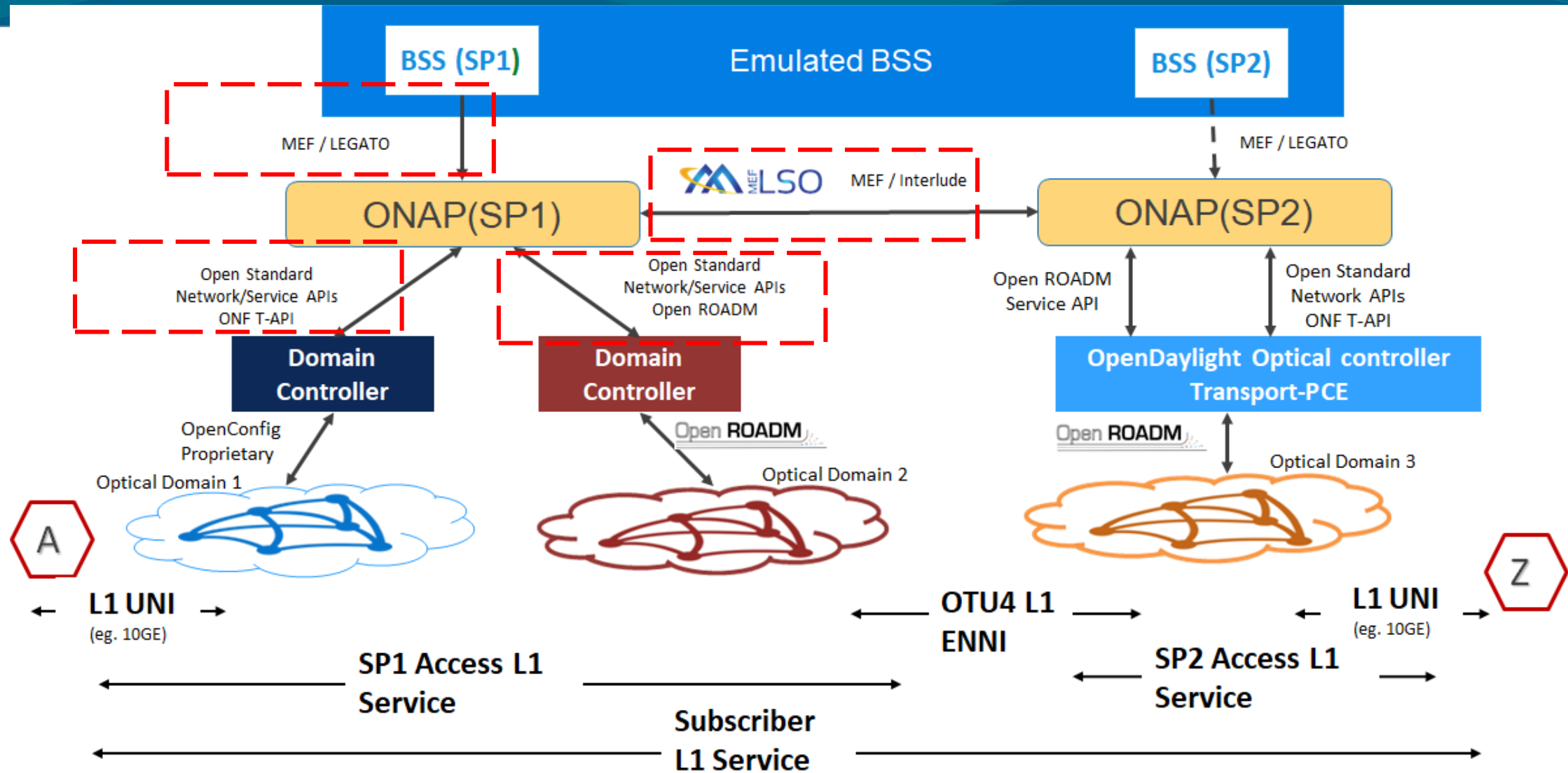


# Multi Domain Optical Network Services Use Case Impact Analysis in R6 (supported by ATT and Orange)

Toshimichi Fukuta (Fujitsu), Xin Miao(Fujitsu)

# Use case Overview



New External APIs introduced

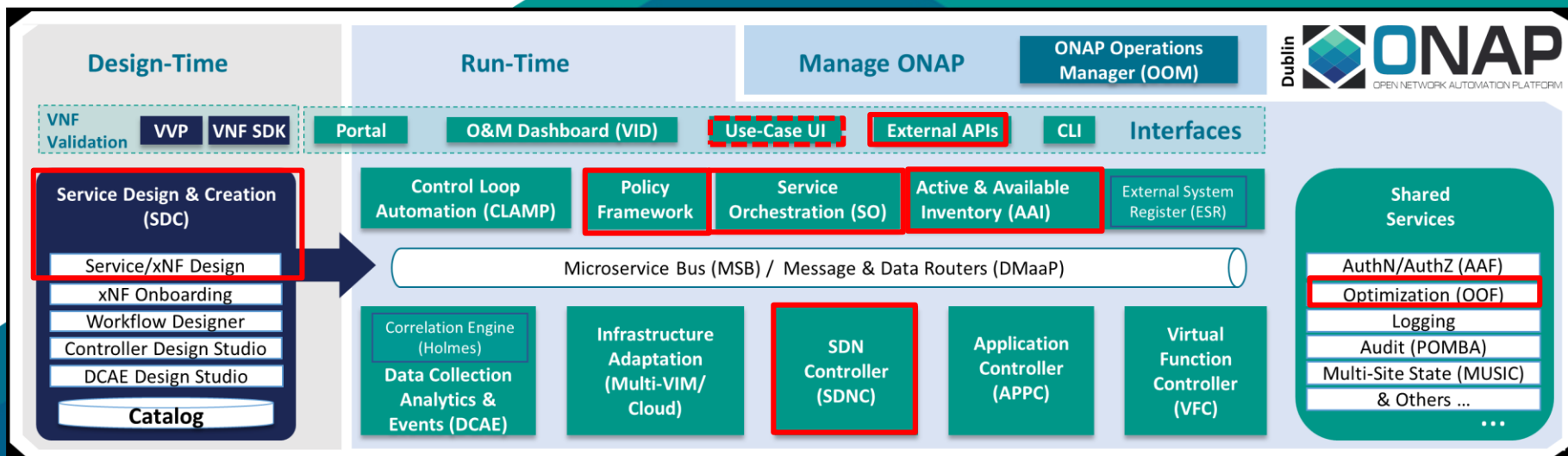
# ONAP Dublin Architecture (Impact Components in R6)



ONAP Architecture  
Version 4.0.10  
Date: May 16th, 2019

OSS / BSS / Other

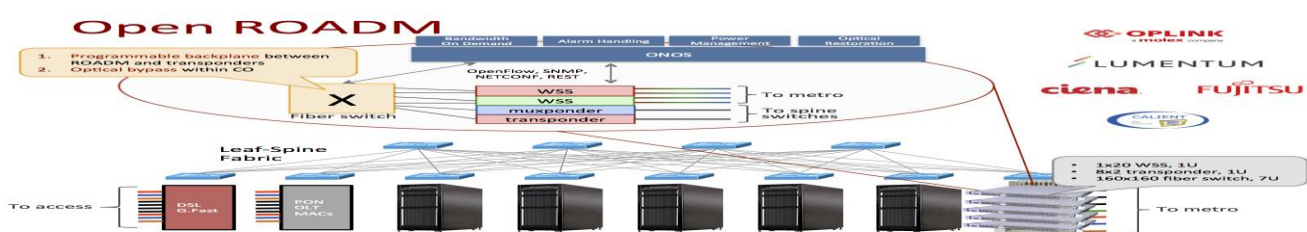
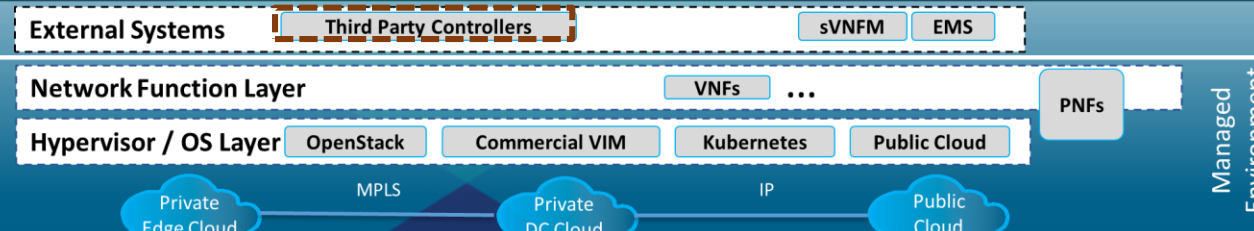
Legend Design **Orchestration & Management** Operations



Impacted Component

Nice to support

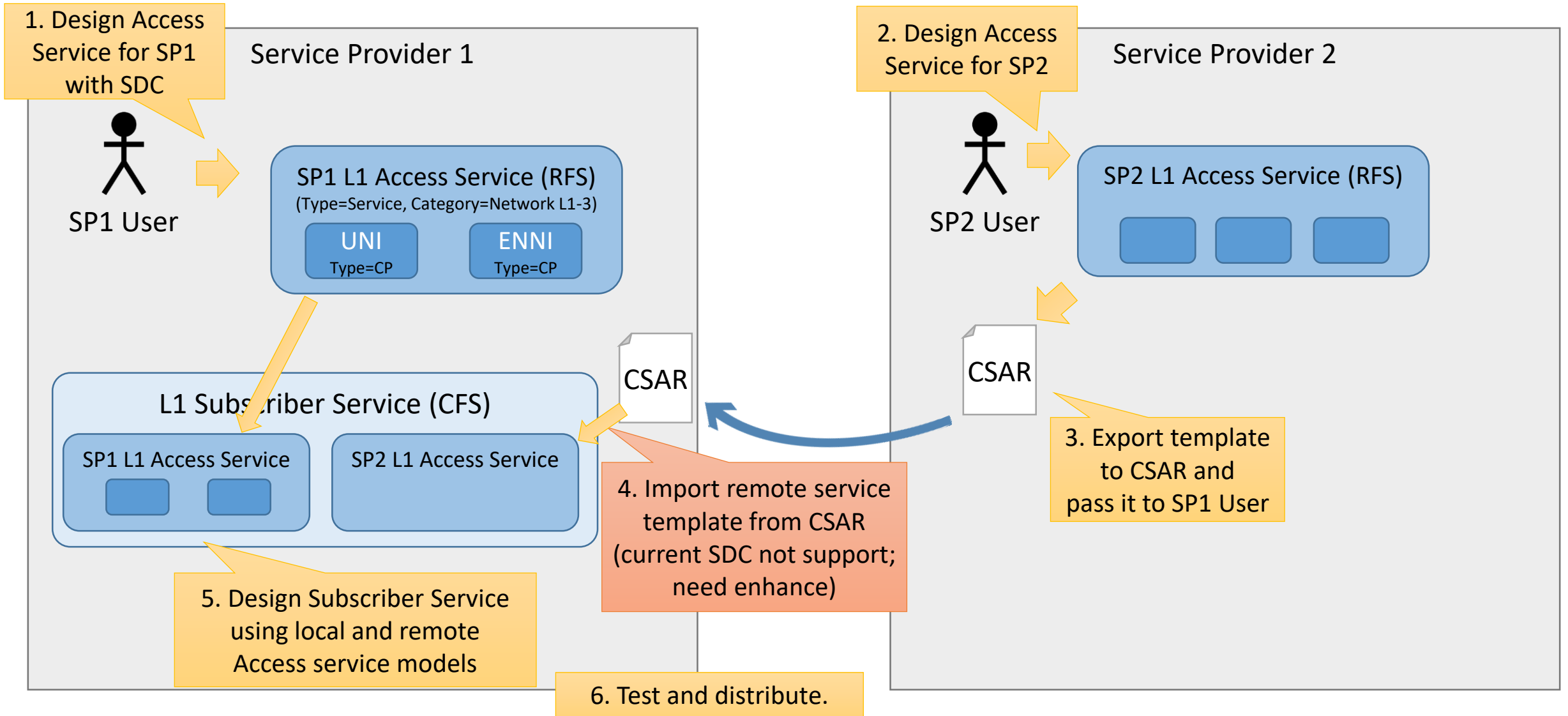
3<sup>rd</sup> Party Component



# Requirements to SDC

- 1. Service modeling
  - No impact: can be done with existing SDC features
- 2. Importing service template from remote ONAP
  - To design L1 subscriber service, we need to import remote **access service** template
  - Need new feature to import service template from CSAR file
    - Current SDC doesn't have that
  - option 2: or import from service specification (e.g. RFSS)
    - ExtAPI exposes API to get service specification (compatible with TMF633)
    - Similar approach to TODM use case
- 3. Service composed of nested services
  - In MDONS use case, Subscriber service will be composed of Access services
  - Probably no impact: current SDC supports nested services (Service Proxy concept)

# Diagram: L1 Service Design Flow <Draft>



# Potential Impacts to SDC

## Code changes in Frankfurt:

- New feature: Importing service template from CSAR file
  - Parse CSAR file
  - Import all resources to SDC catalog
  - Validation: CSAR validity, resource conflict, etc...

# Frankfurt Phase-1 Topology Example

node1 → Xponder

A → Port

— → Link

Service Provider 1

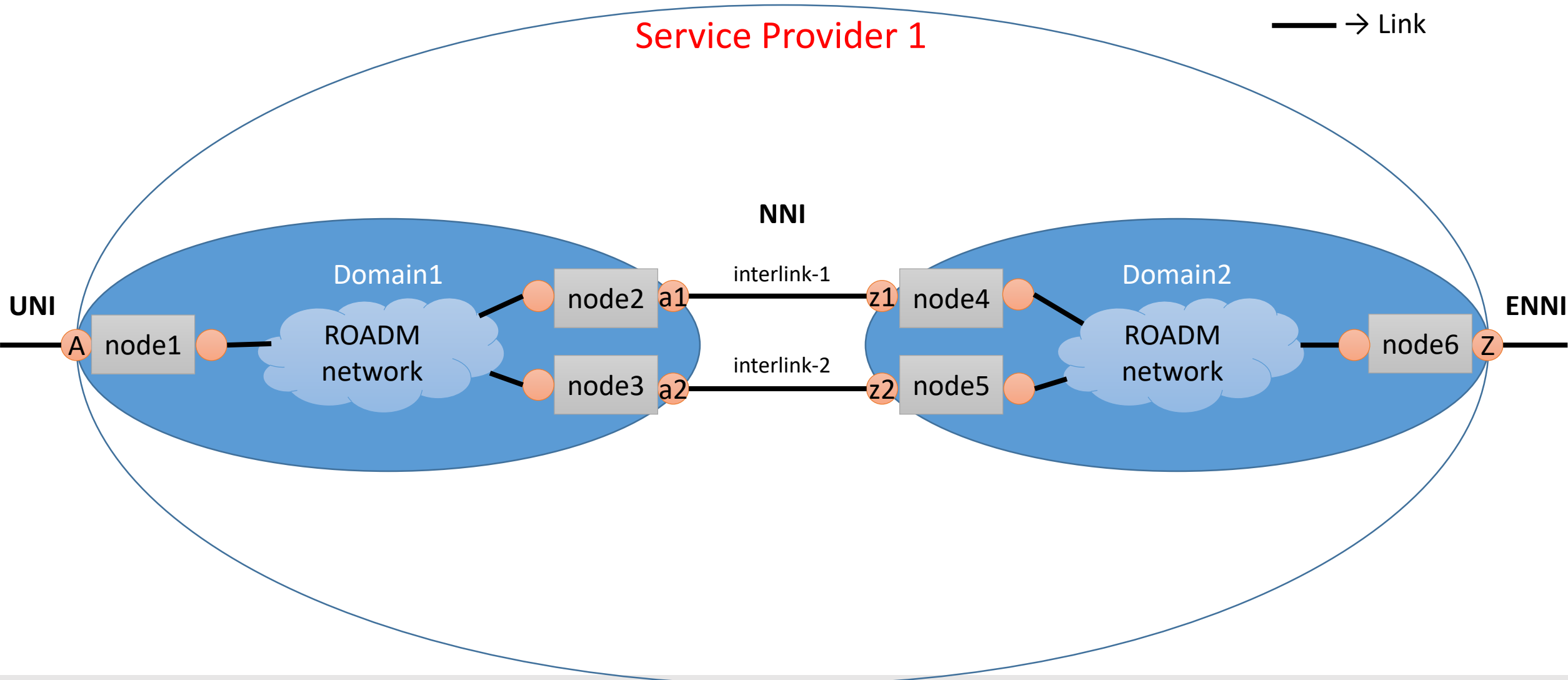
NNI

Domain1

Domain2

UNI

ENNI

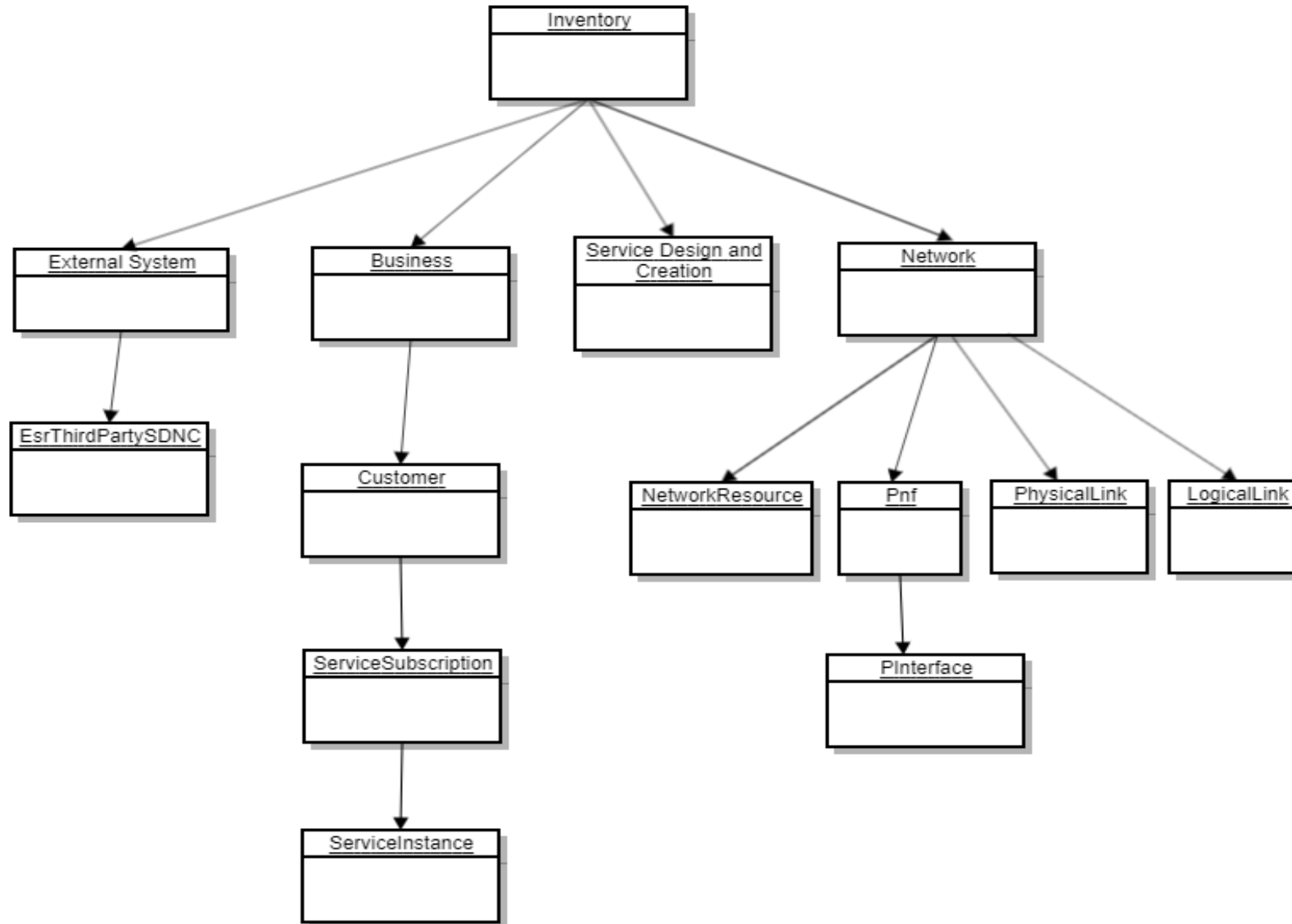


# AAI Changes: Proposal

- For "**network-resource**", add string "**network-type**" attribute. (This has already been proposed for the CCVPN use case, we can reuse it to determine if its a OpenRoadM topology or OTN topology).
- Add following attributes to "**p-interface**":
  - i. "**network-interface-type**" : To indicate if that p-interface is a UNI, NNI or ENNI.
  - ii. "**available-capacity**" : To indicate the current capacity of the p-interface. The existing "**speed-value**" could be used to indicate the total capacity.
- Add following attributes to "**logical-link**":
  - i. "**available-capacity**" : To indicate the current capacity of the logical-link. The existing "**speed-value**" could be used to indicate the total capacity.
- Add following attributes to "**physical-link**":
  - i. "**available-capacity**" : To indicate the current capacity of the physical-link. The existing "**speed-value**" could be used to indicate the total capacity.
- Add **Edge Rule** to represent "**service-instance**" to "**p-interface**" relationship to indicate the p-interfaces associated with that particular service. (Note: If we use the "**service-instance**" to "**pnf**" relationship, it becomes unclear as to which p-interface is used for that service, as a **pnf** can have many p-interfaces).
- For "**service-instance**" following attributes are added :
  - i. "**due-date**": To indicate the due-date of the service.
  - ii. "**end-date**" : To indicate the end date of the service.
  - iii. "**service-rate**" : To indicate the service-rate.Eg 10GE.
  - iv. "**service-layer**" : To indicate the service-layer. Eg: OTN.
- Add **Edge Rule** to represent "**esr-thirdparty-sdnc**" to "**network-resource**" relationship to relate a group of network resources to a particular third party controller. For eg (Openroad topology and OTN topology could be related to a SDNC controller).



# A&AI Models used by MDONS Use Case



# A&AI Model Attributes Used

Nodes in AAI	AAI Attributes	Data Type	Description
pnf	pnf-name(key)(M)	string	UUID
	pnf-id	string	Node ID + CLLI
	operational-status	string	Planned, deployed, maintenance
	in-maint (M)	boolean	True/False
	equip-type	string	XPONDER, ROADM
p-interface	interface-name (M)	string	UUID
	port-description	String	Port name
	network-ref	string	Network ID
	interface-type	string	XPONDER-NETWORK, XPONDER-CLIENT
	operational-status	string	Creating, Created/Active, Deleting
	in-maint (M)	boolean	True/False
	network-interface-type(newly added)	string	UNI, NNI, ENNI
	speed-units	string	
	speed-value	string	

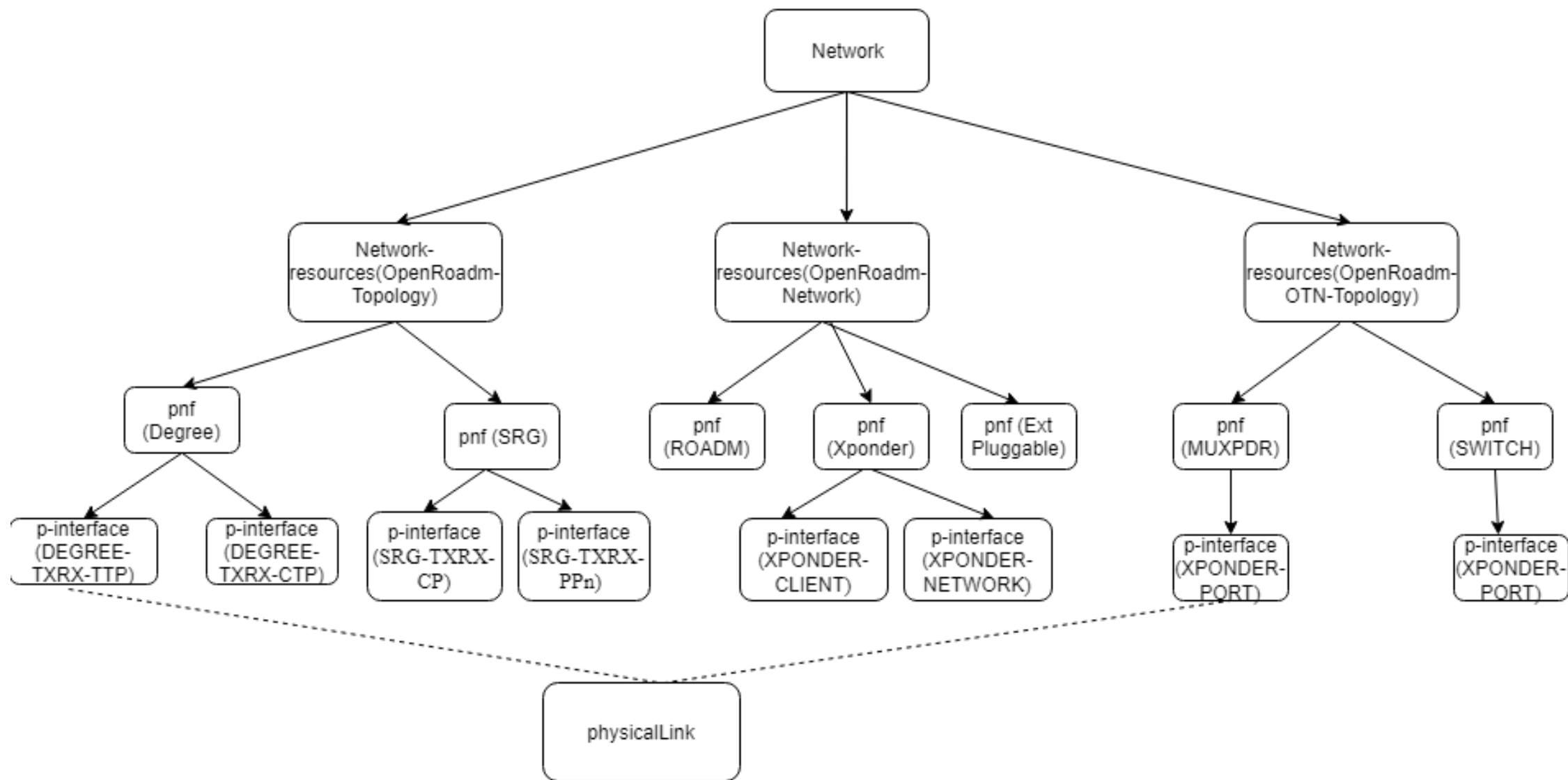
# A&AI Model Attributes Used

Nodes in AAI	AAI Attributes	Data Type	Description
physical-link	link-name (M)	string	Link name
	speed-value	string	
	speed-units	string	
logical-link	link-name(M)	string	Link Name
	link-type(M)	string	OTN-Link
	in-maint(M)	boolean	True/False
	speed-value	string	
	speed-units	string	
	operational-status	string	Creating, Created/Active, Deleting

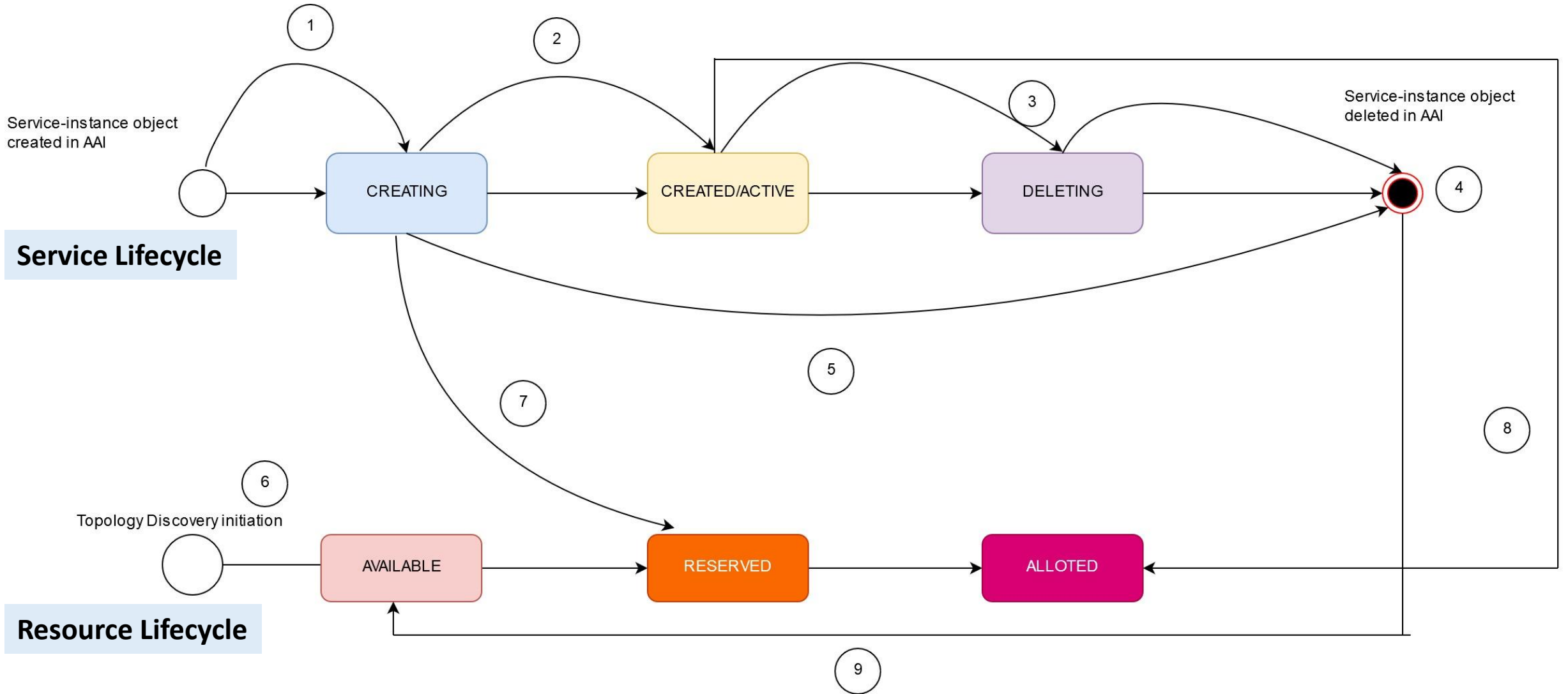
# A&AI Model Attributes Used

Nodes in AAI	AAI Attributes	Data Type	Description
service-instance	service-instance-id(M)	string	UUID
	service-instance-name	string	
	service-type	string	Access, Domain
	orchestration-status	string	Creating, Created/Active, Deleting
	due-date(newly added)	string	
	end-date(newly added)	string	
	service-rate	string	10GE
	service-layer	string	OTN

# Topology Model Tree View



# Service and Resource Lifecycle Diagram



# Service Status Table

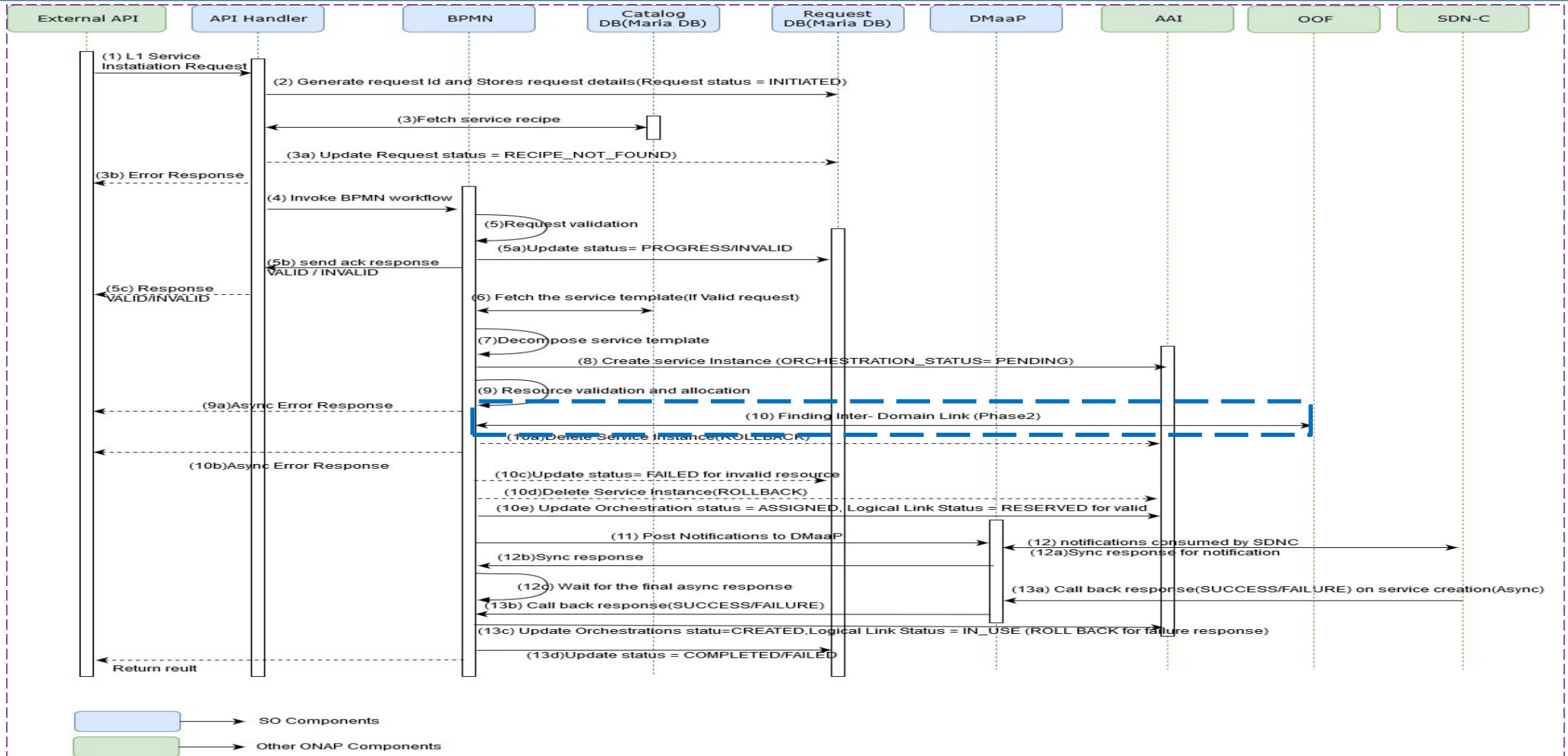
S.No.	STATUS in AAI	Actions taken by SO	Actions taken by SDN-C
1.	Available	<ul style="list-style-type: none"> <li>Request received and validated</li> <li>Service decomposed and SDN-C triggered</li> </ul>	<ul style="list-style-type: none"> <li>SDN-C validates request</li> <li>Sends create request to controller</li> <li>Allocates resource in AAI</li> </ul>
2.	Created/ Active	<ul style="list-style-type: none"> <li>After all the async responses for create request from the SDN controller is successful</li> </ul>	<ul style="list-style-type: none"> <li>Receives successful async response from the SDN controller</li> </ul>
3.	Deleting	<ul style="list-style-type: none"> <li>Delete request from UI</li> <li>Request validated and sent to SDN-C</li> </ul>	<ul style="list-style-type: none"> <li>Service delete request from SDNC</li> <li>Request validated and sent to controller</li> </ul>
4.	None	<ul style="list-style-type: none"> <li>After all the async responses for delete request from the SDN controller is successful</li> </ul>	<ul style="list-style-type: none"> <li>Service delete async response successful</li> </ul>
5.	None	<ul style="list-style-type: none"> <li>Resource validation fails/SDN-C sends sync/async response with 'failure' or if timer expires</li> </ul>	<ul style="list-style-type: none"> <li>Request validation fails</li> <li>Async response fails for both service creation and deletion</li> </ul>

# Resource Status Table

S.No.	Status in AAI	Resource in AAI	Actions taken by SO	Actions taken by SDN-C
6.	Available	<ul style="list-style-type: none"> <li>Pnf</li> <li>P-interface</li> <li>Physical-link</li> <li>Logical-link</li> </ul>		During topology discovery, SDNC updates the status of all the resources as available in AAI
7.	Reserved	<ul style="list-style-type: none"> <li>P-interface</li> <li>Logical-link</li> </ul>		SDN-C reserves the status of the p-interface and physical-link that is used for a particular service during Service creation request
7.	Reserved	<ul style="list-style-type: none"> <li>Logical-link</li> </ul>	SO reserves the inter-domain link that is the logical-link for that service.	
8.	Allotted	<ul style="list-style-type: none"> <li>P-interface</li> <li>Logical-link</li> </ul>		Once the domain service is successfully created (i.e after the async response), SDN-C marks the resources as allotted
8.	Allotted	<ul style="list-style-type: none"> <li>Logical-link</li> </ul>	Once the access service is successfully created (i.e after the async response), SO marks resources as allotted	
9.	Available	<ul style="list-style-type: none"> <li>P-interface</li> <li>Logical-link</li> </ul>		Once the domain service is successfully deleted(i.e after the async response), SDN-C marks the resources as available
9.	Available	<ul style="list-style-type: none"> <li>Logical-link</li> </ul>	Once the access service is successfully deleted(i.e after the async response), SO marks the resources as available	



# Service Creation



New features introduced in P2

# SO Requirements/Impacts in R6

S.No	Requirement	Code change needed?	Impacted model and required high-level changes (bpmn->so-bpmn-infrastructure-flows,so-bpmn-infrastructure-common)
1	Upon distribution of MDONS service template from SDC, SO to download the template and store it.	No	
2	Upon reception of service creation/deletion request from UI, SO to:	(a) Validate the request	<ul style="list-style-type: none"> <li><b>Existing workflow to be reused:</b> CreateCustomE2EServiceInstance</li> <li>Enhance the existing workflow to validate if the necessary endpoints are given in request to process.</li> </ul>
		(b) Send a synchronous response to UI with success/failure indication along with the reason.	<ul style="list-style-type: none"> <li><b>Existing workflow to be reused:</b> CreateCustomE2EServiceInstance</li> <li>Enhance the existing workflow to send the success/failure indication with reason as per this use-case.</li> </ul>
		(c) If it is allowed to process the request further, decompose the service using the design template.	<ul style="list-style-type: none"> <li><b>Existing workflow to be reused:</b> DecomposeService</li> <li>Enhance the existing workflow to adapt L1Access service template decomposition</li> </ul>
		(d) Check feasibility (check AAI), and then determine inter-domain link by 1.hard-coded logic (Phase 1) 2.triggering OOF (Phase 2)	<ul style="list-style-type: none"> <li><b>Existing workflow to be used:</b> DoCreateE2EServiceInstance</li> <li>Enhance the existing workflow to invoke workflow -“Homing” which is an existing workflow to determine the inter-domain link with the aid of OOF</li> </ul>
		e. Update the inter-domain link status in AAI	<ul style="list-style-type: none"> <li><b>Existing workflow to be used:</b> DoCreateE2EServiceInstance</li> <li>Enhance the existing workflow by adding a new task to update the inter-domain link status = “DOWN” in AAI</li> </ul>

# SO Requirements/Impacts in R6

S.No.	Requirement	Code change needed?	Impacted model and required high-level changes (bpmn->so-bpmn-infrastructure-flows,so-bpmn-infrastructure-common)
3	<b>Upon reception of response from OOF (Phase 2) (For phase 1, the following steps will simply follow step 2(d))</b>	Prepare and send a DMaaP message to SDN-C for each domain service to be created.	<ul style="list-style-type: none"> <li>• <b>Existing workflow to be reused:</b> CreateCustomE2EServiceInstance</li> <li>• Enhance the existing workflow by creating a new task to reuse the existing DMaaP client resides in package "org.onap.so.client.dmaap"</li> </ul>
		Store the request(s) details in local DB.	<ul style="list-style-type: none"> <li>• <b>Existing workflow to be reused:</b> CreateCustomE2EServiceInstance</li> <li>• Enhance the existing workflow to store the request details in request-DB to track the request progress and handle the call back response from SDN-C</li> </ul>
4	<b>Upon reception of synchronous response from SDN-C, SO to:</b>	(a) Send update to UUI	<ul style="list-style-type: none"> <li>• <b>Existing workflow to be reused:</b> CreateCustomE2EServiceInstance</li> <li>• Existing workflow to be enhanced to send synchronous success/failure response to UUI after getting the response from SDN-C on all domain controllers. Need to expose an API to send the response to UUI.(*Note)</li> </ul>
		(b) Update AAI of service status (creating)	<ul style="list-style-type: none"> <li>• <b>Existing workflow to be reused:</b> CreateCustomE2EServiceInstance</li> <li>• Enhance the existing workflow to update the service status in AAI based on the synchronous responses received from SDN-C on all domain controllers. If the response is success update the service status = "creating"</li> </ul>

# SO Requirements/Impacts in R6

S.No	Requirement	Code change needed?	Impacted model and required highlevel changes (bpmn->so-bpmn-infrastructure-flows, so-bpmn-infrastructure-common)
4	Upon reception of synchronous response from SDN-C, SO to:	(c) Update local DB of request status (if success response)	Yes <ul style="list-style-type: none"> <li>• <b>Existing workflow to be reused:</b> CreateCustomE2EServiceInstance</li> <li>• Enhance the existing workflow to update the request status in request-DB if response is success.</li> </ul>
		(d) Start a timer (if success response)	Yes <ul style="list-style-type: none"> <li>• <b>Existing workflow to be reused:</b> CreateCustomE2EServiceInstance</li> <li>• Existing workflow to be enhanced by adding tasks from existing workflow - "SDNCAAdapterV1" to start the timer for success response (to wait for asynchronous response from SDN-C)</li> </ul>
		(e) Rollback for failure indication (delete the AAI service instance for rollback)	Yes <ul style="list-style-type: none"> <li>• <b>Existing workflow to be reused:</b> CreateCustomE2EServiceInstance</li> <li>• Enhance the existing workflow by adding a task to invoke existing roll back workflow - "DoCreateServiceInstanceRollback" to delete the service instance in AAI in case of failure.</li> </ul>
5	Upon reception of asynchronous response over DMaaP from SDN-C, SO to:	(a) Determine for which request the response has come.	Yes <ul style="list-style-type: none"> <li>• <b>Existing workflow to be reused:</b> CreateCustomE2EServiceInstance</li> <li>• Existing workflow can be enhanced to check if response from all domain controllers has been received by creating a new task</li> </ul>

# SO Requirements/Impacts in R6

S.No	Requirement	Code change needed?	Impacted model and required highlevel changes bpmn->so-bpmn-infrastructure-flows,so-bpmn-infrastructure-common	
5	Upon reception of asynchronous response over DMaaP from SDN-C, SO to:	(b) Update AAI inventory with service details (status: active)	Yes	<ul style="list-style-type: none"> <li>• <b>Existing workflow to be reused:</b> CreateCustomE2EServiceInstance</li> <li>• Enhance the existing workflow to update the service status = "active" in AAI if the asynchronous response of all domain controllers from SDN-C is success.</li> </ul>
		(c) Send info (async API) to UI with success/failure indication, service details, and reason in case of failure.	Yes	<ul style="list-style-type: none"> <li>• <b>Existing workflow to be reused:</b> CreateCustomE2EServiceInstance</li> <li>• Enhance the existing workflow by adding a new task by exposing a new async API to UI to send the success/failure response, service details and reason for failure case.(*Note)</li> </ul>
		(d) Rollback for failure indication (delete the AAI service instance for rollback)	Yes	<ul style="list-style-type: none"> <li>• <b>Existing workflow to be reused:</b> CreateCustomE2EServiceInstance</li> <li>• Enhance the existing workflow to invoke existing roll back workflow - "DoCreateServiceInstanceRollback" for failure response.</li> </ul>
		(e) Update local DB entries	Yes	<ul style="list-style-type: none"> <li>• <b>Existing workflow to be reused:</b> CreateCustomE2EServiceInstance</li> <li>• Enhance the existing workflow by adding a task to update the service request progress based on the asynchronous success/failure response in request-DB.</li> </ul>
		(f) Update the inter-domain link status in Aai based on the success/failure response.	Yes	<ul style="list-style-type: none"> <li>• <b>Existing workflow to be reused:</b> CreateCustomE2EServiceInstance</li> <li>• Enhance the existing workflow by adding a task to update inter-domain link status = "UP" in AAI if the response is success.</li> </ul>

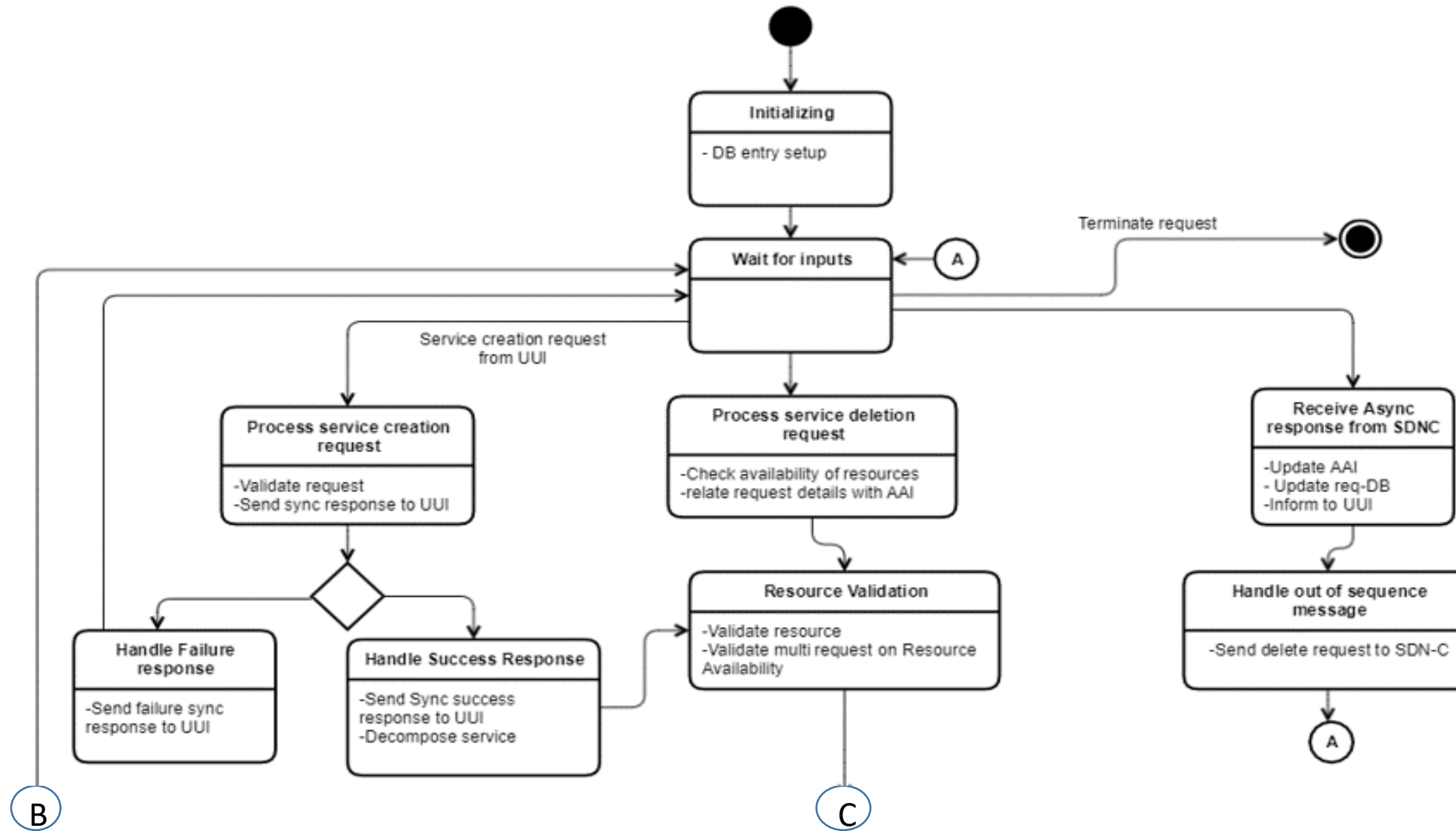
# SO Requirements/Impacts in R6

S.No	Requirement	Code change needed?	Impacted model and required highlevel changes bpmn->so-bpmn-infrastructure-flows,so-bpmn-infrastructure-common
6	Upon expiry of timer for async response from SDN-C, SO to:	(a) Send a failure indication to UI with service info and reason	<ul style="list-style-type: none"> <li>• <b>Existing workflow to be reused:</b> CreateCustomE2EServiceInstance</li> <li>• Enhance the existing workflow by adding task created for the requirement (5c)(*Note)</li> </ul>
	(b) Update local DB entries	Yes	<ul style="list-style-type: none"> <li>• <b>Existing workflow to be reused:</b> CreateCustomE2EServiceInstance</li> <li>• Enhance the existing workflow by adding a task to update the service request failure in request-DB.</li> </ul>
7	SO to be able to handle multiple service creation/deletion requests in parallel (Phase 2), i.e., handle a 2nd request before the first one is fully complete	Yes	<ul style="list-style-type: none"> <li>• <b>Existing workflow to be reused:</b> CreateCustomE2EServiceInstance</li> <li>• The existing workflow to be enhanced to support the multiple request handling logic.</li> </ul>

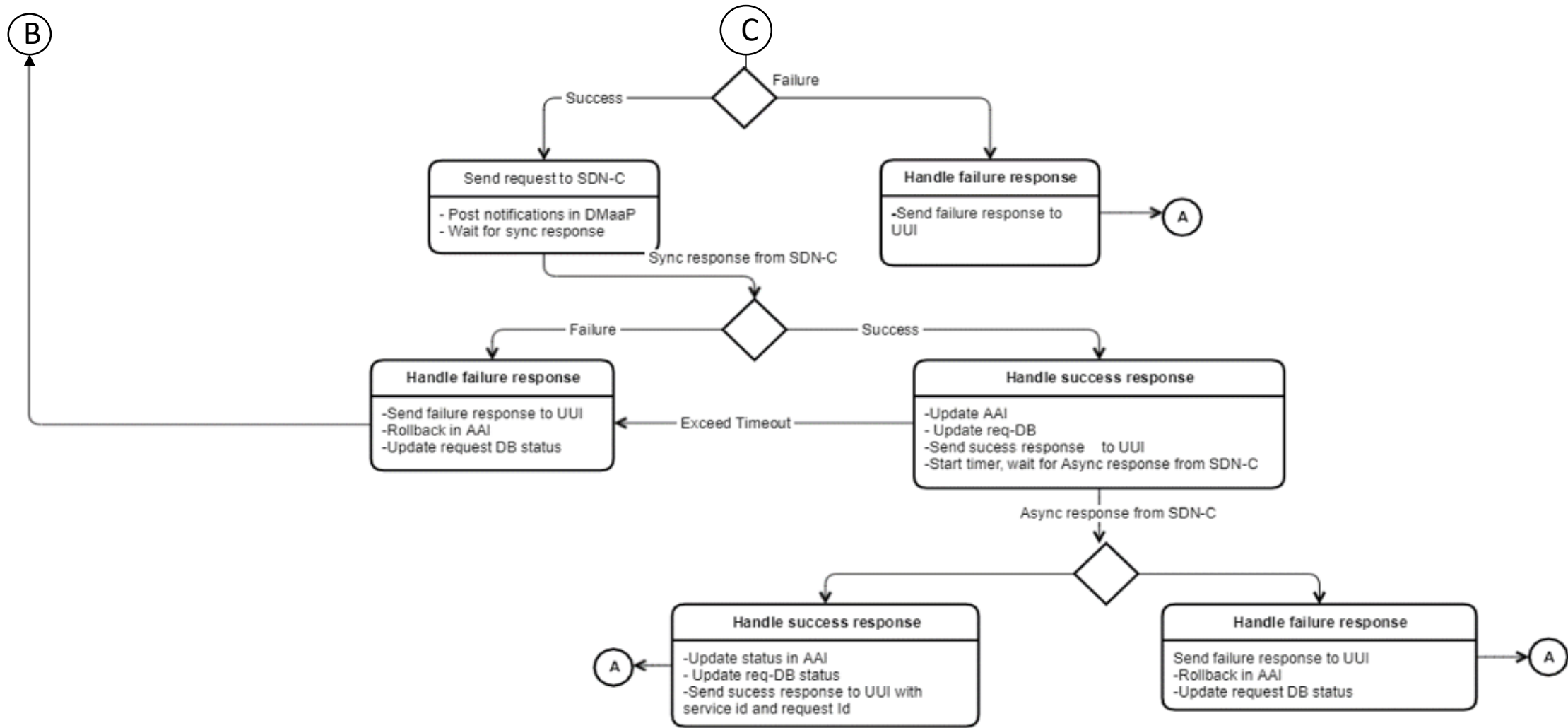
\*Note: Pending confirmation from External-API if any API is exposed to consume the response from SO. Based on that existing workflow will be enhanced.



# SO State Diagram



# SO State Diagram





# SDNC Requirements/Impacts in R6

1. SDN-C should be able to receive DMaaP messages from SO for service creation and deletion.
2. Upon reception of DMaaP messages from SO for service creation/deletion:
  - a) SDN-C to determine which external SDN controller to be invoked using the “domain-type” info received in the request from SO.
  - b) Persist the request details in local DB
  - c) Check validity of request, and if valid, go to step (d), else send a synchronous response to SO with failure indication.
  - d) SDN-C to prepare and send the request for service creation request to the SDN controller determined in 2(a), and start a timer.
3. Upon reception of synchronous response from SDN controller, SDN-C to:
  - a) Send a synchronous response (over DMaaP) indicating acceptance/rejection of the request (as received from the SDN controller)
  - b) Update the resource status (under service instance [domain]) as creating.
4. Upon reception of asynchronous response from SDN controller, SDN-C to:
  - a) Determine for which request the response has come (ignore if no request found)
  - b) Prepare and send DMaaP message to SO with the appropriate details (success/failure, service details, reason code in case of failure)
  - c) Update DB entries
5. Upon expiry of the async response timer, SDN-C to:
  - a) Send a DMaaP message to SO with failure details
  - b) Update DB entries (Note)
6. Topology discovery

# SDNC Impacts

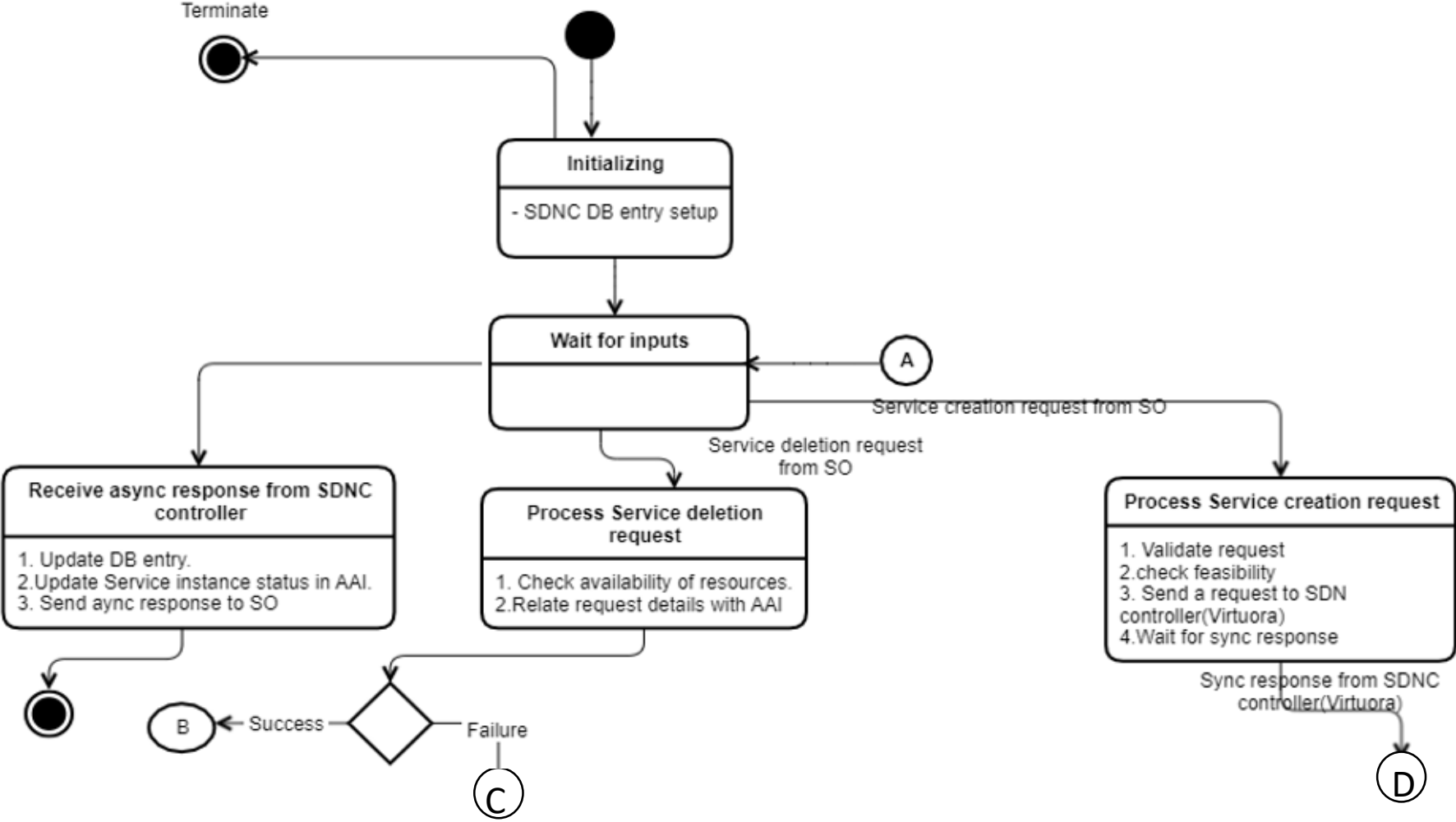
Class/sub-component	Impact Description	Requirement reference	Remarks
dmaap-listener under ccsdk-sli-northbound package	New SDNC-SO Consumer class	1, 2.a,	<ul style="list-style-type: none"> <li>A new SDNC-SO consumer class to be written to get notifications from SO and perform validation logic and invoke RPCs for Service Creation and Deletion.</li> </ul>
SDNC DB	New table in SDNC DB	2.b. , 4.a	<ul style="list-style-type: none"> <li>A new table to be created in DB to store request details.</li> </ul>
ccsdk/sli/adaptors - PublisherApilmpl Class	Reuse existing adaptor	2.c	<ul style="list-style-type: none"> <li>Existing class/adaptor can be used to publish notifications with success or failure response back to SO.</li> </ul>
ccsdk-sli-northbound	New Package - RPCs and timer logic	2.d	<ul style="list-style-type: none"> <li>A new package to be created to write RPCs for OpenROADM Service Creation/Deletion and T-API Service Creation/Deletion.</li> </ul>
generic-resource-api 'org.onap.ccsdk.sli.plugins.restapicall.R estapiCallNode'	Reuse rest-api-call-node adaptor to invoke External Controllers	2.d	<ul style="list-style-type: none"> <li>rest-api-call-node will be used in DG to invoke External controller to send Request for Service creation or Deletion.</li> </ul>
generic-resource-api - messengerouter- publisher	Reuse existing adaptor – To be used from DG	2. c, 3.a, 5.a,4.b	<ul style="list-style-type: none"> <li>Existing class/adaptor will be used to publish callback sync/async notifications back to SO via DG.</li> </ul>

# SDNC Impacts

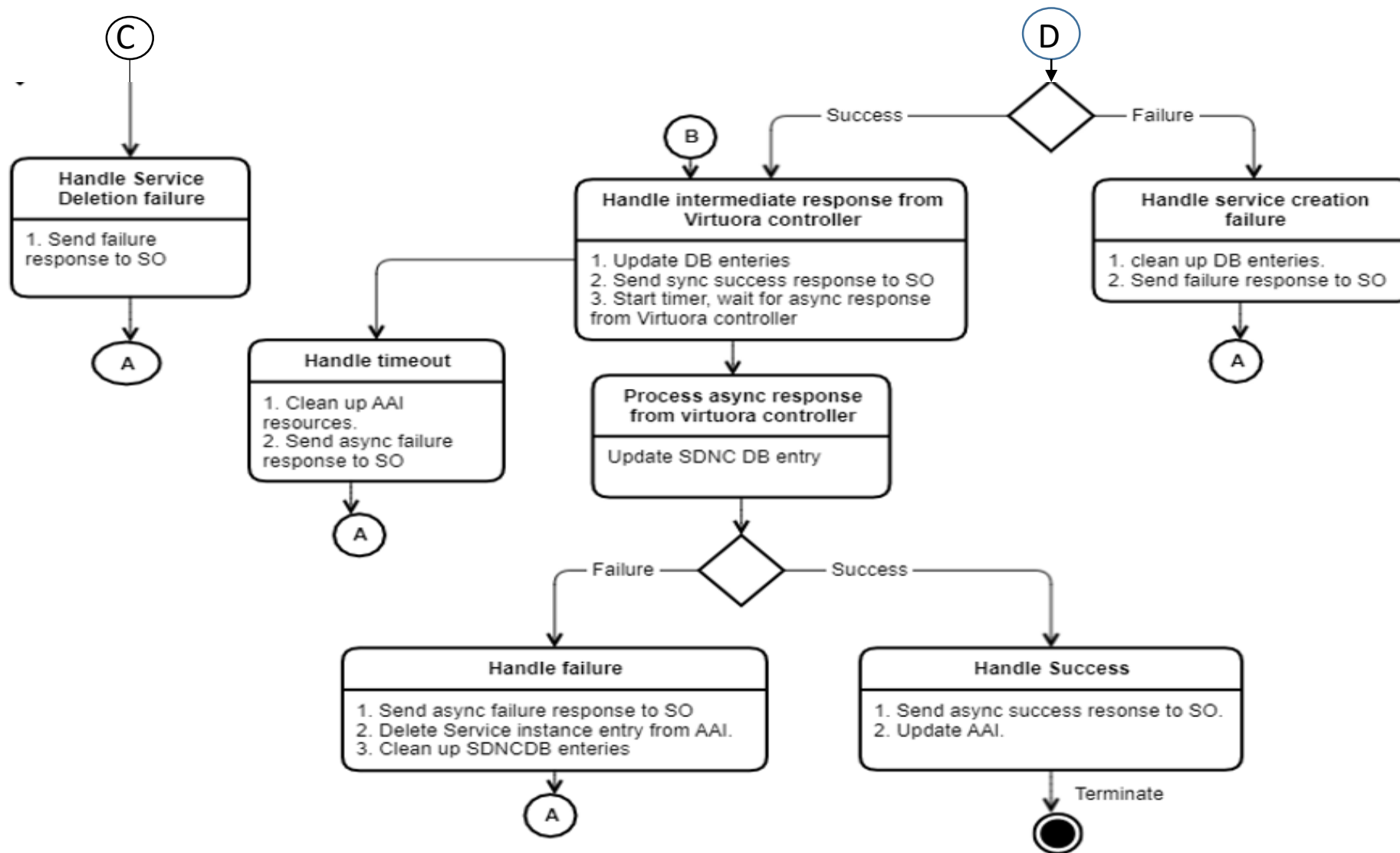
Class/sub-component	Impact Description	Requirement reference	Remarks
generic-resource-api 'org.onap.ccsdk.sli.adaptors.aai.AAISe rvice'	Reuse existing adaptor	3.b	<ul style="list-style-type: none"><li>• An existing AAI plugin will be used to create or update resources in AAI.</li></ul>
generic-resource-api 'org.onap.ccsdk.sli.adaptors.resource. sql.SqlResource'	Reuse existing plugin	4.a, 4.c,5.b	<ul style="list-style-type: none"><li>• In case of async response, to co-relate response and request ids a new table needs to be created.</li><li>• Update operation to be performed on DB to change request status.</li></ul>

Note\* - New DGs to be designed for OpenROADM Service Create/Delete, T-API Service Create/Delete and Resource Topology of OpenROADM and T-API based Virtuora controllers.

# SDNC – State Diagram



# SDNC – State Diagram



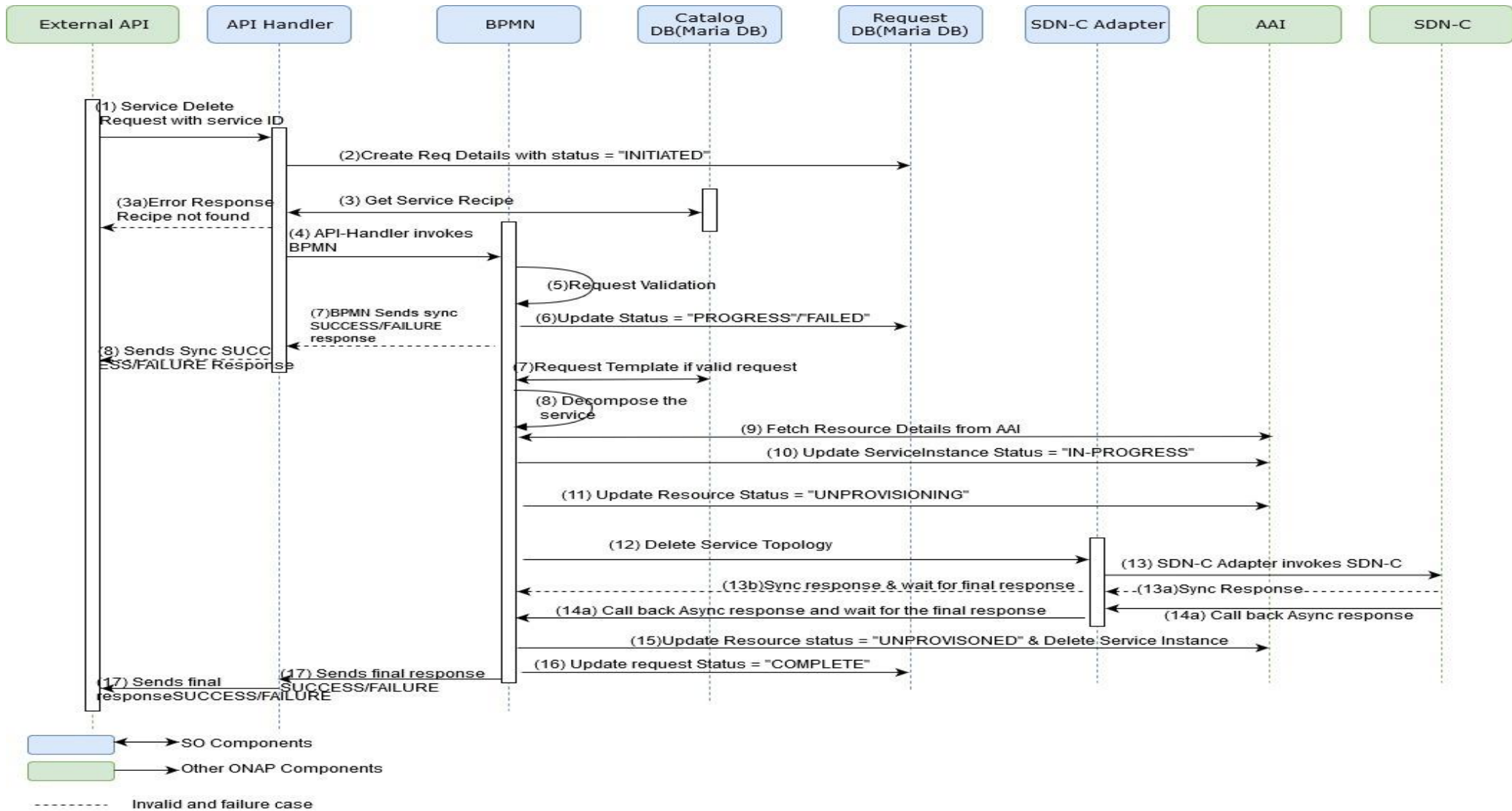
# References

- <https://wiki.onap.org/display/DW/Multi-domain+Optical+Network+Services>

# Backup

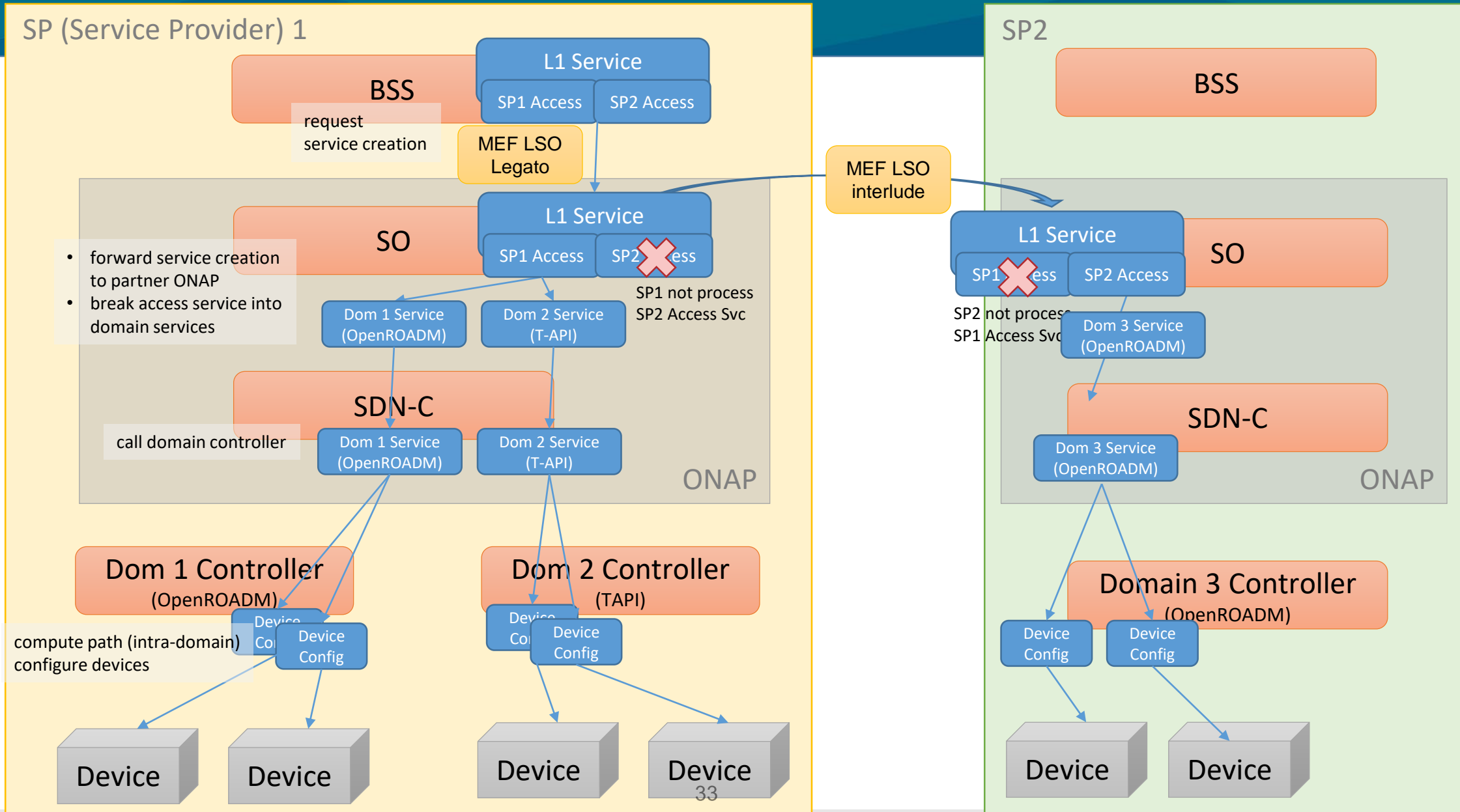
- Service Termination Flow
- Run Time Data Flow

# Service Termination





# Run-time Data Flow



# AAI Tree Structure (after Current 3<sup>rd</sup> Party Controller Onboarding)

