

Session B

Network architecture for mmWave & TeraHertz communications

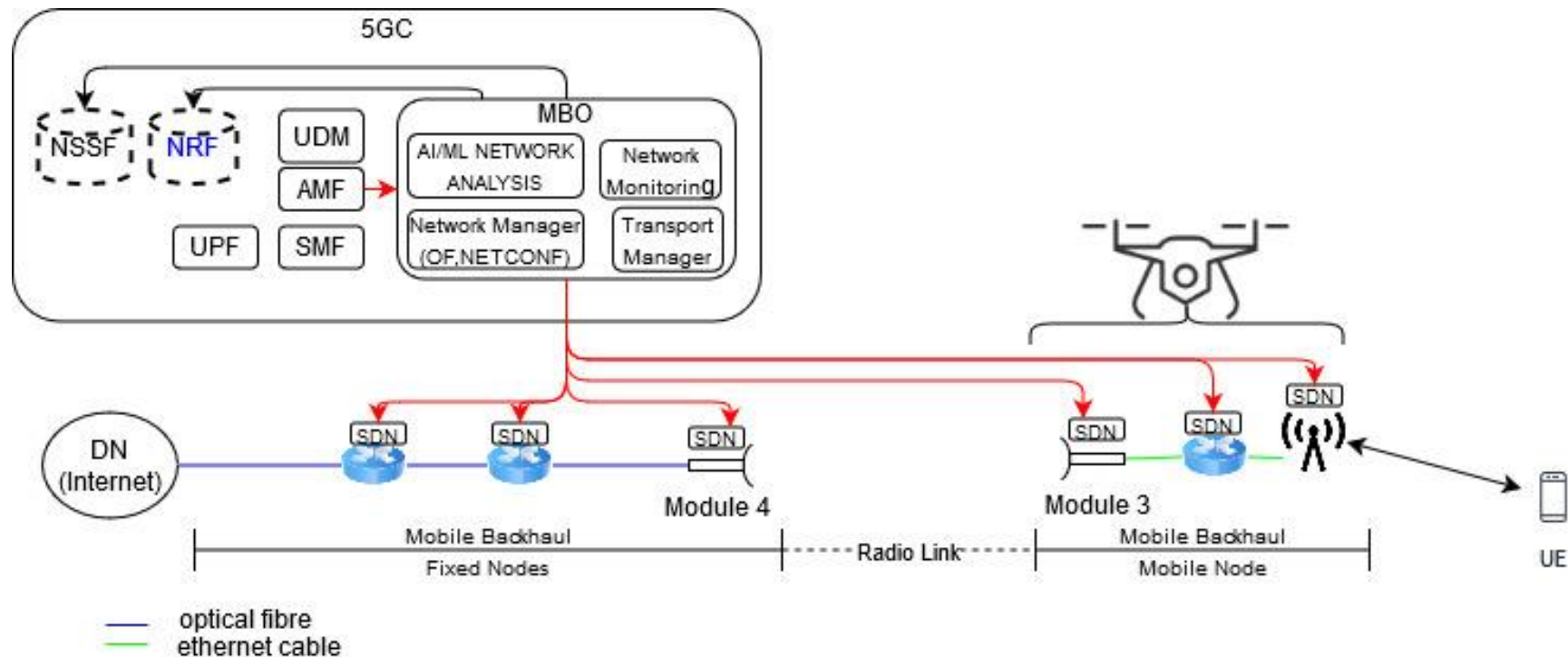
Session B: Network architecture for mmWave & TeraHertz communications

THz integration into 3GPP network slicing (Dr. Jose Costa-Requena)

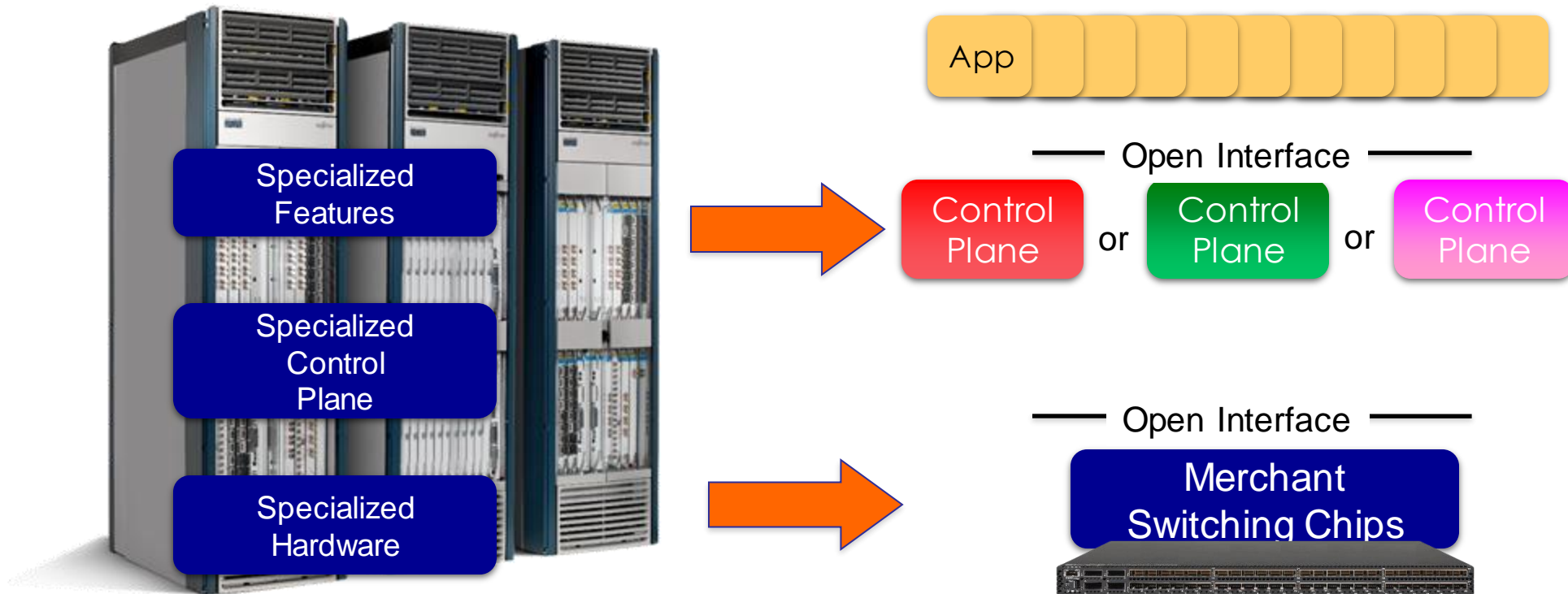
FG2 Key achievements: NMS



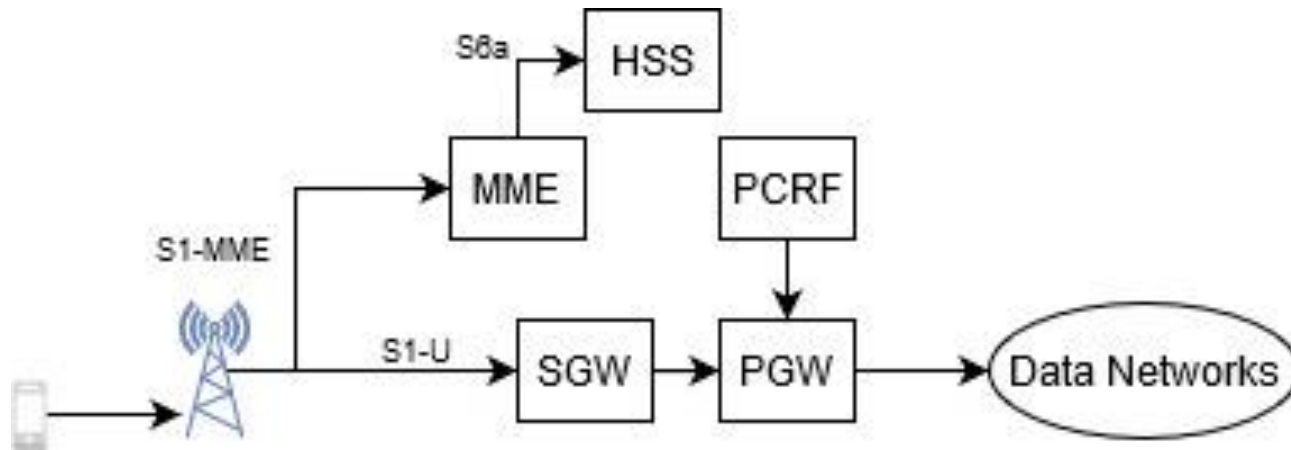
- Completed the prototype of the Controller that interacts with THz radio modems following TR-532
- Implementation of Network Data Analytics function (NWDAF) including Network agent for the slice transport management.
- Integration of network slice management controller as part of 3GPP architecture
- Network slice management completed and validated



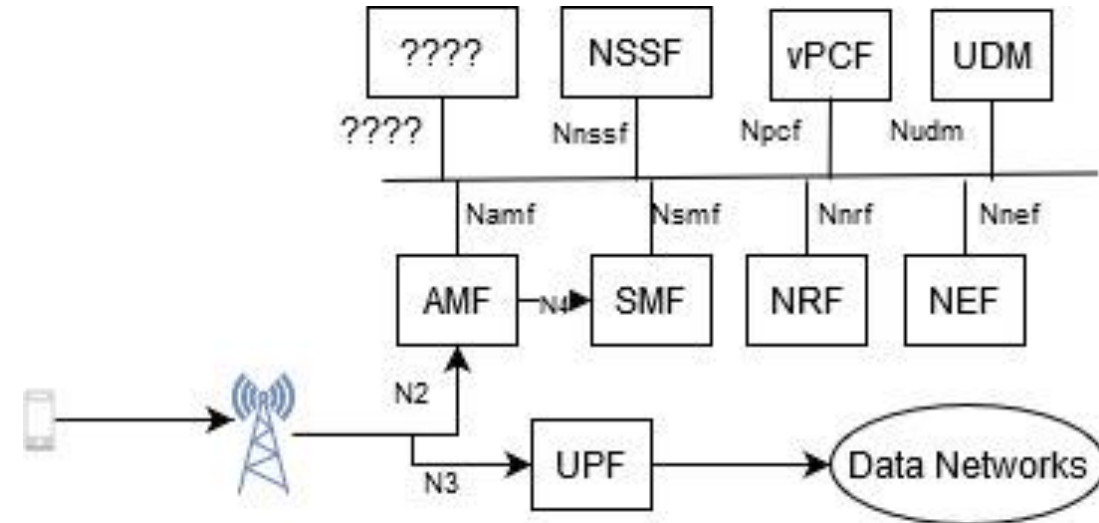
- Services were integrated with the core network and most cases HW dependent.



- 4G Architecture



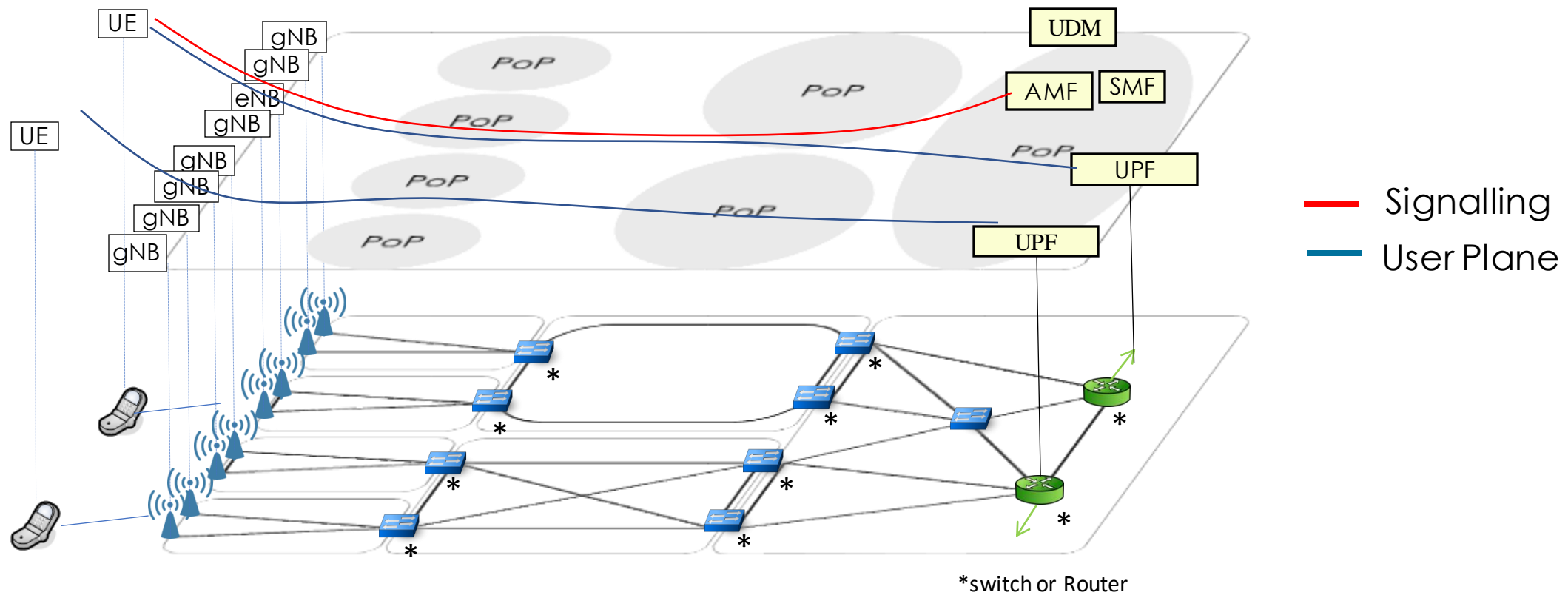
- 5G Architecture (SBA)



Mobile Architecture Transport agnostic



- 5G logical architecture fully distributed interacts with different transport technologies.

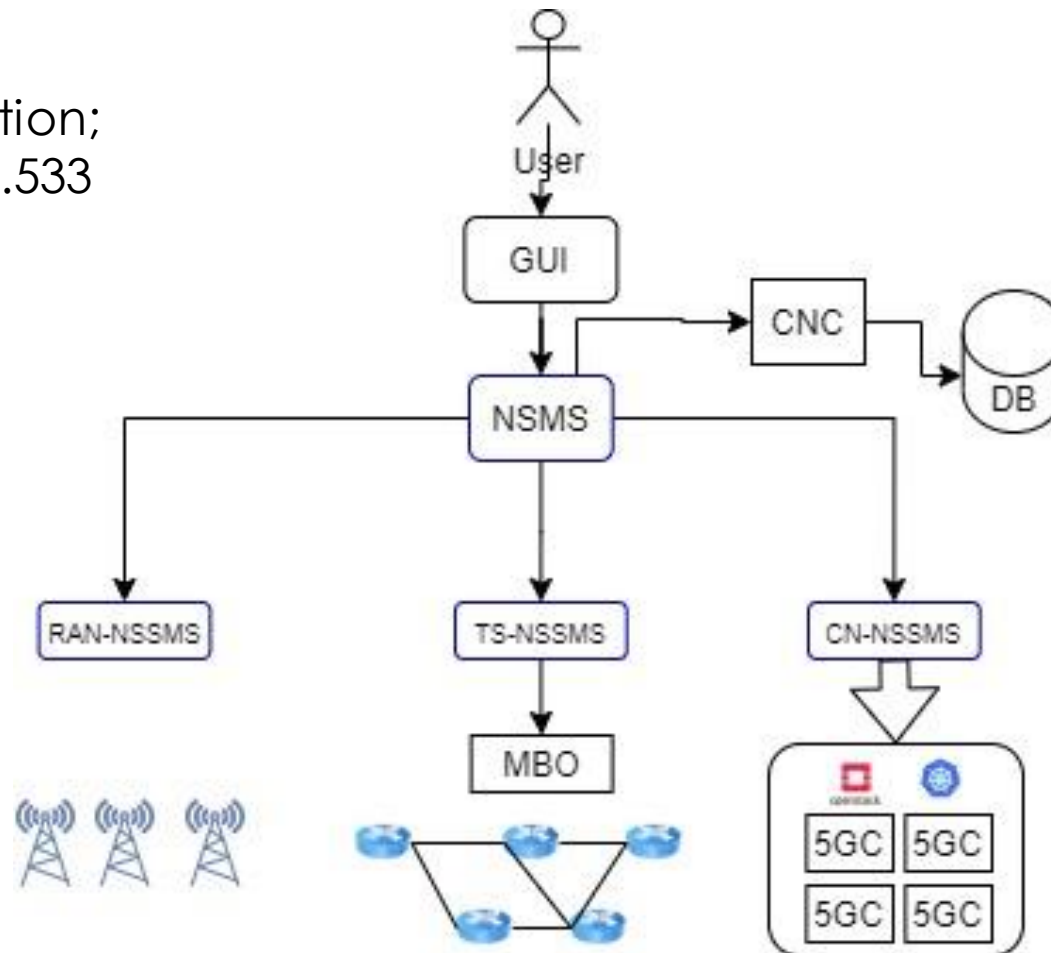


5G Network Slicing



- 5G SBA can integrate new transport through additional network functions (NF) that hide technology dependencies

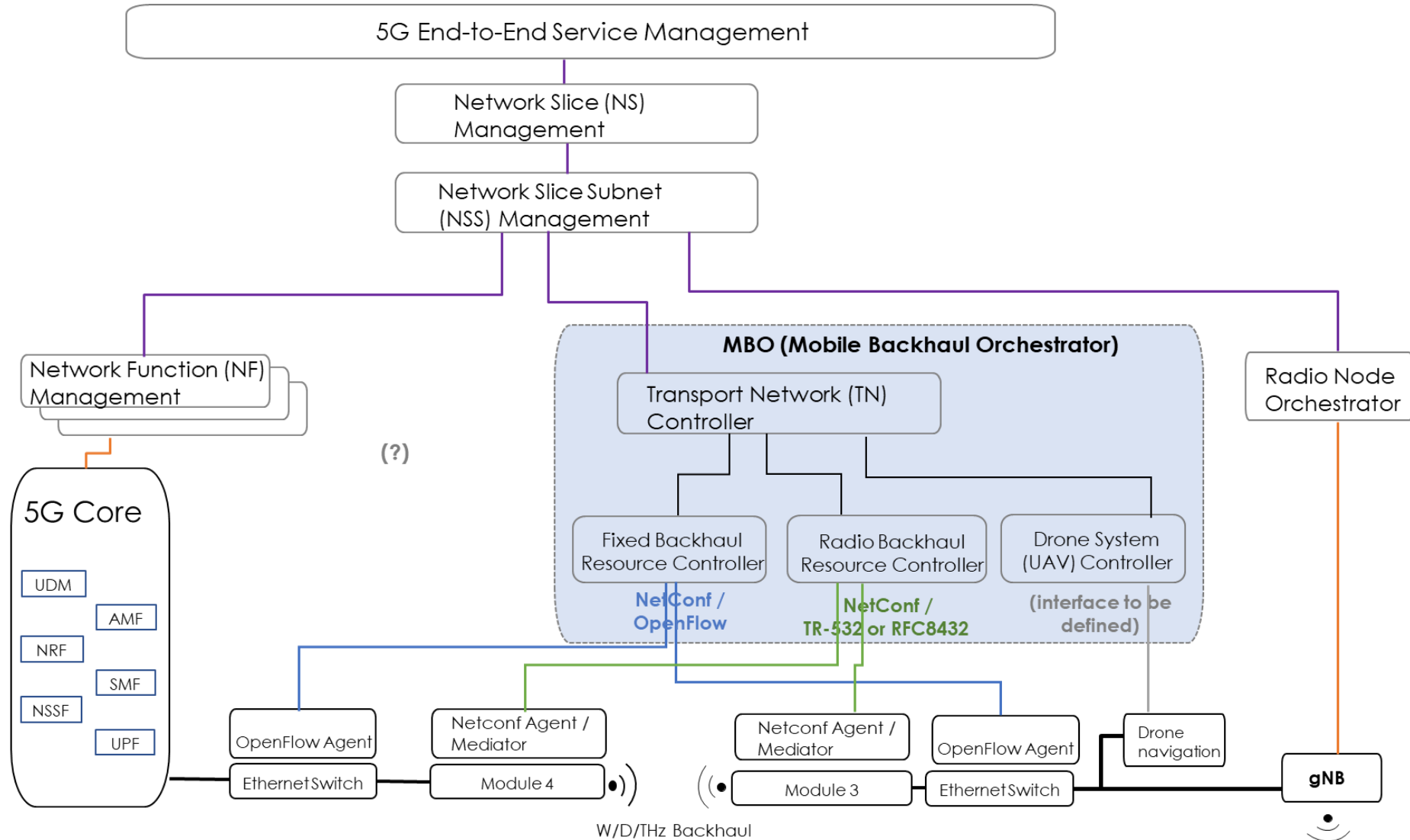
Slicing management and orchestration;
Architecture framework (3GPP TS 28.533
version 15.3.0 Release 15)



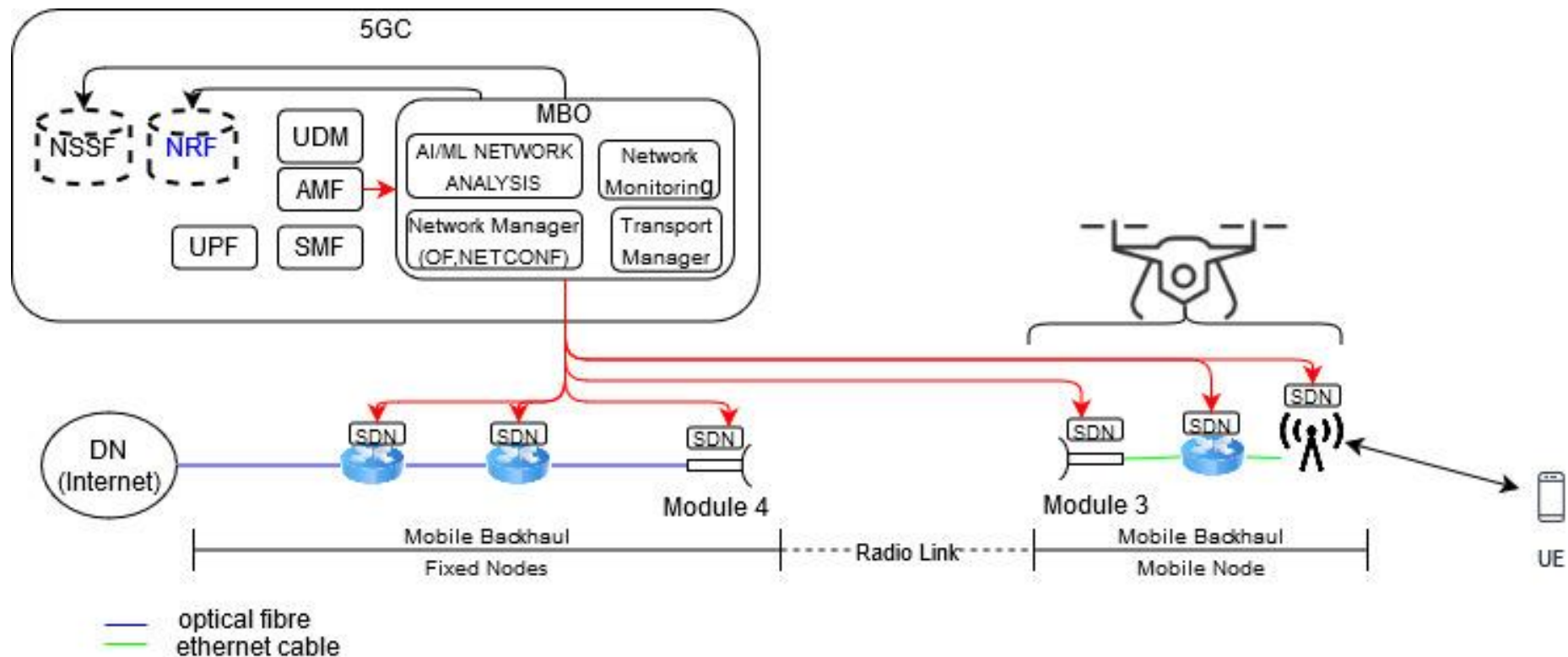
THz transport part of 5G Slicing architecture



- 5G SBA can integrate both fixed and THz transport



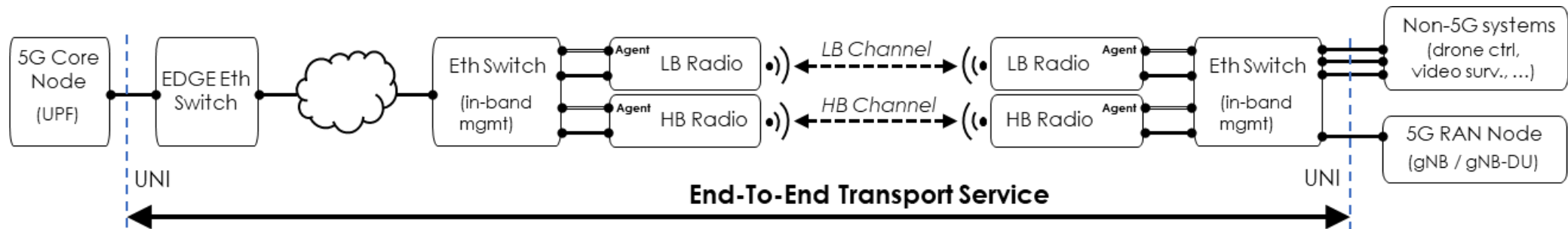
- Network Slicing NFs integrated as part 5G SBA allows to manage fixed and THz modems to create different slices based on traffic requirements.



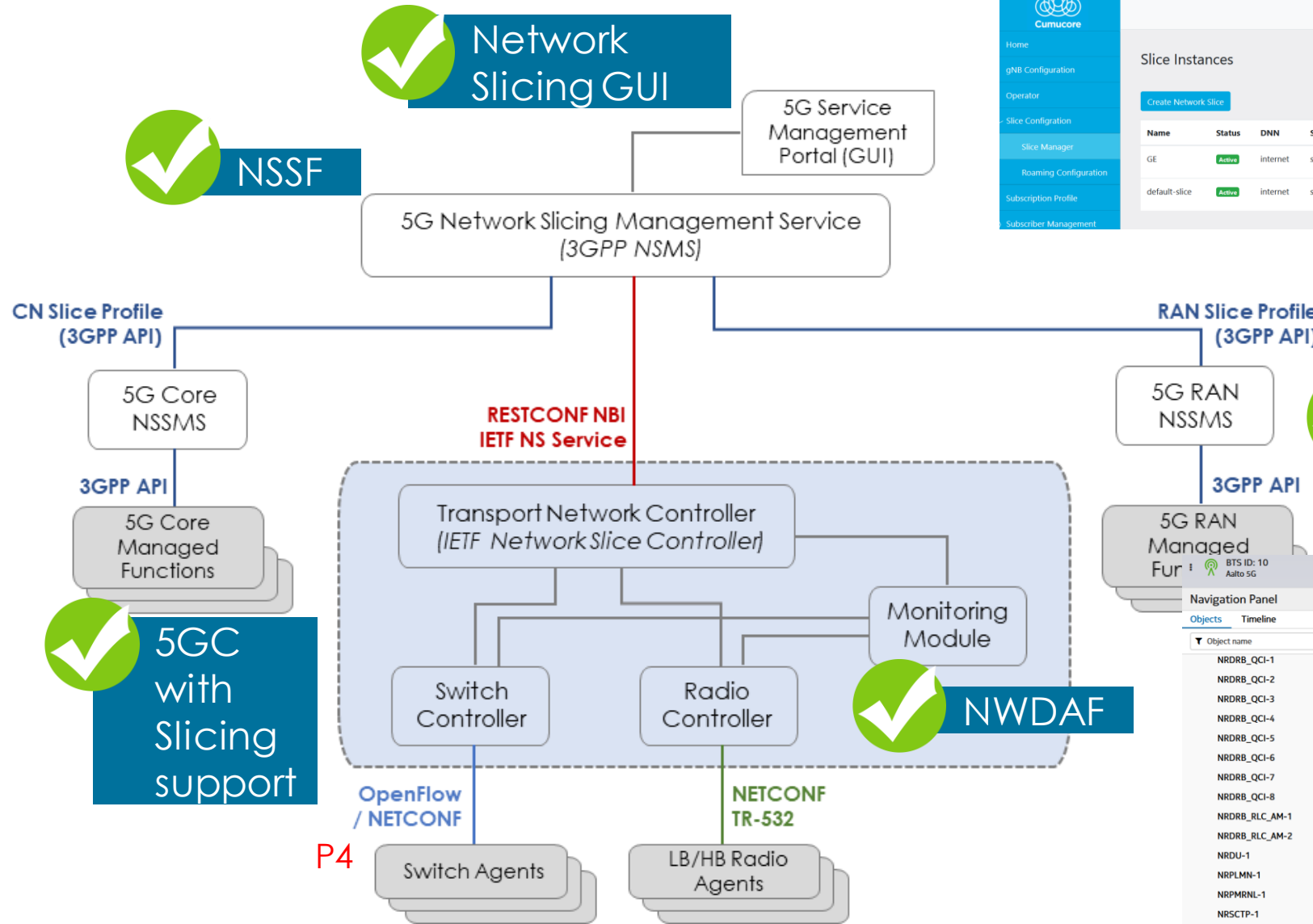
Radio based network slicing strategies



- **Slice realization**
 - Ethernet (wired): VLAN tagging + metering/policing at ingress, priority queueing, active queue mgmt
 - Radio (THz): PHY and modem params (tx, rx frequency, channel bw, modulation, coding)
- **SDN Interfaces and Data models**
 - Integration in 5G Management System (SBA)
 - IETF Transport Slicing Framework



TERAWAY Deployment status



Name	Status	DNN	SST	Maximum Number of UEs	TAC	Default Slice	#	#	#
GE	Active	internet	sst 1	10	14545	No			
default-slice	Active	internet	sst 1	1000	14545	Yes			

RAN Slicing GUI

Configuration Management

Commissioning Wizard | Parameter Editor | Definition Errors | Relation Errors | Hardware Errors | Compare Objects

Q Search all

SNSSAI-1 MRBTS-10/NRBT5-10/SNSSAI-1

Network Slicing

Status	Parameter name	Abbreviation	Planned Value
*	Administrative state	administrativeState	Unlocked
	NG User Plane IP configuration	ngUplane	
*	List of NRPLMN distinguished names	nrPlmnDnList	
*	#1		MRBTS-10/NRBT5-10/NRPLM
	Operational state	operationalState	Select value
	Slice Differentiator	sd	
*	Network Slicing instance identifier	snssaid	1
*	Slice Service Type	sst	1
	User label	userLabel	
	Xn User Plane configuration	xnUplane	

- 5G SBA increase flexibility of mobile networks to integrate new transport technologies.
- Network slicing allows to select different transport based on service requirements.
- Software Defined Networks with 5G Core integrated controllers provides dynamic management of end-to-end mobile networks.

Terahertz technology for ultra-broadband and ultra-wideband operation of backhaul and fronthaul links in systems with SDN management of network and radio resources



THANK YOU

Contact: jose.costa-requena@cumucore.com



Terahertz technology for ultra-broadband and ultra-wideband operation of backhaul and fronthaul links in systems with SDN management of network and radio resources



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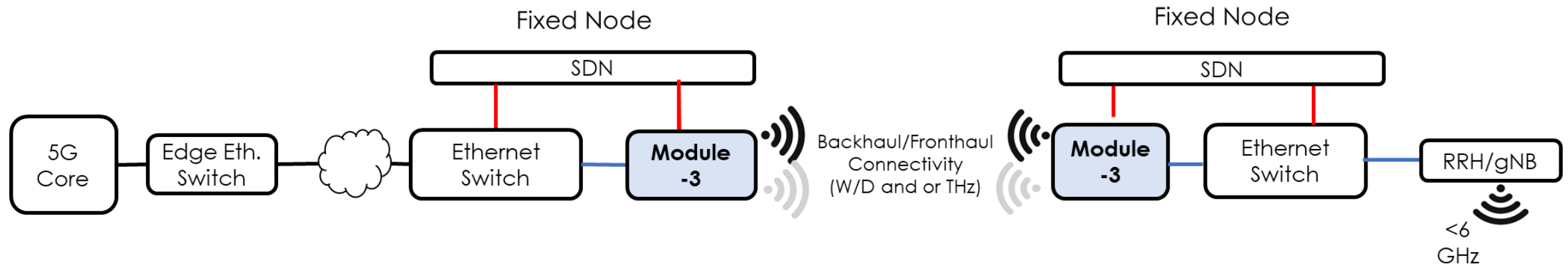
Website: <https://ict-teraway.eu/>

THz management controller (ONF)

Nicola Carapellese

SIAE Microelettronica, Milan, ITALY





TERAWAY Network Architecture in the context of:

- Transport networks
- Radio technologies
- Network Management

- Technological challenges:
 - Multiple frequency bands (microwave, mm-wave), bandwidth vs reach vs reliability tradeoffs
 - Time-varying, unpredictable radio channel (precipitation fading, multipath, interference, ...)
 - Link capacity dynamically varies with channel conditions (ACM)
 - Multiple-link aggregation at physical layer (BCA)
 - Few redundant paths (chain and tree, sometimes ring)
 - Large number of nodes, broad geographical distribution
 - Control channel with limited bandwidth and unreliable
- Issues for network operators:
 - Single-vendor hardware equipment (vendor lock-in)
 - Network operation, config, maintenance is manual and not run-time
 - Network Management Software (NMS) is proprietary, with closed interfaces
 - NMS is not integrated with other network domains

SDN is the way to go

State-of-the-art now

- Multi-vendor unified OAM functions
 - Open interfaces, vendor-independent resource abstraction
 - Centralized control (inventory, configuration, monitoring, performance, alarms)

TERAWAY Innovation

- Dynamic adaptation to radio impairments
 - Automated frequency allocation/reallocation
 - Interference handling
 - Dynamic path protection, path redundancy
- Dynamic adaptation to traffic changes
 - On-demand bandwidth assignment
 - Traffic routing optimization, pro-active rerouting
 - Efficient power consumption
- 5G «Transport» Network Slicing
 - Radio resource abstraction towards NBI
 - End-to-end QoS management

Beyond TERAway...

- Network Virtualization
 - Cloud-native NFV architectures (connectivity + compute + storage VNFs)

Radio Transport in SDN Architecture

Open SDN Apps Ecosystem



Network Orchestrator

Cross-Technology/Multivendor

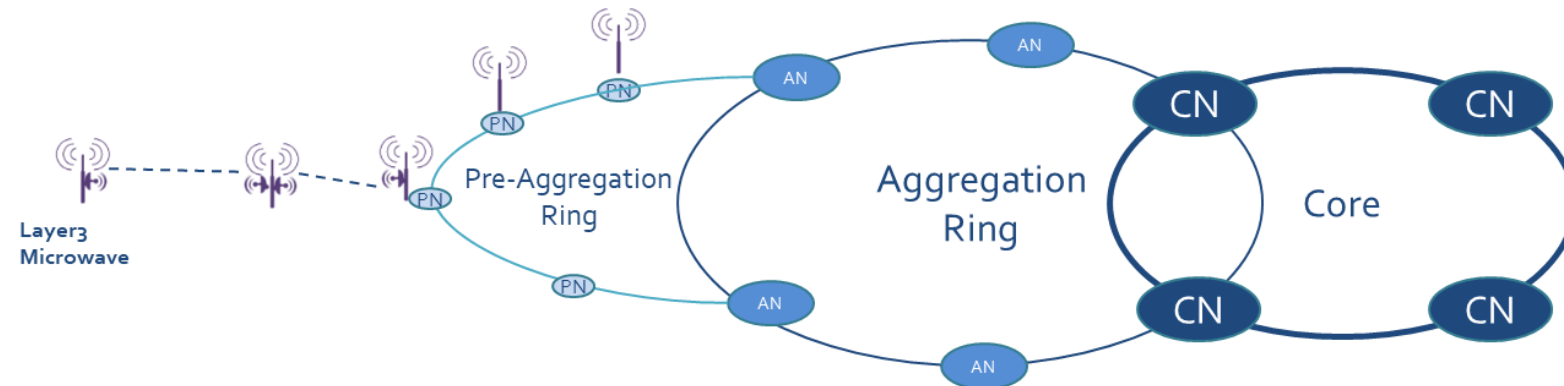
- Provisioning & Monitoring
- Automation & Optimization
- Network Abstraction



- Network Element Management
- Resources Abstraction over Restconf



Multivendor, Multidomain Transmission Network



mWT SDN Plugtests



- “ISG mWT” activities
- Wireless Transport Profile for NBI (WI#24)
- Wireless Backhaul and Service Automation for SBI (WI#25)

SDN Wireless Transport Project



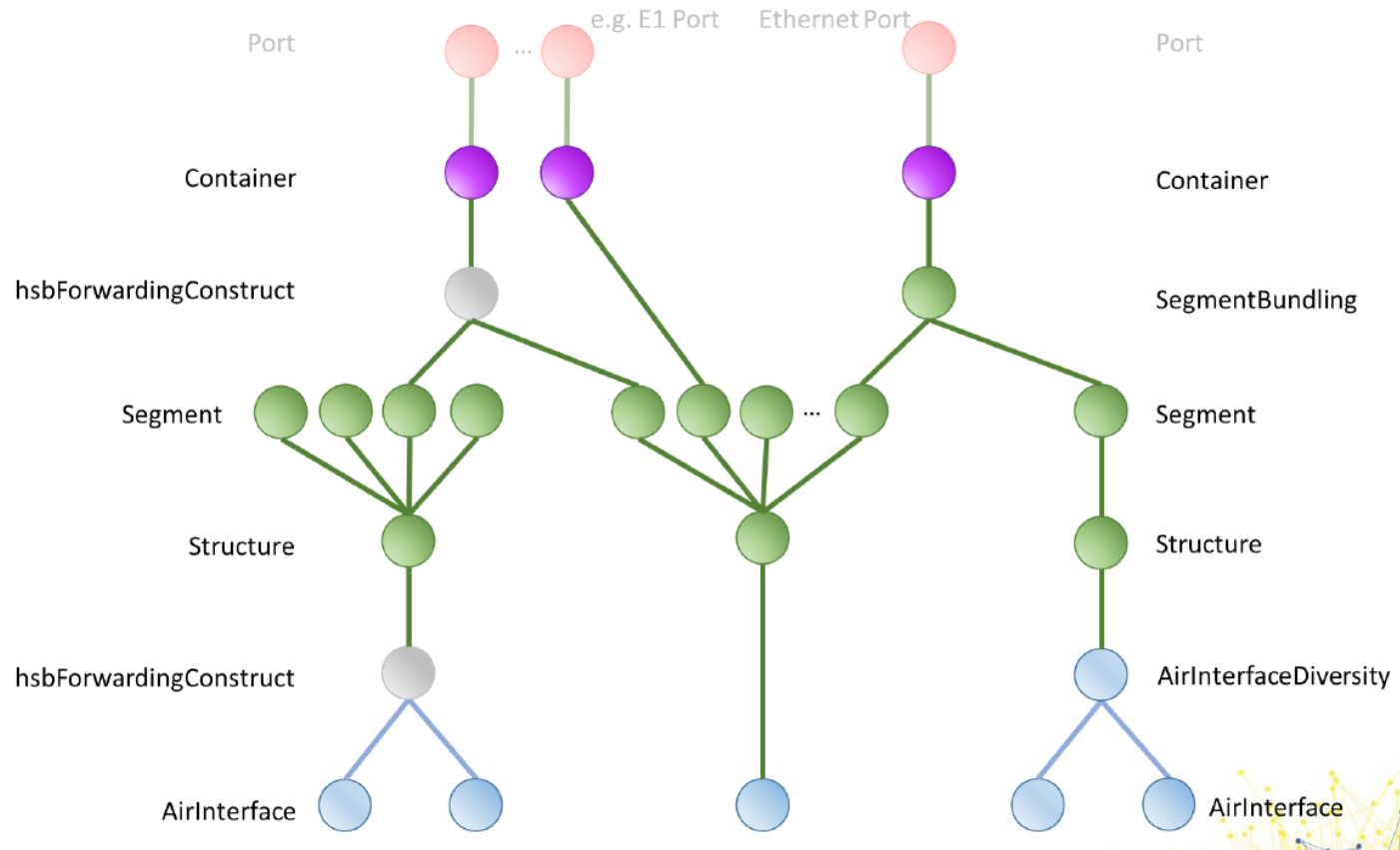
OPEN NETWORKING
FOUNDATION

- Microwave SDN Proof-of-Concept demos
- Specification of TR-532 Microwave Information Model

ONF TR-532 Microwave Information Model



- Technology-specific extension of TR-512 Core Model
- Carefully chosen balance: General/Abstract vs Practical/Concrete



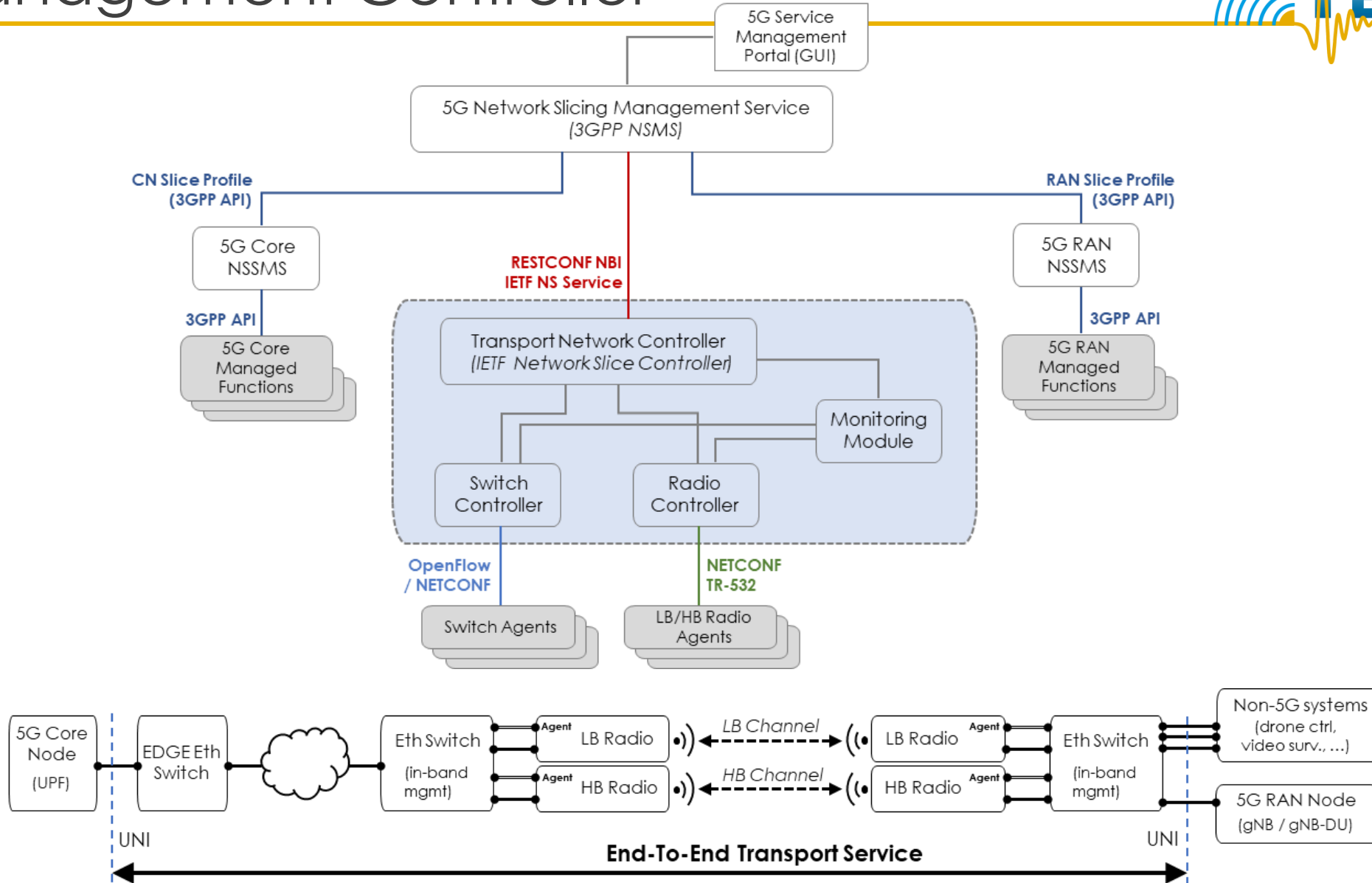
Container

Structure

AirInterface

- Capabilities
- Configuration
- Status
- Problems
- Performance

THz Management Controller



- THz inherits challenges of microwave/mmWave
- SDN is needed to manage complexity and dynamicity
- Hierarchical SDN controllers for abstraction and integration in 5G/B5G
- Open interfaces for multi-technology integration
- Data models open to customization and extension

Thank you for your attention!

For more info, visit TERAway website: ict-teraway.eu/



 PHOTONICS²¹  5G PPP

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