E2E Network Slicing Use Case Requirements for R11

Requirements Subcommittee Review

Participants: STL, Wipro, China Telecom, TIM, Huawei, Tech Mahindra, Amdocs, CMCC, AT&T

Authors: Kevin Tang (STL), Ahila P (Wipro), Dong Wang (China Telecom), Henry Yu (Huawei), N.K. Shankar (STL), Borislav Glozman (Amdocs)

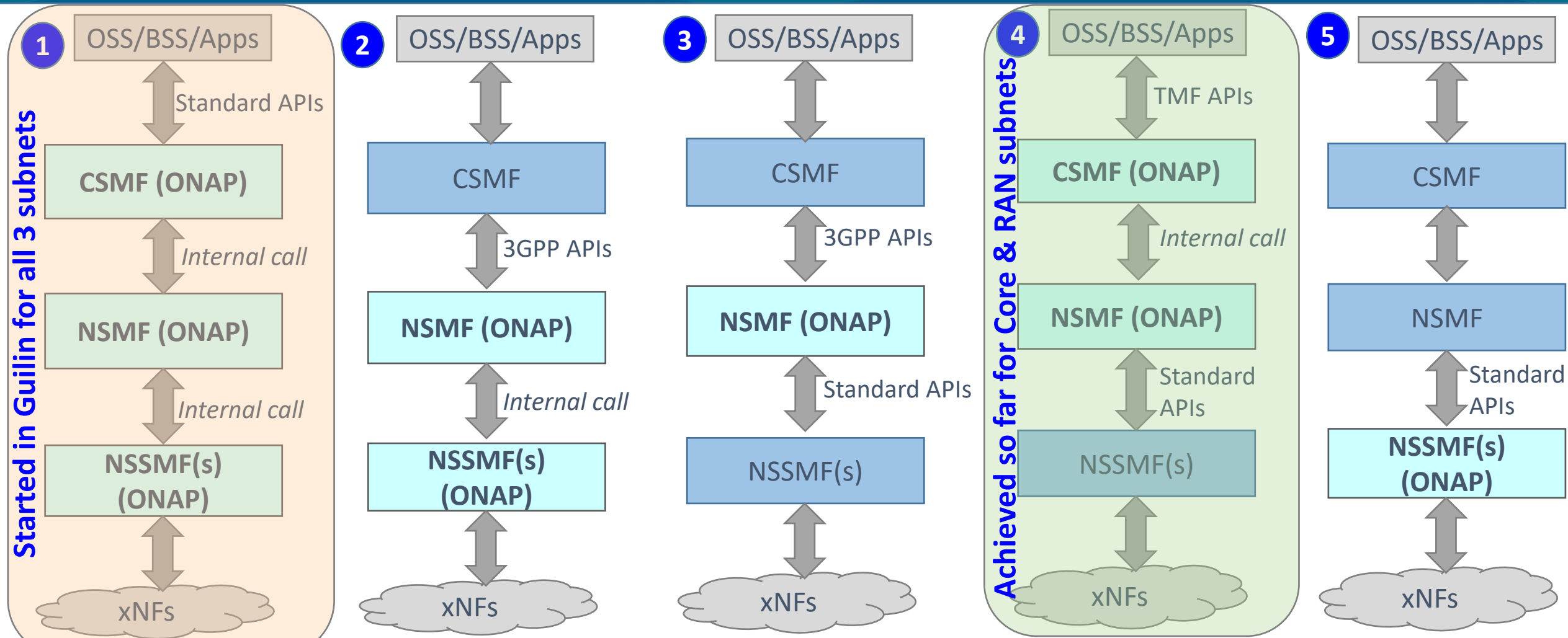
Reporters: Kevin Tang (STL) and Ahila P (Wipro)

May 8, 2022

Contents

1. ONAP-based Slice Management Overall Architecture and Choices
2. ONAP-based Slice Management NSI Life-cycle View
3. Kohn Release Requirements and Impacts
4. Summary of Kohn Release API Impacts

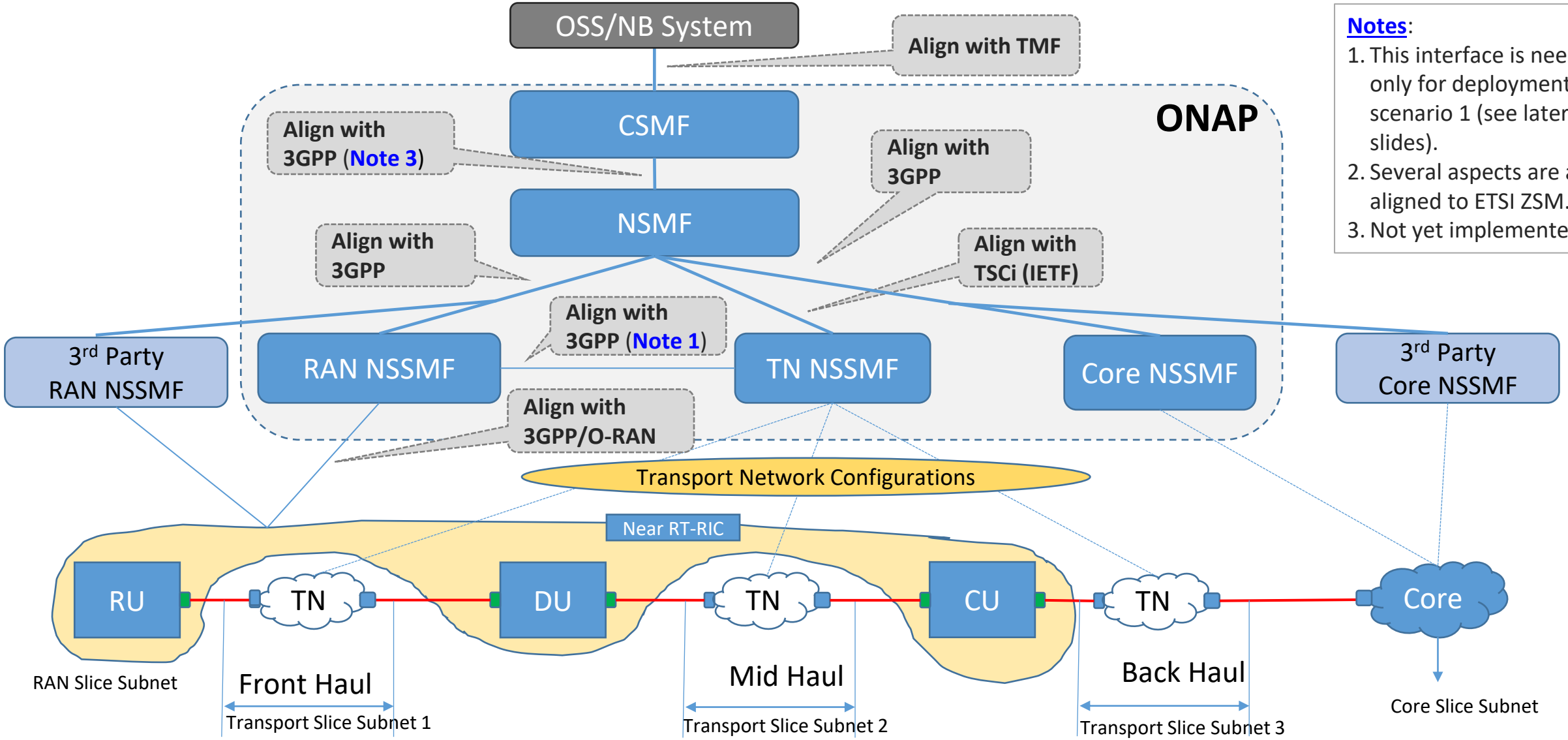
ONAP-based Slice Management Overall Architecture Choices



3rd party component

In K-release, we will continue with enhancements for Scenario 1, and aim to stabilize the existing functionality for different scenarios.

E2E Network Slicing: Architecture & Interfaces

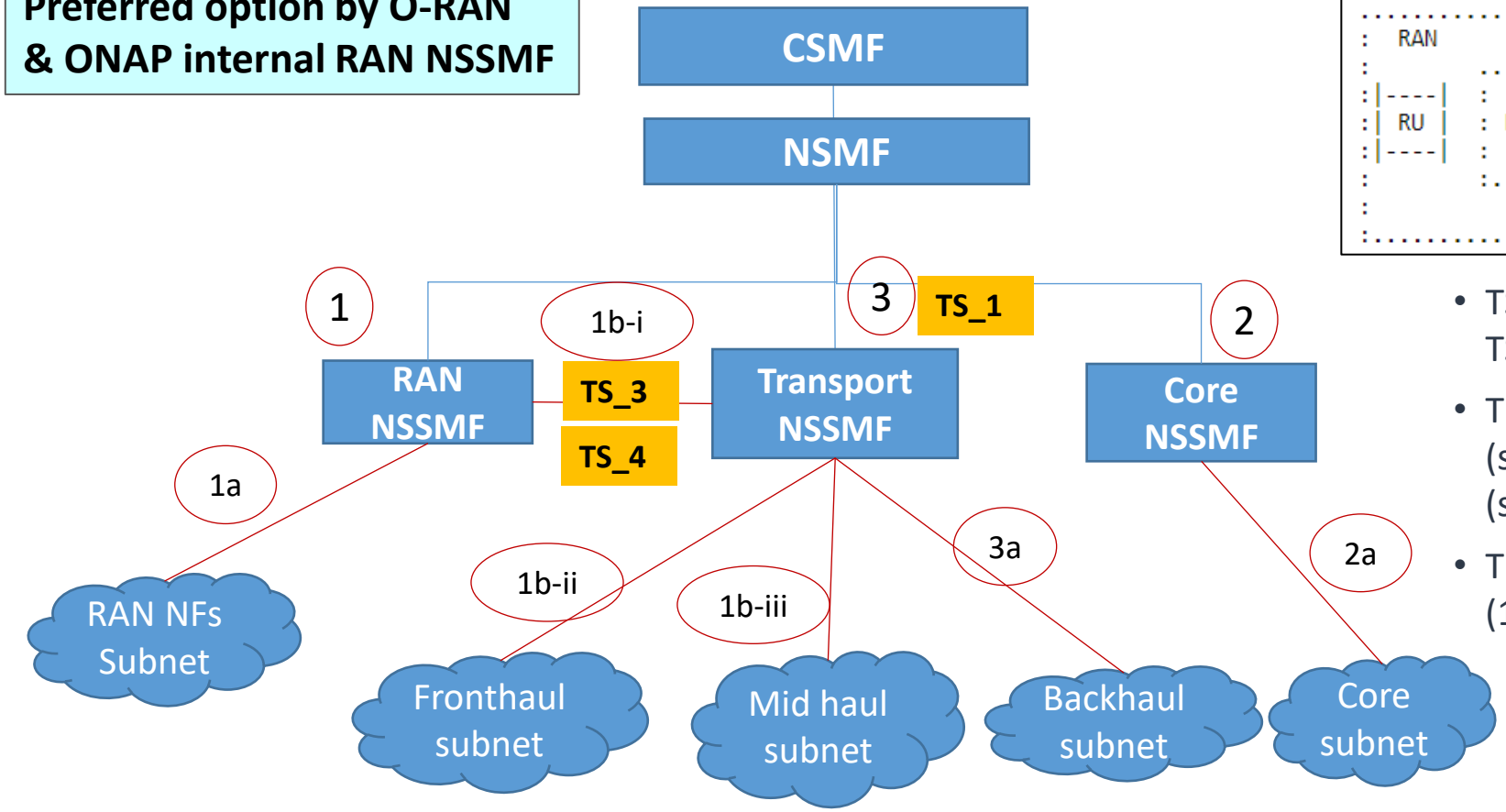


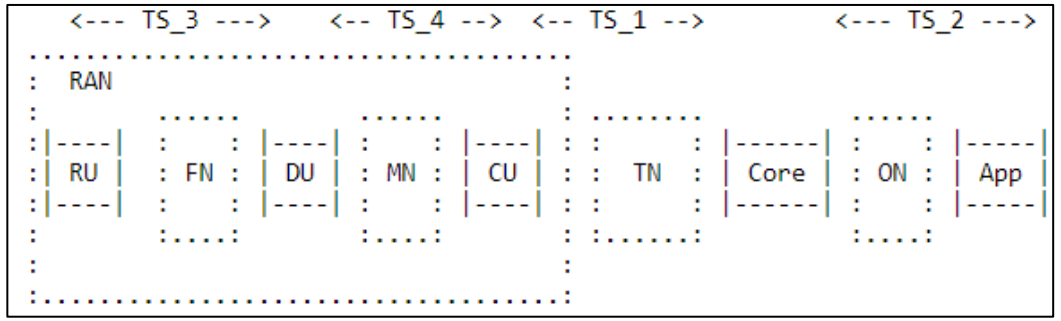
Notes:

1. This interface is needed only for deployment scenario 1 (see later slides).
2. Several aspects are also aligned to ETSI ZSM.
3. Not yet implemented

RAN & Transport Subnet: Interaction Scenario 1

Preferred option by O-RAN & ONAP internal RAN NSSMF





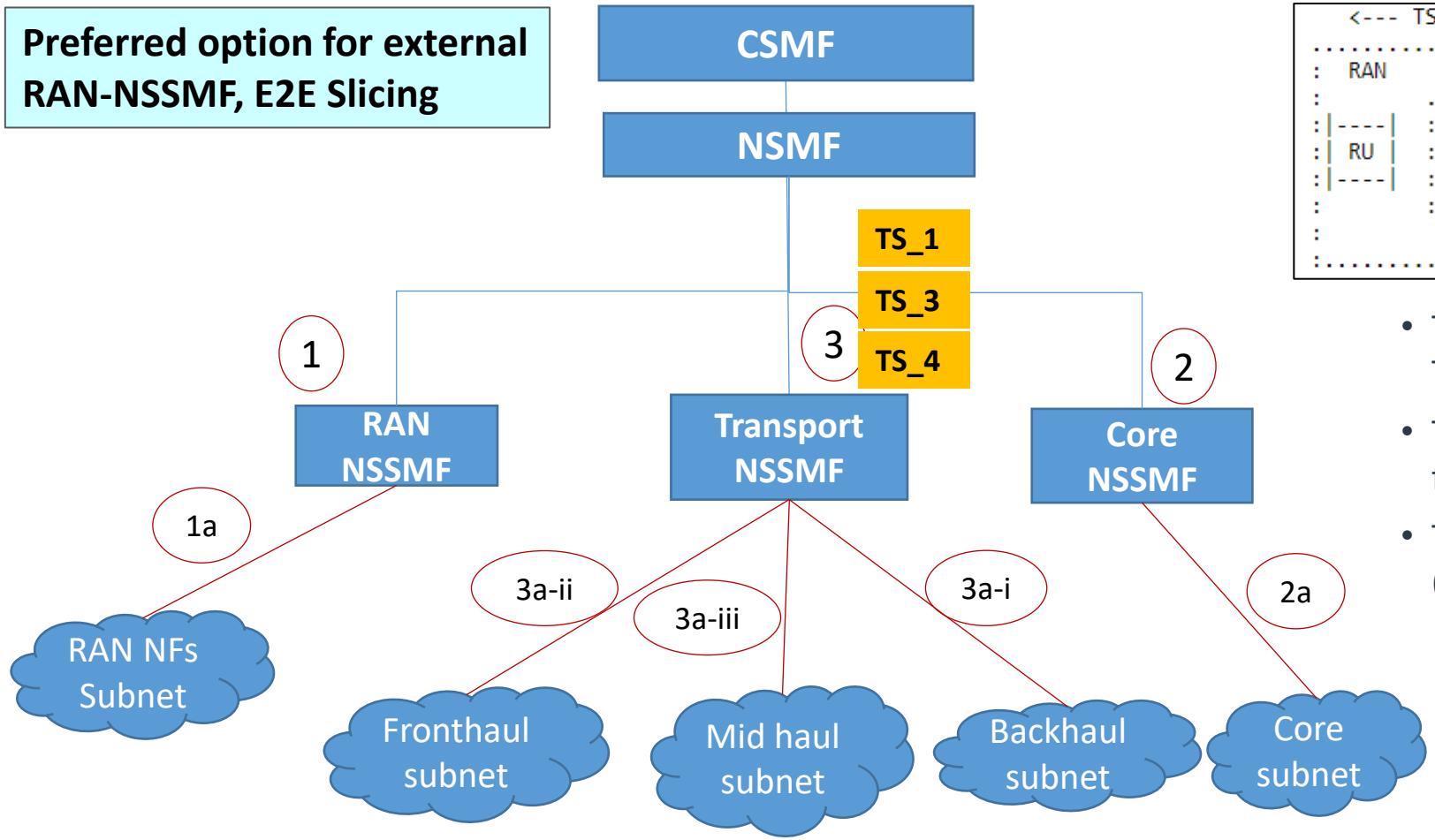
- TS_1 is backhaul transport slice; TS_3, fronthaul; TS_4, midhaul.
- TN MD (T-NSSMF) receives TS_1 from NSMF (step 3), and TS_3 and TS_4 from RAN NSSMF (step 1b-i).
- TN MD then configures backhaul (3a), fronthaul (1b-ii), and midhaul (1b-iii), respectively.

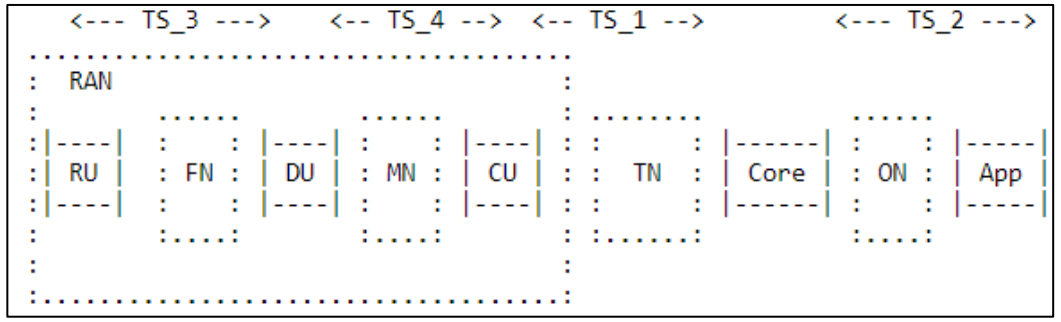
Done in J release and Enhancements to be done in K release

- **RAN NSSMF shall be responsible for determination of Slice Profile of FH, MH and RAN NFs.**
- **RAN NSSMF shall be responsible for entire RAN subnet comprising FH and MH (stitching together, CL actions, etc.)**

RAN & Transport Subnet: Interaction Scenario 2

Preferred option for external RAN-NSSMF, E2E Slicing





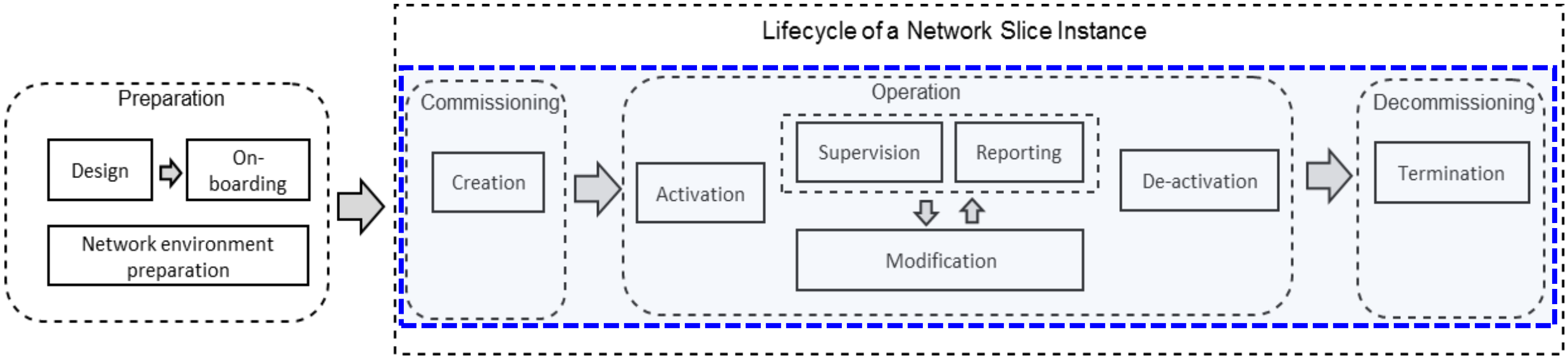
- TS_1 is backhaul transport slice; TS_3, fronthaul; TS_4, midhaul.
- TN MD (T-NSSMF) receives TS_1, TS_3 and TS_4 from NSMF (step 3).
- TN MD then configures backhaul (3a-i), fronthaul (3a-ii), and midhaul (3a-iii), respectively.

Activation, deactivation & termination testing completion in K release

- **NSMF shall be responsible for determination of Slice Profile of FH, MH and RAN NFs.**
- **NSMF shall be responsible for stitching together e2e slice including FH and MH.**

ONAP-based Slice Management - NSI Life Cycle View

Objective: Demonstrate e2e slice design instantiation and operation, including RAN, core and transport slice sub-nets



Focus area for minor enhancements in Kohn

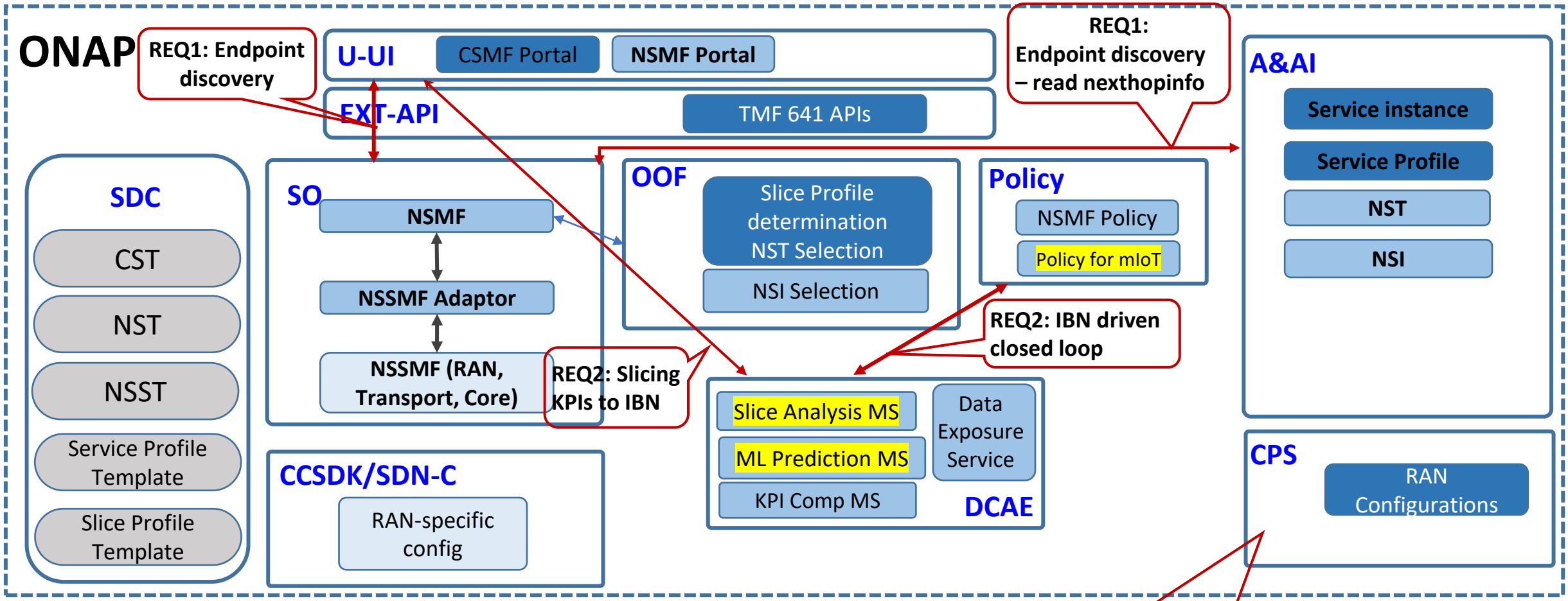
Ref.: 3GPP TS 28.530

- **Design and pre-provision**: Creation of necessary slice/slice sub-net templates.
- **Instantiation/Configuration & Activation/Deactivation** of NSIs, including instantiation/mapping of its constituent slice sub-nets (RAN, Core and Transport).

E2E Network Slicing: Proposed Requirements for Kohn

- **REQ-1: Dynamic discovery of Core and RAN endpoints at NSMF (carry-over)**
  - Carry-over requirement from Jakarta release.
  - NSMF discovers the Core and RAN endpoints for back haul dynamically at the time of slice allocation/reuse
  - RAN, Core endpoint of back haul is considered for Kohn release
  - Front haul and mid haul end points discovery is a stretch goal
- **REQ-2: IBN driven E2E Network Slicing (new, joint with IBN)**
  - Leverage ML prediction MS done in Jakarta release as a PoC
  - Focus on RAN subnet slicing only
  - Integration of ML prediction MS with DCAE (IBN and NS teams)
  - Enhancement to intent creation and workflow to support E2E Network Slicing based on UUI, AAI and DCAE (IBN team)
  - Enhancement to the closed-loop and the ML/Slice analysis MS for slicing KPI monitoring to support IBN (NS team)
- **REQ-3: mIoT slice support (New)**
  - Support Slice creation, activation, deactivation and termination for mIoT applications
- **REQ-4: Use case test automation (carry-over)**
  - Carry out test automation for slicing use case in phases
  - Target to accomplish test automation for manual configurations

E2E Network Slicing: Impact Overview



New interface Enhanced interface

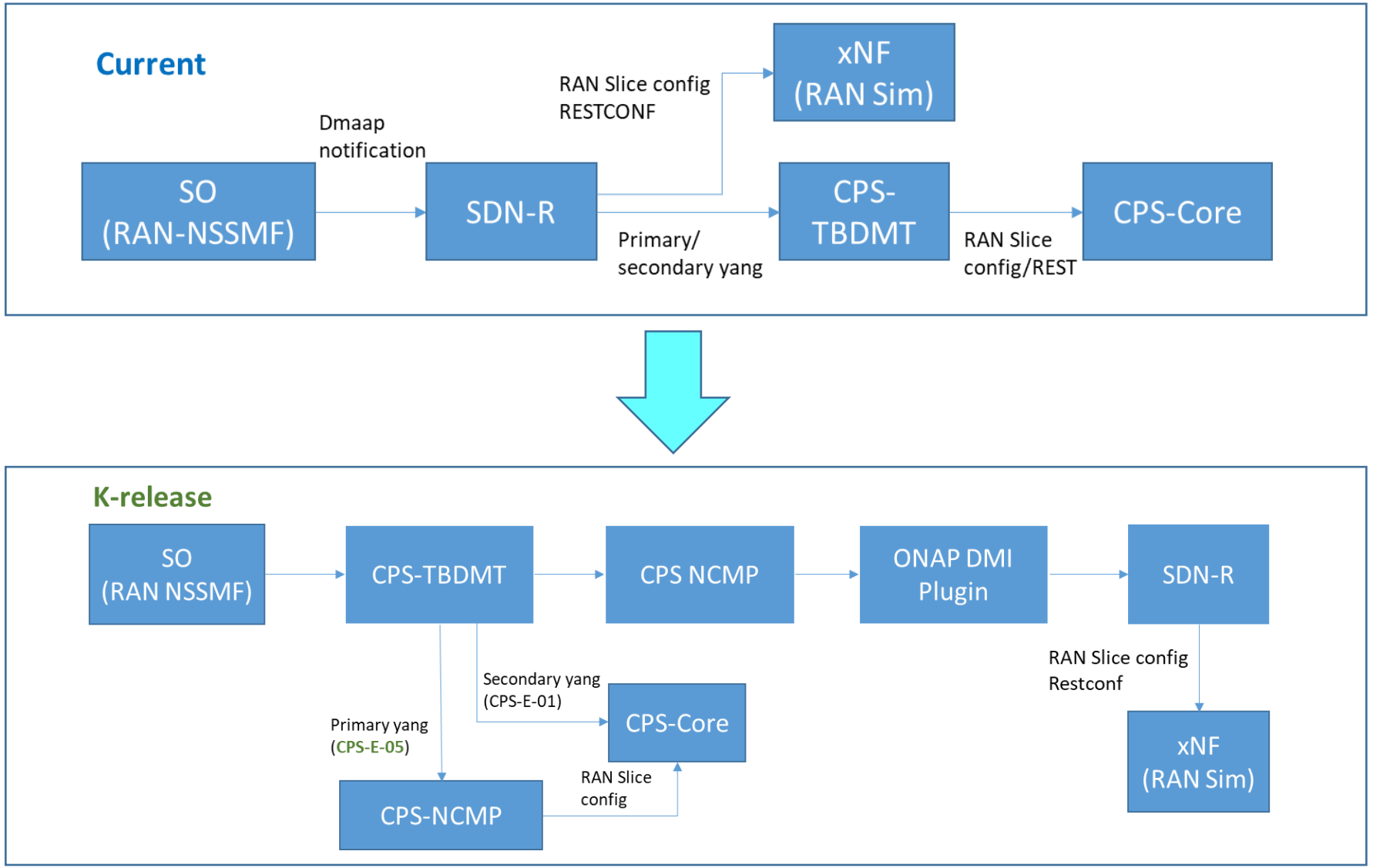
Impacts in Kohn

* Other relevant impacts are covered by IBN use case

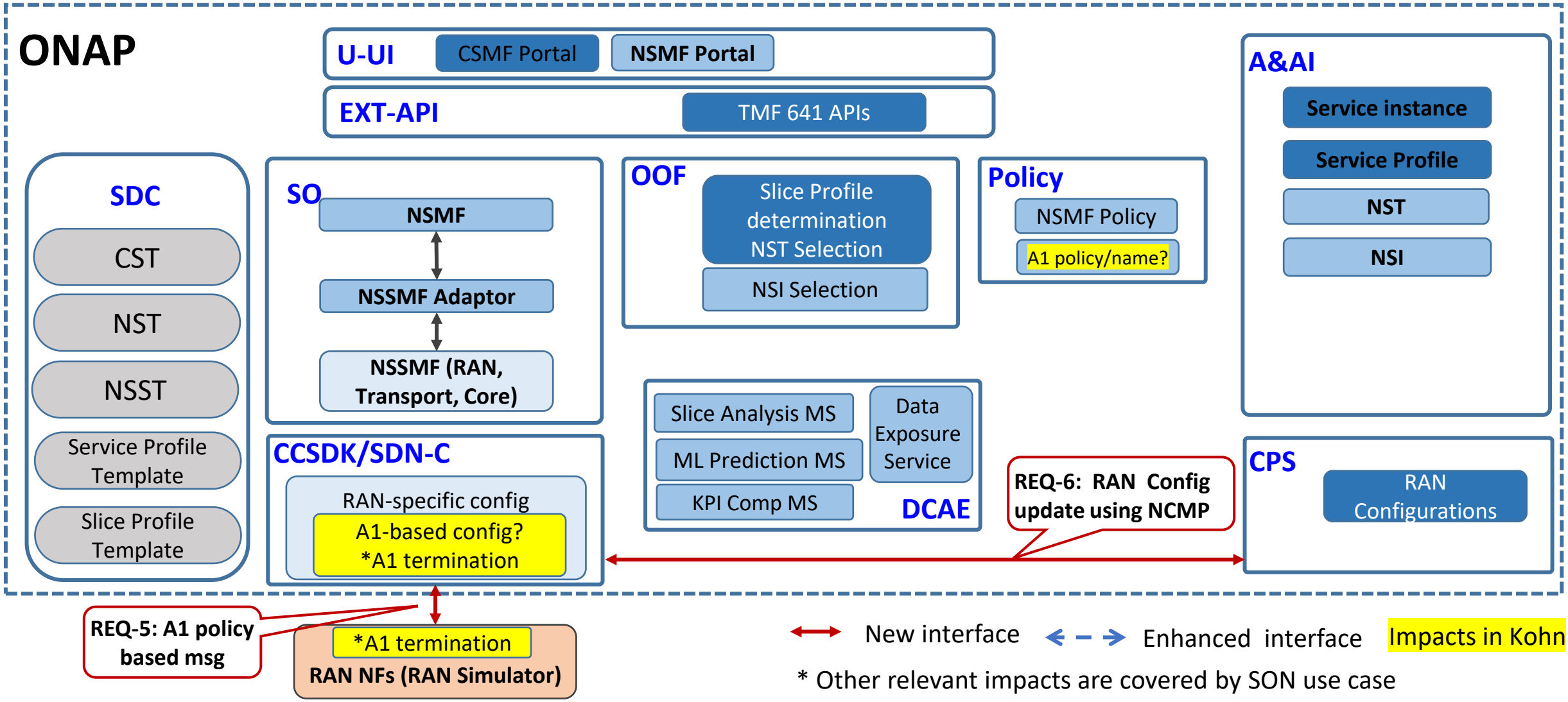
RAN Slicing: Proposed Requirements for Kohn

- **REQ-5**: **RAN-Configuration over A1 enhancements (new) (Stretch goal)**
  - Sending AI/ML based config updates to Near-RT RIC over A1 from closed loop (throughput guidance or maxNumberofConns)
  - Alignment with O-RAN A1 specification and information models
  - Work with SON use case to leverage A1 termination work in SDN-R and RAN Simulator (TBD)
- **REQ-6**: **CPS-TBDMT enhancement to integrate with NCMP (Carry-over) (Stretch goal)**
  - For RAN Slice configuration, CPS Core is invoked directly from TBDMT.
  - Support for CPS-E-05 interface requires Cache to be enabled
  - Support RAN configuration update using NCMP to SND-R
    - RAN slicing requires multiple manipulations while CPS can only do the xNF updates but cannot provide placeholder for other manipulations.
    - SO (RAN NSSMF) cannot invoke CPS for every xNF read/write operations that each RAN slice operation involves
    - More investigation needed with CPS project on the support for the CPS impacts or potential new solutions.
- **REQ-7: CSIT for RAN Slicing**

CPS-TBDMT Enhancement to Integrate with NCMP



RAN Slicing: Impact Overview



TN Sub-net Slicing: Proposed Requirements for Kohn

- **REQ-8**: TN NSSMF enhancements according to IETF latest specification (Carry-over) (Covered by CCVPN use case)
- **REQ-9**: Transport Slicing enhancement to support IBN based TN slicing (Carry-over) (Covered by CCVPN use case)
- **REQ-10**: CSIT for TN slicing (Carry-over) (Covered by CCVPN use case)

Carry-over requirements from Jakarta Release

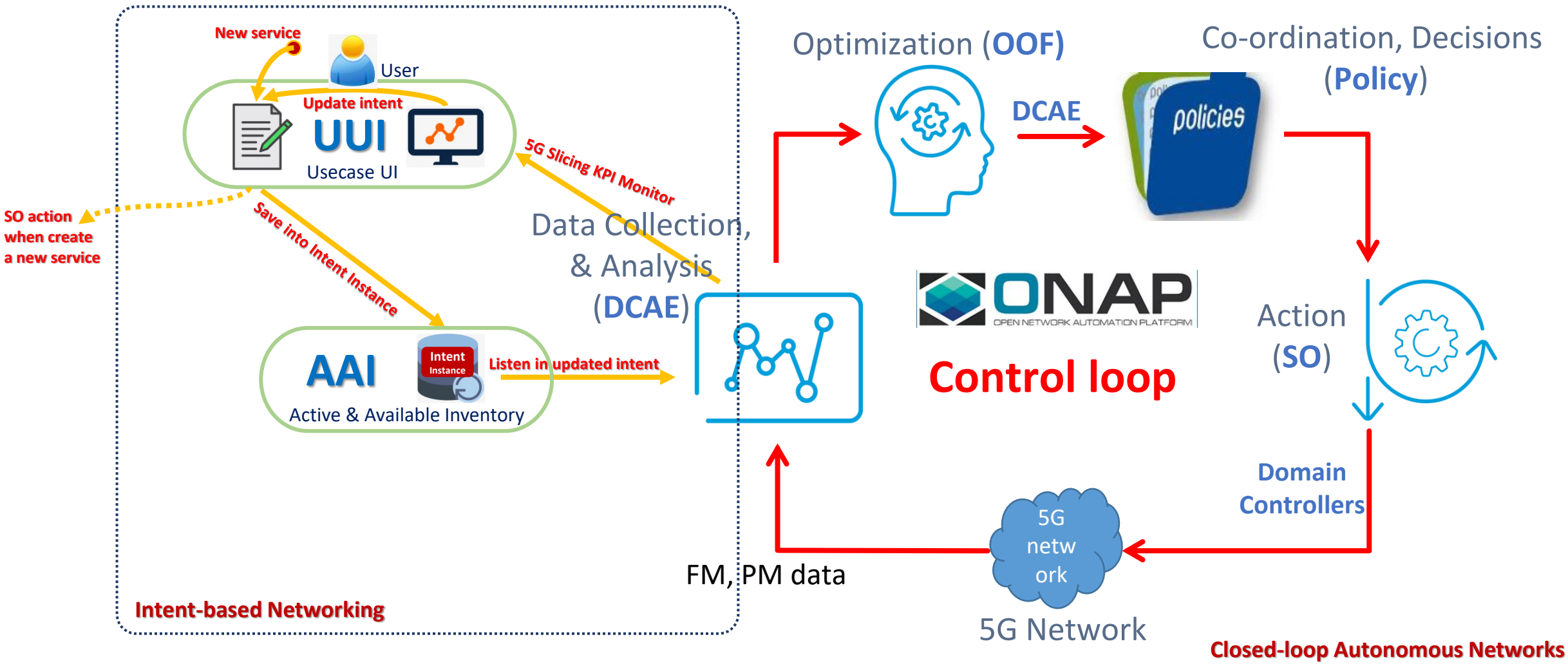
- **REQ-11: DCAE Non-functional requirements (Carry-over)**
  - DCAEGEN2-2907: REQ-358 No root (superuser) access to database from application container
  - DCAEGEN2-2801: Enhancements to KPI Computation MS (partial)
- **REQ-12: Fix to Core Slicing issues (Carry-over) (could also be put to the Jakarta maintenance release)**
  - https://jira.onap.org/browse/SO-3810
  - https://jira.onap.org/browse/SO-3835
  - https://jira.onap.org/browse/SO-3838
- **REQ-13: Carry-over integration tests from Jakarta**
  - Depending on the progress of the testing in Jakarta release

API impact summary

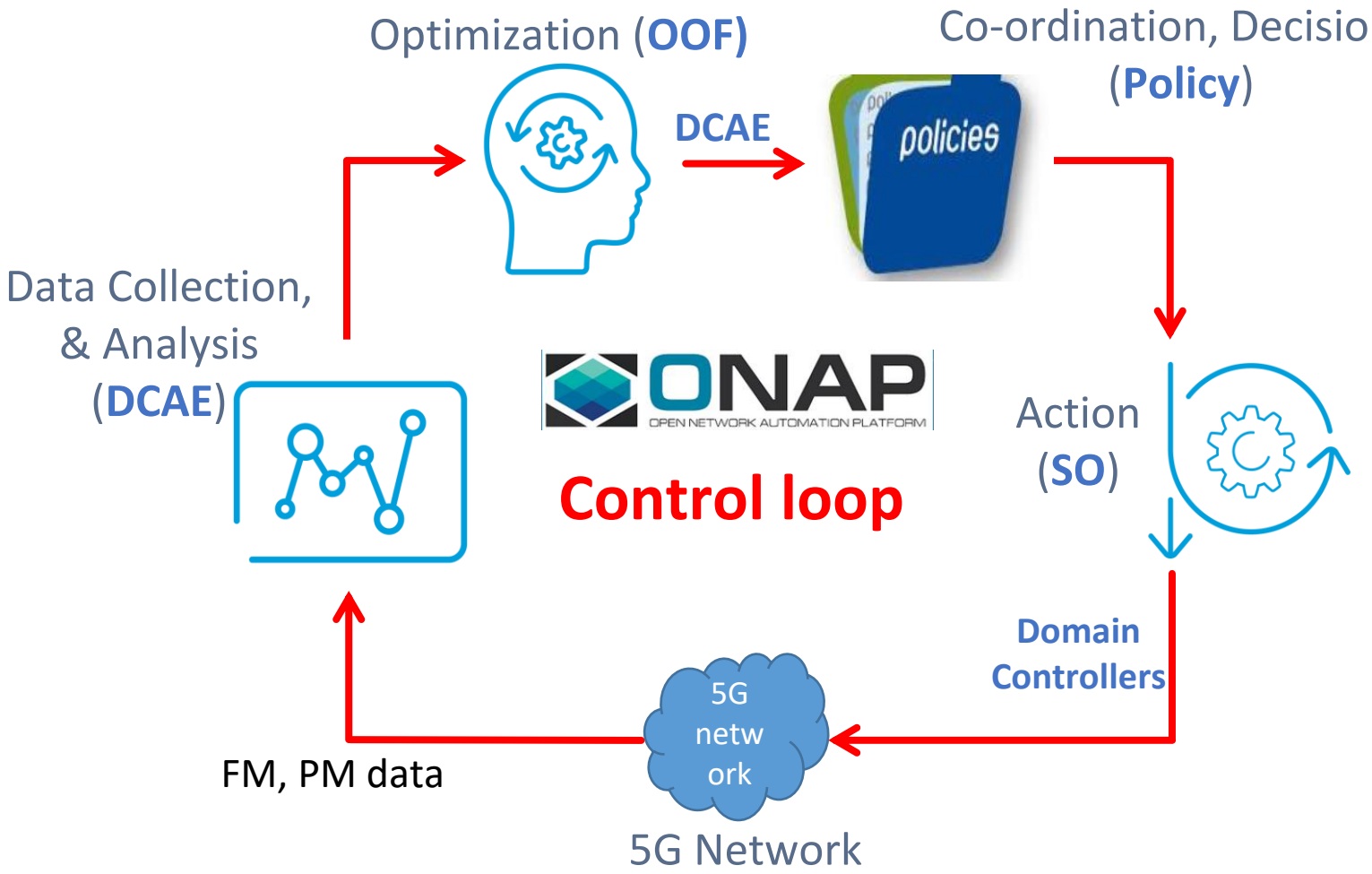
Interacting components	API impact?	Remarks
ExtAPI -> Northbound	No	
UUI -> SO	**Yes**	Dynamic endpoints discovery at NSMF
SO -> OOF	No	
OOF -> CPS	No	
SO (NSMF) -> SO (NSSMF)	**Yes**	Dynamic endpoints discovery at NSMF
SO (NSSMF Adapter) -> SO (External RAN NSSMF)	No	
SO -> SDN-C/SDN-R	No	
SDN-R -> RAN Simulator	**Yes**	A1 interrace for RAN policy/configuration
Any component / SO -> AAI	**Yes**	SO invokes AAI to read the nexthopinfo
DCAE Slice Analysis MS -> CPS	No	
CPS -> CCSDK/SDN-C	**Yes**	Use CPS as an abstract layer to update xNF
UUI -> DCAE	**Yes**	Slicing KPIs monitoring
AAI -> DCAE	**Yes**	For IBN driven closed loop

Thank You!

3.4 Intent-driving E2E Slicing usecase

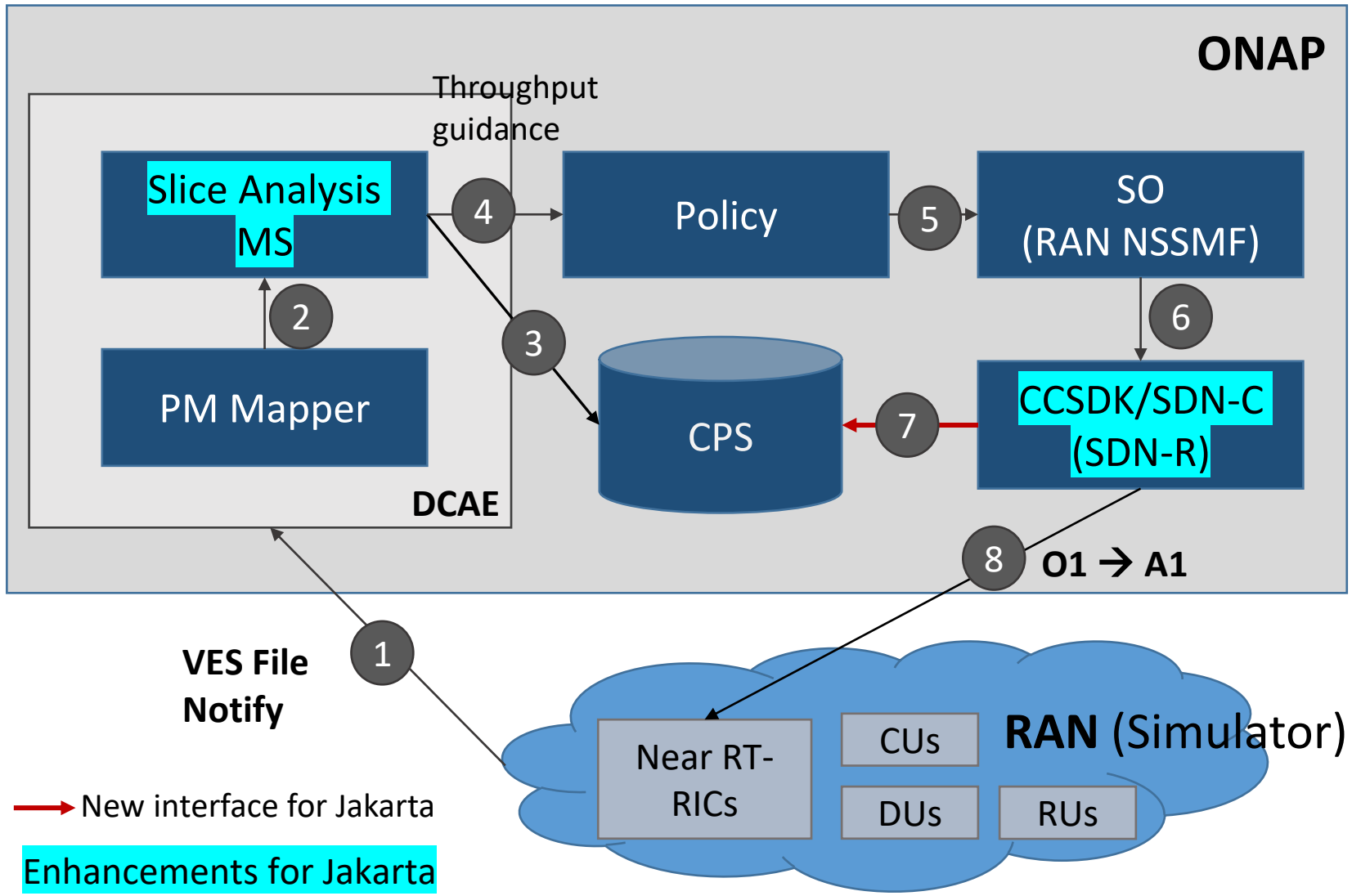


Closed Loop: Overview



- Leverage the SON ⇔ Control Loop (CL) framework in ONAP
- Based on PM/FM data, analyze NSI/NSSI traffic patterns, KPI adherence, and resource occupancy in NSI/NSSI
- Based on analysis, trigger OOF for NSI resource optimization/re-allocation to guarantee KPI adherence and optimal use of resources
- Perform necessary resource adjustments via SO and Domain Controllers (modify NSI/NSSI/S-NSSAI mapping/etc.)

Closed Loop: Jakarta Release Impacts

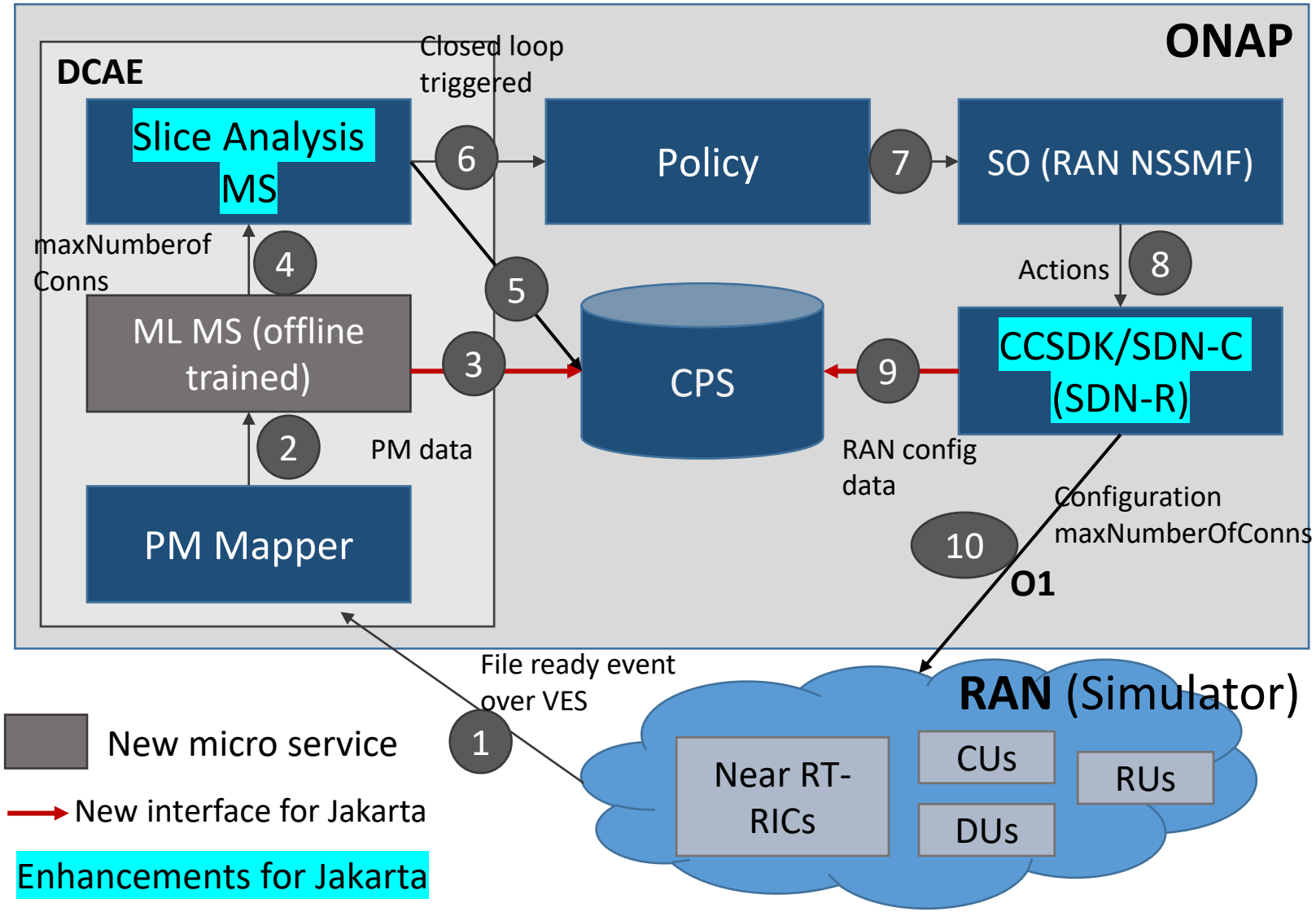


- The PM data collected from RAN in Step 1 is DL/UL PRB usage for data traffic.
- The configuration update determined by Slice Analysis MS and triggering Policy in Step 4 is slice specific throughput guidance for Near-RT coverage area (i.e., at Near-RT RIC level).
- Step 8 is over **O1** in Jakarta, it will be over **A1** in future releases.

Notes:

1. DFC and VES Collector are not shown in the flow but are used.

Intelligent Slicing (IBN Based CL): Jakarta Release Impacts



- The PM data collected from RAN in Step 1 is PDU sessions requested, setup successfully & failures.
- 2 micro services are required, one for training and exporting the model (downloaded to the local machine in J release) , and another for prediction.
- At Step 4, predicted output from ML MS, which should be aligned with the intent, is slice specific maxNumberof Conns for each cell (i.e., cell level for each S-NSSAI).
- Control loop is triggered by Slice Analysis MS using policy
- Step 10 is over O1 in Jakarta and will be over A1 in future releases

Notes

- DFC and VES Collector are not shown in the flow but are used.