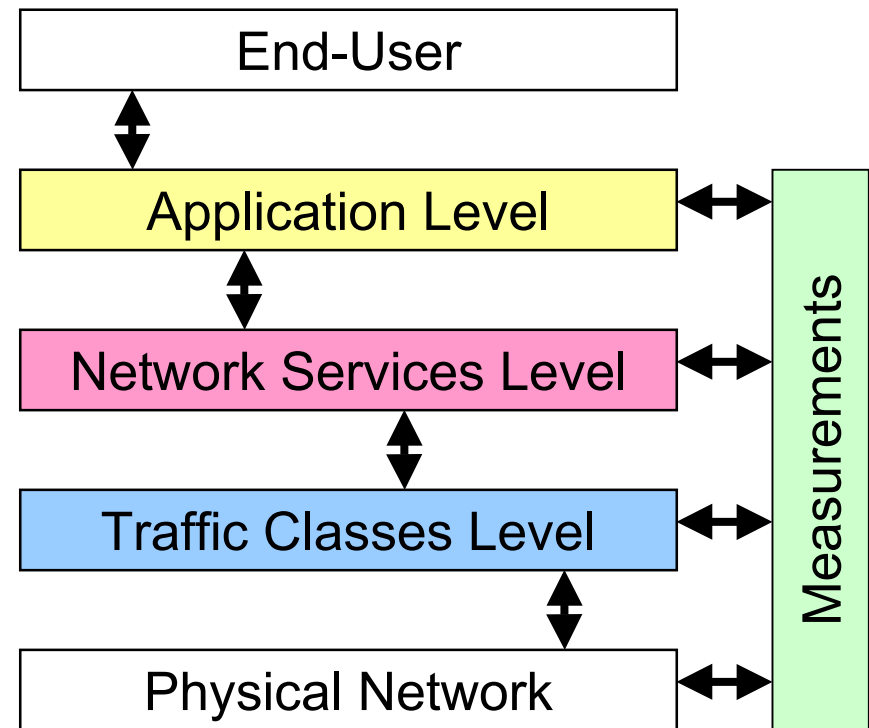
## ■ Further Information

- URL: <http://www.ist-aquila.org/>

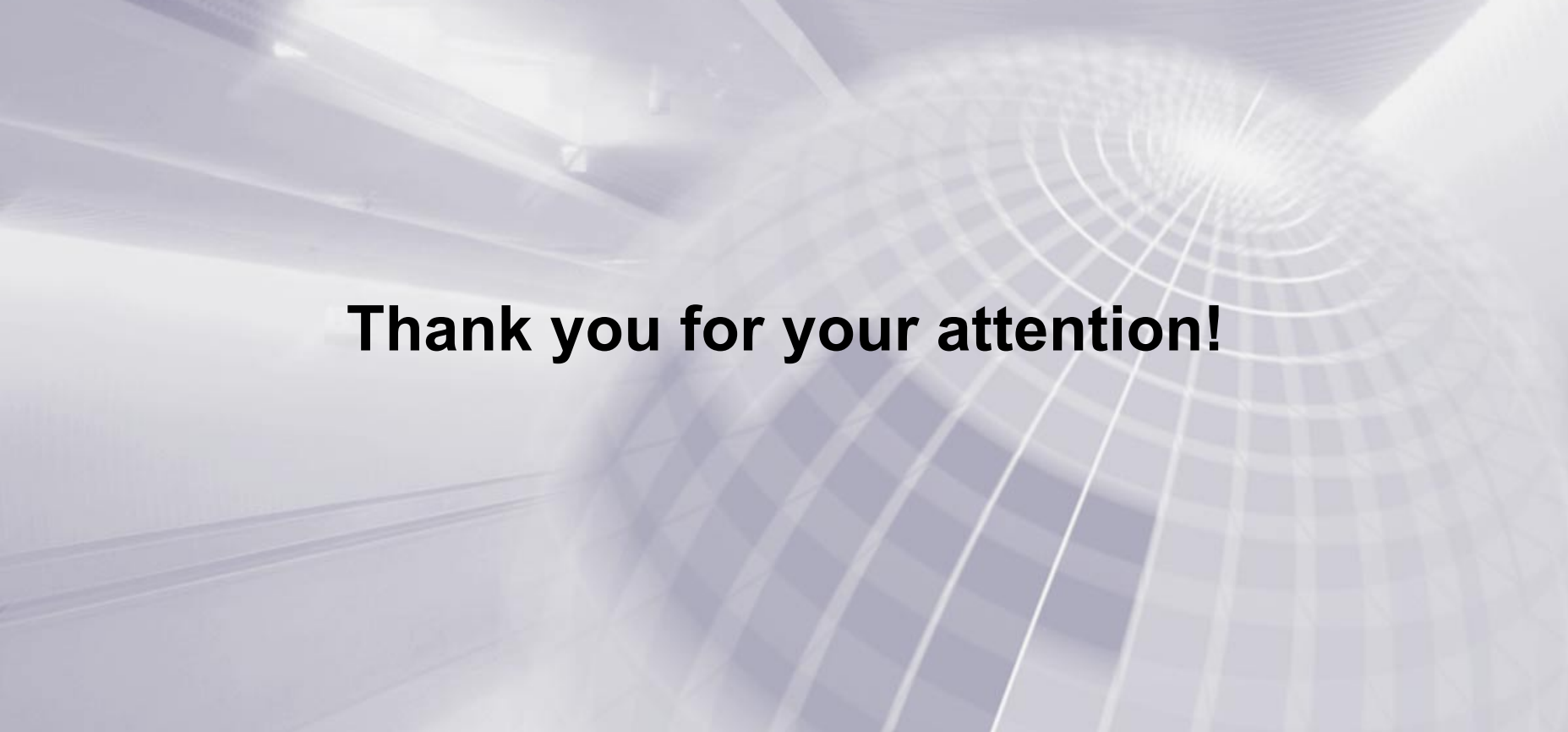
# Summary

## ■ A Level based Approach ...

- reflects the **Innovative** chain: customer  $\Leftrightarrow$  ISP  $\Leftrightarrow$  operator
- provides predefined services for **Internet** application support
- allows optimised network entity configuration **Computing**
- ensures the given guarantees by measurements
- supports a vertical and horizontal **System's** scalability





The background of the slide is an abstract image with a blue and white grid pattern that appears to be a dome or a large architectural structure, possibly a stadium or a modern building interior, with a bright light source creating a lens flare effect.

**Thank you for your attention!**