FIRST IDEA

5G powered service bot for IP Broadcasting

INTRODUCTION

Serial digital interface (SDI) is a standard for digital video and audio transmission over coaxial or fiber optic cabling.
Speeds currently range from 270 megabits per second (Mbps) up to 12 gigabits per second (Gbps) for the latest standard released in 2015.
The shift from SDI to IP network has been a discussion in the broadcasting industry for a long time. Yet it wasn't until recently that the technologies enabled a swift transition between the two.
Currently, many major broadcasting companies worldwide are nearing the transition to using IP-based systems.
The broadcasting industry is currently looking at whether 5G technology can deliver both linear, and nonlinear broadcasts, whilst supporting them with enhanced media services (EMS), which are a combination of both.
('Linear media' refers to conventional TV or radio channels where programmers such as news, sport, entertainment and documentaries are scheduled by a service provider to be viewed at the time of transmission; whereas 'nonlinear media' is a type of media content that is offered on-demand at the request of the user.
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Flow chart of live content broadcast through IP broadcasting using 5G technology

Start
|
|---[Capture Content] --- Cameras capture live content.
|
|---[Encode Content] --- Content is encoded for transmission.
|
|---[5G Transmission] --- Encoded content is transmitted via 5G network.
|
I---[Network Slicing]-- A portion of the 5G network is dedicated to the broadcast

|
|---[Remote Production]--- Content is sent to a centralized production hub.
|
|---[Content Delivery] --- Content is delivered to distribution networks.
|
|---[End User] --- Viewers receive the content on their devices.
|
End

Factors that can cause delays

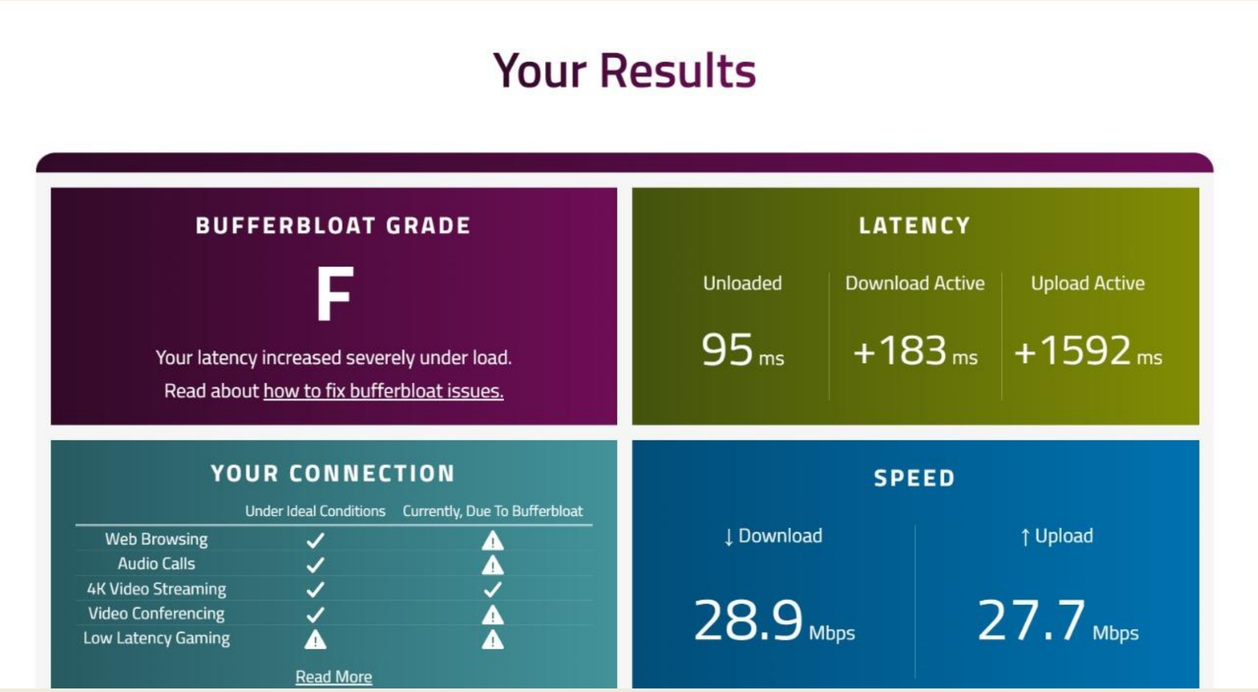
7 Seconds of Standard delay

1. **Latency (1 to 2 ms)** : This is the time it takes for data to travel from the source to the destination.
2. **Jitter** : This refers to the variation in packet arrival times. delay is due to the irregular arrival times of data packets. fluctuate based on network conditions, such as congestion or scheduling variations.
3. **Encoding and Decoding (1 to 5 sec).**
4. **Network Congestion :** High traffic on the network can slow down data transmission, leading to delays.
5. **Handover Delays (20ms to 30ms) :** As mobile users move, they may switch from one cell tower to another. This handover process can cause brief interruptions or delays in the broadcast.
6. **Propagation Delay :** This is the physical delay of signals traveling long distances.
7. **Buffering (30 sec to 2 min):** buffering delay in 5G networks is generated by large buffer sizes that lead to increased sojourn time (amount of time an object is expected to spend in a system before leaving it permanently) for packets. Implementing AQM techniques like CoDel can help mitigate these delays and ensure timely delivery of priority traffic.

BufferBloat

Bufferbloat is a software issue with networking equipment that causes spikes in Internet connection's latency when a device on the network uploads or downloads files.

It happens when data packets are temporarily stored in large buffers before being transmitted, causing delays in their delivery. While buffering is essential for maintaining a stable connection (it helps smooth out variations in throughput, ensuring continuous data flow even when network conditions fluctuate), excessive buffering can result in poor network performance.



Some techniques to address bufferbloat:

- **Smart Queue Management (SQM):** SQM algorithms help manage buffer sizes dynamically to prevent excessive queuing.

Some popular SQM algorithms include:

- CoDel (Controlled Delay): CoDel aims to keep the queue delay low by dropping packets when necessary. It prevents bufferbloat by ensuring that packets are not unnecessarily held in queues.

- FQ-CoDel (Fair Queue Controlled Delay): combines fair queuing with CoDel to provide better performance for interactive applications.

- SFQ (Stochastic Fair Queuing): SFQ assigns packets to queues based on hashing, ensuring fair distribution of bandwidth.

Concern : hashing technique (Round Robin O(1)) why still it is suffering from delay ? Because of the inefficient resource utilization .

Alternate / Another Solution

MLFQ: In this scheme, processes are categorised into different levels or queues based on their priority or other characteristics. Each queue has a different allocation of CPU time, and processes move between queues based on their behaviour (such as requesting 1/0 operations). The goal is to balance fairness and efficiency in process execution.

As a system administrator you have noticed that usage peaks between 10:00AM to 5:00PM and between 7:00PM to 10:00PM. The company's CEO decided to call on you to design a system where during these peak hours there will be three levels of users. Users in level 1 are to enjoy better response time than users in level 2, who in turn will enjoy better response time than users in level 3. You are to design such a system so that all users will still get some progress, but with the indicated preferences in place.

Sol: **(Multilevel Queue Feedback Scheduling)** A process of level-1 will have 3 entries in the ready queue, distributed evenly over the queue. A process of level-2 will have 2 entries, while a process of level 3 will have one entry. In a run, a process at level 1 will get 3 times as much as a process at level 3 on the CPU.
Care should be taken such that when a process requests an 1/0 operation, that all its entries would be removed from the ready queue simultaneously. Also, when a process is added to the ready queue, it has to be entered with all its entries even distributed over the entire queue.