Ongoing works on Service Defined Networks

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SDN Workshop, August 27th 2015

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Dependability on SDN

Dependability

Ability to deliver a set of services that can be justifiably trusted

Motivation

- High recovery cost and economic losses
- Risk is a crucial factor to SLA
- Virtualization introduces a number of risk/dependability challenges

What are the risks associated to the SDN paradigm?

Shift from reliability and availability per network element to end-to-end service

Dependability on SDN

Dependability Concerns in SDN

- General dependability characterization in SDN
- Continuous dependability monitoring in SDN
- Dependability assessment of virtualized components
- Use of dependability strategies to make SDN more resilient in SDN

S. Fernandes, M. Santos, *SDN Dependability: Assessment, Techniques, and Tools*, SDN Research Group, IETF 93, July 19-24, 2015, Prague, Czech Republic

Dependability assessment of SDN

Target

Realize a comprehensive model in order to evaluate the overall availability of SDN while taking into account each network failure source

Dependability assessment of SDN

Related Work 1

- Model of SDN controller
- *Pros:*
  - Hierarchical control plan (root - local)
  - Availability inversely dependent of load
  - Non Markovian failure process
- *Cons:*
  - Independence of control elements failures
  - No internal communication
  - Control element is a black box
  - No correlation between failures

F. Longo, S. Distefano, D. Bruneo, M. Scarpa, *Dependability modeling of software defined networking*, Computer Networks 83, 280 – 296, 2015

Dependability assessment of SDN

Related Work 2

- Small SDN case study
- Structural analysis
- Distribution of the cardinality of the minimum cuts sets

Minimum cut sets

The system is failed if and only if all the subsystems in a minimal cut set are failed, given that all the other subsystems that are not in the set are working.

P.E. Heegaard, V.B. Mendiratta, B.E. Helvik, *Achieving dependability in software-defined networking - a perspective*, 7th International Workshop on Reliable Networks Design and Modeling (RNDM), October 5-7, 2015, Munich, Germany

Two-level model of SDN availability

Target

Highlighting how the complexity changes by moving the control logic of a system from distributed to centralized

Two levels

- Structural analysis
- Markov model of network elements

Why: Ability to capture the global connectivity, without neglecting essential details of the network elements

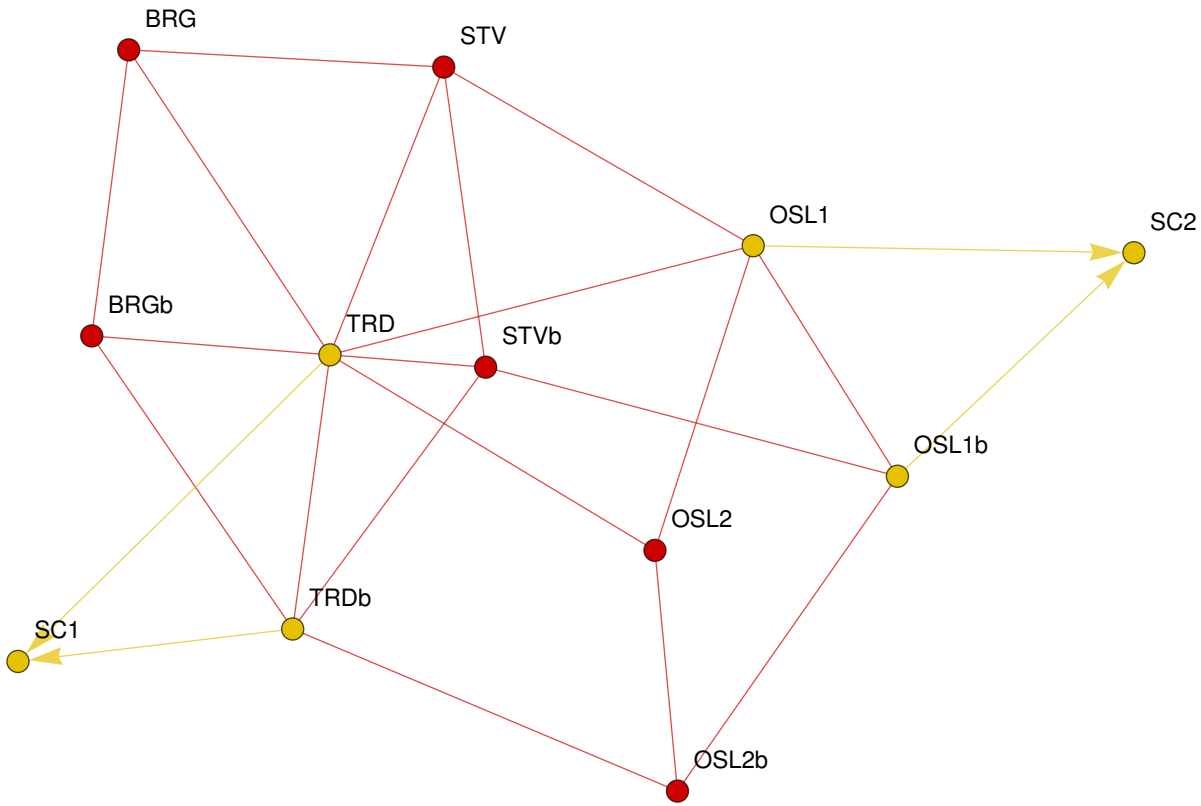
P.E. Heegaard, B.E. Helvik, G. Nencioni, J. Wäfler, *Managed dependability in interacting systems*, Book in honor of K. Trivedi, 2015

Two-level model of SDN availability

Case study

Network topology

- 4 traffic source (OSLx, TRDx, BRGx, STVx)
- 2 dual-homed SDN controllers



Two-level model of SDN availability

Higher level

Considered connections in SDN

- Flow triggering
- Network state update and route directive
- Forwarding

Procedure for minimum cut sets

- converting paths in network elements
- obtaining structure functions
- extracting list of cuts sets

Two-level model of SDN availability

Lower level

Network elements

- *Traditional network:*
  - Links
  - Routers
- *SDN:*
  - Links
  - SDN forwarding nodes
  - SDN controllers

Considered failures

- Software
- Hardware (transient/permanent)
- Coverage
- O&M

Two-level model of SDN availability

Numerical Evaluation

System availability

Inclusion-exclusion principle, technique for obtaining the elements in the union of finite sets

Main outcomes

- Using of commodity hardware and centralised control has a moderate effect on the overall availability
- O&M failures and software/logical failures that causes a control cluster to fail, are very important

Future improvements

- SDN controllers placement
- Failure correlation

Conclusions and future works