



Year 1 Review of UMass Lowell Programmable Edge Node (UMLPEN)

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Progress in Year 1

- Hardware procurement and setup
 - Acquired and assembled a Programmable Edge Node (PEN), a multi-core server consisting of a network processor based acceleration card (Netronome NFE-i8000)
 - Acquired a Dell 6224 switch and two PCs for Emulab/ProtoGENI testbed
- Software development
 - Created virtual environment (VEs) on OpenVZ as virtual routers to forward IP packets
 - Instantiated virtual NICs with the support of Netronome Flow Manager (NFM, a vendor provided software)
 - Enabled direct access of VNICs from virtual routers to reduce the overhead of bridging
- Integration to Emulab/ProtoGENI
 - Setup Emulab testbed at UMass Lowell (boss,ops, two physical PCs connected via Dell Ethernet switch)
 - Integrated PEN with Emulab software through modified Emulab code and database
 - Created virtual topology with Emulab web interface and mapped virtual topology to physical resources including PEN (GEC4 demo)
 - Performed measurement of packet sizes and distributions (tcp/udp) on the NP based card (GEC4 demo)

Challenges in Year 1

- Hardware/Software
 - Do not have a Emulab-supported Ethernet switch
 - Emulab code supports a small set of switches from vendors such as Cisco
 - Status: using a Dell switch and modified scripts in Emulab, looking into extension of the Emulab “snmpit” script to support Dell switch
 - Software compatibility issues
 - Resolve software dependencies and compatibility issues among Linux kernels, OpenVZ releases, vendor device drivers
 - Status: in the process of upgrading to the latest FC and OpenVZ. More tests needed.
- Integration with Emulab/ProtoGENI
 - Understand Emulab code base and database
 - Status: fairly good understanding.
 - Understand Rspec and node assignment algorithm
 - Status: in progress
 - Develop component manager to integrate with ProtoGENI clearinghouse
 - Status: initial version done, enhanced version in progress

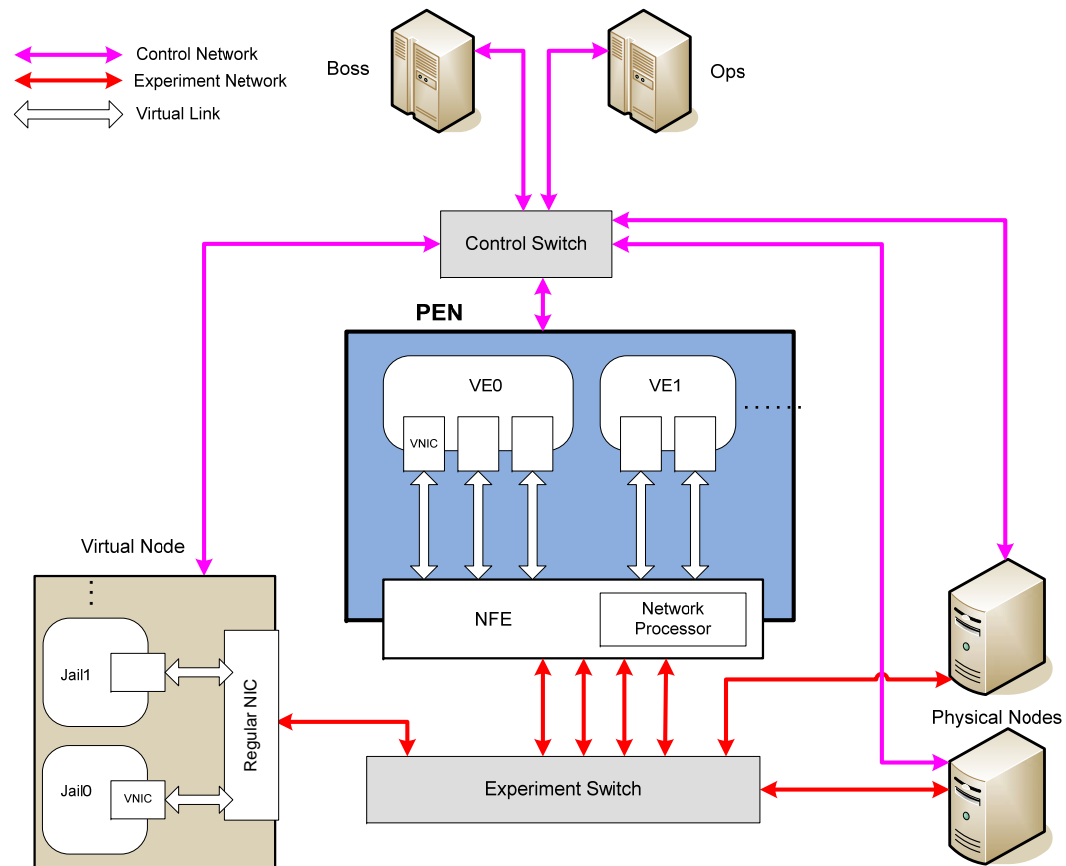
Integration with ProtoGENI Clearinghouse in Serial 1

- Initial integration with Emulab through modified Emulab code
 - Added PEN and VEs to database as a physical node with multiple NICs
 - Added scripts (e.g. "pcpen_setup", "ve_setup") to instantiate VEs when swapping in experiments
 - Modify "os_setup" script to distinguish PEN from regular Emulab nodes
- GEC4 demo of a simple experiment using Emulab + PEN
 - Created an experiment with virtual topology
 - Mapped virtual topology to physical nodes including PEN
 - Performed measurement on network processor
- Ongoing work
 - Create RSpec for PEN
 - Develop component manager

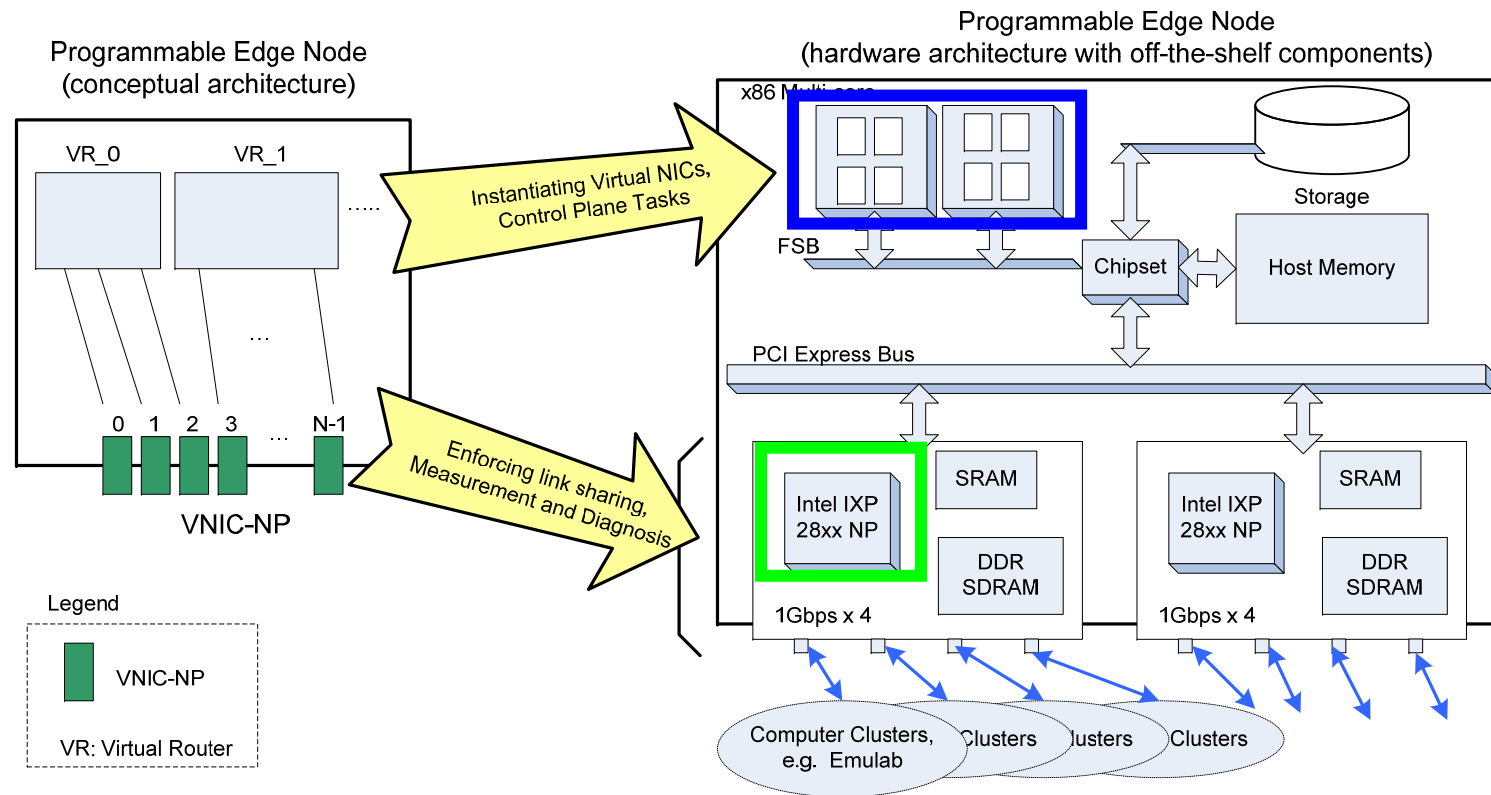
Plans for Spiral 2

- Have deployable PEN node ready (regression test, bill of materials, user guide wiki) by 10/1/09
- Work with U. of Utah to deploy two PENs in Internet2 backbone, if funds available
 - Deployment in Internet2 not in year 2 budget
 - Would like to proceed if funds available
- Enhance the measurement and diagnosis capabilities on NP acceleration card
 - Provide APIs to users to specify interested flows to measure
 - Limit measurement experiments within authorized slices
 - Provide diagnosis tools to trouble-shoot experiment failures
- Support external research on PEN
- Outreach activities

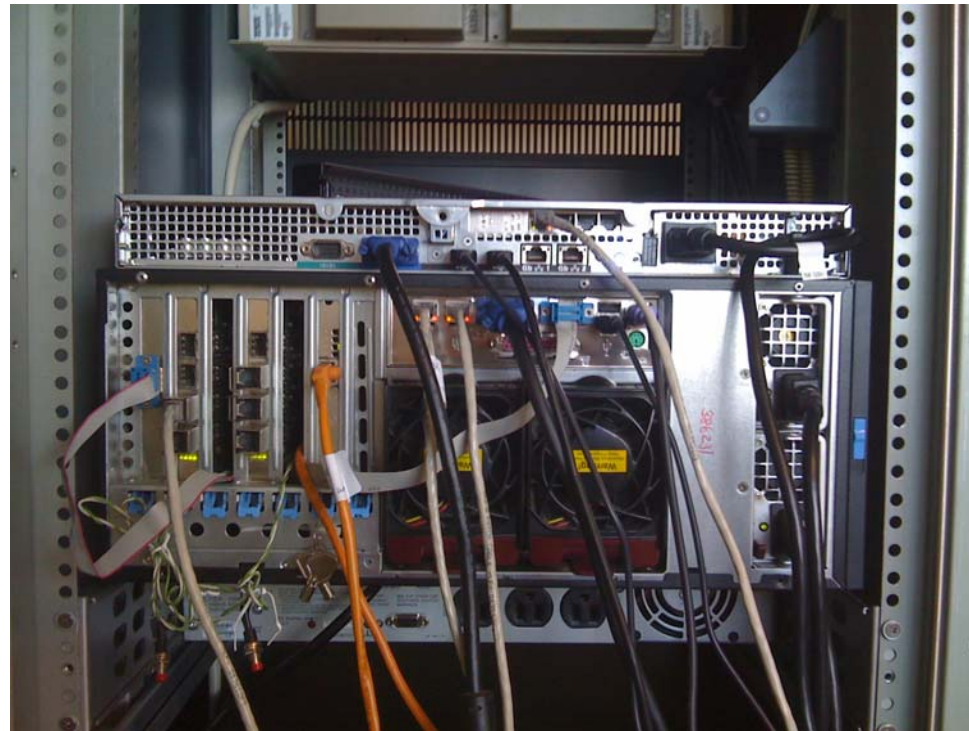
How PEN Fits in ProtoGENI



PEN with Hybrid Multi-core Processors

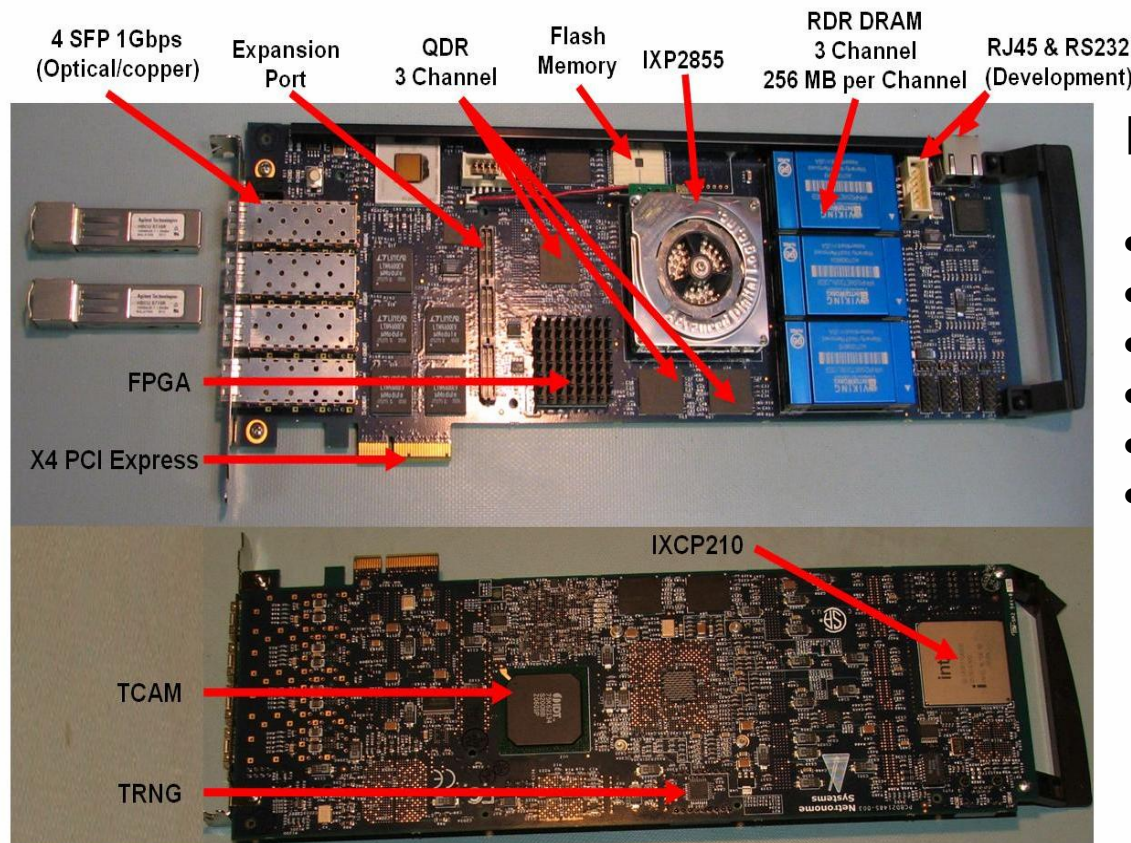


Rear View of a PEN



Netronome's Network Processor Card

NFE: Hardware Overview



NFE-i8000 Specifications

- 1.4GHz IXP2855 NPU
- crypto units
- 4x1Gbps Ethernet ports
- 9Mb TCAM
- 40MB QDR2 SRAM
- 768MB RDRAM

Thank you !

Q & A

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