



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

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

TU Clausthal: Prof. Dr. Harald Richter

Hochschule Darmstadt: Prof. Dr. Thomas Glotzbach

Hochschule Fulda: Prof. Dr. Sebastian Rieger

# Kontext

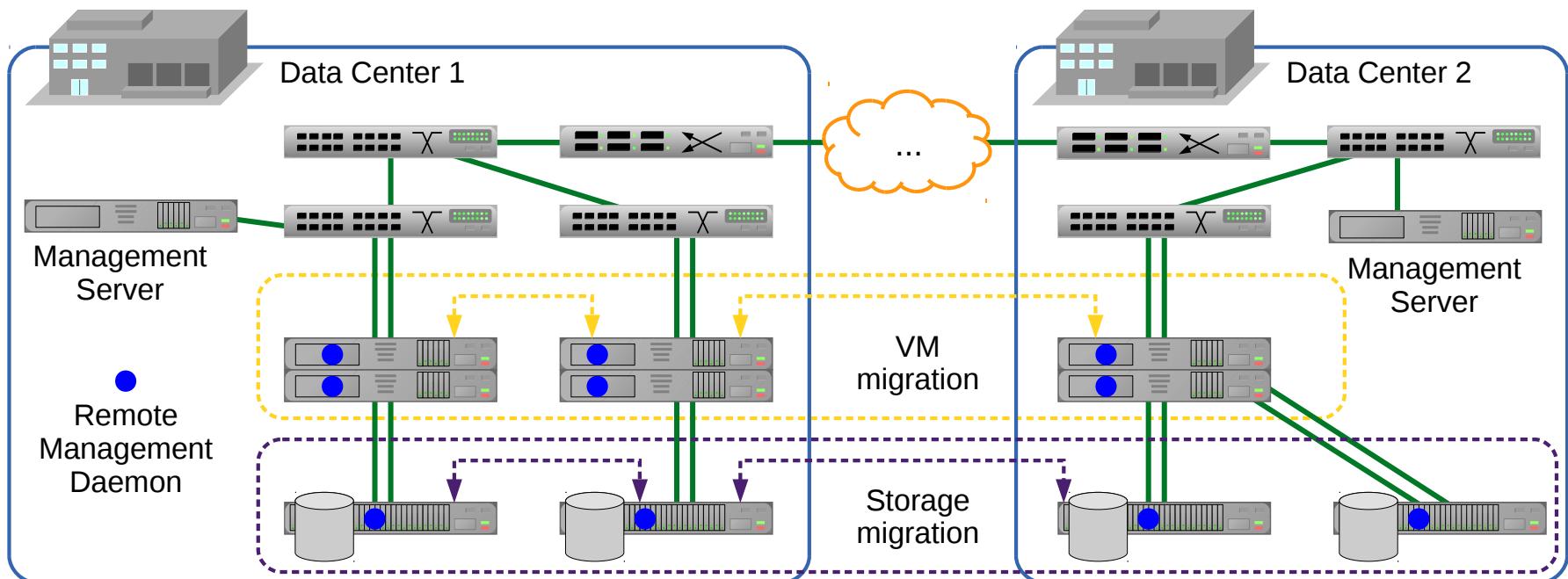


Figure 1: K. Spindler, S. Reissmann, and S. Rieger, "Enhancing the energy efficiency in enterprise clouds using compute and network power management functions," in ICIW 2014, The Ninth International Conference on Internet and Web Applications and Services, 2014



- Optimierung Energie-Effizienz von Rechenzentren
- Kernaspekt auf alternative Energien
- Ermitteln von Migrationskosten
- Projektumgebung basierend auf OpenStack

# Motivation Migration



- Fehlertoleranz
- Optimierung der Auslastung IT Ressourcen
- Leistungsfähigkeit von Diensten erhöhen

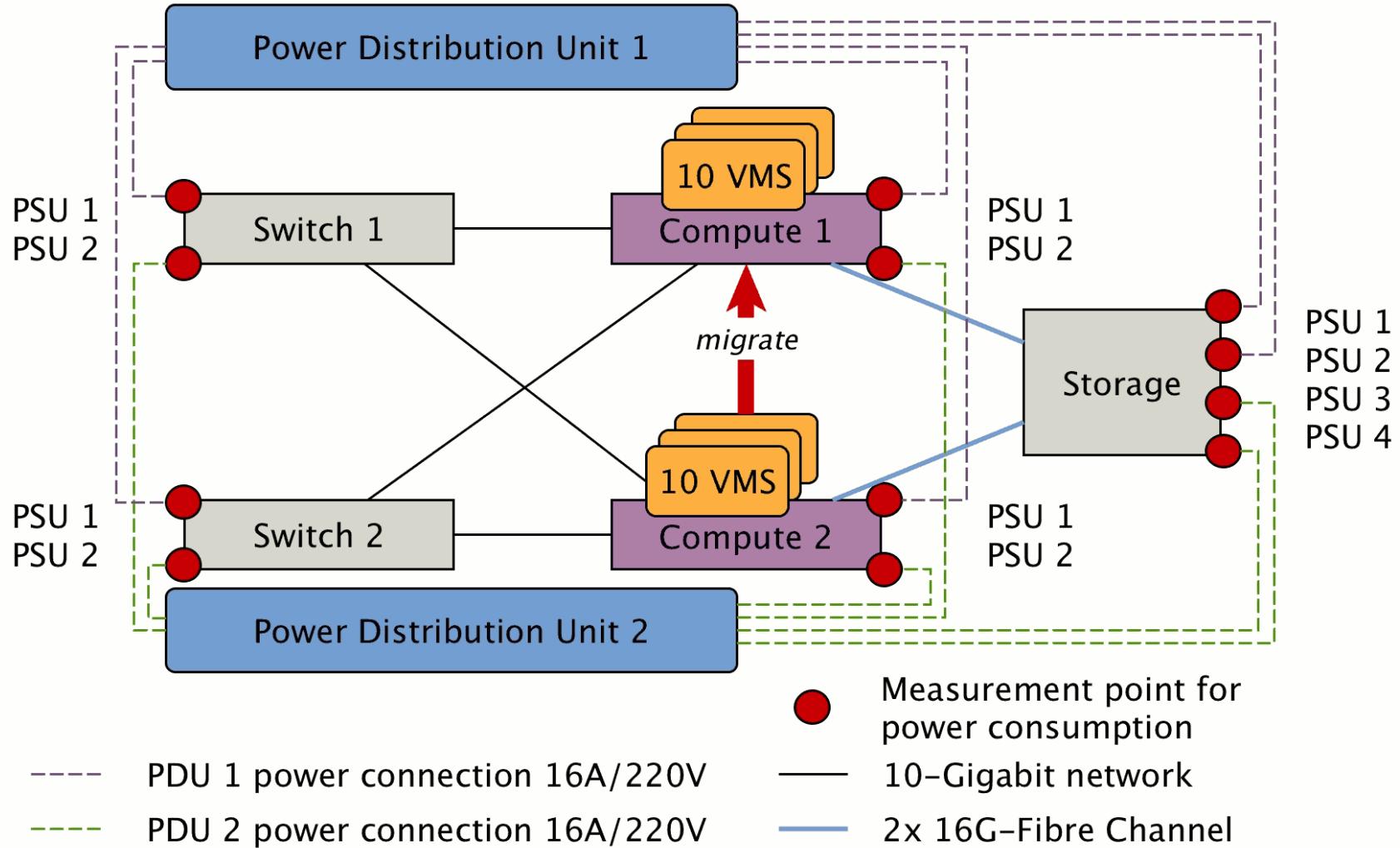


- Non-Live Migration
- Shared storage-based live migration
- Block live migration
- Volume-backed live migration

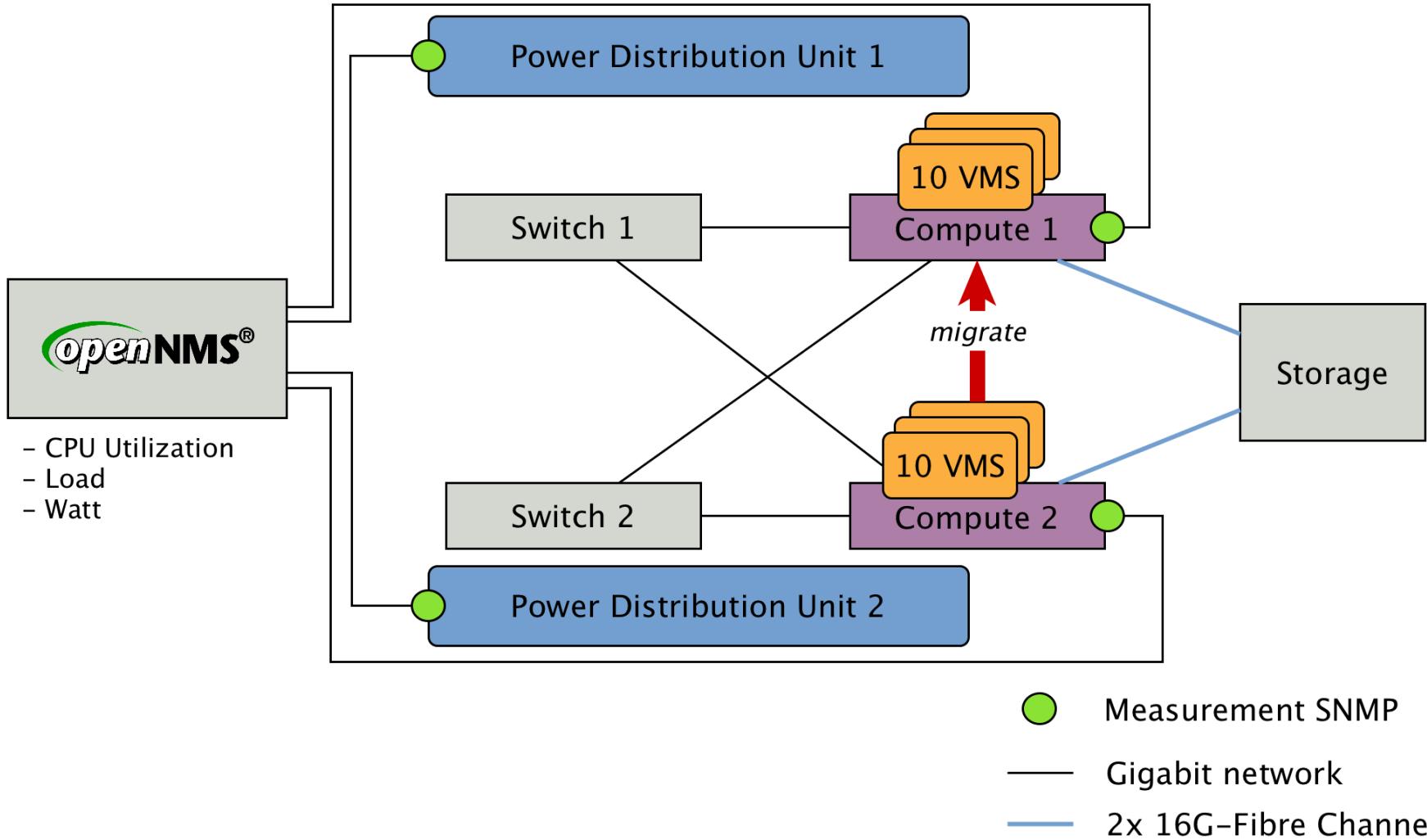


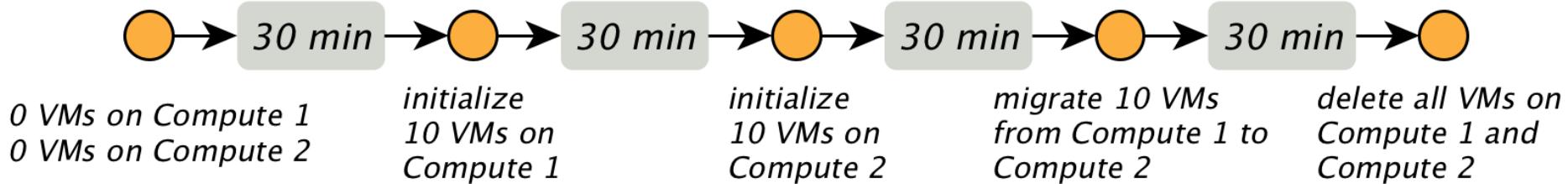
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# Testaufbau



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## VM Profile

- m1.xsmall
- 1GB RAM
- 1 VCPU
- 10.0GB Disk

- Last Simulation
- stress I/O, Mem, CPU
- Ziellast ~80% CPU Utilization

# Testablauf



## SPECpower\_ssj2008

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Dell Inc. PowerEdge R630 (Intel Xeon E5-2699 v3 2.30 GHz)

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
$\Sigma \text{ssj\_ops} / \Sigma \text{power} =$				9,749

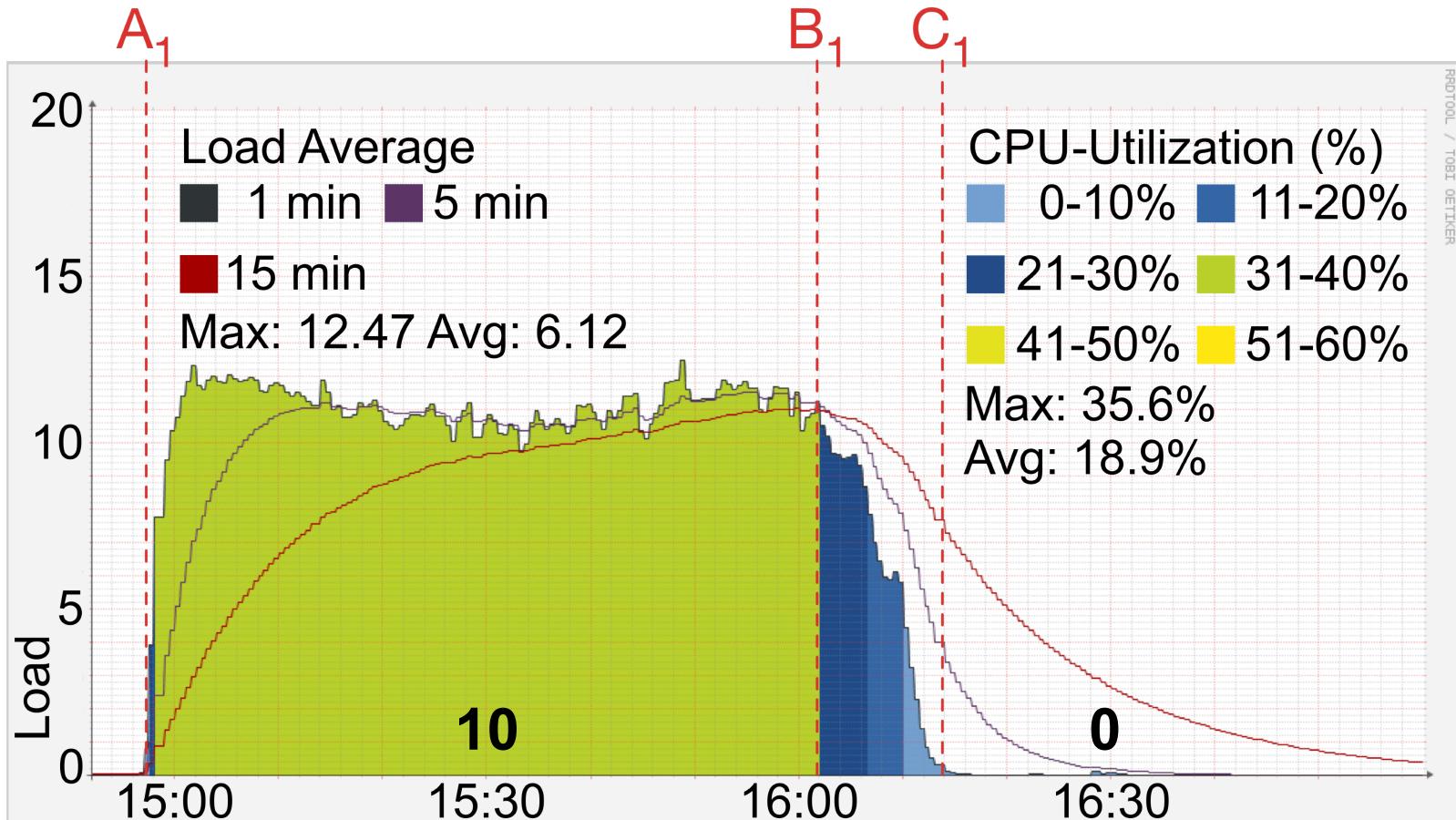


SPECpower\_ssj2008: [https://www.spec.org/power\\_ssj2008/results/res2015q2/power\\_ssj2008-20150317-00691.html](https://www.spec.org/power_ssj2008/results/res2015q2/power_ssj2008-20150317-00691.html)

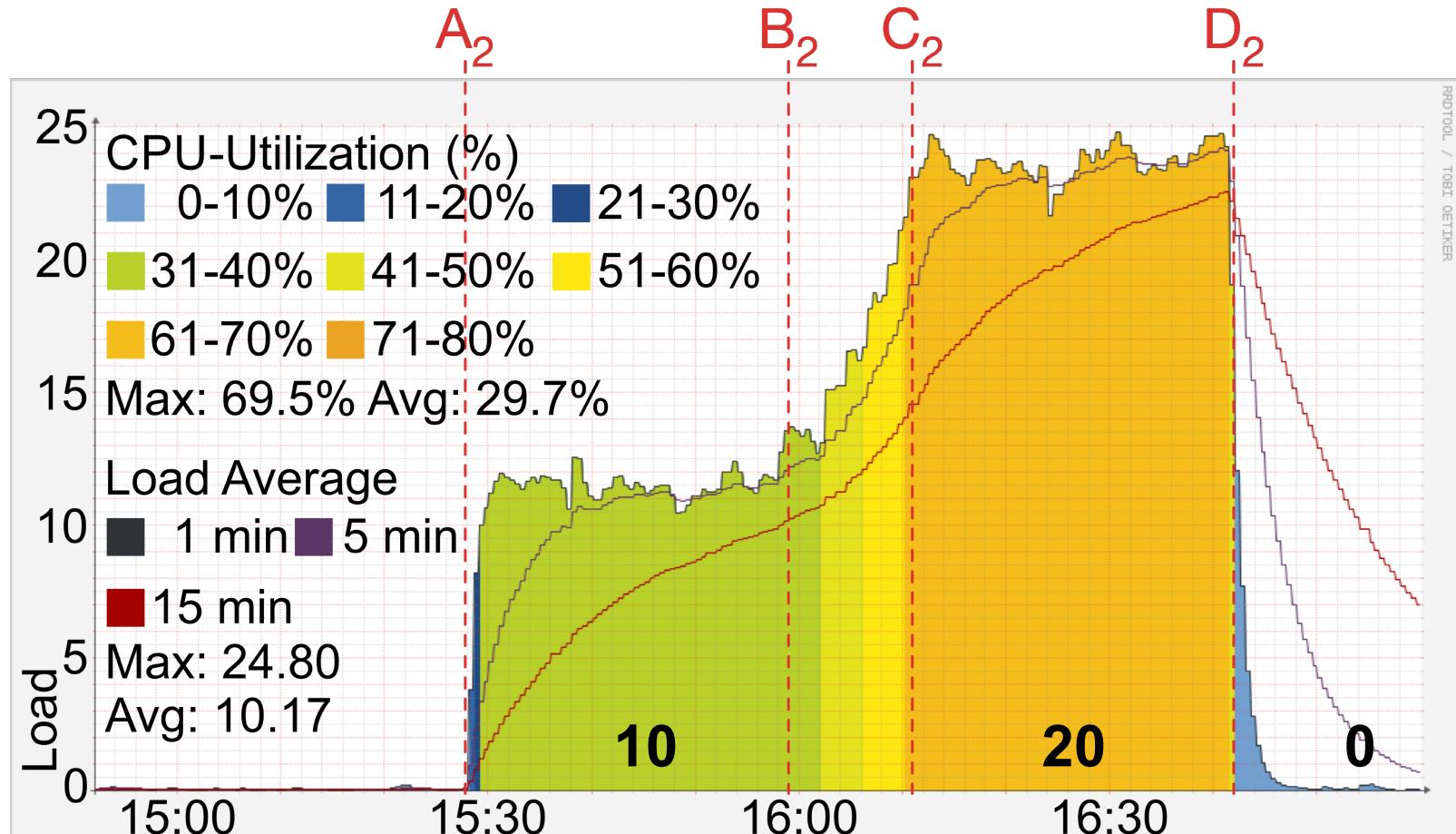
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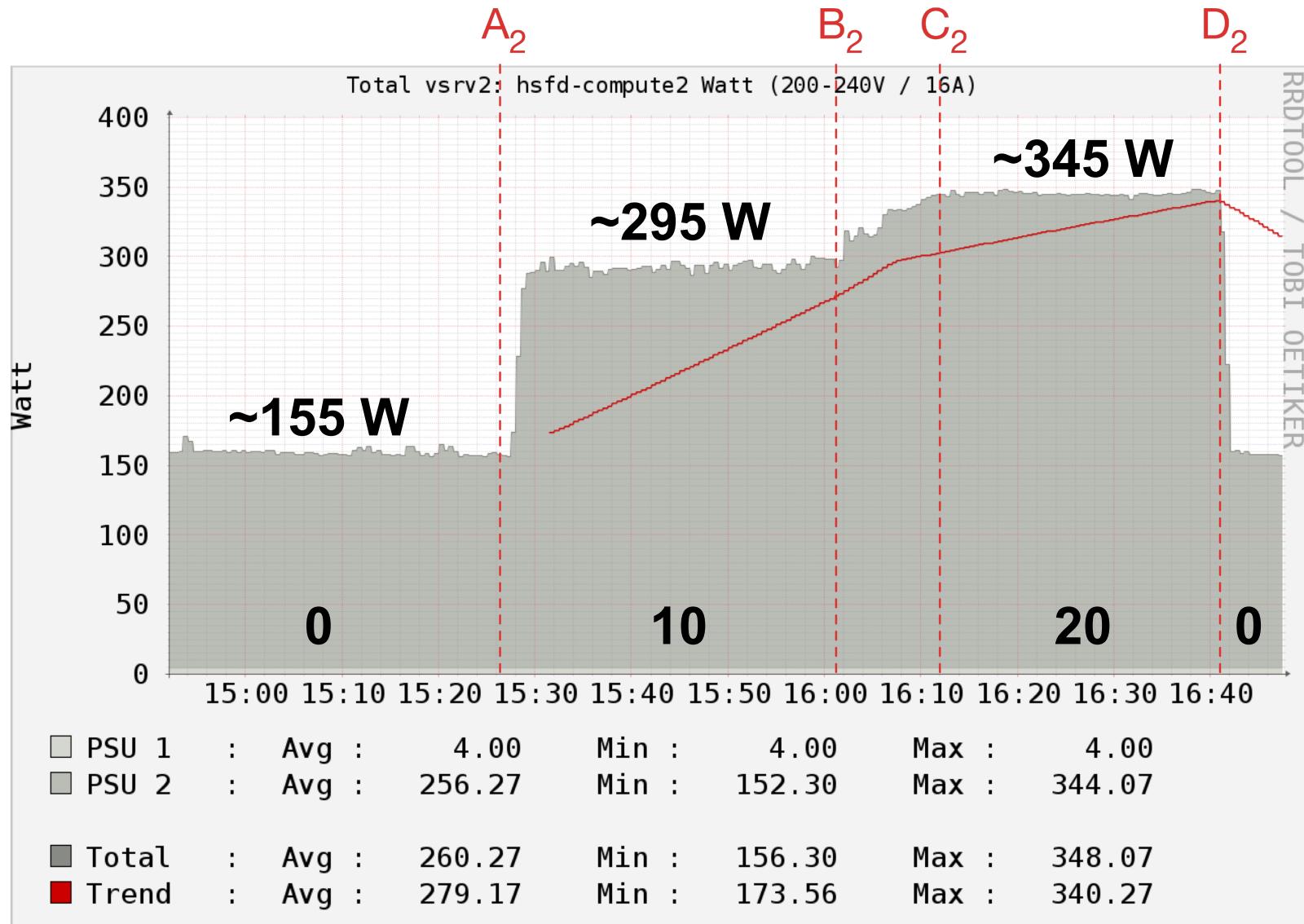
# Ergebnisse



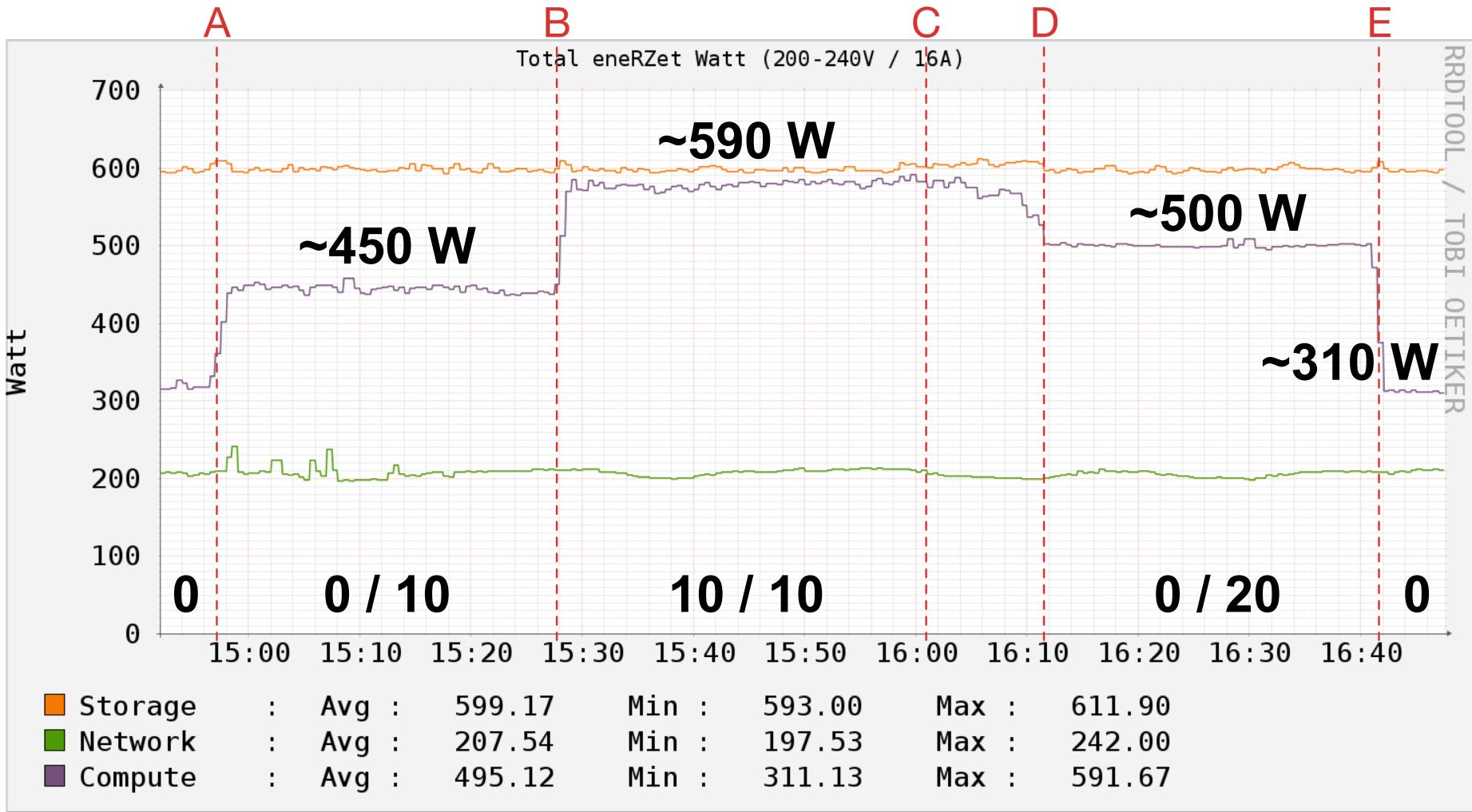
# Ergebnisse



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# Ergebnisse





- Server: Energieproportional
- Netzwerk: Nicht energieproportional
- Storage: Nicht energieproportional
- Während der Migration keine erhöhte CPU Last / Load, keine höhere Leistungsaufnahme bei Netz- und Storage-Komponenten



- Ersetzen der Last-Simulation von stress mit echtem Service
- Erweiterung der Tests um den Aspekt der Dienstgüte
  - Anzahl Anfragen pro Sekunde
  - Antwortzeit eines Dienstes
- Gegenüberstellung VM / LXC