QoS in 5G networks

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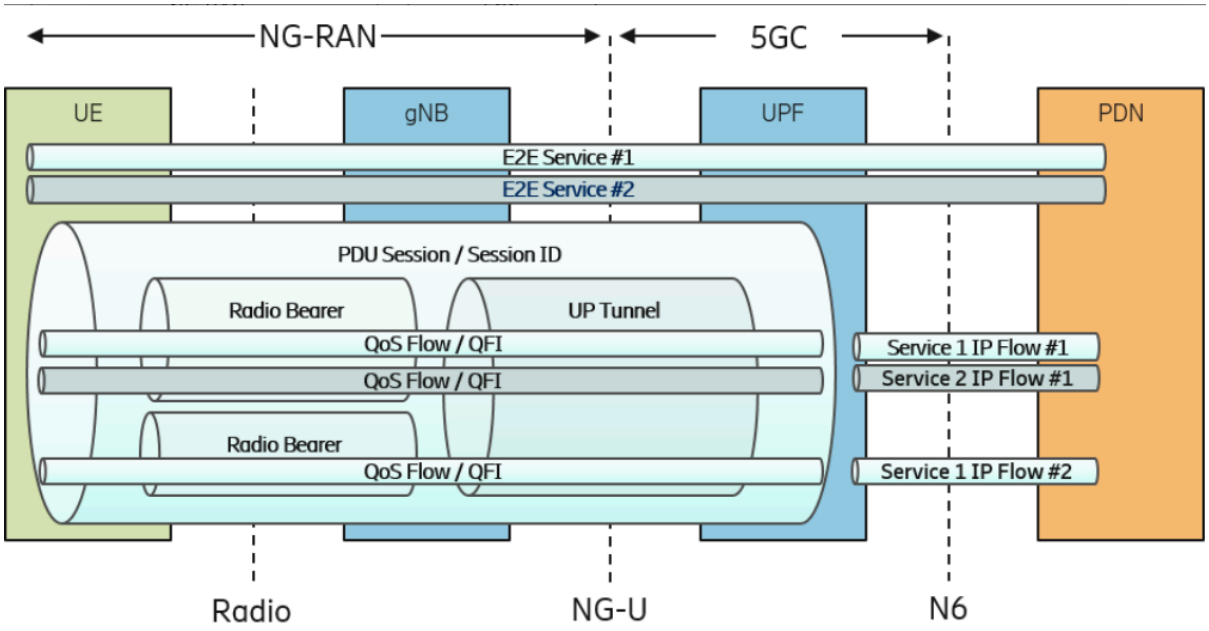
Within the 5G network, a Quality of Service (QoS) Class Identifier (QCI) mechanism is called 5QI

5QI is a mechanism in which packets are classified into different QoS classes. In this way, the QoS can be tailored to specific requirements. Each QoS class has its own assigned QoS characteristics (such as packet delay and packet loss). As a result, some packets can get better QoS than other packets.

The QoS concept is **flow-based**. Packets are classified and marked with **QoS Flow Identifier (QFI)**.

There are two types of flows: one with standardized QoS profiles and the other with operator-specific QoS profiles.



The QoS flow is the lowest level granularity within the 5G system and is where policy and charging are enforced.

One or more Service Data Flows (SDFs) can be transported in the same QoS flow if they share the same policy and charging rules (similar to an EPS bearer in 4G LTE). All traffic within the same QoS flow receives the same treatment. There are several standardized 5QI values.

The following table, from ***3GPP TS 23.501***, provides the mapping from 5QI to QoS characteristics.

Table 5.7.4-1: Standardized 5QI to QoS characteristics mapping

5QI Value & QFI	Resource Type	Priority Level	Packet Delay Budget	Packet Error Rate	Example Services
1	GBR	20	100 ms	10^{-2}	Conversational Voice
2		40	150 ms	10^{-3}	Conversational Video (Live Streaming)
3		30	50 ms	10^{-3}	Real Time Gaming, V2X messages
4		50	300 ms	10^{-6}	Non-Conversational Video (Buffered Streaming)
65		7	75 ms	10^{-2}	Mission Critical user plane Push To Talk voice (e.g., MCPTT)
66		20	100 ms	10^{-2}	Non-Mission-Critical user plane Push To Talk voice
75		25	50 ms	10^{-2}	V2X messages
5	Non-GBR	10	100 ms	10^{-6}	IMS Signalling
6		60	300 ms	10^{-6}	Video (Buffered Streaming) TCP-based (e.g., www, e-mail, chat, ftp, p2p file sharing, progressive video, etc.)
7		70	100 ms	10^{-3}	Voice, Video (Live Streaming) Interactive Gaming
8		80	300 ms	10^{-6}	Video (Buffered Streaming) TCP-based (e.g., www, e-mail, chat, ftp, p2p file
9		90			sharing, progressive video, etc.)
69		5	60 ms	10^{-6}	Mission Critical delay sensitive signalling (e.g., MC-PTT signalling)
70		55	200 ms	10^{-6}	Mission Critical Data (e.g. example services are the same as QCI 6/8/9)
79		65	50 ms	10^{-2}	V2X messages

5G QoS Flow Descriptions

5G Network can provide the UE, one or more **QoS flow** descriptions associated with a **PDU session** during the PDU **session establishment** or at the PDU **session modification**. Each QoS flow contains the following details:

- A 5G QoS Identifier (**5QI**)
- An Allocation and Retention Priority (**ARP**)
- In the case of a **GBR** QoS Flow
  - Guaranteed Flow Bit Rate (**GFBR**) for both uplink and downlink;
  - Maximum Flow Bit Rate (**MFBR**) for both uplink and downlink;
  - Maximum Packet Loss Rate for both uplink and downlink;
  - Delay Critical Resource Type;
  - Notification Control.

- In the case of **Non-GBR** QoS Flow
  - Reflective QoS Attribute (RQA)
  - Session-**AMBR**
  - UE-**AMBR**

5G QoS Flow Characteristics

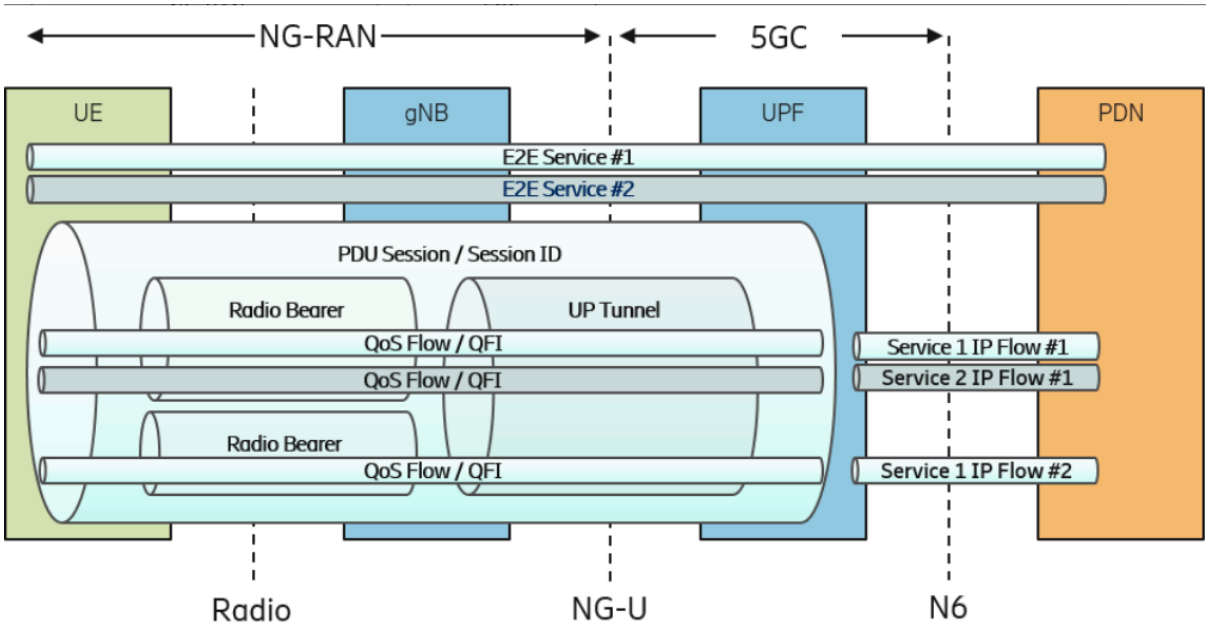
5G QoS characteristics describe the packet forwarding treatment that a **QoS Flow** receives edge-to-edge between the UE and the **UPF** in terms of the following performance characteristics:

- Resource Type (GBR, Delay critical GBR or Non-GBR)
- Priority Level
- Packet Delay Budget
- Packet Error Rate
- Averaging window (for GBR and Delay-critical GBR resource-type only)
- Maximum Data Burst Volume (for Delay-critical GBR resource-type only)

Source: https://5ghub.us/quality-of-service-qos-in-5g-networks/

References:

- **3GPP TS 23.501**, see chapter 5.7 (QoS model), in which the entire 5G QoS model, including 5G QoS Parameters, is detailed.
- **3GPP TS 28.552** (Management and orchestration 5G performance measurements). NOTE: the measurements related to QoS Flow are abbreviated as "QF" (see page 24).



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