

Integration of Network Slice Controller for Enhanced Intent-Based Networking in 5G/6G Networks

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Introduction

01

Context and Motivation

- Intent-Based Networking to help network management
- Network Slicing to provide connectivity
- Intent-Based Networking + Network Slicing



Objetives

1. Propose IBN paradigm for B5G networking
2. Network Slice Controller (NSC) architecture
3. Evaluate an optimal integration approach
4. Provide insights and recommendations for this implementation

Background

02

Intent-Based Networking (IBN) fundamentals

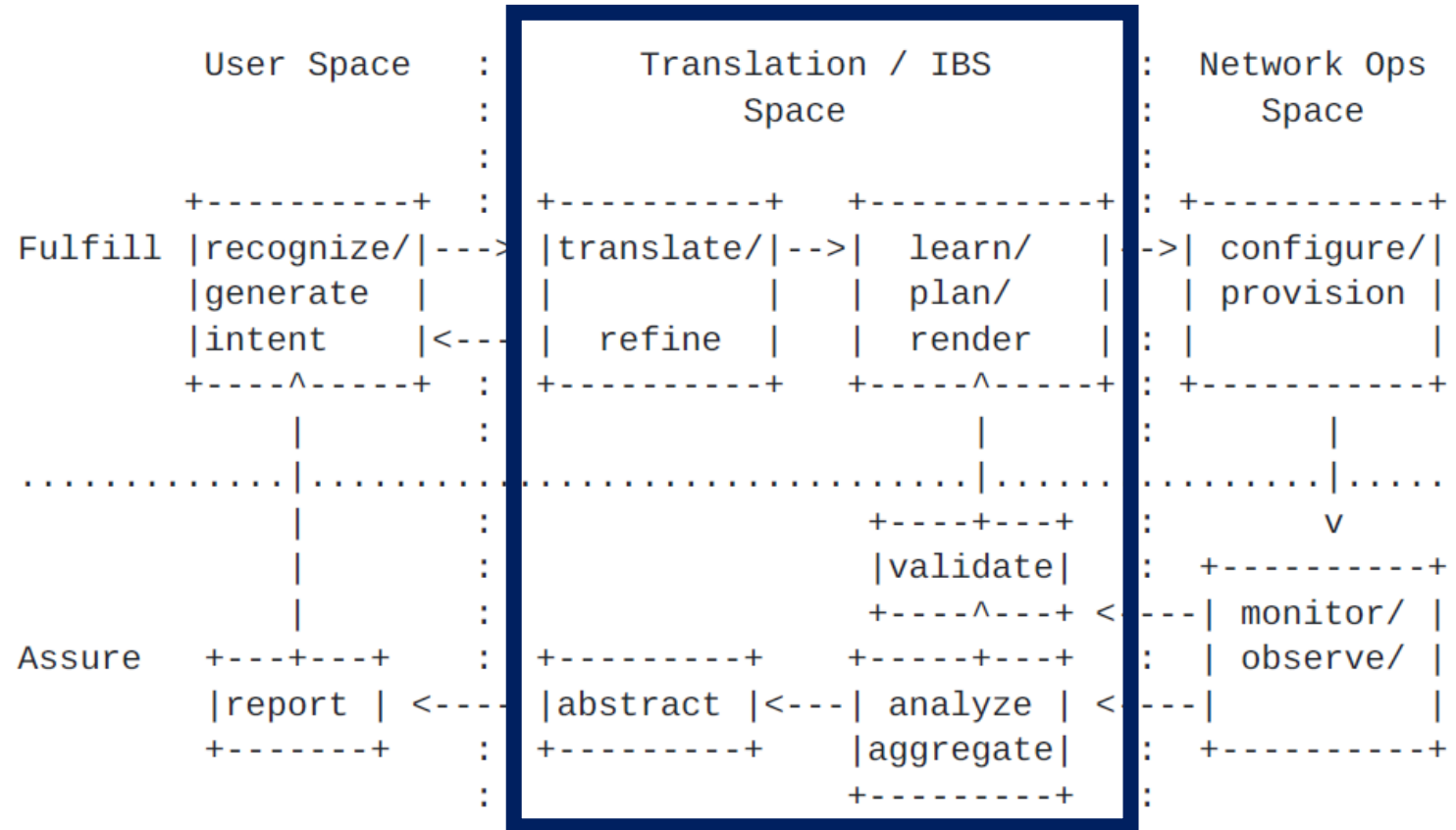
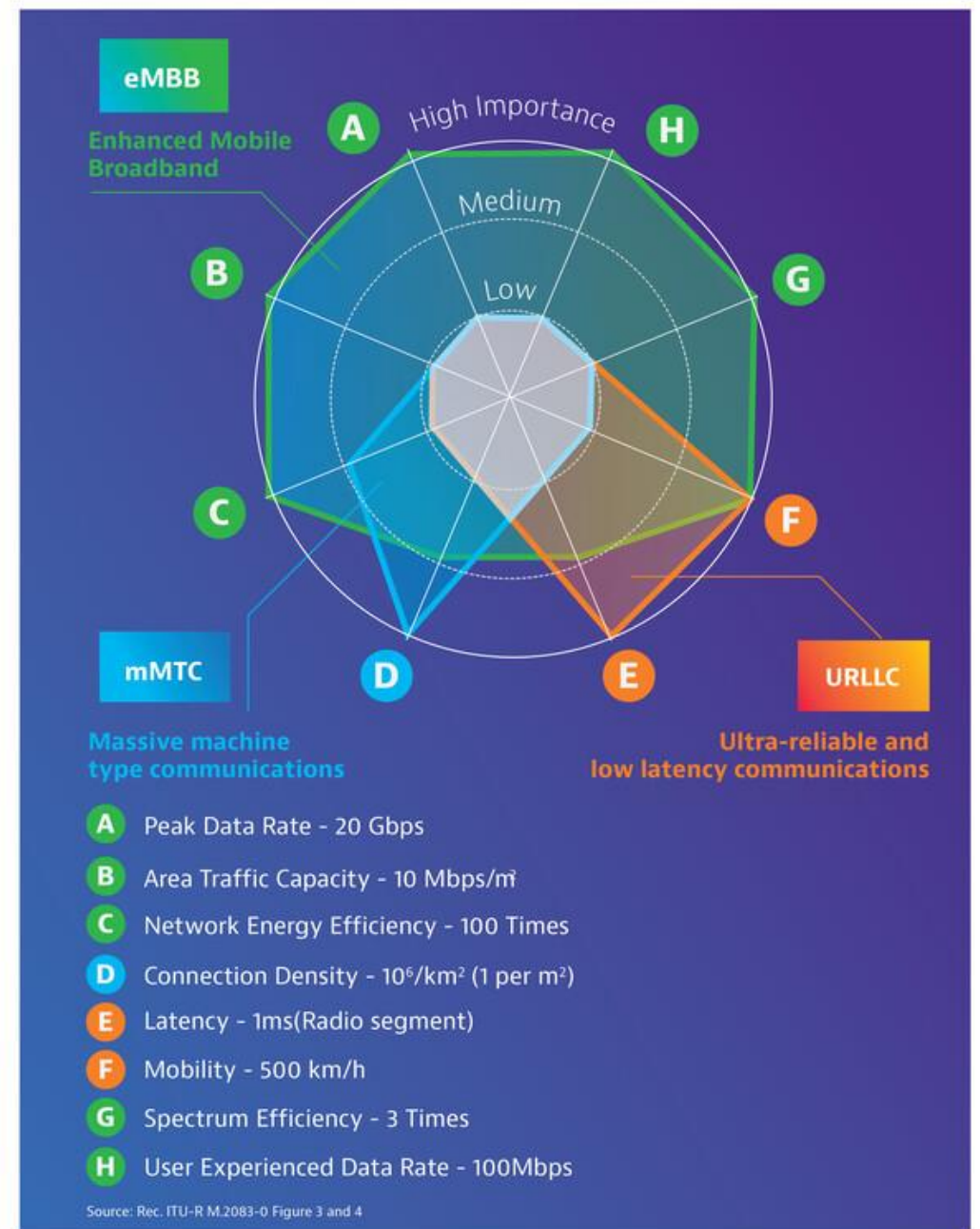
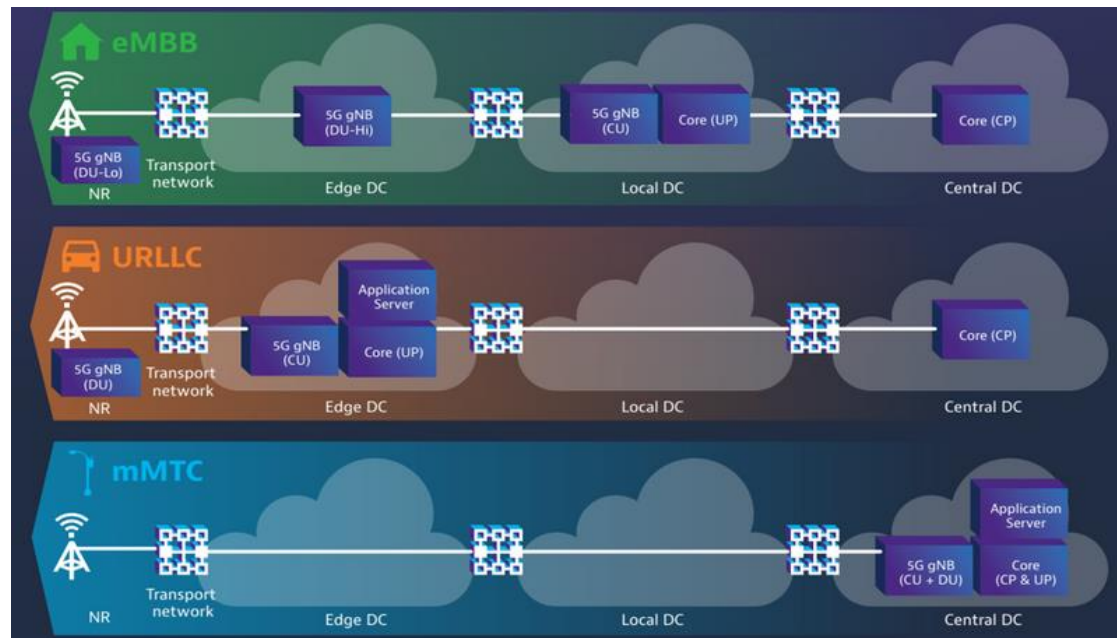


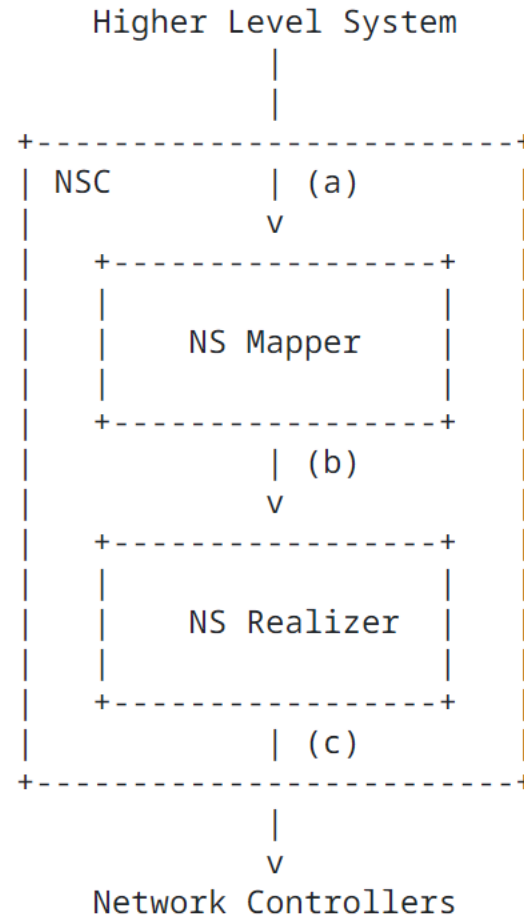
Figure 1: Intent Lifecycle

INTEGRATION OF NETWORK SLICE CONTROLLER FOR ENHANCED INTENT-B

5G / B5G network slicing



Network Slice Controller (NSC)



- * (a) -> customer's view, e.g. [\[I-D.ietf-teas-ietf-network-slice-nbi-yang\]](#).
- * (b) -> provider's view, including more detailed but yet technology-agnostic resource view as e.g. [\[I-D.liu-teas-transport-network-slice-yang\]](#), and/or alternative technology-specific augmentations as e.g. for OTN [\[I-D.ietf-ccamp-yang-otn-slicing\]](#) or for IP/MPLS NRP [\[I-D.wd-teas-nrp-yang\]](#).
- * (c) -> models per network controller, out of scope of this document. An example of applicability of existing models is in [\[I-D.barguil-teas-network-slices-instantiation\]](#).

: IETF Network Slice Controller structure and associated data models

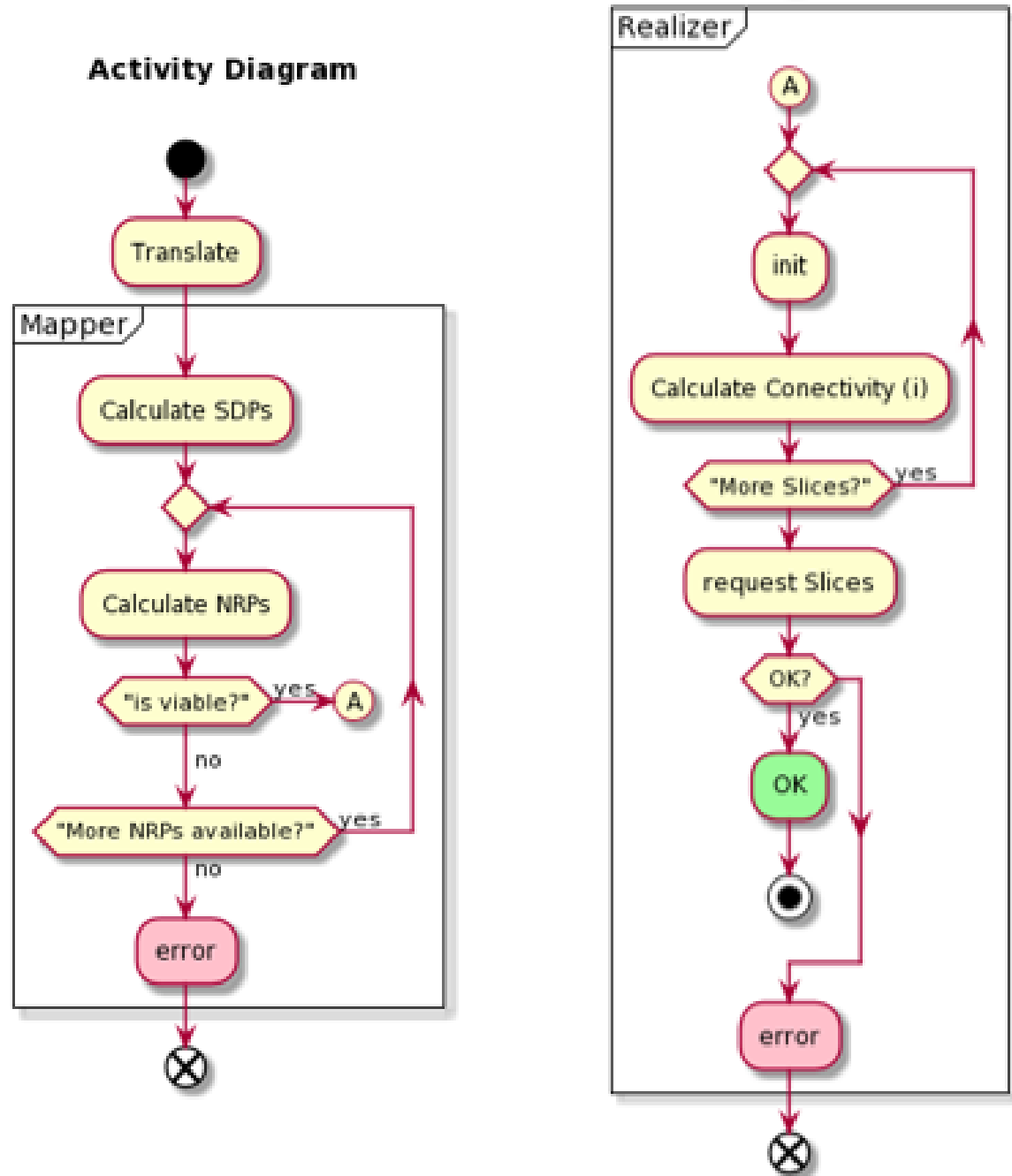
Application of IBN in 5G/B5G networks

03

Key components

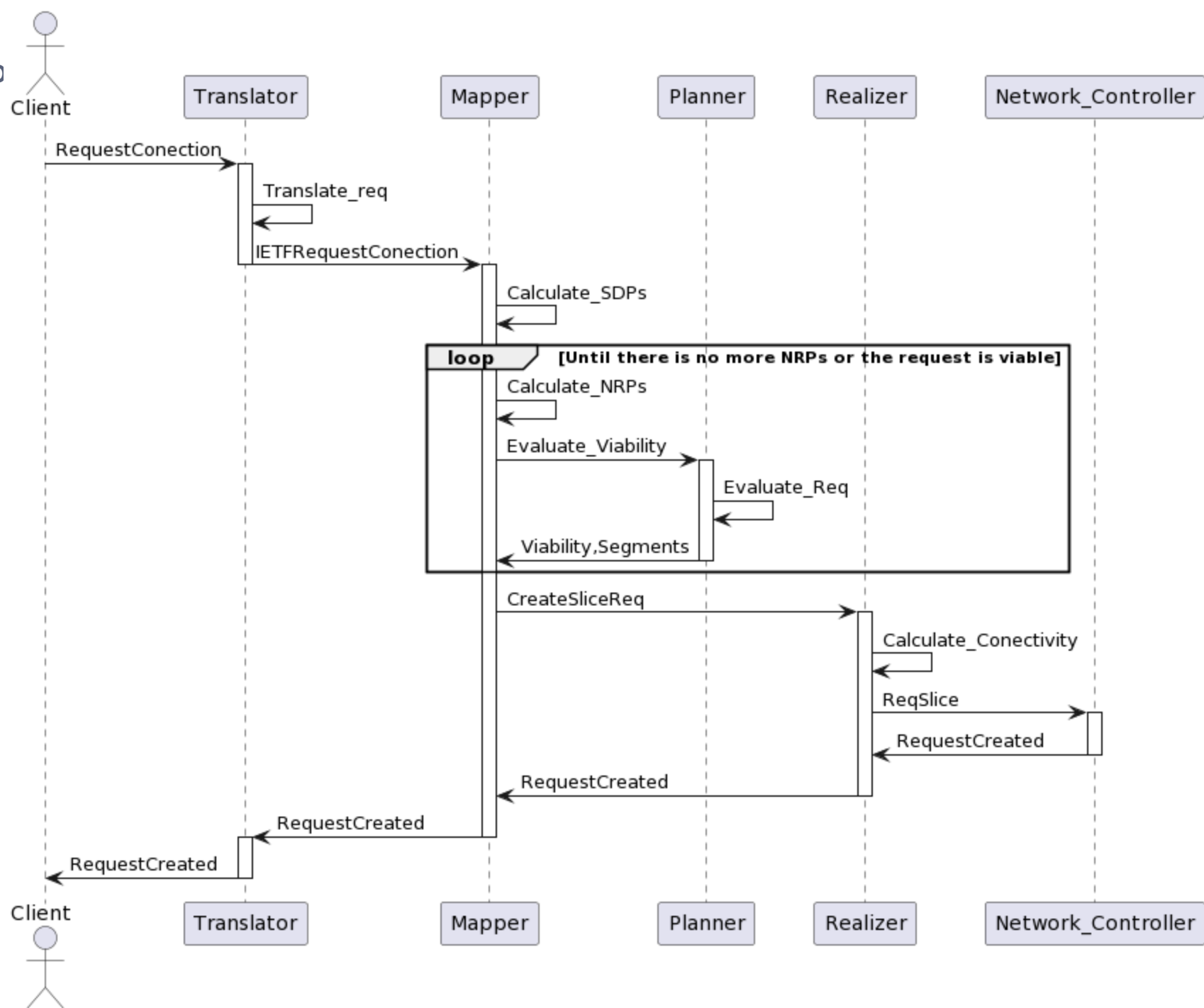
- Translation Module
- IA based planification module
- Network Slice Controller
- SDN Controller / Network Commands executor

Activity Diagram



INTEGRATION OF NETWORK SLICE CONTROL

Workflow



Network Slice Request

```
ubuntu@tfcontroller:~/nsc$ python3 network_slice_controller.py
{'slices': [{'slice_id': {'context_id': {'context_uuid': {'uuid': 'admin'}}, 'slice_uuid': {'uuid': 'test-iron-16952844604443318'}}, 'name': 'test-iron-', 'slice_config': {'config_rules': [{'action': 1, 'custom': {'resource_key': '/settings', 'resource_value': {'address_families': ['IPV4'], 'bgp_as': '', 'bgp_route_target': '', 'mtu': ''}}}, {'action': 1, 'custom': {'resource_key': '/device[HL5-1-2]/endpoint[eth-1/0/25]/settings', 'resource_value': {'router_id': 'HL5-1-2'}}}, {'action': 1, 'custom': {'resource_key': '/device[HL5-2-2]/endpoint[eth-1/0/25]/settings', 'resource_value': {'router_id': 'HL5-2-2'}}}], 'slice_constraints': [{'endpoint_location': {'endpoint_id': {'device_id': {'device_uuid': {'uuid': 'R1'}}, 'endpoint_uuid': {'uuid': '1/2'}}, 'location': {'region': ''}}}, {'endpoint_location': {'endpoint_id': {'device_id': {'device_uuid': {'uuid': 'R4'}}, 'endpoint_uuid': {'uuid': '1/3'}}, 'location': {'region': ''}}}], {'sla_capacity': {'capacity_gbps': 50}}, {'sla_availability': {'availability': 0, 'num_disjoint_paths': 1, 'all_active': True}}, {'sla_isolation': {'isolation_level': [0]}], 'slice_endpoint_ids': [{'device_id': {'device_uuid': {'uuid': 'HL5-1-2'}}, 'endpoint_uuid': {'uuid': 'eth-1/0/25'}, 'topology_id': {'context_id': {'context_uuid': {'uuid': 'admin'}}}, 'topology_uuid': {'uuid': 'admin'}}}, {'device_id': {'device_uuid': {'uuid': 'HL5-2-2'}}, 'endpoint_uuid': {'uuid': 'eth-1/0/25'}, 'topology_id': {'context_id': {'context_uuid': {'uuid': 'admin'}}}, 'topology_uuid': {'uuid': 'admin'}}}], 'slice_status': {'slice_status': 1}}]}
```

Conclusions

04

Integration Conclusions

- Use of plug-ins in NBI to reduce the integration complexity with other networks
- Two possible decision integrations:
 - Classical algorithms
 - AI driven modules
- Emphasis on standardized approaches
- NSC as key component
- Integration approaches:
 - Over the Network controller
 - Inside the Network Controller

Functional Conclusions

- Potential incorporation of additional factors
- Utilization of AI and the NSC architecture
- Focus on efficient and effective management of next-generation networks

Opportunities and Future Work

- Opportunities
 - Network Resource Request Scalation
 - Outsourcing of Resource Evaluation
 - Modular Operation of Intent Processing
- Future Work
 - Intelligent Modules Development
 - Extension to Other Access Networks

Acknowledgments

This work has been partially funded by the 2020 Horizon Europe project Int5Gent (grant agreement No. 957403) and the 2022 Horizon Europe project Desire6G (grant agreement No. 101096466).

- [int5Gent | EU Project – Integrating 5G enabling technologies in a holistic service to physical layer 5G system platform](#)
- [DESIRE6G – Deep Programmability and Secure Distributed Intelligence for Real-Time End-to-End 6G Networks](#)





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