BGP L3VPN Virtual PE

draft-fang-l3vpn-virtual-pe-01

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Motivation

- Extend BGP IP VPNs [RFC 4364] into Cloud/DC/Mobile environment as part of the network virtualization effort.
- Why?

  Leverage the SP strength on l3vpn in building virtual private cloud

    - L3VPN is the most deployed SP provisioned VPN
    - It has been proven to scale
    - Provide end-to-end native l3vpn connectivity to distinguish from Internet overlay
- Reality check
  - 11/2011 IETF 82, Taipei: VPN4DC was requested/supported by many SPs with large L3VPN deployment
  - Today: Many SPs said I'd like to have it deployed "yesterday"

Virtual PE Definition

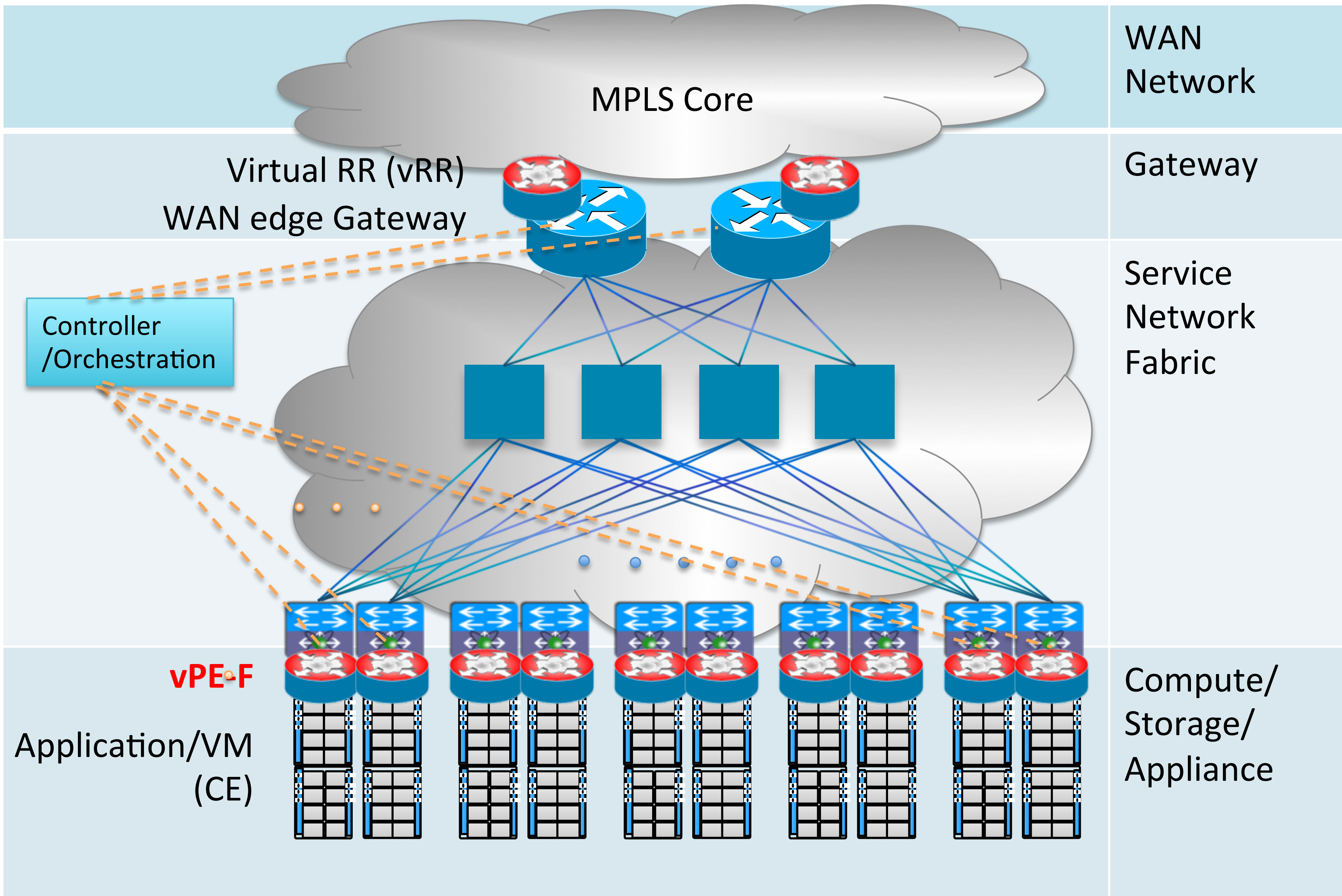
- A virtual PE (vPE): a BGP IP VPN PE software instance which may reside in any network or computing devices.
  - vPE-F: vPE Forwarding Plane
  - vPE-C: vPE Control Plane
- vPE-C and vPE-F can be decoupled, they may reside in the same physical device, or most often in different physical devices.

vPE Architecture and Design Options

	Design Options	Notes
1. vPE-F location	1a. End device, such as a server	co-resident with applications.
	1b. Top of the Rack (ToR)	Needed when facing bare metal servers, or if overlay-unaware physical appliances, or serving higher throughput traffic to VM
	1c. Any other devices, e.g., a Gateway router	vPE can be anywhere basically, DC or any networks.
2. vPE-C location	2a. Controller (centralized or distributed)	Control and forwarding decoupling
	2b. Same location as vPE-F, using mp-bgp for signaling	In the same fashion as in physical PE, except it is virtual PE
3. Orchestration models	3a. Push model: push IP VPN provisioning from NMS or other central control provisioning systems to the IP VPN network elements.	Top down approach, Common model for SP Enterprise IP VPN provisioning.
	3b. Pull model: pull from network elements to network management/AAA based upon data plane or control plane activity.	Bottom-up approach. Common model for broadband provisioning.

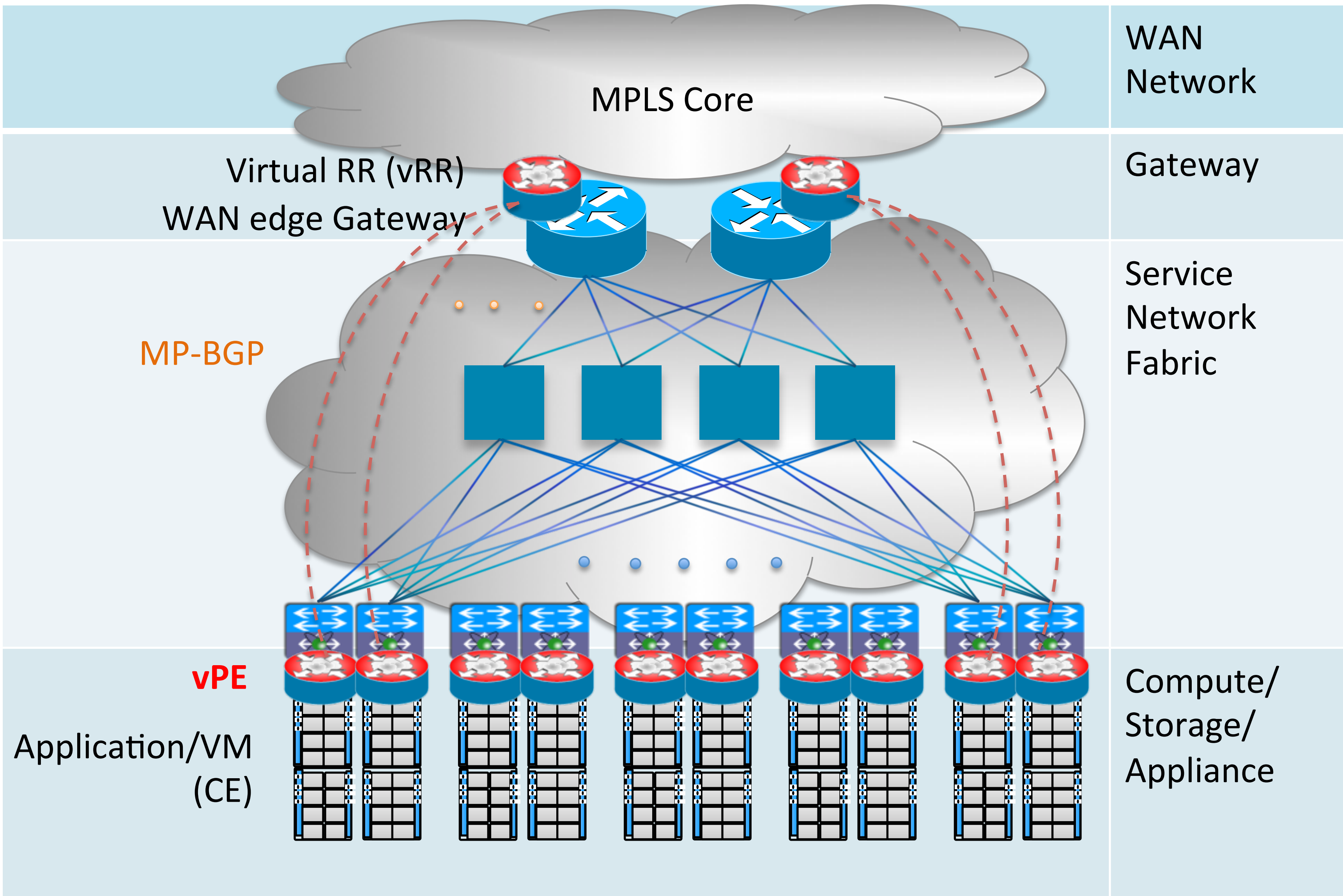
vPE Architecture Reference Models (1)

vPE-F in the end device, vPE-C in the controller



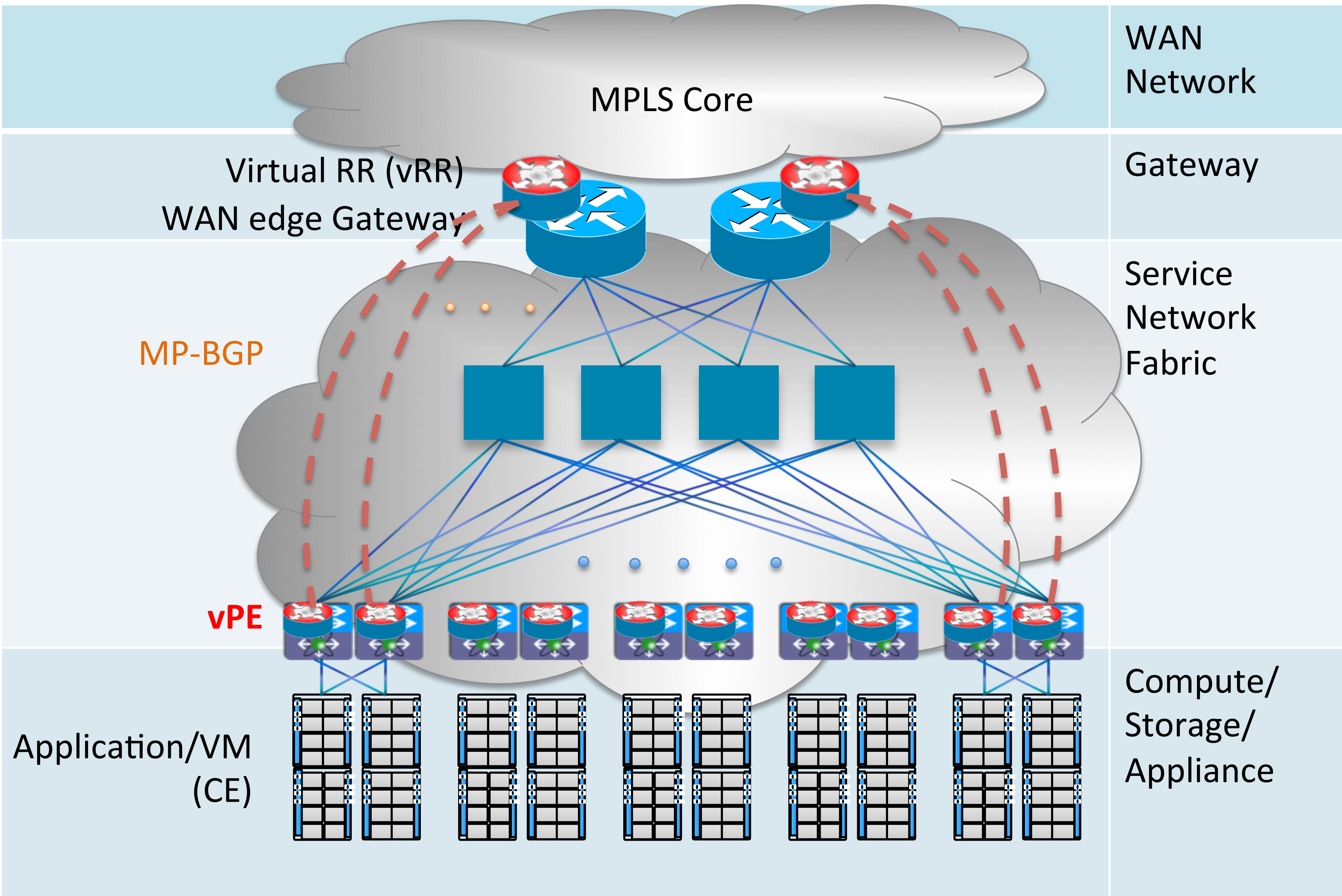
vPE Architecture Reference Models (2)

vPE in the end device, using MP-BGP for control



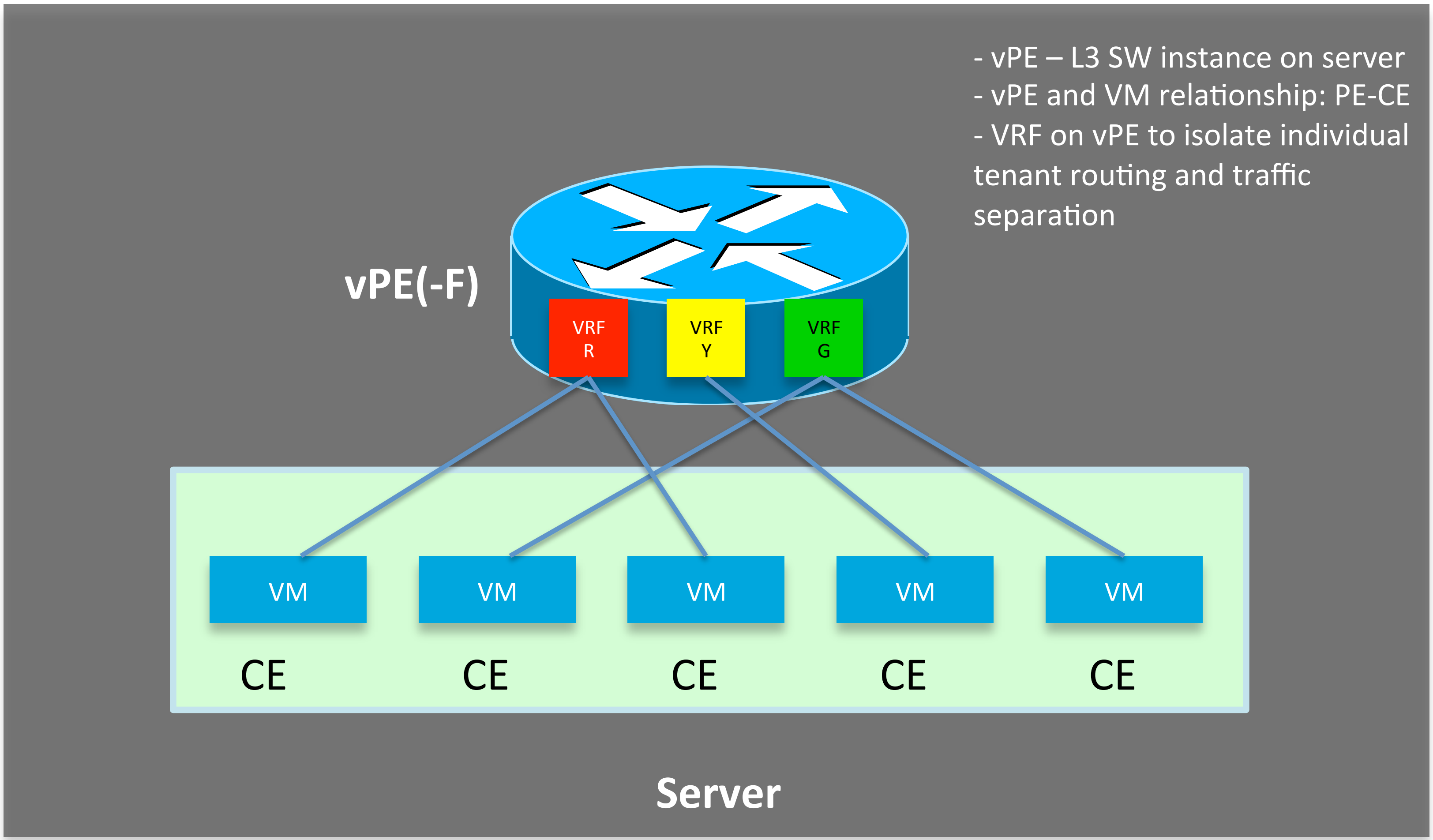
vPE Architecture Reference Models (3)

vPE in the ToR, using MP-BGP for control

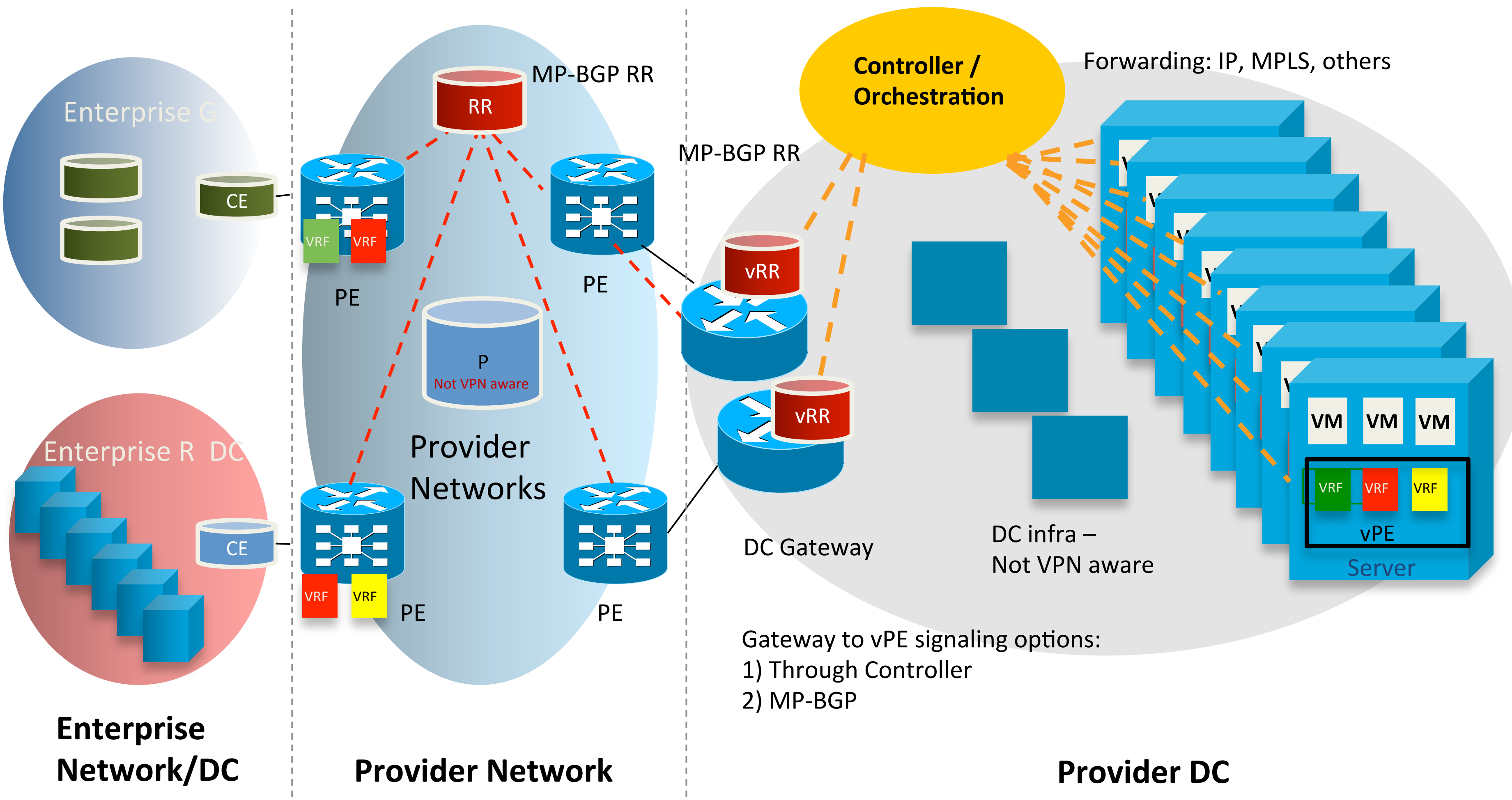


vPE(-F) on a Server

vPE and VM relationship -> PE-CE



End-to-end L3VPN Overlay from Enterprise to SP DC with vPE in End Device



Control Plane

1. SDN Controller approach
   - vPE control plane and data plane are physically decoupled. The control plane directing the data flow may reside elsewhere, such a centralized controller.
   - The controller can be used for routing information distribution / directly insert the entries into FIB.
2. Distributed MP-BGP control plane
   - vPE participates in overlay BGP IP VPN control protocol: MP-BGP [RFC4364].
3. vPE-C can be anywhere
4. Use RR and RT Constrain [RFC4684] to scale.

Data Plane

1. The VPN forwarder location options:

   1) within the end device where the CE (e.g., application/VMs) are.

   2) in an external device which the end device connect to, for example, a Top of the Rack (ToR) in a data center.

2. Considerations in design:
   - Device capability
   - Overall solution economics
   - QoS/firewall/NAT placement
   - Optimal forwarding
   - Latency and performance
   - Operational impact

3. Encapsulation

   1) MPLS

   2) IP / GRE tunnel [RFC4023], [RFC4797]

   3) Other IP network overlay encapsulations e.g. VXLAN, NVGRE.

Management/Orchestration

The orchestration system

1) MUST support IP VPN service activation in virtualized Data Center.

2) SHOULD support automated cross provisioning accounting correlation between WAN IP VPN and Data Center for the same tenant.

3) MAY support automated cross provisioning state correlation between WAN IP VPN and Data Center for the same tenant

vPE Push Model

- Top down approach - push IP VPN provisioning from management/orchestration systems to the IP VPN network elements.
- Common model in SP IP VPN enterprise deployment.
- When extending existing WAN IP VPN solution into the a Data Center, it SHOULD support off-line accounting correlation between the WAN IP VPN and the cloud/DC IP VPN for the tenant, the systems SHOULD be able to bind interface accounting to particular tenant. It MAY requires offline state correlation as well, for example, bind interface state to tenant.

vPE Pull Model

- Bottom-up approach - pull from network elements to network management/AAA based upon data plane or control plane activity.

- Common model used in broadband deployment.

- Dynamic accounting correlation and dynamic state correlation are supported. For example, session based accounting implicitly includes tenant context state correlation, as well as session based state which implicitly includes tenant context.

Next Steps

- Address all comments on the list and in the meeting
- Submit a new version
- Ask the WG to check interest for adopting this work as WG item