Borg El-Arab Technological University
Faculty of Industrial and Energy Technology
Information Technology Department — 3rd Year

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Course: Data Communication (Assignment 1)

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Assignment Question:

*Briefly discuss the following: You are downloading: **(a) A movie, (b) Attending an online class, (c) Playing an online game**. How do bit rate and bandwidth affect the quality and speed of these activities? Give a real-life example of each.*

Bandwidth (Capacity):
The maximum theoretical data-carrying capacity of the communication channel per second (measured in **bps / Mbps**). Represents the width of the network pipe.

Bit Rate (Actual Throughput):
The actual number of bits transmitted or processed per unit of time (measured in **bps / Mbps**). Represents the speed and volume of current active traffic.

(a) Downloading a Movie (Bulk Data Transfer / Non-Real-Time)

Impact on Speed & Quality: Movie downloading relies on reliable full-file delivery (TCP). Higher bandwidth provides a wider transmission path, allowing higher download bit rates. If bandwidth is low, the download bit rate drops, significantly increasing completion time. Because it is pre-recorded, file quality is fixed; bandwidth and bit rate solely dictate **download speed** and waiting time.

Real-Life Example: **Example:** Downloading a **2 GB 1080p movie** over a **100 Mbps** broadband link finishes in ~2.7 minutes (bit rate ~100 Mbps). On a congested **4 Mbps** connection, the transfer bit rate is severely limited, taking over an hour to complete.

(b) Attending an Online Class (Real-Time Video Conferencing / Interactive)

Impact on Speed & Quality: Requires steady symmetric bandwidth and continuous bit rate streaming for live two-way audio and video. Higher bit rate yields crisp 1080p resolution and smooth frame rates. If available bandwidth drops below the needed stream bit rate, adaptive software forces compression, causing video pixelation, robotic audio, or buffering pauses.

Real-Life Example: **Example:** In a **Zoom / Microsoft Teams** lecture, having **10 Mbps** bandwidth allows HD streaming at a stable **2.5 Mbps** bit rate. If bandwidth falls below **500 kbps**, the application automatically downgrades to low-res video or cuts camera feed to preserve audio.

(c) Playing an Online Game (Real-Time Low Latency / Fast Packets)

Impact on Speed & Quality: Online gaming transmits small, rapid coordinate packets requiring very low bit rates (often < 1 Mbps). High bandwidth is not strictly required, but the channel must be wide enough to prevent queue congestion. If bandwidth is saturated by background downloads, packets queue up, leading to high latency (ping spikes), jitter, and packet loss (in-game rubber-banding).

Real-Life Example: **Example:** Playing **Valorant or CS2** only requires a bit rate of ~**300 kbps**. On a clear connection, ping stays at **25 ms**. If someone starts a heavy download that consumes all bandwidth, ping spikes to **300+ ms**, causing desync and character teleportation.

Activity	Bandwidth Requirement	Bit Rate Demand	Primary Limiting Metric
(a) Movie Download	High (determines completion speed)	Maximum available (bulk transfer)	Throughput & total transfer time
(b) Online Class	Moderate (continuous upload & download)	Steady stream (~1.5 – 3.0 Mbps)	Bandwidth stability & packet loss
(c) Online Game	Low (very small packet payload)	Very Low (~150 – 500 kbps)	Latency (Ping) & Jitter