Network Control Function Virtualization for Transport SDN

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SDN RG
IETF 88 Vancouver

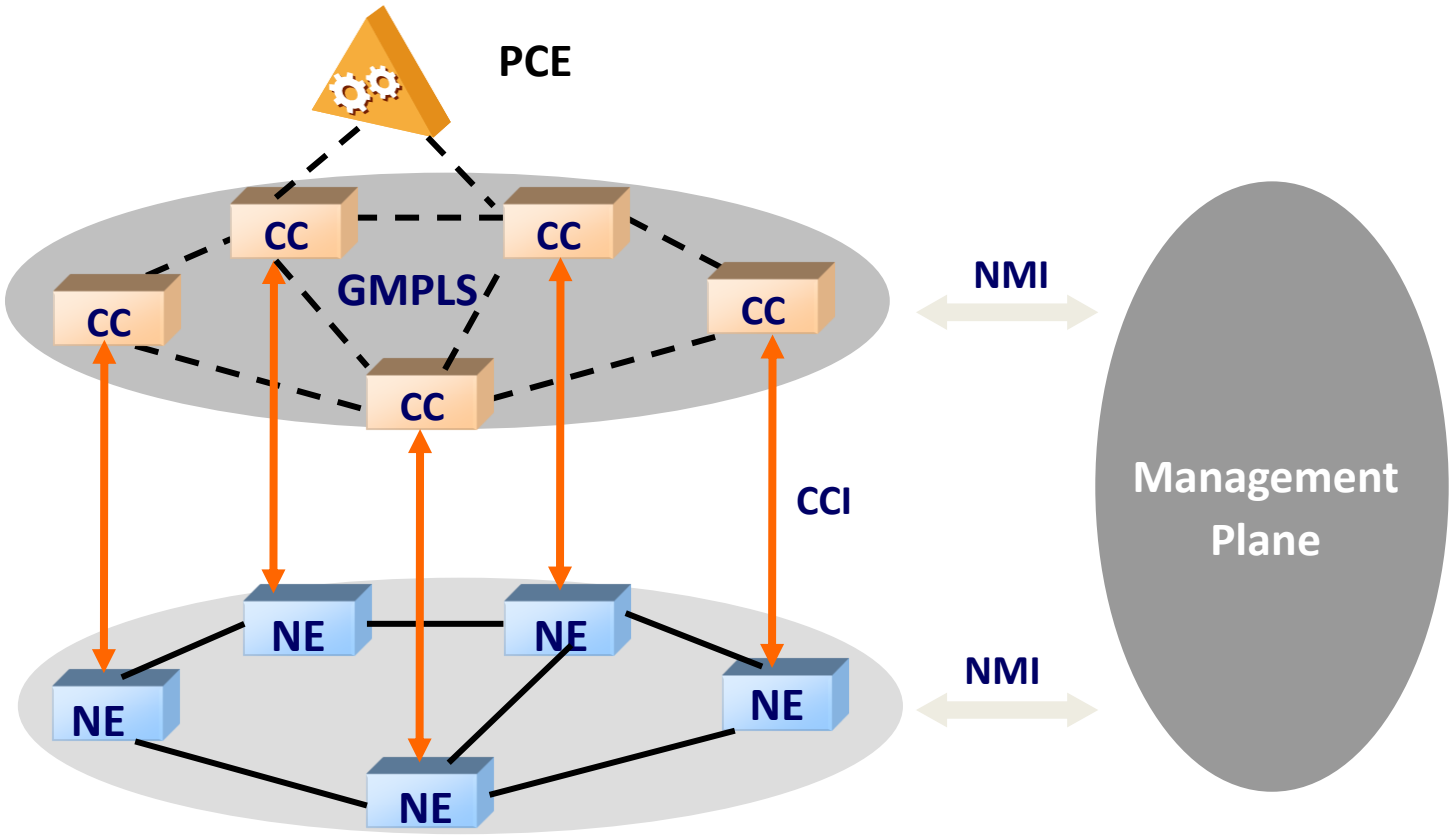
Transport Network Control

- SDN concept has been applied for transport networks.
  - Separation of control plane functions from data planes by GMPLS/ASON control plane technology
    - Link Discovery (LMP)
    - Dissemination of Link/Resource Information (OSPF-TE)
    - Connection/Provisioning (RSVP-TE)
  - Global view of a network
    - TEDB, LSDB give the global domain view of a network
  - Logically centralized control
    - PCE for path computation; Stateful PCE for initiation of path provisioning (in cooperation with GMPLS signaling)
- There is little value of reinventing these network control protocols.

IETF Control Plane Architecture

GMPLS Control Plane

- Neighbor Discovery & Link/Resource discovery (LMP)
- Routing (OSPF-TE/ISIS-TE)
- Signaling (RSVP-TE)



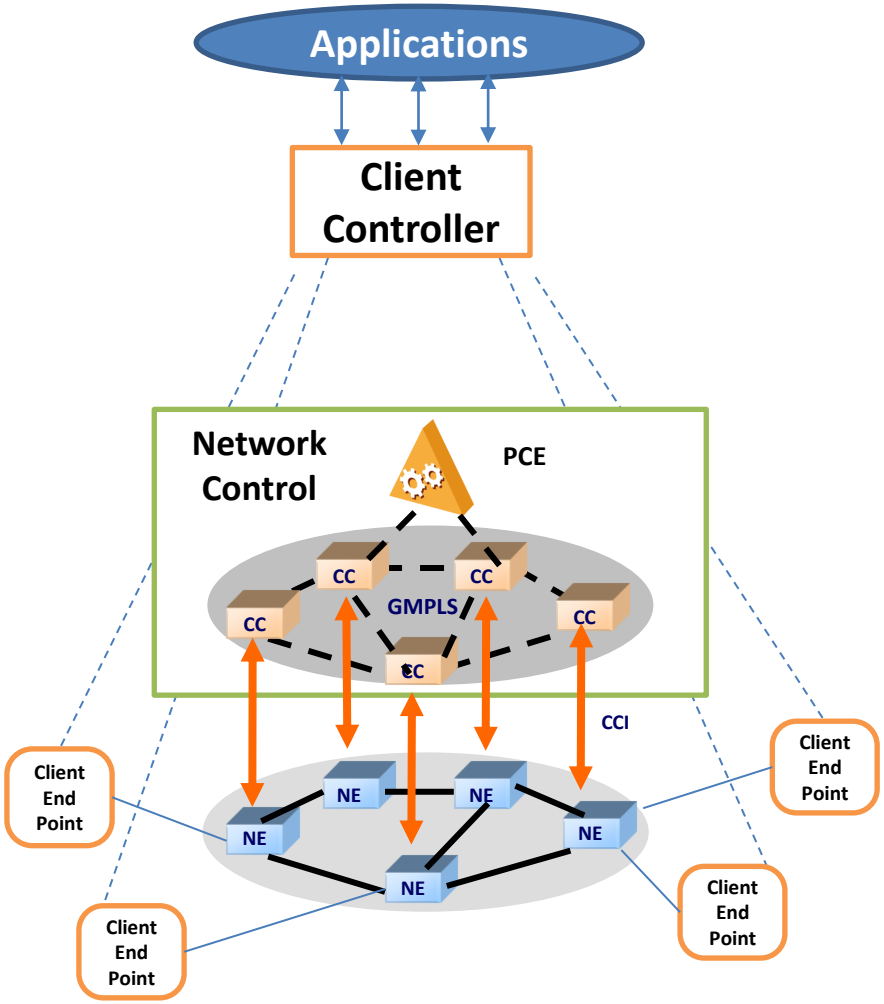
CC: Connection Control
CCI: Connection Control Interface
NE: Network Element
NMI: Network Management Interface

Is there a need to virtualize network control function?

- Why?
- How?

Client Control

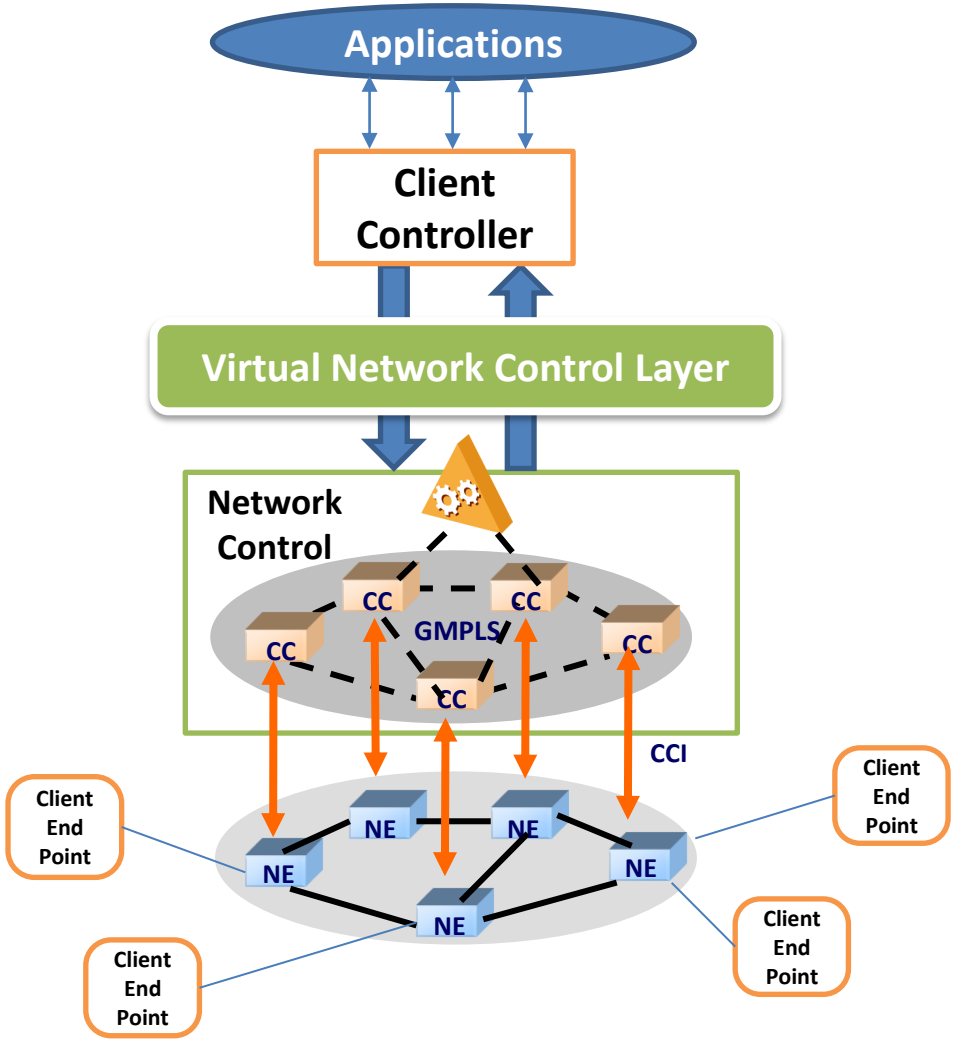
- Supports various applications via various NB APIs (e.g., OpenStack, etc.)
- Various types of client to network
  - Data Center Operators
  - Virtual Network Providers
  - Contents Providers
  - Carriers of carrier
- Primary source for application service/connectivity requirements and location information (client end points).



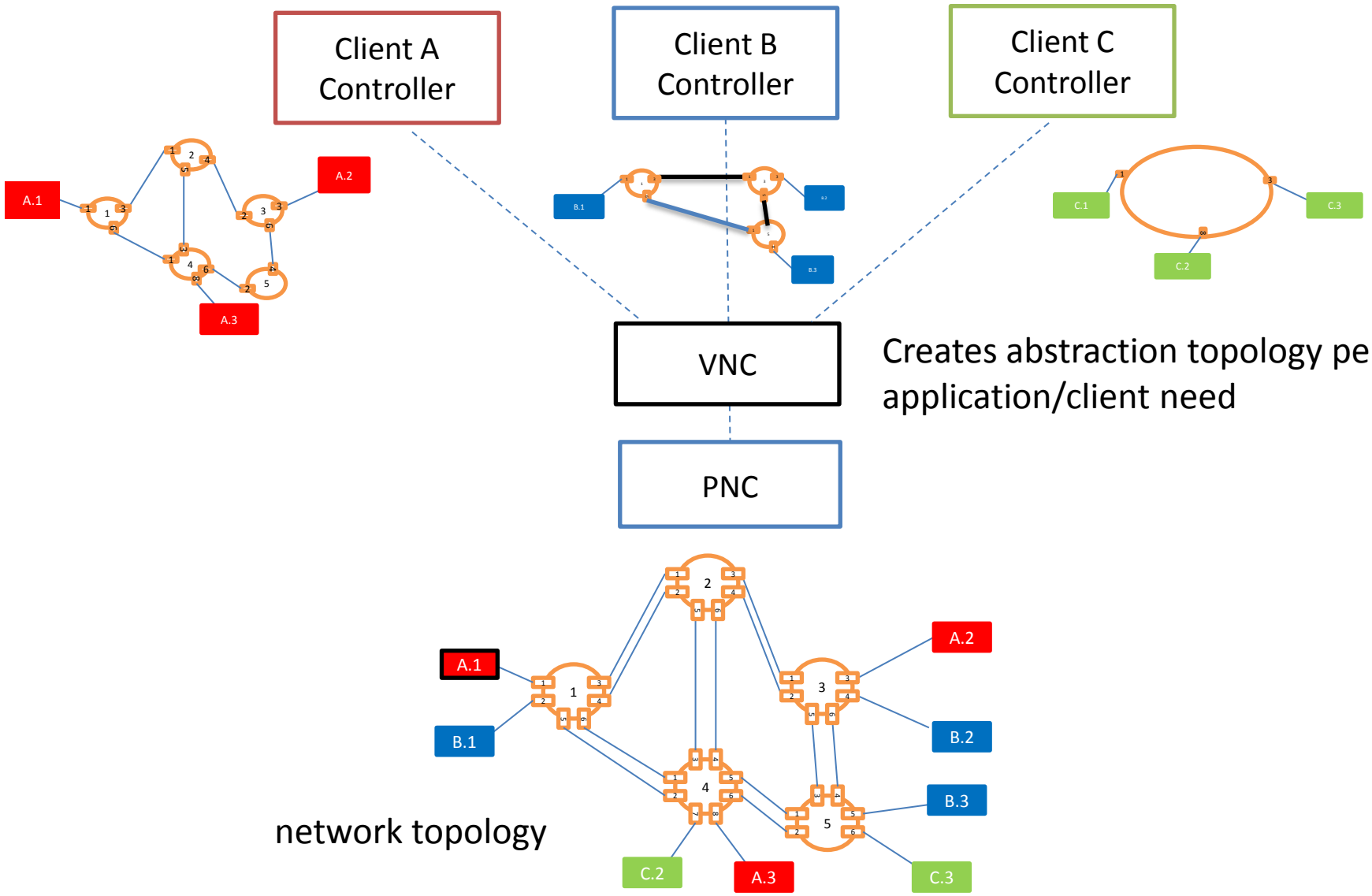
But current GMPLS/PCE architecture does not support programmable interfaces for network virtualization

Virtual Network Control Layer

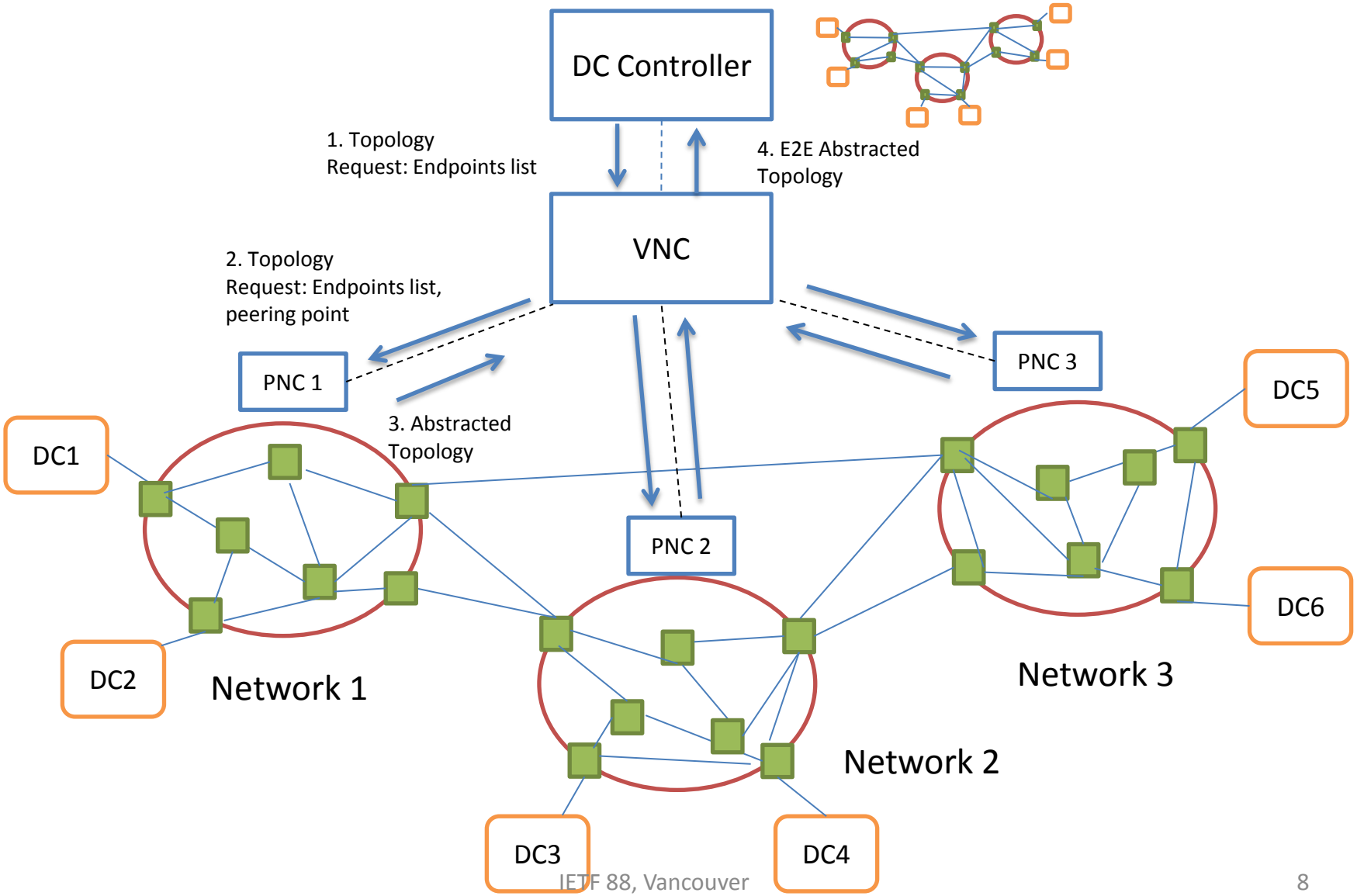
- Virtual Network Control separated from Physical network control
  - Open interfaces creation
  - Third party developer can develop VNC layer
- Virtual Network Control Layer provides virtual network control functions:
  - Virtual Service Creation
  - Virtual Path Computation
  - Virtual Topology Database Creation
  - Virtual Network Discovery
  - Topology Abstraction for Virtual Service
  - Virtual connection setup



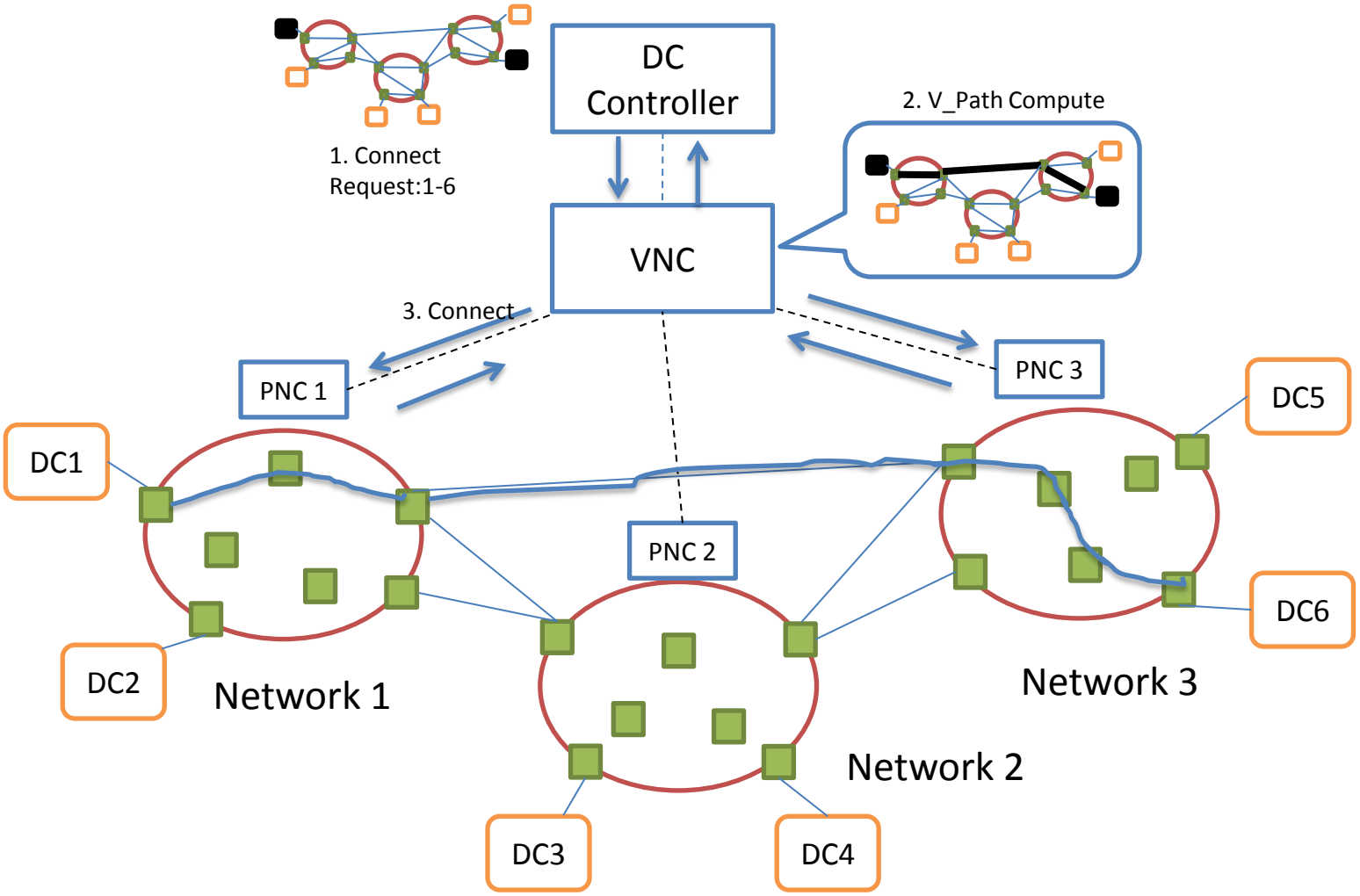
Use-case A: application-specific topology abstraction and virtual control



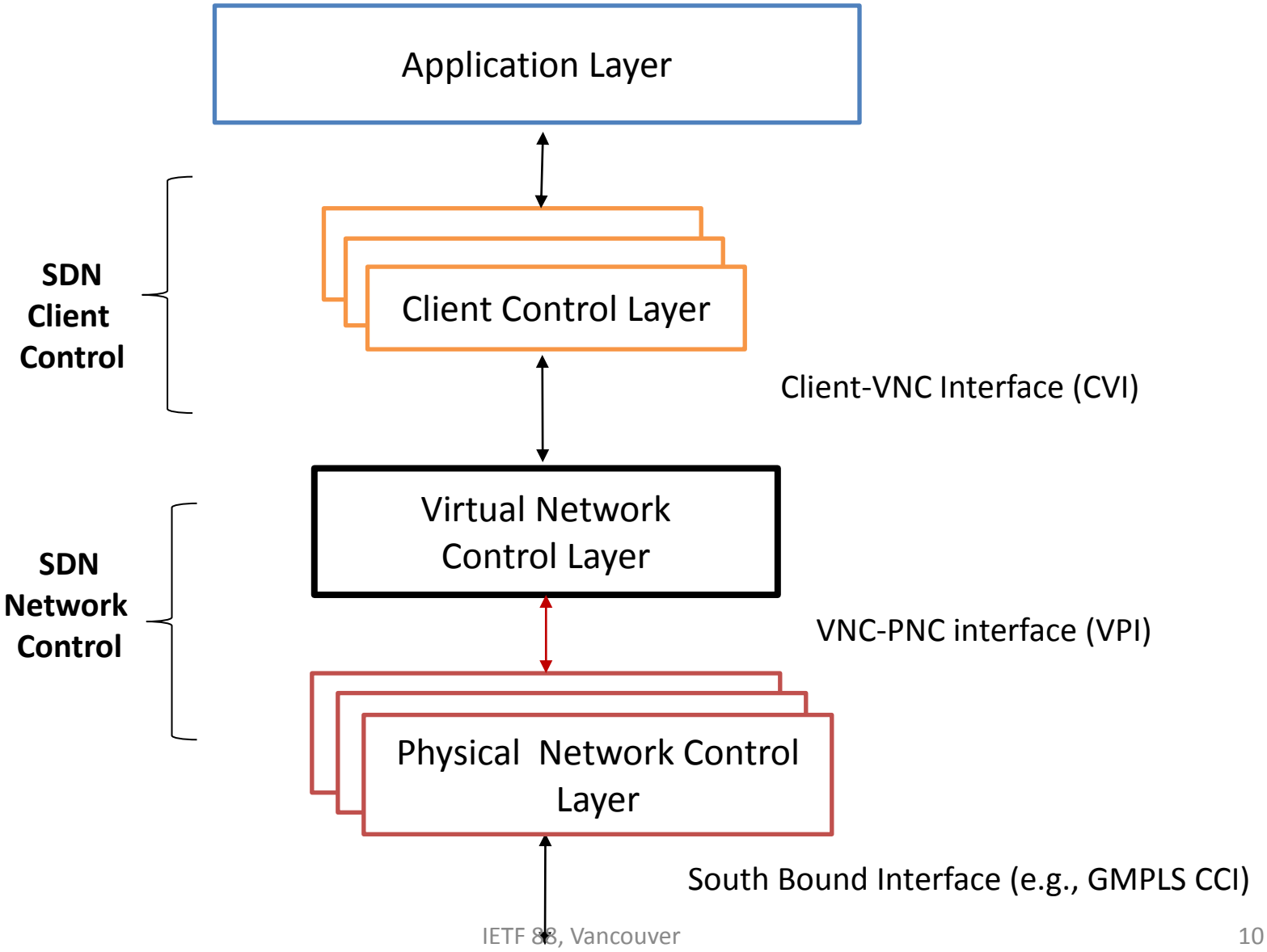
Use-case B1: Dynamic DCI in multi-domain network (Topology Request)



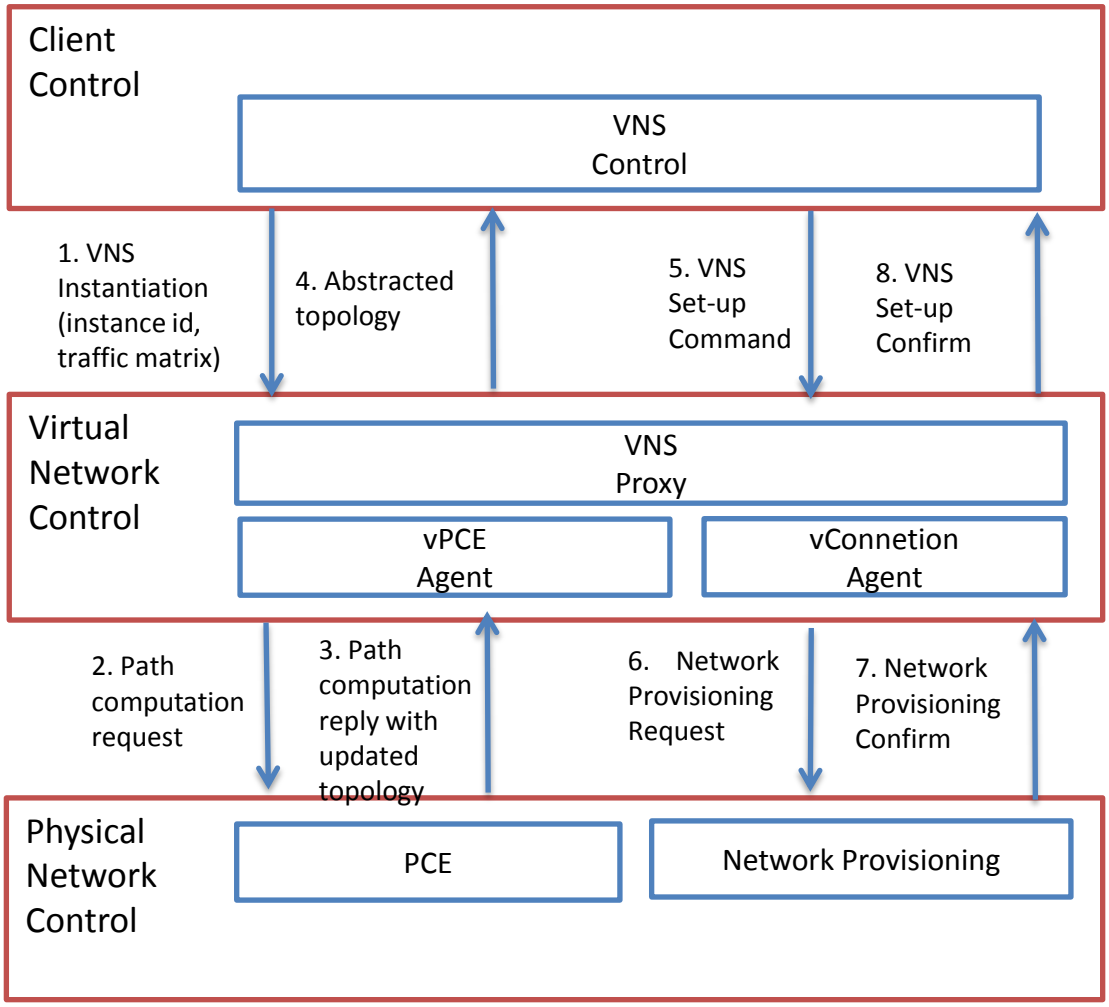
Use-case B2: Dynamic DCI in multi-domain network (Connection Request)



Interfaces


Application Layer
SDN Client Control
Client Control Layer
Client-VNC Interface (CVI)
SDN Network Control
Virtual Network Control Layer
VNC-PNC interface (VPI)
Physical Network Control Layer
South Bound Interface (e.g., GMPLS CCI)

Control Workflows



Work Items

- Which network control functions can be virtualized?
  - V-path computation
  - Abstraction topology database creation
  - V-connection
  - others??
- What is the right level of client control?
- How to represent abstracted topology?
  - Granularity level of topology abstraction
  - Information hiding without losing bottleneck link resource information
  - Modeling tool: JSON based, …
- Who owns virtual network control?
- Related work on topology abstraction
  - ALTO topology Service [I-D.yang-alto-topology]& [I-D.lee-alto-app-net-info-exchange]
  - OGF NML: General framework for multi-layer network modeling in XML/RDF based on ITU-T G.800
- If you are interested in this work, more discussion will be held, 8:30-9:30pm, November 5 (today) @Plaza B