Energieverbrauch von Live-Migrationen in OpenStack-basierten Private-Cloud-Umgebungen

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Kontext

Forschungsprojekt: **eneRZet** - Improving energy efficiency in data centers by using SDN technologies, renewable energy and power management

TU Clausthal: Prof. Dr. Harald Richter

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Hochschule Fulda: Prof. Dr. Sebastian Rieger

Forschungsprojekt enRZet: http://www.hs-fulda.de/?id=215&L=1

Kontext

Data Center 1

Management Server

Remote Management Daemon

VM migration

Storage migration

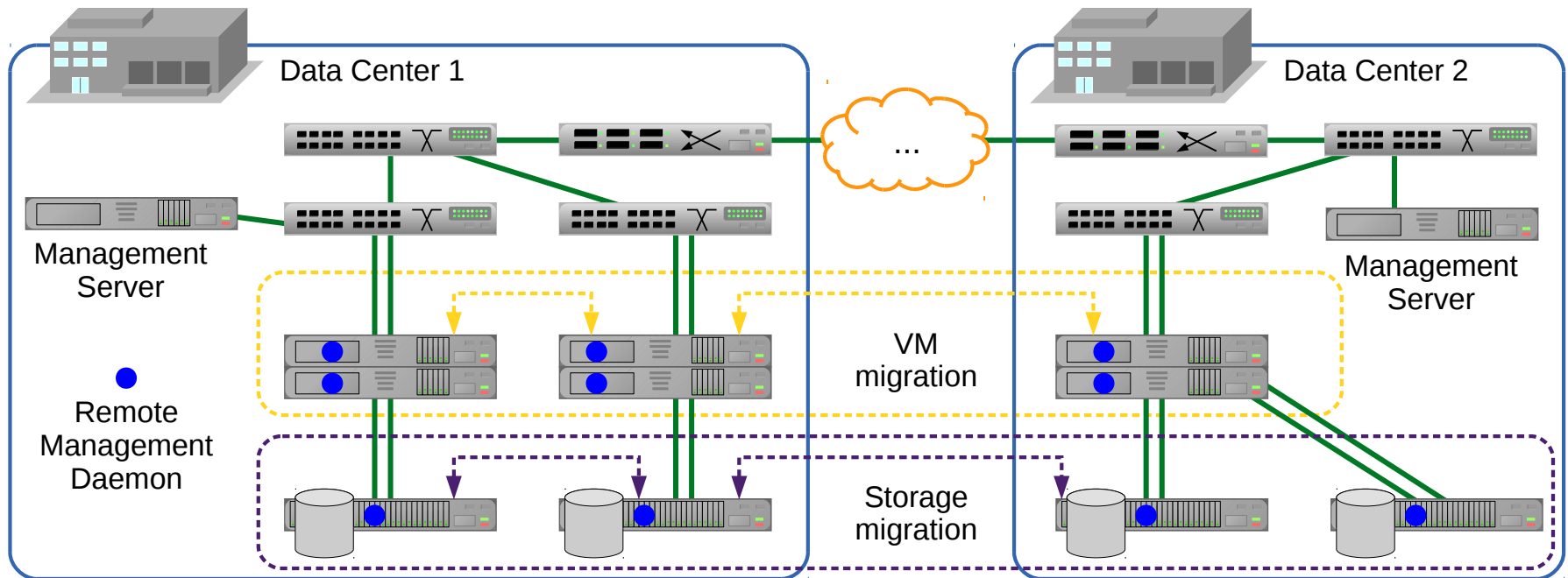Data Center 2

Management Server

Figure 1: K. Spindler, S. Reissmann, and S. Rieger, "Enhancing the energy efficiency in enterprise clouds using compute and network power management functions," in ICIW 2014, The Ninth International Conference on Internet and Web Applications and Services, 2014
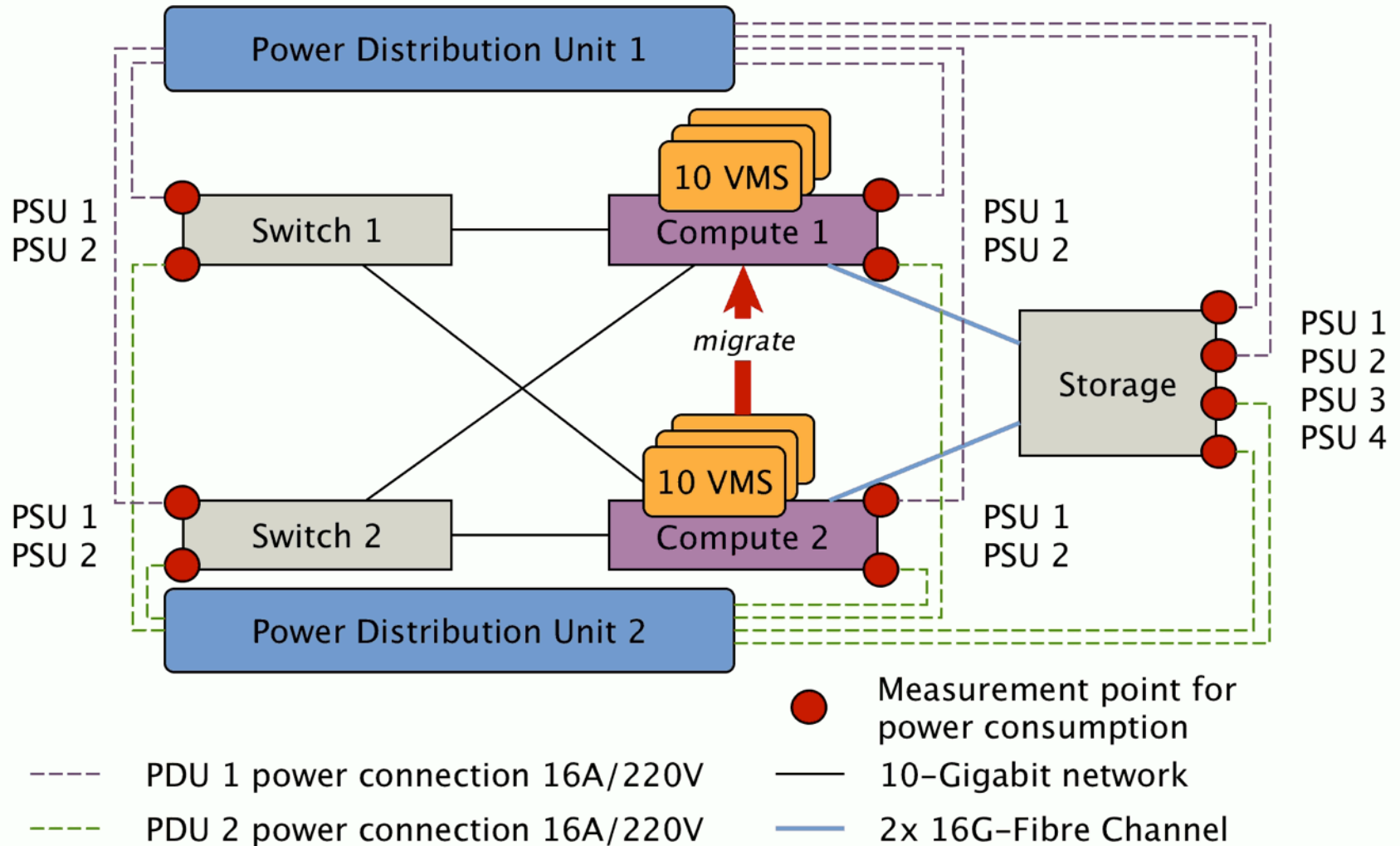
Kontext

- Optimierung Energie-Effizienz von Rechenzentren

- Schwerpunkt auf alternative Energien

- Ermitteln von Migrationskosten

- Projektumgebung basierend auf OpenStack

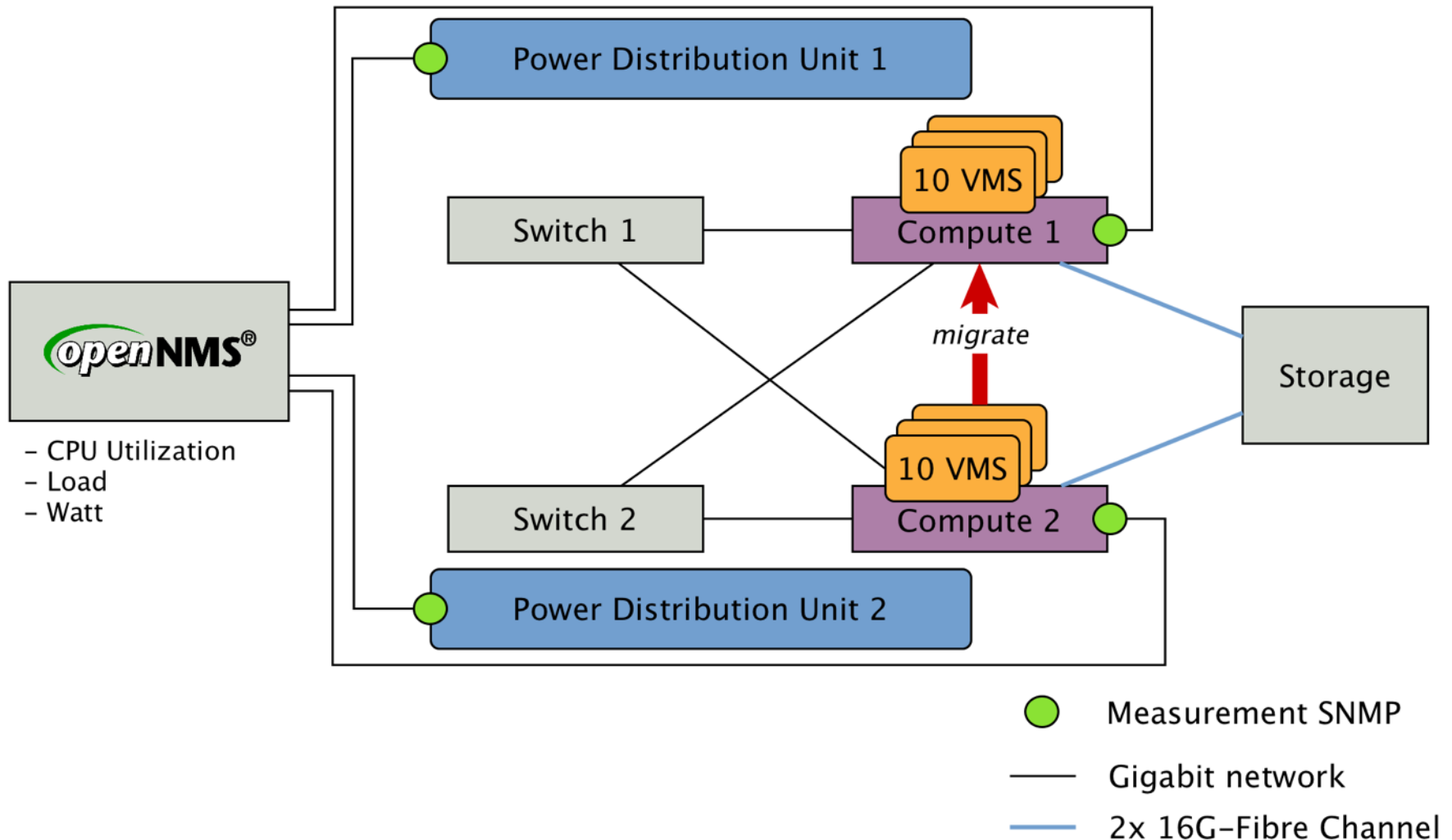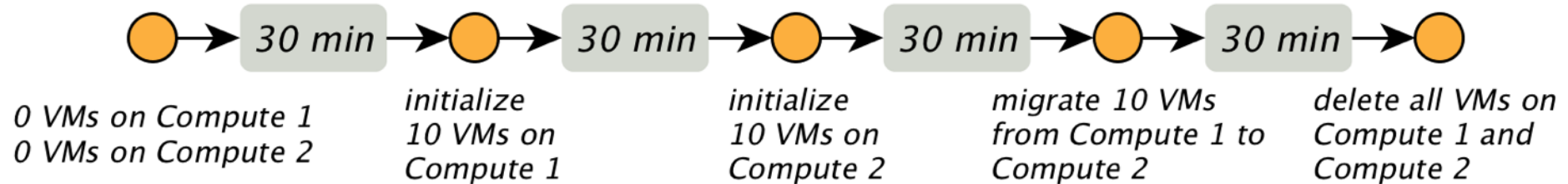- Live-Migration von virtuellen Maschinen

Migration Strategien

Hochschule Fulda
University of Applied Sciences

- Non-Live Migration

- Shared storage-based live migration

- Block live migration

- Volume-backed live migration

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Testaufbau

```
  ○ ──→  30 min  ──→  ○  ──→  30 min  ──→  ○  ──→  30 min  ──→  ○  ──→  30 min  ──→  ○
```

0 VMs on Compute 1   initialize   initialize   migrate 10 VMs   delete all VMs on
0 VMs on Compute 2   10 VMs on   10 VMs on   from Compute 1 to   Compute 1 and
                      Compute 1   Compute 2   Compute 2   Compute 2

VM Profile

- m1.xsmall

- 1GB RAM

- 1 VCPU

- 10.0GB Disk

- Last Simulation

- `stress`
 I/O, Mem, CPU

- Ziellast ~80%
  CPU Utilization

SPECpower_ssj2008

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spec

Dell Inc. PowerEdge R630 (Intel Xeon E5-2699 v3 2.30 GHz)			SPECpower_ssj2008 = 9,749 overall ssj_ops/watt	
Test Sponsor:	Dell Inc.	**SPEC License #:**	55	**Test Method:**	Single Node
Tested By:	Dell Inc.	**Test Location:**	Round Rock, TX, USA	**Test Date:**	Mar 13, 2015
Hardware Availability:	Apr-2015	**Software Availability:**	Jun-2013	**Publication:**	Apr 1, 2015
System Source:	Single Supplier	**System Designation:**	Server	**Power Provisioning:**	Line-powered

Benchmark Results Summary

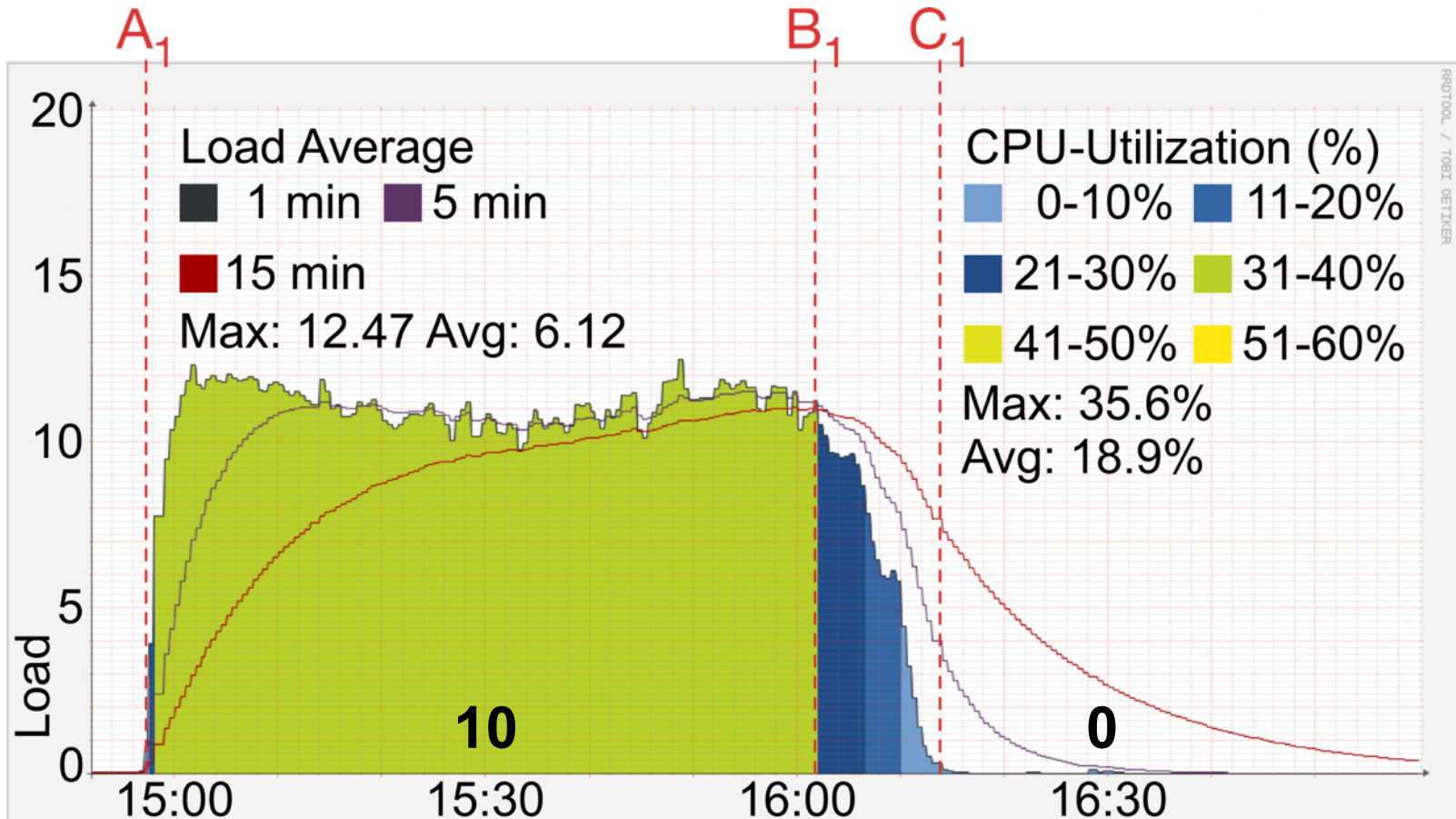|	Performance		Power	Performance to Power Ratio
Target Load	**Actual Load**	**ssj_ops**	**Average Active Power (W)**	
100%	100.1%	3,240,418	287	11,284
90%	91.0%	2,946,465	255	11,560
80%	80.2%	2,594,563	223	11,623
70%	69.9%	2,261,881	197	11,505
60%	60.2%	1,947,214	176	11,033
50%	49.9%	1,615,345	162	10,000
40%	40.0%	1,294,673	146	8,889
30%	30.0%	970,456	129	7,528
20%	20.0%	648,195	111	5,830
10%	10.0%	324,418	93.4	3,473
Active Idle		0	51.2	0
			∑ssj_ops / ∑power =	9,749
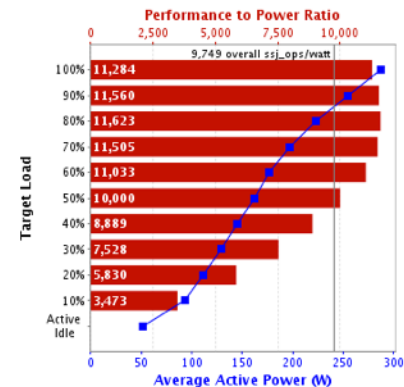
SPECpower_ssj2008: https://www.spec.org/power_ssj2008/results/res2015q2/power_ssj2008-20150317-00691.html

Testablauf

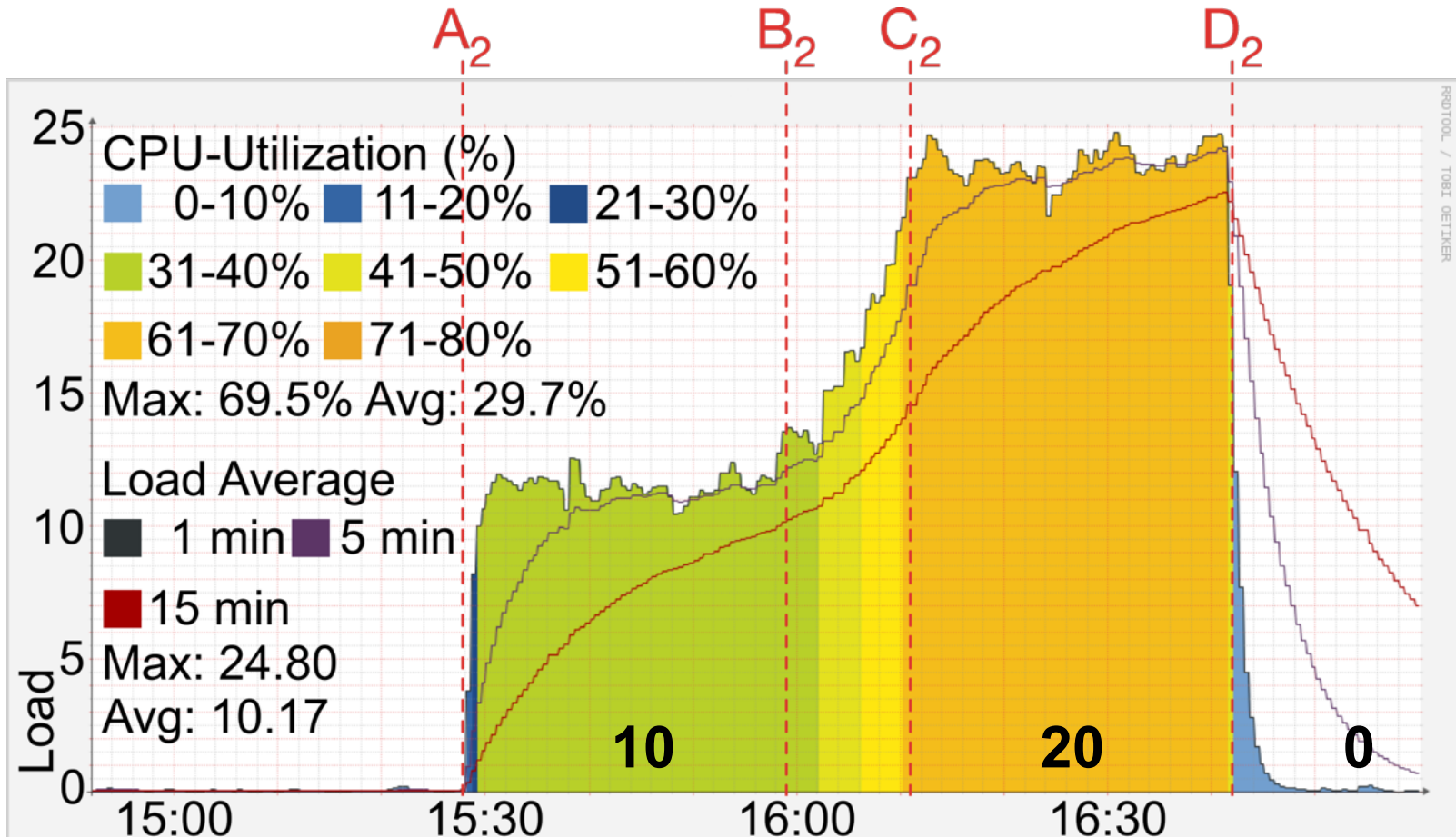| Performance		Power	Performance to Power Ratio
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Ergebnisse

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Total eneRZet Watt (200-240V / 16A)

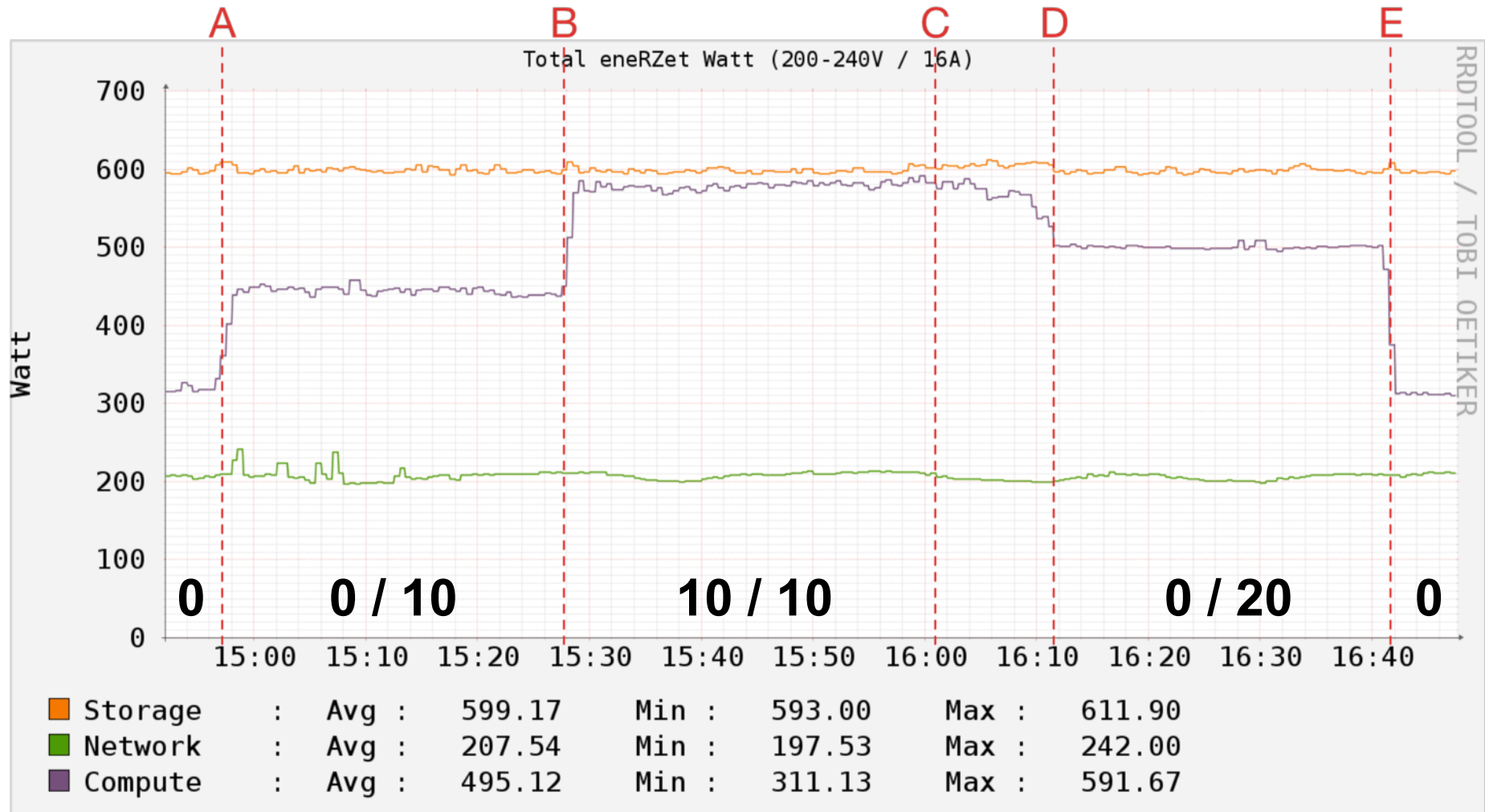|	Avg	Min	Max
Storage	599.17	593.00	611.90
Network	207.54	197.53	242.00
Compute	495.12	311.13	591.67

Ausblick
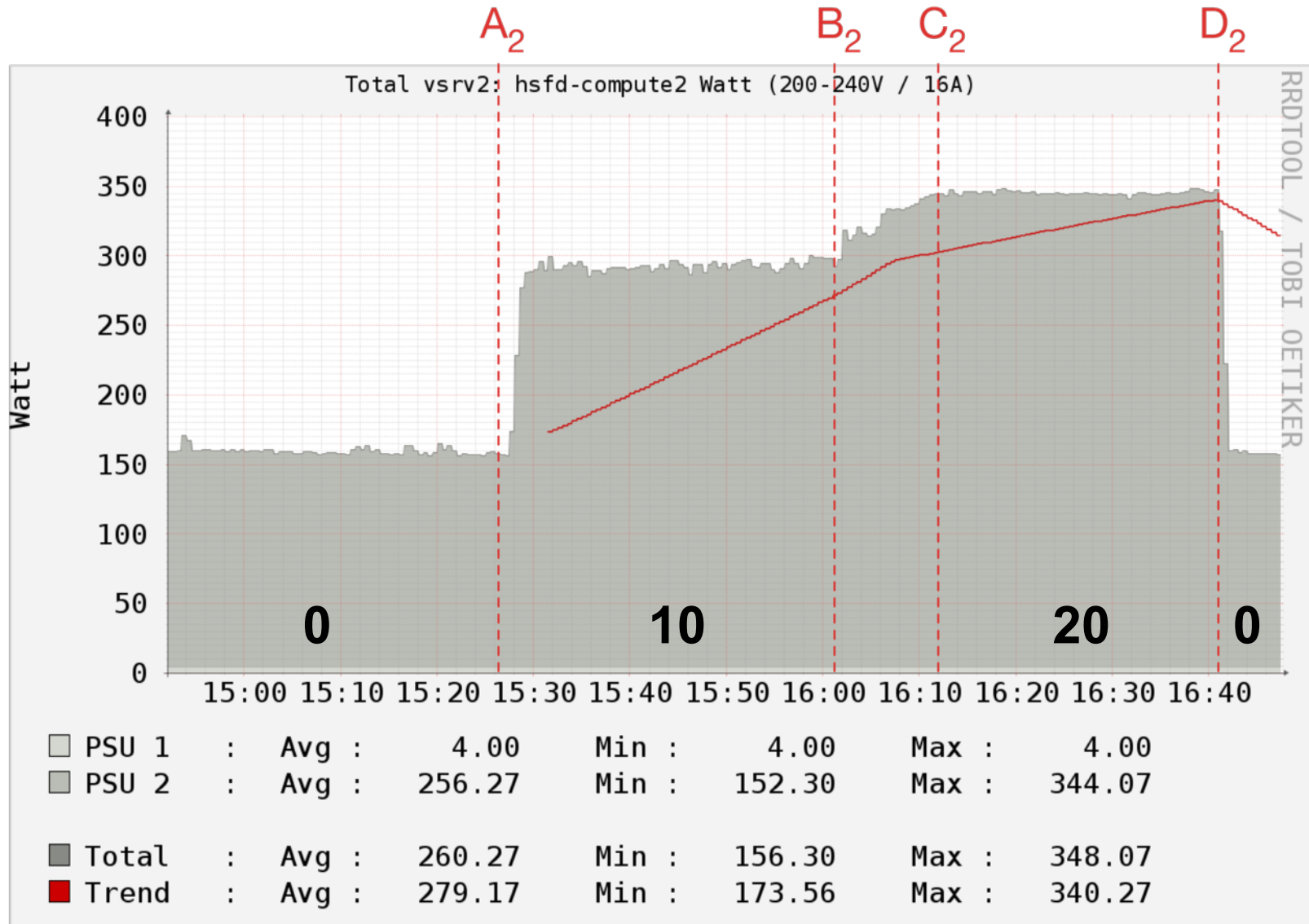
- ACPI auf Switch Geräten

- Ersetzen der Last-Simulation von `stress` mit echtem Service

- Erweiterung der Tests im Hinblick auf der Dienstgüte während der Migration

  - Anzahl Anfragen pro Sekunde

  - Antwortzeit eines Dienstes

- Leistungsaufnahme VM vs. LXC