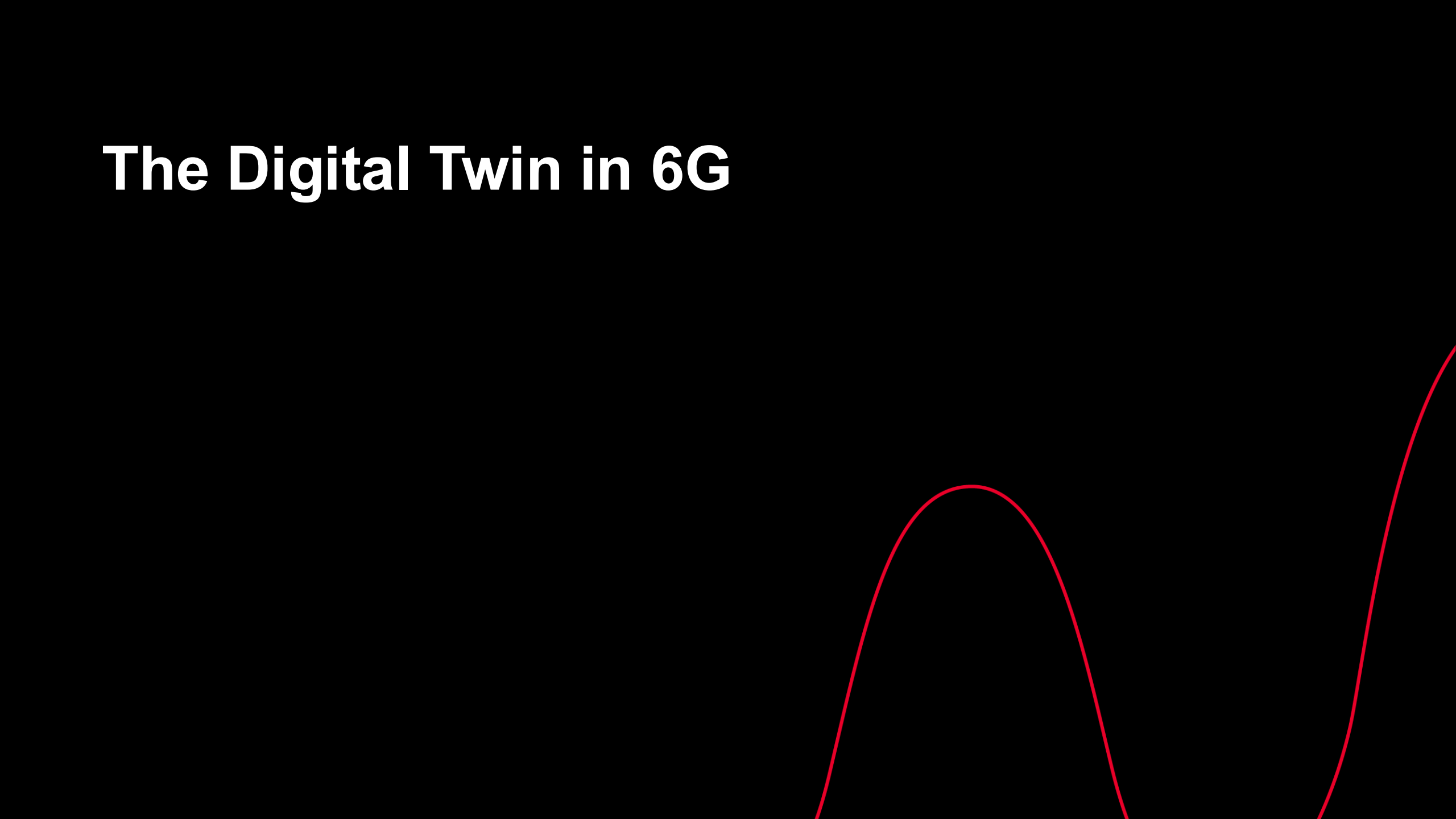
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Digital Twins Their Uses in 5G and 6G

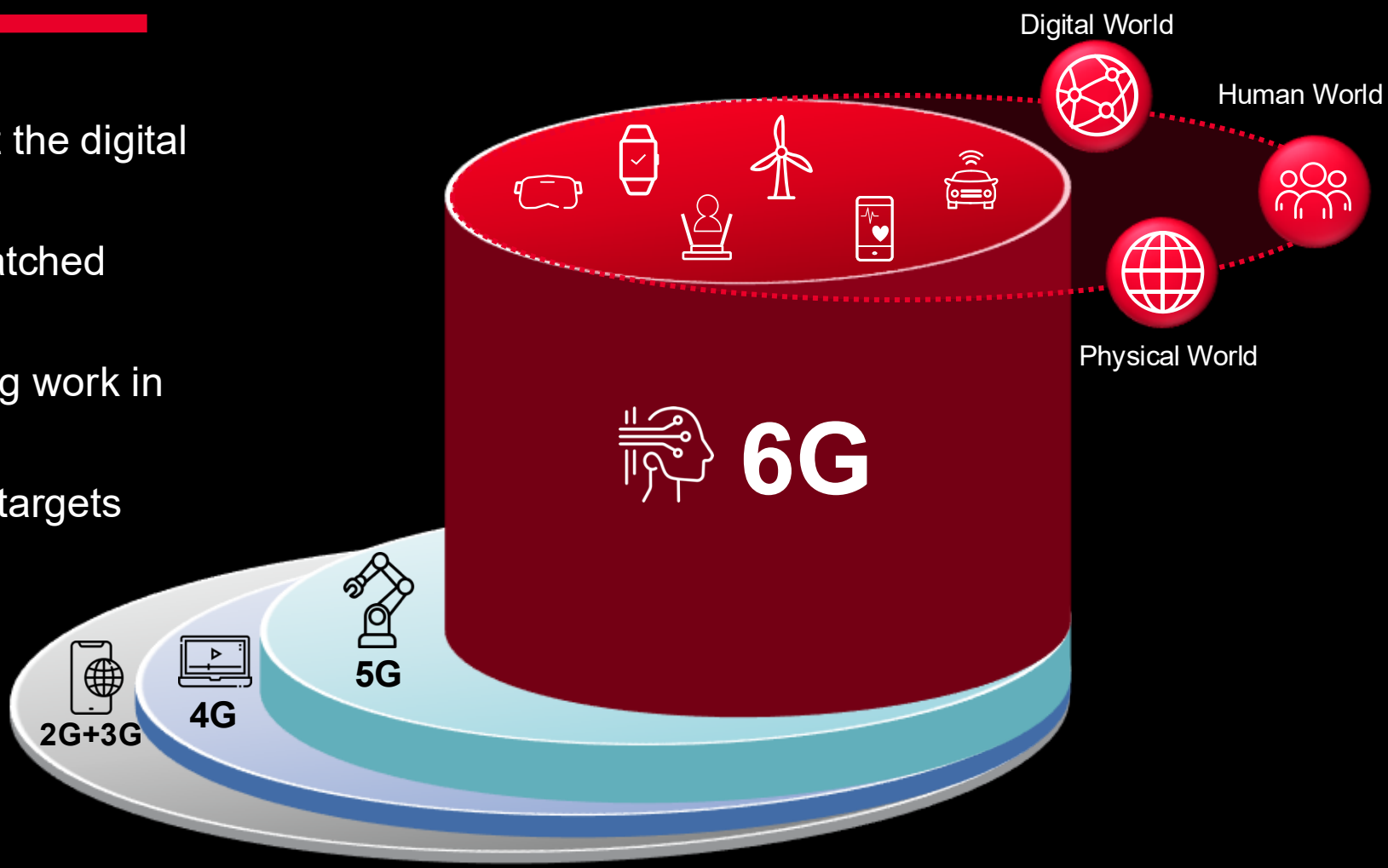
Maxime Remy, R&D Engineer
October 2026

The Digital Twin in 6G



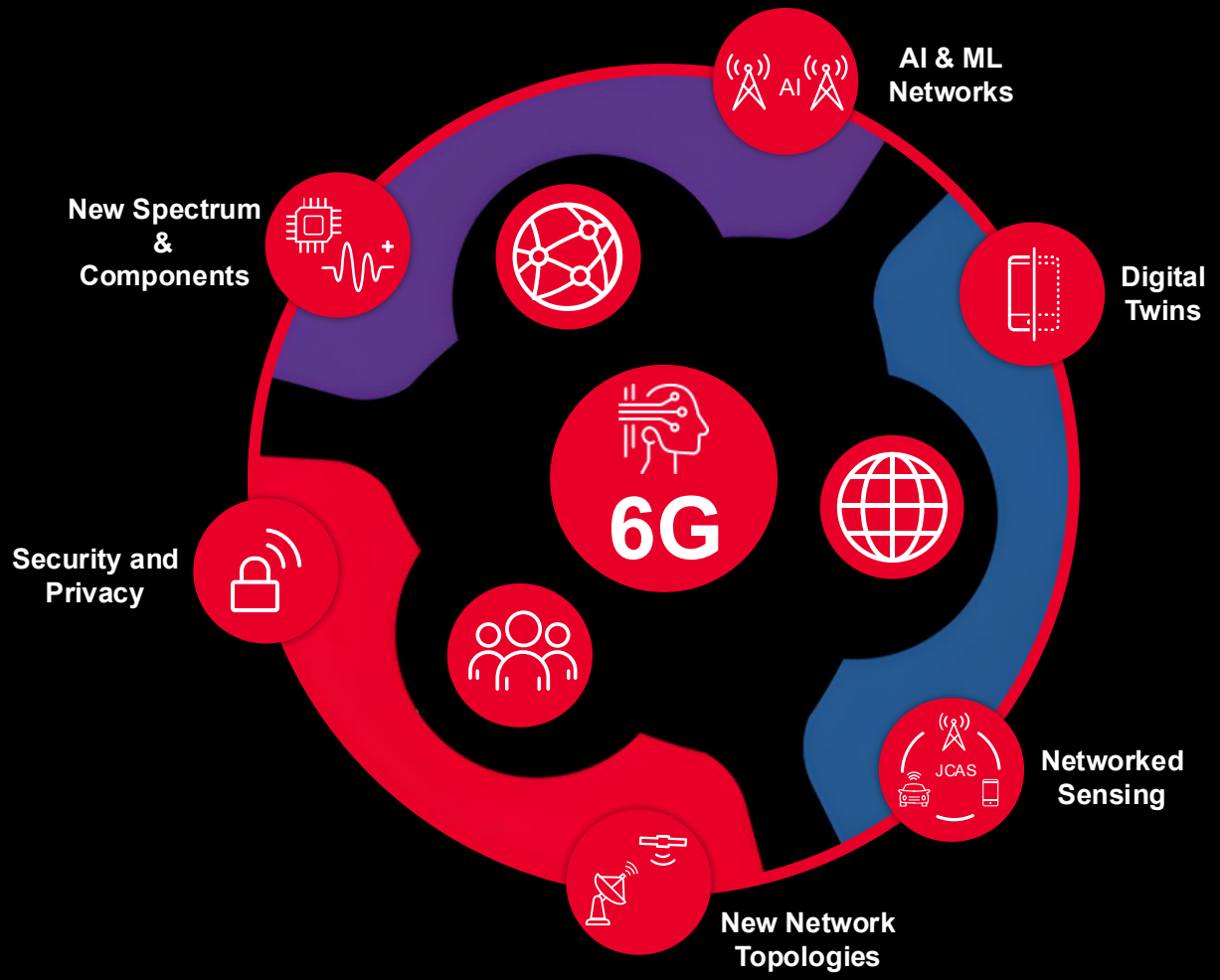
6G Vision

- Create a new approach to connect the digital and physical worlds
- Leverage massive data from unmatched number of devices
- Use intelligence to make everything work in unprecedented ways
- All while striving to meet Net Zero targets



© Keysight Technologies, Inc.

6G Key Technologies and How AI impact Them



AI will speed up design cycles for complex circuits by improving data handling, simulations, and digital compliance

AI will improve network performances by learning from historical data and adapting to changing conditions

Digital twins provide a sandbox for experimentation and a source of synthetic data used for AI/ML algorithm training

AI boosts JCAS systems by using deep learning to filter noise, detect patterns, and extract useful information

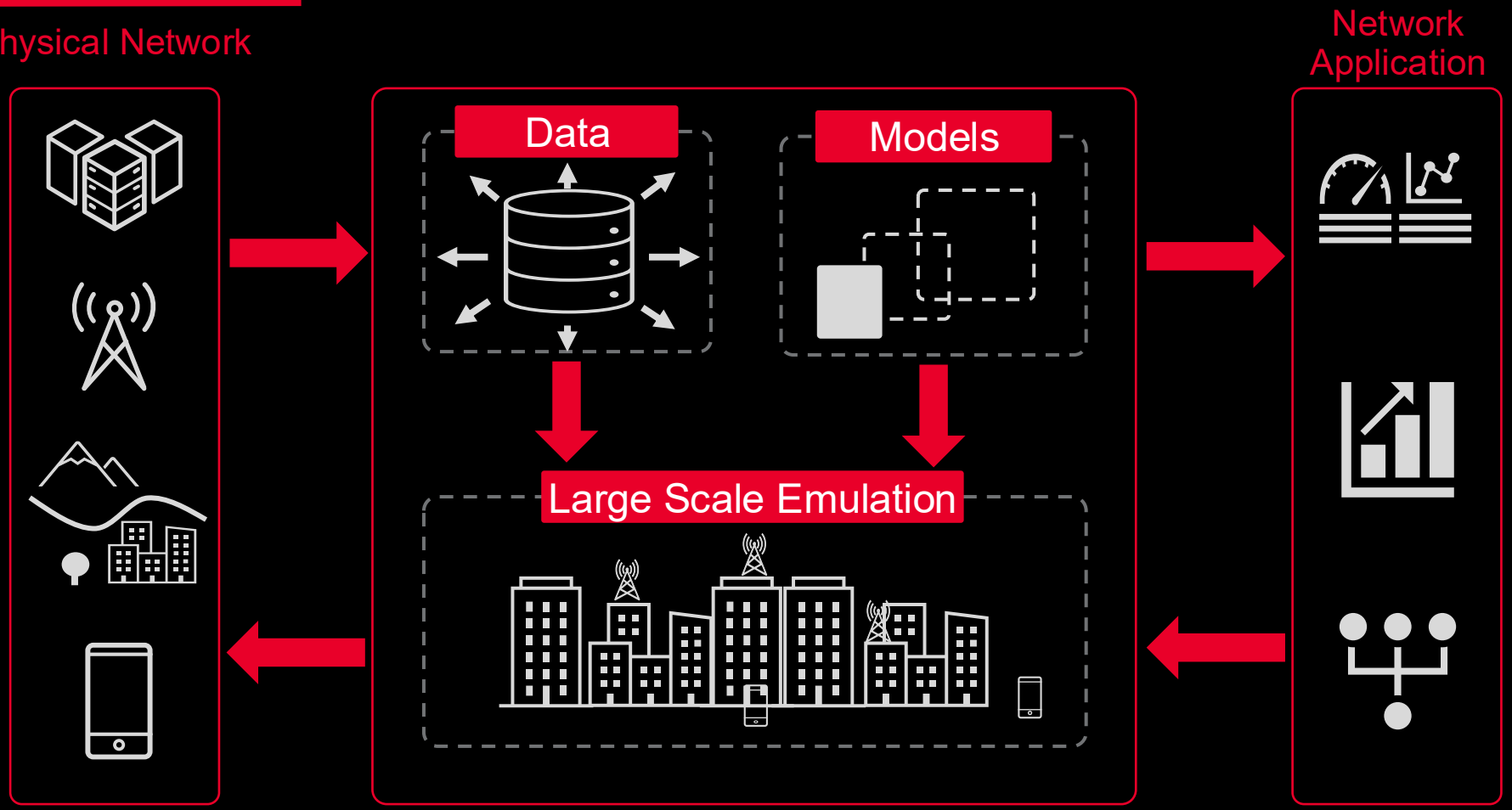
AI and ML solutions are can effectively discern patterns within dynamic, multi-dimensional data, providing superior performance

AI can implement advanced encryption techniques and privacy-preserving algorithms to protect user data

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The value of Digital Twin

- What's a Digital Twin (DT)?
  - DT Networks
- What can be the DT do?
  - What if analysis
  - Private network planning
  - Sandbox for AI
  - End-to-end simulation



Unlike traditional simulation systems, DT allows **two-way communication** between the physical and virtual networks.

How to get a Digital Twin



The Vision and Challenges

Scale

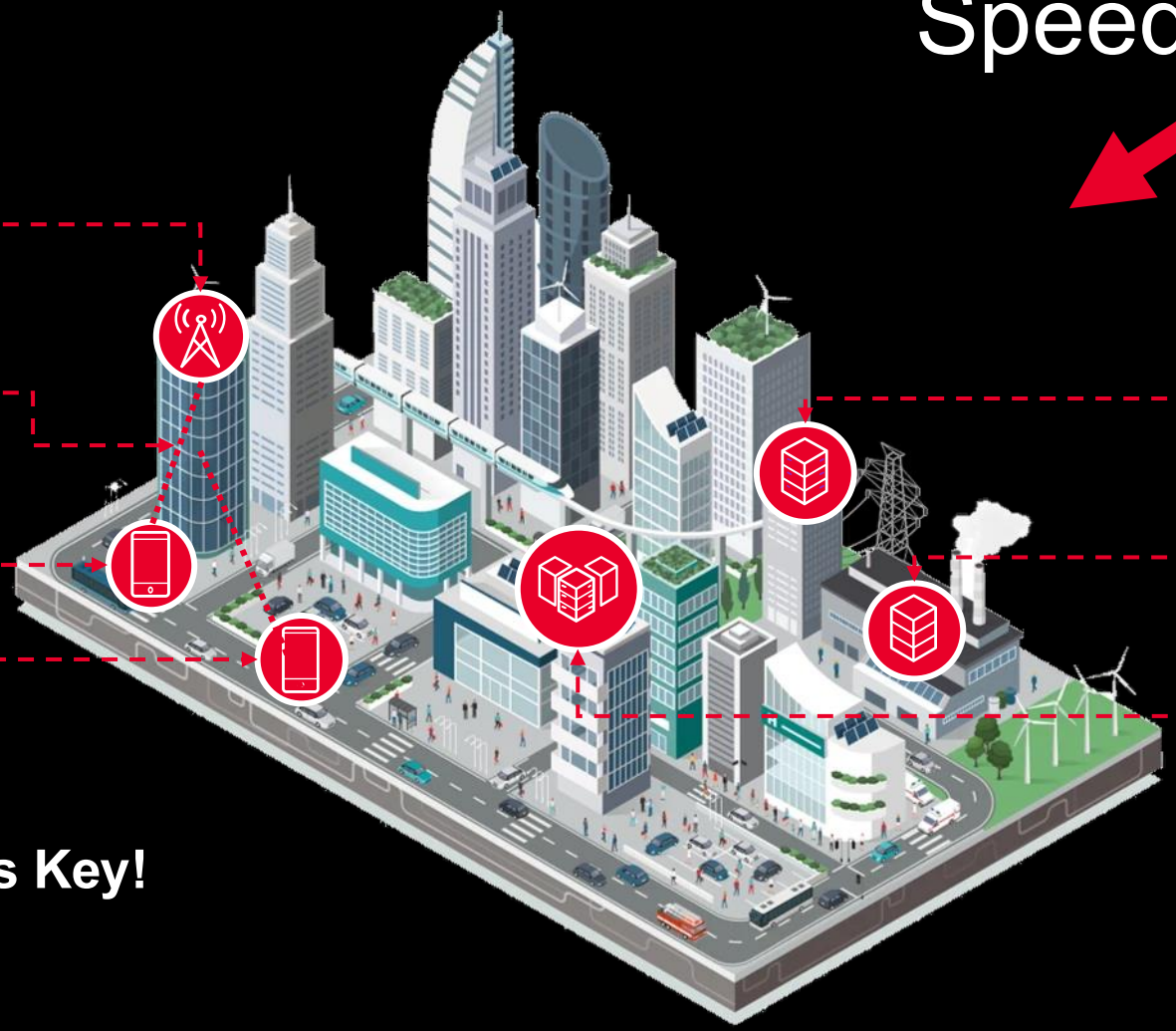
Speed

Fidelity

ORU or gNB

3D Ray Tracer

User Equipment



VNF

VNFs (CU, DU, …)

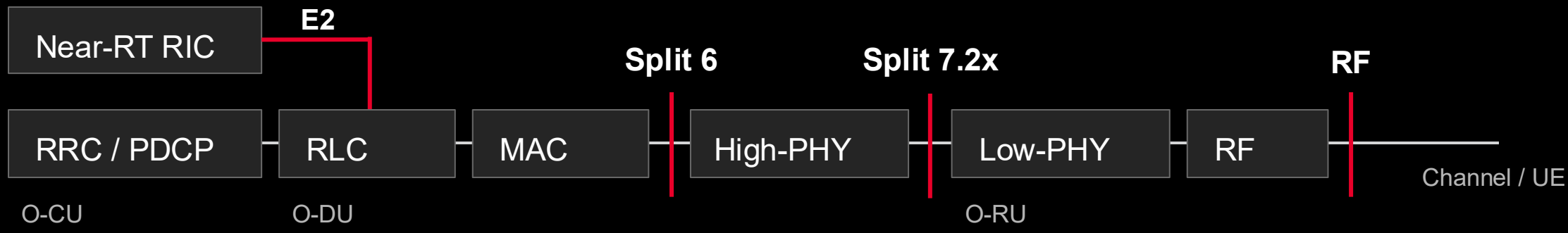
5G Core

Abstraction is Key!

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Levels of Abstraction

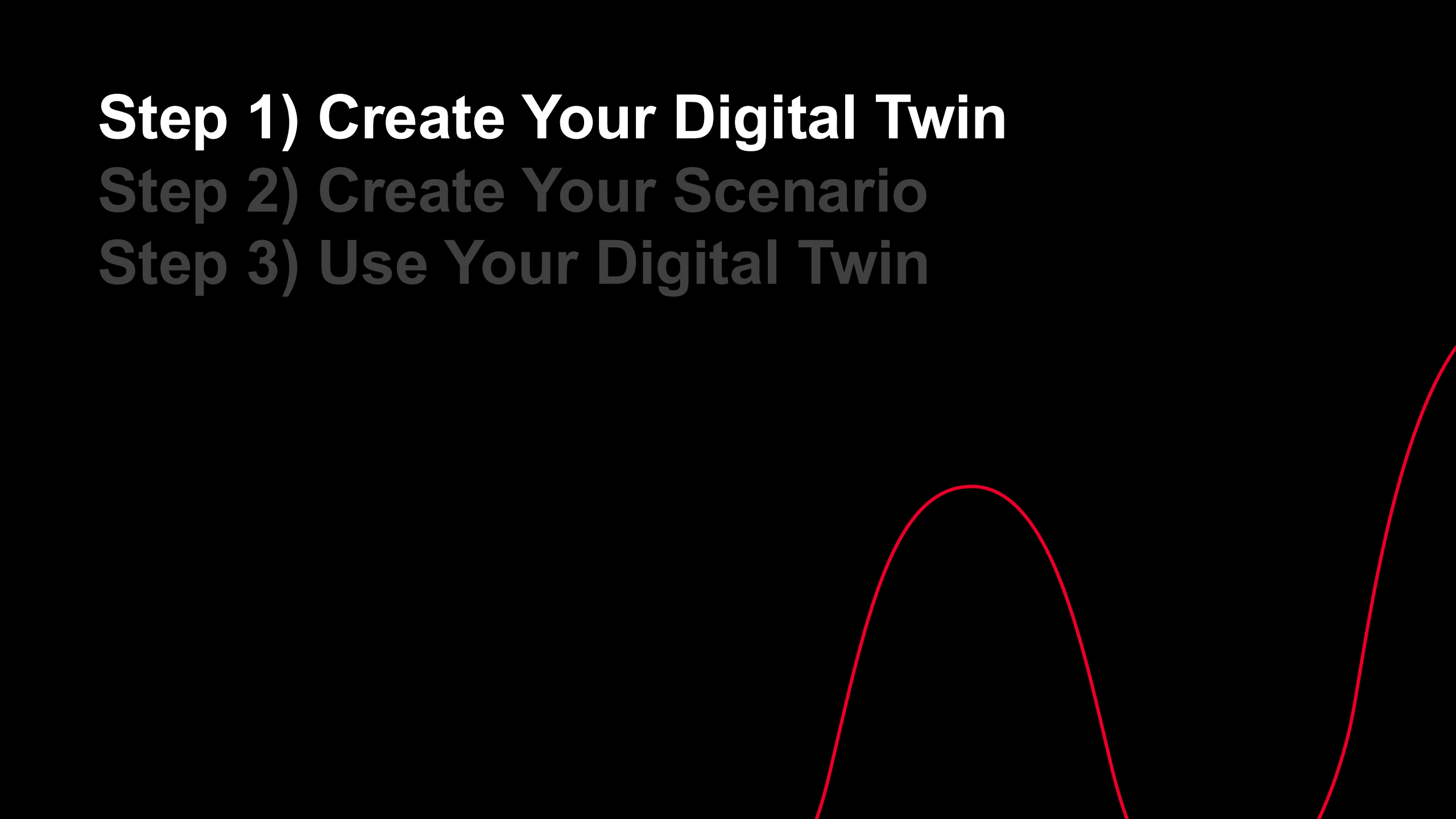
Abstraction still requires Fidelity



TEST BOUNDARY	SCALE / FIDELITY
RF (no functional split)	Typically 1 cell Few UEs with UXM
7.2x (High-PHY / Low-PHY)	Several cells
Split 6 (MAC / PHY)	Dozens of cells
RIC test (E2 interface)	Full city scale

Higher abstraction shifts the test boundary toward MAC and RIC, enabling larger simulated networks.

Step 1) Create Your Digital Twin
Step 2) Create Your Scenario
Step 3) Use Your Digital Twin



Making Off & Fly Over

Step 1) Create The Digital Twin of Yeouido Island



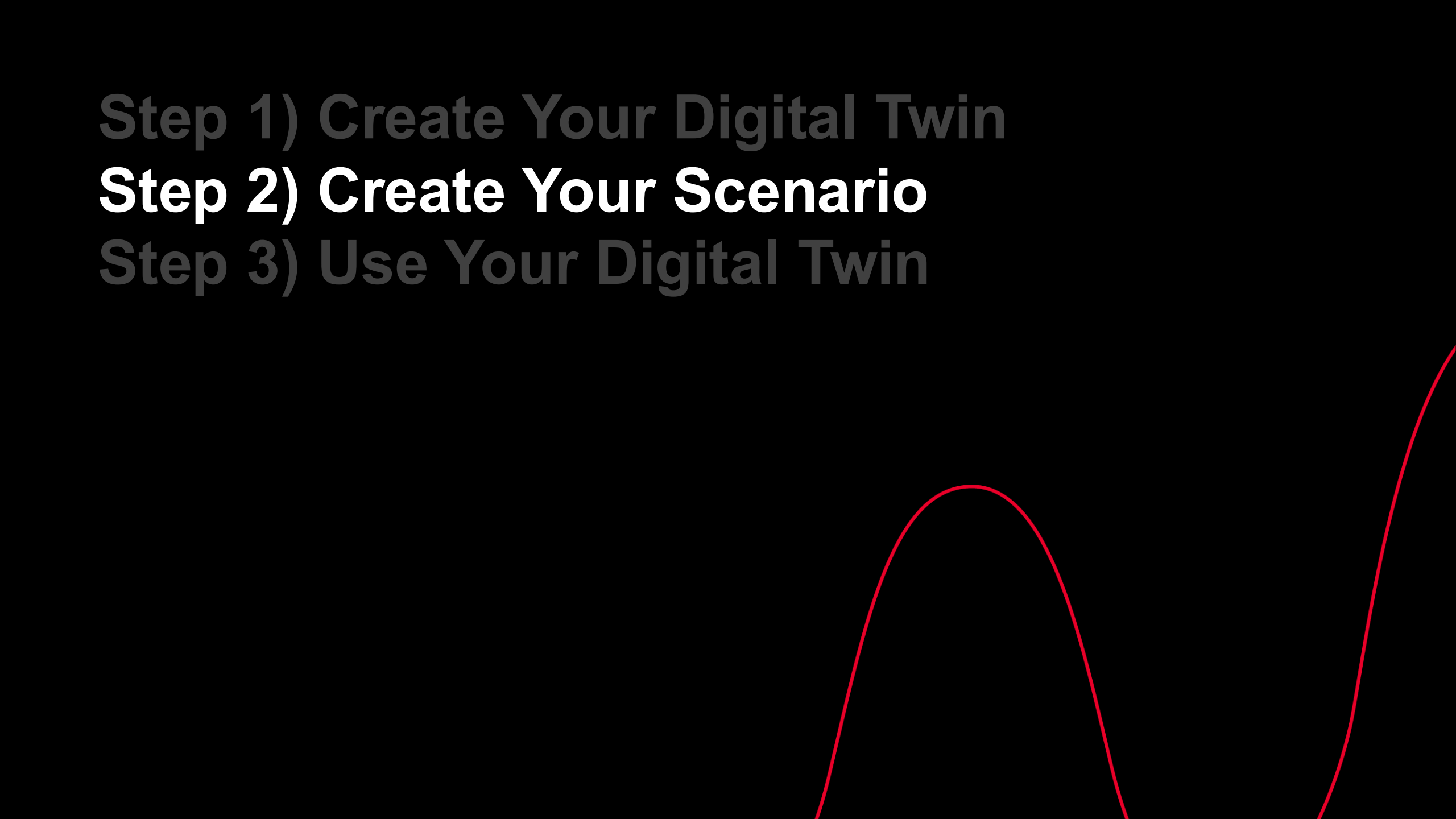


There are different options for 3D Maps, and the Drone is the most photorealistic.

Step 1) Create Your Digital Twin

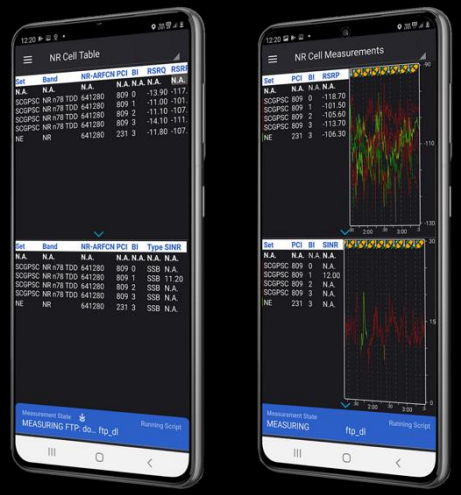
Step 2) Create Your Scenario

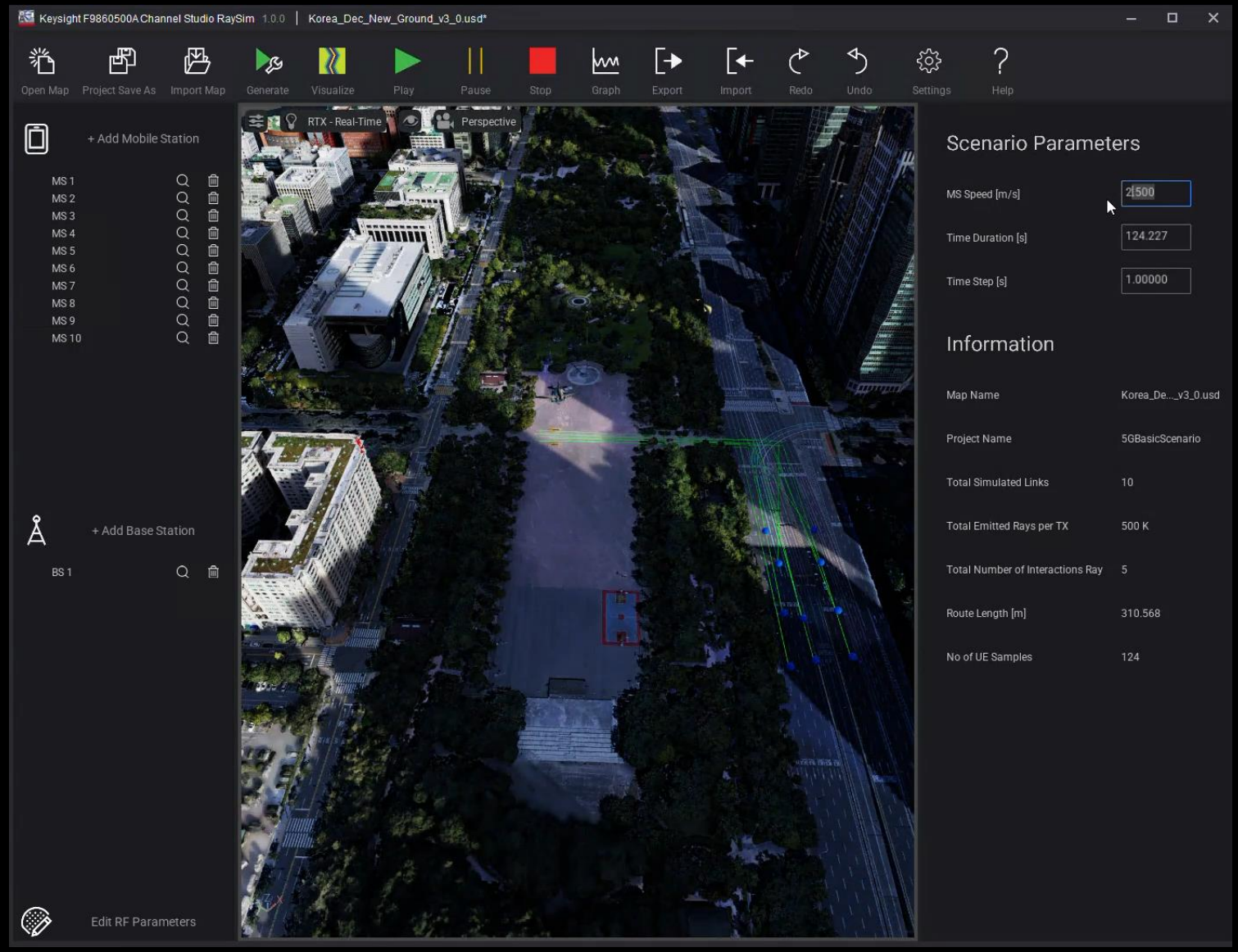
Step 3) Use Your Digital Twin



Step 2) Create Scenario

- The process can be fully automated & it is possible to import GPX from field measurements (NEMO Solution) and replicate the path in RaySim.





Keysight Channel Studio - Raysim

Step 1) Create Your Digital Twin

Step 2) Create Your Scenario

Step 3) Use Your Digital Twin



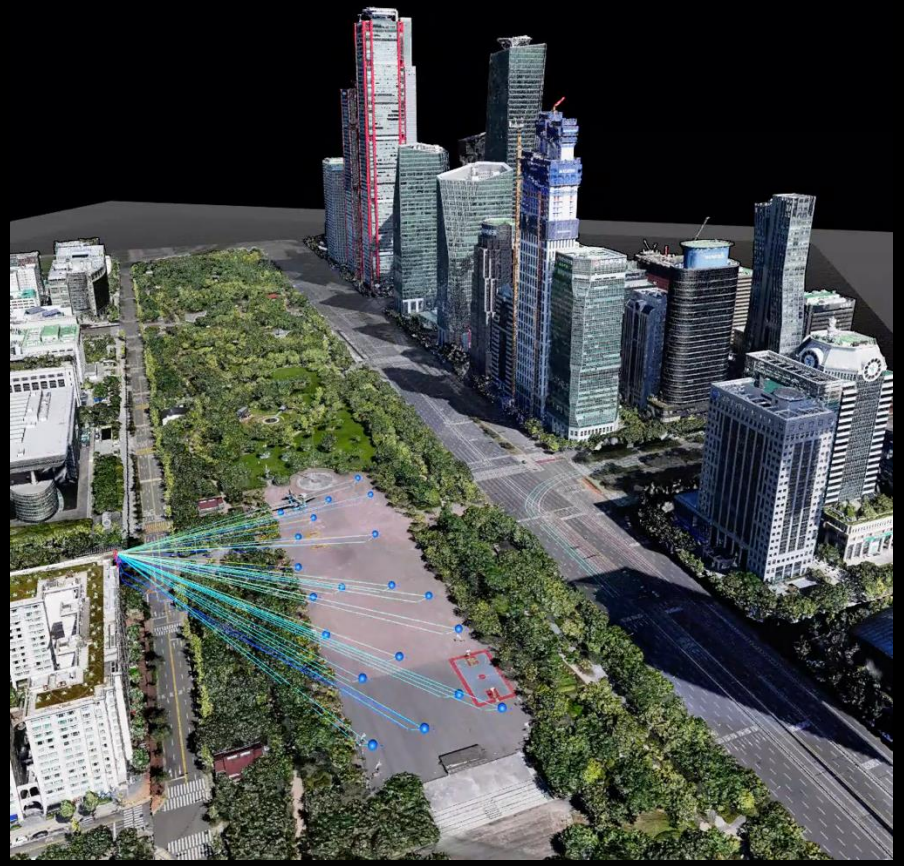
Scenario Details (AE: {8, 64, 256}, 100MHz BW, CF:3 GHz)

What's the Baseline Performance of a 5G System?

Scenario Description

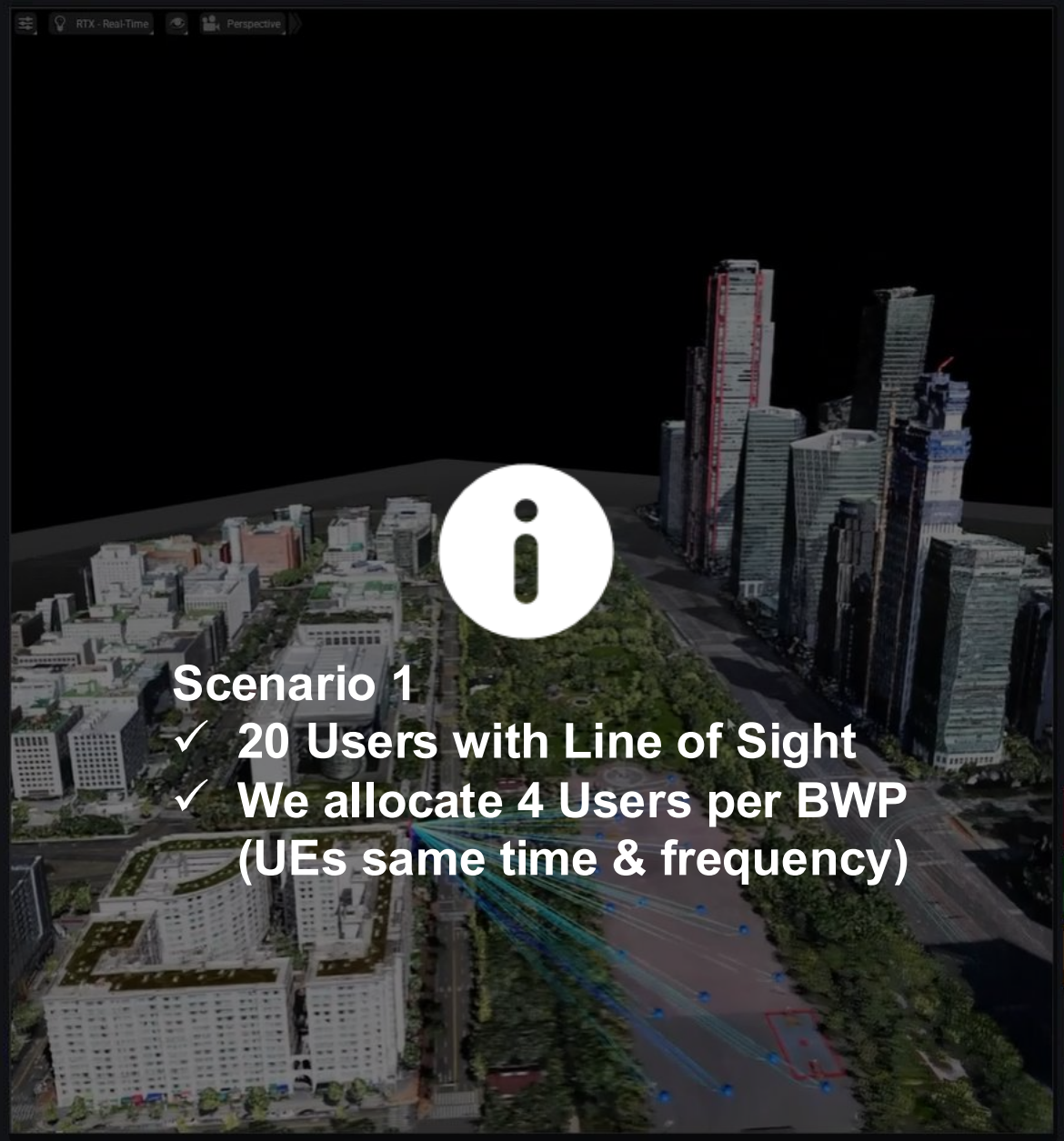
- Up to 40 Users streaming **4K Video**.
- Scenario with static users in the park.
- Ideal beam scheduling: users too close to each other don't share the same bandwidth part (BWP).
- Up to 8 Users/BWP & 20MHz/BWP.

→ Very demanding scenario! Can 6G help?
(For this demo, we focus on capacity)



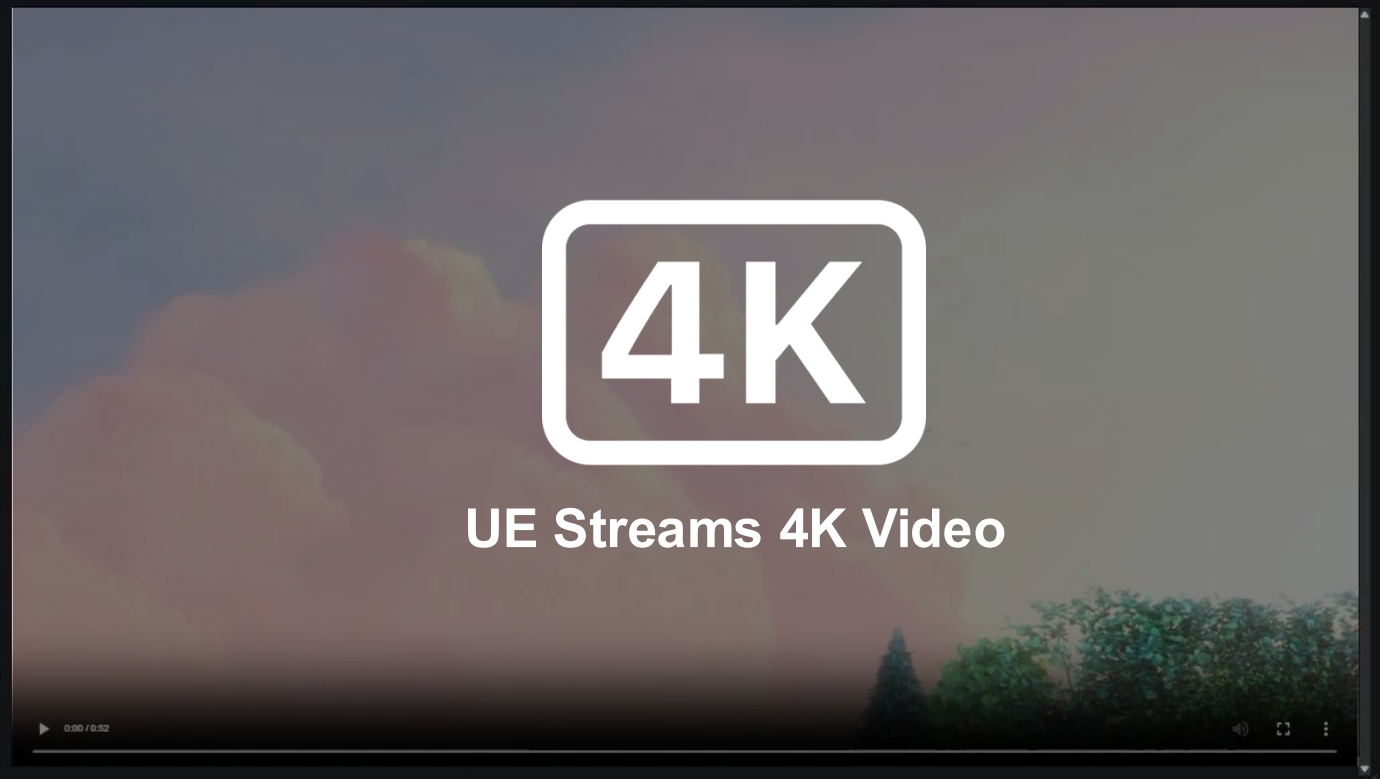
Scenario 1 | Scenario 2 | Scenario 3 | 8 Antennas | 64 Antennas | 256 Antennas

VIDEO UE 1 | VIDEO UE 2 | VIDEO UE 3 | VIDEO UE 4



Scenario 1

- ✓ 20 Users with Line of Sight
- ✓ We allocate 4 Users per BWP (UEs same time & frequency)



UE CQI



CQI
Higher CQI → Higher Tput

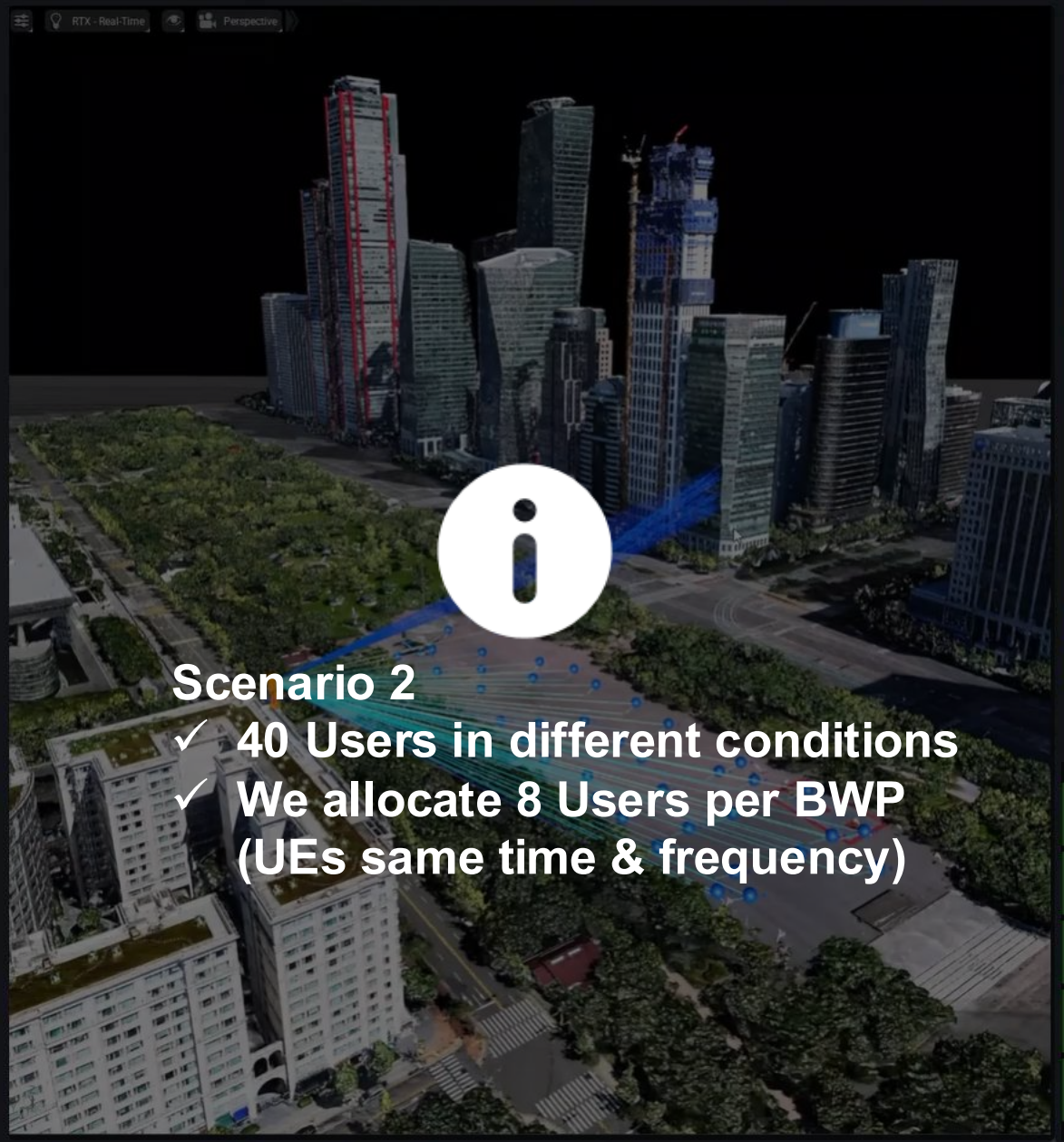
Total number of UEs

20

CQI Range	Quality	Indicator
10 < CQI ≤ 15	Good	
5 < CQI ≤ 10	Fair	
0 ≤ CQI ≤ 5	Poor	

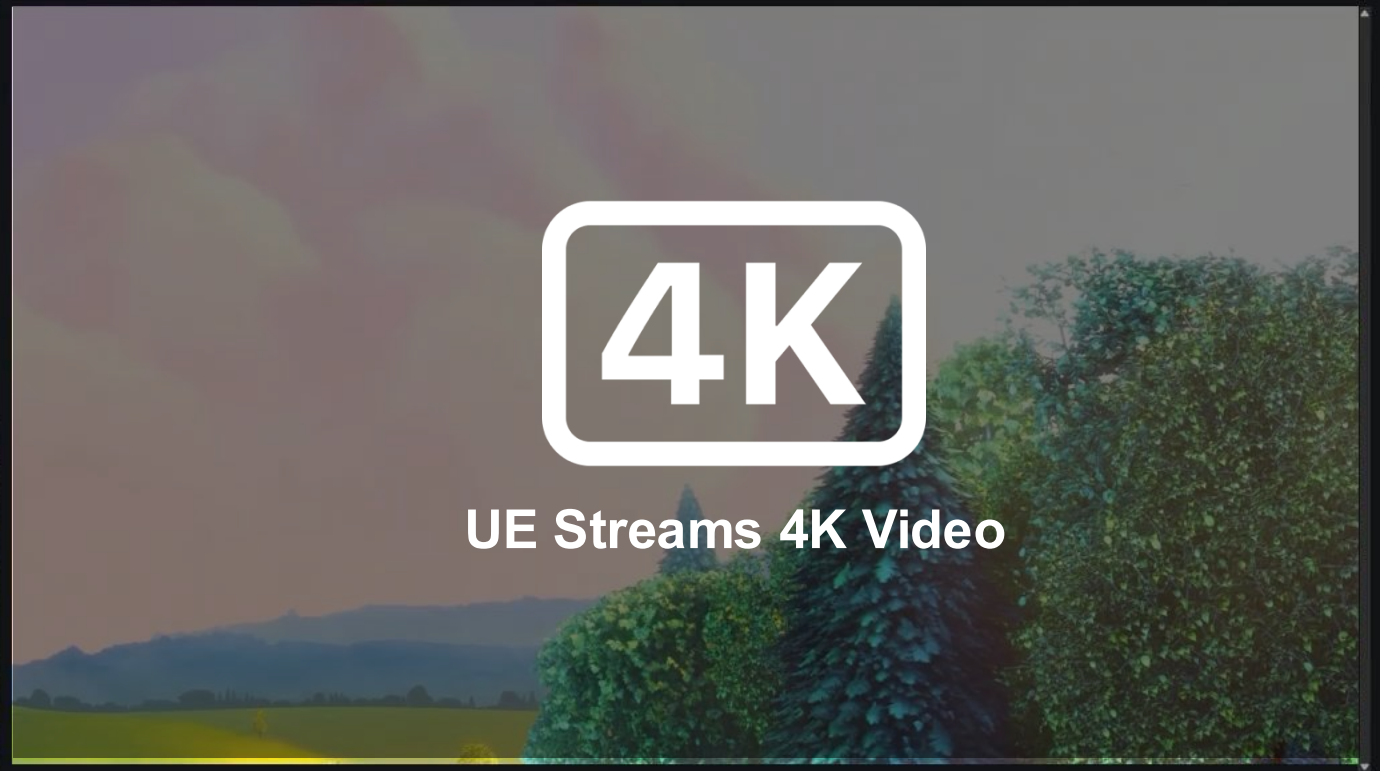
Scenario 1 | Scenario 2 | Scenario 3 | 8 Antennas | 64 Antennas | 256 Antennas

VIDEO UE 1 | VIDEO UE 2 | VIDEO UE 3 | VIDEO UE 4



Scenario 2

- ✓ 40 Users in different conditions
- ✓ We allocate 8 Users per BWP (UEs same time & frequency)



UE CQI



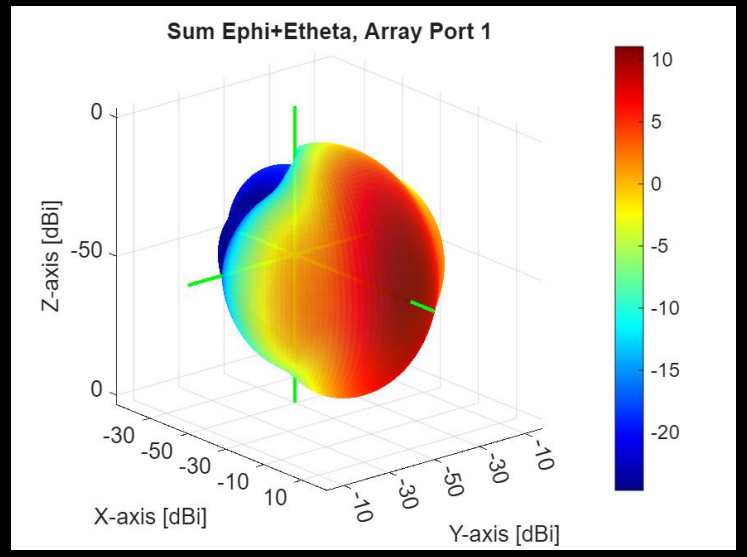
CQI
Higher CQI → Higher Tput

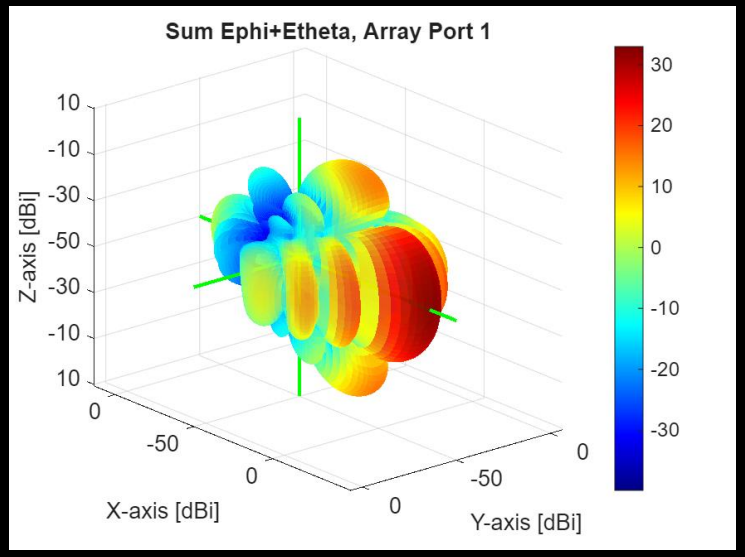
Total number of UEs

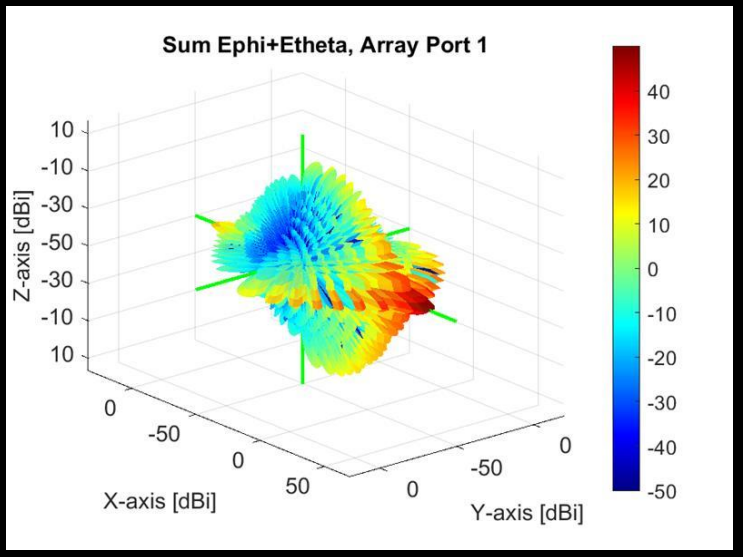
40

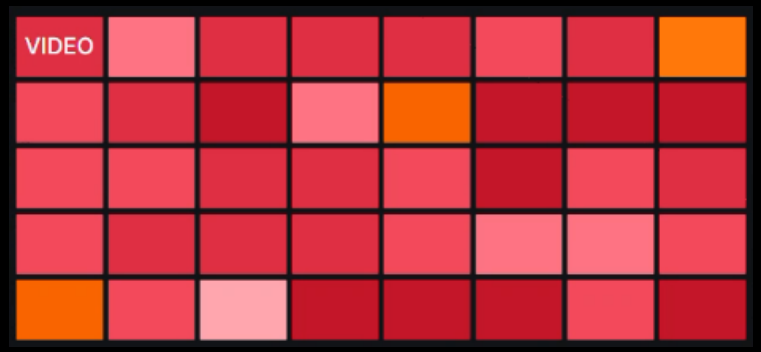
CQI Range	Quality	Indicator
10 < CQI ≤ 15	Good	
5 < CQI ≤ 10	Fair	
0 ≤ CQI ≤ 5	Poor	

6G Scenario Summary

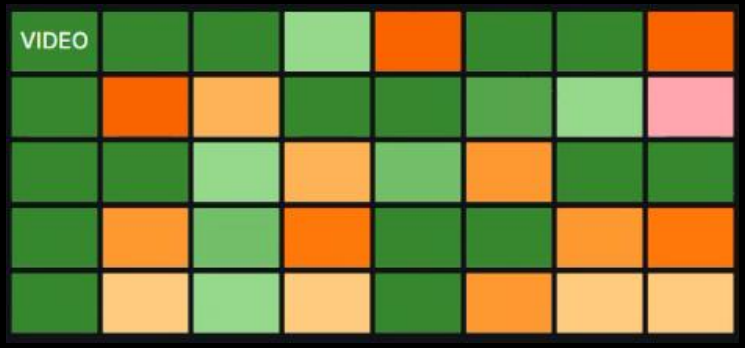












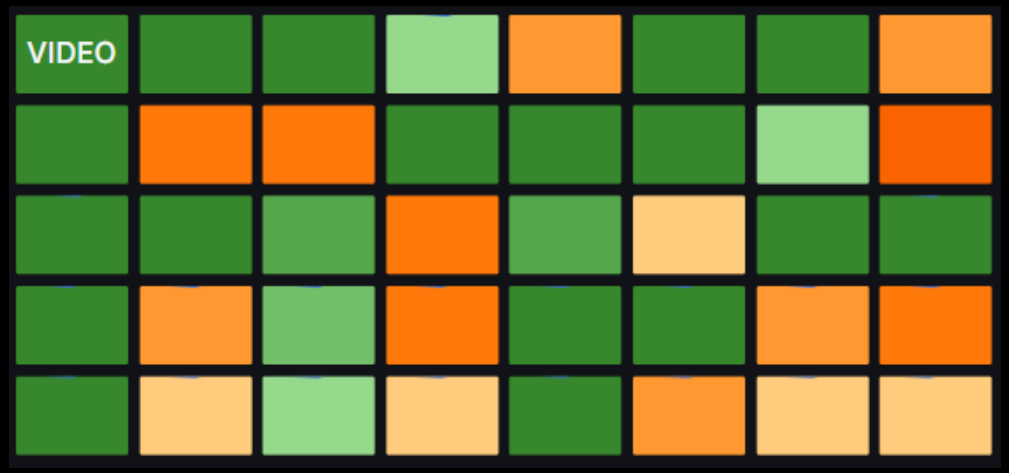
8 Antennas

64 Antennas

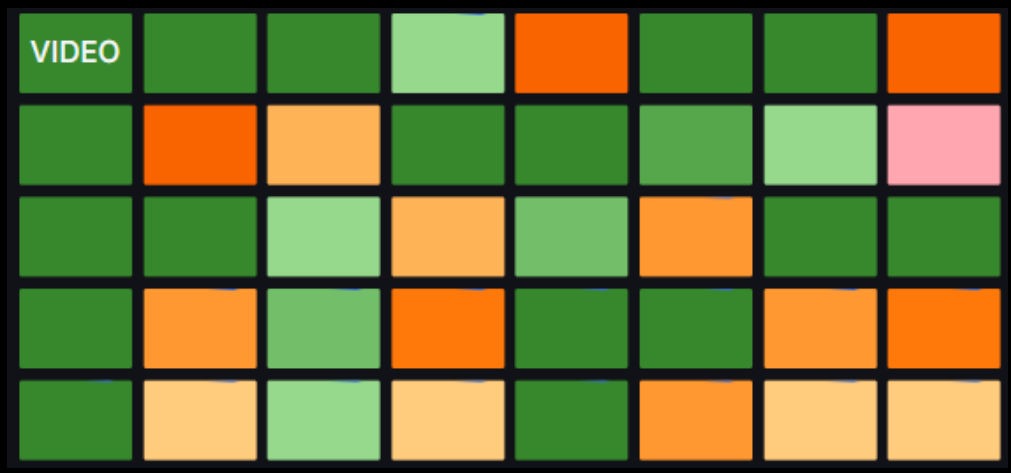
256 Antennas

Comparison for FR1 vs FR3

FR1 – 3.6GHz



FR3 – 7.5GHz

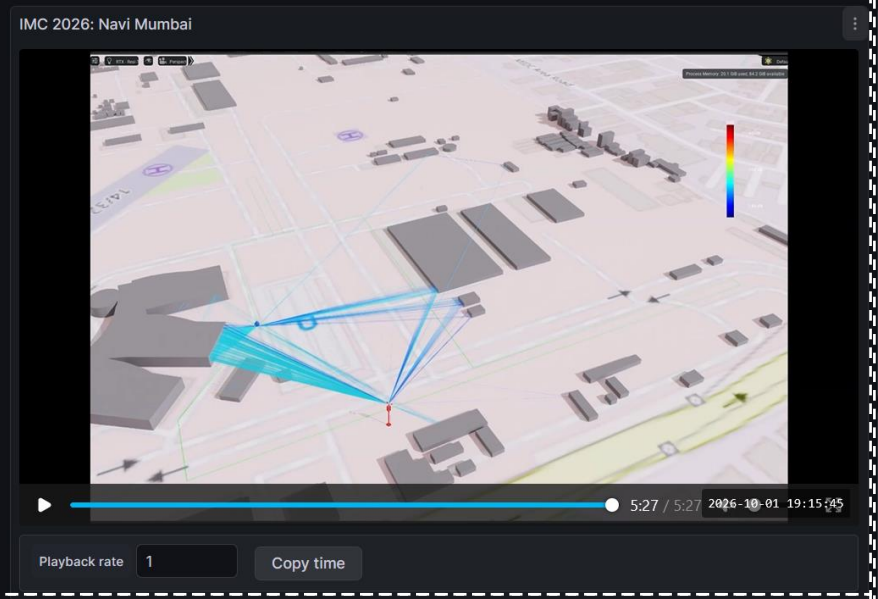


Similar results for the scenarios considered (outdoor)

KEYSIGHT in collaboration with Jio

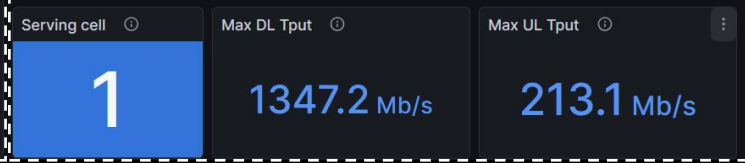
AI-Driven RAN Validation

Raytracer View









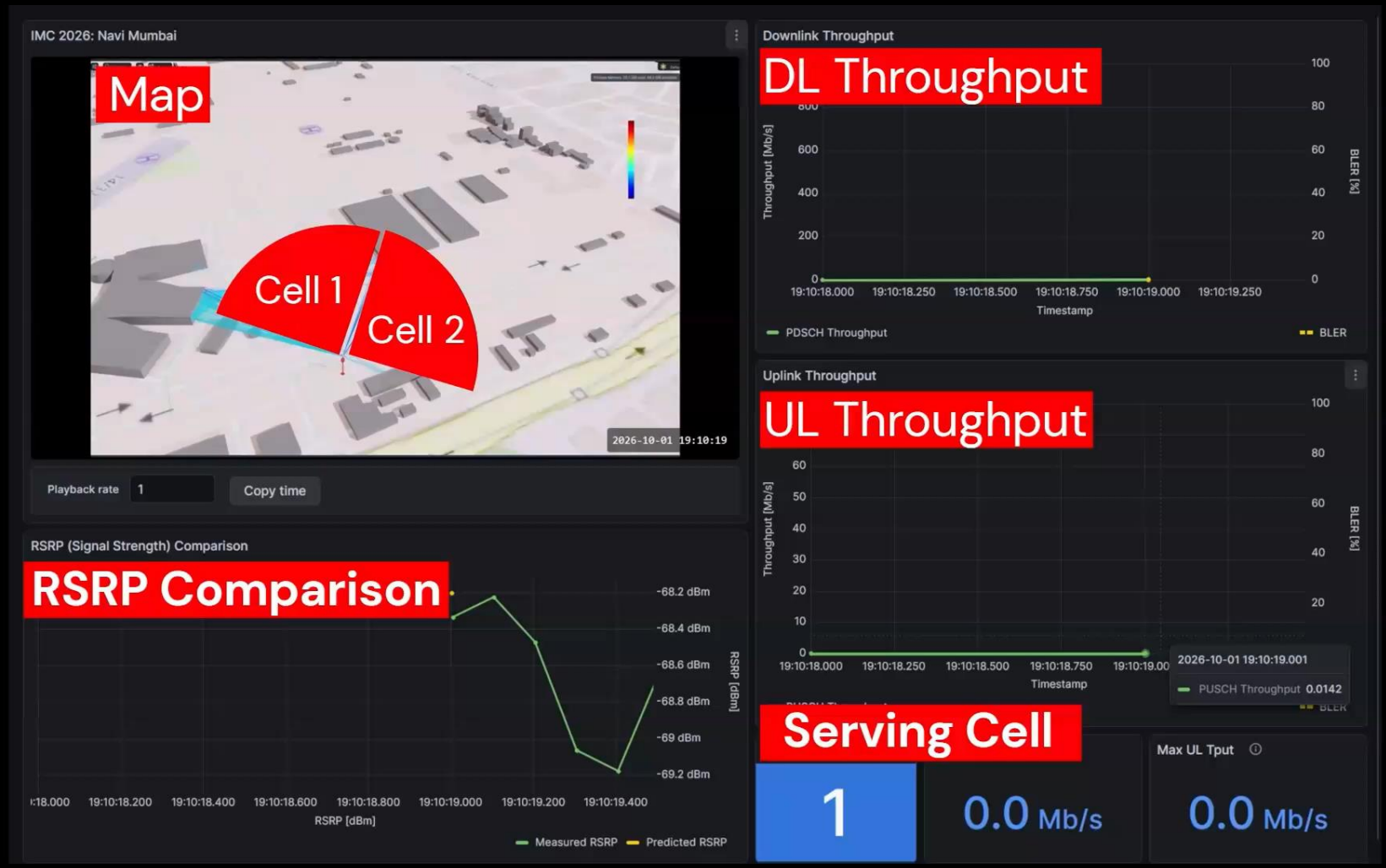
Live Network KPIS

Emulation vs. Real-word



KEYSIGHT in collaboration with

AI-Driven RAN Validation




KEYSIGHT