Compute-Aware Traffic Steering for Midhaul Networks

<draft-lcmw-cats-midhaul-03>

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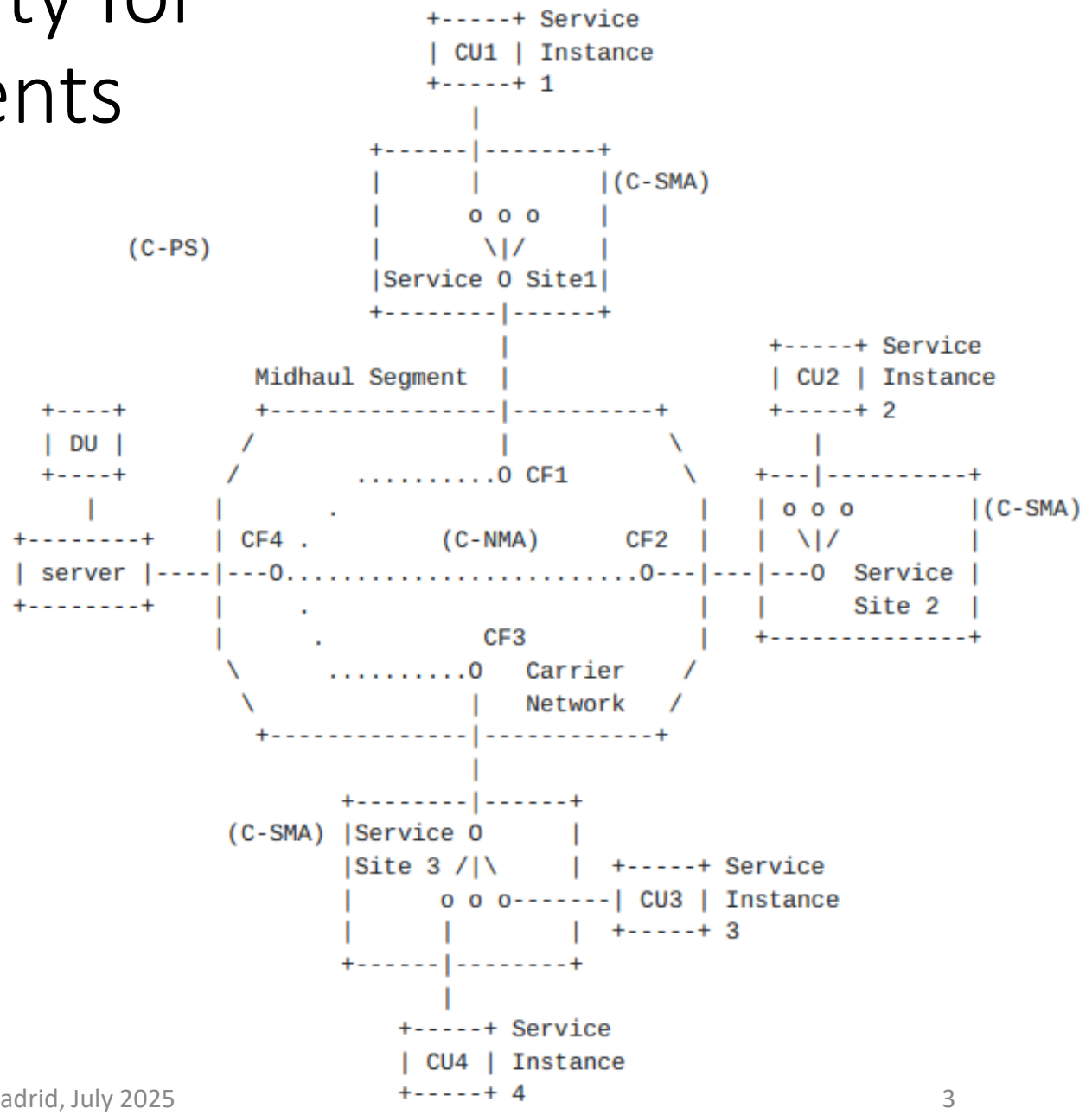
Intersection of CATS and O-RAN Midhaul

- O-RAN splits radio functions into RU, DU, and CU with IP-based aggregation network.
- Midhaul connects DU to CU over an IP/MPLS aggregation network with Transport Network Elements (TNEs) acting as PE nodes.
- CATS considers both compute and network metrics for traffic steering.
  - Midhaul traffic steering can dynamically select CU instances based on CPU, memory and network bandwidth, latency metrics.
  - All DU traffic is steered as a whole to a CU instance, simplifying flow classification.
- DU-CU association can be dynamic, affected by compute load and network conditions.

CATS framework applicability for Midhaul Unique requirements (in blue)

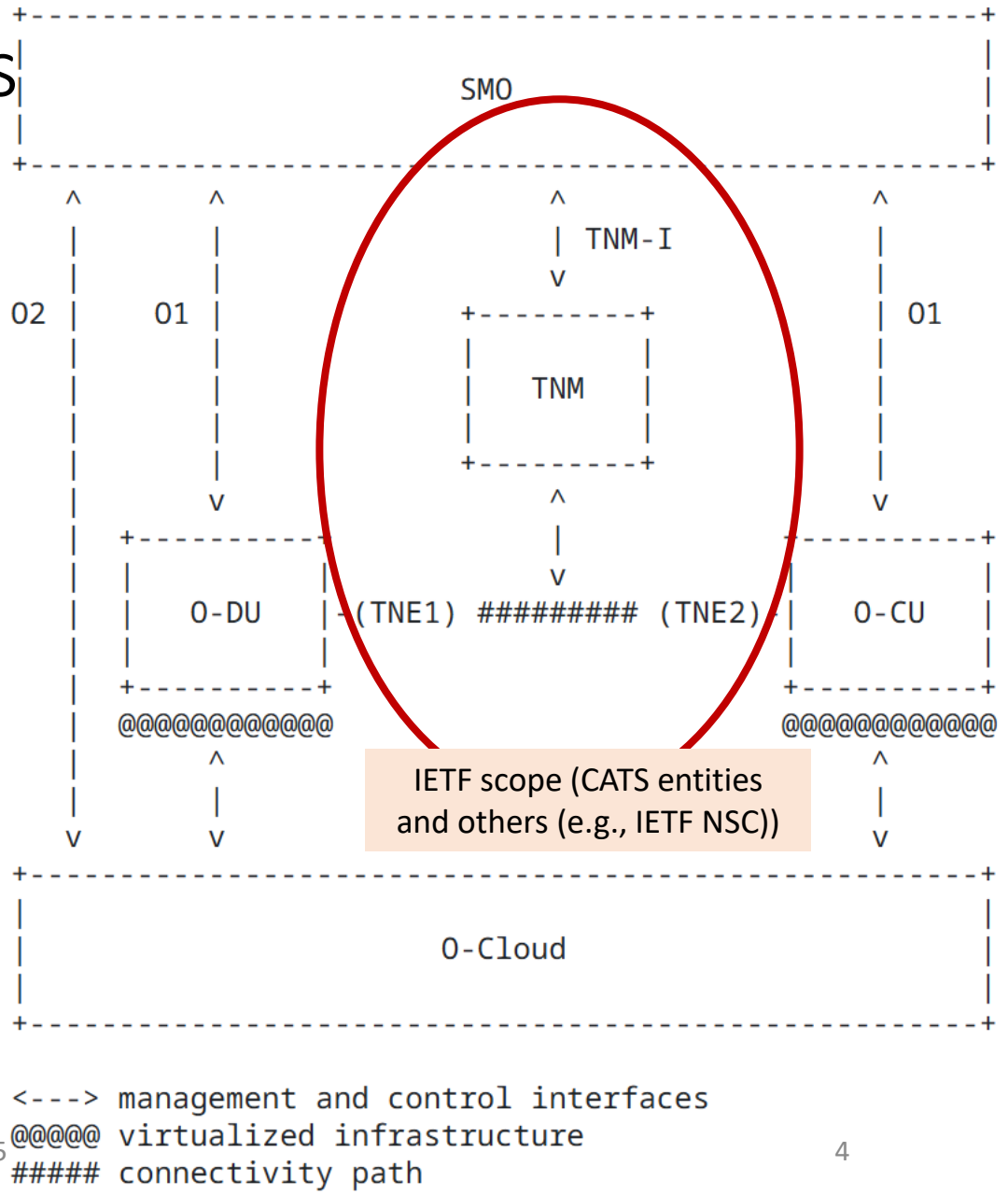
- DU as client of CU instances
- C-PS will take decision on which CU (or Service Instance) deliver all the DU traffic (until any change applies)
  - **CATS entities (e.g. C-PS) to support interfaces for integration with higher-layer systems** (e.g., O-RAN SMO)
  - Maybe an App of O-RAN control architecture
- C-NMA and C-SMA will provide views on metrics relevant for networking and compute respectively
  - O-RAN considers **CPU average utilization or the memory and energy usage of every CU-UP instance** (as defined in O-RAN specs)



Control plane interactions between O-RAN and IETF management entities

- O-RAN management entity (SMO) handles the DU <-> CU-UP association
- O-RAN O-Cloud is the management entity in charge of managing the cloud-based applications (DU, CU-UP instances, etc)
  - Metrics related to O-RAN functional entities would be obtained through it
- Transport Network Manager is the entity in charge of the control and management of the network
  - IETF-related entities would play that role; an initial case is the IETF Network Slice Controller for the application of slices in O-RAN transport scenarios
  - Metrics related to networking would be obtained through it
  - CATS brings the need for further interworking (e.g., the interaction with the C-PS)
- A new interface should be defined for leveraging on CATS for compute-aware midhaul steering

Focus on architectural implications in -03 vs -02



CATS Framework Integration and Metrics

- PE nodes (TNEs) function as CATS Forwarders.
- Compute metrics (CPU, memory) come from O-RAN O-Cloud.
- Network metrics (bandwidth, delay) from Transport Network Manager (TNM).
- SMO orchestrates and manages RAN functions and interacts with TNM.
- CATS Path Selector can reside in SMO or TNM for making steering decisions.
  - Different implications in each case
- After CU instance is selected, TNM enforces steering paths in the network.

Open Points and Next Steps

- Ensure that metrics and requirements particular to CATS in O-RAN are covered by exsting adopted document, focusing here on architectural implications
- Analyze the architectural implications of having the CATS Path Selector as part of SMO or TNM for making steering decisions.
- Cover dynamic changes in service affinity and interaction with O-RAN orchestration

- Prepare new version for IETF 124
  - Already presented at IETF 119, 120, 121 and interim (Jan. 2025)
  - Keep working on the interplay between O-RAN orchestration framework and CATS components
  - Adoption of the document could help on the task of considering CATS for O-RAN. If so, authors would intend to request adoption for IETF 124, as long as the document progresses