Conectando ideias, antecipando o futuro:
inovação colaborativa para as redes 5G e 6G.

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From Static Slicing to Network Slicing as a Service

Cristiano Bonato Both
Gustavo Zanatta Bruno

Inatel/UNISINOS

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Mini CV

Full professor in the Applied Computing Graduate Program at the University of Vale do Rio dos Sinos (UNISINOS)

Coordinator of the project “A New Minimum Common Base for NovaGenesis and NSaaS: Advancing Cyber-Physical Infrastructures with Blockchain and AI Functions” of xGMobile

Gustavo Zanatta Bruno is a postdoctoral researcher at (xGMobile Project) Inatel, Brazil

His research spans infrastructure automation, 5G, B5G, O-RAN, and cloud computing

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Agenda

- Mobile Networks, basic Concepts
  - Background
  - Demo: Network Slicing Static
- The evolution of 5G Network Customization
  - Related Work
  - Network Slicing as a Service Plataform
  - Demo: Network Slicing as a Service
- Work in progress

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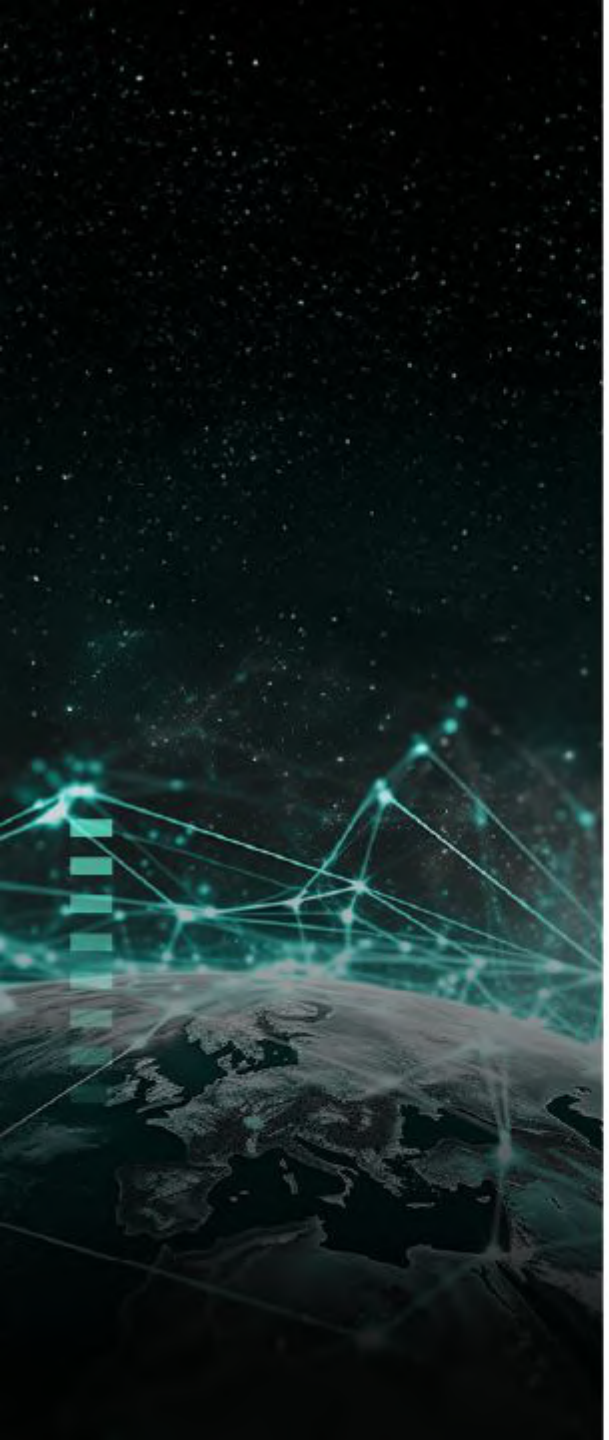

Mobile Networks, basic Concepts

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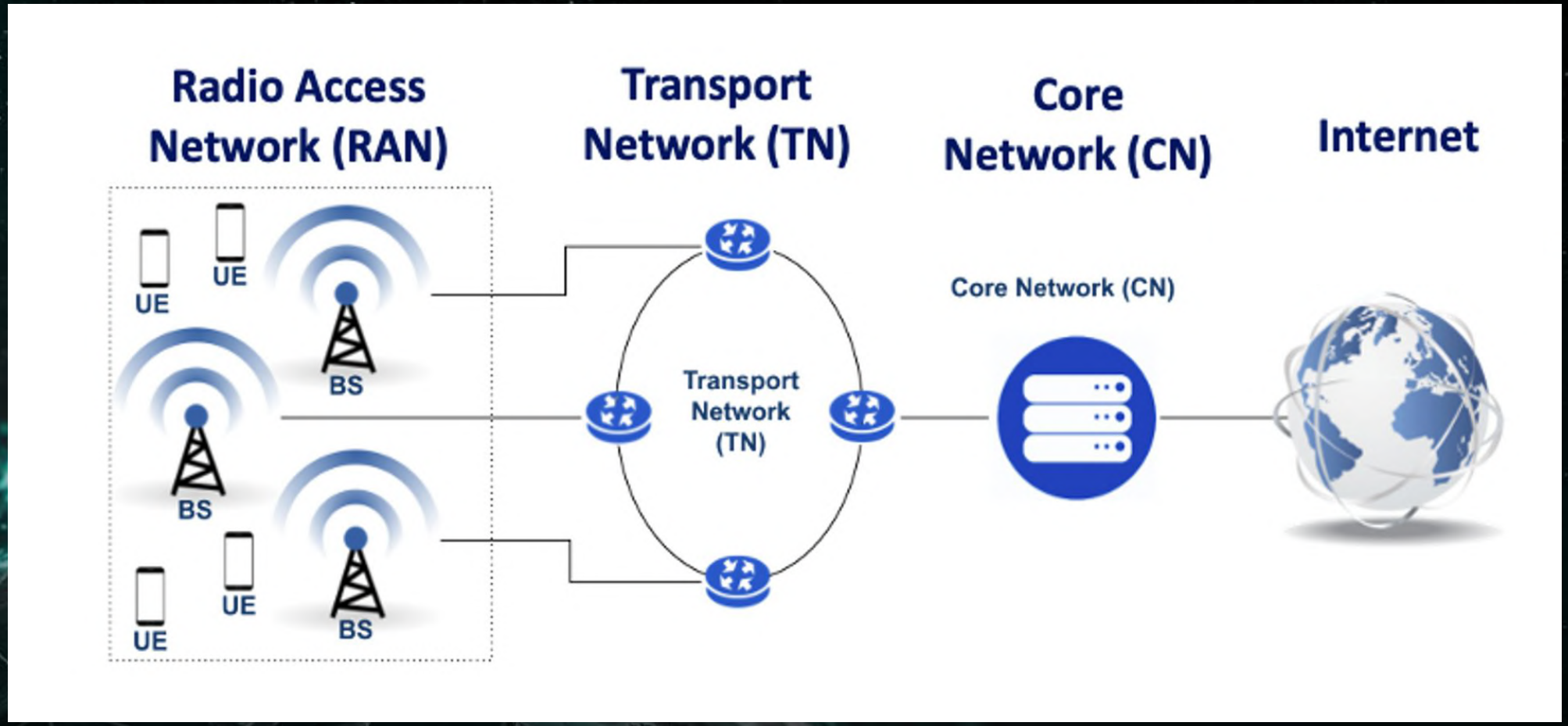
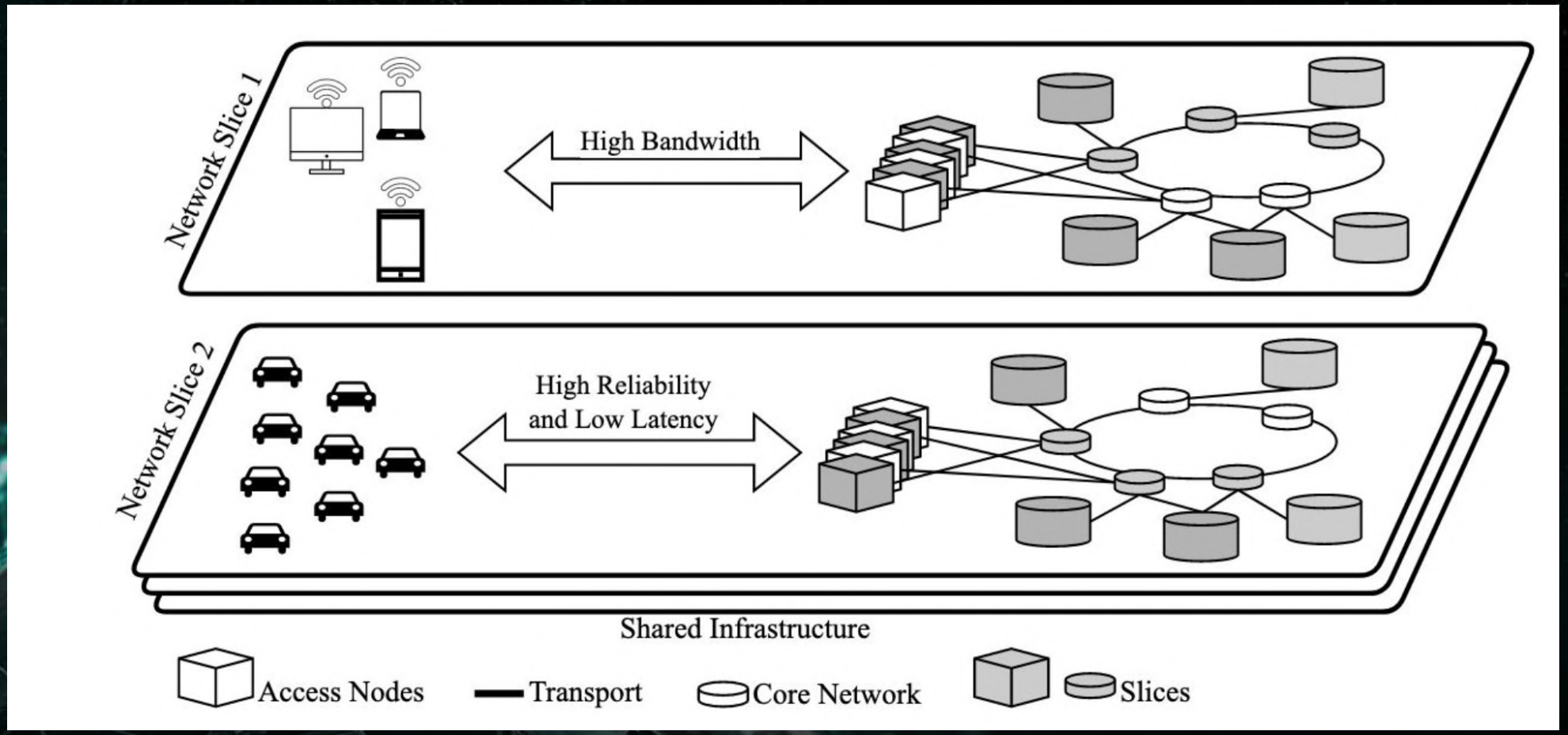

Radio Access Network (RAN)
Transport Network (TN)
Core Network (CN)
Internet
UE
UE
UE
UE
BS
BS
BS
Transport Network (TN)
Core Network (CN)

Background



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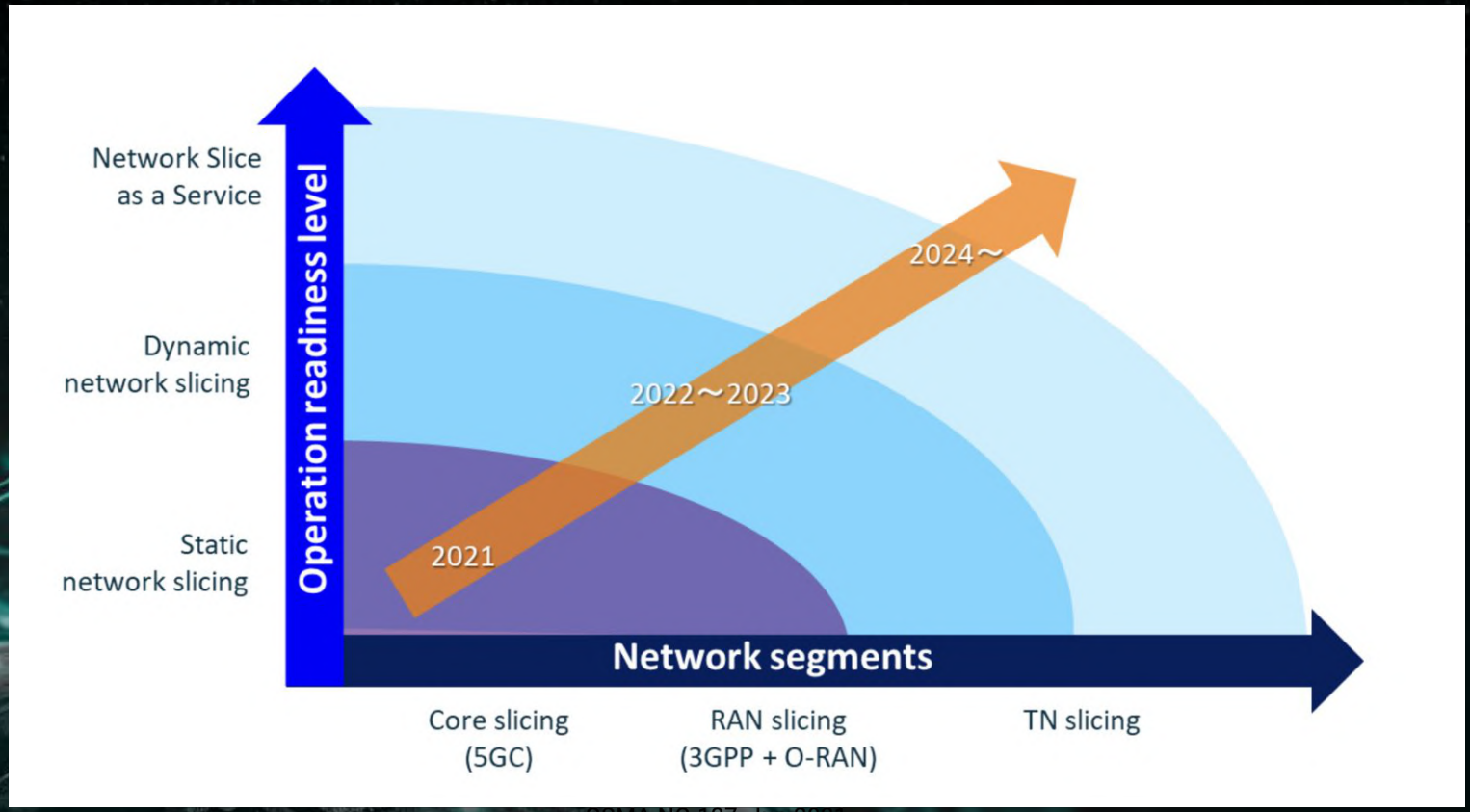

GSMA NG.127, Jun 2021

GSMA NG.127, Jun 2021

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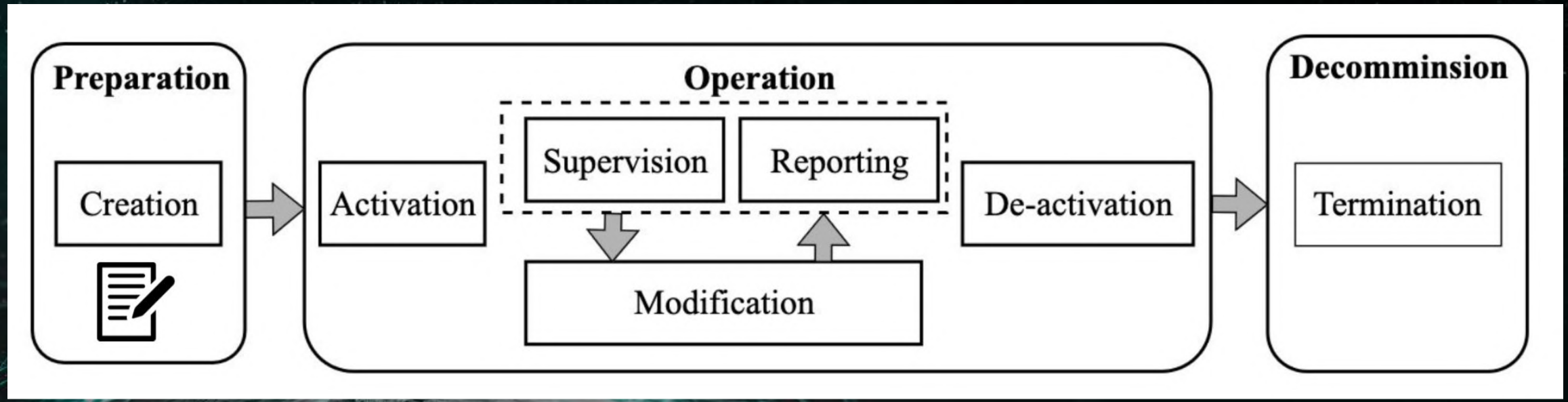
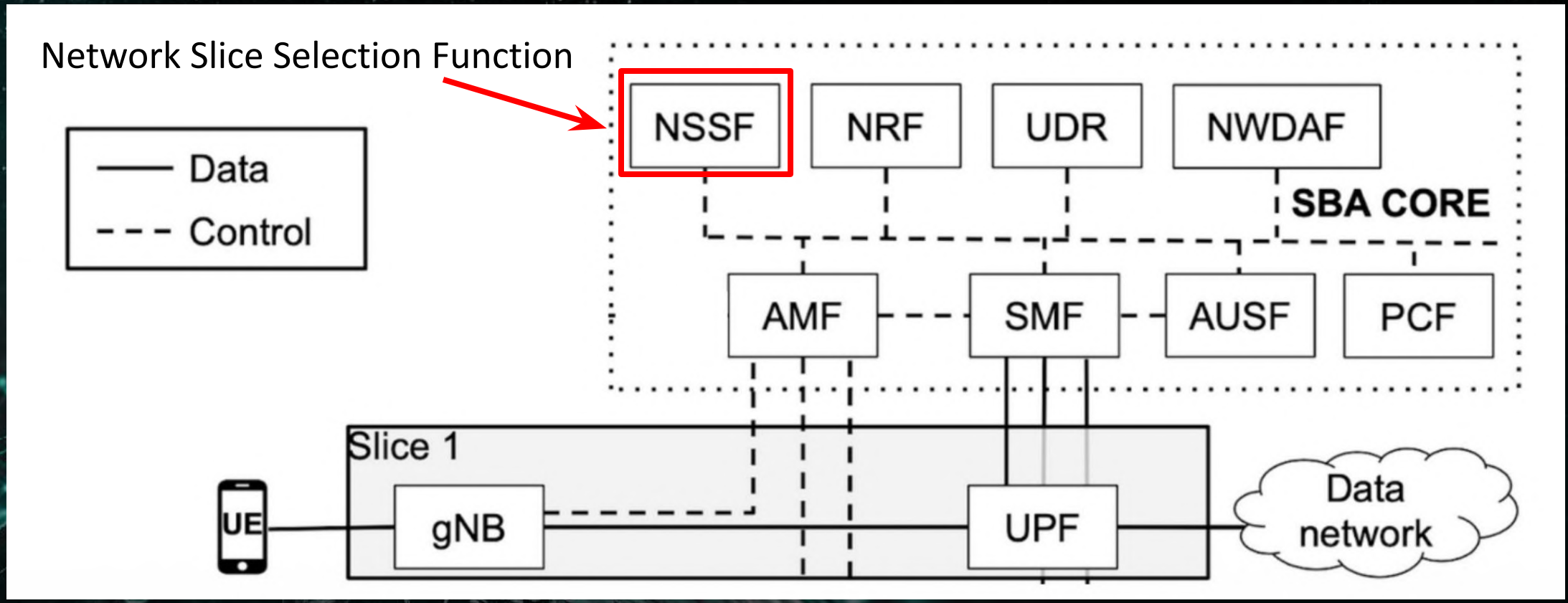
Network slicing life cycle



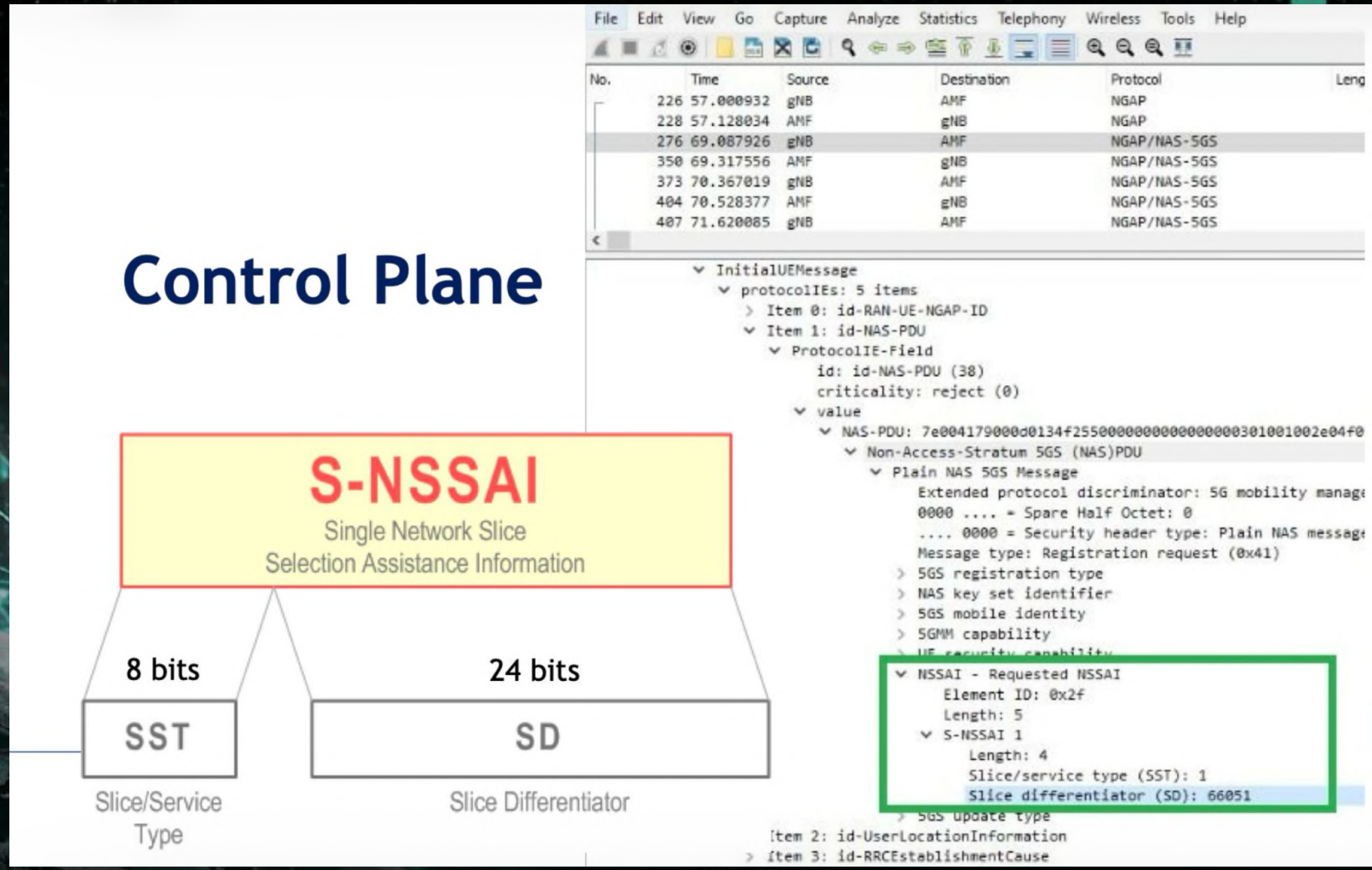
5G Core Network



Slice Identification

```
spec:
  imsi: "999700000000002"
  key: "465B5CE8B199B49FAA5F0A2EE238A6BC"
  opc: "E8ED289DEBA952E4283B54E88E6183CA"
  sd: "111111"
  sst: "1"
```

- **Network Slice Type** (NEST): a standardized grouping of requirements that defines what the slice actually does
- The S-NSSAI is the pointer and the NEST is the contract



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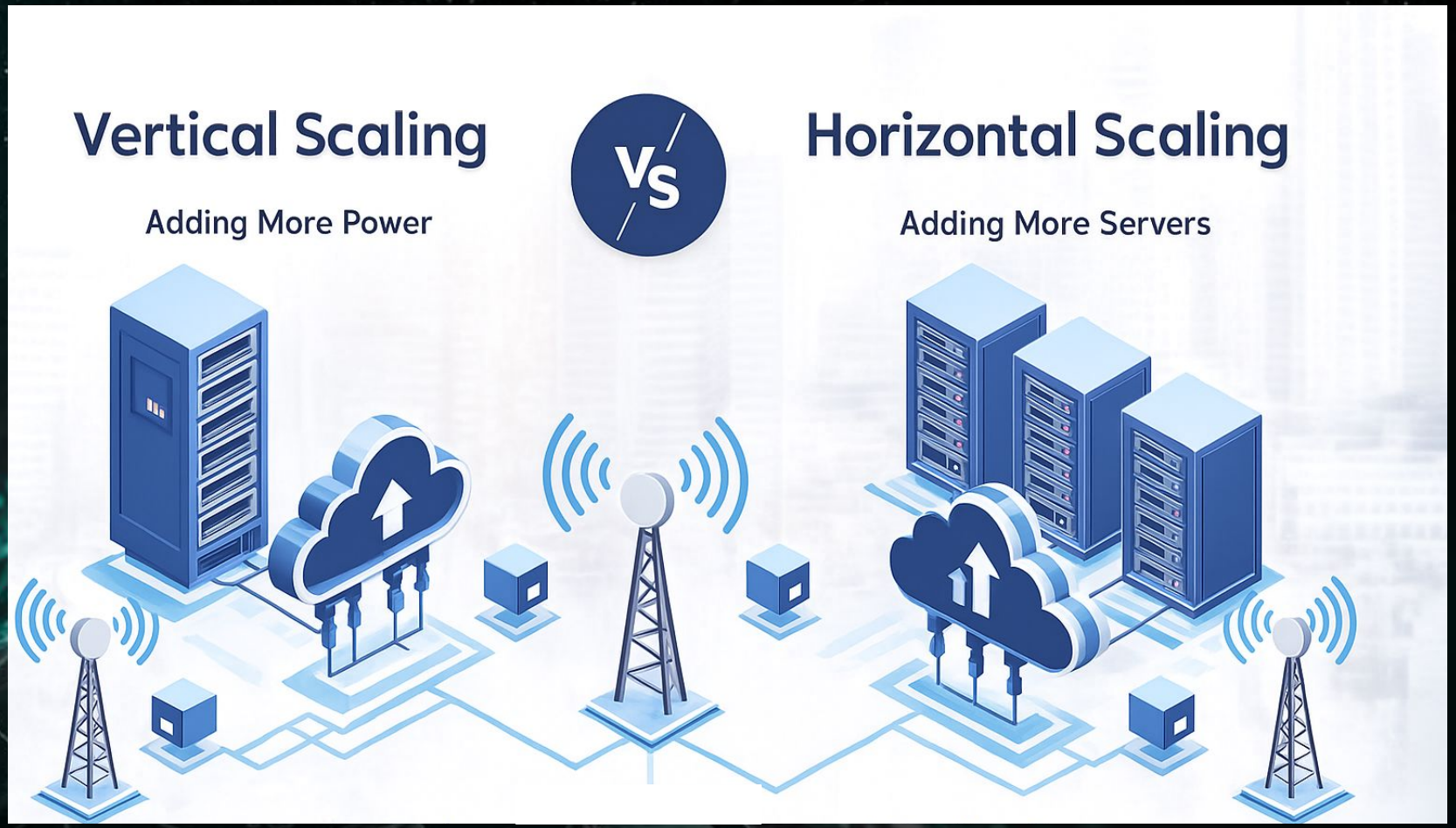
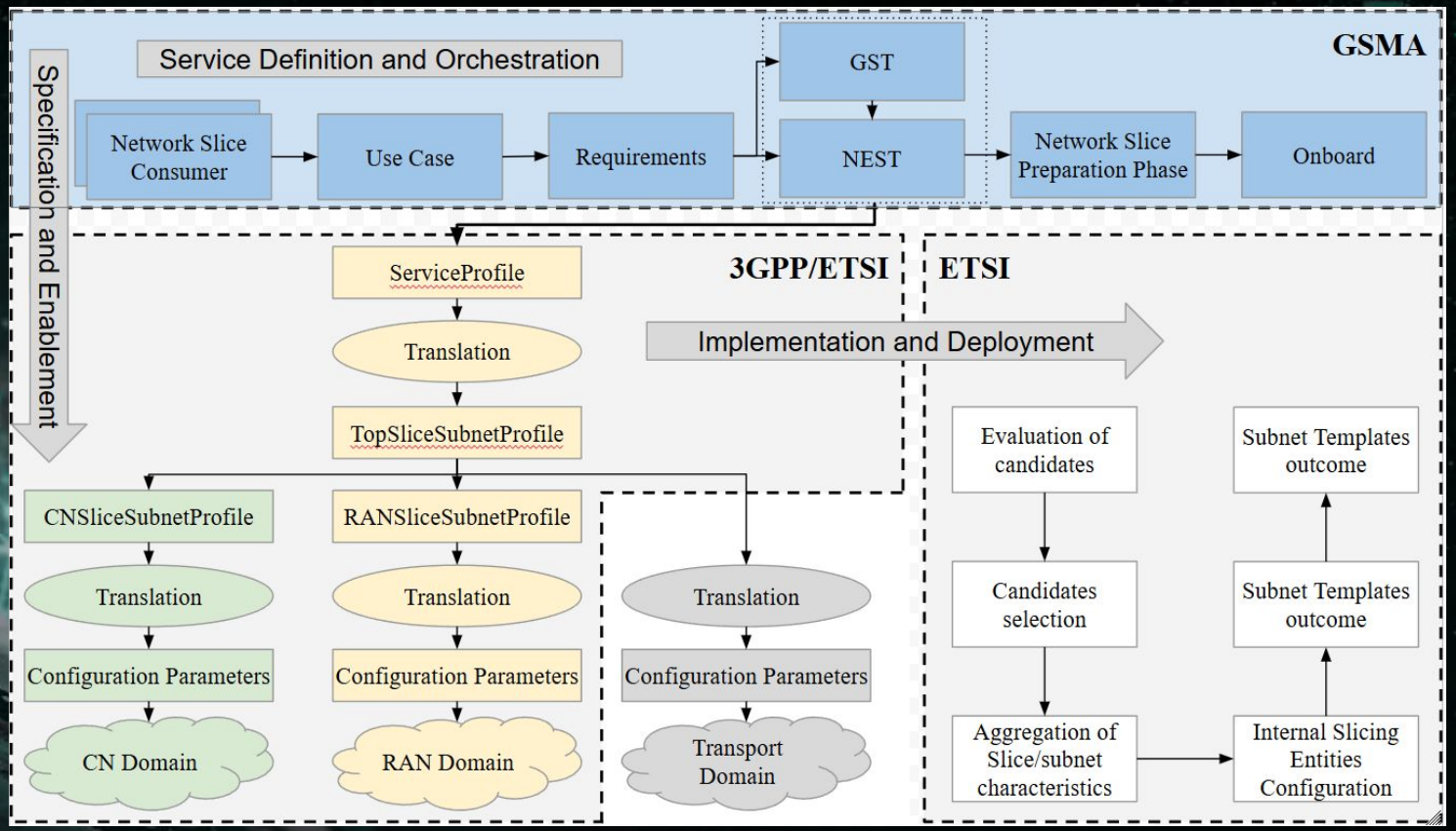
Cloud Computing and Mobile networks



Standardization

- Orchestration aligns with ETSI ZSM and NFV-MANO frameworks
- Closed-loop management enables self-configuration, -healing, and -optimization
- AI/ML integration for proactive assurance and SLA enforcement



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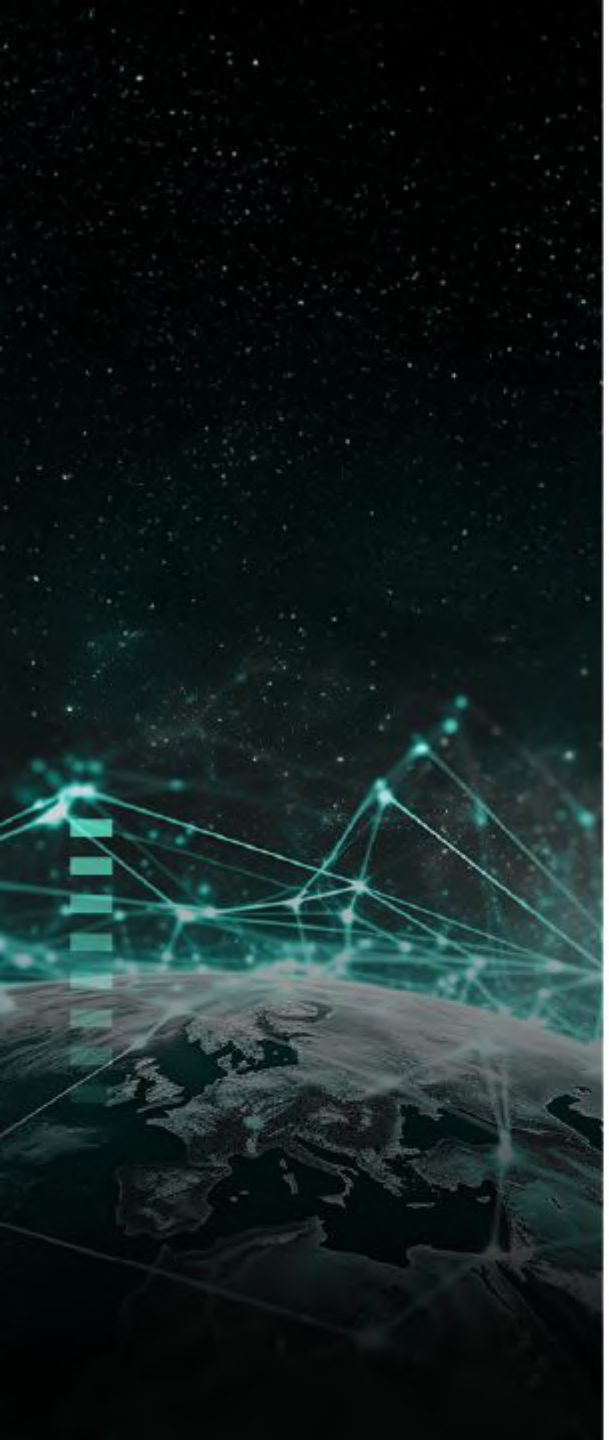
Static Slicing - First Slicing

- Manual Provisioning: Relies on human intervention to all configurations
- Fixed Allocation: Resources are permanently reserved, leading to inefficiency and over-provisioning
- Slow Time-to-Market: Deployment takes days or weeks due to manual "stitch-up" across domains
- No Lifecycle Management: Once deployed, the slice is fixed and it cannot auto-scale or self-heal

Demo: Network Slicing Static



The Evolution of 5G Network Customization

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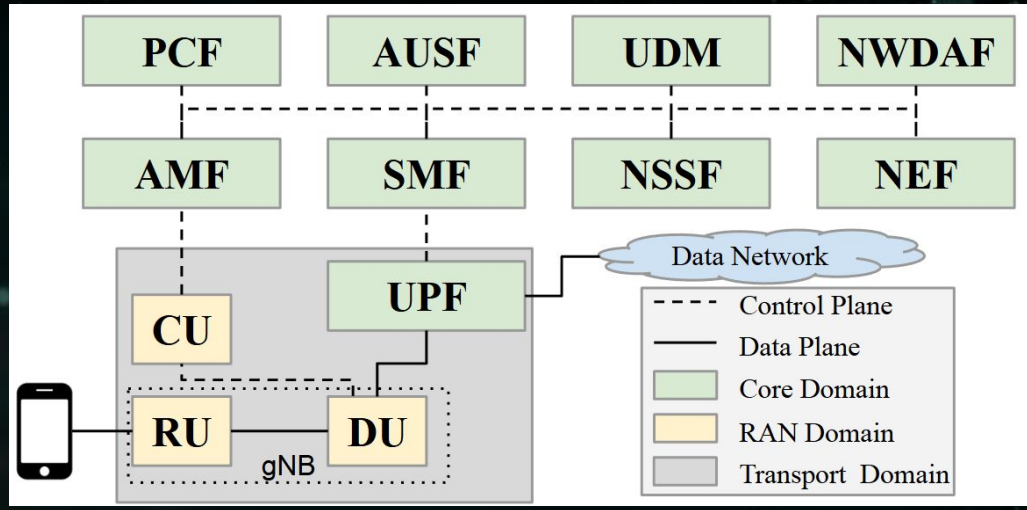
The Evolution of Network Customization

- 5G networks require flexible, programmable, and dynamic service creation
- Traditional static slicing limits scalability and agility
- **Network Slicing as a Service** (NSaaS) enables on-demand, API-based customization
- NSaaS is driven by cloud-native cores, NFV, SDN, and AI-enabled orchestration.



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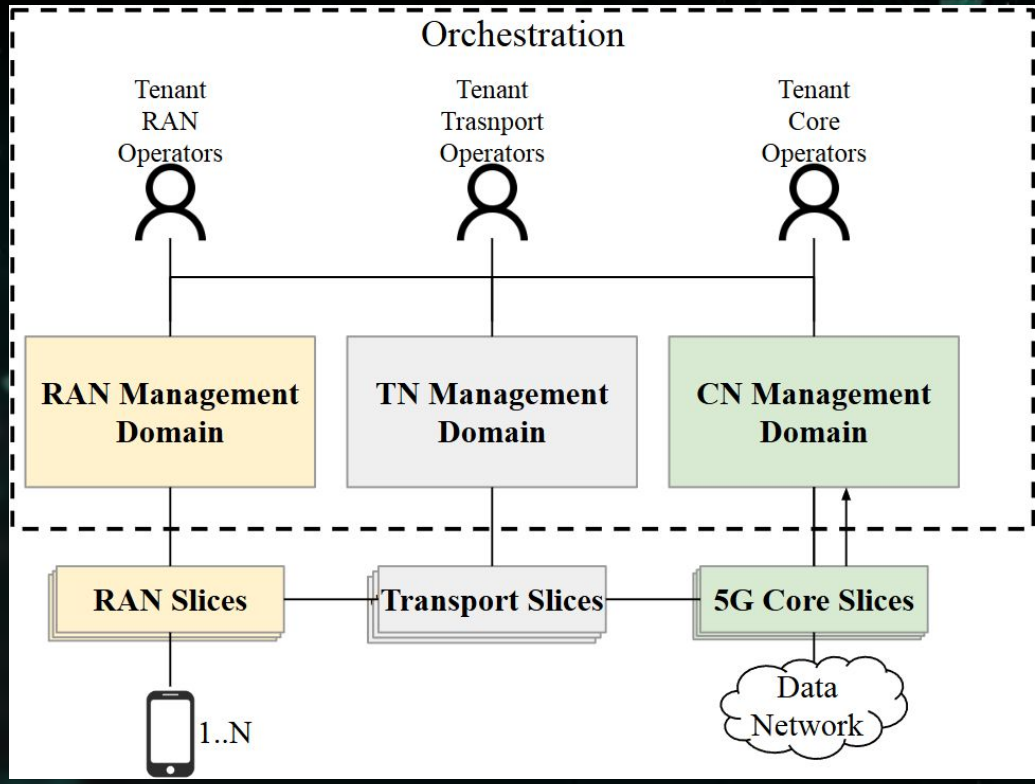
Related Work

Works	Type	B5G/AI Ready	Project Model	Architecture	Service Automation	E2E Service LC Mgmt.	NSaaS
ONAP (2022)	Project	L	H	H	M	M	L
ETSI MANO (2022)	Project	L	H	H	M	M	L
5G Tours (2024)	Project	L	H	H	M	M	L
Breitgand et al. (2021)	Project	M	M	M	L	L	L
Baranda et al. (2020)	Project	L	H	H	L	L	L
Tranoris (2021)	Project	M	H	H	M	M	L
CAMARA Project Consortium (2025)	Project	M	H	–	H	–	M
ETSI TeraFlowSDN and OpenCAPIF Team (2025)	Project	M	H	M	M	L	L
Nephio Project Community (2025)	Project	H	H	H	H	M	M
Project Sylva Consortium (2024)	Project	M	H	H	M	L	L
Hexa-X-II Consortium / SNS JU (2025)	Project	H	M	H	H	M	M
MonB5G Project Consortium (2023)	Project	H	M	M	H	M	L
DAEMON Project Consortium (2023)	Project	H	M	H	H	M	L
Li et al. (2018)	Article	L	H	L	L	L	L
Jiang et al. (2019)	Article	M	H	L	H	M	L
Bega et al. (2020)	Article	M	H	L	L	H	L
Abbas et al. (2020)	Article	M	H	M	H	M	L
Fernández-Fernández et al. (2021)	Article	M	H	M	M	L	L
Theodorou et al. (2021)	Article	H	H	L	H	H	L
Larrea et al. (2023)	Article	M	H	L	L	M	L
Scotece et al. (2023)	Article	M	M	M	H	L	L
López et al. (2023)	Article	H	L	M	H	M	L
Wyszkowski et al. (2024)	Article	M	L	H	L	L	L
Dalgitsis et al. (2024)	Article	H	H	M	M	H	L
Esmat and Lorenzo (2024)	Article	H	H	H	M	H	L
Chowdhury (2024)	Article	H	H	H	H	M	L
Smith and Doe (2024)	Article	H	L	H	H	H	M
Zhao et al. (2025)	Article	H	H	H	H	M	L
NASP (This Work)	Article	H	H	H	H	H	H

Maturity: Low (L), Medium (M), High (H); "–" = not applicable.

Network Slicing Fundamentals

- Network Slicing: logical partitioning of network resources to meet diverse SLAs
- Standards: 3GPP (architecture), ETSI (ZSM, NFV-MANO), GSMA (service templates)
- Limitations of static slicing: rigidity, manual provisioning, and poor resource efficiency
- **Challenge:** Business intents (GSMA) and Technical configurations (3GPP) speak different languages



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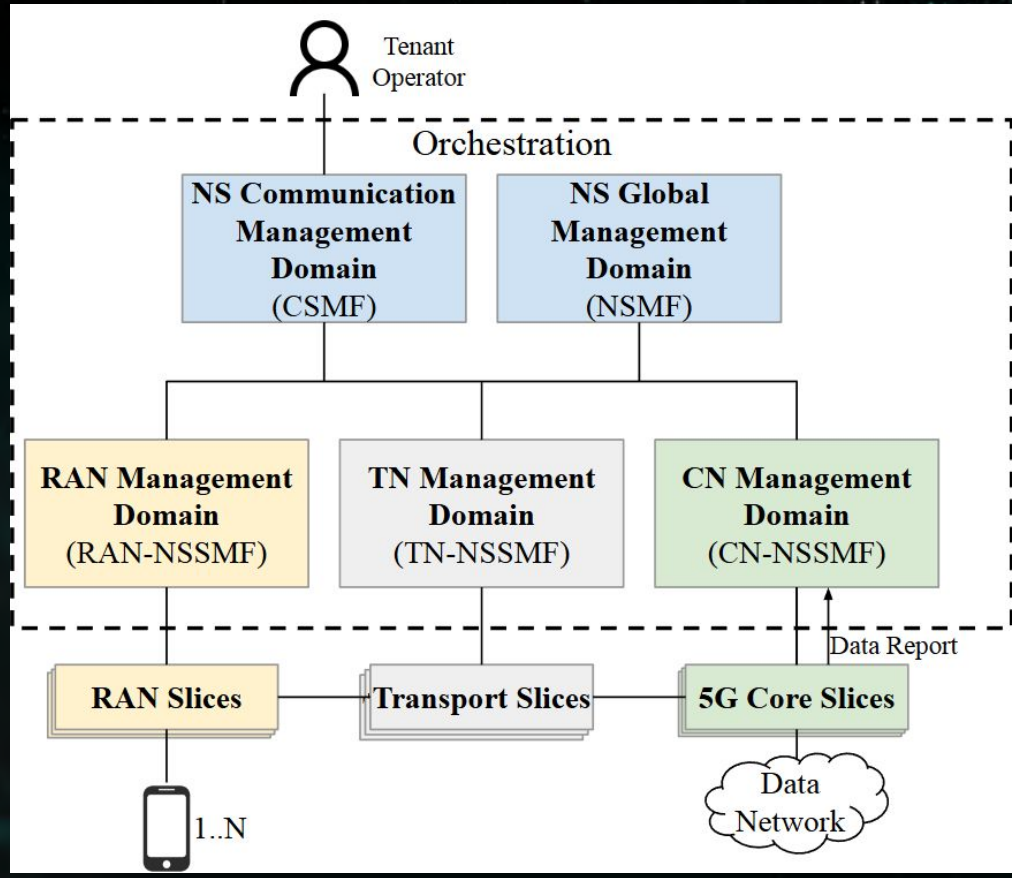
NASP: Network Slice as a Service Platform

- Bridges business-level templates (GSMA GST) and network configurations
- Implements hierarchical orchestration
- Integrates CI/CD, Infrastructure as Code (IaC), and telemetry-driven automation
- Implements closed-loop Quality Assurance and AI analytics for SLA compliance



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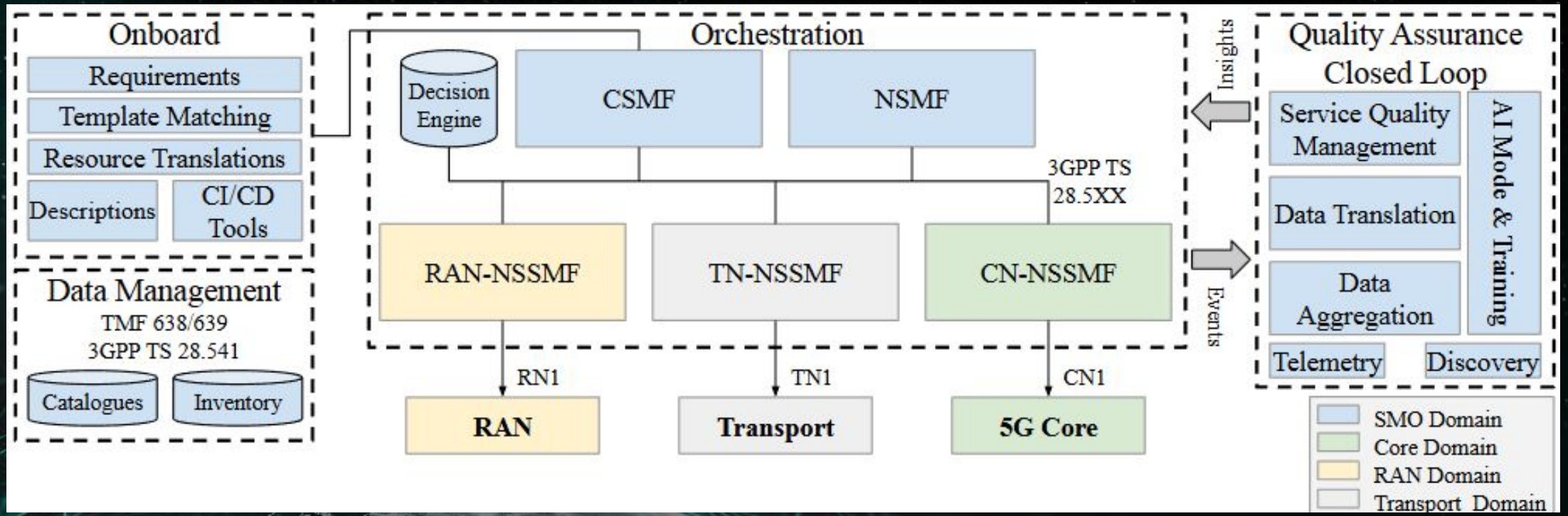
NASP Architecture Overview



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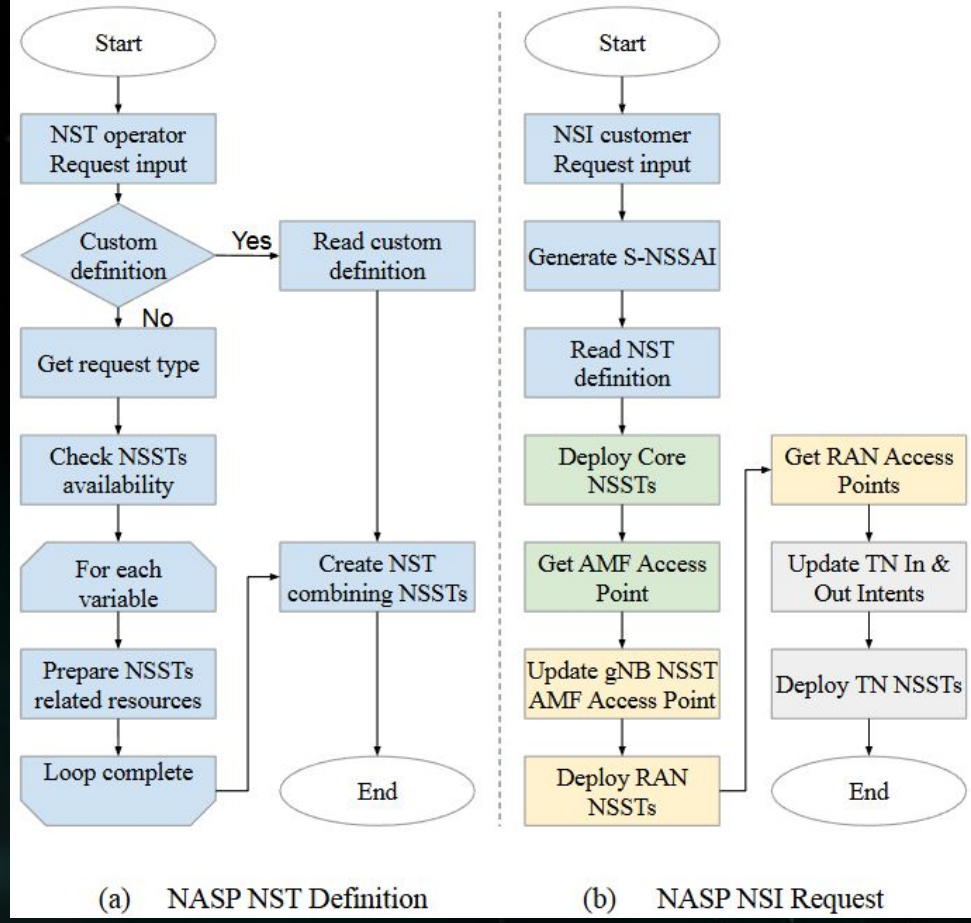
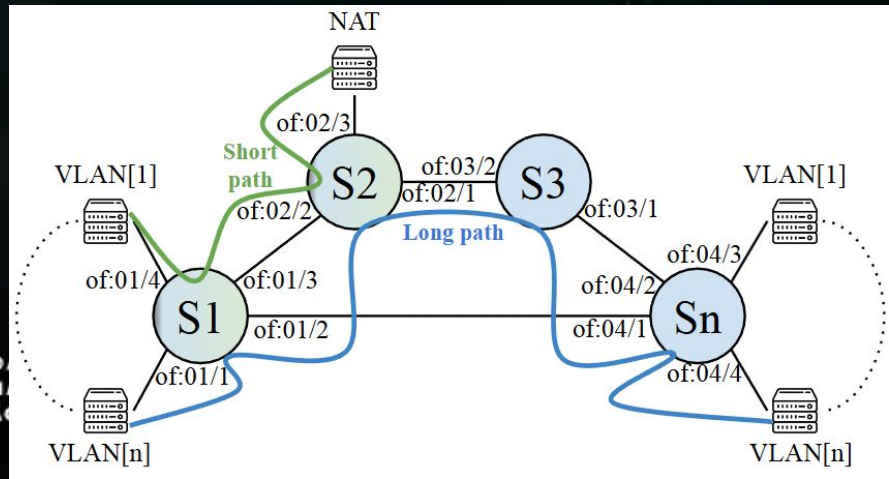
Prototype Implementation

- Deployed using Kubernetes v1.28, ONOS, Free5GC/Open5Gs, and UERANSIM
- NASP uses Helm and YAML descriptors for automation
- Implements REST/JSON APIs for intent-based orchestration
- Supports URLLC, mMTC and eMBB access slices





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Demo: Network Slicing as a Service

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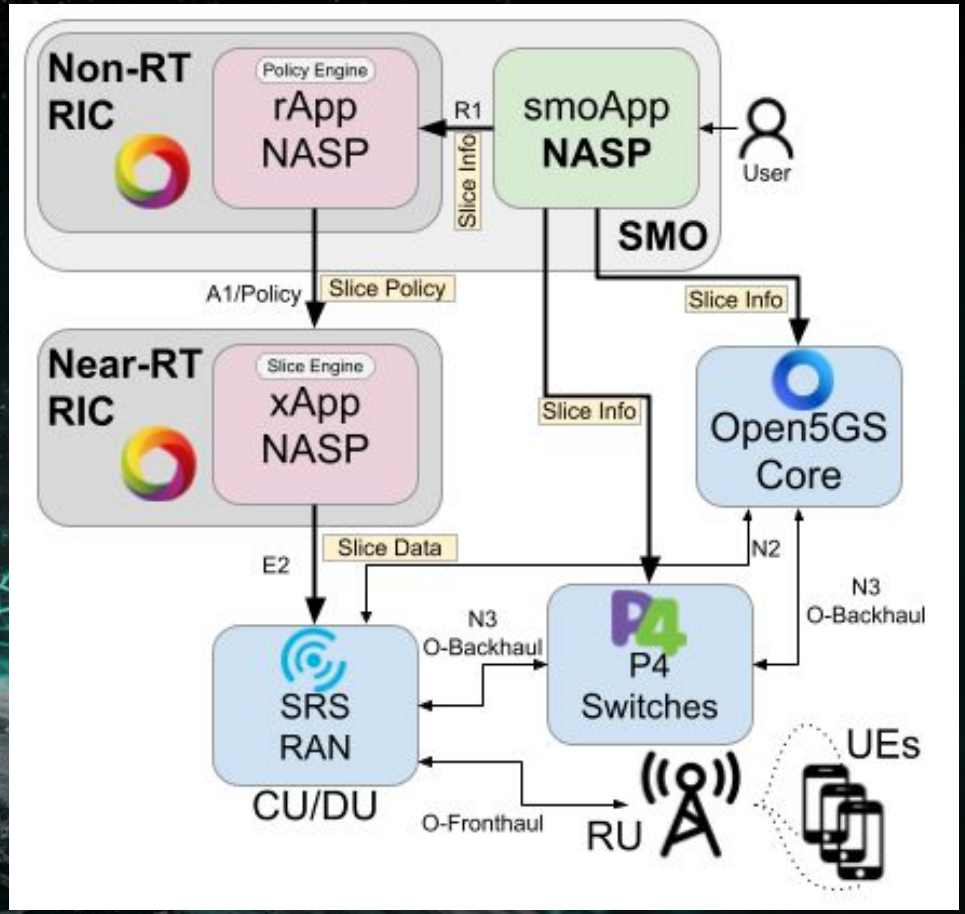
Work in progress



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