

## **A Practical Approach to E2E QoS Using Managed Impairment Accumulation**

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# Outline

- o Problem Statements
  - Users, Net Operators and Equip. Developers
- o Assumptions and Issues/Challenges
- o Current Assets brought to bear
  - Standardized Obj./Measurement/Estimation
- o Impairment Accumulation Process
- o Comparison of Alternative Approaches
- o Overlay on Standards Developments
- o Summary



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# Viewpoints of QoS

I need the network to:  
+ support my app, or  
+ meet my app's req.

I want my app. to work

**CUSTOMER**

Customer's QOS Requirements

QOS Perceived By Customer

**SERVICE PROVIDER**

QOS Offered By Provider

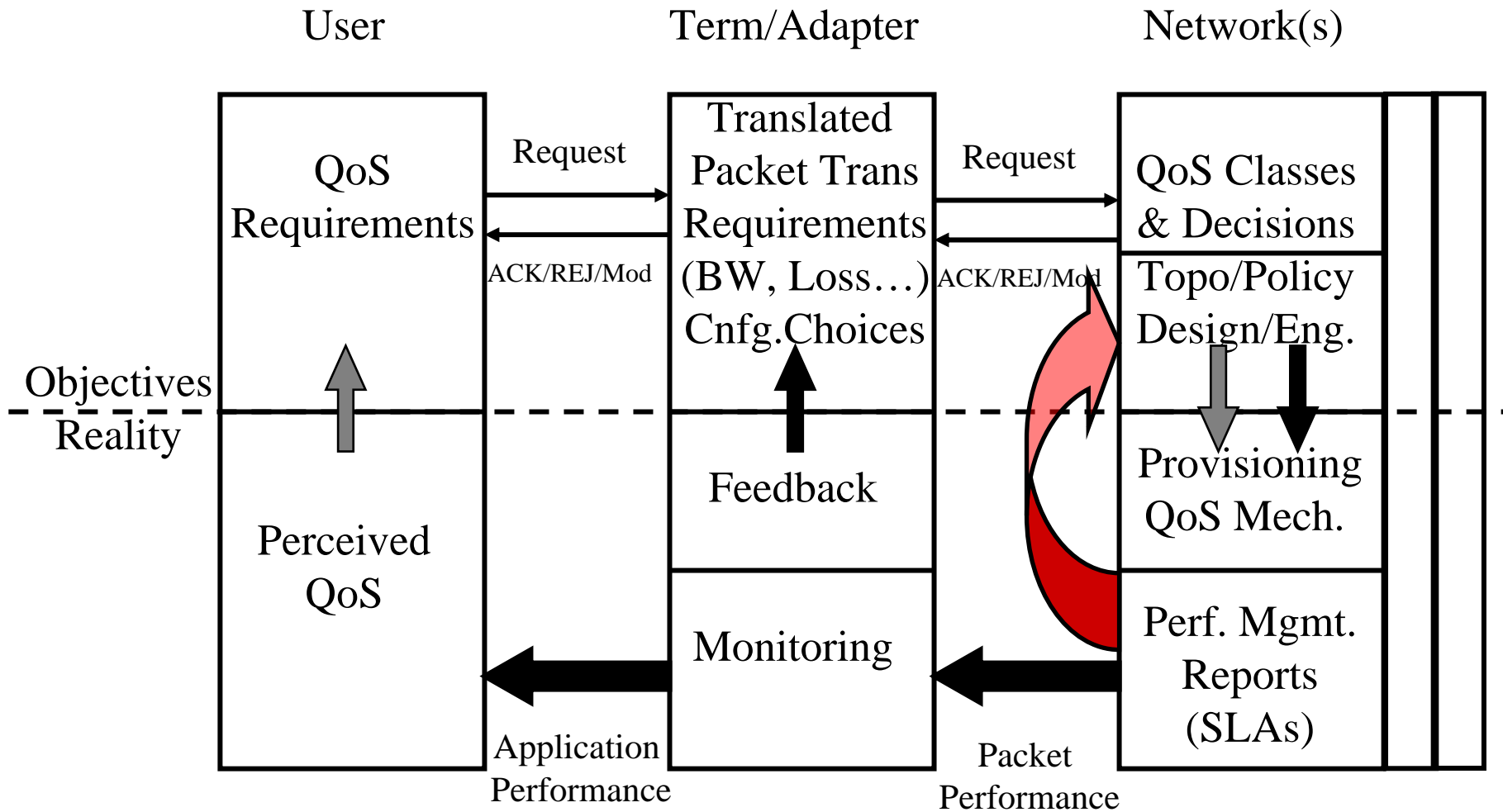
QOS Achieved by Provider

How can I meet the reqs? work with other SPs ?

Here's how we interpreted/satisfied your request within the network

From ITU-T G.1000

# QoS Agreements - Automated





# Assumptions and Issues/Challenges

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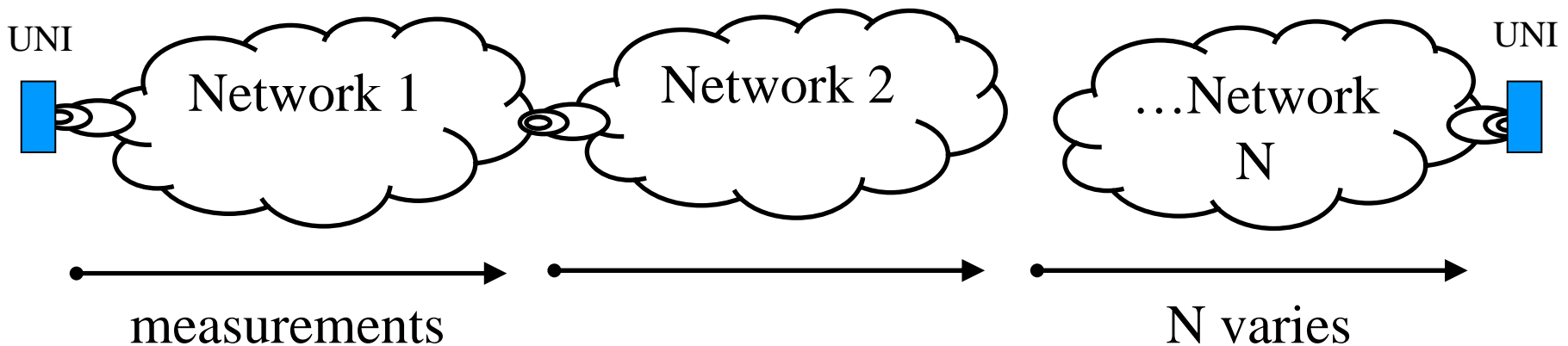
## Decision: QoS or no QoS?

If QoS requested, assume:

- o Managed Networks offering SLAs
- o National Constraints on some networks
- o Response Required

## Challenges:

- o Desire Perf. Estimate
- o Multi-Net Participation
- o Impair. Highly Variable
- o Distance may be unknown
- o Process Automation





# Standards Assets Brought to Bear

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- Bandwidth/Traffic Descriptions - many
  - Need ability to over-book = “statistical reservation”
- Network Performance Objectives - Y.1541
  - Supports a wide range of user applications
  - Applications supported by Classes of Network QoS
    - Simplify requests and make them manageable
  - Includes functions to combine performance of multiple nets and estimate Edge-Edge Perf.
    - IETF IPPM examining more functions & limits
- Agreements on How and What to Measure
  - TR- Performance Monitoring & Mgmt -> Y.PM/Y.PMM
- Signaling - IETF NSIS QSPEC (meets most Sup 51 req)



# Impairment Accumulation Process

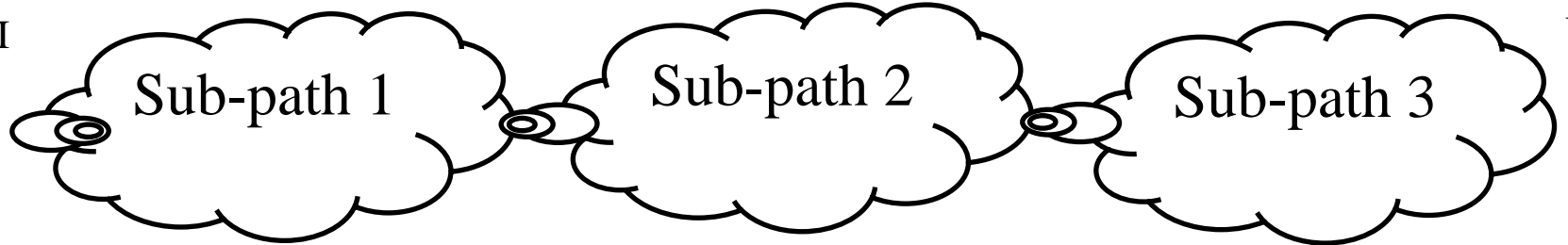
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Determine Path

UNI



UNI

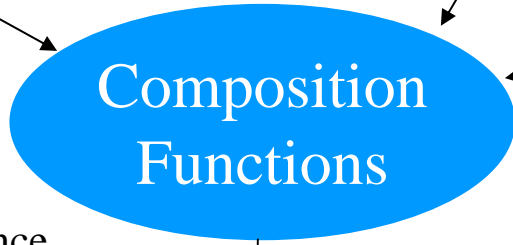


Measurement Sets

M1

M2

M3



(Y.1541, clause 8)

Composed UNI-UNI Performance



No

Composed Perf.  
Meets Objectives?

Yes

+ offer alt. Class, or  
+ seek alternate path

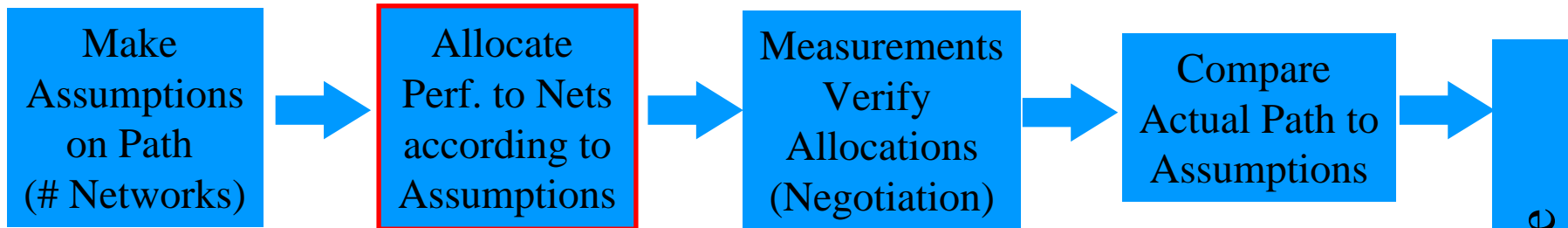
Inform Requestor  
(Done)



# Comparison of Alternatives

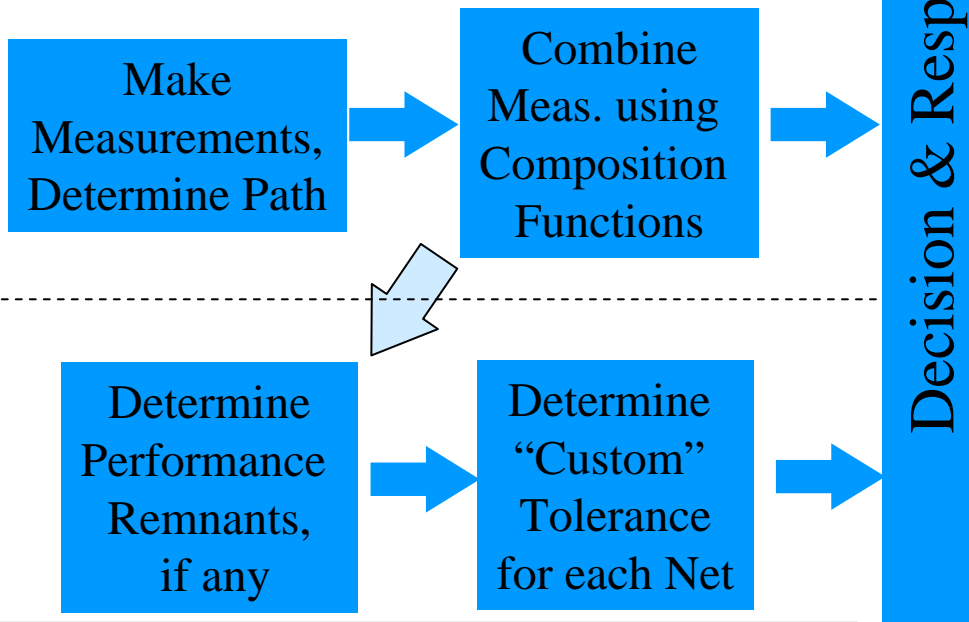
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## Static/Other Allocation Approaches



## Impairment Accumulation

Nets Managed to meet User needs, Compete Favorably, and/or Meet Regulations replace the steps above.



## Additional Steps for Ranged Allocation Approach



# Comparison of Alternatives (2)

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Sub-Path Performance

UNI

UNI

Loss	$10^{-4}$
Delay	22.4 ms
Jitter	25 ms

Loss	$10^{-4}$
Delay	10.6 ms
Jitter	2 ms

Loss	$10^{-4}$
Delay	34.4 ms
Jitter	25 ms

Signaling Protocol

Accumulated Performance

Request:  
Y.1541 Class 0

Loss	$10^{-4}$
Delay	22.4 ms
Jitter	25 ms

Loss	$2 \times 10^{-4}$
Delay	33 ms
Jitter	26 ms

Loss	$3 \times 10^{-4}$
Delay	67.4 ms
Jitter	47.5 ms

Response: ACK Class 0 with this performance estimate

Static Allocation (large enough for any network above)

UNI

UNI

Delay 35ms  
Jitter 25ms

Delay 35ms  
Jitter 25ms

Delay 35ms  
Jitter 25ms

Does not meet Class 0



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# Overlay on Stds Development

Offering Quantified Network Performance in response to Users Requests is Required for NGN, just as is done today with static agreements. So...

- o RACF must be ready to speak performance across Network Operator's Boundaries
  - Collect necessary info and make Decisions to Support Offering Y.1541 Classes
  - Controlling Resources on the Basis of BW alone is not sufficient
- o Implications for Signaling Protocols, too



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# Summary

- Users will Require Quantified Performance Commitments, as well as application assurance by category
- Network Operators Need Additional Capabilities to meet User's Needs in the Multi-operator environ.
- Impairment Accumulation describes both a set of Techniques and a Process:
  - Composed Estimates may succeed where Alloc. fails
  - Process has the flexibility and simplicity for a wide range of circumstances
  - Benefits from Existing Emphasis on Managed Nets
- Progress toward Assuring E2E QoS