

A Brief Research Report

– Internet Dependability and other projects –

Elias P. Duarte Jr.

`www.inf.ufpr.br/elias`

Federal University of Parana

Curitiba, Brazil

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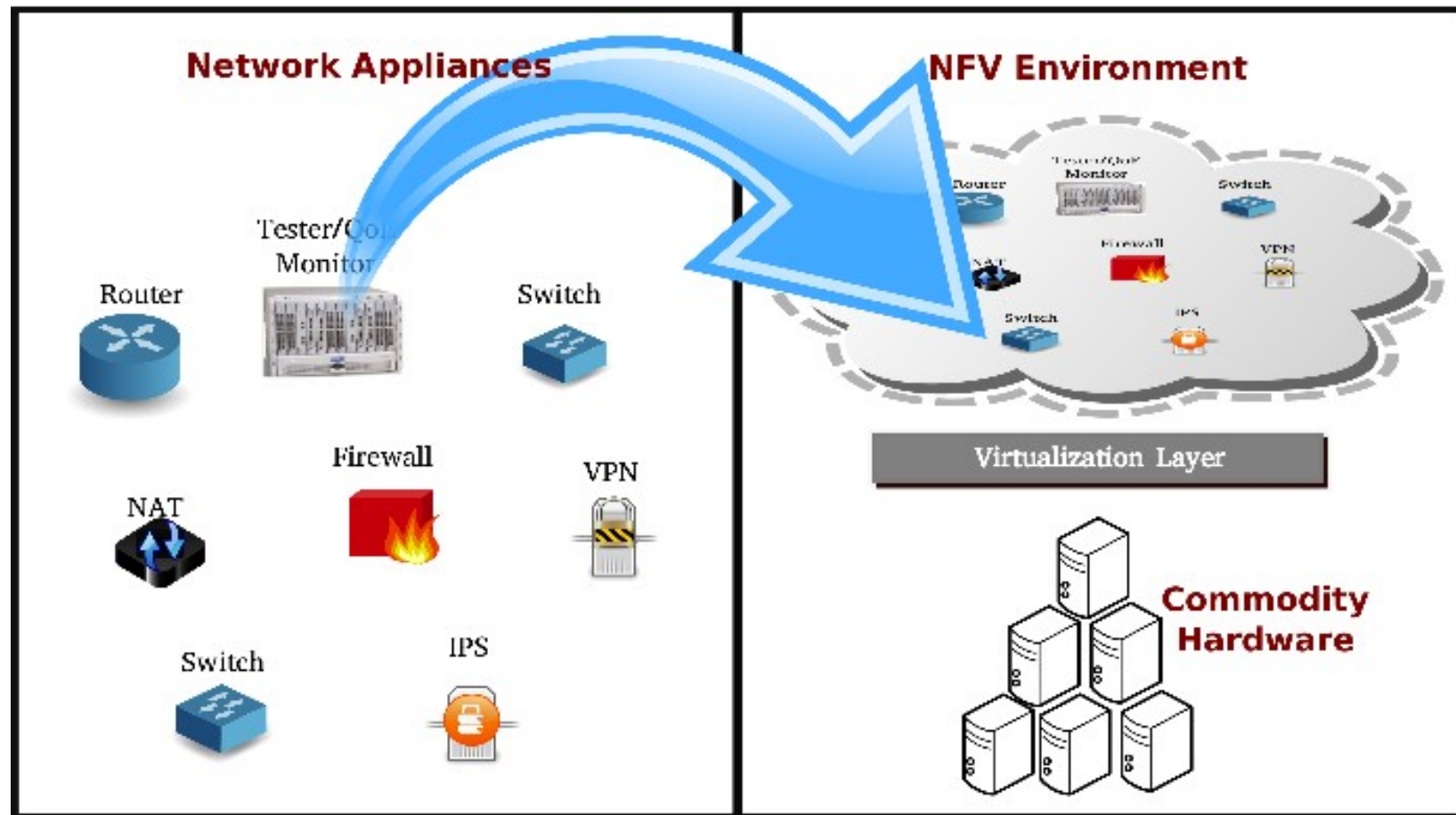
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Outline

- Network Function Virtualization (NFV) Dependability
 - DISN, The Workshop: 2015 & 2016
- 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)



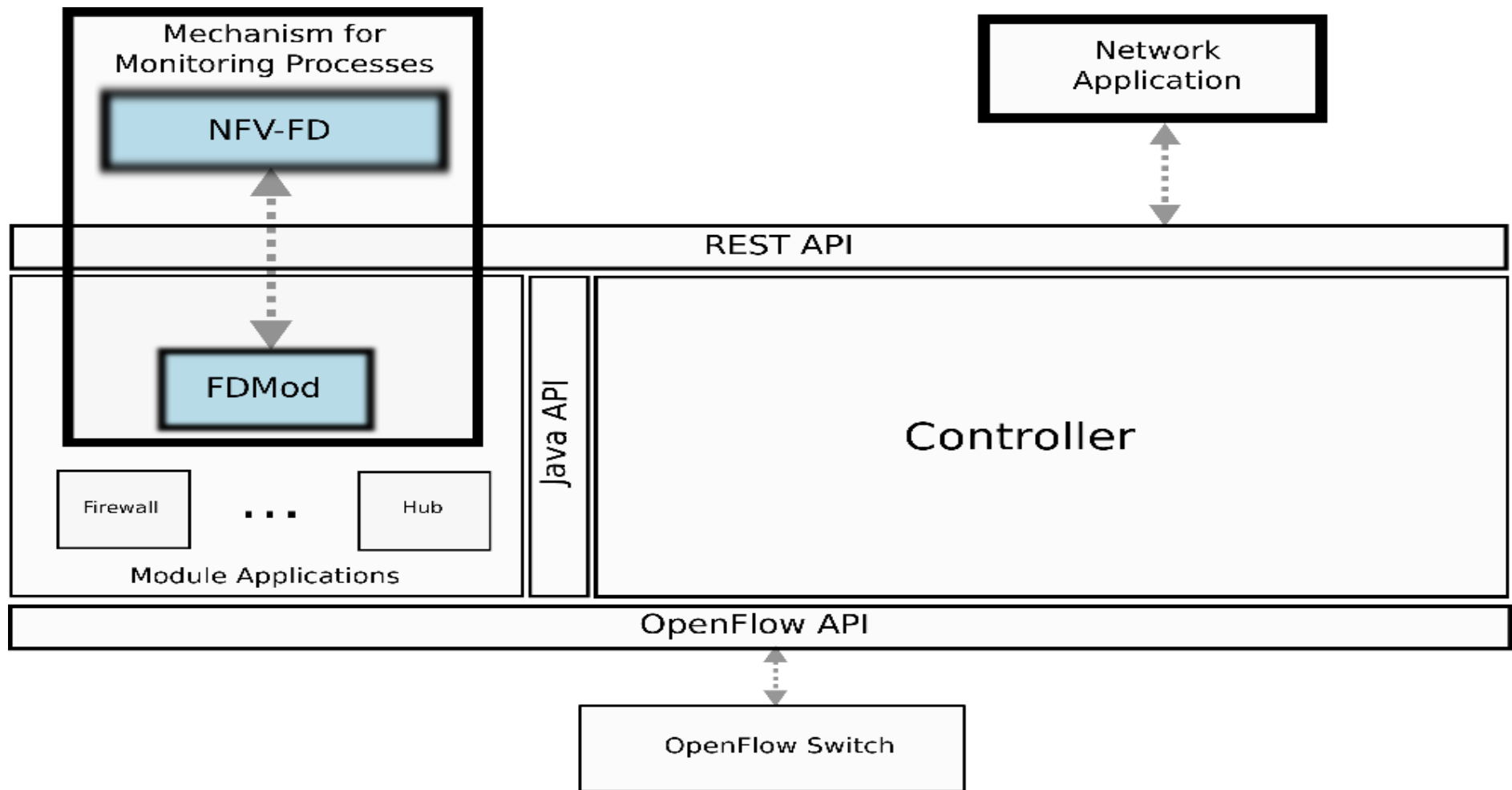
Network Function Virtualization (NFV)

- 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

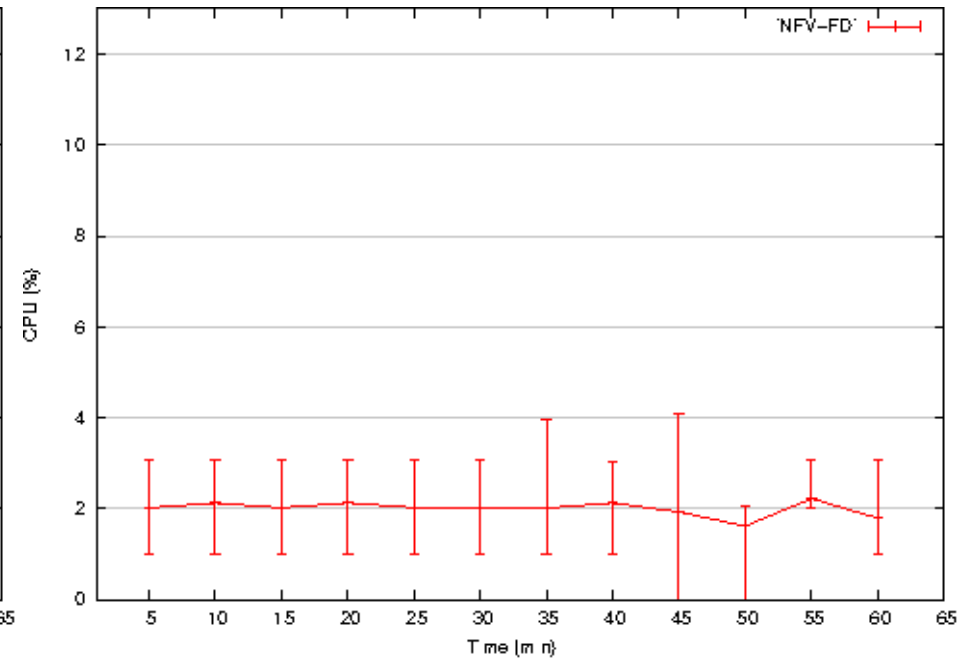
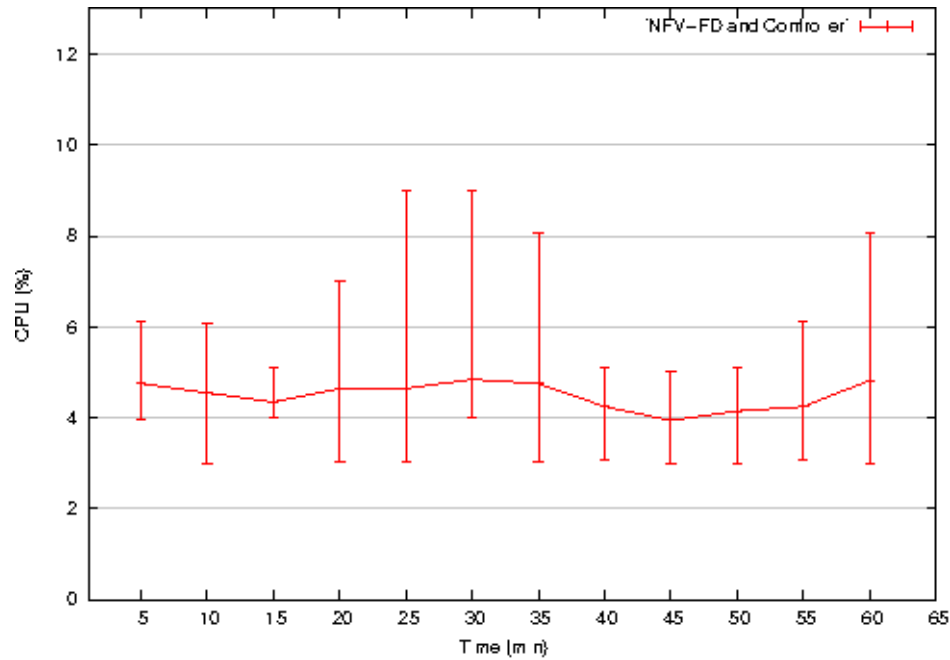
NFV-FD

- 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



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

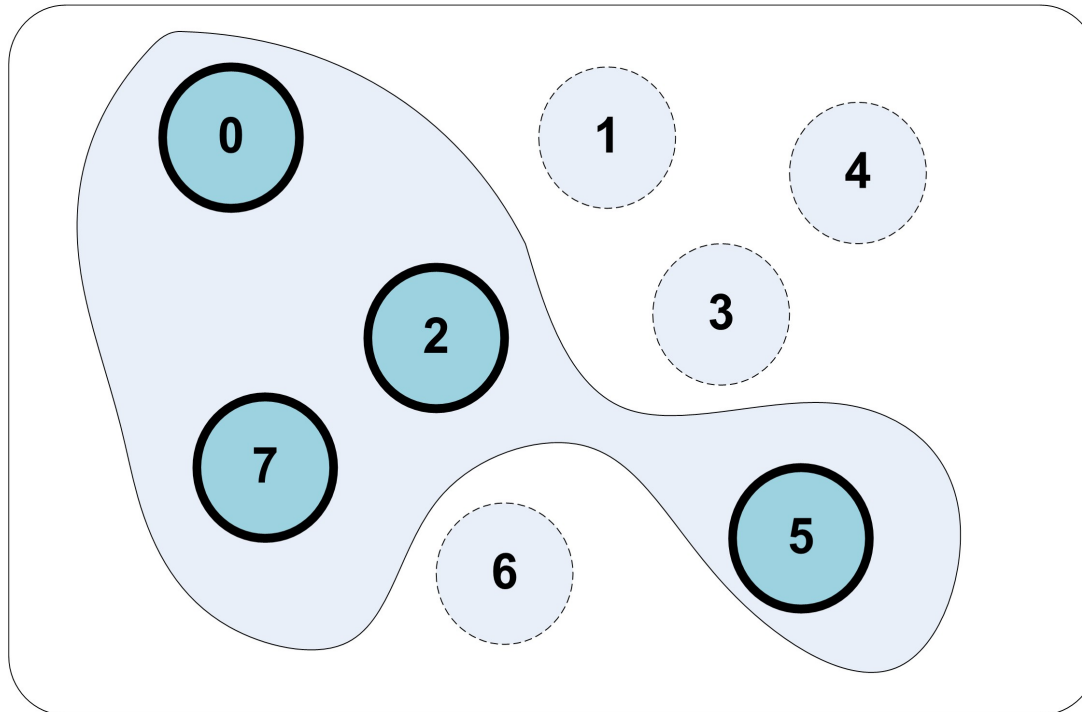
- PlanetLab: first approach find a clique!
 - Elias P. Duarte Jr., Thiago Garrett, Luis C. E. Bona, et. al., "*Finding Stable Cliques of PlanetLab Nodes*," **DSN'2010**, Chicago, US.
- Then we noticed that another topology better resists the test of time: the k-core
 - Luis C. E. Bona, Elias P. Duarte Jr., Thiago Garrett, "*Monitoring Pairwise Interactions to Discover Stable Wormholes in Highly Unstable Networks*," **TridentCom'2012**, Thessaloniki, Greece
- 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)

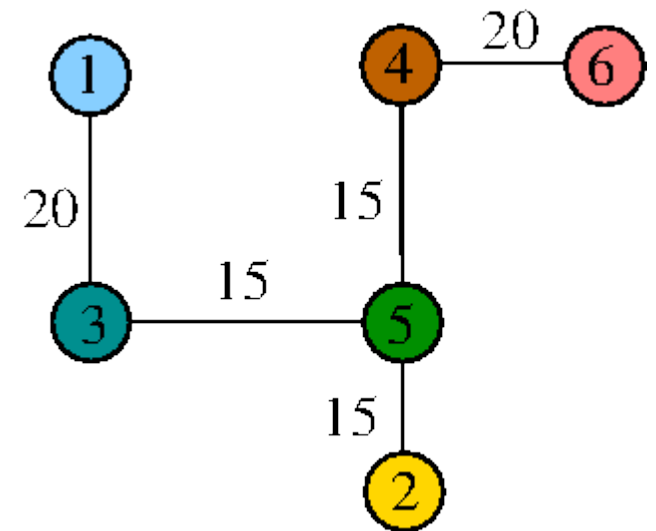
Running MPI Parallel Programs in [Wild] Shared Clusters

- 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
 - Jaime Cohen, Elias P. Duarte Jr., et. al, "A Parallel Implementation of Gomory-Hu's Cut Tree Algorithm," **SBAC-PAD'2012**, New York, USA

A Few Other Projects We Are Working On...

- Parallel Multi-Swarm Algorithms for Many-Objective Optimization Programs
 - Arion de Campos Jr., Aurora T. R. Pozo, Elias P. Duarte Jr., "*Evaluation of Gossip Vs. Broadcast as Communication Strategies for Multiple Swarms Solving MaOPs*," **CEC'2013**, Cancún, Mexico
- Autonomic Distributed Mutual Exclusion
 - Luiz A. Rodrigues, Luciana Arantes, Elias P. Duarte Jr., "*An Autonomic Implementation of Reliable Broadcast Based on Dynamic Spanning Trees*," **EDCC'2014**, Newcastle-upon-Tine, U.K.

Yet Another Few Other Projects We Are Working On...

- Combating polluting attacks in live streaming networking using comparison-based diagnosis
 - Roverli P. Ziwich, 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
 - Christian Lyra, Carmem S. Hara, Elias P. Duarte Jr., "*BackStreamDB: A Distributed System for Backbone Traffic Monitoring Providing Arbitrary Measurements in Real-Time*," **PAM'2012**, Vienna, Austria

Finally: VCube

- A virtual topology that is scalable by definition
 - Elias P. Duarte Jr., Luis C. E. Bona, Vinicius K. Ruoso, "VCube: A Provably Scalable Distributed Diagnosis Algorithm," **Workshop on Latest Advances in Scalable Algorithms for Large-Scale Systems (ScalA)**, at **SC'2014**, New Orleans, USA

