



OPEN**SIGNAL**

Advancing Connectivity For All

Crowdsourced User-centric and End-to-End approaches to measuring Meaningful Connectivity

ITU-WTIS

"Measuring connectivity using open and private sector big data" session

3rd July 2023

*Barry Graham
President, Market Impact*

Opensignal Approach



**Capturing on-device
mobile experience**



**Analysing billions of
records to reveal true
experience**



**Delivering standardized,
independent and
consumer-centric
insights for evidence-
based decision making**

**End-to-end experience
measurements**

Representative sample

**Innovative Data Science
and Analytics**

Impartial respected reports

**Insights into the real
experience**

Trusted Independent partner

Independent

Editorially independent public reports - never sponsored

Trusted

Insights trusted by regulators, analysts and over 150 clients globally

Revealing Network Experience

Experiential metrics measuring typical end to end experience

Scientific Analysis

Sophisticated methodology applied consistently

Valued Candid Partner

Global teams with years of industry experience



Independence Charter

Opensignal is the independent global standard for analyzing consumers' true experience on communications networks. We believe greater transparency will encourage network improvements, help consumers choose an operator, boost competition and lead to better connectivity for everyone. Our company, employees, analysts and analysts, industry reports and market data are completely independent and abide by a clear set of principles.

- Standard methodology:** Opensignal applies a single, consistent methodology globally. We do not allow others to influence our methodology for a particular report.
- Equal access without influence:** Opensignal's business model is to sell independent analytics and insights. Any company is able to subscribe to receive this analytics service, but becoming a customer grants no additional influence over Opensignal's independent results, methodology, reports or analysis.
- Reporting free of commercial influence:** Opensignal will never charge a company to be included in our reports or analysis. Nor will Opensignal take payments to guarantee that a public report will favor a specific company or to record any other predetermined outcome.
- Editorial independence:** Opensignal retains editorial control of our reports and the analysis and opinions are always our own, based on the real-world experience data we collect.
- Independent reporting calendar:** Opensignal's public reporting schedule is independently set by our internal editorial team. We never change the timing of Opensignal public reports because of requests of any third party.
- Independent Citation Policy:** Mobile operators, analysts, regulators or other

Experience Charter

Opensignal's data collection is designed to measure the true experience of the end user as accurately as possible. We compare networks based on measures that matter to customers, not abstract engineering parameters. Opensignal collects the most representative data possible to ensure the experience of the broadest base of users are reflected equally in our data. Our tests are carefully designed to accurately reflect the user experience and exclude sources of bias and error. We believe these data collection policies, when combined with the data science techniques laid out in our Analytics Charter, lead the industry and produce the most accurate reports and insights which reveal the true experience.

- Consistent methodology:** Opensignal's data collection methodology has been developed independently over several years and examined by many industry stakeholders. Fundamental to our approach is that we never change our methodology to suit the needs of a particular country or operator. Our methodology only changes as we make improvements which are consistently applied. By doing this we ensure that global comparisons can be made.
- Typical experience:** Our tests are designed to represent the experience a typical user will receive. Unlike other "best-case" performance tests, we are not in certain conditions or in the methodology at every step user is likely to experience.
- Wide range of real device devices:** Our tests use a wide range of real devices (not just smartphones) because we collect data and smartphone models is a key element of the user's experience.
- Automated random testing:** Our tests are automated to ensure that we can test a wide range of devices and configurations.
- Device to real-world end:** Our tests are designed to measure the experience when using a device in a real-world environment. Our tests are designed to measure the experience when using a device in a real-world environment.

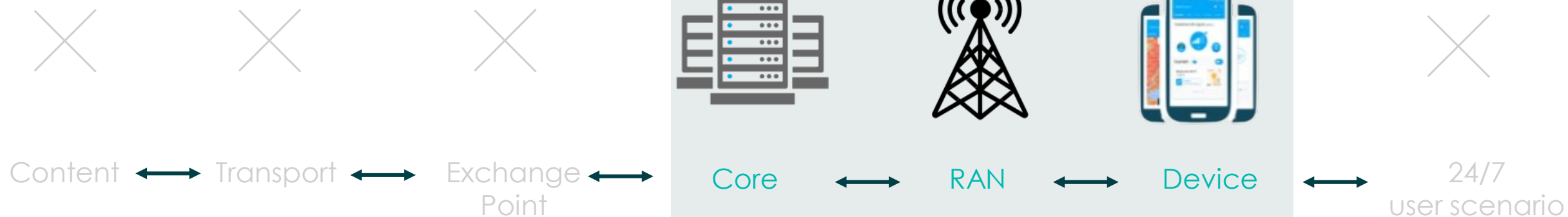
Analytics Charter

Opensignal's public reports are designed to allow an objective comparison of different networks. Our analysts employ data science best practices to ensure that results can be trusted and are not misleading. We believe these analyses, when combined with the reporting standards laid out in our Independence Charter, lead the industry and produce the most accurate reports and insights which reveal the true experience.

- Consistent methodology:** Opensignal's analytics methodology has been developed independently over several years and examined by many industry stakeholders. Fundamental to our approach is that we never change our methodology to suit the needs of a particular country or operator. Our methodology only changes as we make improvements which are consistently applied. By doing this we ensure that global comparisons can be made.
- Real users with equal weighting:** Our analysts are designed to ensure that each user equally contributes to results. Our analysts ensure as far as possible that we only include data from devices that display normal user behavior and not the behavior of test and engineering devices, research projects, etc.
- Confidence intervals always considered:** We always use confidence intervals in our analytical conclusions. These are clearly displayed in our charts, unless including them seems unnecessary. Confidence intervals represent the upper and lower bound of what a value is likely to be between long confidence intervals a standard scientific practice when reporting on sampled data.
- Only statistically significant conclusions drawn:** If a difference between operators is a given, we do not conclude that we have a difference between operators as long as we are confident in our results. We do not report the data of all to ensure that we only public results in which we are confident.
- Only an operator's direct experience is included:** To ensure that our data truly represents the experience of an operator's own customers we exclude measurements generated by roaming and other non-national operators and channels, as they may not be subject to different service agreements. Measurements generated by national operators are attributed to the user's home operator so that a full set of their network experience is included in our reports and insights.
- Consistent standard time intervals used:** We normally only report on standard time intervals, and the most recent data, we do not " cherry-pick " an arbitrary time period in a report to support a predetermined conclusion. Where a different time window is being used, we will always be clearly identified.
- Comparisons must be like-for-like operators:** In comparisons we only include operators whose network is widely represented across the area under study. Regional operators are not shown in regional comparisons. Opensignal's public reports are designed to allow an objective comparison of different networks.
- Our analysts employ data science best practices:** To ensure that results can be trusted and are not misleading.
- We believe these analytics policies, when combined with the measurement methodology laid out in our Independence Charter, lead the industry and produce the most accurate reports and insights which reveal the true experience.**
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Openly sharing the standards we uphold for published content

The **Limitations** of Traditional Quality of Service (QoS) measurements



Network Testing (e.g. Drive-testing)

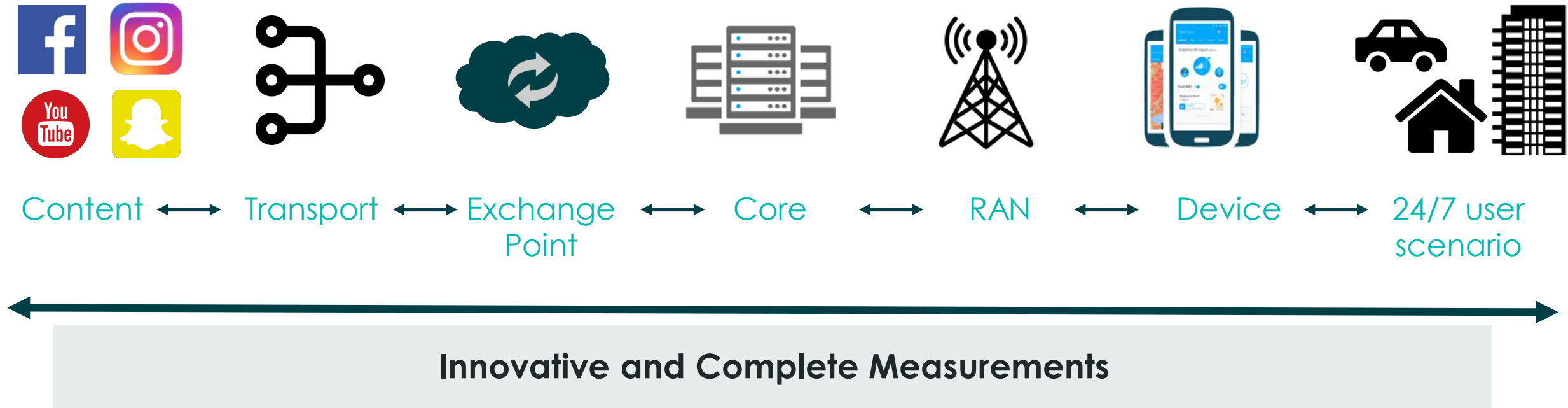
Peak Speed (e.g. manual speed test app data)



Only Opensignal measures the full **end-to-end user experience** (active & passive testing)

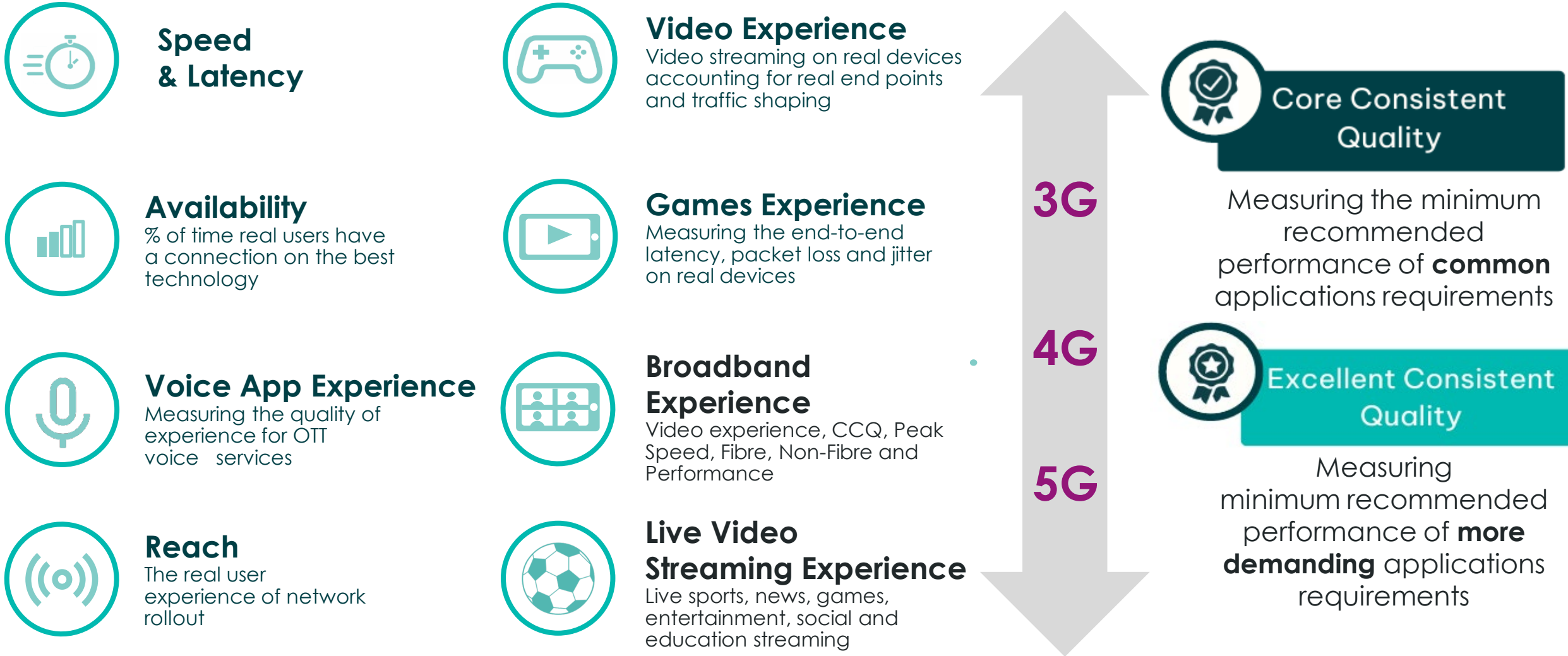


A Complete view of Mobile Experience



Opensignal enables regulators to have a holistic view of consumers' experience, both from a **user-centric** and **network-centric** perspective.

Leading experiential metrics



Leading the evolution from network **performance** to network **experience**

Opensignal Testing Methodologies Avoid Data Bias

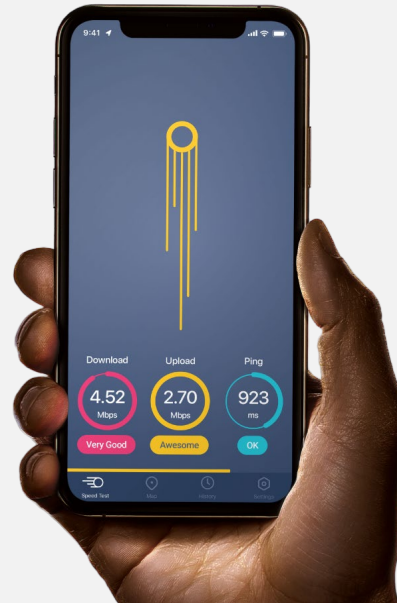
Background Testing

Run on the device in the **background** of an app



User-Initiated Testing

A user hits a **“run test now” button** to start a test



Active Testing

Traffic is put on the network and the response is measured

Passive Testing


Data is recorded from the device, but no traffic is put on the network.

Global Institutional use of Opensignal's end-to-end methodology


ITU Publications International Telecommunication Union
Development Sector

Pandemic in the Internet age

From second wave to new normal, recovery, adaptation and resilience



2021 ITU-D publication "Pandemic in the Internet Age".



OECD publishing

BROADBAND NETWORKS OF THE FUTURE

OECD DIGITAL ECONOMY PAPERS
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OECD publishing

DEVELOPMENTS IN SPECTRUM MANAGEMENT FOR COMMUNICATION SERVICES

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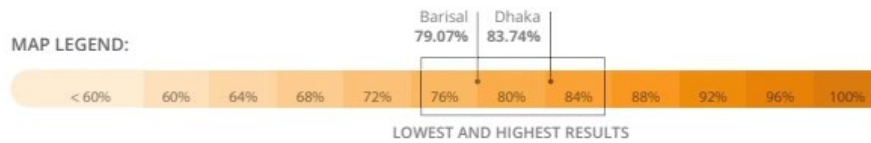


4G for Meaningful Connectivity

Bangladesh Colombia Indonesia Pakistan

4G Availability in Bangladesh

% time, Jan-Mar 2021



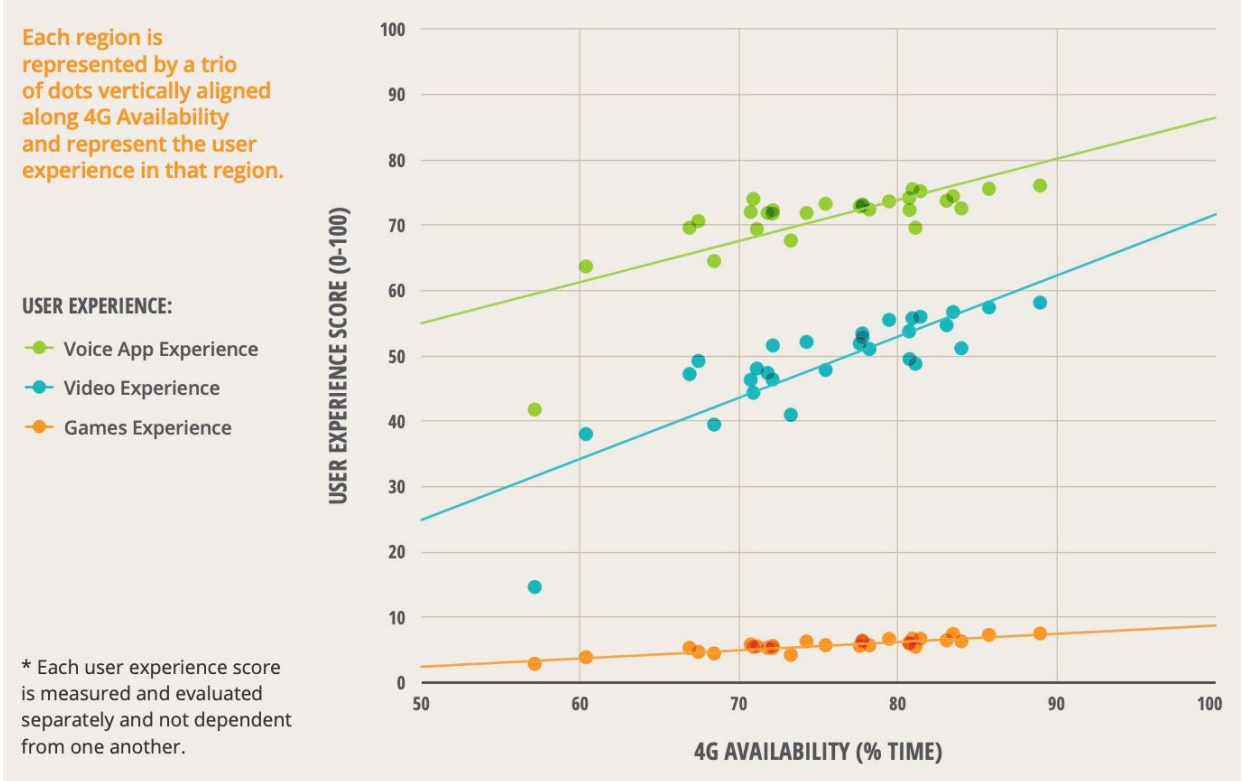
MOBILE INTERNET DOWNLOAD SPEED EXPERIENCE (IN MBPS)

Overall	3G	4G
7.9 (±0.057)	5.0 (±0.057)	9.1 (±0.073)

+/- numeric values represent confidence intervals. [Read why confidence intervals are important.](#) © Opensignal Limited

4G Availability & User Experience in Colombia

Sep-Nov 2021



Closing the Information Gap

Across a wide range of use cases, including but not limited to:

- QoS and QoE
- Network Coverage
- Spectrum Utilization
 - Energy Consumption

Evidence-based Regulatory Approaches

Facilitating the dialogue between governments and industry and effectively managing consumers' expectations

Meaningful Connectivity

- Not all QoE data is equal
- Human-centric measurements are essential
- Must assess level of consistent, high-quality connectivity to be deemed **meaningful**

Thank You

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