ITU Workshop on "Telecommunication Service Quality"

QoS and QoE evaluation in networks with multiple access technologies

Ensuring Exceptional Quality of Service and Quality of Experience isn't just a priority for Tmcel—it's our commitment to bringing smiles to our customers' faces, as we understand that seamless connectivity and superior experiences are the cornerstone of their satisfaction.

Presentation By: Feliciano Linguaze

Tmcel – Moçambique Telecom, SA

www.tmcel.mz

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Abstract

This presentation explores the concepts of evaluating Quality of Service (QoS) and Quality of Experience (QoE) in networks characterized by multiple access technologies, focusing on Multi-RAT (Radio Access Technology) from Tmcel (Mozambique Telecom, SA). Relying on the fundamental concepts of QoS and QoE, we navigate the diverse technological and multi-vendor landscape of Tmcel's access network. Finally, the methodologies and metrics used to guarantee ideal network performance and user satisfaction in a highly competitive environment are examined.

1. Moçambique Telecom, SA (Tmcel)

- ✓ Tmcel is a public limited company resulting from the merger between TDM – Telecomunicações de Moçambique, SA and mcel- Moçambique Celular SA.

- ✓ Tmcel's Main objective: Provide telecommunications services throughout the national territory and in the Region.

- ✓ Technological modernization and innovation constitute one of Tmcel's biggest strengths, translated into the offering of **fixed** and **mobile** telephony products and services, trunking, satellite communications, switched data transmission service, transmission and reception service for radio and television signals, pay television programming services and audiovisual services.

2. Introduction

As a leading mobile operator navigating the complexities of modern telecommunications, Tmcel recognises the importance of optimising Quality of Service (QoS) and Quality of Experience (QoE) across diverse network infrastructures.

Objectives:

- Explore evaluation techniques for optimising QoS and QoE in a heterogeneous network environment.
- Provide insights and strategies tailored to Tmcel's perspective, encompassing multi-access technologies.

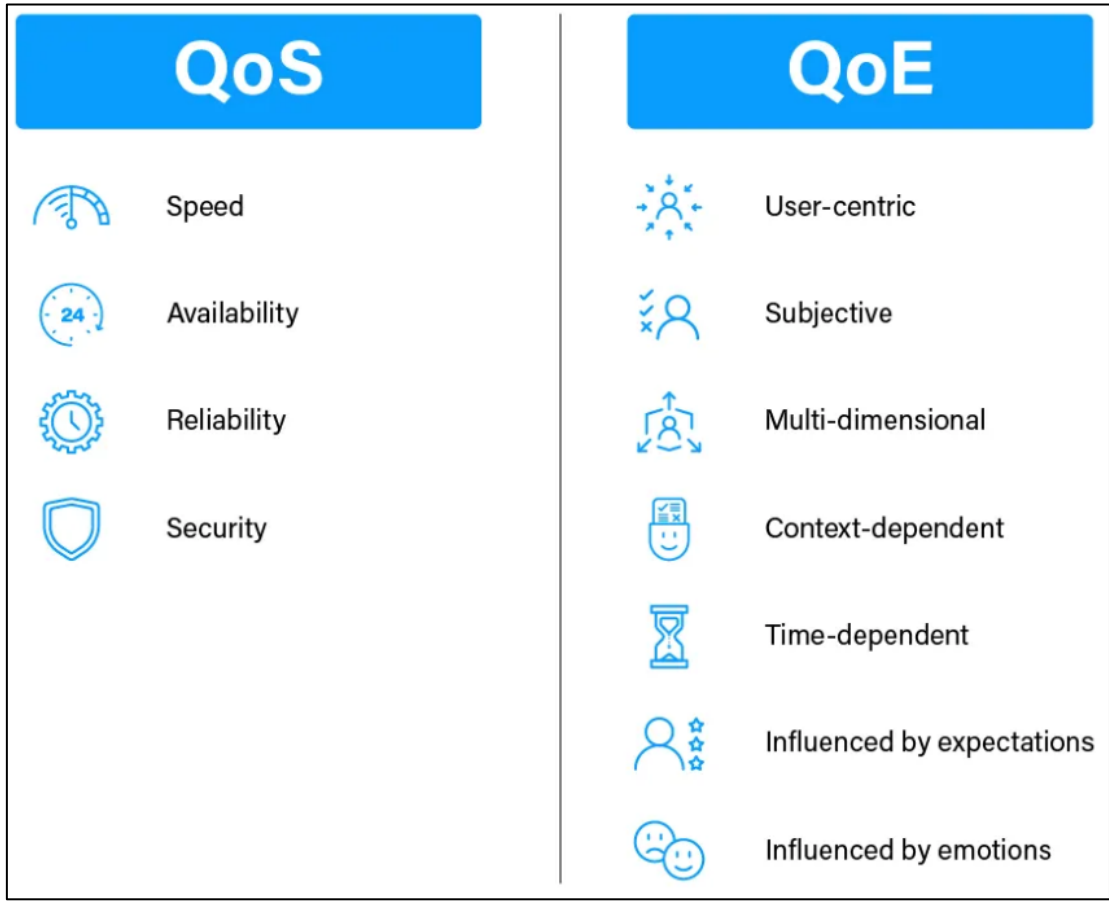
Key Takeaways:

- Understanding the significance of QoS and QoE in meeting customer expectations.
- Highlighting examples of KPIs which help in managing heterogeneous networks.
- Exploring evaluation techniques and integration strategies to enhance QoS and QoE across multiple access technologies.

3. Key Concepts

Definition of QoS and QoE

- **Quality of Service (QoS)** refers to the technical parameters and performance metrics that define the reliability and efficiency of a telecommunications network.
    - Within Tmcel priority QoS factors include **latency**, **packet loss**, and **throughput**, which directly impact the network's ability to deliver services consistently.
- **Quality of Experience (QoE),** on the other hand, represents the subjective perception of service quality experienced by our end-users. It reflects their overall satisfaction with the network's performance, including factors such as audio and video quality, responsiveness, and reliability.



Significance to Tmcel

- For Tmcel, ensuring high QoS and QoE is not only a technical imperative but also a strategic priority. By delivering superior service quality, we aim to enhance customer satisfaction, loyalty, and retention. Happy and satisfied customers are the foundation of our success as a mobile operator.

4. Evaluation of QoS and QoE

Measurement Techniques for QoS

Tmcel makes use of various monitoring tools to actively and passively measure QoS.

- **Active Monitoring:** Measuring network performance Key Performance Indicators (KPIs) such as latency, packet loss, and throughput.
- **Passive Monitoring:** Collecting data on network performance from user devices or network equipment without actively probing the network.

Evaluation Techniques for QoE

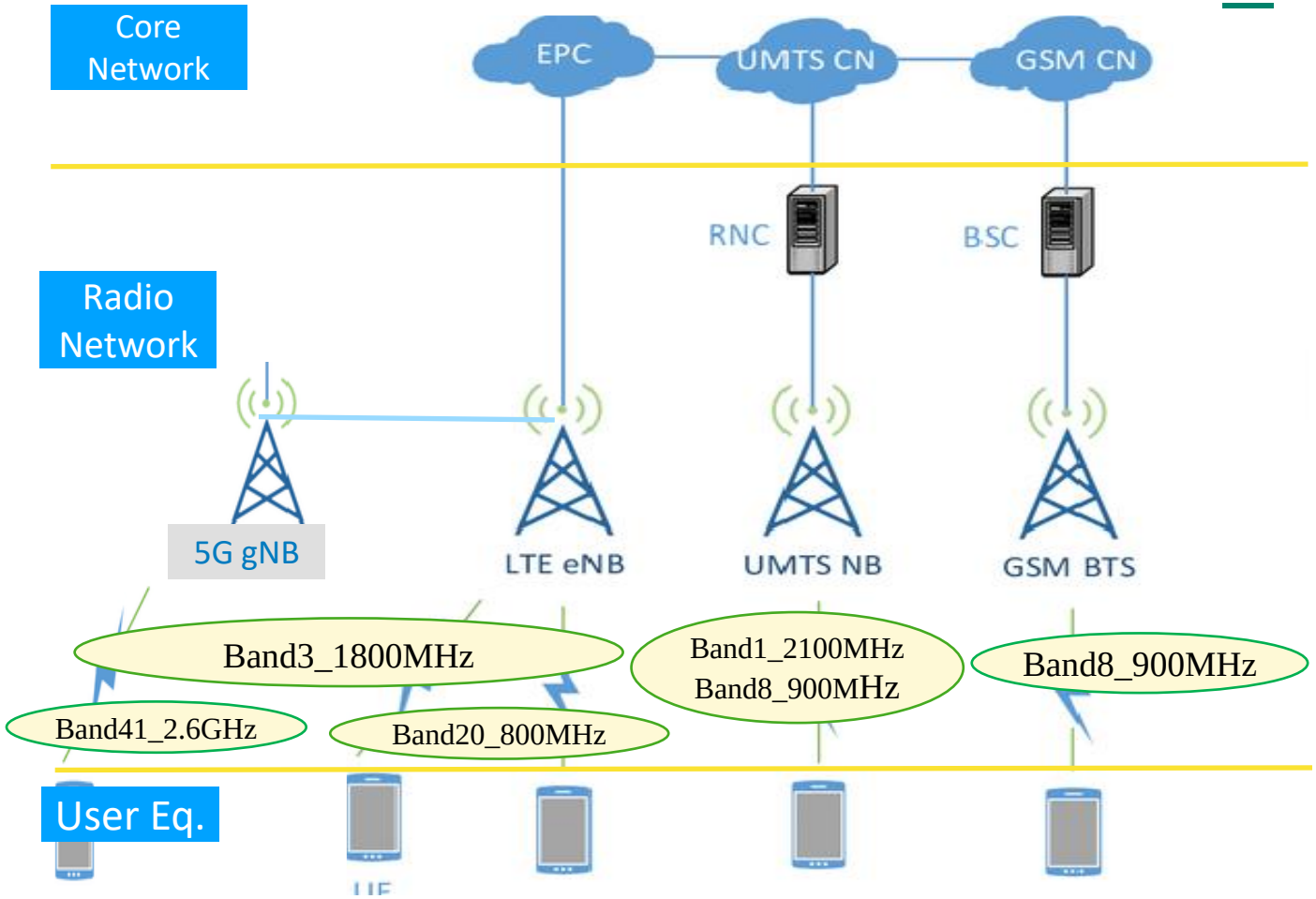
Tmcel uses subjective and objective assessments.

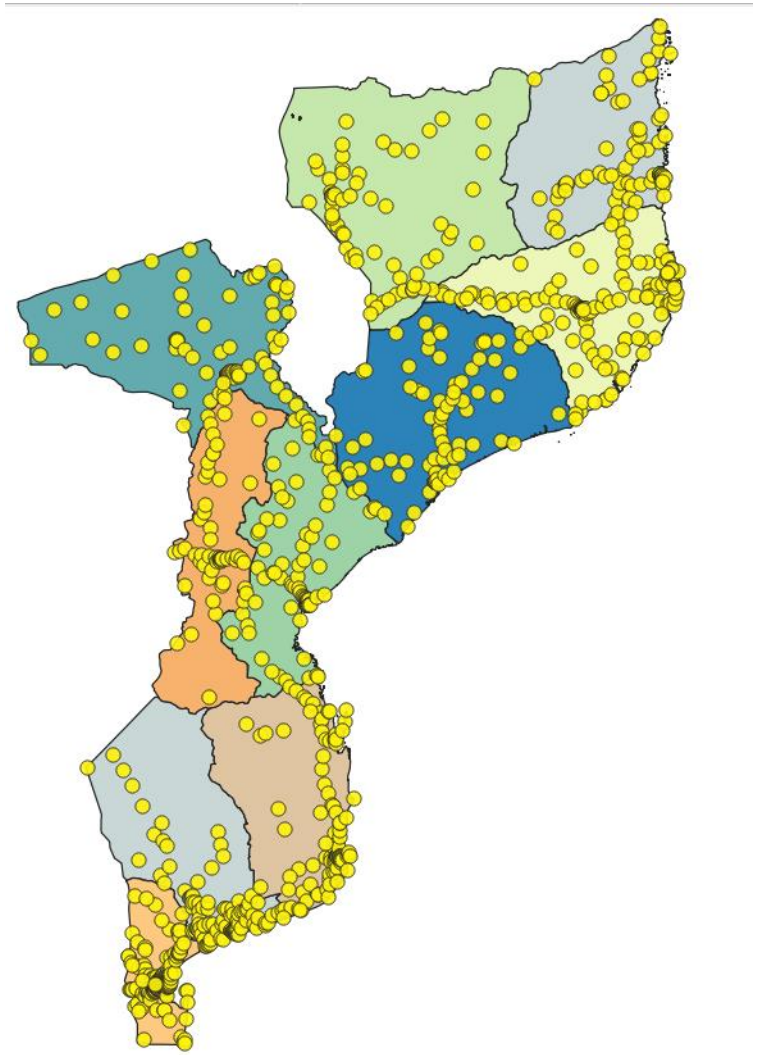
- Subjective Assessment: Gathering user feedback through surveys or interviews to assess their perceived quality of experience.
- Objective Assessment: Utilising algorithms or metrics derived from network data to quantify aspects of user experience, Key Quality Indicators (KQIs), such as video and audio quality.

Integration of QoS and QoE Metrics

- Correlating QoS and QoE metrics to gain insights into the relationship between technical network performance and user satisfaction.
- Developing models or frameworks that incorporate both QoS and QoE parameters for a comprehensive evaluation of service quality.

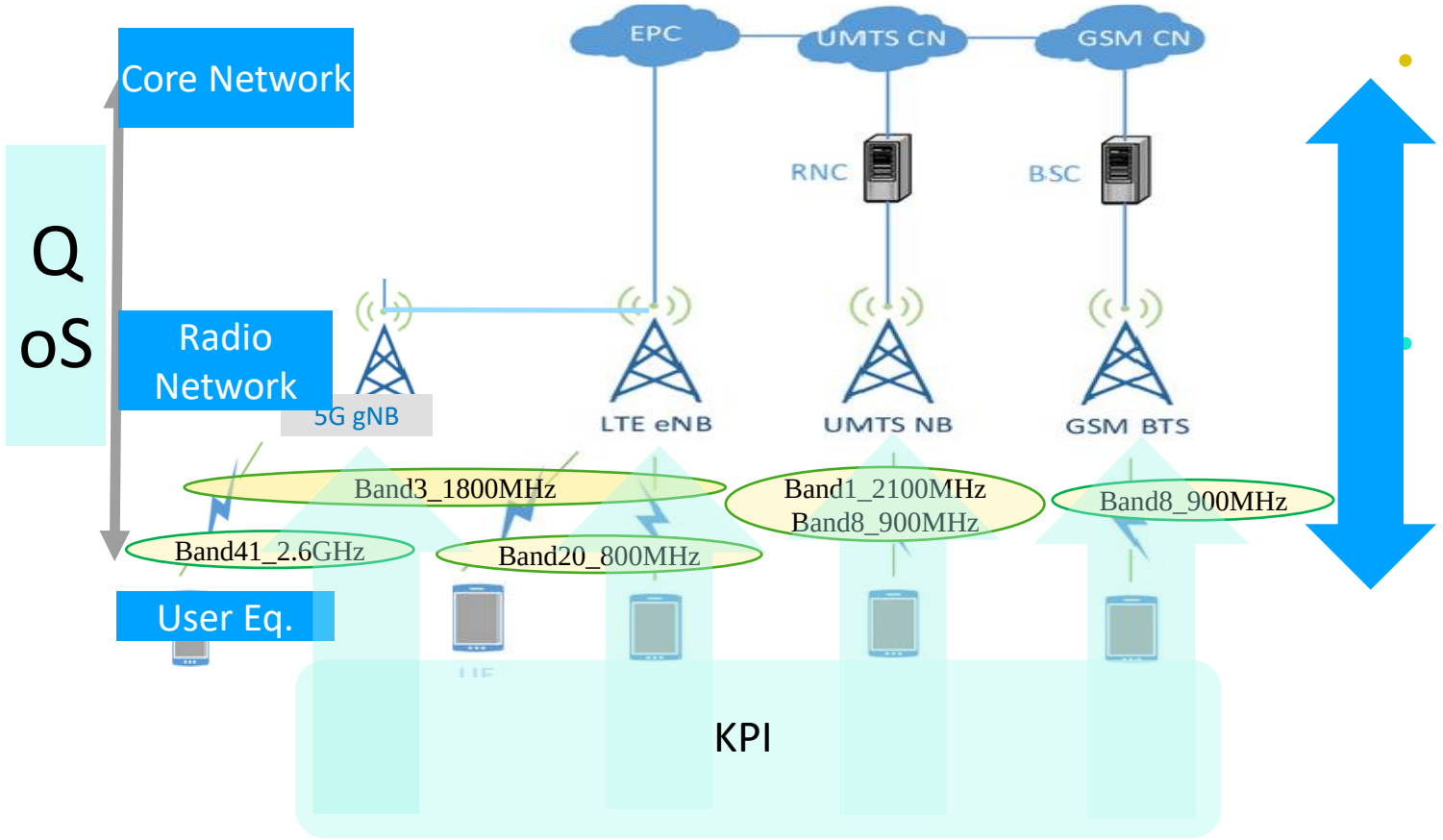
5. Multi-RAT Environment_Tmcel





- Multivendor Access Network
- Multiband Radio Access across the country (2G,3G,4G,5G) technologies

6. QoS Evaluation



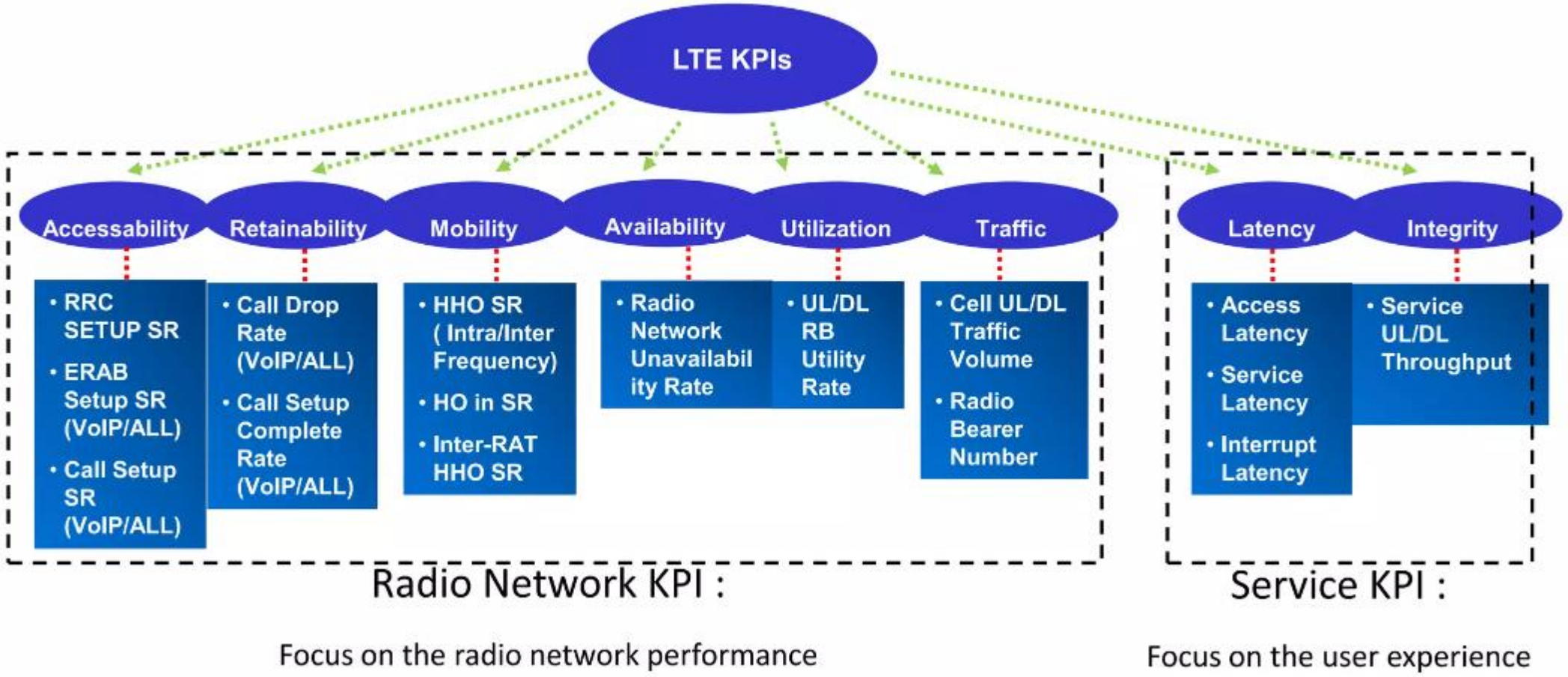
KPI

- **Drive Test**
  - MOS- Mean Opinion Score
  - Coverage (RxLev)
  - Interference
- **Network Performance Monitoring**
  - Accessibility
  - Retainability
  - Mobility
  - Integrity

- The evaluation of KPIs is done on each access technology
- Prone to different sources of external interference
- Technology footprint difference
- Complex mobility management

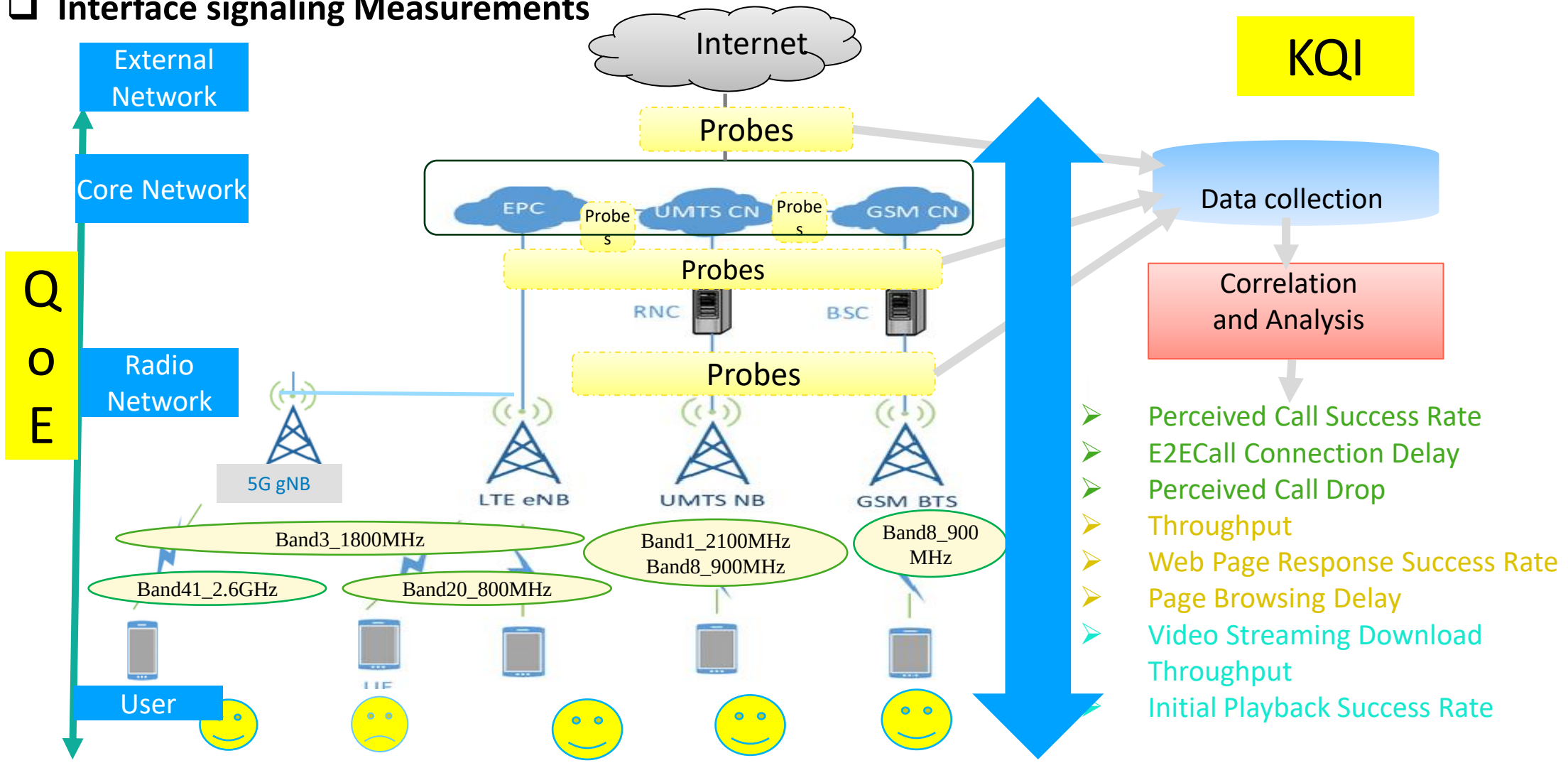
7. Key Performance Indicators (KPIs) an example of LTE (4G)

Tmcel utilises Key Performance Indicators (KPIs) such as those indicated in the figure below to rigorously assess Quality of Service (QoS) attributes, ensuring seamless connectivity and optimal user experiences across our multi-access technologies.



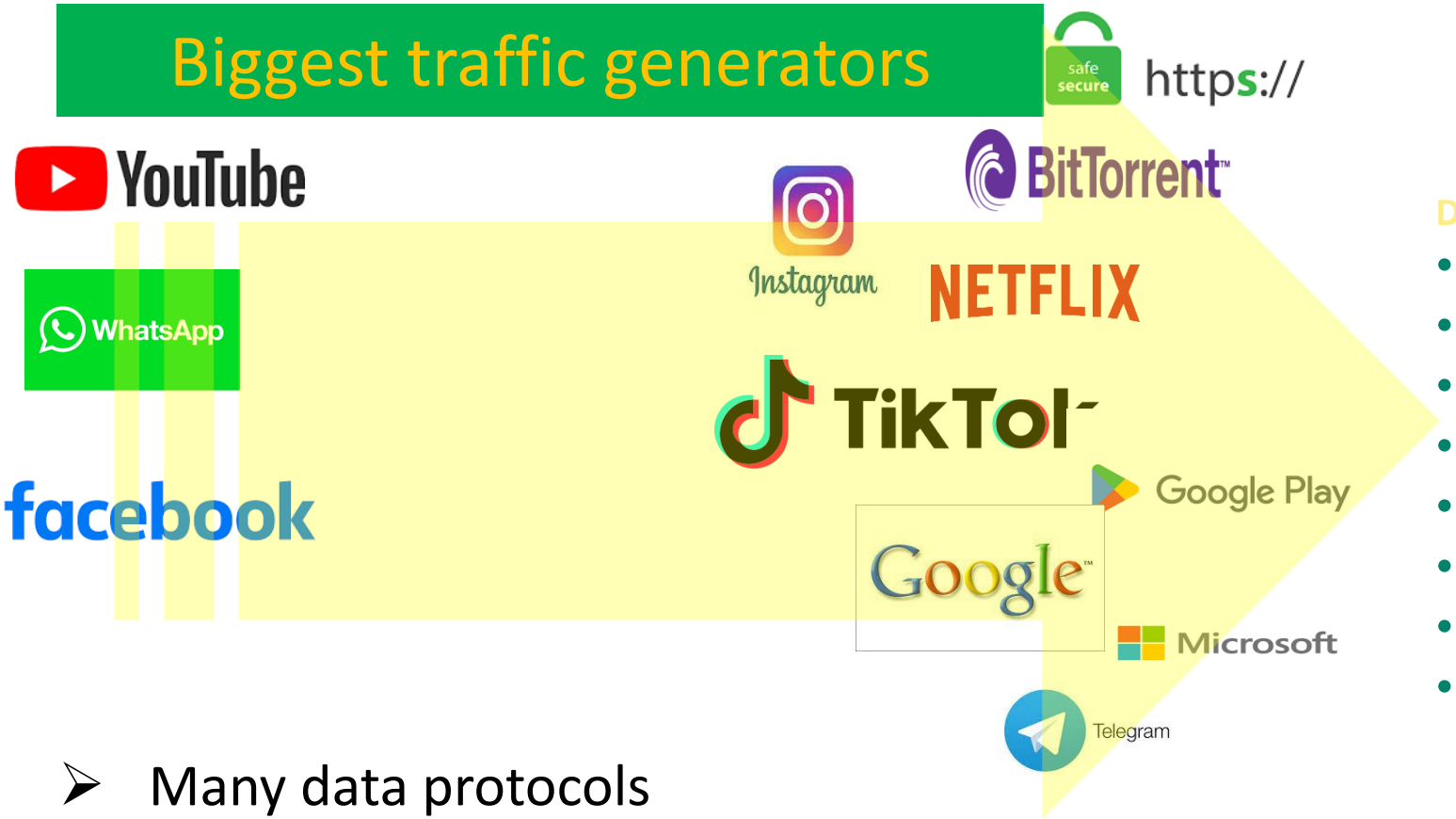
8. QoE Evaluation

- **Interface signaling Measurements**



- **User feedback through surveys or interviews and customer complaints management**

9. Services_Data Traffic Applications

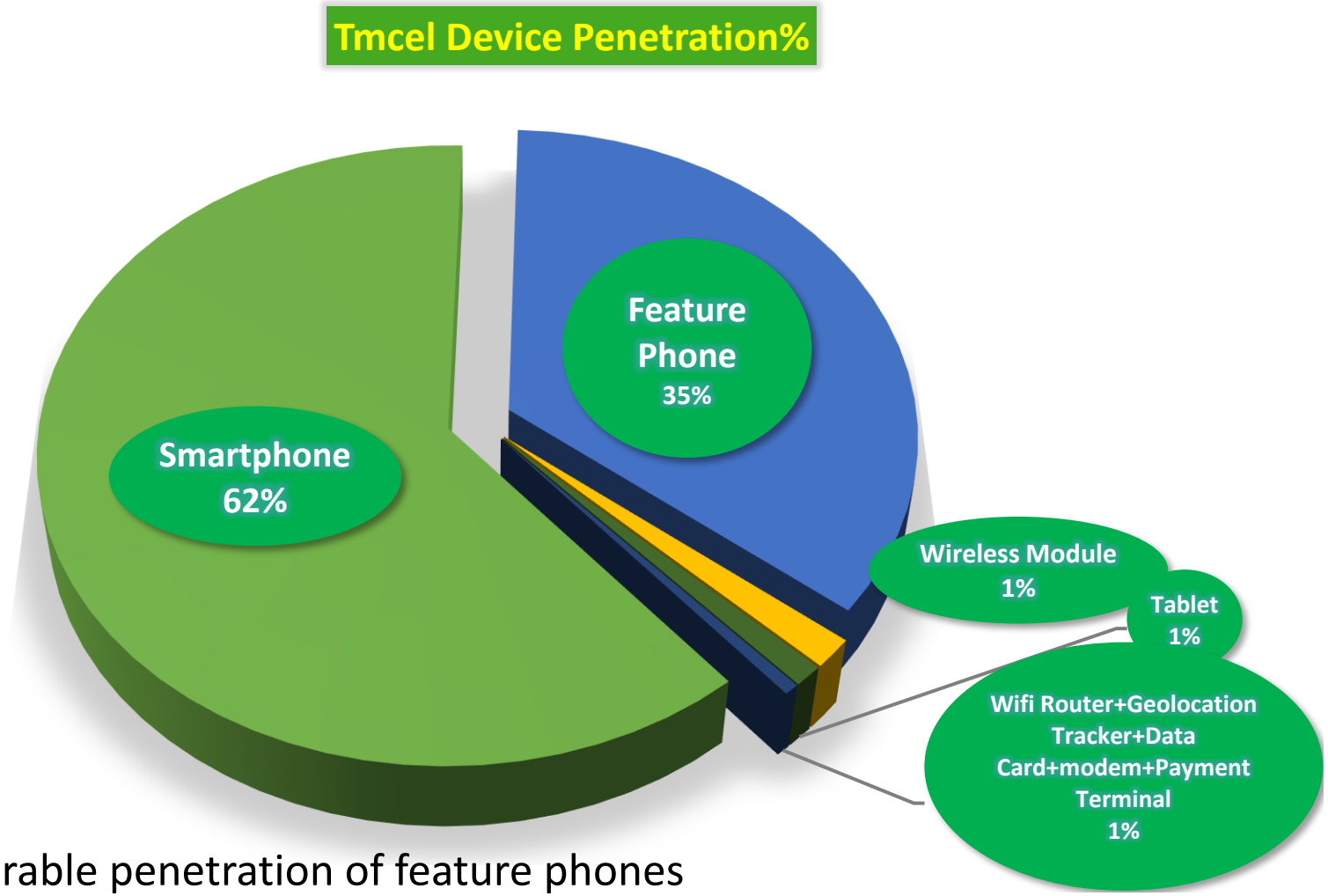


Data Protocols Categories

- Streaming
- Web browsing
- P2P
- File Access
- Gaming
- VoIP
- Email
- Navigation

- Many data protocols
- Many KPIs and KQIs to monitor
- Tmcel focuses on monitoring the interfaces and protocols through which these services flow

10. Device Penetration



- Considerable penetration of feature phones
- Trend towards increase in smartphones penetration
- Existence of devices with not very significant penetration, but which require attention
- Tmcel KPIs and KQIs evaluation take into account device penetration

11. Key Quality Indicators (KQIs) examples

Tmcel utilises KQIs for Objective Assessment of QoE, Utilising algorithms or metrics derived from network data to quantify aspects of user experience, such as video and audio quality, across the network, including interfaces to content providers.

Circuit Switched Services

- Perceived Call Success Rate
- E2ECall Connection Delay
- Perceived Call Drop

Web Services

- Throughput
- Web Page Response Success Rate
- Page Browsing Delay

Video StreamingService

- Video Streaming Download Throughput
- Initial Playback Success Rate

12. Benefits of Monitoring KPIs

Benefits of Monitoring KPIs:

- **Ensures Quality of Service (QoS):** By monitoring these KPIs, Tmcel proactively identifies and addresses network performance issues to maintain high QoS standards for customers.

- **Optimises Network Performance**: Regular assessment of KPIs allows Tmcel to optimise network resources and infrastructure to meet growing user demands and technological advancements.

- **Enhances User Experience:** Meeting or exceeding KPI targets translates to improved network reliability, faster speeds, and better overall user experience or QoE for Tmcel subscribers.

13. Challenges in QoE Evaluation

- Complex access network
- Costly KPI assessment
- Varied and different user equipment
- Rapid development of data services, mainly video services and OTTs
- Many KPIs and KQIs to analyze
- Maintain availability and KPIs within network targets in remote areas

14. Conclusion

In conclusion, the evaluation of QoS and QoE across multiple access technologies is crucial for Tmcel's mission to deliver exceptional telecommunications services. Through the utilisation of advanced evaluation techniques, integration of QoS and QoE metrics, and meticulous monitoring of KPIs and KQIs, Tmcel ensures that its networks meet the diverse needs of users across various technologies, including 2G, 3G, 4G, and fixed networks. By prioritizing the optimisation of network performance and enhancing user satisfaction, Tmcel remains committed to providing seamless connectivity and enriching digital experiences for all customers. As we continue to innovate and adapt to the ever-changing telecommunications landscape, Tmcel reaffirms its dedication to excellence, collaboration, and customer-centricity, driving towards a future of unparalleled connectivity and empowerment.

Thank You