CRON (http://www.cron.loni.org)

- Experimental Networking Testbed for 10Gbps High Speed Networks and Cloud Computing Research Over High Speed Networks.

Components

- Hardware
  - Cisco N5000 switch with 48 X 10Gbps ports
  - High-end servers with 10GE NICs
  - 10Gbps hardware emulators

- Software
  - Emulab-based interface & controller
  - 10Gbps software emulators

Example Scenario

- Y-shape Topology
  - 1 virtual router (3X10Gbps NICs)
  - 3 X 10Gbps virtual links (30ms delay)
  - 2 competing flows

- Software
  - OS: Ubuntu 64bit & FreeBSD 64bit
  - Measurement S/W: Nuttcp & iPerf
  - TCP variants: TCP Reno, HSTCP, Cubic, HTCP, Hadoop etc.

Introduction to CRON

CRON@ProtoGeni <-> MAX@PlanetLab

- GENI Aggregate Managers (AM) at CRON and MAX provide resources to experimenters with GENI credentials.
- A GENI user creates slice/slices which hold a collection of computing resources capable of running an experiment from CRON and MAX.
- The Internet2 ION Aggregate Manager does VLAN stitching to connect CRON and MAX.

<stitchingResourceid="urn:aggregate=geni.maxgigapop.net:rspec=max pl_sutesstslice1:stitching=3022" type="p2pvlan"/>

Virtual Cloud Computing Clusters with 10Gbps High Speed Network at CRON

Experiment Scenario over CRON

- Software Stack
  - Computational Biology Applications
  - Distributed Computing Framework (Hadoop, MapReduce)

  Cloud Management System (Eucalyptus)

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  High Speed Networks Based on Emulation

  Control Plane

  Network Topology

  ① Listresources
  ② CreateSlice
  ③ CreateSlice
  ④ Experiments

Configuration of Multiple Clouds over CRON

- LAN-Cloud1
  - CLC-Cloud1
  - NCI-Cloud1
  - NC2-Cloud1

  ① Create Nodes
  - set CLC-Cloud1 $ns node
  - set NCI-Cloud1 $ns node
  - set NC2-Cloud1 $ns node

  ② Create a LAN
  - set LAN-Cloud1 $ns make-lan "$CLC-Cloud1 $NC1-Cloud1 $NC2-Cloud1" 10000Mb 0ms
  - create a link with delay
  - set Router1toRouter2 $ns duplex-link $Router1 $Router2 10000Mb 120ms DropTail

- LAN-Cloud2
  - CLC-Cloud2
  - NCI-Cloud2
  - NC2-Cloud2

  ① Create Nodes
  - set CLC-Cloud2 $ns node
  - set NCI-Cloud2 $ns node
  - set NC2-Cloud2 $ns node

  ② Create a LAN
  - set LAN-Cloud2 $ns make-lan "$CLC-Cloud2 $NC1-Cloud2 $NC2-Cloud2" 10000Mb 0ms
  - create a link with delay
  - set Router1toRouter2 $ns duplex-link $Router1 $Router2 10000Mb 120ms DropTail

- Configure a experiment slice with a TCL script over CRON
  - Physical machines with Ubuntu 10.04 OS
  - 2 Virtual Eucalyptus Clouds connected with 10Gbps routers and links
  - Create a virtual network with 3 X 10Gbps virtual links
  - 1 emulated link with 10Gbps bandwidth and 120ms delay

Research Impact of CRON

- Next generation networking and computing research
- Distributed computing for large scale computational sciences
- Physics, Computational Biology, Remote visualization, etc.