

Why Do We Need Open Router Platforms?

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What do we mean by an “Open” Router..

- Network programmability
 - Any change in network layer functionality or in the way the network is operated
 - Co-location of third-party functions on blades integrated in routers (“edge intelligence”)
- Platform allowing third party code to be executed on the router
 - Programming bare metal? API’s for standard libraries?
 - Both control plane and data plane?
 - What degree of protection?

Is there a case for network programmability?

- Haven't we tried this before and failed?
 - "Open Signaling" initiative in ATM community
 - DARPA Active Networking program in late 90's
- Why?
 - Divergent viewpoints of problem to be solved
 - Technical challenges too hard (poor performance, security risks, etc.)
 - Business model
- Position: Single most pressing problem facing service providers:
 - ***Difficult to quickly and safely deploy new services***
 - Will open routers help?

Why is service deployment hard?

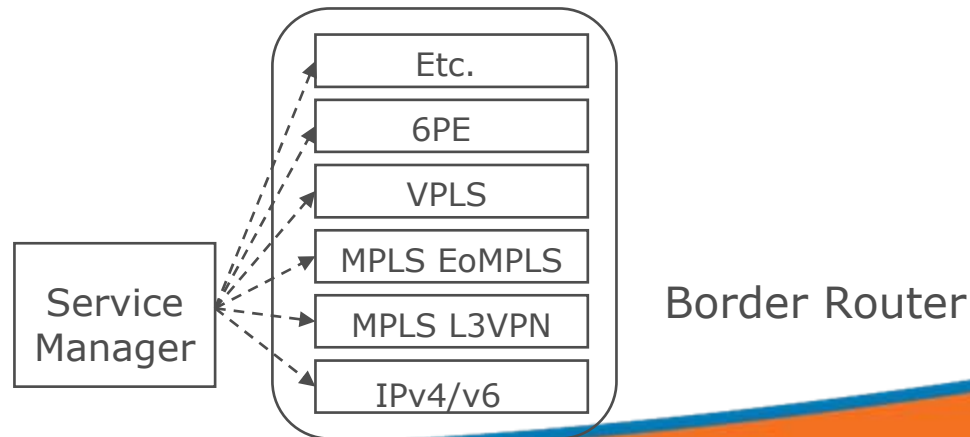
- Lack of vendor support
 - Specialized needs falling off the implementation roadmap
- Impact on existing services
 - Networks are inherently shared
 - Protocol dependencies
 - Stringent availability and reliability requirements
- Support systems
 - Ordering and provisioning systems
 - Including change management
 - Billing systems
 - Network/service assurance systems
 - Alarming and rules engines
 - Performance monitoring
 - Capacity management tools
 - Customer databases/portals

Can Network Programmability help?

- Lack of vendor support
 - Network programmability could help significantly
 - Opportunity for service provider differentiation
- Impact on existing services
 - Third party code might make things worse
 - Partitioning through virtualization?
- Support systems
 - Potential to simplify some development / deployment challenges
 - E.g., adaptation functions
 - E.g., measurement data

What Do We Mean by Virtualization?

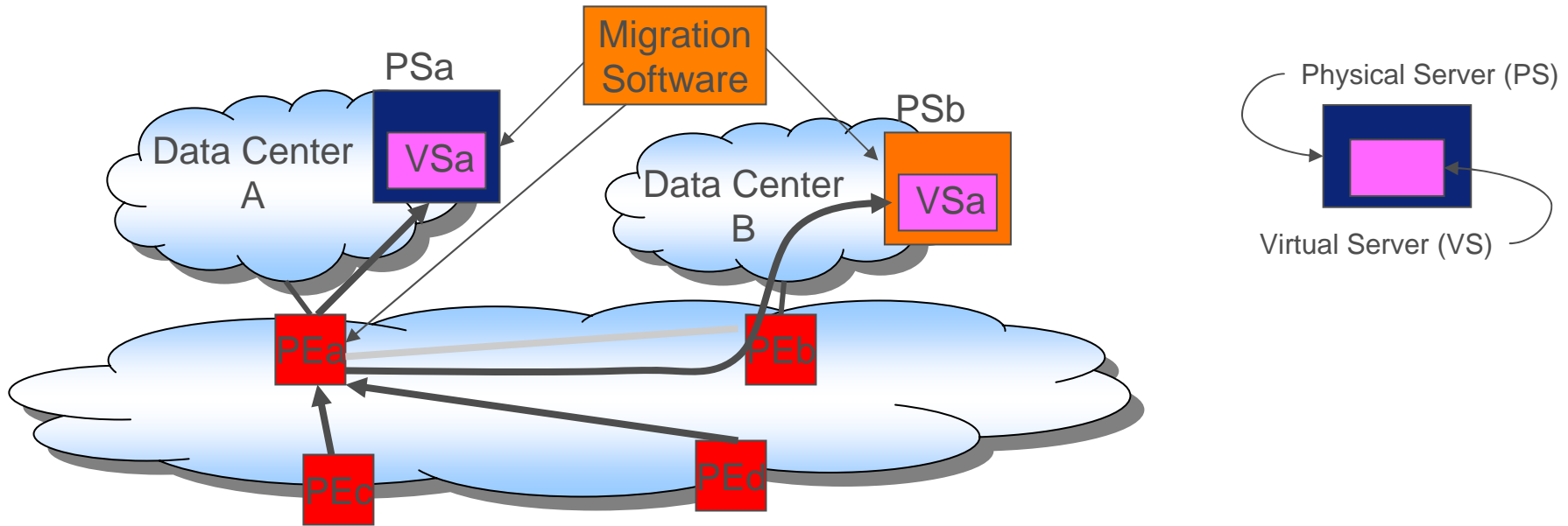
- Slices and slivers
 - Subset of network resources (links/nodes/subnets) plus management framework
- Commercial network virtualization solutions already exist...
 - Network / link virtualization
 - E.g., Cisco “MPLS Carrier in Carrier”
 - Control plane virtualization
 - E.g., Each Juniper “logical router” performs independent routing tasks
 - Transport substrate
 - E.g., dynamic bandwidth services



Example Network Services

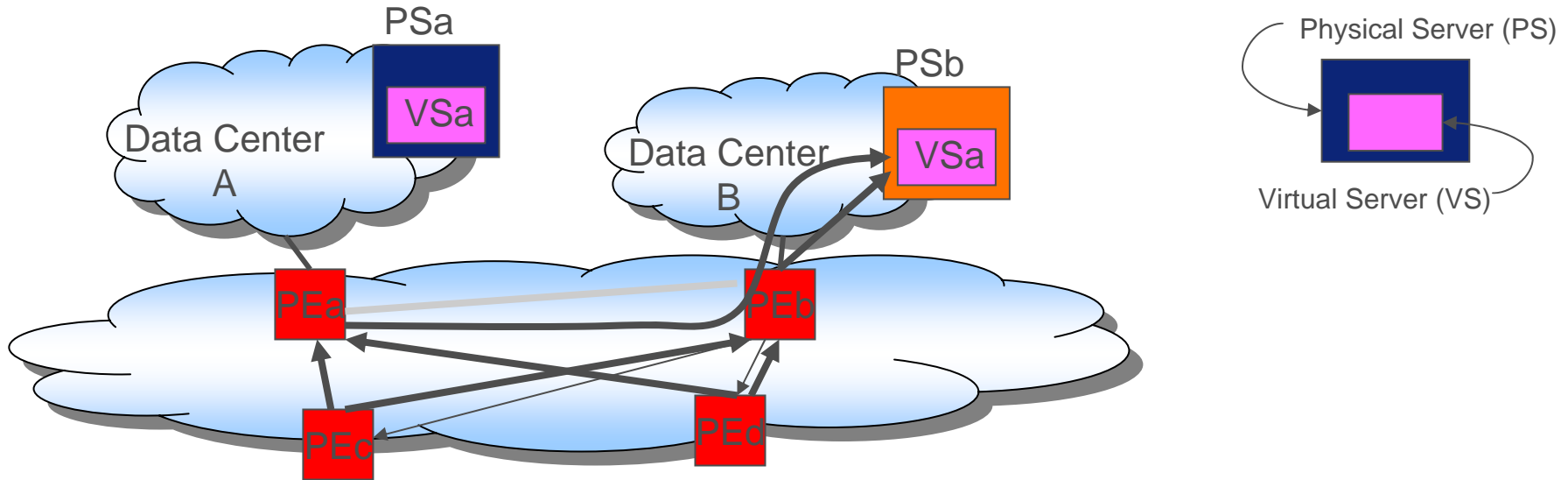
- Network Aware Server Migration
 - Example cross-layer-aware service
 - Control plane
- Service Aware Network Monitoring
 - Support system
 - Data plane (monitoring)
- Many Other Ideas
 - Robust framework for hitless upgrades and incremental deployment
 - Meta-management plane
 - Application/customer specific control planes
 - Application Load Balancing
 - Etc.

MigrationNet - Operation



- Server virtualization technologies have made live server migration a reality
- Approach currently limited to local area environment because no network support exist in wide area
- Potentially valuable tool for handling planned/unplanned outages

MigrationNet - Operation cont

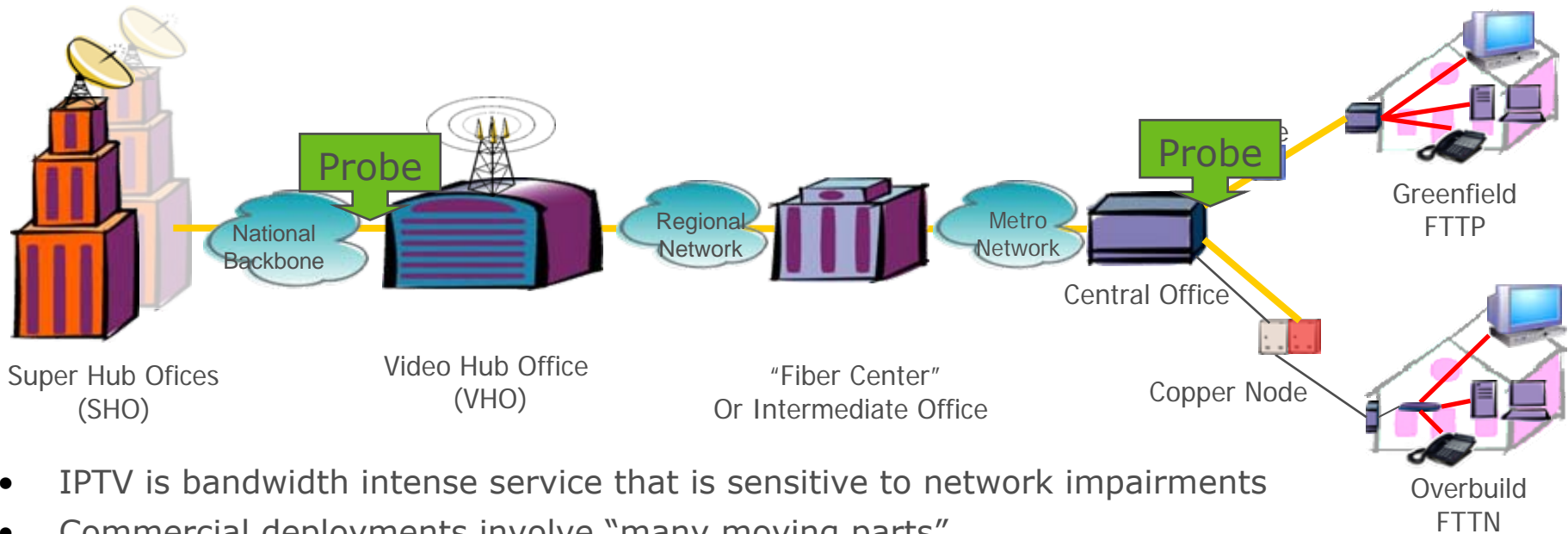


- Once server migration is complete, optimize routing

Network Programmability: Needed for the real-time, application controlled switchover of traffic to new data center

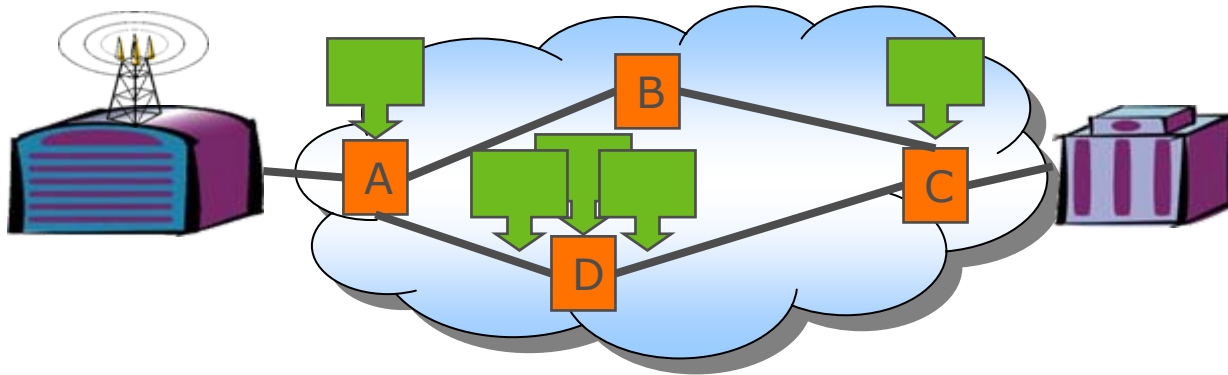
Service-aware network monitoring

E.g., IPTV



- IPTV is bandwidth intense service that is sensitive to network impairments
- Commercial deployments involve “many moving parts”
- Ensure end-to-end service and/or root cause analysis, need flexible monitoring *anywhere* along the path
 - E.g., what is the video quality for a particular stream when it enters/leaves/traverses the north-east regional network?
- State of the art: statically deploy flexible (programmable) probes in network
 - Problems: slow (deployment), expensive, coverage (always in wrong place)

Service-aware network monitoring



- What is the video quality for a particular stream when it enters/leaves/traverses the north-east regional network?
 - Being able to deploy custom network monitoring code at *relevant* node(s)/interface(s) in the network
- E.g., suppose “flow of interest” traverse A-D-C
- Network monitoring application:
 - Determine appropriate nodes (A,D,C)
 - Instantiate appropriate monitoring software
 - Report video quality per probe point

Network Programmability: Need per-interface, programmable, network monitoring capabilities

Summary

- There *is* a case for open routers
 - to allow service providers to customize network functionality, independent of vendor implementation roadmap
- There is more to it than just adding new protocols and functions:
 - Because networks are shared, strong support for virtualization is needed to protect existing services
 - Right abstraction (or abstractions) remains an open question
 - Should make some problems with “support systems” easier
- Vendor support is needed to make this a success
 - Open routers is a different business model (selling an SDK rather than a box)
 - This is an opportunity for differentiation for router vendors

Thank You!



Q&A

