Hierarchy of IP Controllers (HIC)
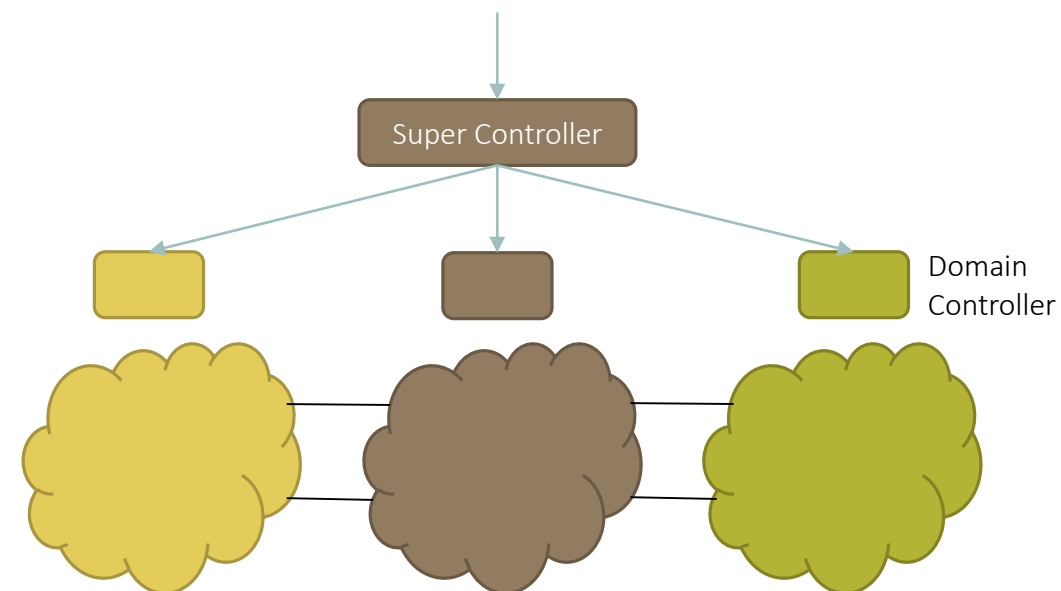
draft-li-teas-hierarchy-ip-controllers-00

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Introduction

- This I-D describes how multiple IP controllers work in a hierarchical fashion
  - How the ACTN framework is applied to IP controllers
  - Interactions between TE and non-TE components
  - Control Plane and Management Plane considerations

- IP Services Realization
  - Seamless MPLS
  - L3VPN
  - L2VPN/EVPN

- Scope for possible new extensions

Hierarchy of IP controllers (HIC)

- The Super Controller receives request from the network/service orchestrator to setup dynamic services spanning multiple domains.

- The Super Controller breaks down and assigns tasks to the domain controllers, responsible for communicating to network devices in the domain. It further coordinates between the controller to provide a unified view of the multi-domain network.

Super Controller

Domain Controller

Mapping to ACTN

- Interface b/w controllers
  - TE & non-TE
  - Control Plane Protocol
    - PCEP, BGP
  - Management Protocol
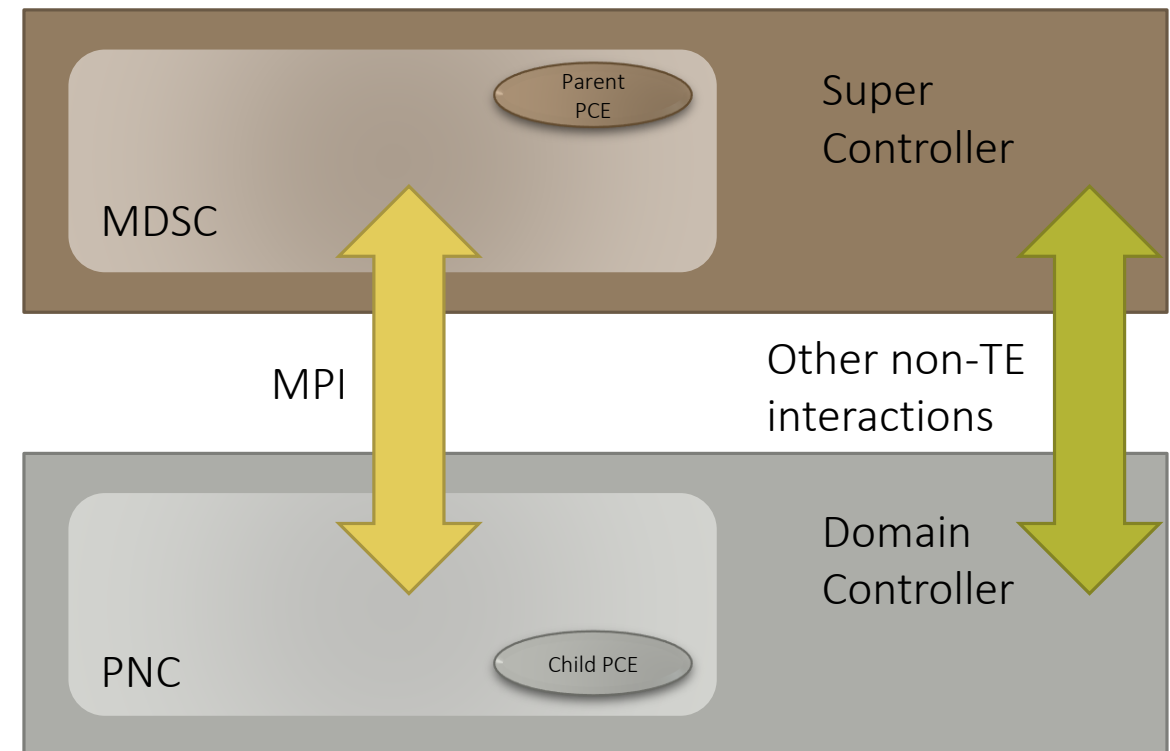   - RESTCONF/NETCONF/gRPC

Main Functions in ACTN

- Multi-domain Coordination
- Virtualization/Abstraction
- Customer mapping/translation
- Virtual Service Coordination

Parent PCE

Super Controller

MDSC

MPI

Other non-TE interactions

PNC

Child PCE

Domain Controller

Topology

Domain Controller / PNC

- Learn Domain Topology
- IGP, BGP-LS, PCEP-LS, Yang based

Super Controller / MDSC

- Learn abstract topology from Domain Controller
- Level of abstraction
- BGP-LS , PCEP-LS, Yang based interface
- Manage E2E topology

Path Compute/Instantiate

- Domain Controller computes/setup per-domain paths

- Super Controller responsible for E2E inter-domain paths

- PCEP Based
  - Stateful H-PCE framework on how E2E path computation, setup, stitching etc

- YANG Based
  - Path Computation Yang Model (via RPC)
  - TE Tunnel Yang Model
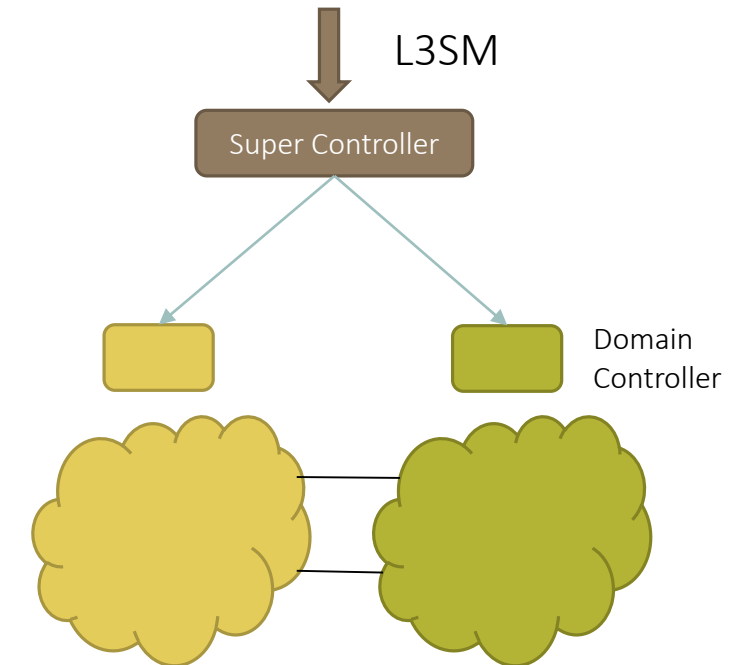
- Same as ACTN framework!

Seamless MPLS

- Extend MPLS to the edge mobile backhaul.

- The super controller is aware of the E2E topology

- Super Controller is responsible to setup the seamless MPLS service from the service model

- The super controller selects the right ABR and create corresponding per-domain tunnels

- Based on the service model, the Super Controller translates to the network configuration model for the domain controller.

- The domain controller further breaks into the device configuration model to the PE/ABR to make E2E services.

- Routes can also be learned via the BGP sessions between Domain Controller and Super Controller for intelligent decisions

Super Controller

Domain Controller

IGP-X1 (MBH)   IGP-Y (Core)   IGP-X2 (MBH)

E2E BGP LSP

Per Domain LSP

L3VPN

L3SM

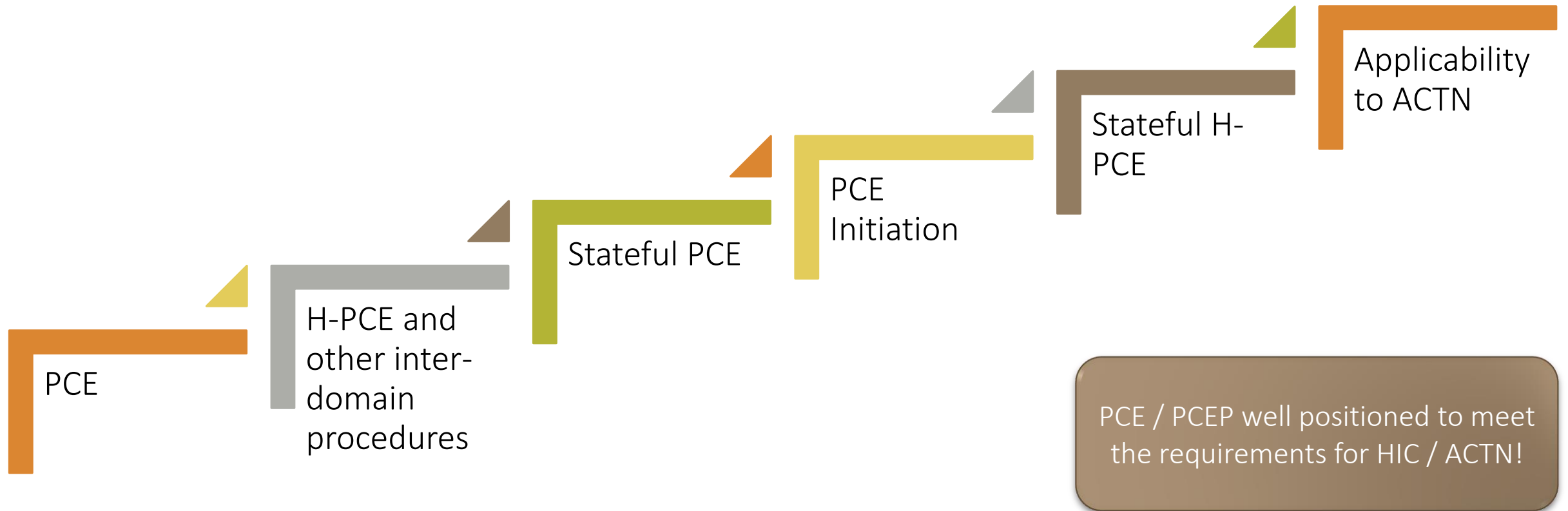Super Controller
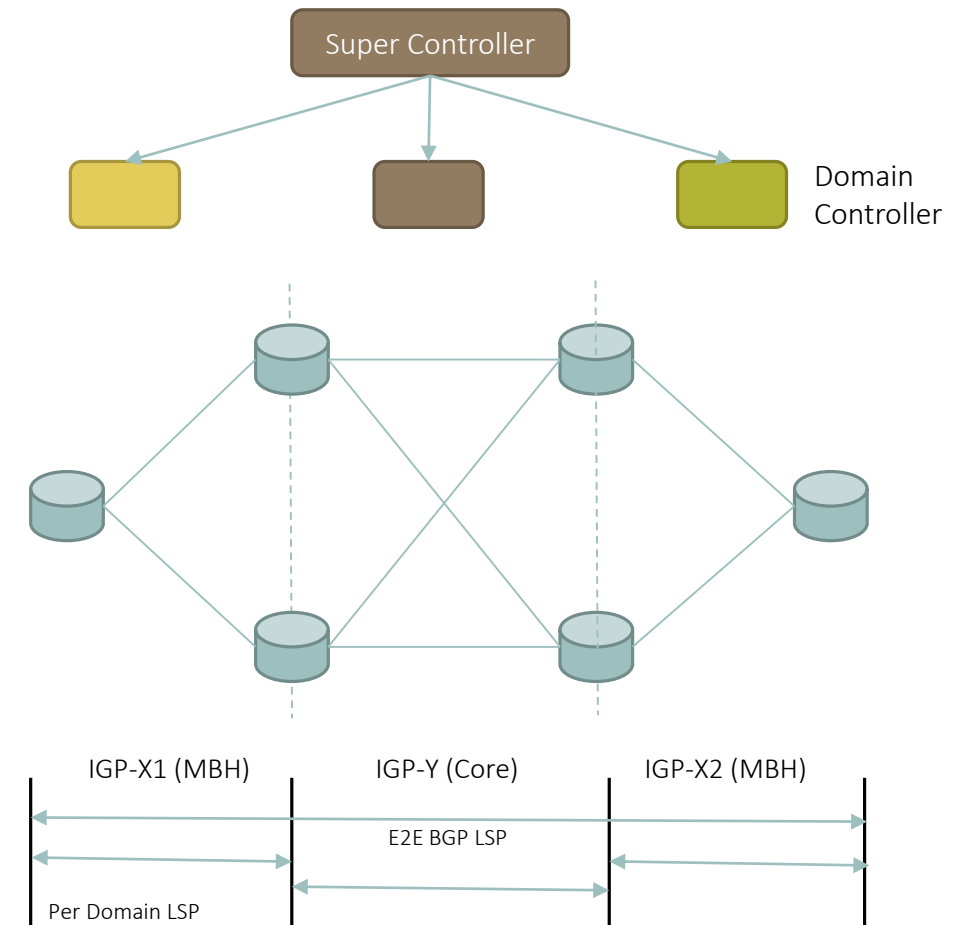
Domain Controller

- The Super-controller implements the L3SM model and translate it to network models towards the domain controller, which in turn translate it to the device model.

- Based on QoS/Policy, the Super Controller may -
  - Set the tunnel selection policy at the PE/ASBR routers so that they could select the existing tunnels
  - Select an existing tunnels at the controller level and bind it to the VPN service
  - Initiate the process of creating a new tunnel based on the QoS requirement and bind it the VPN service
  - Initiate the process of creating a new tunnel based on the policy

- Apart from Management Plane, control plane interface between controllers can also be used to setup and maintain the L3VPN service!

* -- applicable to L2VPN/EVPN in similar fashion!

PCE / PCEP

PCE

H-PCE and other inter-domain procedures

Stateful PCE

PCE Initiation

Stateful H-PCE

Applicability to ACTN

PCE / PCEP well positioned to meet the requirements for HIC / ACTN!

YANG Models

Service Models (L3SM, L2SM)	Network Configuration Models (?)	Device Configuration Models	Topology Related
Tunnel related	VN and Service-Mapping related	OAM	?

Possible Features/Extensions

Initial Configurations between controllers

- Initial Session Establishments
- Discovery via other protocols
- Service Discovery (DNS)

Relationship / Role of controllers

Learning the mutual capabilities of controllers

Handling of multiple instances of controller for reliability

?

Next Steps

- Get Feedback
  - What is missing?
  - What else can be added / removed?
  - Is such an informational document useful?

- Identified Gaps
  - Need to add more details about other Yang Models that are useful between controllers
  - Need to add more details about usage of BGP between controllers
  - Need to add more details about OAM
  - If you have expertise in these areas please provide help – Call for collaboration!

Thank you!