Part II:
- What are my main use cases?
- What IETF work is in progress?

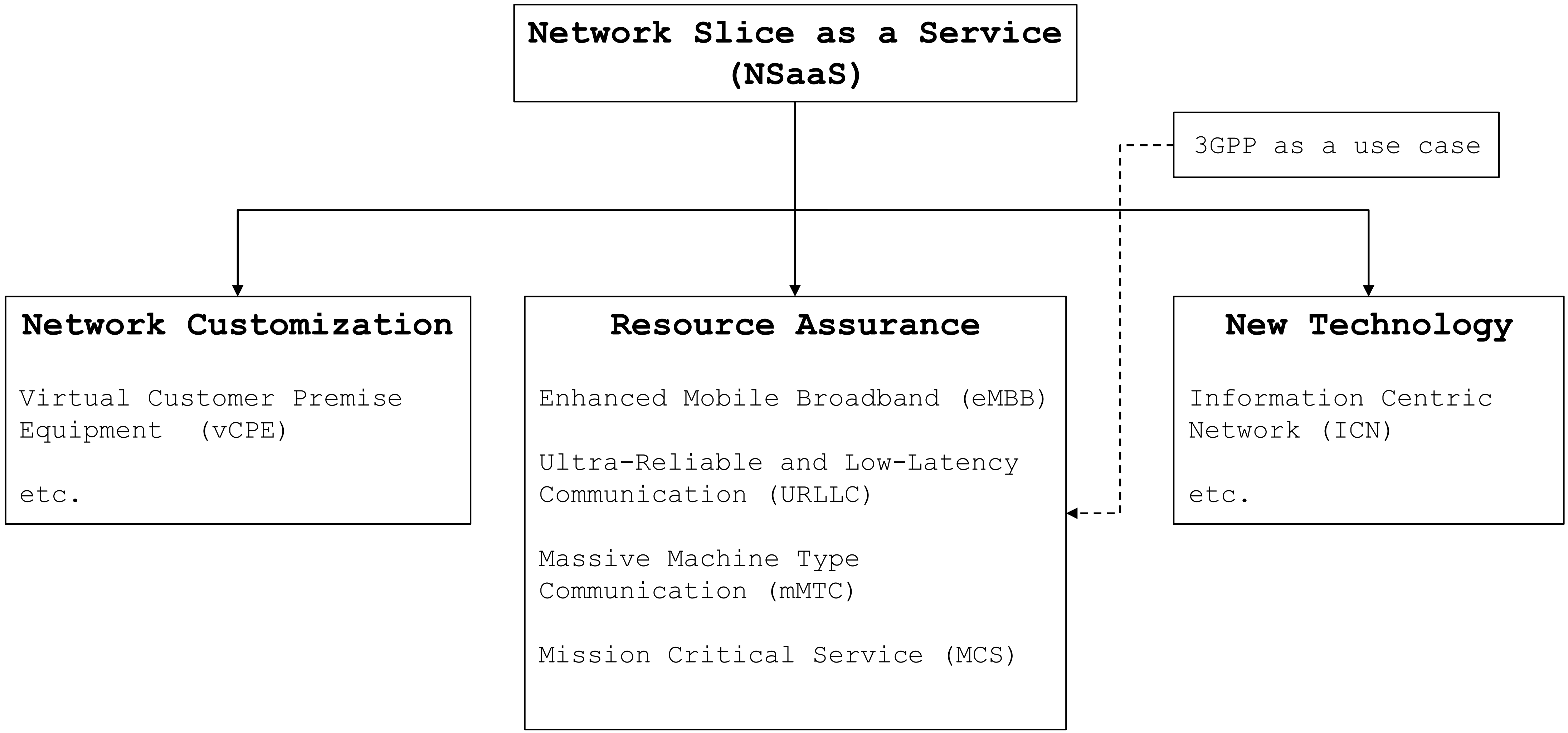
Main Use Cases and Gap Analysis for Network Slicing

draft-netslices-usecases-01

draft-qiang-netslices-gap-analysis-01

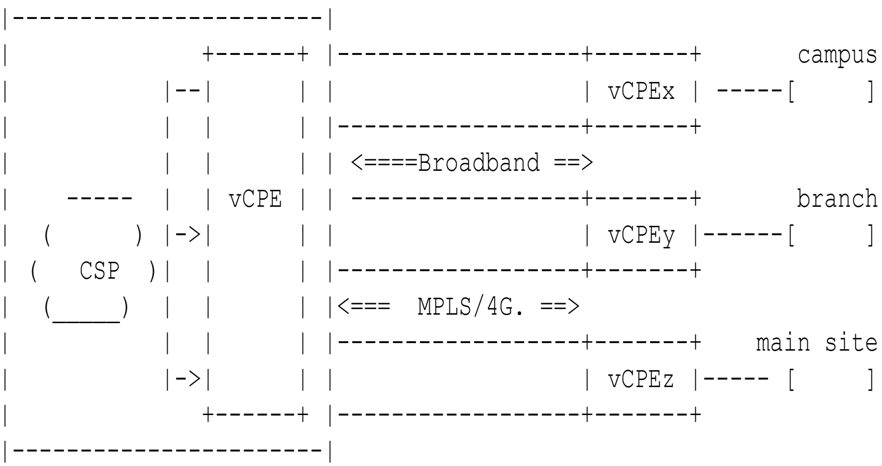
Cristina QIANG

Identified Network Slice Use Cases

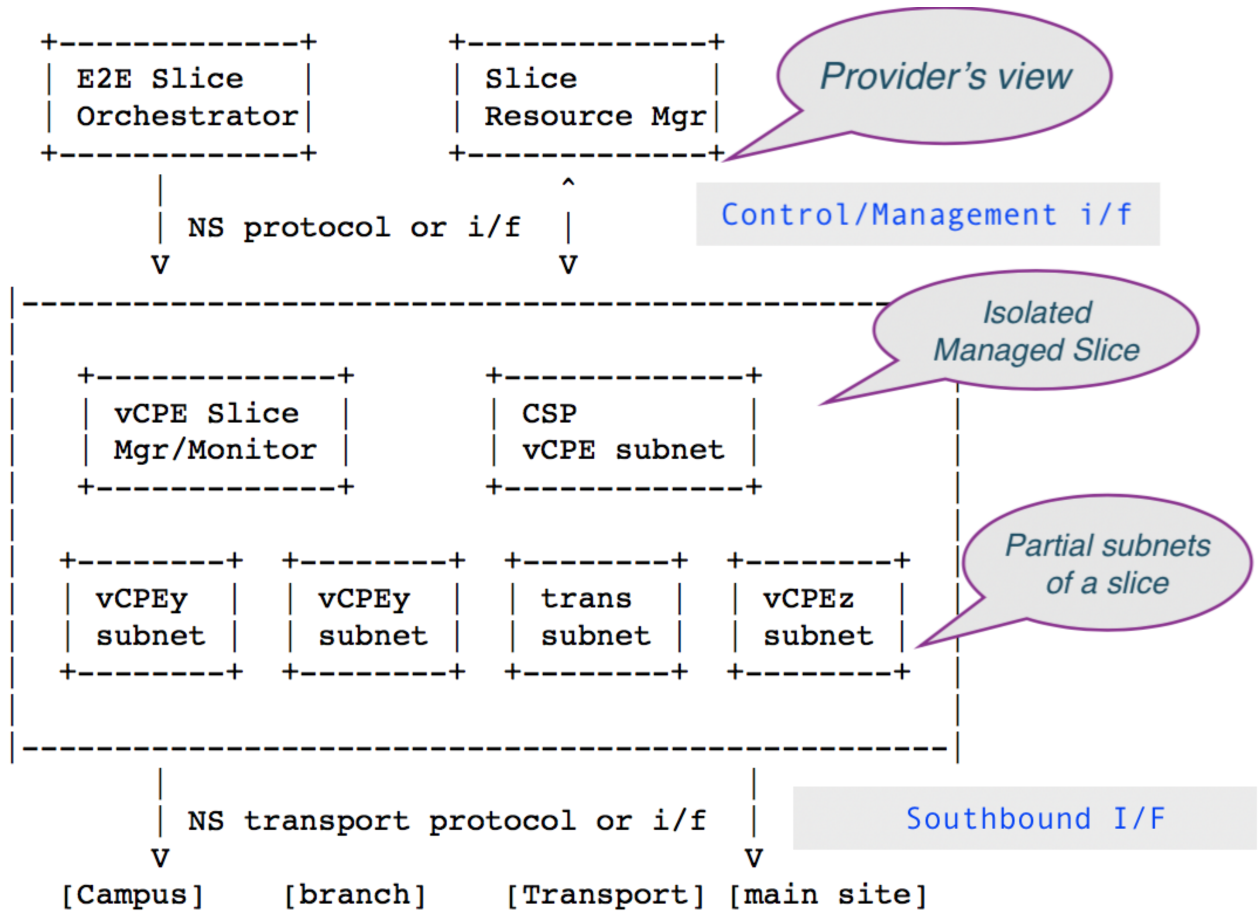


Flexibility (network functions placement)	Soft Resource Requirement (status monitoring for performance guarantee)	Hard Resource Requirement (infrastructure sharing)

Network Customization Type Use Case - Virtual Customer Premise Equipment (vCPE)



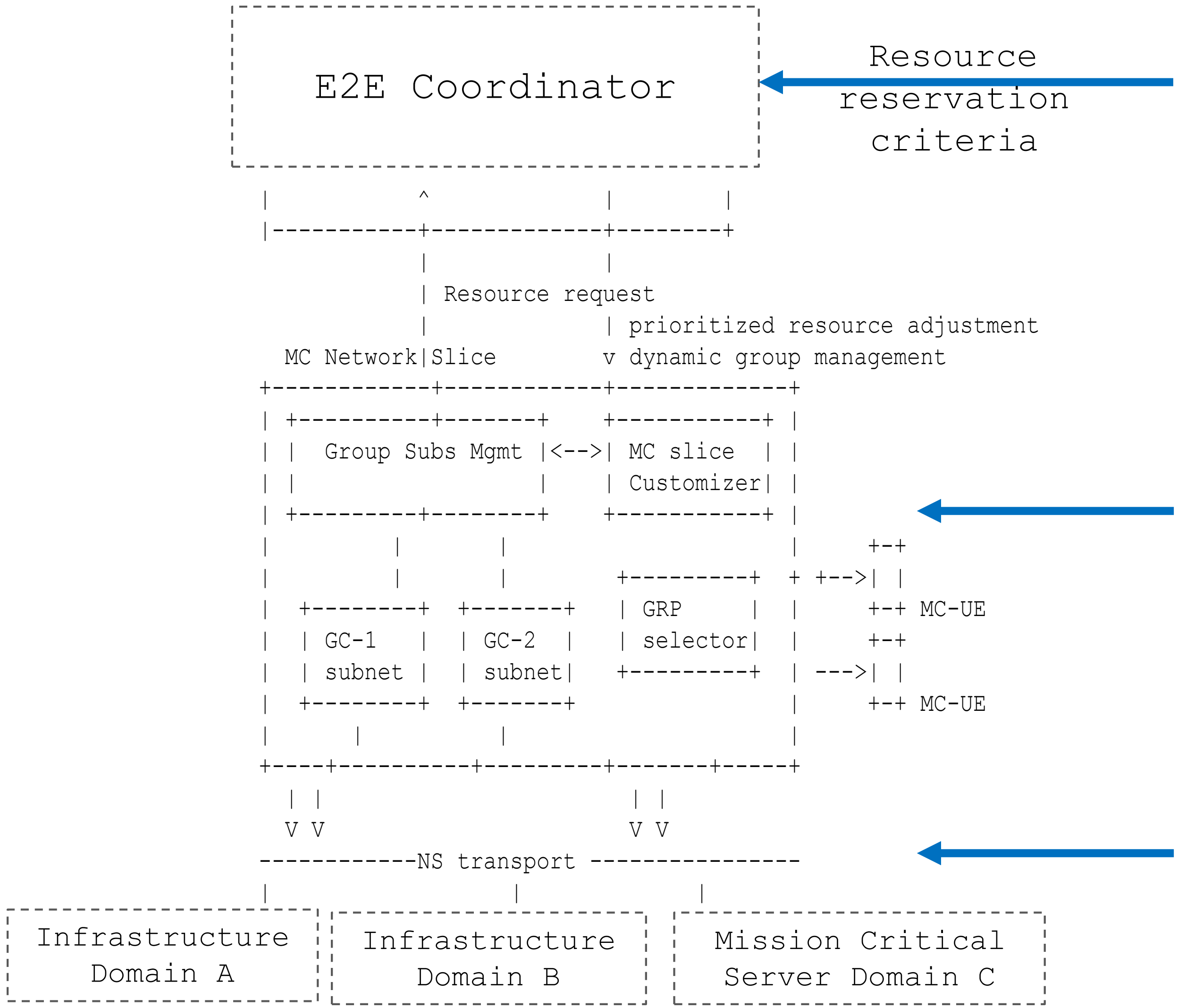
Traditional vCPE



vCPE in a Slice

An autonomous OAM of a slice can make existing customizations better isolated, traffic-engineered and flexible

Resource Assurance Type Use Case – Mission Critical Services (MCS)

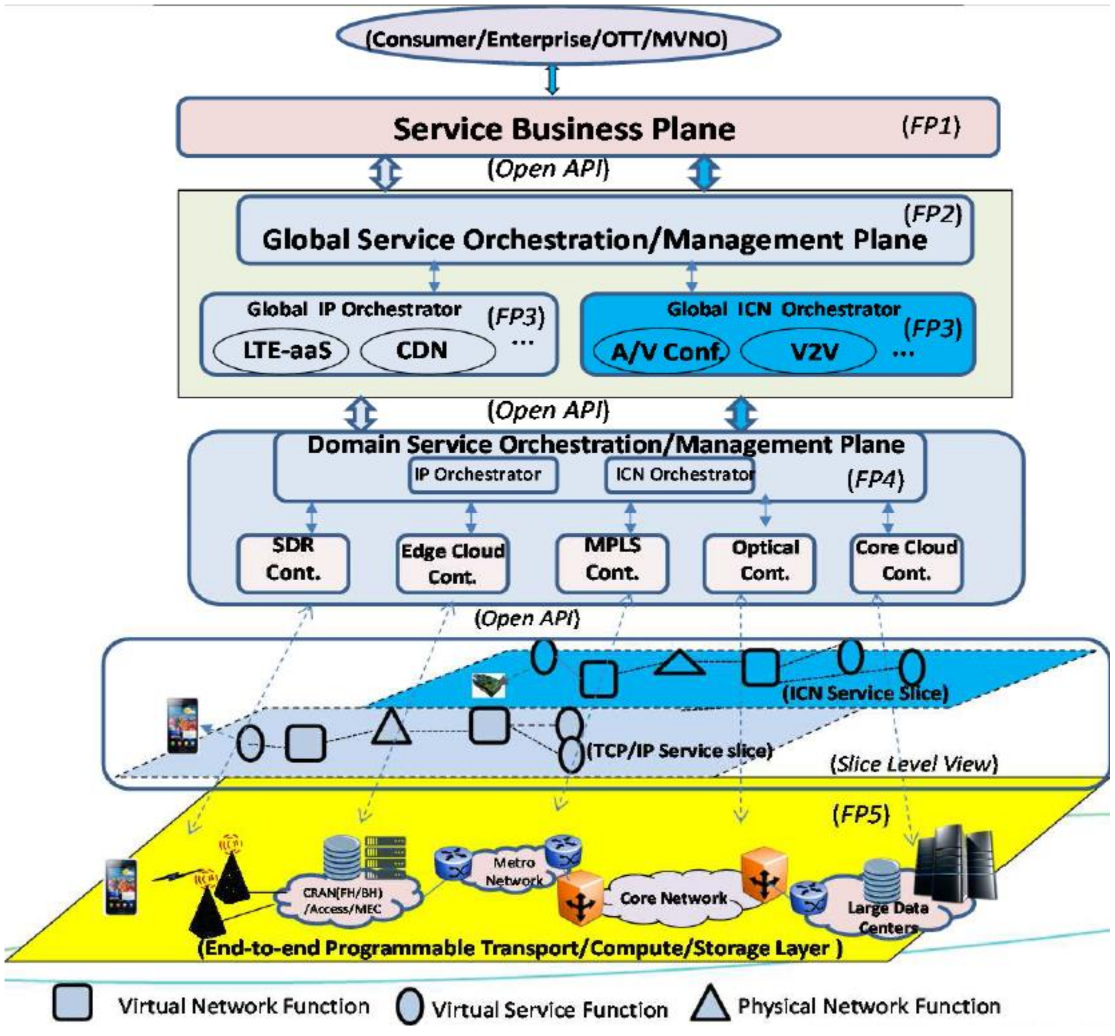


Subscriber management functions
- Admission control
- Fast Authentication
- Group Management

Transport
- Dedicated connectivity and high-availability
- 0 packet loss transmission

Dedicated physical medium/transport but flexible control of subscriber management done by tenant – enhanced reliability & security & flexibility

New Technology Type Use Case - Information Centric Network (ICN)



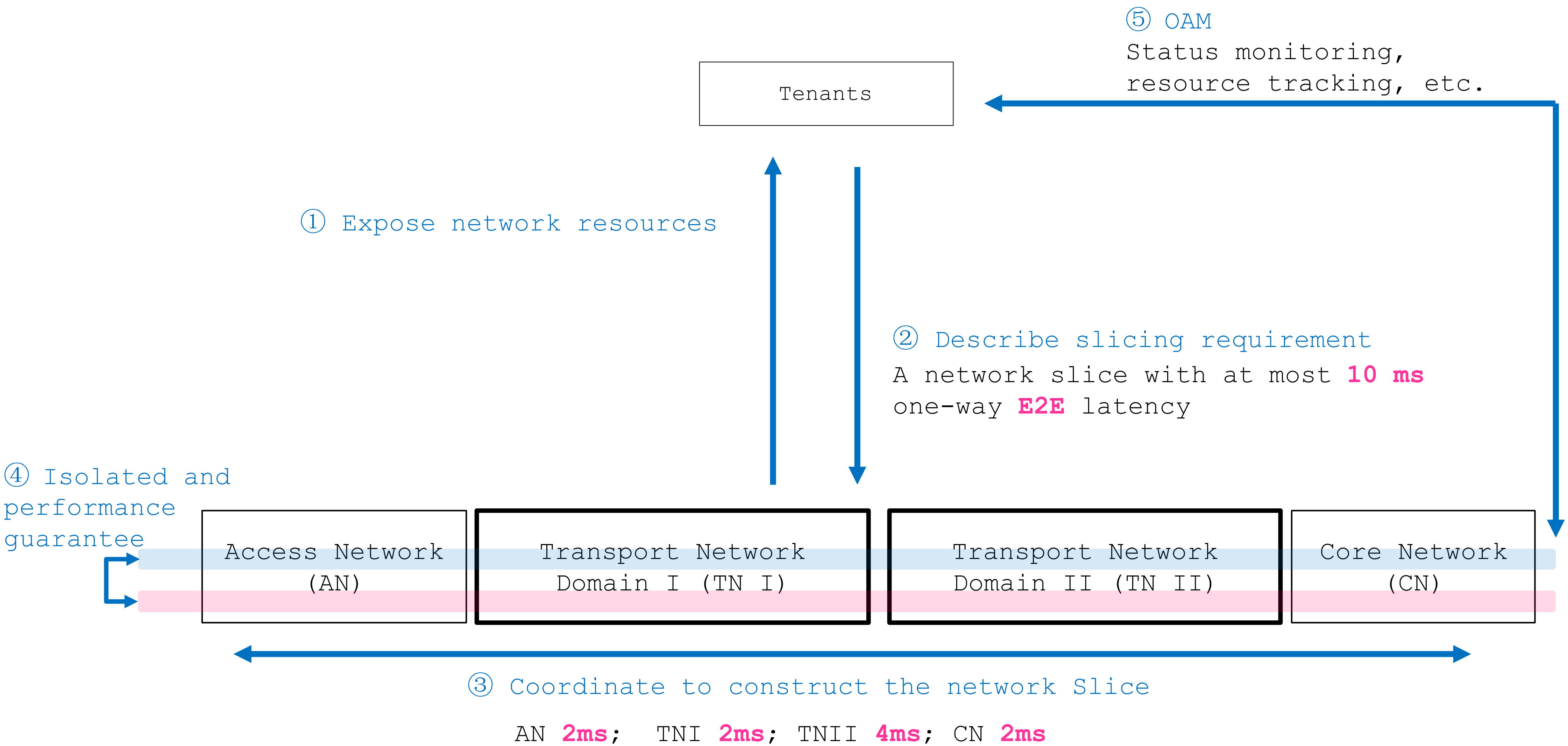
ICN is a non-IP paradigm based on name-based routing

ICN based services can be offered as a network slice in parallel with traditional IP based services

Proper resource isolation between ICN and IP based slices

“Realizing ICN as a Network Slice for Mobile Data Distribution”, IETF 98 Network Slicing Side Meeting

Elicited 4 KEY Requirements



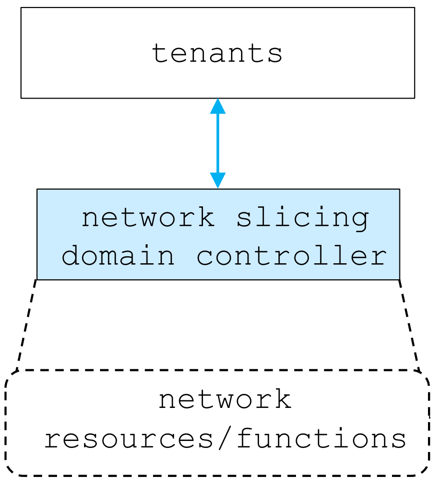
Req1: Slicing Resource & Requirement Description

Req2: Cross-Domain Coordination

Req3: Performance Guarantee and Isolation

Req4: Network Slicing OAM

Req1: Slicing Resource & Requirement Description



- performance metrics
- protection requirements
- isolation constraints
- path restriction (e.g., must pass through some points for security)
- high-availability guidelines (e.g., URLLC service restoration within 10ms, 100ms, or 1 second)
- etc.

▫ Related Work in IETF

YANG Data Models

L2SM, L3SM, EVPN, etc.
technology-specific

Connectivity Provisioning Profile (CPP) Template

(Traffic) objectives of traffic engineering functions and service management functions

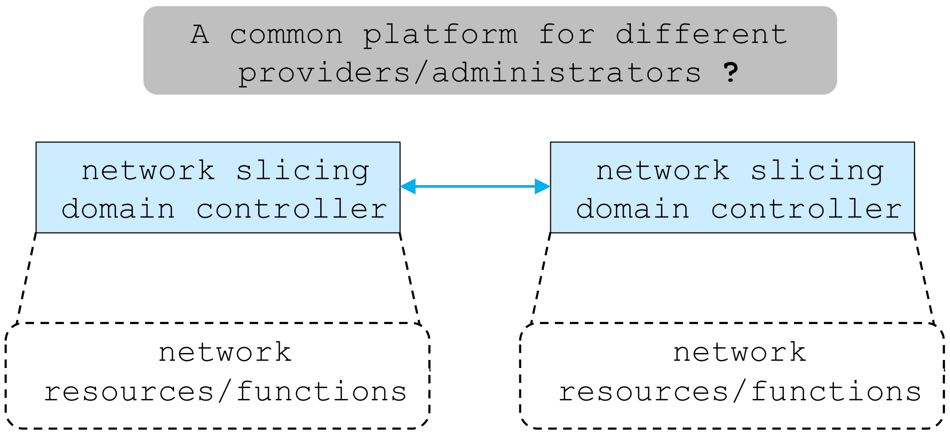
Traffic Engineering Architecture and Signaling (TEAS) base & TEAS

Abstract topologies with traffic engineering constraints

Templates for links or resources

Conclusion: 1) Lack of resource abstraction and management on Layer 3+ (e.g., routing table)
2) Specification of advanced service functions to be invoked and their invocation order

Req2: Cross-Domain Coordination



- network slice resource coordination (e.g., 10ms latency E2E slice → 2ms in RAN + 4ms in TN1+ 2ms in TN2 + 2ms in CN)
- configuration information coordination (e.g. VLAN ID, remote IP address, physical port ID)
- other coordination (e.g., notify TN about the location of attachment point)

▫ Related Work in IETF

Abstraction and Control of TE Networks (ACTN)

Multi-domain coordination in Traffic Engineering (TE) network through a (hierarchical) Multi-Domain Service Coordinator (MDSC)

A Generic Autonomic Signaling Protocol (GRASP)

Autonomic negotiation protocol in underlying infrastructure layer

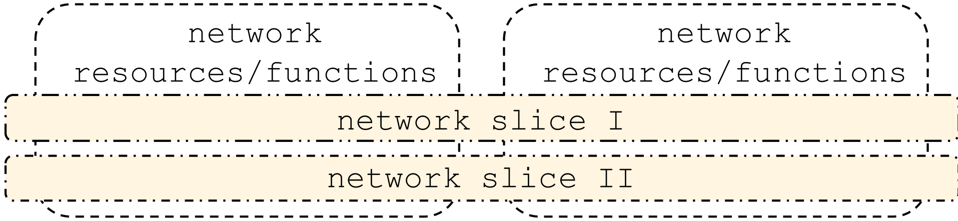
connectivity provision negotiation protocol (CPNP)

Dynamic negotiation protocol for connectivity provisioning (and other service-specific) parameters between customer and provider

Conclusion: 1) A flat cross-domain coordination solution

2) Extension on NS specific behaviors and objects

Req3: Performance Guarantee and Isolation



- performance isolation
- secure isolation
- management isolation

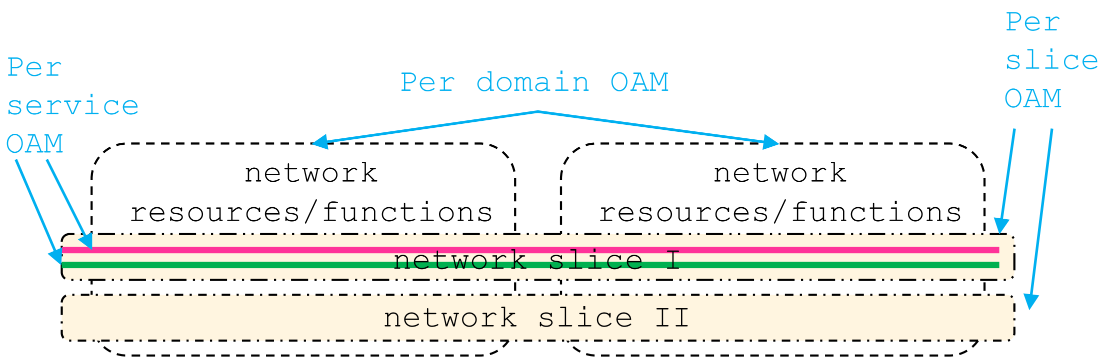
▫ Related Work in IETF

Virtual Private Network (VPN)	Network Virtualization on Overlays (NVO3)	Segment Routing (SR)	Flexible Ethernet (FlexE)	Deterministic Networking (DetNet)	Resource Reservation Protocol-Traffic Engineering (RSVP-TE)
Logically separated routing/bridging regions	Layer 2/3 service for virtual networks enabling multi-tenancy	SR-based LSPs provide TE features	Complete decoupling of MAC layer and physical layer	Deterministic data paths with extremely low packet loss rates, low delay variation and assured maximum E2E delivery latency over Layer 2 and Layer 3	Signal protocol to establish E2E TE LSP with bandwidth reservation

Conclusion: 1) Tighter coupling between underlay and overlay

2) Enhancement to data plane and control plane

Req4: Network Slicing OAM



- **O**perations: keeping all resources associated with a network slice up and running (e.g., monitoring, identifying problems to a slice operator)
- **A**dministration: tracking resource usage within the provider network as well as within a slice
- **M**aintenance: facilitate repairs and upgrades within a slice without any impact to other slices. Also involves corrective and preventive measures (e.g., adjusting configuration)

▫ Related Work in IETF

Technology-Specific OAM tools [RFC7276]

IP Ping (IPv4/IPv6)

IP Traceroute (IPv4/IPv6)

BFD (generic)

MPLS OAM (MPLS)

MPLS-TP OAM (MPLS-TP)

Pseudowire OAM (Pseudowire)

OWAMP and TWAMP (IPv4/IPv6)

TRILLA OAM (TRILL)

Overlay OAM

A generic OAM header for overlay network OAM [I-D.ooamdt-rtgwg-ooam-header]

Service Function Chain (SFC) OAM

Service Function Component: test service functions

Service Function Chain Component: test service function paths

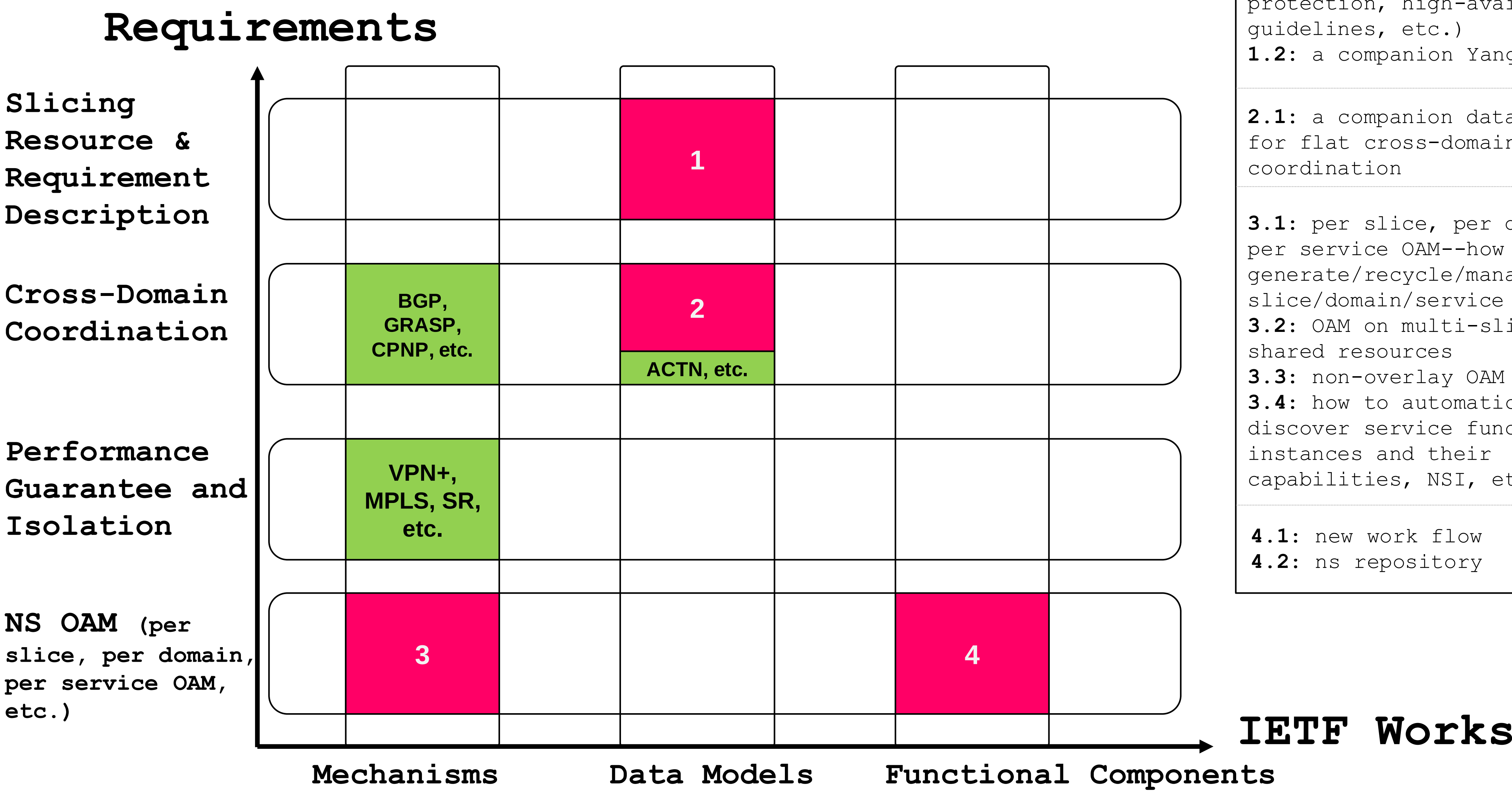
Classifier Component: test classifiers (mapping flows to service chains)

Conclusion: Customized granularity NS OAM

Two Dimensions

Non-covered by IETF WGs

IETF Slicing specific extension on existing technologies



Identified Gaps:

1.1: a detailed network slicing specification (performance metrics, protection, high-availability guidelines, etc.)
1.2: a companion Yang Model

2.1: a companion data Model for flat cross-domain coordination

3.1: per slice, per domain, per service OAM--how to generate/recycle/manage slice/domain/service ID
3.2: OAM on multi-slice shared resources
3.3: non-overlay OAM solution
3.4: how to automatically discover service function instances and their capabilities, NSI, etc.

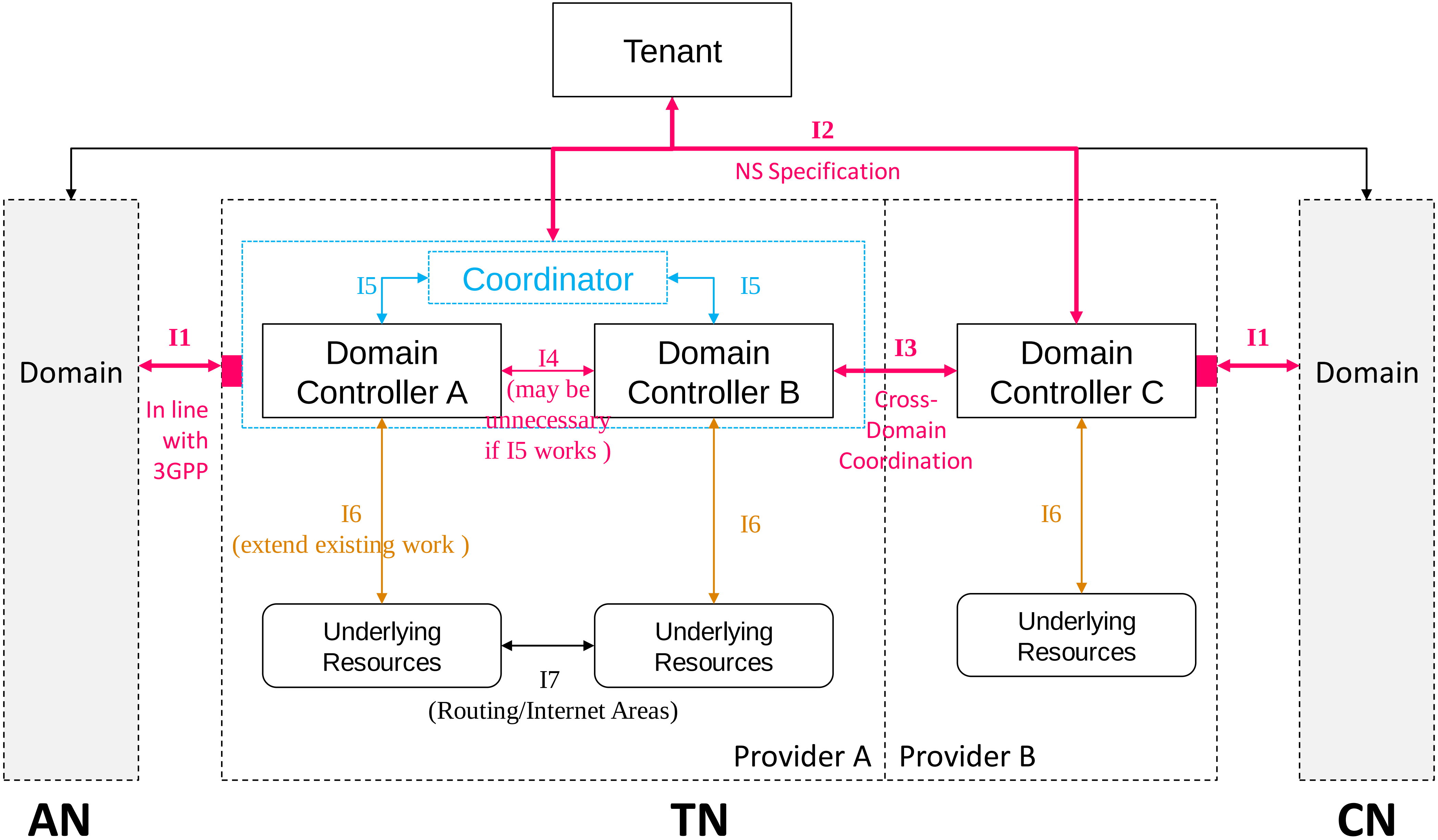
4.1: new work flow
4.2: ns repository

Conclusion: 1) Need a new home to resolve the red regions

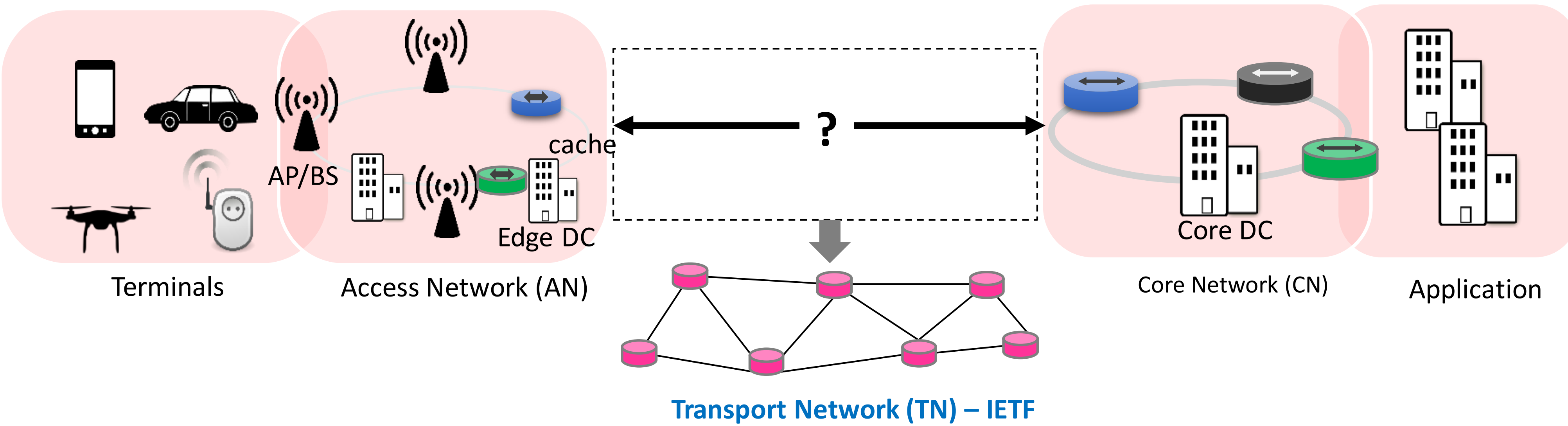
2) Need extension work for green regions

Thank you!

Suggested Data Models to Identify Interactions

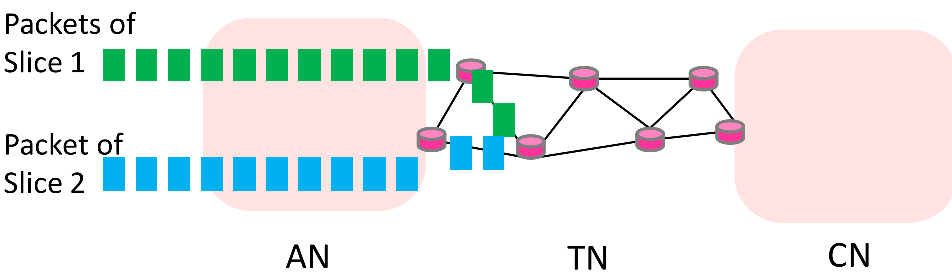


End-to-End Network Slicing



1. TN provides connectivity

2. TN (**IP based** network) provides Isolation



3. TN provides matching resources