



ARTificial Intelligence Aided D-band Network for 5G long term Evolution

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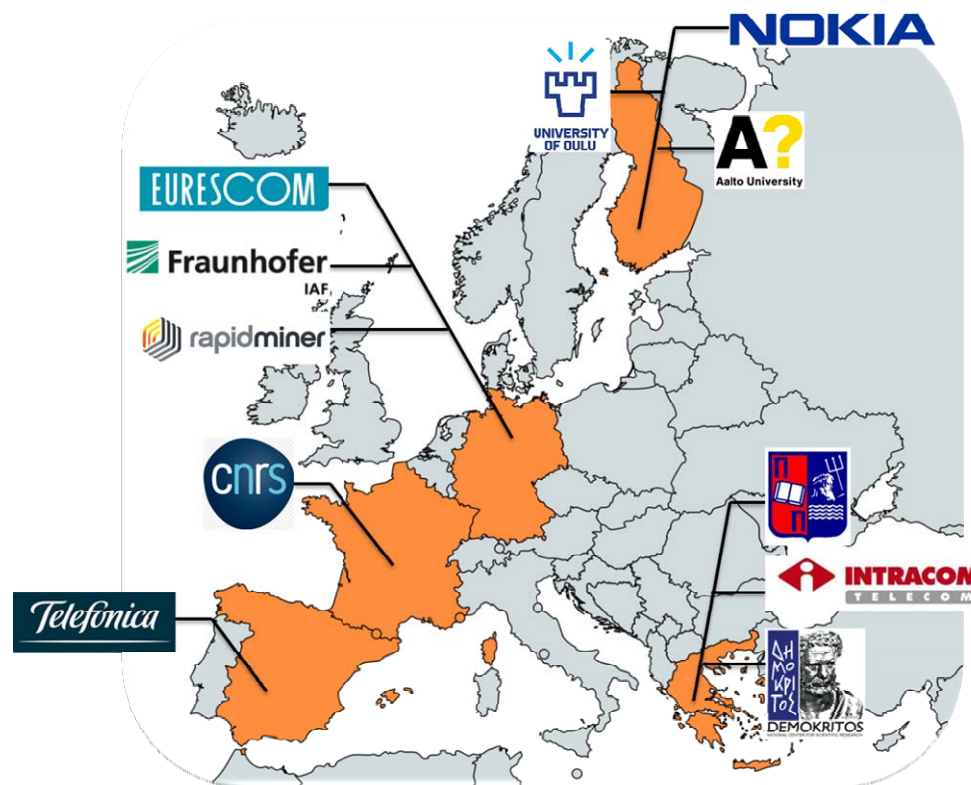
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ARIADNE outline

Topic	ICT-20-2019
Duration	36 Months
Start Date	1/11/2019
Project Coordinator	Halid Hrasnica, Eurescom
Technical Manager	Angeliki Alexiou, UPRC
Consortium	11 Beneficiaries and 1 third Party from 5 European countries



ARIADNE objectives

- Objective-1: To *design 100 Gbit/s capable, energy and spectral-efficient wireless B5G networks based on D-Band connectivity*
- Objective-2: To *provide ultra-reliable D-band connectivity and reconfigurability in all usage environments*
- Objective-3: To *transform networks beyond 5G to intelligent platforms* integrating ultra-reliable connectivity and highly-efficient computing

ARIADNE approach

ARIADNE proposes a novel hybrid wireless system architecture, which combines the benefits of **D-band** and **Artificial Intelligence**, optimised by means of:

- novel radio technologies for **D-band connectivity** enabled by **transceivers capable of electronic beam steering and reflected connectivity**;
- intelligent surfaces (*metasurfaces*) used to enable tunable or switchable reflections and overcome limitations in obstructed links and NLOS scenarios;
- a novel *Communication Theory framework beyond the Shannon paradigm*, according to which the environment itself is made reconfigurable and can assist to establishing reliable communications;
- **propagation characterisation in the D-band** for indoor/outdoor, LOS/NLOS;
- *Machine Learning-based approaches* for ultra-reliable connectivity, optimal and adaptive RRM and E2E network optimisation (resource allocation, routing, etc).

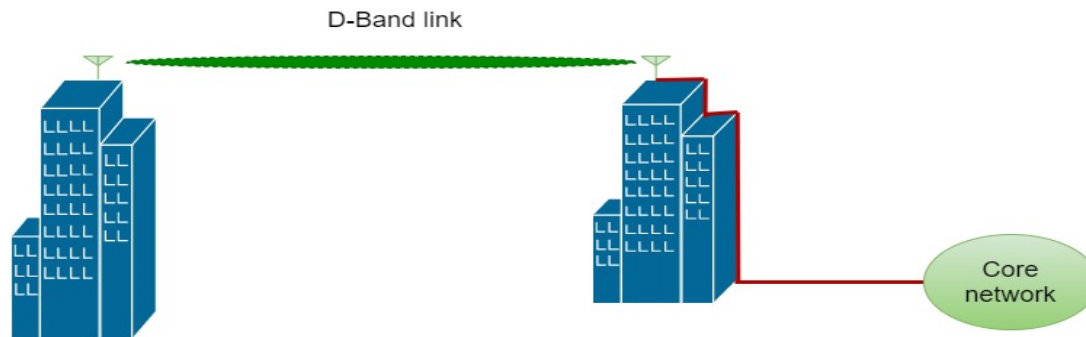
ARIADNE Use Cases

Use Case 1 – Backhaul/Fronthaul networks of fixed topology

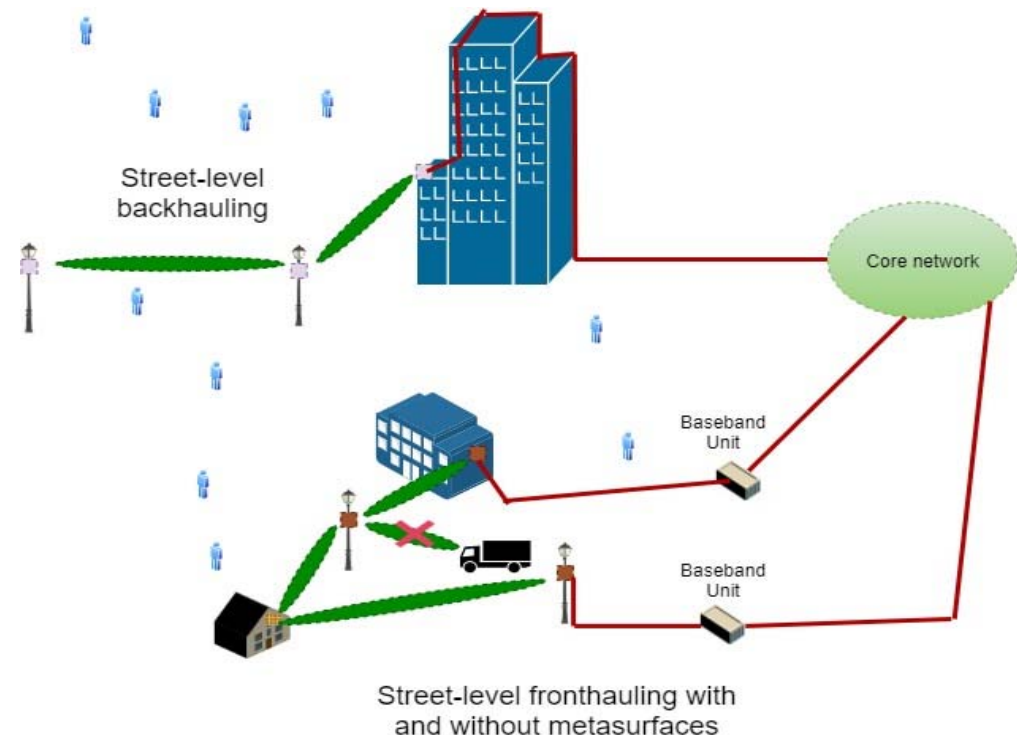
Use Case 2 - Advanced NLOS connectivity based on metasurfaces

Use Case 3 – Adhoc connectivity in moving network topology

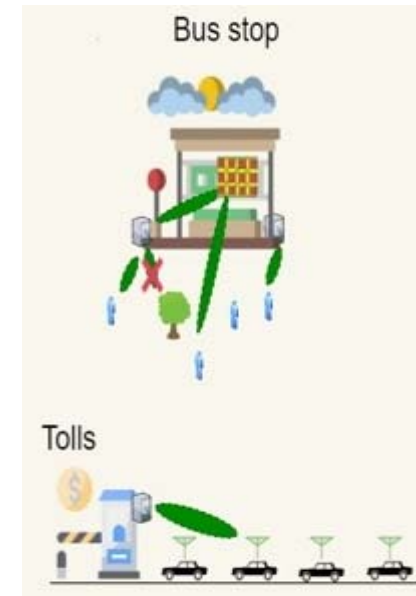
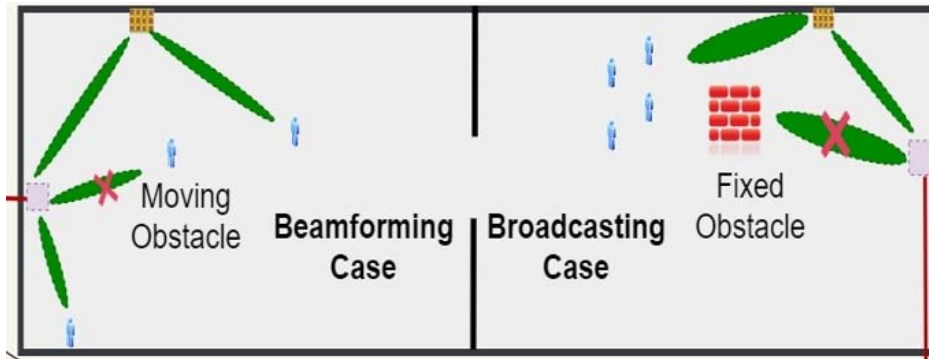
Use Case 1 – Backhaul/Fronthaul networks of fixed topology



- Outdoor environment with LOS or NLOS conditions
- No mobility
- Use of metasurfaces to avoid signal blocking
- Optimal routing, adjustment of metasurface parameters
- KPIs: Throughput, Latency, Reliability, Availability

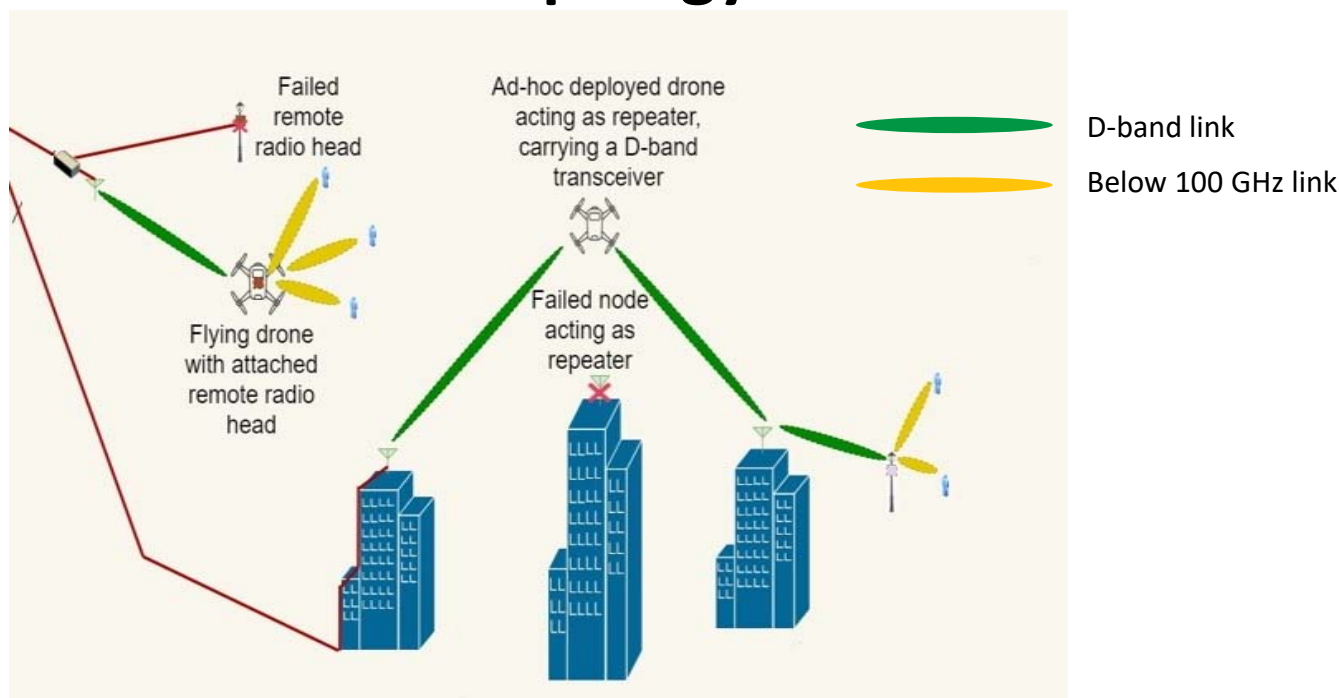


Use Case 2 - Advanced NLOS connectivity based on metasurfaces



- Indoor and outdoor environment
- Up to low-to-moderate mobility
- NLOS connectivity through reconfigurable metasurfaces
- Optimal beamforming, user tracking
- KPIs: Throughput, Latency, Availability

Use Case 3 – Adhoc connectivity in moving network topology

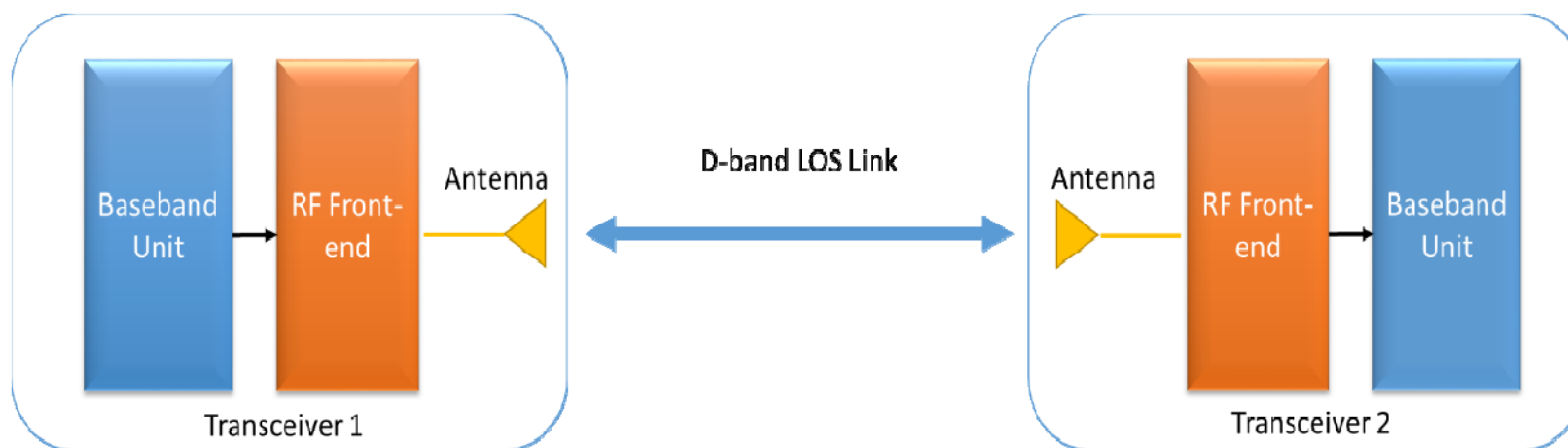


- Outdoor environment
- Mobile nodes assist network connectivity
- low-to-moderate mobility
- Demanding beamforming, tracking and alignment
- KPIs: Throughput, Latency, Reliability, Availability

ARIADNE demonstrators

- Point-to-Point LOS demonstrator (HW demo)
- Metasurface NLOS demonstrator (HW demo)
- Intelligent D-band network demonstrator (SW demo)
- Demonstrations will be realized around mid-2022

Point-to-Point LOS demonstrator



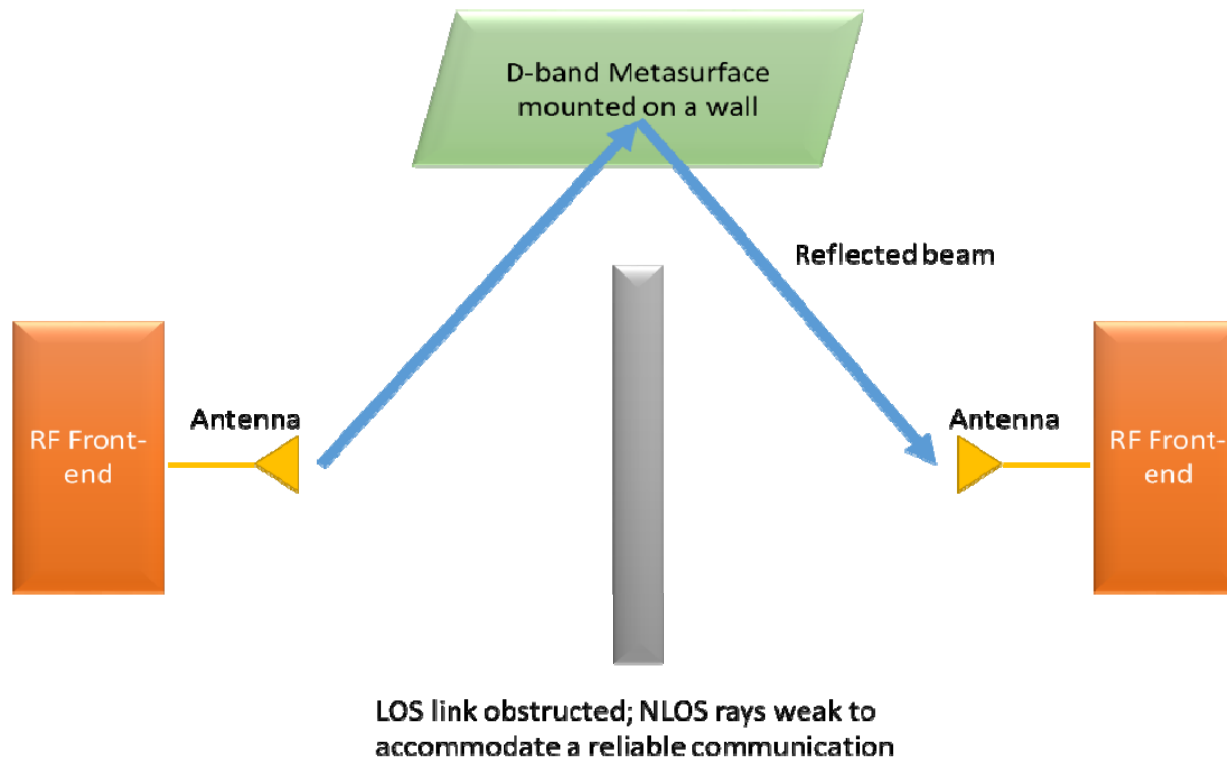
COMPONENTS

- Spectral efficient Baseband Unit, polarization diversity, FDD operation
- Highly integrated transceiver RF-frontend
- High-gain antennas

TARGET

- Error free **long-range LOS outdoor** communication at the D-band (> 100 m)

Metasurface NLOS demonstrator (1)



Metasurface NLOS demonstrator (2)

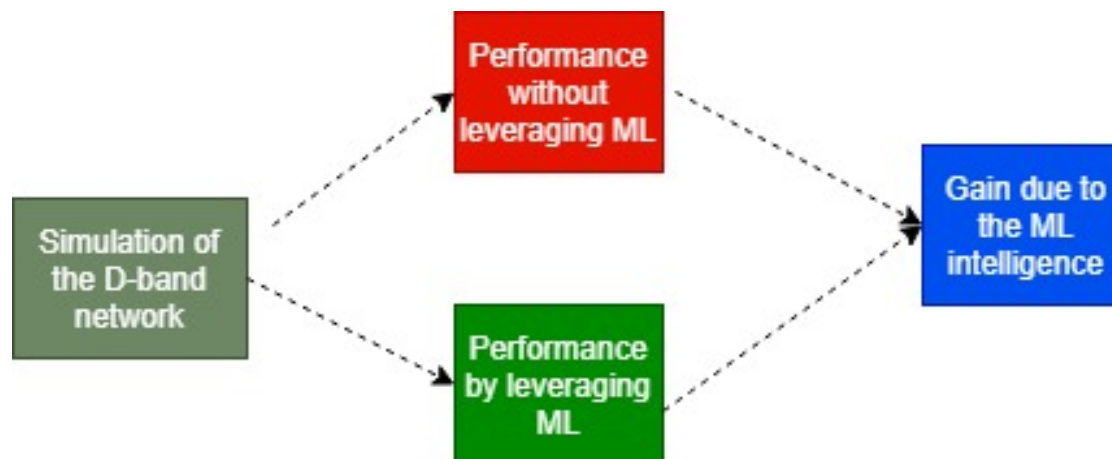
COMPONENTS

- RF front-end
- **Passive metasurface** acting as a reflector
- Low-cost **reconfigurable reflect array antenna**

TARGET

- Showcase an alternative propagation route in NLOS cases through reflection on a passive metasurface structure

Intelligent D-band (SW) network demonstrator



TARGET

- Validate machine learning algorithms for the D-Band network optimization
 - Simulate a dynamic D-Band network with time-varying traffic demands and channel conditions
 - Apply ML algorithms to adjust parameters (power and spectrum allocation) as well as reconfigure metasurface structures to optimize network performance

Thank You!

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