# Is 5G really better than 4G?

Genaro Soto Valle


中国移动
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5G
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# 5G's Pillars of Improvement vs. 4G

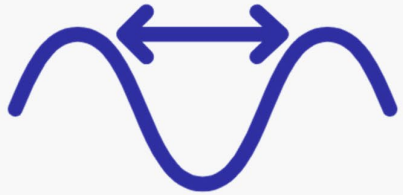
Dgtl Infra
REAL ESTATE 2.0

## Lower Latency

Low-latency applications like cloud / mobile gaming

## Increased Speed

Drastic improvement for high bandwidth apps, HD video

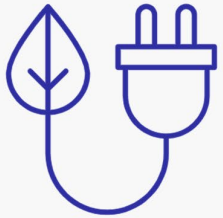


## Higher Density

Densely packed IoT devices for "device to device" connections

## Added Capacity

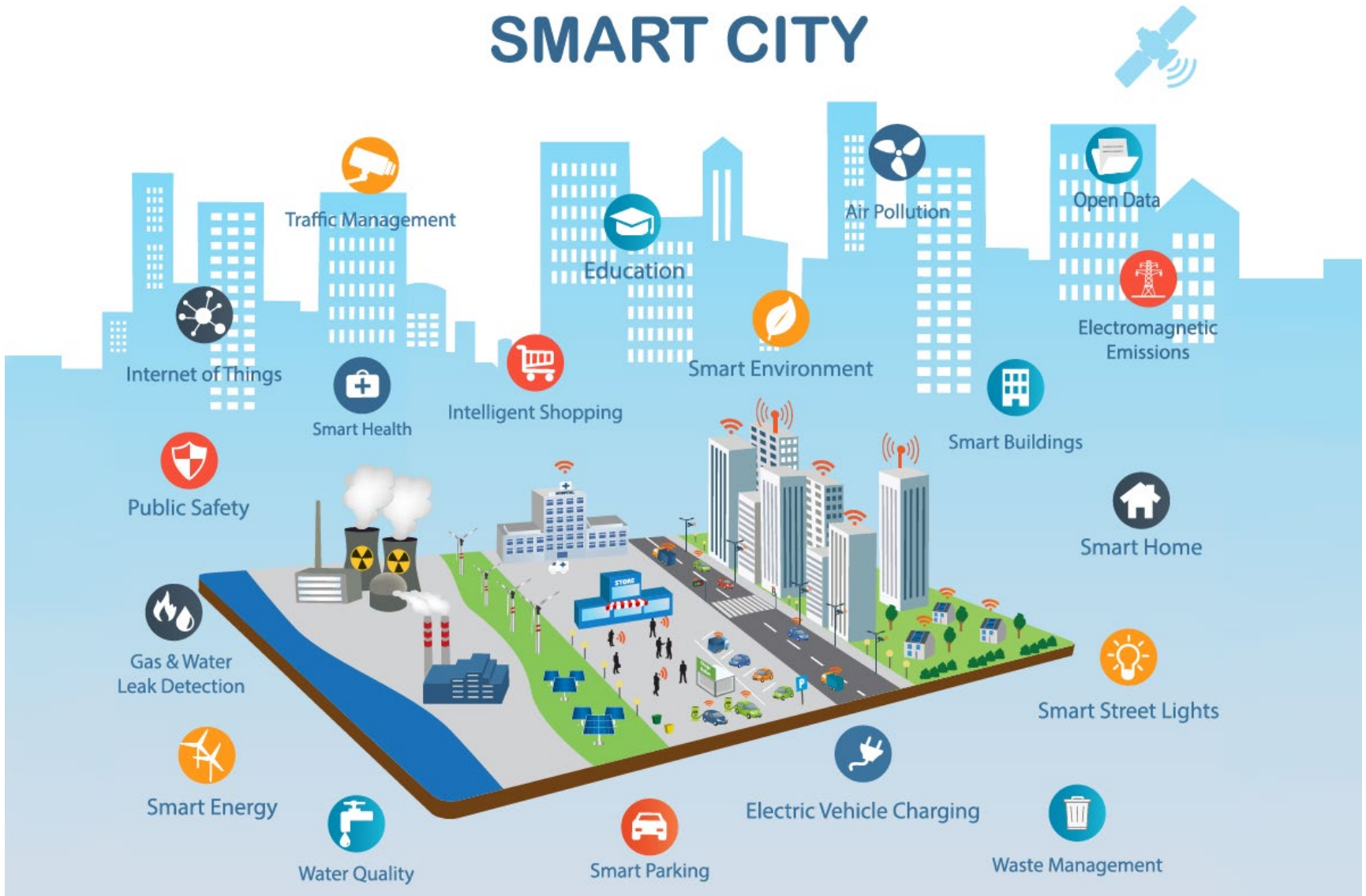
Networks able to carry a heavier content load



## Energy Efficiency

More efficient devices and 5G wireless network equipment

| 5G vs. 4G Comparison | | | | |
|---|---|---|---|---|
| **Roundtrip Latency:** 5x to 10x lower | **Download Speeds:** 10x to 100x | **# of Connected Devices:** 10x | **Network Throughput:** 100x | **Energy Consumption:** 90% lower |


SMART CITY
Traffic Management
Education
Air Pollution
Open Data
Internet of Things
Smart Health
Intelligent Shopping
Smart Environment
Electromagnetic Emissions
Smart Buildings
Public Safety
Smart Home
Gas & Water Leak Detection
Smart Street Lights
Smart Energy
Electric Vehicle Charging
Water Quality
Smart Parking
Waste Management

# Motivation

- Determine if 5G networks are actually better than 4G, or if it is not significantly better

**How?**

- Analyze and compare the channel performance between 5G and 4G cellular networks

# Database

## YOUTUBE GOES 5G: BENCHMARKING YOUTUBE IN 4G VS 5G

☆☆☆☆☆ *0 ratings - click the stars to submit your rating*


Citation Author(s): Raza Ul Mustafa *(University of Campinas)*
Christian Esteve Rothenberg *(University of Campinas)*
Chadi Barakat *(INRIA, Université Côte d'Azur)*



Submitted by: Raza Mustafa
Last updated: Mon, 12/12/2022 - 08:50
DOI: 10.21227/h00h-ew92
Data Format: *.csv (zip)
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IEEE

"... Massive 4G and 5G dataset collection campaign using commercial 4G and 5G networks, where we consider YouTube as a baseline for video streaming to collect Channel Level Metrics (CLM) and YouTube Quality of Experience (QoE) logs with 1-second granularity."

Carried out in Nice, France

# What is in the data?

2 types of data

- **YouTube Quality of Experience (QoE) data**
  - Resolution, percentage of loaded bytes, record of events (playing, paused, *buffering*)
- Channel Level Metrics (CLM)
  - Information about mobile network and received power

Table 1: 4G and 5G dataset statistics.

| Parameter | Statistics |
|---|---|
| Mobility – Total Kilometers | 1000+ (Approx) |
| Pedestrian – Total Kilometers | 250+ (Approx) |
| Number of Videos | 10 |
| Total Video Sessions | 300 +, 1500 + Minutes Streaming |
| 4G and 5G Data Consumed | 300+ GB |
| 5G Smartphone | Samsung Galaxy S21 5G |
| 4G Smartphone | Samsung Galaxy S8 |

**Null hypothesys**

- The distribution of (Youtube QoE/Network Channel) metrics is the same

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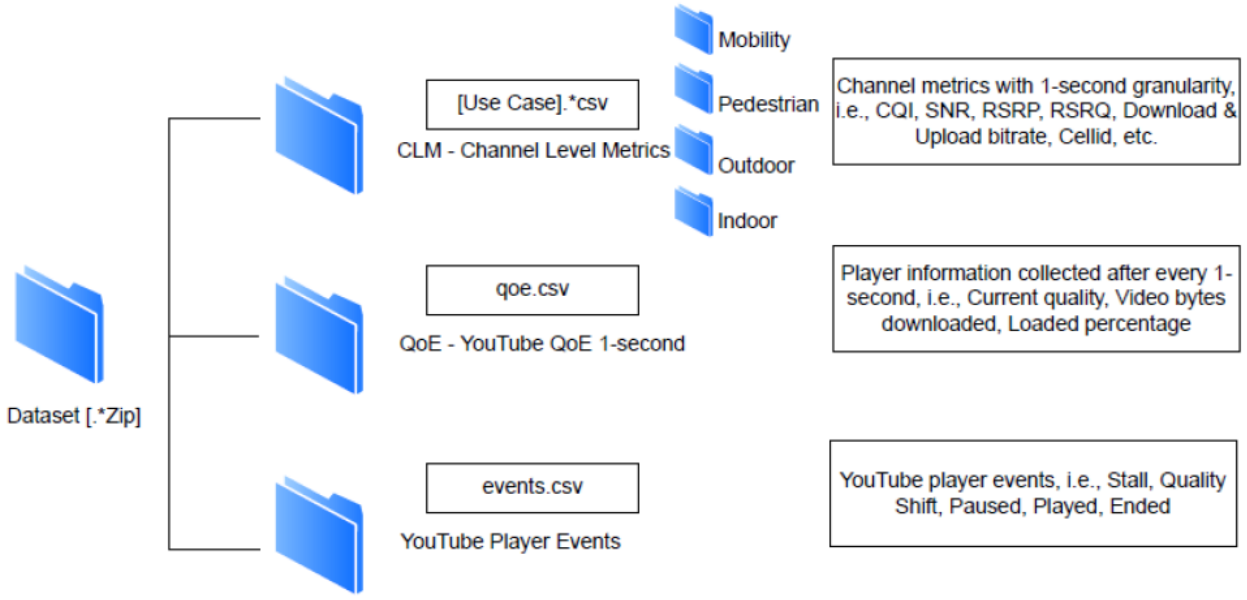


Figure 1. Files overview.

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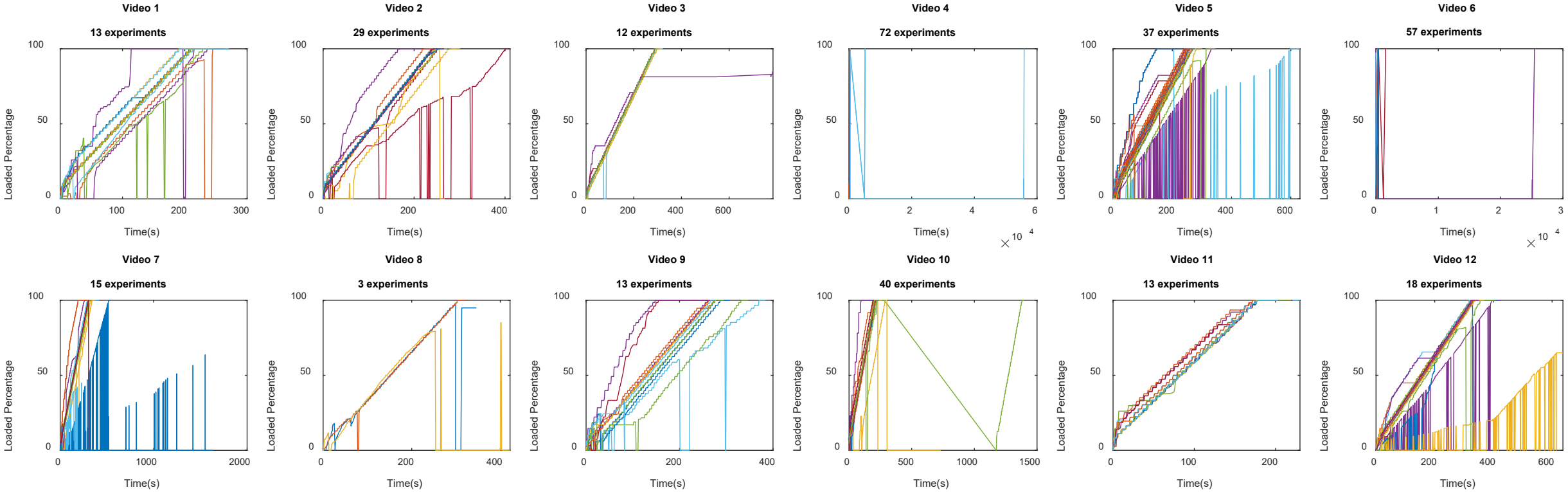
# YouTube QoE Logs of *Percentage of Bytes Loaded*



# YouTube QoE Logs: *Events*

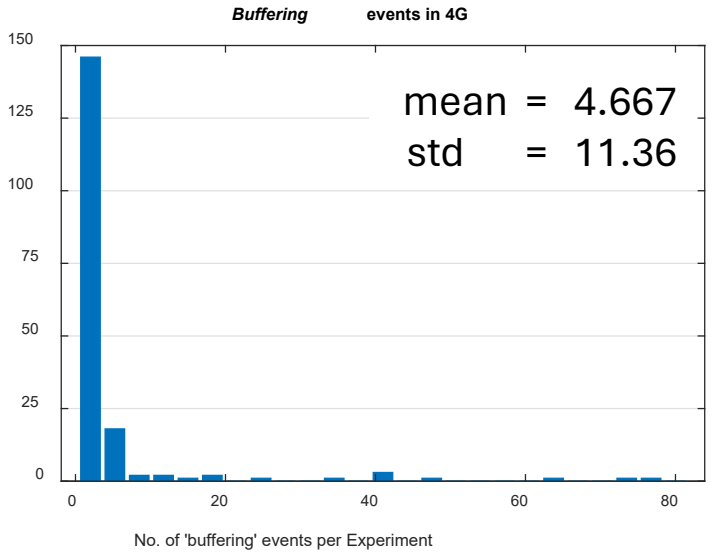
- Buffering events
- Change detection on ‘Video Quality’

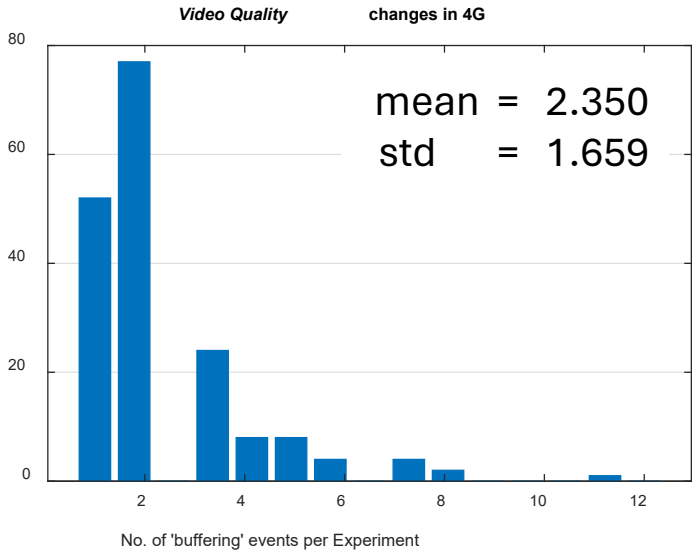
**Wilcoxon rank sum test**
*ranksum*(A,B)

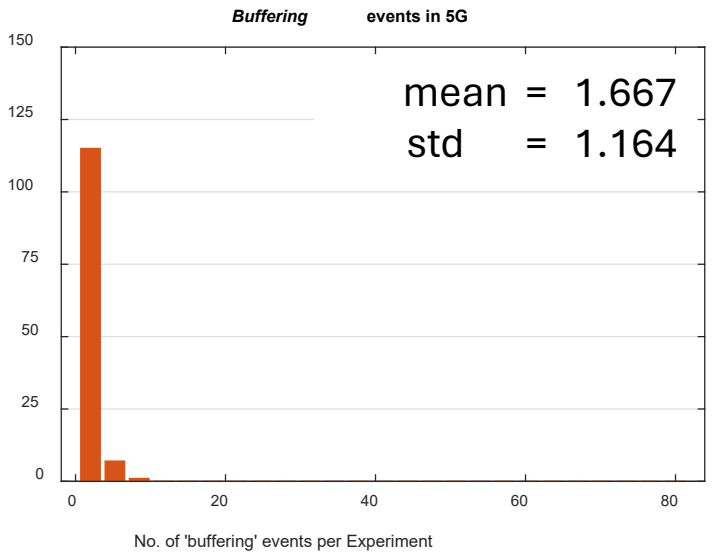
- null hypothesis:
  distributions of 4G and distribution of 5G have equal medians

Results:

- **Reject** null hypothesis for dist. of *buffering events*
- Failure to reject null hypothesis for dist. of *changes in video quality*




# References


- Raza Ul Mustafa, Christian Esteve Rothenberg, Chadi Barakat, December 12, 2022, "YouTube goes 5G: Benchmarking YouTube in 4G vs 5G", IEEE Dataport, doi: https://dx.doi.org/10.21227/h00h-ew92.

- GitHub repository: https://github.com/razaulmustafa852/youtubegoes5g

Thank you!