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Satellite Workshop

Block 1 – Industrial Use Cases and Network Requirements

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DLR

Gefördert durch:



aufgrund eines Beschlusses
des Deutschen Bundestages



Middleware for Automated use of
Edge Resources In Campus networks

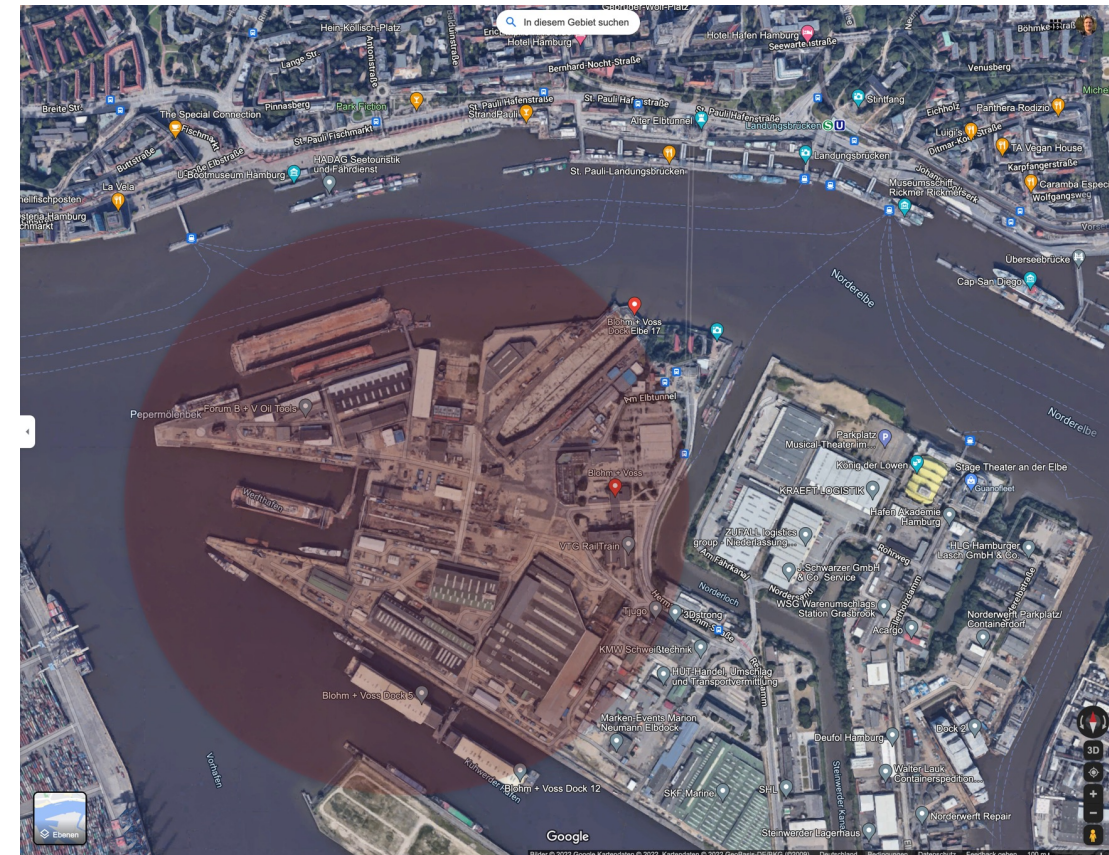


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Objectives

Middleware for Automated use of Edge Resources In Campus networks

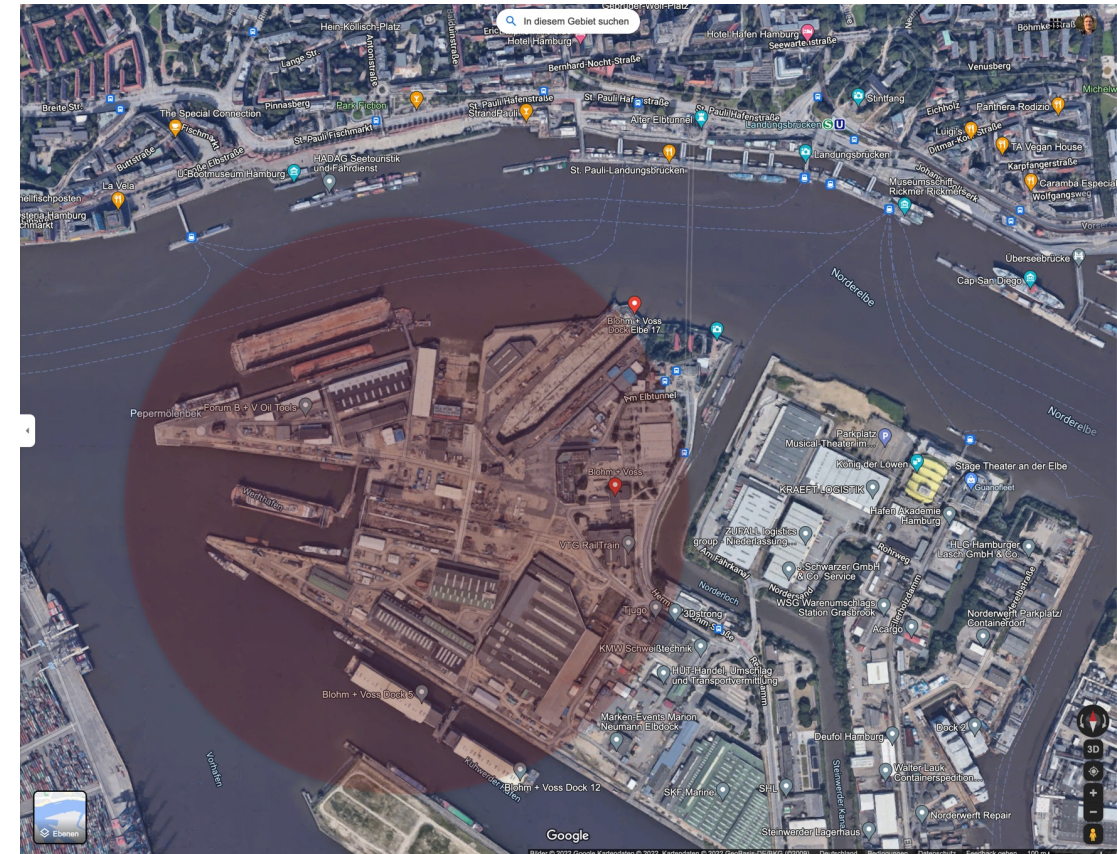
- **Challenges**
 - Difficult radio environments
 - Unstable backhaul, Pop-Up networks
- **Adequate robust application support**
 - Ubiquitous access to online resources (manuals etc.)
 - Application proxies (edge computing)
 - Automatic distribution of application proxies and state synchronization after disconnections
- **Support for heterogeneous deployments**
 - 5G (ORAN, BBU+RRU), LTE, WLAN
 - Assess technical and economic case for ORAN
- **Security**
 - Zero-Trust needed for radio network
 - Secure integration into enterprise networks and AAA infrastructure



Use Cases

Overview

1. Ubiquitous coverage for “always-on” access
 - Whole campus
 - General-purpose networking
2. Ship in construction (in dock, at pier)
 - In-ship connectivity
 - Difficult radio conditions
3. Ship in test operation
 - Pop-up Network
 - Challenged or non-existent backhaul
4. Potentially: multi-site operation with roaming (later)



MAVERIC Use Case One Pager

1. Ubiquitous Coverage for "Always-On"

<p>Brief Use Case Description</p> <ul style="list-style-type: none"> • Large campus with challenging building structures (docks etc.) • Mix of different UE equipment, including non-5G • 5G as enterprise core network (no ubiquitous fixed infrastructure) • Outdoor and indoor radio units • LTE and 5G • WiFi CPE • General-purpose networking but support for more demanding applications as well (low latency, high bandwidth) 	<p>Innovation</p> <ul style="list-style-type: none"> • Heterogeneous network (5G, LTE, ORAN, non-ORAN, non-3GPP) • Network slicing and service differentiation in challenged networks 	<p>Market Relevance</p> <ul style="list-style-type: none"> • Production campuses with challenging network conditions • For big outdoor areas • Flexible connectivity – network anywhere anyhow • Typical enterprise environments with heterogeneous legacy networks and UEs
<p>Use Case KPIs (Application Viewpoint)</p> <ul style="list-style-type: none"> • Coverage and throughput-related <ul style="list-style-type: none"> • Details (number of users, throughput KPIs etc) • Reliability of the network – meantime between failure <ul style="list-style-type: none"> • Latency • Throughput 	<p>Implementation Partners and Locations</p> <ul style="list-style-type: none"> • University campuses as developer networks • NVL campus in Hamburg (Blohm&Voss shipyard) 	

MAVERIC Use Case One Pager

2. Ship in Construction

<p>Brief Use Case Description</p> <ul style="list-style-type: none"> • Ship in dock or at pier – want to provide connectivity on and within the ship • Challenged radio environment • Possibly challenged backhaul connectivity 	<p>Innovation</p> <ul style="list-style-type: none"> • Dedicated antennas (e.g., coax cables) • Potential dedicated radio control • Autonomous networks • In-Network Computing – distributing application logic depending on network performance and availability 	<p>Market Relevance</p> <ul style="list-style-type: none"> • Applicable to other challenged environments as well • Indoor production environments, mines etc.
<p>Use Case KPIs (Application Viewpoint)</p> <ul style="list-style-type: none"> • Coverage and throughput-related <ul style="list-style-type: none"> • Details (number of users, throughput KPIs etc.) • Application-level „Quality of Experience“ 	<p>Implementation Partners and Locations</p> <ul style="list-style-type: none"> • NVL campus in Hamburg (Blohm&Voss shipyard) 	

MAVERIC Use Case One Pager

3. Ship in Test Operation

<p>Brief Use Case Description</p> <ul style="list-style-type: none"> • Ship on test trip (Elbe/Weser, North Sea etc.) • Objective: provide adequate connectivity (ideally: similar to shipyard network from applications' perspective) • Backhaul access to enterprise network may be limited or non-existent • Limited satellite or public mobile network coverage could be used 	<p>Innovation</p> <ul style="list-style-type: none"> • Pop-Up Networks: Self-contained networks with multiple backhaul connectivity options • Support for challenged backhaul • Smart, automated application provisioning on local pop-up network (in-network computing) 	<p>Market Relevance</p> <ul style="list-style-type: none"> • High relevance expected: concept can be applied to different types of networks, with different levels of performance constraints
<p>Use Case KPIs (Application Viewpoint)</p> <ul style="list-style-type: none"> • Per-application KPIs (TBD) • For example, we will define a set of applications that are supposed to work and then refactor them with respect to application modules, server components etc. that can be provisioned on the pop-up network platform. • Examples <ul style="list-style-type: none"> • Document access • AR • What else? 	<p>Implementation Partners and Locations</p> <ul style="list-style-type: none"> • NVL campus in Hamburg (Blohm&Voss shipyard) • Ship in production 	

MAVERIC Network Requirements

Network Aspects	Characteristics	Requirements of Use Case 1	Requirements of Use Case 2	Requirements of Use Case 3
5G Network Coverage	Long term / short term / nomadic indoor / outdoor, Easily extensible / modifyable	Ubiquitous, outdoor & indoor	Support for challenged radio environments	Challenged backhaul
5G Network QoS	Focus on low latency / high throughput / high device density focus on availability / reliability temporally/spatially adaptable / adaptive scalable device counts / device req.	High device density, availability	availability	Temporally/spatially adaptable, low latency, high throughput (without perfect backhaul)
5G Network Control	Automated operation self optimizing application controlled	Automated operation	Self-optimizing (radio)	Automated operation, application-controlled/adequate in-network computing
5G Network Monitoring	QoS monitoring network element monitoring usage traceability detailed health check on demand	QoS monitoring	Radio monitoring	Ideally: zero-monitoring
Other 5G Network Requirements		Zero-trust (heterogeneous RAN)	Zero-trust (heterogeneous RAN)	Seamless in-networking computing for challenged backhaul
Overarching Nw. Infrastructure	Integration with other LAN infrastructure integration with other WAN infrastructure	WiFi 6 integration		

MAVERIC Use Cases Implementation Timeline

- When will use cases be ready for testing in the envisaged Open RAN testbed ?
- When is Open RAN testbed envisaged to be ready for use case testing ?
- When will use cases be tested and evaluated in Open RAN testbed ?
- When will use case demos be available ?

	Use Case Development			Testbed	Evaluation	Demo
	UC1	UC2	UC3			
2022 Q2						
2022 Q3	X					
2022 Q4	X			X		
2023 Q1	X	X				
2023 Q2	X	X				
2023 Q3	X	X	X			
2023 Q4		X	X		X	
2024 Q1		X	X			
2024 Q2			X			
2024 Q3			X			X
2024 Q4						
2025 Q1						