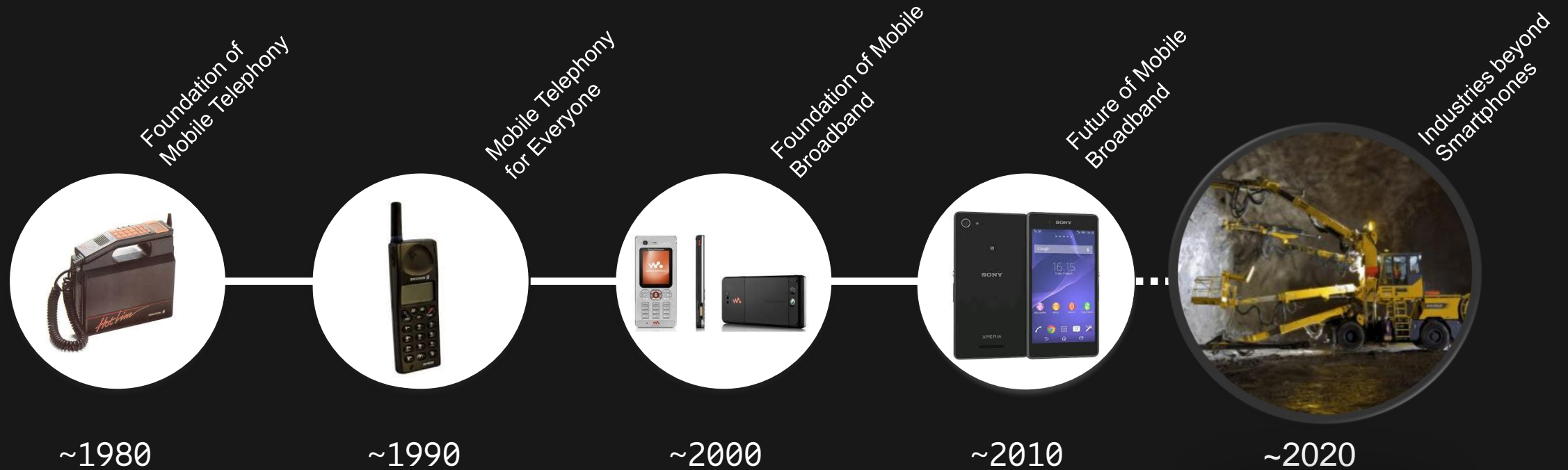


# 5G in underground mining



# The 5<sup>th</sup> generation wireless communication



# 5G



## Massive

Connect everything



**100x**  
Connected Devices

**~15 years**  
Battery Life

**1.000.000 /km<sup>2</sup>**  
Density of connected devices

Sensors  
Actuators  
Etc.

## Critical

Cut the wires



**99,999%**  
Data transmission reliability

**10Gb/s**  
Extreme bandwidth

**<10ms**  
Ultra low latency

Automation  
Remote control  
Etc.

Industrial digitalization



# PoC Projects – PIMM & SIMS

Use-case driven Demonstrations & Assessments of Technology



# SIMS

SUSTAINABLE  
INTELLIGENT  
MINING SYSTEMS

A HORIZON 2020 FUNDED PROJECT

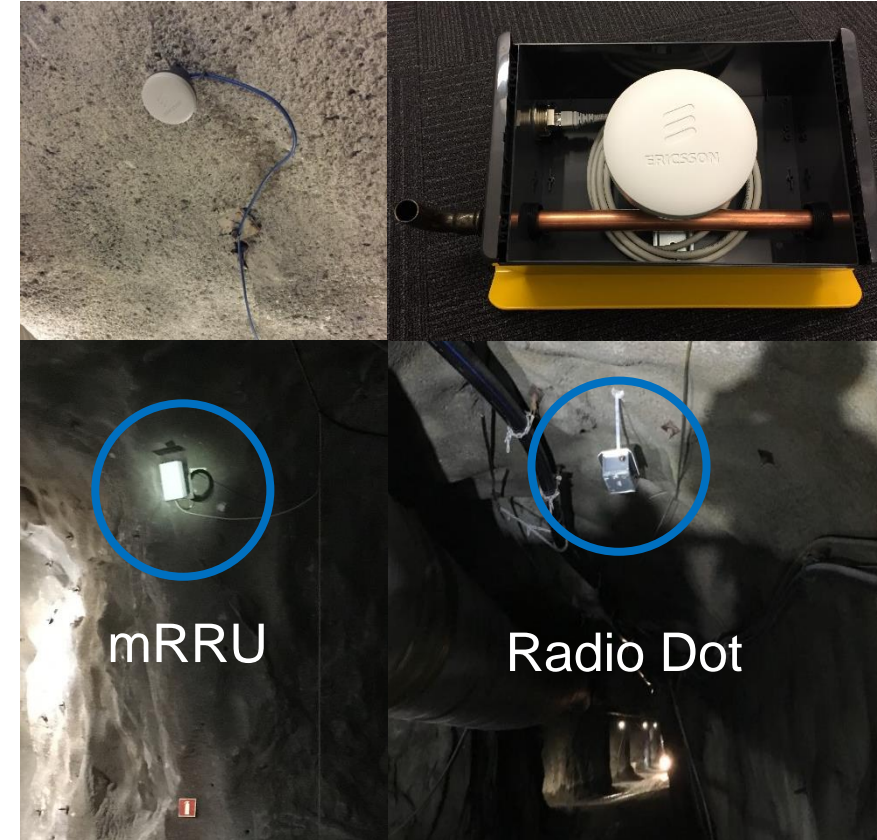
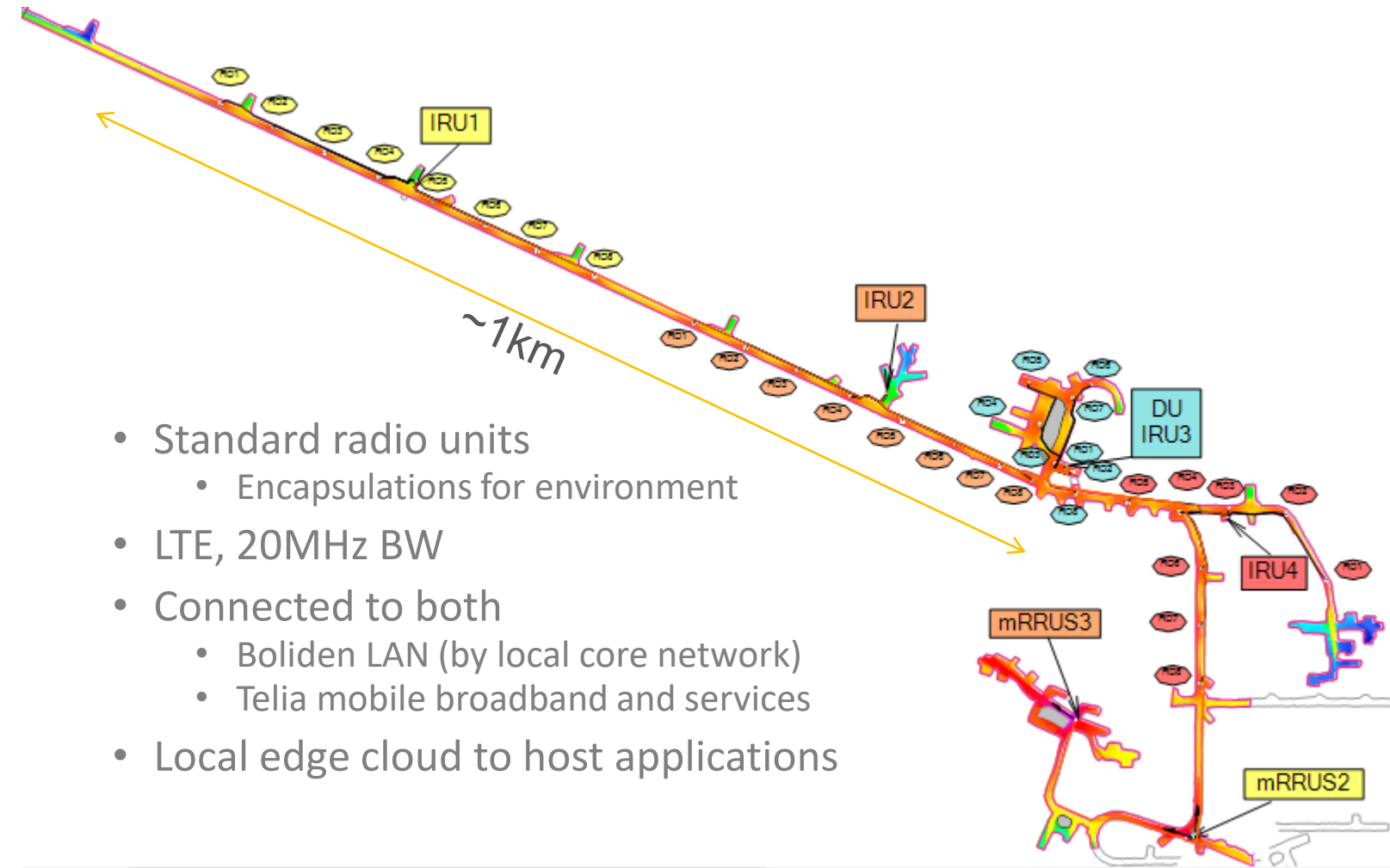
[www.SIMSmining.eu](http://www.SIMSmining.eu)

# Key benefits of 4G and 5G

- 4G LTE provides high reliability by predictable performance for all services
  - Also in mobility and at high network load
  - Avoiding disruptions in services with real-time requirements (no video freeze, speech drop-out, protocol time-out, etc.)
- Many alternative radio network deployment options and good coverage
  - For different use case mixes and for different environments
- 5G offers further steps in latency, throughput, reliability & differentiation

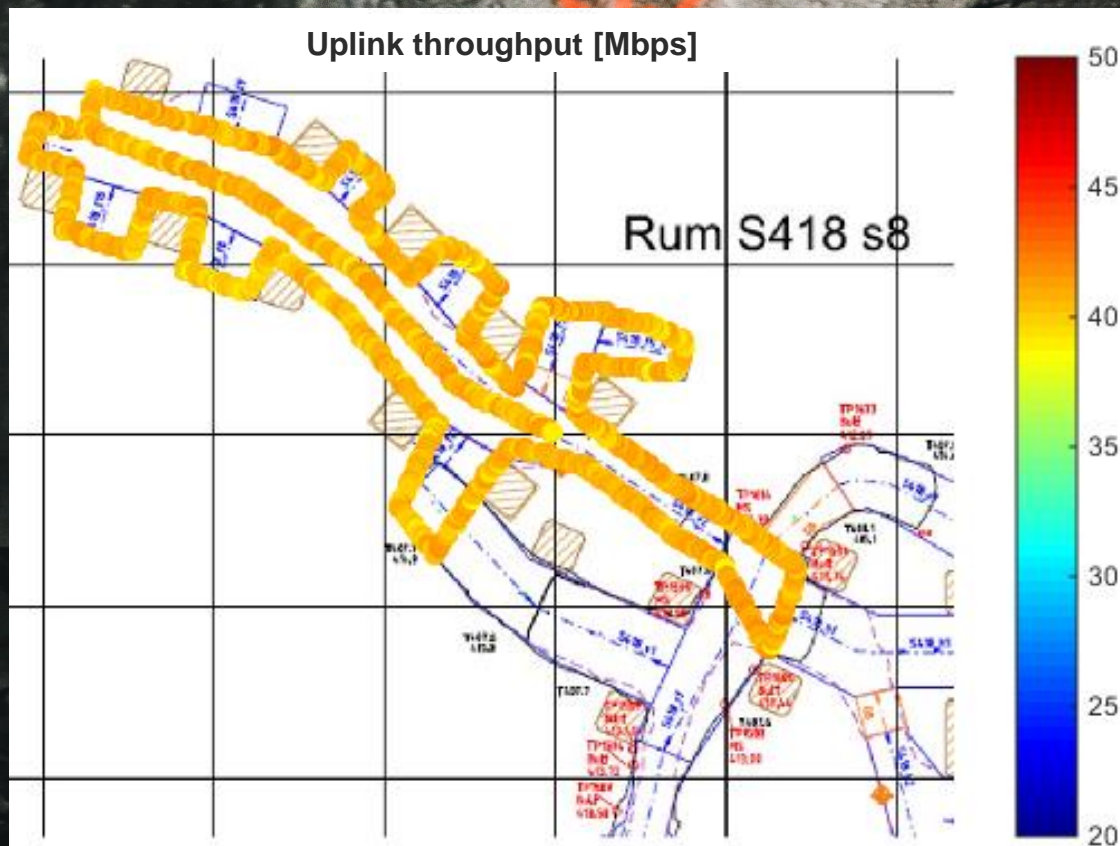
# Kankberg 4G network

- Standard radio units
  - Encapsulations for environment
- LTE, 20MHz BW
- Connected to both
  - Boliden LAN (by local core network)
  - Telia mobile broadband and services
- Local edge cloud to host applications

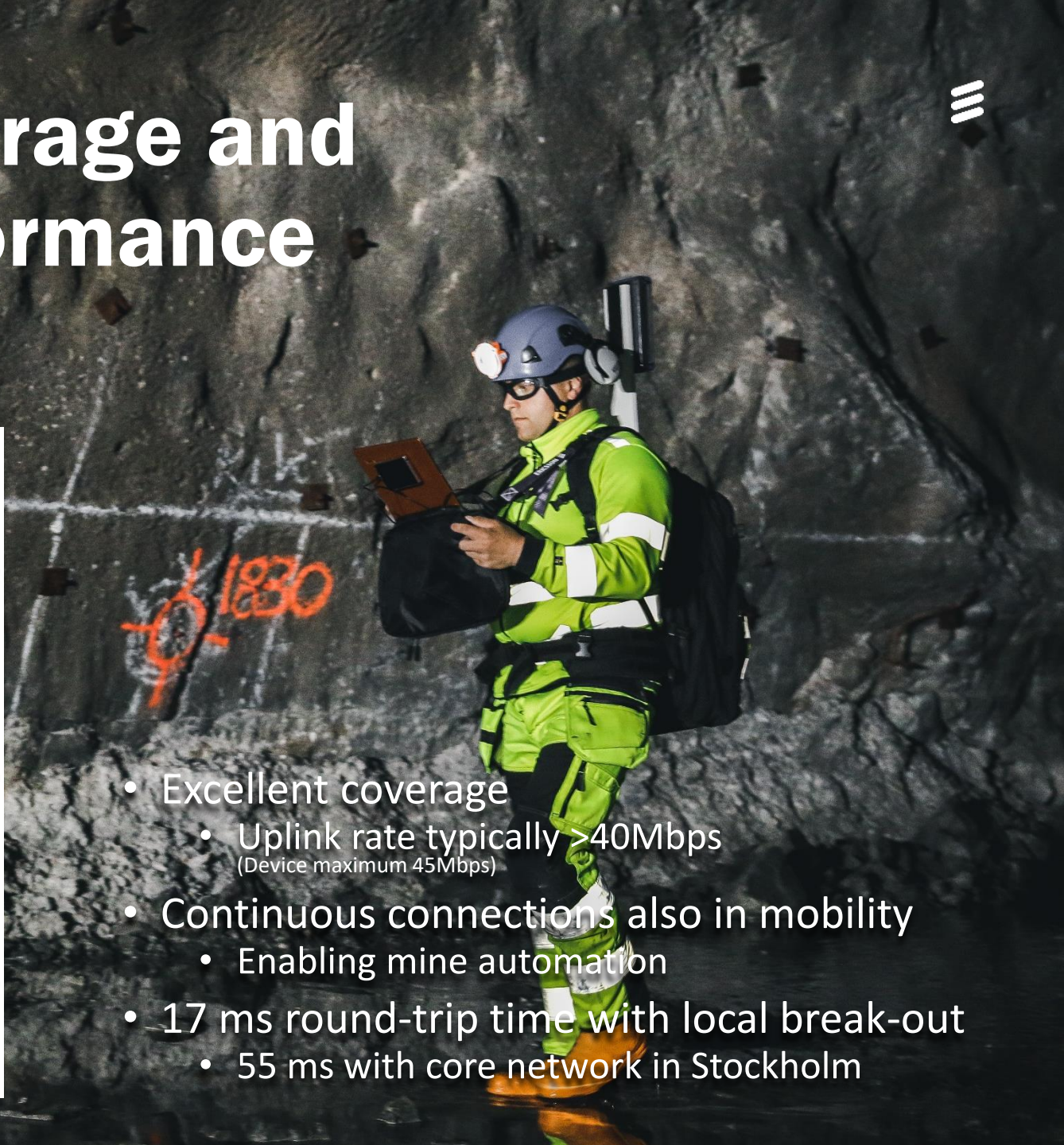




# Kankberg Radio Coverage and Communication Performance



- Excellent coverage
  - Uplink rate typically >40Mbps (Device maximum 45Mbps)
- Continuous connections also in mobility
  - Enabling mine automation
- 17 ms round-trip time with local break-out
  - 55 ms with core network in Stockholm





# Massive IoT in the Mine

## Support for NB-IoT and LTE Cat-M devices

*“As a mine operator I want to secure good air quality for improved safety by more advanced control of ventilation”*

*“As responsible for mine safety I want to secure improved safety by understanding rock movements”*



Photos: Boliden







*“Good connectivity and technology collaboration are critical foundation for Industry 4.0 success”*

Photo: Boliden/Tomas Westermark







**Thank you!**



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**European Sustainable Intelligent Mining Systems for the Global Mining Industry**