



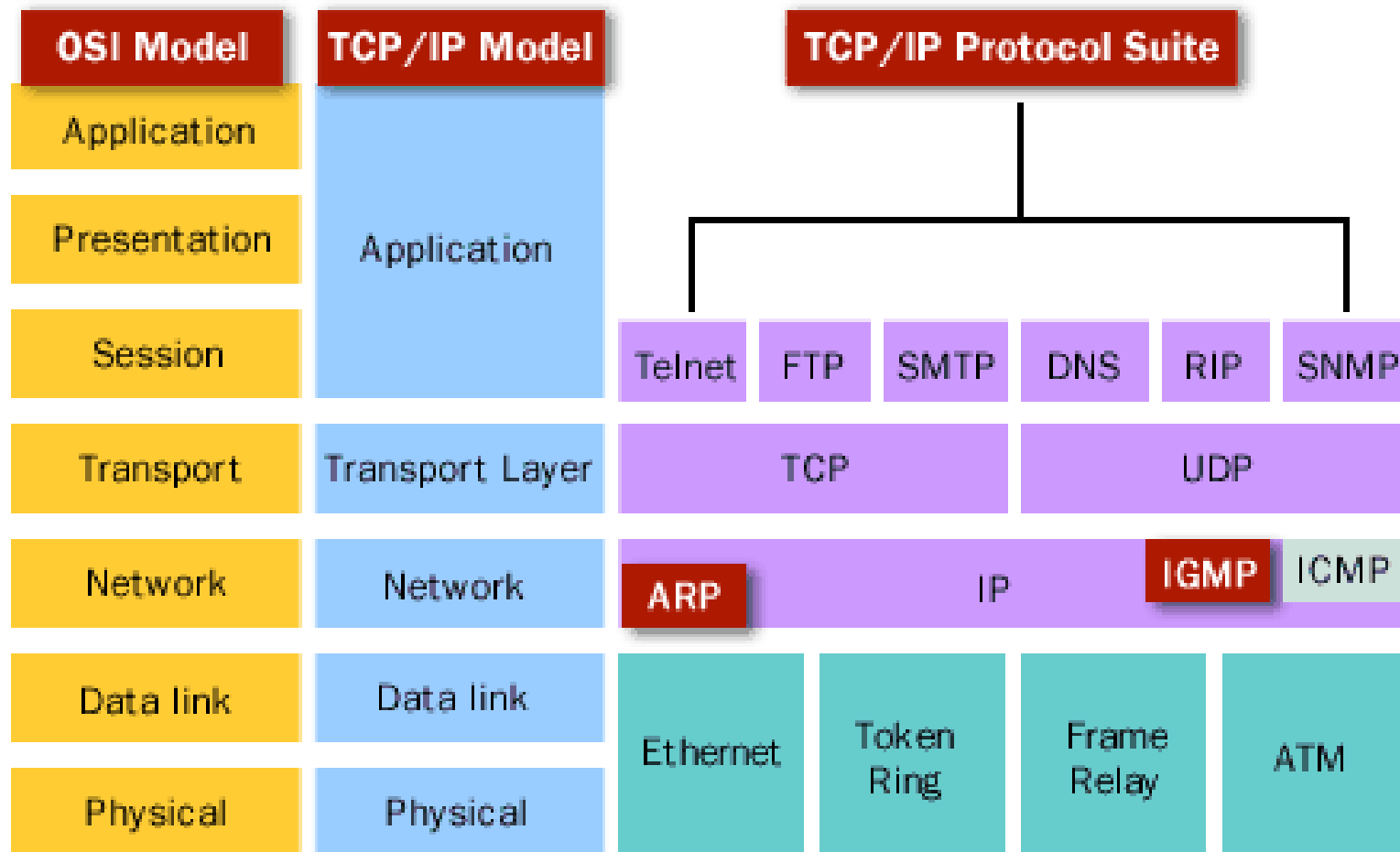
Broadband : Quality of Service Perspective

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“Quality is the extent to which **products, services, processes, and relationships** are free from defects, constraints, and items **which do not add value for customers**”

“Quality refers to how good something is compared to other similar things”

Broadband : A Transport Service



An Expressway: a physical transport Service



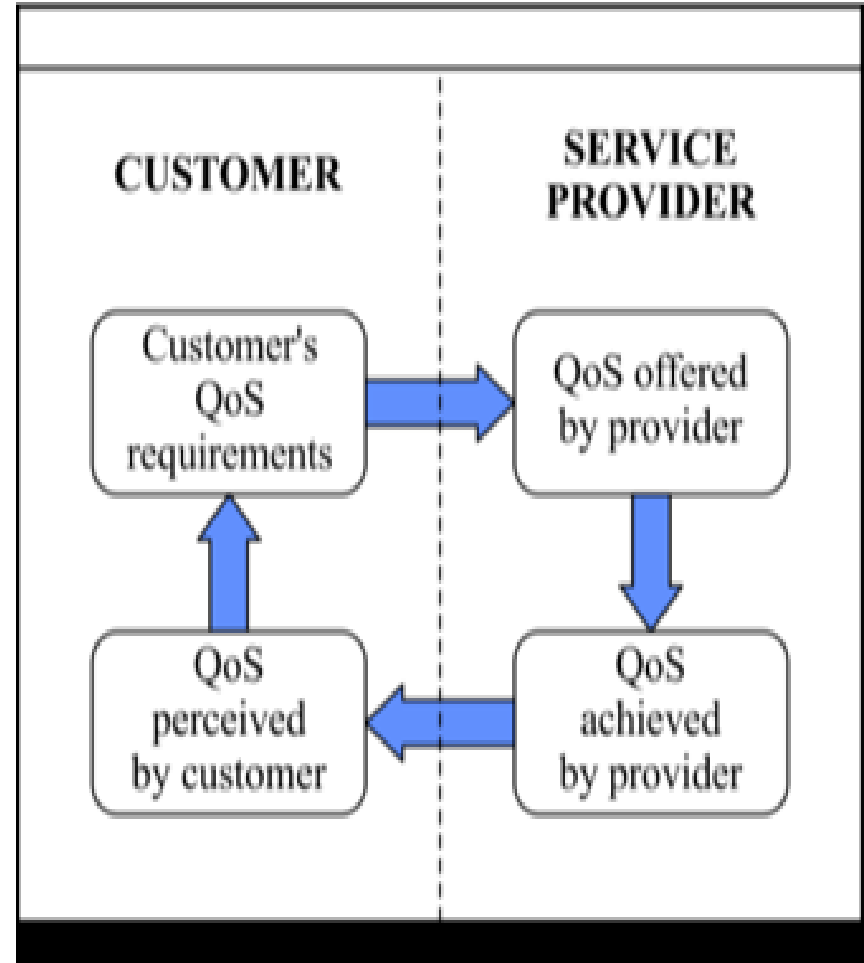
- ✓ Expressway should be available for use :
Availability
- ✓ Faster and timely movement, no queue at toll plaza - Latency
- ✓ Predictable and consistent travel time - Jitter
- ✓ No loss of vehicle on the way: Packet Loss
- ✓ Sufficient Lanes on the expressway : Throughput

Quality of Telecom Service (QoS) ?

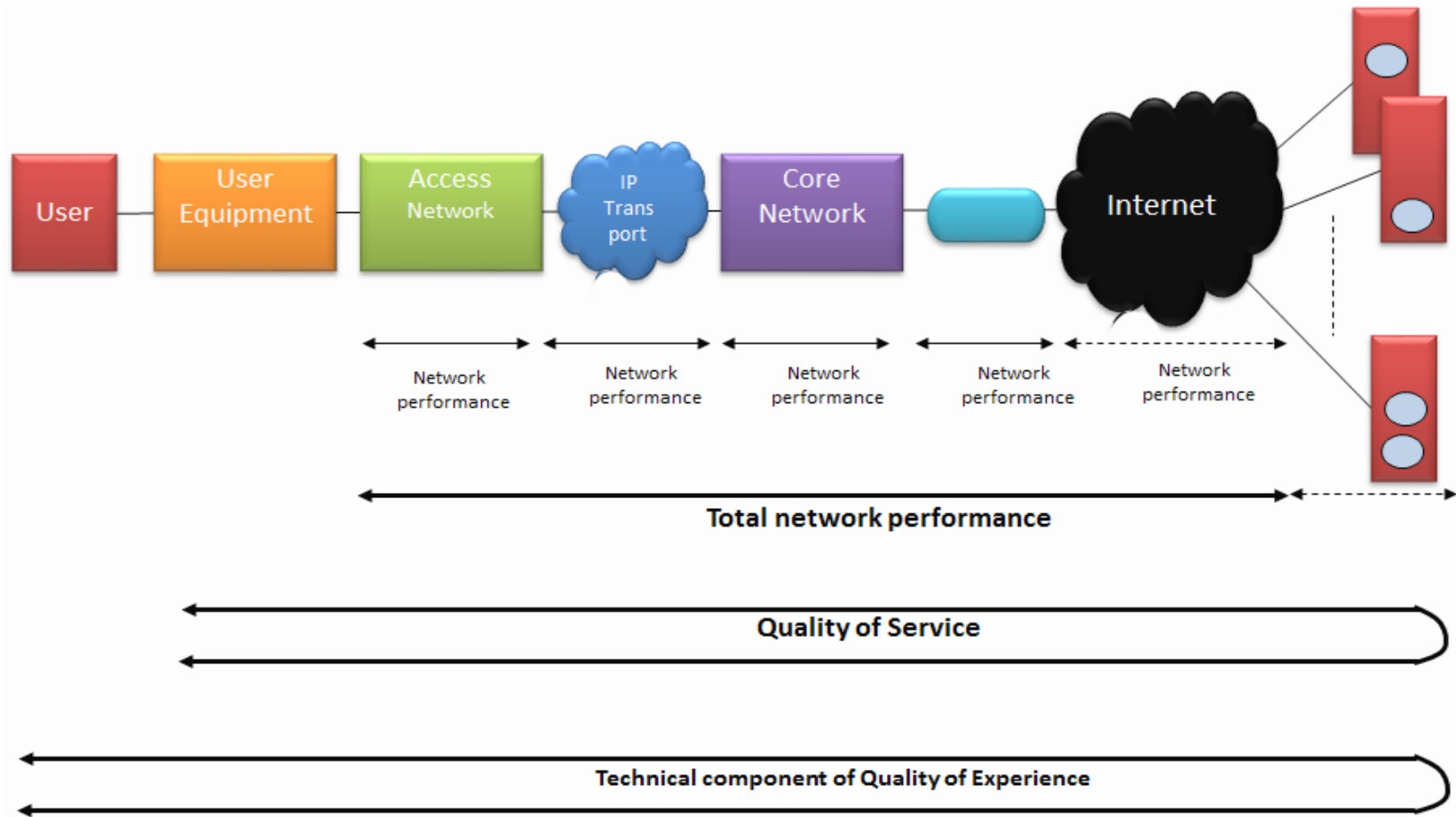


ITU-T Rec. E.800

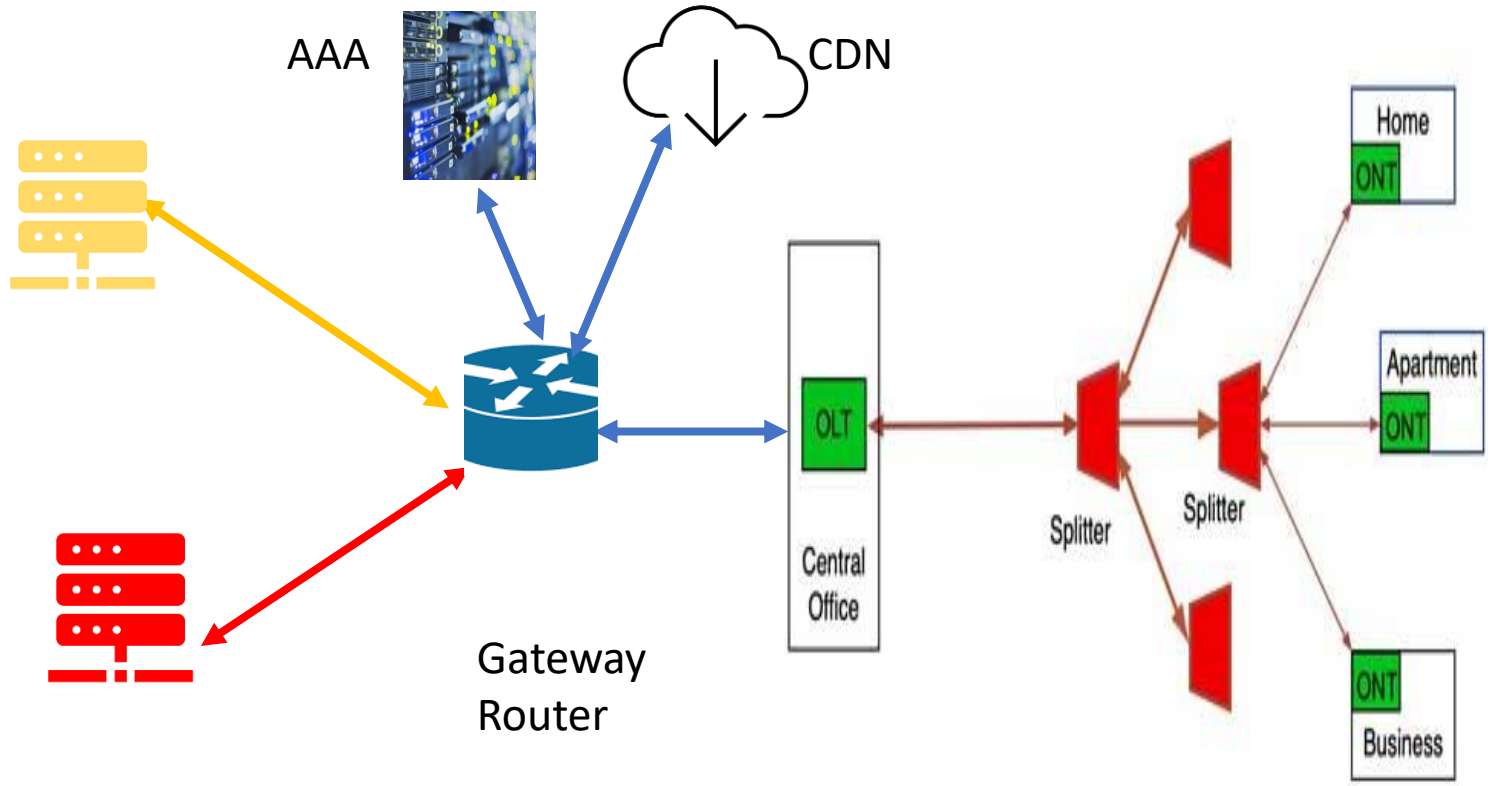
*‘Totality of characteristics of a telecommunications service that bears on its ability to satisfy **stated** and **implied needs** of the user of service’*



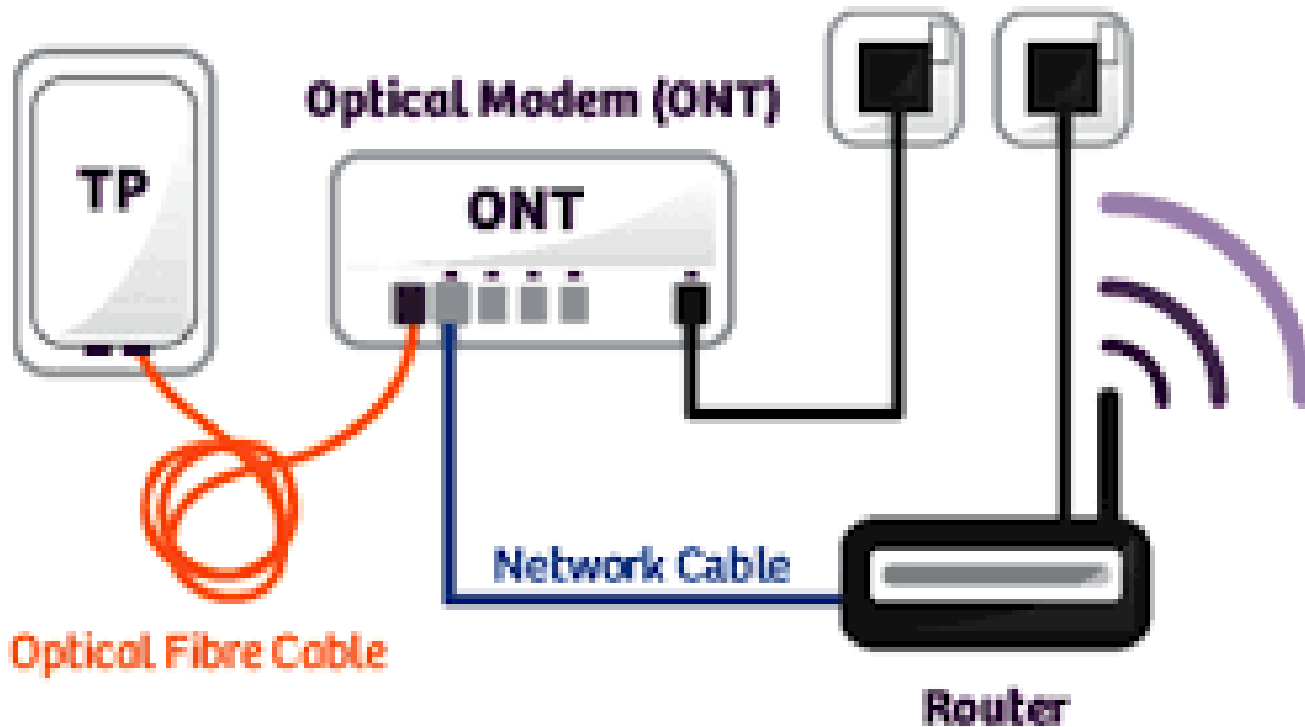
ITU-T Framework for QoS



QoS in Broadband



Termination Point (TP)



➤ QoS by Design

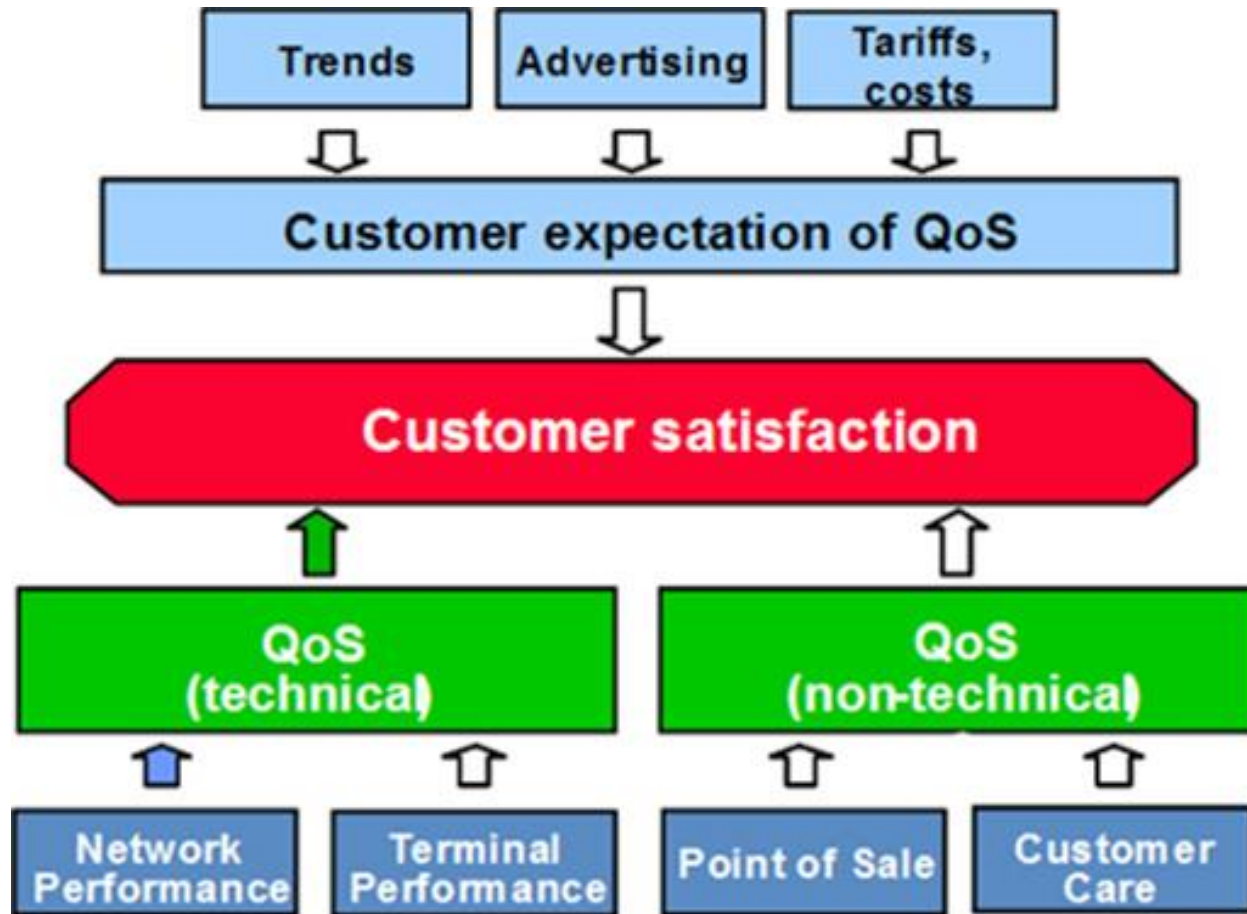
➤ QoS in Layers

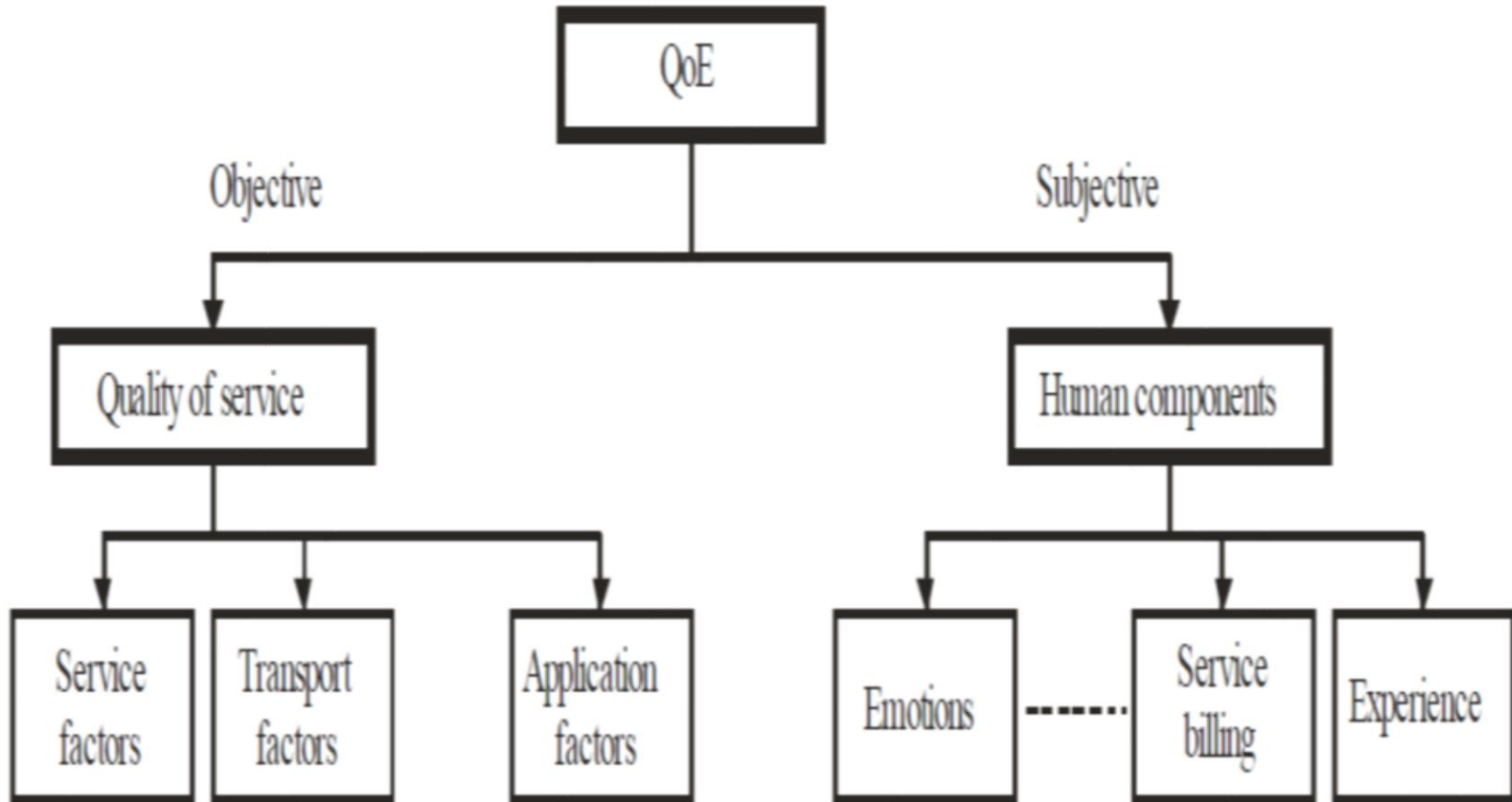
- ✓ Quality of Network Elements- Router, CPE, uplinks, interconnections etc.
- ✓ Quality of installation
- ✓ Quality of Maintenance process and methodology
- ✓ Quality of Monitoring system
- ✓ Quality and training of O&M team
- ✓ Quality of Support

[ITU-T P.10/Amd.1]:

*“The overall acceptability of an application or service, **as perceived subjectively** by the end-user”*

- Quality of Experience includes the complete end-to-end system effects (client, terminal, network, services infrastructure, etc.).
- Overall acceptability may be **influenced by user expectations and context.**





ITU-T QoS Enforcement Framework



- **QoS- Technical Parameters**

- **Bandwidth Utilization/ Throughput**

- Bandwidth Utilization [PoP to ISP G/W) Intra-network links] <80%
- Broadband Connection Speed (download) : Subscribed Broadband Connection Speed to be met >80% from ISP Node to User.

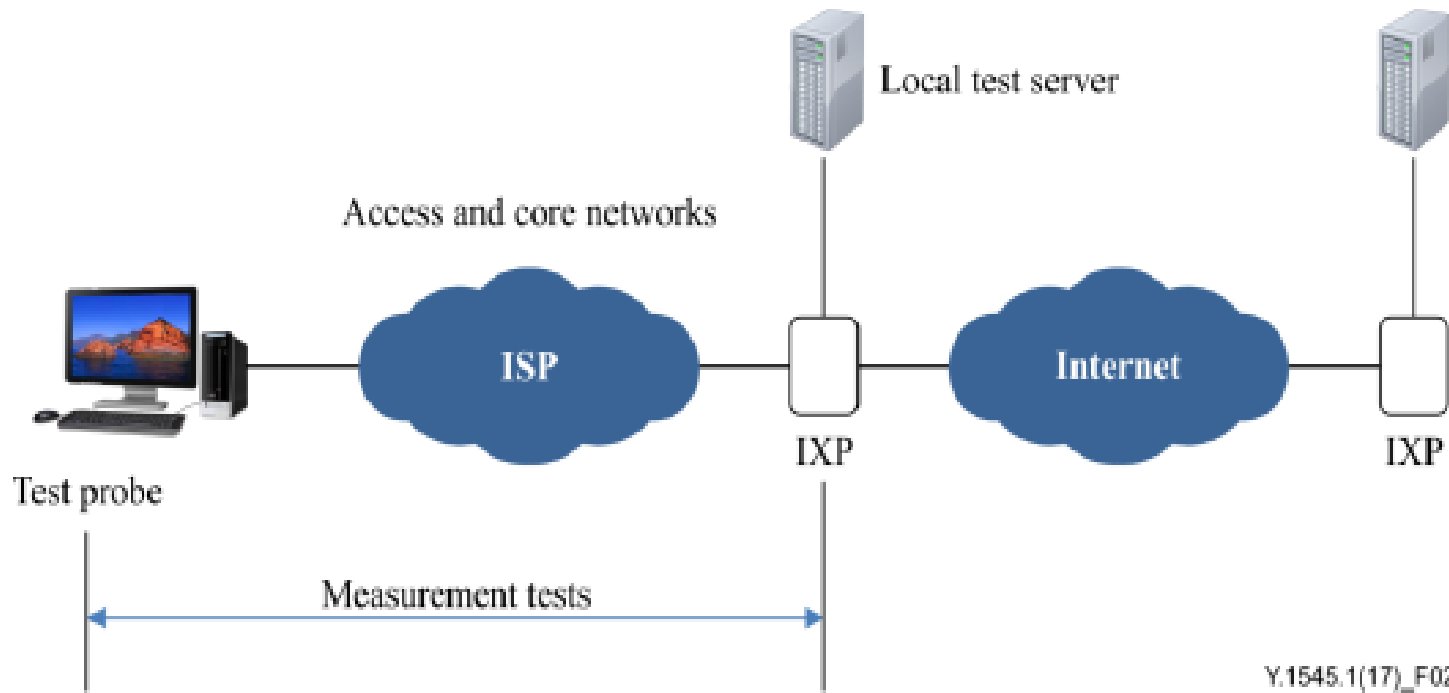
Data download speed	=	size of the test file (data) in ISP Server
		Transmission time required for error free transfer of the entire data

- **Service Availability / Uptime >98%**
- **Packet Loss < 1%**
- **Network Latency (user reference point at PoP to ISP G/W) < 120ms**

- **QoS Non-Technical Parameters**

- Service Provisioning/Activation Time - <= 15 days
- Fault Repair/ Restoration Time – 99% within 3 days
- Billing Performance : Billing complaints per 100 bills <2%
- Response time to the customer for assistance within 90 seconds

ITU-T – Measurement Setup at National Level



QoS Performance against key benchmarks



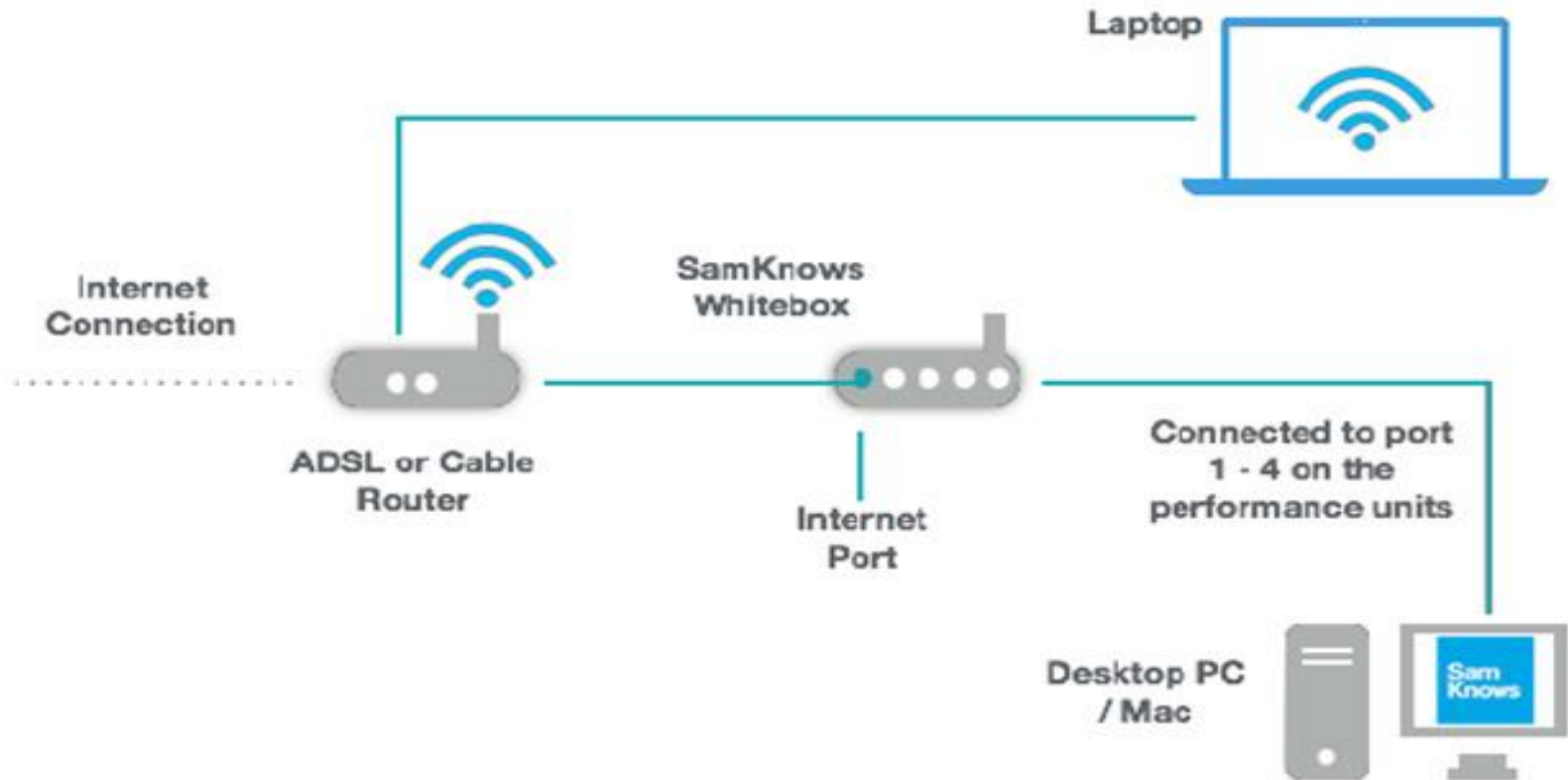
- ISPs need to install download speed measurement software in the server at ISP node to enable independent measurement by user
- Q.E March 2023 : 88 ISPs submitted performance reports
- Latency (user reference point at PoP to G/W < 120 ms) varies from 2ms to 100 ms
- Latency (ISP G/W to nearest international NAP < 350 ms) varies from 4ms to 320 ms
- International B/W utilisation during peak hours (< 90%) is up to 88.83%
- Service Availability > 98% for all ISPs

Quality Measurement Platforms



- **Measurement Lab (M-Lab)** : <https://www.measurementlab.net/>; Licensed as open source- an open, distributed server platform provided to researchers to deploy internet measurement tools developed by different parties
- **RIPE Atlas**: <https://atlas.ripe.net/> ; It is global network of h/w devices-called probes and anchors-that actively measures internet connectivity
- **SamKnows** : <https://www.samknows.com/> is distributed network of whiteboxes in actual consumer homes used to accurately measure the performance of fixed line broadband connections

Quality Measurement Platforms-SamKnows



- QoS
 - Only need incremental investment
 - is biggest differentiator in competitive market
 - Is an effective tool and strategy to gain and retain customers
 - fetch premium on services
 - Can be used to compete with big players



THANK YOU