Prototype Deployment of Internet Scale Overlay Hosting

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Project Objectives

- Deploy five experimental overlay hosting platforms
  - located at Internet 2 PoPs
  - compatible with PlanetLab, moving to GENI control framework
  - performance characteristics suitable for service deployment
    - integrated system architecture with multiple server blades
    - shared NP-based server blades for fast-path packet processing
- Demonstrate multiple applications
Role in Cluster B

- Overlay Hosting Platform
- Deployed at 5 locations
- Serve as backbone linking cluster partners (and others)
- Demonstrate high quality service delivery on overlays
- Managed using experiment support tools

Target Internet 2 Deployment
Hosting Platform Details

Chassis Switch
- CP
- GPE
- GPE
- NPE
- PLOS

General Purpose Processing Engine
- net FPGA
- External Switch
- Chassis Switch
- Line Card
- 10x1 GbE
- Line Card
- Network Processing Engine
- parse
- lookup
- header format
- queues
- Slice manager

Application Framework

- Fastpath/slowpath
  - fastpath mapped onto NPE
  - slice manager in vServer on GPE
- Configurable elements
  - code option - determines how packets processed by parse, header format
  - logical interfaces
    - may be public or tunnel
    - guaranteed bandwidth
  - TCAM filters
  - Queues
    - length, bandwidth
- Slice manager can configure fastpath using provided library
  - or manually, using command line interface
Creating a Slice

Starting up a Slice
Configuring an External Port

- Request external port number on specific interface thru Resource Manager Proxy (RMP)
- RMP relays request to System Resource Manager (SRM)
- SRM configures LC filters for interface
- Arriving packets directed to slice, which is listening on socket

Setting Up a Fast Path

- Request fastpath through RMP
- SRM allocates fastpath
- Specify logical interfaces and interface bandwidths
- Specify #of filters, queues, binding of queues to interfaces, queue lengths and bandwidths
- Configure fastpath filters
Planned Wide-Area OpenFlow

NP Blade
Line Card Datapath

- Filter/route and rate-control traffic
- Network Address Translation for outgoing flows
- Record traffic statistics for all outgoing flows

NPE Datapath (version 1)

- Parse and Header Format include slice-specific code
  - parse extracts header fields to form lookup key
  - Hdr Format does any required post-lookup processing
- Lookup uses opaque key for TCAM lookup
- Multiple static code options can be supported
  - multiple slices per code option
  - each has own interfaces, filters, queues and private memory
NPE Datapath (Version 2)

- Use both NPs, enabling 10 Gb/s throughput
- Integrated Decap, Parse, Lookup uses MEs more efficiently
- Multicast supported by substrate

Project Plan Highlights

- Initial deployment
  - first two (maybe three) nodes deployed by mid 2009
  - shooting for v2 of NPE software
  - PlanetLab control with local resource allocation
- GENI-compatible control software
  - implement component manager interface
  - resource allocation using rspecs/tickets
- Working with users
  - online and hands-on tutorials
  - collaborating with users on new code options
- Completing deployment
  - final nodes deployed in late 2010
  - complete support for netFPGA
Looking Ahead

Bad news
- slow market for ATCA means high cost, limited support
- Intel dropped IXP and Radisys discontinuing IXP blades

Good news
- ATCA market now projected to grow rapidly and become more cost-competitive (10x growth over 3 years)
- new NPs and NP blades
  - Netronome 3200 – IXP successor with 40 microengines
  - Cavium Octeon, RMI XLR732 – MIPS-based, uses cache
- can also assemble systems from commodity components
  - 10 GbE switches now at $400-500 per port
  - conventional rack-mount servers with 8-16 processor cores
  - NPs and FPGAs on lower cost PCI-express cards