Framework for Abstraction and Control of Transport Networks

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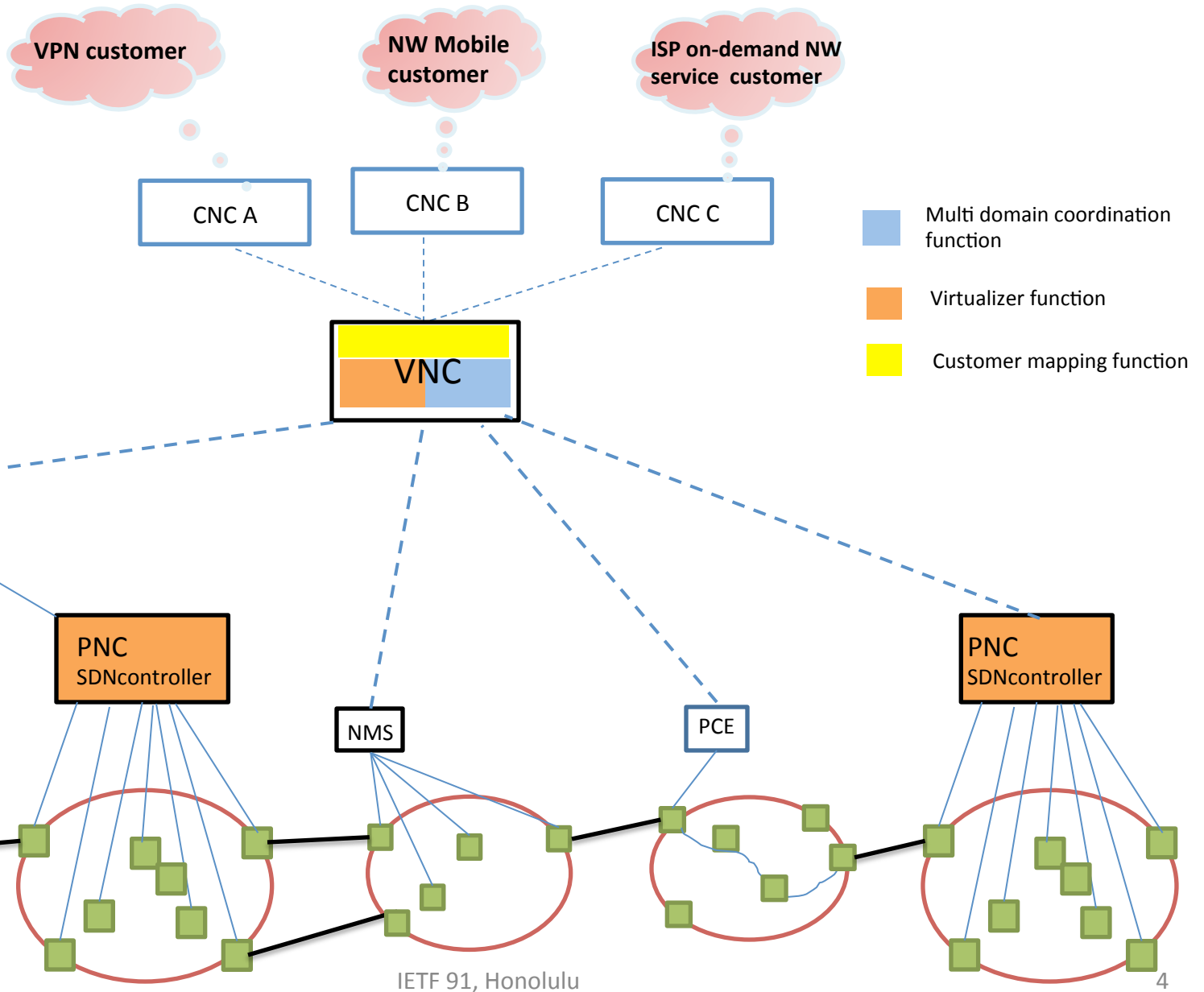
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Drivers of ACTN

- Operators want to build on top of what they have deployed while pursuing new green field. One of the drivers for ACTN is an horizontal integration based on multi-domain coordination function to enable legacy control/management domains while allowing new domain control like ONF SDN controller.

- Separating "virtualizer" layer from (physical) network control/ management (with minor add-on on these). By doing so, the operational simplification for operators can achieved, helping the introduction of new services/applications that are not tied with specific data plane technologies.

- ACTN reference model zooms on control hierarchy with specific roles/ functions of control entities to support the two main drivers in the aforementioned bullets.
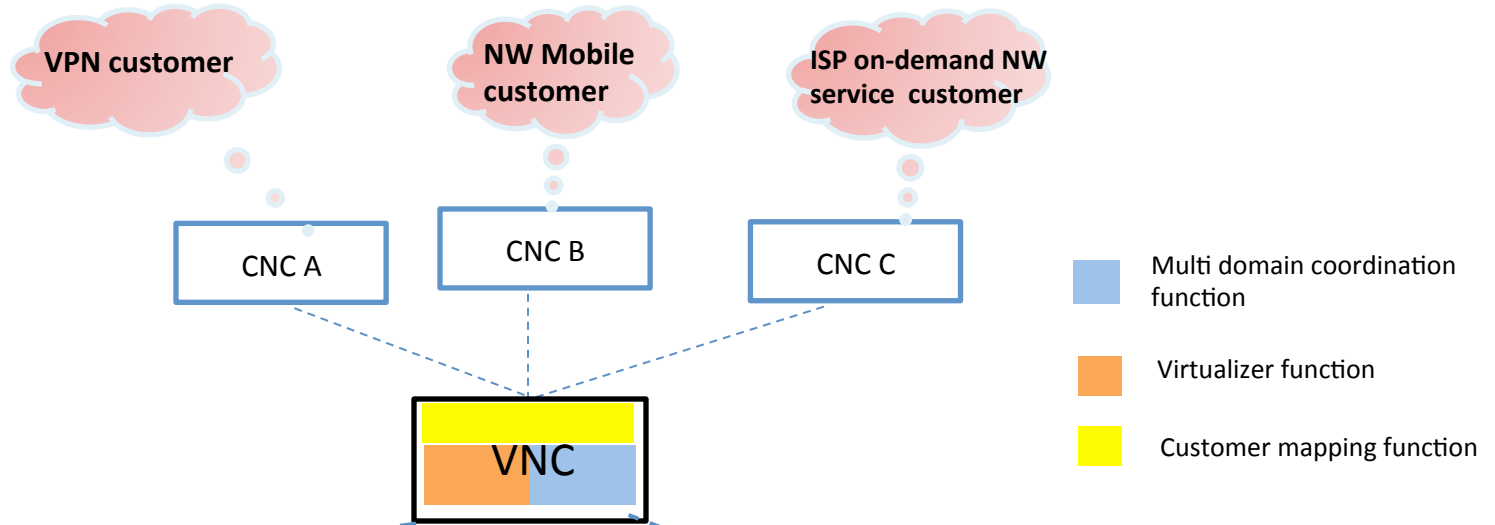
Terminology

- Control Domain: Everything that is under the control of the same controller.
- PNC (Physical Network Controller) is a domain control/management entity (e.g., GMPLS/ASON CP, PCE, OF controller, NMS/EMS) that is responsible for domain-specific network control operations such as configuring network elements, provisioning, monitoring, protection and recovery of the networks in charge.
- VNC (Virtual Network Controller) is VN operation coordinator/orchestrator that is responsible for supporting customers' VN creation, modification and deletion and for multi-domain coordination/orchestration in creating an end-to-end network topology based on each providers' network topology (raw of abstract) and mapping customer's virtual network requirements into network control mechanisms so that PNCs can support.
- CNC (Customer Network Controller) is responsible for creating VN service instantiation and providing service/application requirement including endpoint information to network operators. Examples of Customers are VPNs, MVNO, ISP, etc.
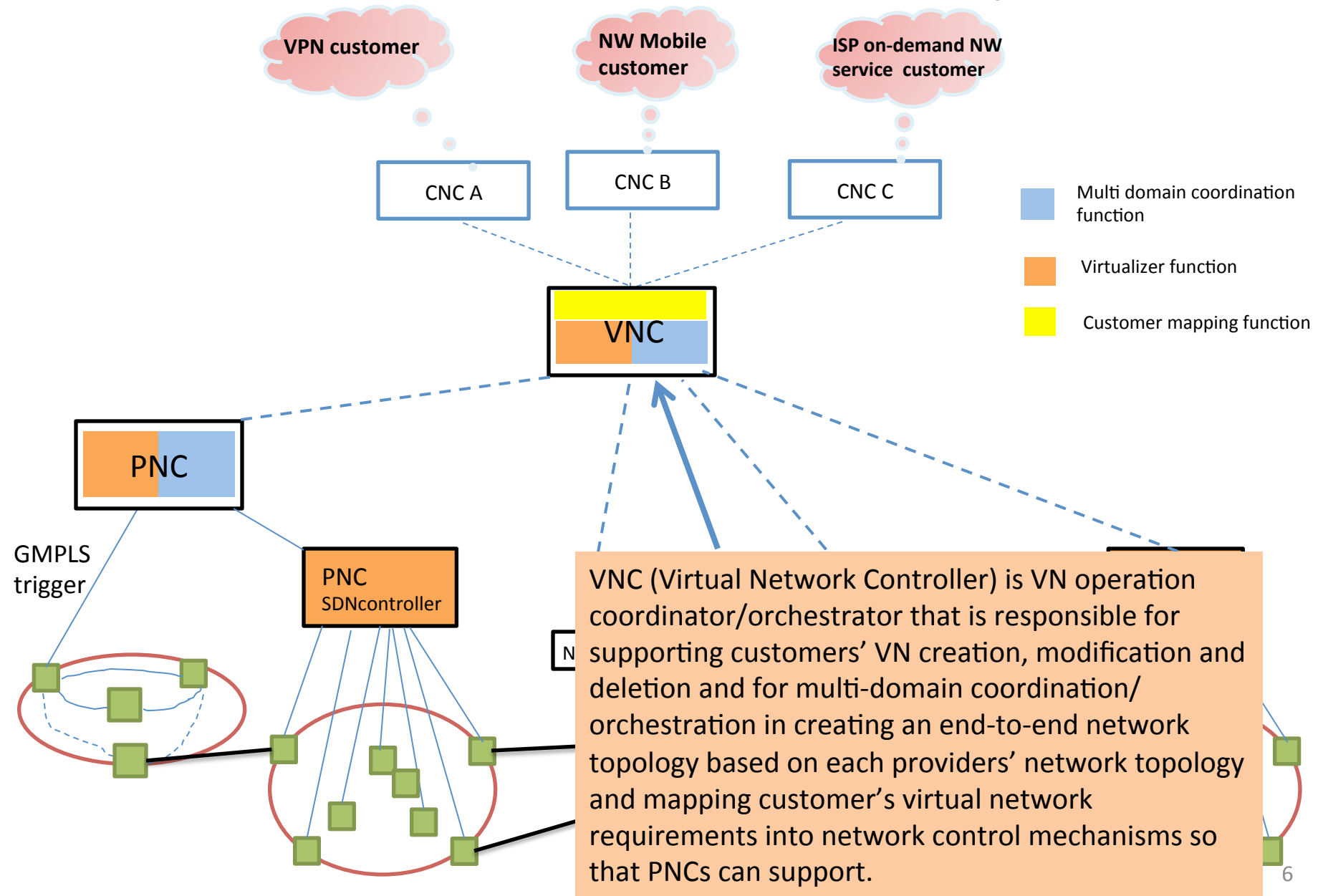
Controller Role Hierachy

Controller Role Hierachy

VPN customer

NW Mobile customer

ISP on-demand NW service customer

CNC A

CNC B

CNC C

Multi domain coordination function

Virtualizer function

Customer mapping function
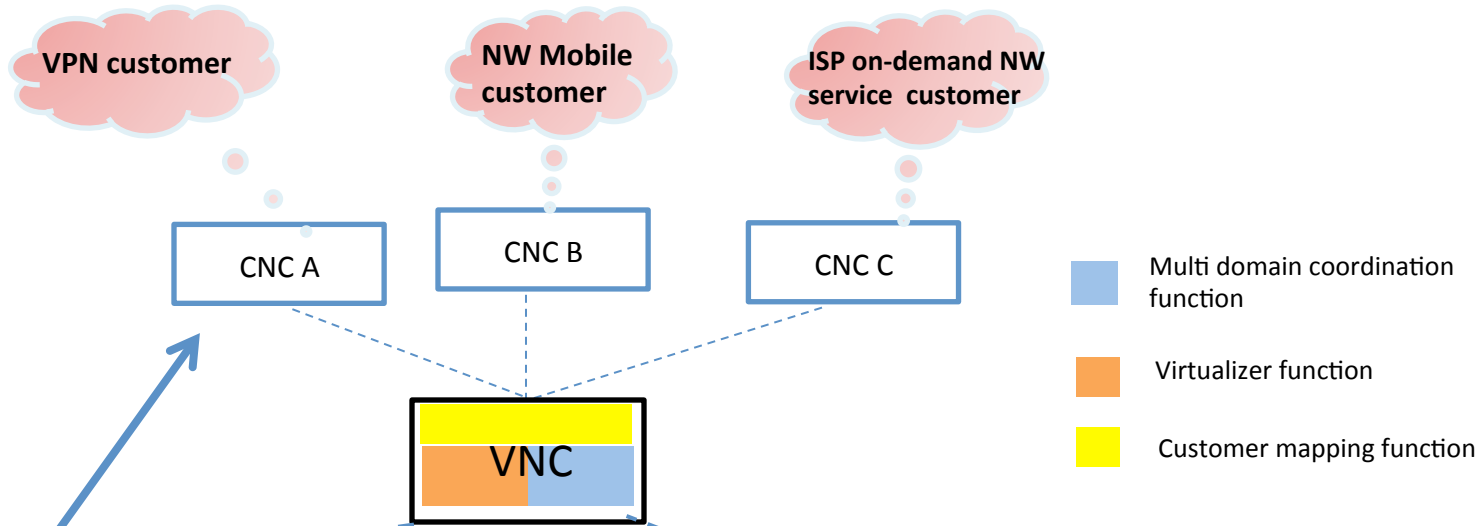
VNC

PNC

GMPLS trigger

PNC
SDNcontroller

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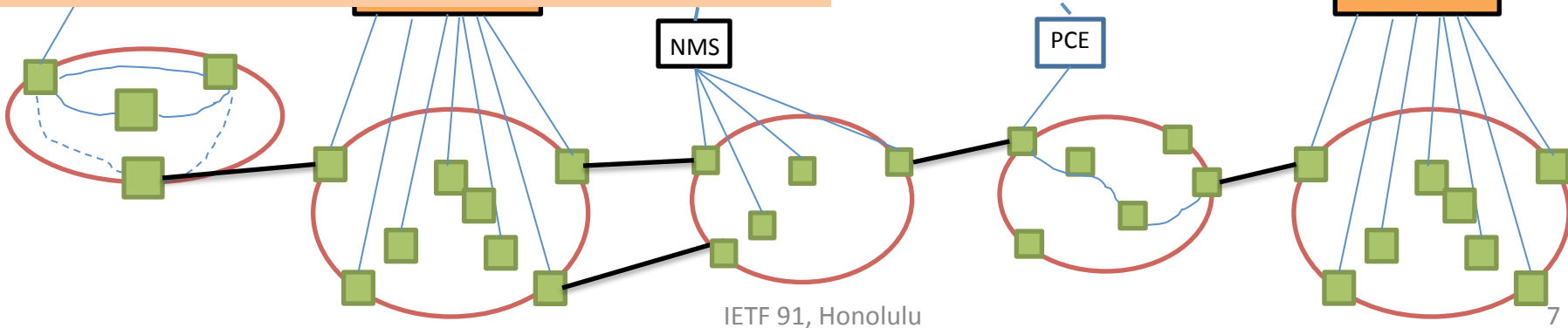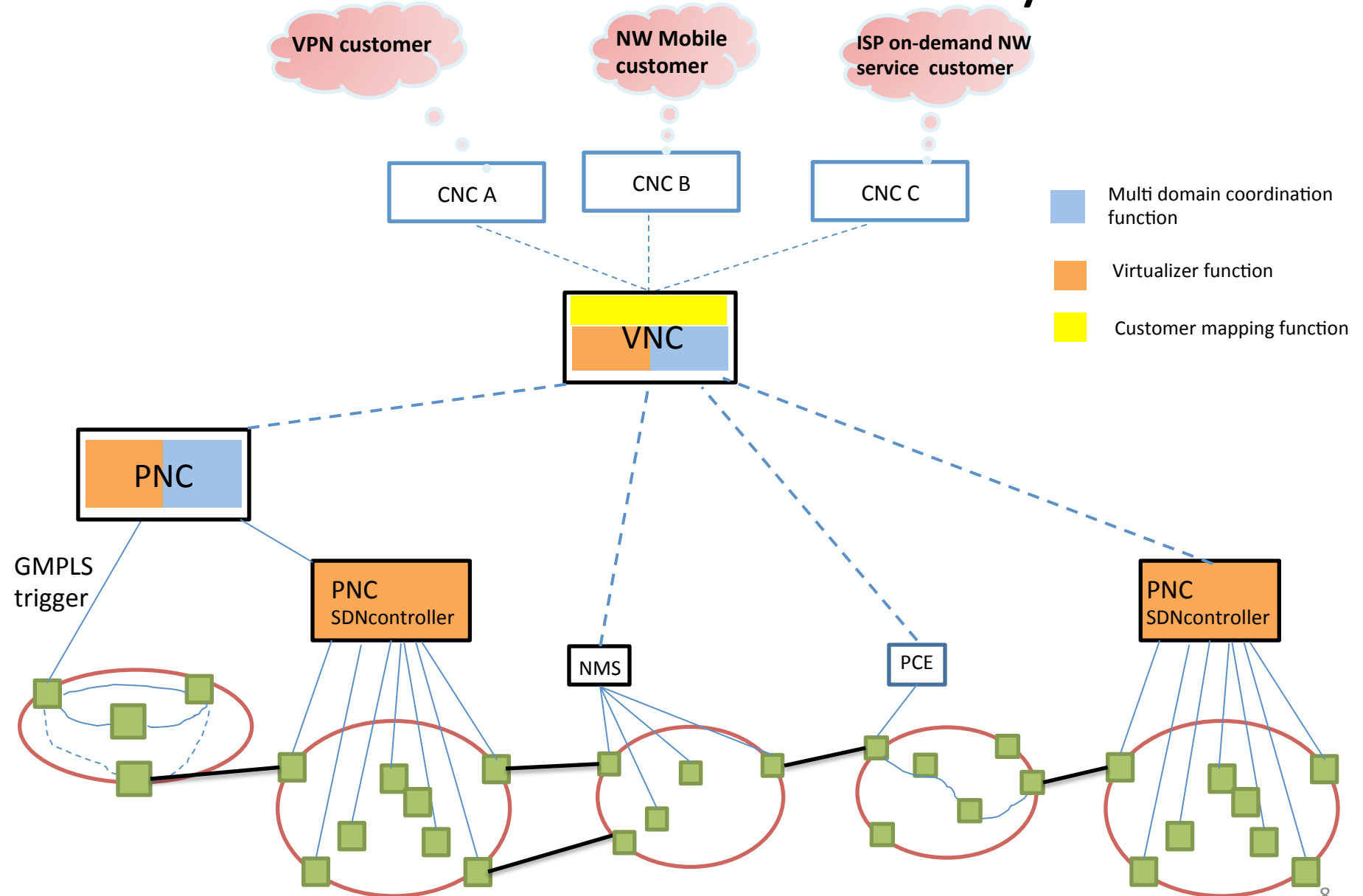
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VNC

PNC

PNC SDNcontroller

GMPLS trigger

Multi domain coordination function

Virtualizer function

Customer mapping function

VNC (Virtual Network Controller) is VN operation coordinator/orchestrator that is responsible for supporting customers' VN creation, modification and deletion and for multi-domain coordination/ orchestration in creating an end-to-end network topology based on each providers' network topology and mapping customer's virtual network requirements into network control mechanisms so that PNCs can support.

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Controller Role Hierachy

VPN customer

NW Mobile customer

ISP on-demand NW service customer

CNC A

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CNC C

Multi domain coordination function

Virtualizer function

Customer mapping function

VNC

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NMS

PCE

PNC
SDNcontroller

Controller Role Hierachy

- **Control Domain: Everything that is under the control of the same controller.**

Controller Functions

Multi-domain coordination function:
- What is a domain? Everything that is under the control of the same controller.
- To overcome specifities of the different domain building a single abstracted end-to-end network topology to coordinate end-to-end path computation and provisioning.
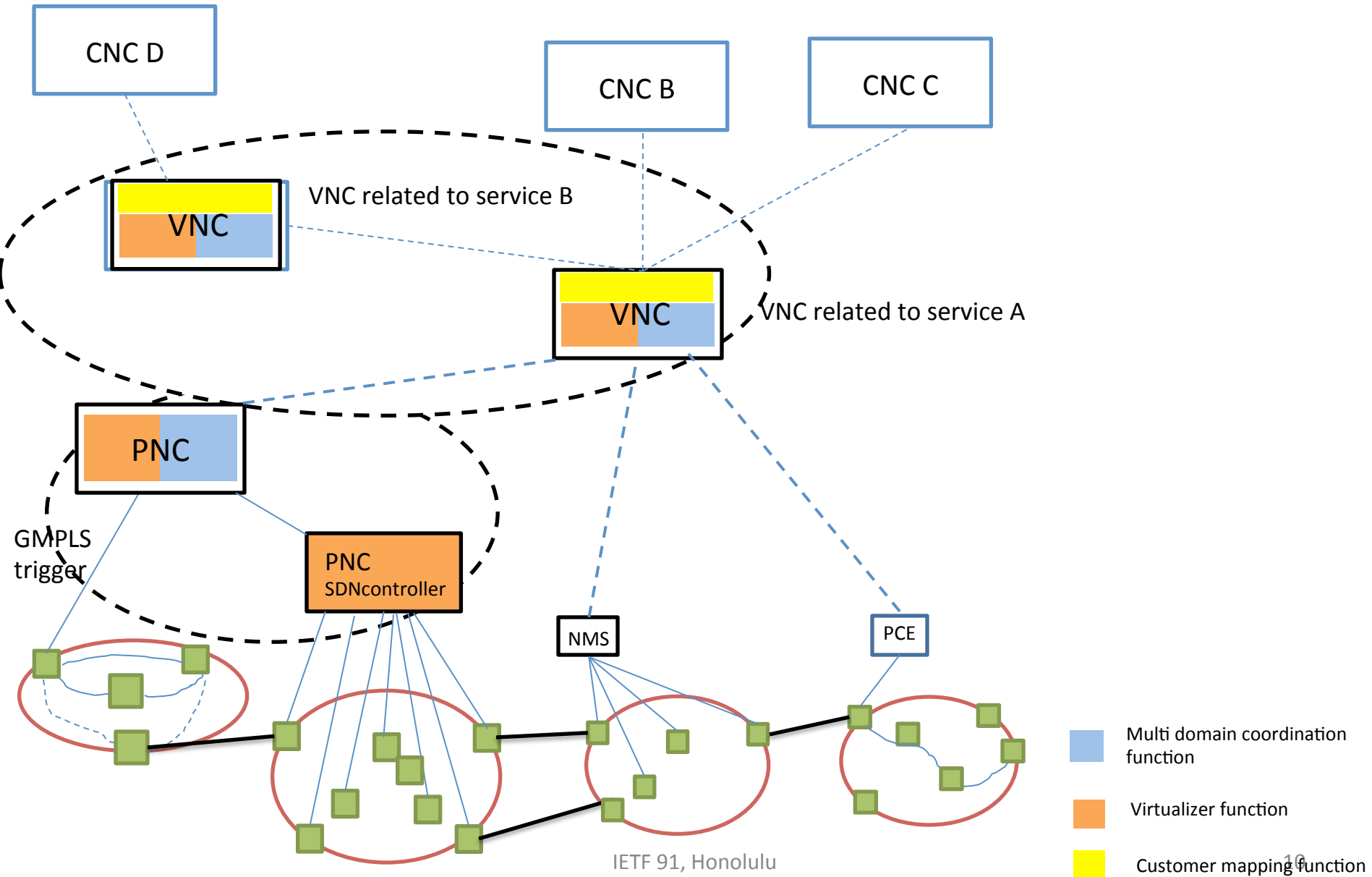
Virtualizer function:
- To provide an abstracted view of the underlying network resources towards client (i.e. customer/higher level controller PNC/VNC).
- Is present with different scope but same target, at any of the 3-tier level of ACTN Reference Model.
- In the VNC to provide allocation of abstract resources for the specific customer or application.
- In the PNC to provide mapping between the abstracted CP model of VNC and the specifics of the controlled domain.
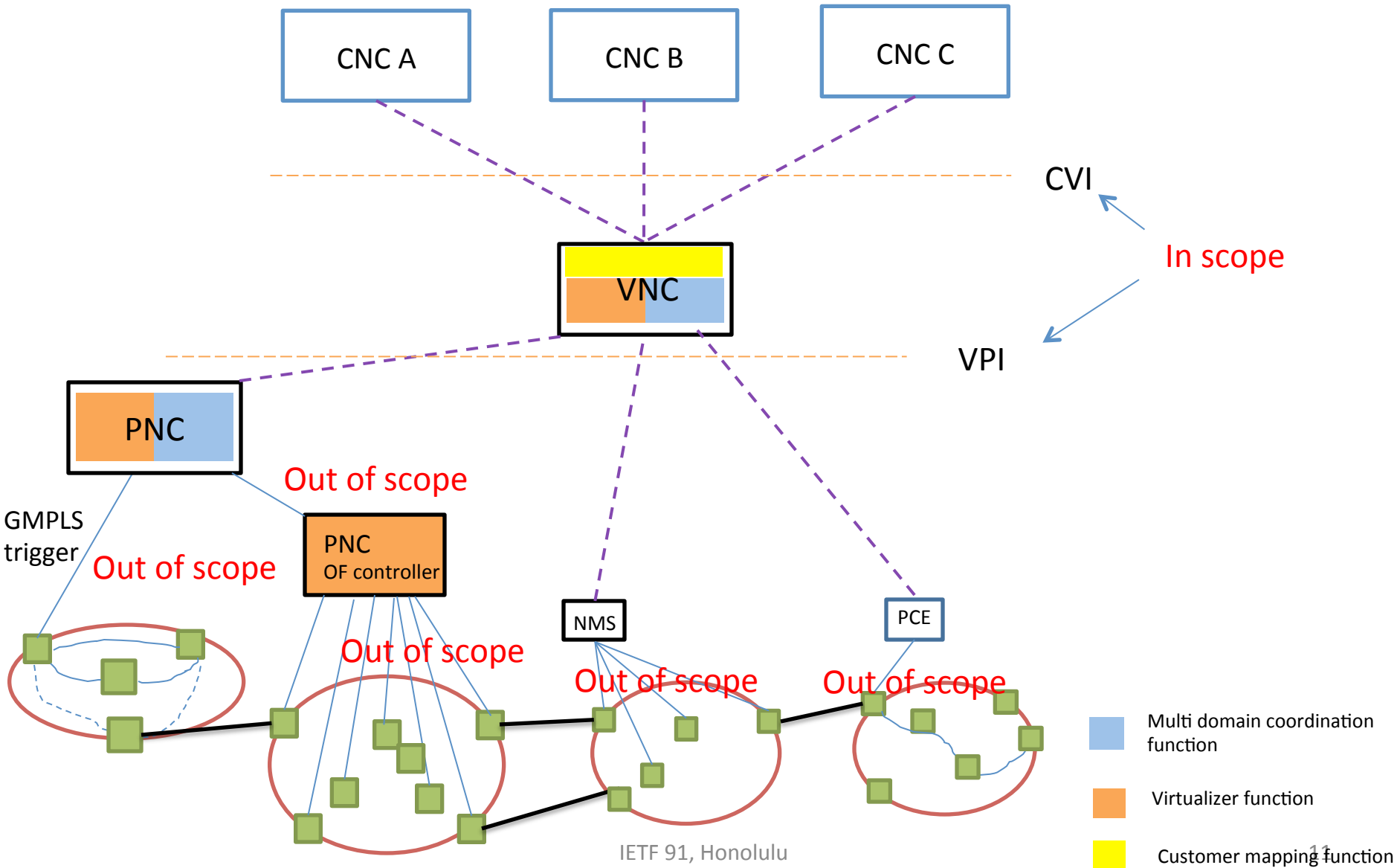
Customer mapping function:
- In charge of mapping customer VN setup commands into network provisioning requests to the PNC according to business OSS/NMS provisioned static or dynamic policy .

Controller Role Recursivness

CNC D

CNC B

CNC C

VNC related to service B

VNC

VNC

VNC related to service A

PNC

GMPLS trigger

PNC
SDNcontroller

NMS

PCE

Multi domain coordination function

Virtualizer function

Customer mapping function

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Key Interfaces

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Interfaces Definitions

CNC -VNC Interface (CVI):

- To allow programmability to create, modify and delete virtual network service instances .
- Should support open standard information models and protocol-specific interface data schema able to carry abstracted topology
- It could report potential network topology availability (available path in tunnel or graph) if queried from CNC
- To permit request of configuration of virtual network resources exposed to CNC by virtualization function at the VNC level.

VNC-PNC Interface (VPI):

- To allow programmability to service provider(s) (through VNCs) to facilitate path computation, provisioning, and restoration
- To communicate creation request of new conncetivity in the physical network (including OAM, layers mapping, performances)
- Since physical NW may itself be virtual, seamless mapping and translation between physical and virtual resources.

CVI and VPI are different but some function/model may intersect

- For example: case for interfaces not fitting the recursive model (e.g. GMPLS)

PNC-PNC or VNC-VNC : which interface for recursivness?