CPE314 Data Communications and Computer Networks Reading Assignment: From Communication Requirements to QoS, QoE, and QoX

Purpose of This Reading

This document extends the conceptual discussion from Lecture 2. It connects:

- Communication characteristics
- Network criteria
- Network capabilities
- Quality of Service (QoS)
- Quality of Experience (QoE)
- QoX (Holistic Quality Perspective)

The goal is to build a structured mental model of how engineering decisions translate into measurable and perceived quality.

1 Communication Characteristics

The fundamental characteristics of data communication are:

- **Delivery** – Data must reach the intended destination.
- **Accuracy** – Data must be error-free.
- **Timeliness** – Data must arrive within acceptable delay.
- **Jitter** – Delay variation must be controlled.

These describe what the communication system is expected to achieve.

2 Network Criteria

To evaluate whether communication requirements are satisfied, networks are assessed using three main criteria:

- **Performance**
- **Reliability**
- **Security**

The relationship is conceptual:

- Delivery and Accuracy → Reliability
- Timeliness and Jitter → Performance
- Accuracy (data integrity) → Security

3 Network Capabilities

To maintain criteria under real-world constraints, networks require engineering capabilities:

- Scalability
- Mobility
- Energy efficiency
- Cost efficiency
- Coverage
- Flexibility and reconfigurability

These capabilities enable the network to preserve performance, reliability, and security even as conditions change.

4 Conceptual Mapping

Characteristic	Criterion	Supporting Capabilities
Delivery	Reliability	Scalability, Mobility, Coverage, Flexibility
Accuracy	Reliability / Security	Energy efficiency, Cost efficiency, Flexibility
Timeliness	Performance	Scalability, Mobility, Coverage, Flexibility
Jitter	Performance	Scalability, Energy efficiency, Flexibility

5 From Characteristics to QoS

While characteristics describe requirements, Quality of Service (QoS) provides measurable parameters.

Characteristic	QoS Metric
Delivery	Packet loss rate
Accuracy	Bit error rate (BER)
Timeliness	End-to-end delay
Jitter	Delay variation

QoS translates abstract requirements into measurable indicators.

6 QoS and QoE

QoS (Quality of Service)

- Network-centric
- Technically measurable
- Examples: delay, jitter, packet loss, throughput

QoE (Quality of Experience)

- User-centric
- Based on perception
- Examples: smooth video, clear voice, responsive applications

Improved QoS generally improves QoE, but the relationship is not strictly linear.

7 Toward QoX

QoX represents a broader and integrated quality perspective. It may include:

- Technical performance (QoS)
- User perception (QoE)
- Security assurance
- Energy sustainability
- Cost effectiveness

Thus, QoX reflects overall system excellence from technical, user, and operational viewpoints.

Conceptual Hierarchy

Communication Characteristics
↓
Network Criteria
↓
Network Capabilities
↓
QoS (Measured Quality)
↓
QoE (Perceived Quality)
↓
QoX (Holistic Quality)

Reflection Questions

1. Can high QoS exist while QoE remains poor? Provide an example.
2. Which network capability most directly influences timeliness? Justify.
3. How might energy efficiency affect reliability?
4. Why is scalability critical for maintaining QoS in growing networks?