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 intensive 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