Stefano Rosiello

Tutor: prof. Domenico Cotroneo

XXXI Cycle - I year presentation

# Overload Management in Network Function Virtualization

My Background

- **Master of Science:**
  - Cum laude in **Ingegneria Informatica** at University of Naples - Federico II

- **DIETI group:**
  - Dependable Systems and Software Engineering Research Team (**DESSERT**)

- **Type of Fellowship:** PhD Student Grant

- **Industrial Collaboration:**
  - **Huawei Technologies Co. Ltd.** within an industrial research project with the aim to identify possible solutions to overload in NFV.

Network Softwarization

❑ **Network functions** implemented **in software** by leveraging virtualization technologies enabling

    ❑ Minimization of HW dependency

    ❑ Consolidation onto high-volume COTS HW
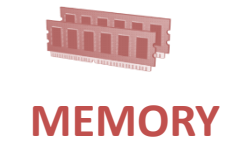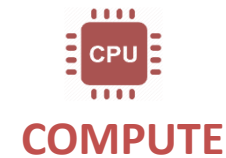
Its success depends upon the ability to **comply with carrier-grade requirements**

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Overload Control Requirements in NFV

❑ It should **maximize service throughput/availability and ensure high-priority services** when an overload condition occurs

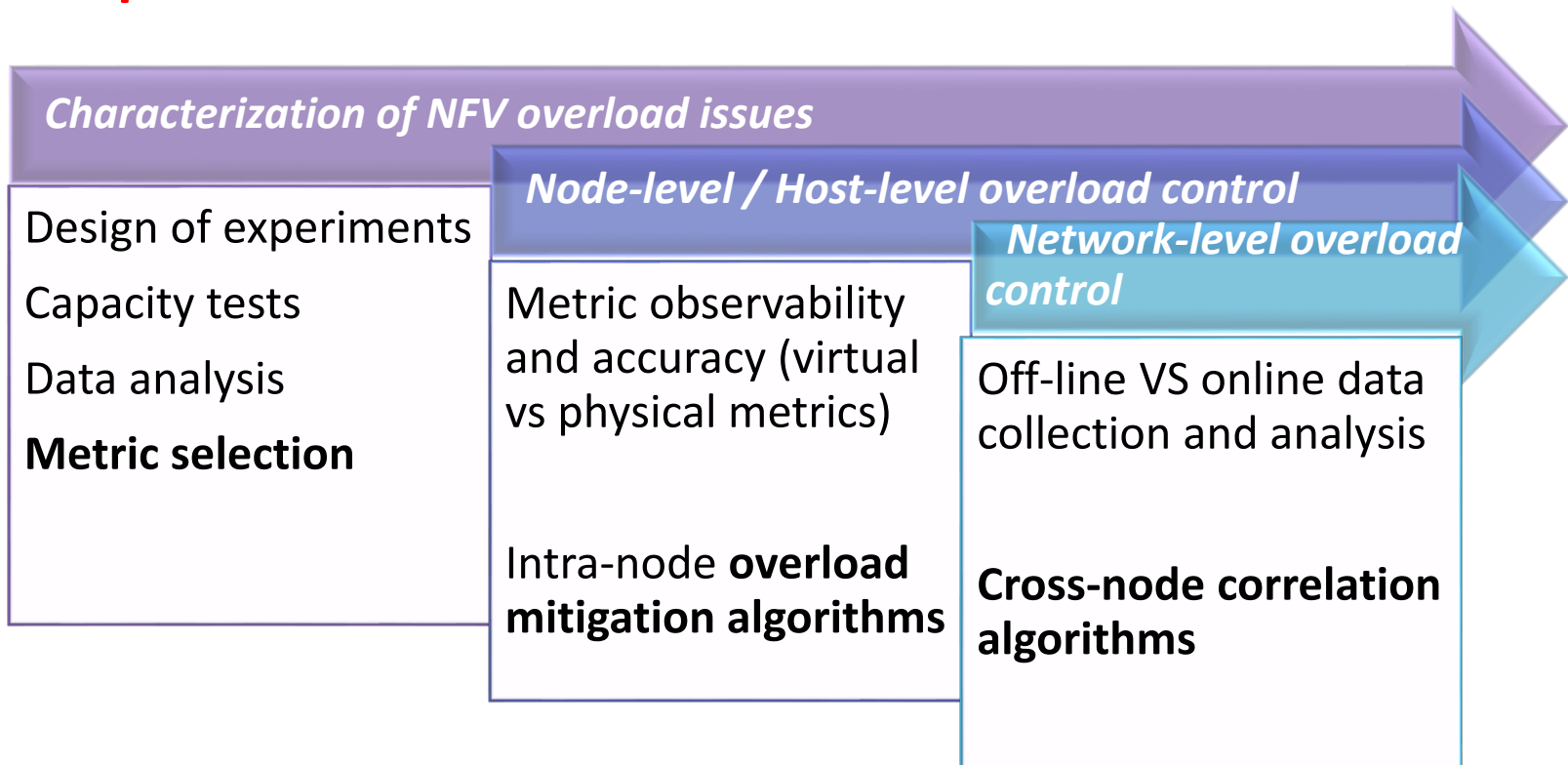| Service name [default SA level]		Normal	Overloaded	Heavily Overloaded	Emergency Situation [dedicated SA level]
Video call service	Video [2]	available [2-I]	available [2-I]	Degraded to Image service [2-II]*	Not available (pre-empted) [2-III]*
	Voice [1] (registered as ETS)	available	available	available	available

❑ It should be able to handle **at least 90% of its engineered throughput even in the case of 1000% overload** (i.e. 10 times)
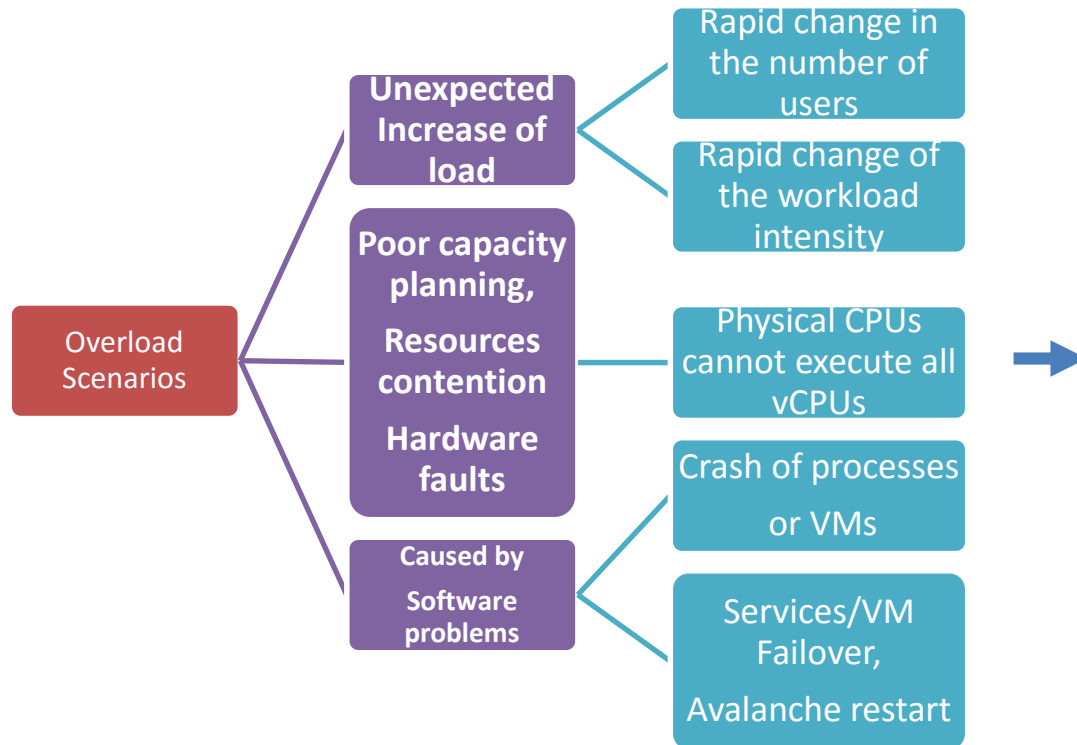

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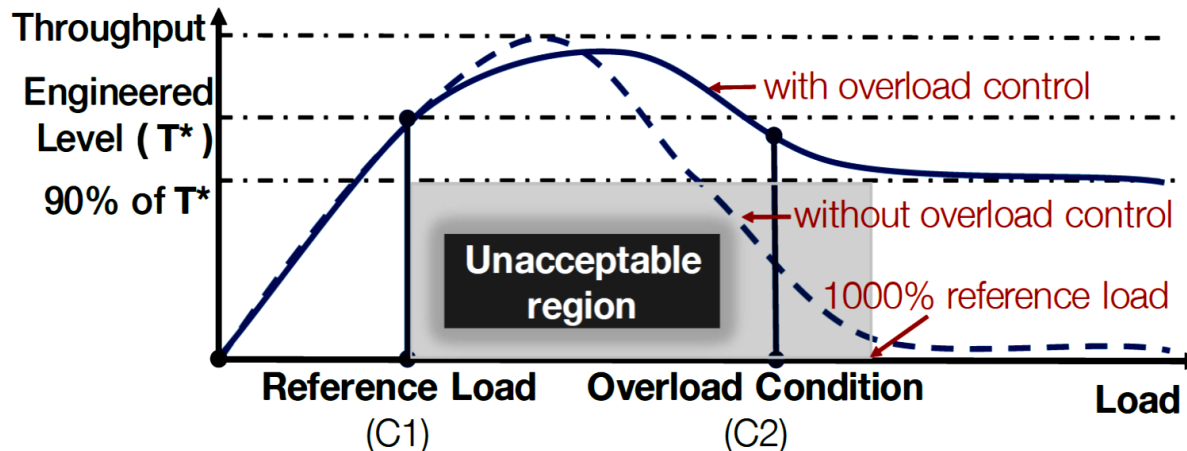
My research activities

➢ **What are the overload causes in NFV ?**

➢ **How an overload condition can be detected ?**

➢ **What action should be taken to guarantee the NFV requirements ?**

Characterization of NFV overload issues

Design of experiments

Capacity tests

Data analysis

Metric selection

Node-level / Host-level overload control

Metric observability and accuracy (virtual vs physical metrics)

Intra-node **overload mitigation algorithms**

Network-level overload control

Off-line VS online data collection and analysis

Cross-node correlation algorithms

Characterization of overload issues

❑ **Performance analysis of an IP Multimedia Subsystem (IMS) under overload conditions**

Overload Scenarios

- **Unexpected Increase of load**
  - Rapid change in the number of users
  - Rapid change of the workload intensity

- **Poor capacity planning, Resources contention, Hardware faults**
  - Physical CPUs cannot execute all vCPUs

- **Caused by Software problems**
  - Crash of processes or VMs
  - Services/VM Failover, Avalanche restart
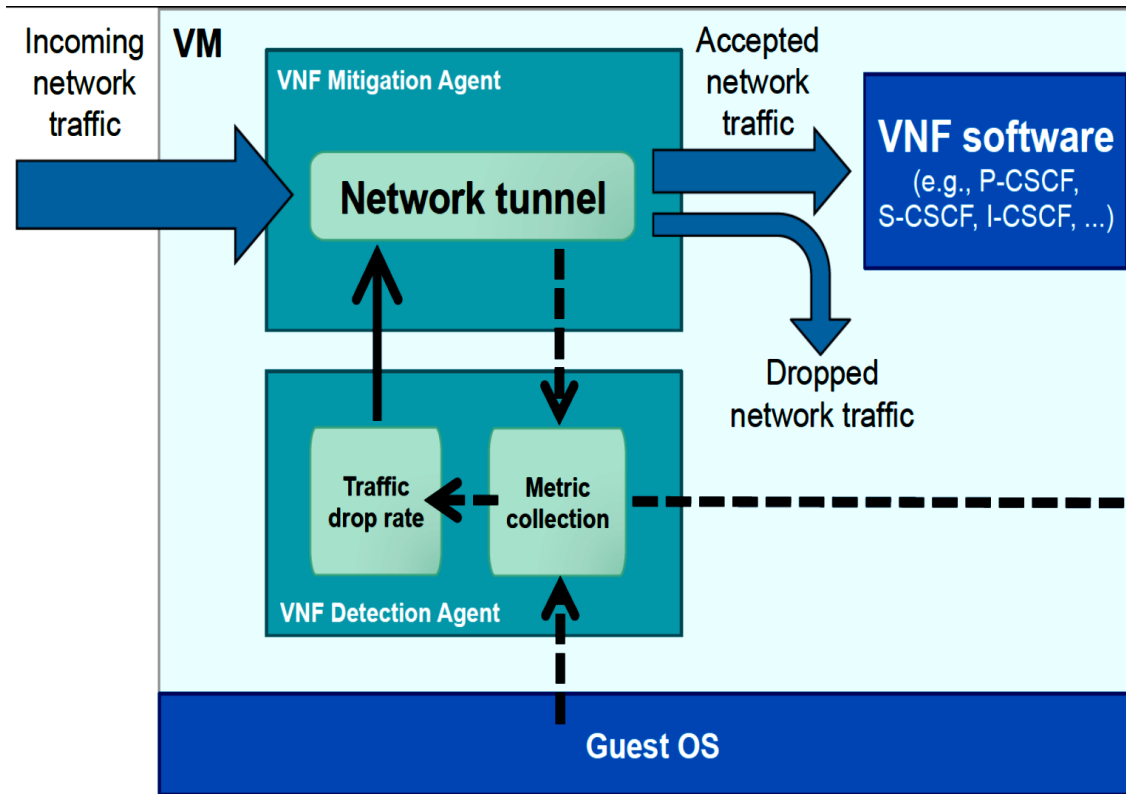
❑ **Metric selection**

Virtual CPU consumption metric is capable to detect all the considered overload conditions.

❑ **Actions**

Overload control should react within 10 seconds to protect service from failures by **rejecting the traffic**.

The proposed solution

❑ **A closed control loop approach to estimate the node capacity**

❑ **A Detection module**

1. collect metrics

2. calculate the amount of traffic to drop

❑ **A Mitigation module**

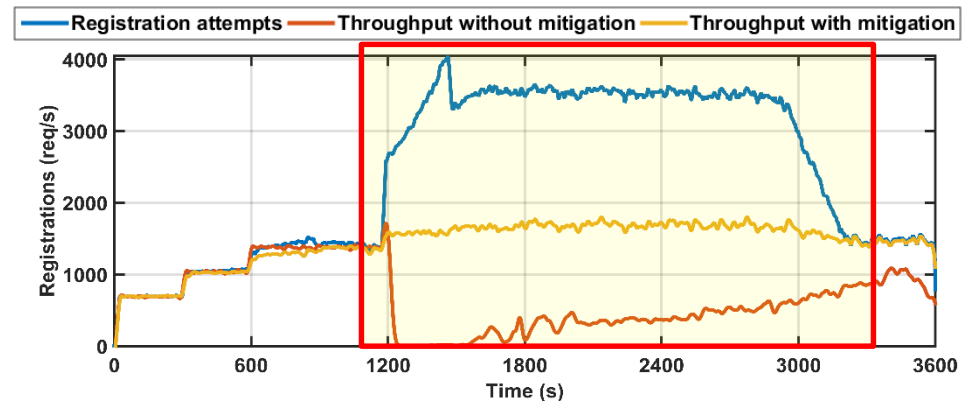**1. Reject new sessions according to the detection agent status**
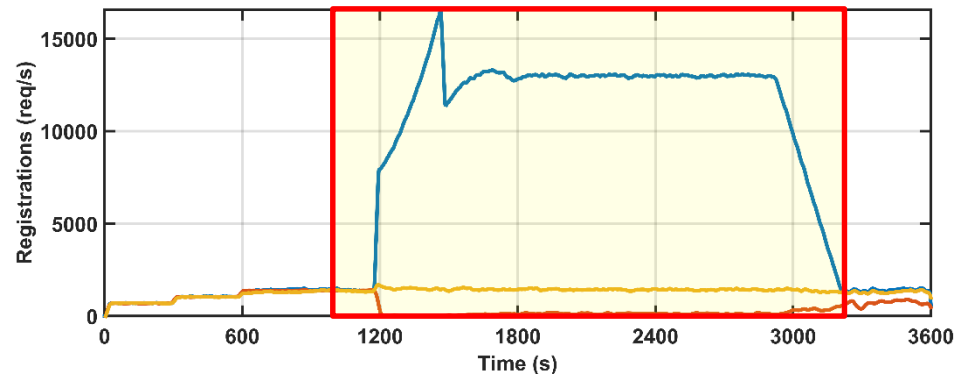
Some results

☐ **Case Study:**

IP Multimedia Subsystem (IMS)

Load spike (150%)
injected at 1200s

Load spike (1000%)
injected at 1200s

Products

- **Journal Paper**

To be published: D. Cotroneo, R. Natella, S. Rosiello – "**NFV Throttle: An Overload Control Framework for Network Function Virtualization**" – IEEE Transaction on Network and Service Management

Training activities and next year

	year 1								year2	year3	
	Estimated	**1** Nov-Dec	**2** Jan-Feb	**3** Mar-Apr	**4** May-Jun	**5** Jul-Aug	**6** Sep-Oct	Summary	**Estimated**	**Estimated**	**Check**
Modules	20	0	7	0	3	0	9	19	15	0	30-70
Seminars	5	0	0,8	0,8	1,2	0	0,5	3,3	5	5	10-30
Research	35	10	2	9	6	10	1	38	40	55	80-140
	60	10	9,8	9,8	10	10	11	60	60	60	180

- During the next year I will focus on:

  - the overload management in **distributed multi-tier software architectures**, on which complex NFV services are implemented.

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