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NFV TUTORIAL SESSION - Reliability

NFV#12

Monday 26th October, 12:30 – 14:00

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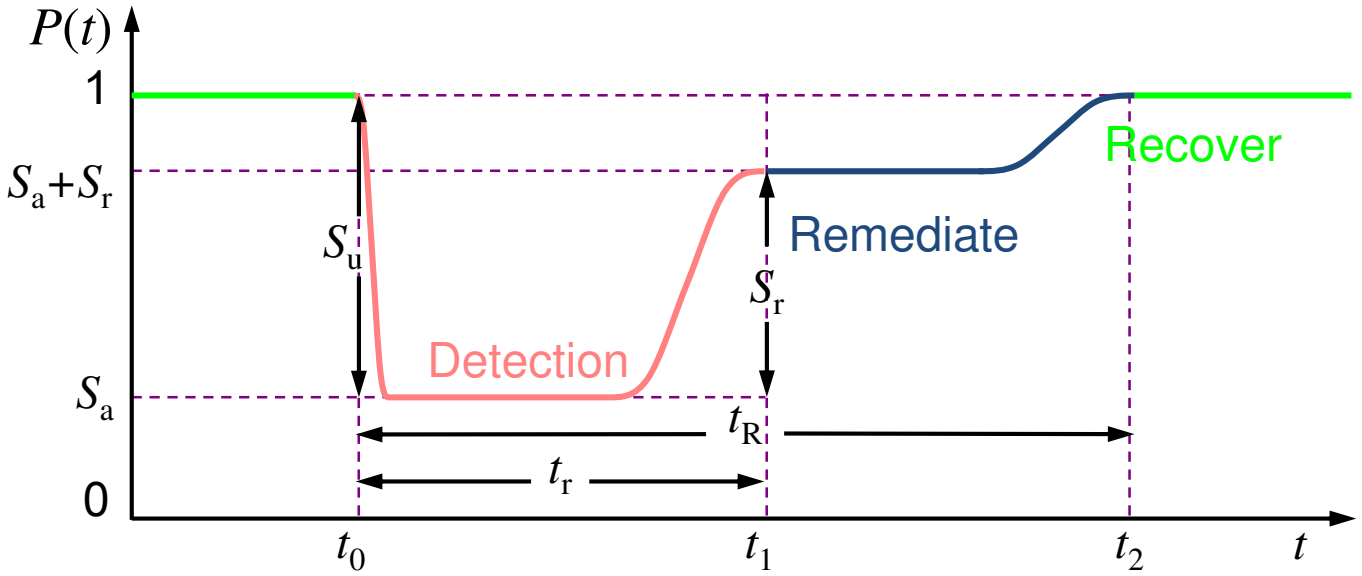
REL001 Resiliency Requirements Report

- Published on **2015-01-07 containing**
  - Use case analysis for reliability and availability in a virtualized network environment
  - Analysis of service availability levels
  - Identification of requirements for maintaining network resiliency and service availability, the focus being additional requirements introduced by virtualization. The mechanisms to be considered include the following:
    - Network function migration within and across system boundaries
    - Failure detection and reporting at the various layers
    - Failure prediction, prevention, and remediation
    - Solving network availability issues caused by overload/call blocking conditions
  - Engineering and deployment guidelines for maintaining network resiliency and ensuring service availability
  - Faults and Challenges catalogue that impact NFV system resiliency

Fault Management – a two step approach

- **Detection** of adverse service conditions and service failures
- **Remediation** that the service delivered is on an acceptable level
- **Recovery** that the service operates normally (what it was designed for) again



Further work items – overview

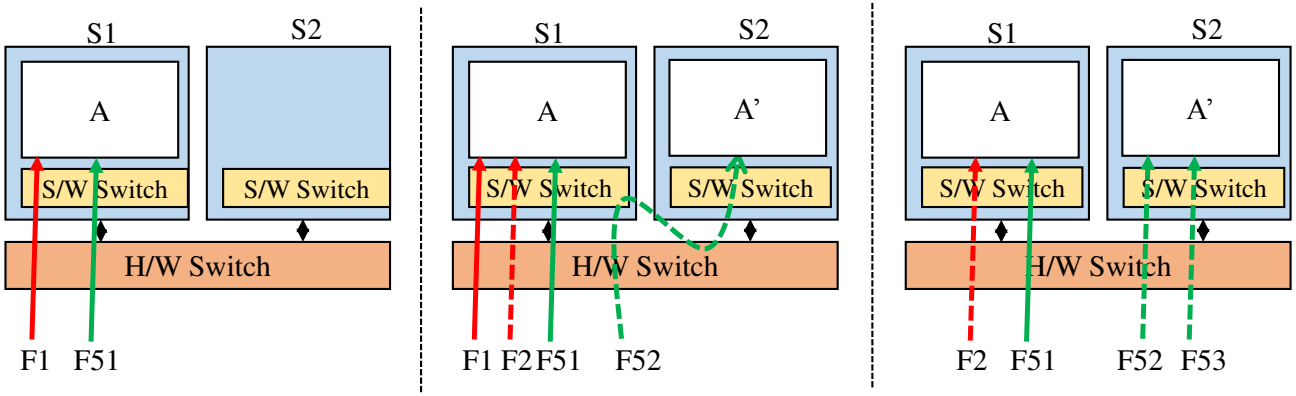
- REL003: Models and Features for E2E Reliability
  - Study and develop reliability estimation model for NFV environments
  - Assessment of system availability during various stages of VNF lifecycle
    - Scaling, Migration, Upgrade, …
- REL004: Active Monitoring and Failure Detection
  - Develop methods for active monitoring of VNFs, NFVI and services
  - Reliability and Availability Testing of NFV deployments
- REL005: Quality Accountability Framework
  - Promotes the development of capabilities by which VNFs, NFV infrastructure and MANO can eventually enable rapid and reliable root cause analysis of service quality impairments, corrective action, and SLA management.

REL002: Scalable Architectures for Reliability Management

- **Objective**
  - Examines Cloud/Data Center Techniques for Reliability Management for delivery of High Availability
  - Develops Scalable Methods for Managing Network Reliability in NFV Environment
- **State management during scaling and failure recovery operations:**
  - Dynamic scaling and recovery of control state
  - Dynamic scaling and recovery of session state
  - Dynamic scaling and recovery of server aggregate state
- **Published September 2015**

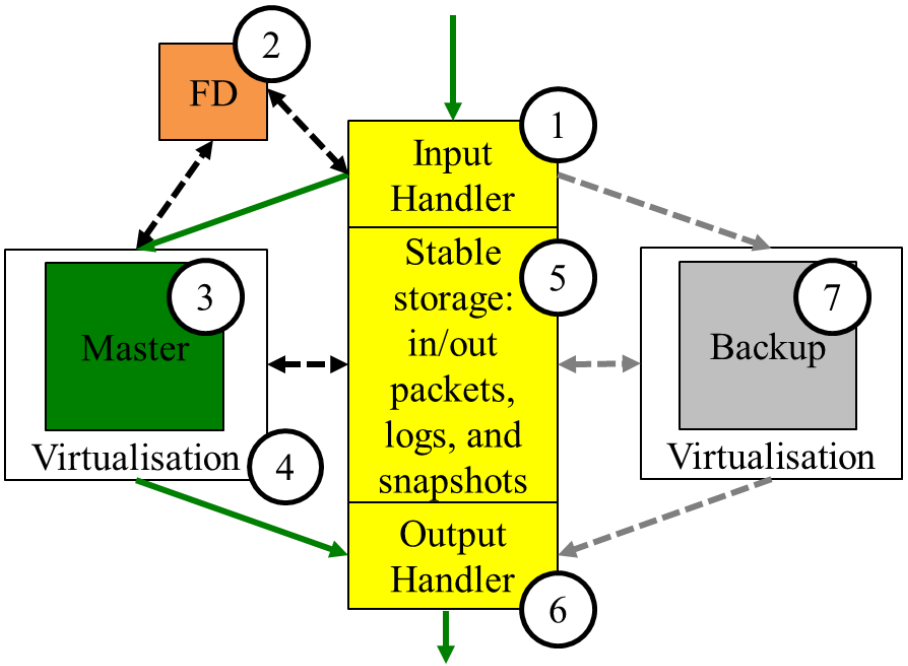
Scale-out with Migration Avoidance

- **Applicability**
  - Dynamic scaling of per-flow state
  - Dynamic scaling of single server aggregate state
- **Approach**
  - Splitting the original range:
  - Flows in $F_{old}(A)$ gradually terminate: remove exception
  - Number of exceptions below threshold



Lightweight Rollback Recovery

- **Applicability**
  - Failure of host system, e.g., hardware, driver, host OS
- **Objectives**
  - Correctness: Same state as prior to failure
  - Low overhead
  - Fast recovery
  - Generality
  - Passive Replicas
- **Approaches**
  - Checkpointing
  - Checkpointing with Buffering
  - Checkpointing with Replay



Scalable Architecture Components

- **Controller (Migration Avoidance):**
  - Supervision of dynamic scaling.
  - Standalone device in support of this process or as part of e.g., the orchestrator.
    a) Indication of overload condition and initiation of migration avoidance process
    b) Determine location (server) of new VNF instance and instantiate it
    c) Configure rules in software and hardware switches
- **Overload Detector (Migration Avoidance):**
  - Active monitoring methodologies as described in RL004: *"Active Monitoring and Fault Detection"*.
- **Failure Detector (Lightweight Rollback Recovery):**
  - Combination of active monitoring techniques [i.7] and the architecture proposed by the OPNFV Doctor Project [i.8] which relies on NFVI analytics.

Future Work

- **Multi-server Aggregate State Recovery**
  - Dynamic Scaling of cross-server aggregate state
  - Recovery of cross-server aggregate state
- **Gracefully phasing out old flows** implemented in HW switch
  - An alternative process that invokes the use of the software switch to configure the final rules for old
- **New methods/algorithms to reduce the checkpointing with buffering latency**
- **Checkpointing+replay process at the application layer**
- **Checkpointing/Logging as Passive Monitoring techniques** in an NFV environment is a topic for further study

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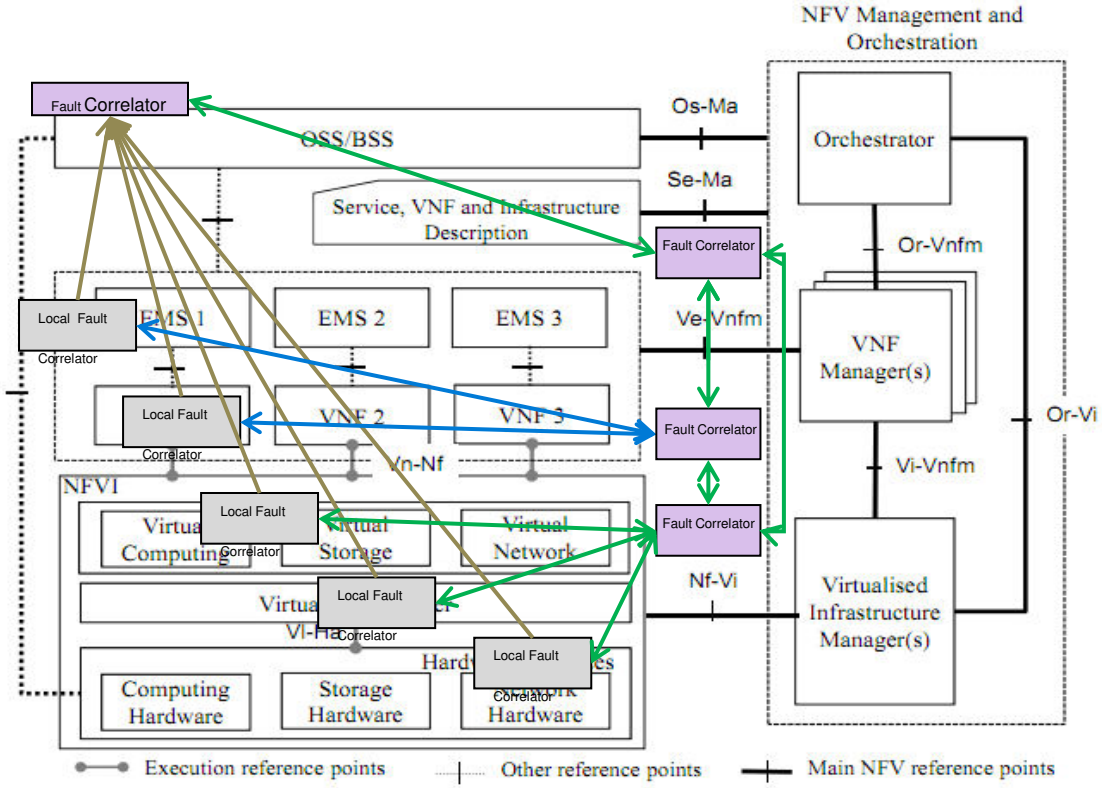
BACKUP

NFV REL – Hot Topic

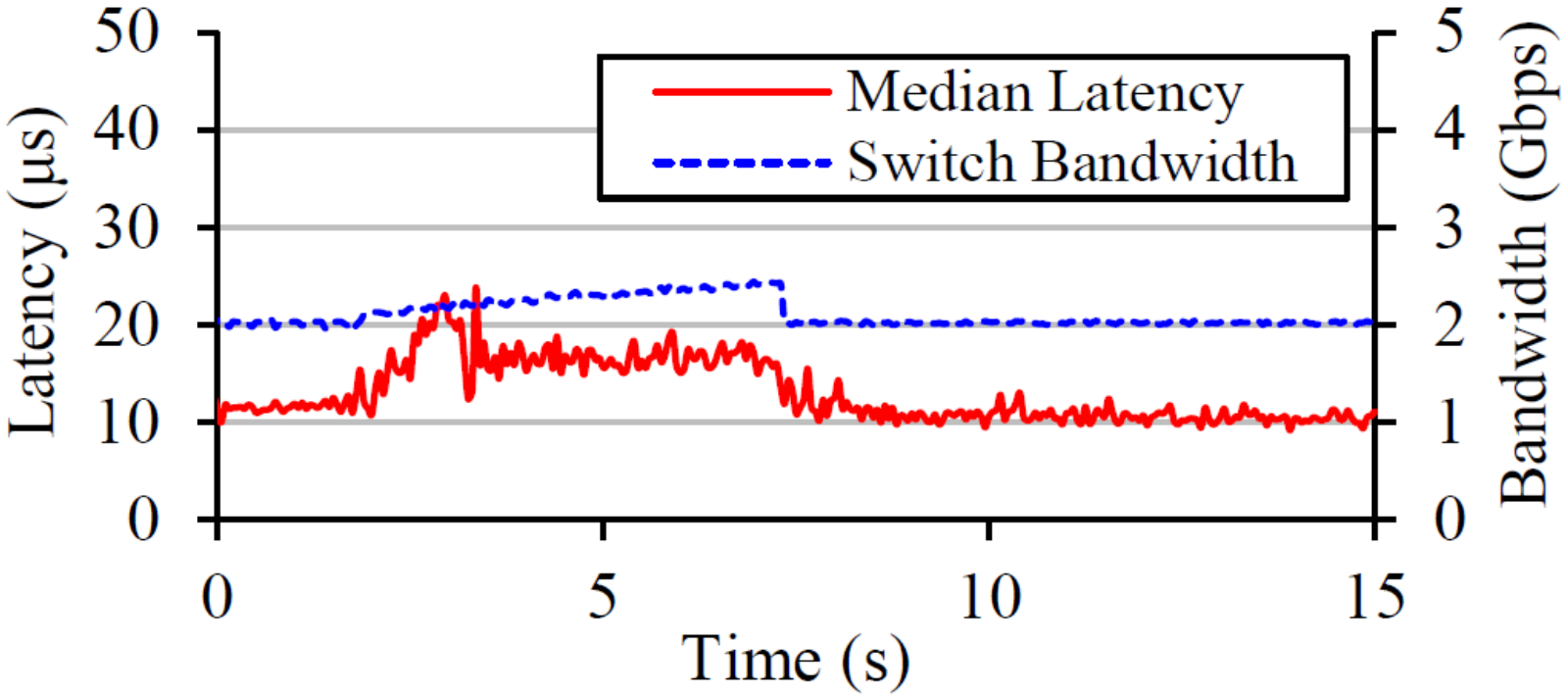
- Early information correlation on different layers to **avoid information floods**
- Correlation in a **multi-vendor environment**



Trade-offs

Approach	Correctness	Latency Overhead	Generality
Checkpointing	Not guaranteed	0 microseconds	Any legacy VNF binary
Checkpointing with buffering	Guaranteed	10s of milliseconds*	Any legacy VNF binary
Checkpointing with replay	Guaranteed	10s of microseconds*	Any legacy VNF source code

Evaluation: Migration Avoidance



Evaluation: Lightweight Recovery