A Brief Research Report
– Internet Dependability and other projects –

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Outline

- Network Function Virtualization (NFV) Dependability
- Running programs in unstable environments: PlanetLab
- Running MPI programs in unstable environments: [wild] shared clusters
- Parallel Cut Tree Algorithms
- A few other projects:
  - Parallel Multi-Swarm Algorithms for Many-Objective Optimization Programs
  - Bio-inspired dissemination of event information in dynamic networks
  - Combating pollution attacks with comparison-based diagnosis
  - ...
Network Function Virtualization (NFV)
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• Network Function Virtualization allows the implementation of key functions without the need for specific hardware or software
• Closely related to SDN (Software Defined Network) technology
NFV-FD

- Motivation: use information available from an OpenFlow controller to monitor process and link faults/reachability (FD: Failure Detector)
- The FD-MOD module acts as a filter that selects information to send to NVF-FD
NFV-FD: A Failure Detector Implementation

Diagram:
- NFV-FD
- FDMod
- REST API
- Controller
- Java API
- OpenFlow API
- OpenFlow Switch
- Network Application
- Module Applications
- Firewall
- Hub
Preliminary Results: Where to Run?
DISN: Dependability Issues on SDN & NVF

- A workshop chaired with Matti Hiltunen (AT&T)
- We had full sessions
- Planning to repeat in 2016!
Running Protocols and Distributed Applications in Unstable Environments

• PlanetLab: first approach find a clique!

• Then we noticed that another topology better resists the test of time: the k-core

• Now we are investigating the impact on the repeatability of experiments
Running MPI Parallel Programs in [Wild] Shared Clusters

- Shared Clusters: you run your parallel programs with several other users
- There is a huge variation in processor load
- We proposed an approach inspired on group membership to select a group of “well-behaved processors” to run an application
- The group is dynamic and changes with time
- Tests are executed in order to determine whether processors are good enough (system-level diagnosis based on imperfect tests)
Running MPI Parallel Programs in [Wild] Shared Clusters

• Edson T. Camargo, Elias P. Duarte Jr., "Running Fault-Tolerant MPI-based Applications in Unstable Systems," Workshop on Exascale MPI (ExaMPI), at The Supercomputing Conference 2014 (SC'2014), New Orleans, USA
Parallel Cut Tree Algorithms

- A cut-tree provides a compact representation of the edge-connectivity between every pair of vertices of an undirected graph.
  - We have been using the cut-tree to compute connectivity numbers of network nodes (DSN'2004), but there are several applications.
Parallel Cut Tree Algorithms

• We have proposed parallel versions of the two well-known cut tree algorithms as well as a new algorithm that presents a more robust performance

  – Jaime Cohen, Elias P. Duarte Jr., et. al., "Parallel Implementations of Gusfield's Cut Tree Algorithm," ICA3PP'2011, Melbourne, Australia

A Few Other Projects We Are Working On...

- Parallel Multi-Swarm Algorithms for Many-Objective Optimization Programs

- Autonomic Distributed Mutual Exclusion
Yet Another Few Other Projects We Are Working On...

- Combating polluting attacks in live streaming networking using comparison-based diagnosis
  - Roverli P. Zwich, Emanuel A. Schimidt, Elias P. Duarte Jr., Ingrid Jansch-Pôrto, "Diagnosis of Content Pollution in P2P Live Streaming Networks," LADC'2013, Rio de Janeiro, Brazil

- Using Stream Processing Engines for backbone traffic monitoring
Finally: VCube

- A virtual topology that is scalable by definition