Swinog-29

REMOTE LAB

For network courses and Cloud Infrastructure Module

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Network Engineering

Bern, 5. November 2015

HSR
HOCHSCHULE FÜR TECHNIK
RAPPERSWIL
FHO Fachhochschule Ostschweiz

ins institute for networked solutions

Agenda

- **HSR**
- **Remote Lab**
- **Used Technologies**
- **Network Pod**
- **Cloud Infrastructure**
- **Present Topics**

- **Hochschule für Technik Rapperswil**
  - The most scenic campus in Switzerland
  - University of Applied Sciences of Eastern Switzerland (FHO)

HSR campus

Institute of Networked Solutions

Main focus of Prof.B.Stettler/ Prof.H.Huser and its 26 employees:

- **Education of future engineers and computer scientists**
- **External trainings:**
  - Microsoft Innovation Center: Training, Consulting and SW-Development for Microsoft Partners and Customers
  - Cisco Networking Academy (CCNA, CCNP and CCIE)
  - Brocade Academy Program (BCNP & BCSPNE)
  - Technical trainings in the area of Networking (IPv6, SDN, Cloud, WLAN, Troubleshooting) and Unified Communications
- **Applied Sciences project focus**
  - Networking technologies
    - Wireless Networks in challenging environments (airports, transportation, logistic, hospitals etc.)
    - Network Access-Control solutions
    - Quality-of-Service / Quality-of-Experience
    - Network Virtualization / Software Defined Networks
  - Cisco VoIP solutions
    - IP-Telephony / Unified Communications SW development
    - Integration of Unified Communications with Business Processes and Applications
  - Microsoft Technologies
    - .NET Competence Center
    - Software developments for Microsoft UCC (Skype4Biz)

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SDN, Cloud Infrastructure, OpenStack, Cisco and Brocade Instructor

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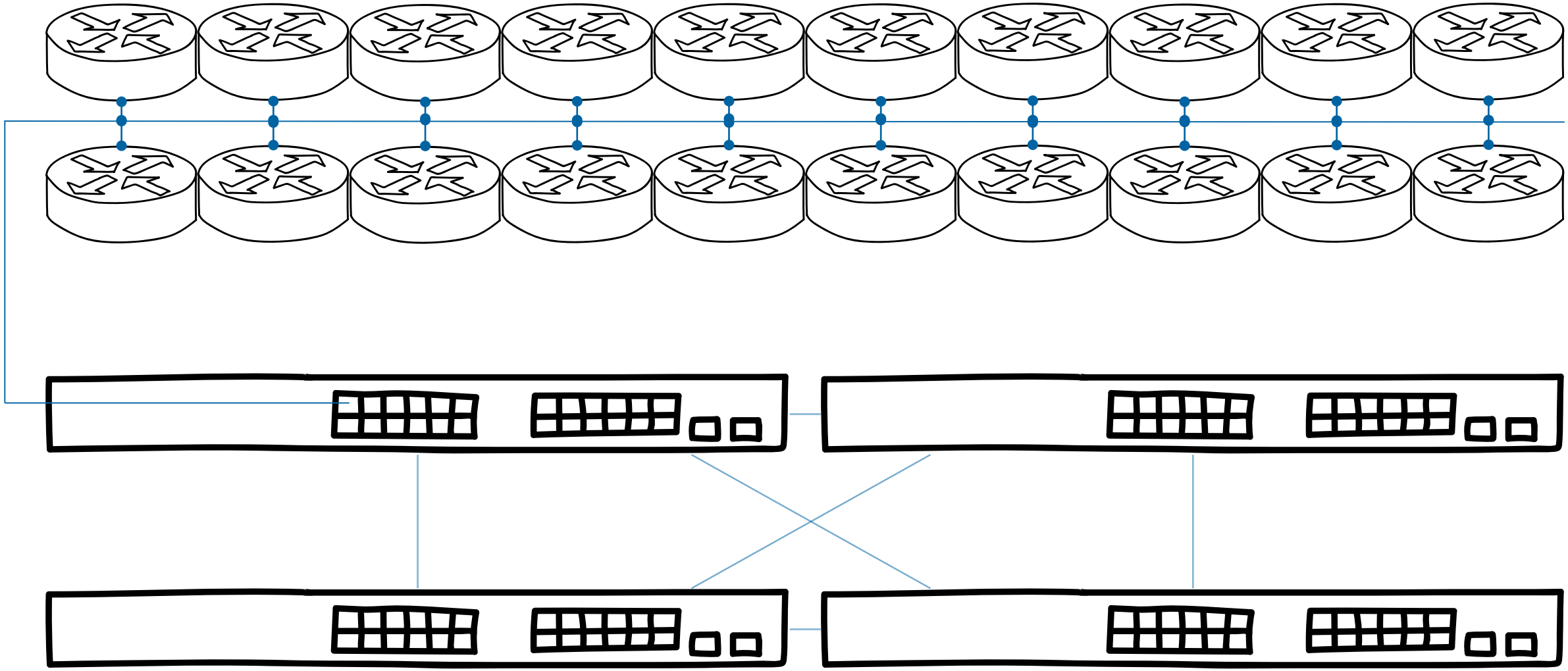
Motivation

- **Cloud Infrastructure Module**
  - Demos
  - Experience
    - Know-How transfer
  - LAB
    - Preparation
    - Deployment
    - Limited time in-house (LAB room)

- **Network Courses**
  - Accessible from anywhere
  - L2 Features on hardware
  - L3 Features on virtual machine
  - Bare-Metal management

Network Pod



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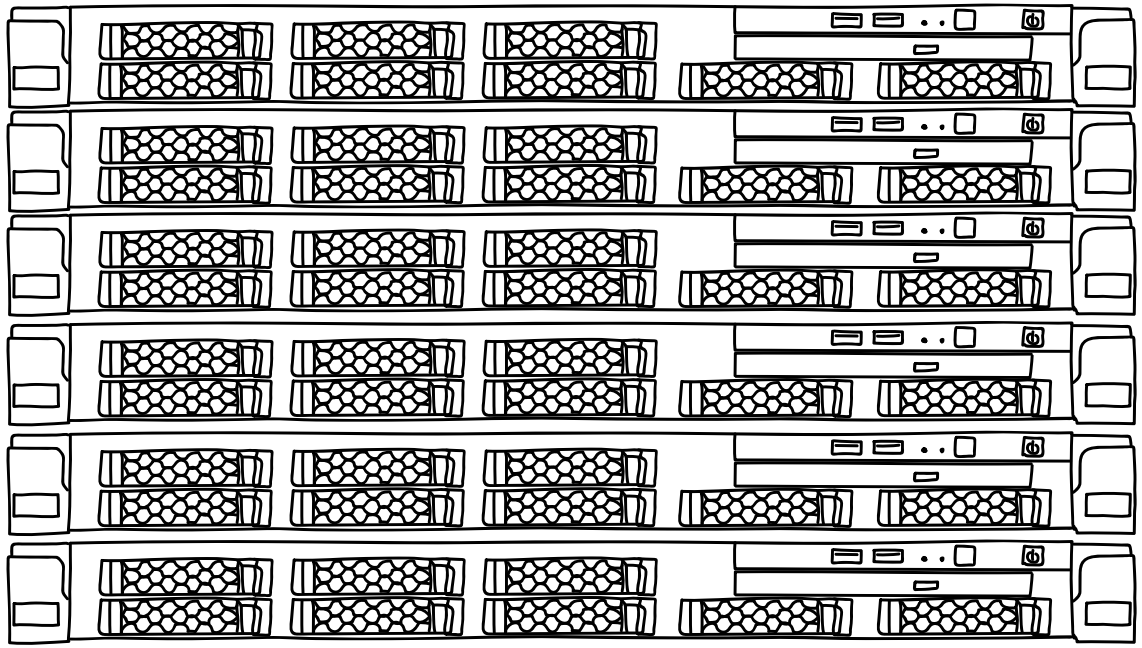
Hands-on LABs

- SDN / OpenFlow
- VXLAN
- NFV
- OpenStack
- Ceph
- LBaaS
- 3-Tier
- …

Solution Requirements

- Infrastructure as a Service
- Templates
- Snapshot
- Multitenancy
- Network Management

Small Budget



- **6 Server**
- **1 Storage system**
- **8 Network pods**
  - 20 NFV
  - Dedicated network port
  - 4 Physical switches (existing)
- **Cloud Environment**
  - ~ 60 Students at the same time

Used Technologies

Network Pod

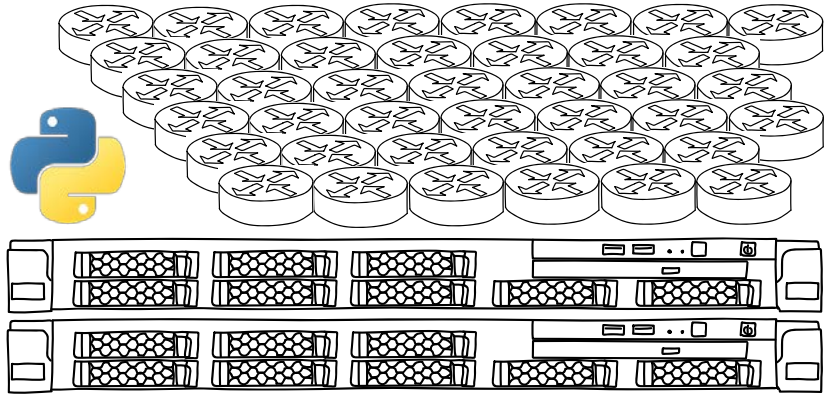
- 2 Server
- VMWare ESXi
- In-house developed deployment tool
  - Configuration management
  - Device control
  - One click lab deployment

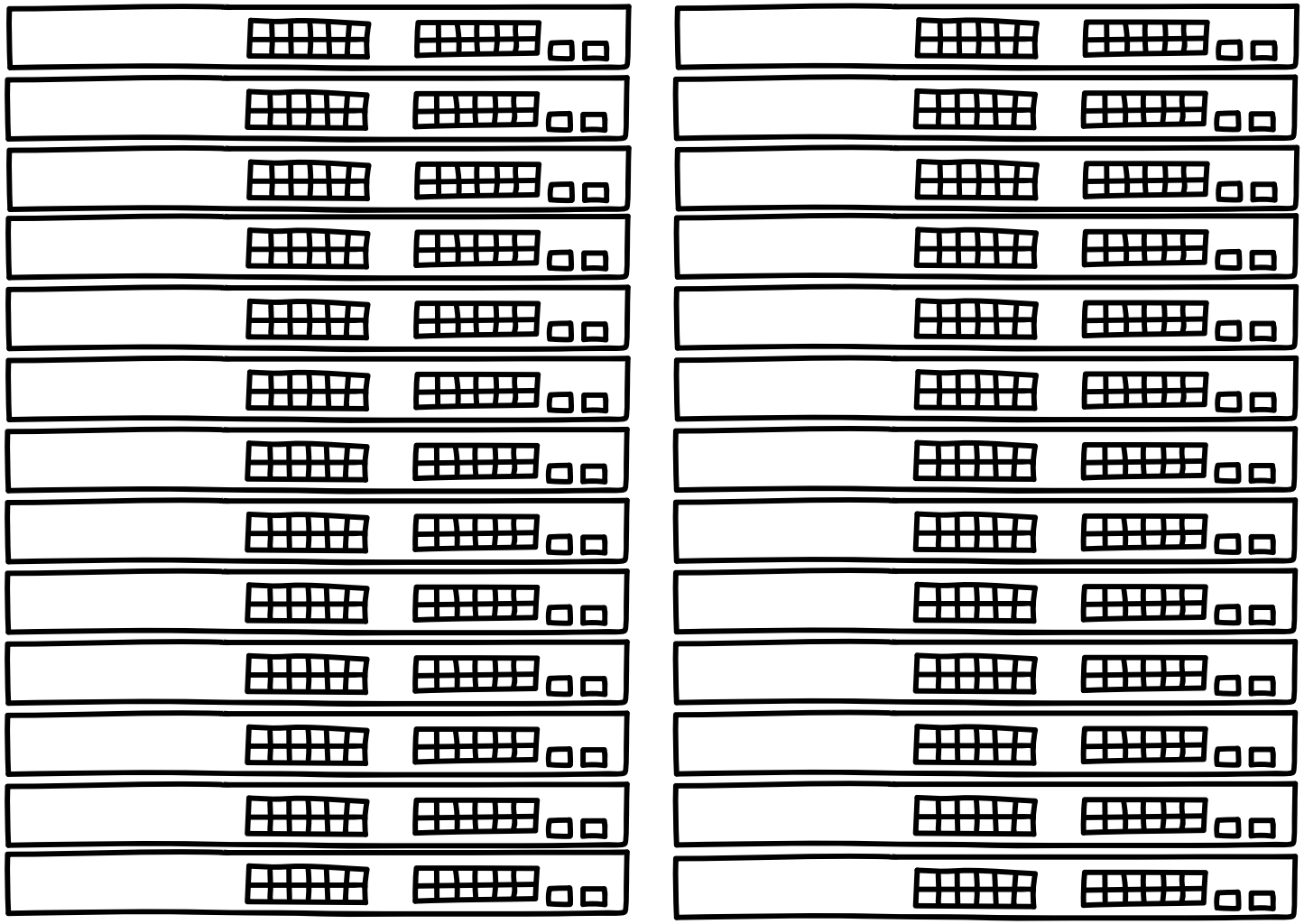
Cloud Infrastructure

- OpenStack
- Ubuntu KVM
- Images / Stacks

Network Pods Components

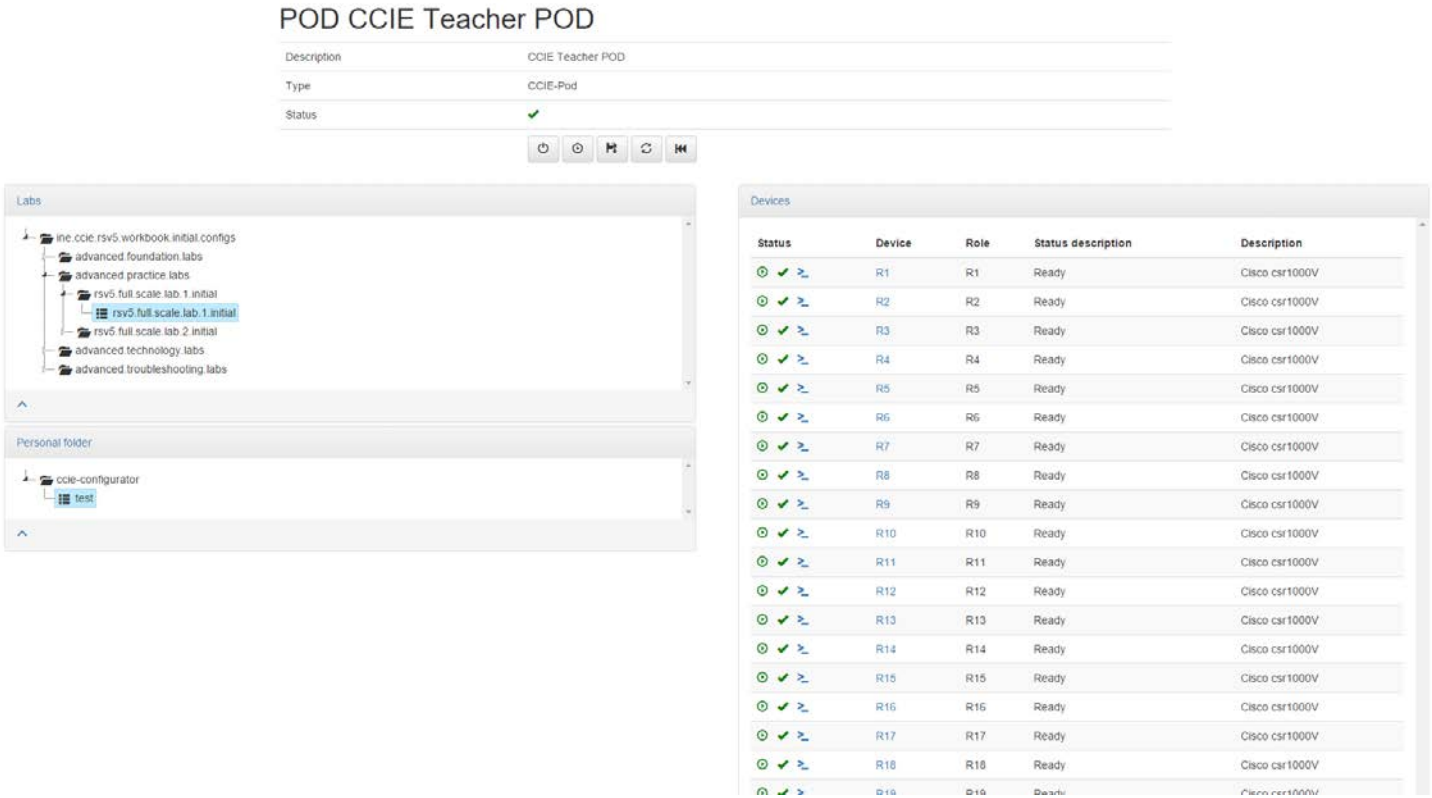
- **2 ESXi Server**
  - 2x 8 Core CPU 2.6 GHz
  - 384 GB RAM
  - 12x 1 Gig NIC
- **Management Tool**
- **160 Virtual Routers**
- **32 L3 Switches (HW)**





Management Tool

- **Web application**
- **Accessible from anywhere (VPN)**
- **Configuration management**
  - Per device / pod
  - Personal configuration folder
  - Predefined labs
  - One click lab deployment
- **Device control**
  - Reset
  - Restart
  - Power ON/OFF
  - Per device / pod



Management Tool

Configsets

Labs

- ine.ccie.rsv5.workbook.initial.configs
  - advanced.foundation.labs
  - advanced.practice.labs
    - rsv5.full.scale.lab.1.initial
      - rsv5.full.scale.lab.1.initial
    - rsv5.full.s
      - Show details
  - advanced.technology.labs
  - advanced.troubleshooting.labs

Configset rsv5.full.scale.lab.1.initial

Valid for POD type	CCIE-Pod
Path	/Labs/ine.ccie.rsv5.workbook.initial.configs/advanced.practice.labs/rsv5.full.scale.lab.1.initial/rsv5.full.scale.lab.1.initial

Config name	Description	Device type
r1.txt	r1.txt	Cisco csr1000V
r2.txt	r2.txt	Cisco csr1000V
r3.txt	r3.txt	Cisco csr1000V
r4.txt	r4.txt	Cisco csr1000V
r5.txt	r5.txt	Cisco csr1000V
r6.txt	r6.txt	Cisco csr1000V
r7.txt	r7.txt	Cisco csr1000V
r8.txt	r8.txt	Cisco csr1000V
r9.txt	r9.txt	Cisco csr1000V
r10.txt	r10.txt	Cisco csr1000V
r11.txt	r11.txt	Cisco csr1000V

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Predefined labs

Config r2.txt

Description	r2.txt
Device type	Cisco csr1000V

```
interface GigabitEthernet1.12
 encapsulation dot1Q 12
 ip address 10.0.12.2 255.255.255.252
 ip pim sparse-mode
 ipv6 address 2001:10:0:12::2/126
!
interface GigabitEthernet1.23
 encapsulation dot1Q 23
 ip address 10.0.23.1 255.255.255.252
 ip pim sparse-mode
 ipv6 address 2001:10:0:23::1/126
!
interface GigabitEthernet1.24
 encapsulation dot1Q 24
 ip address 10.0.24.1 255.255.255.252
 ip pim sparse-mode
 ipv6 address 2001:10:0:24::1/126
!
interface GigabitEthernet1.210
 encapsulation dot1Q 210
```

Back

Personal Config

Edit config test_R20

Name

test_R20

Data

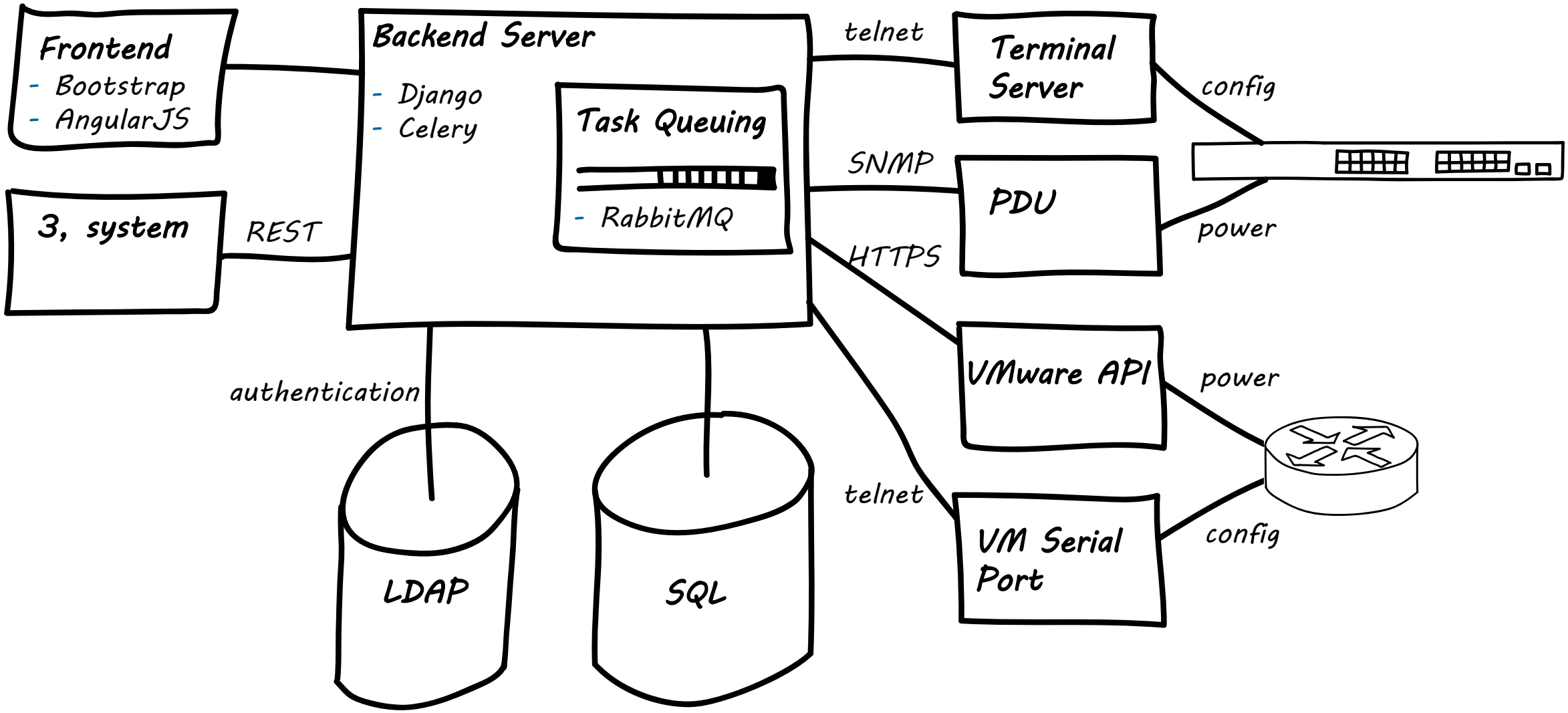
```
!
interface GigabitEthernet1.1020
 ip flow monitor MONITOR input
!
interface GigabitEthernet1.1820
 encapsulation dot1Q 1820
 ip address 172.23.20.20 255.255.255.0
 ip pim sparse-mode
 ip ospf network point-to-point
 ip ospf 22 area 20
 ipv6 address 2004:172:23:20::20/64
!
interface GigabitEthernet1.1920
 encapsulation dot1Q 1920
 pppoe enable group global
!
interface Virtual-Template1
 bandwidth 1000000
 ip address 172.23.19.20 255.255.255.0
 ip nat inside
 ip pim sparse-mode
```

Description

test_R20

Update Back

Architecture



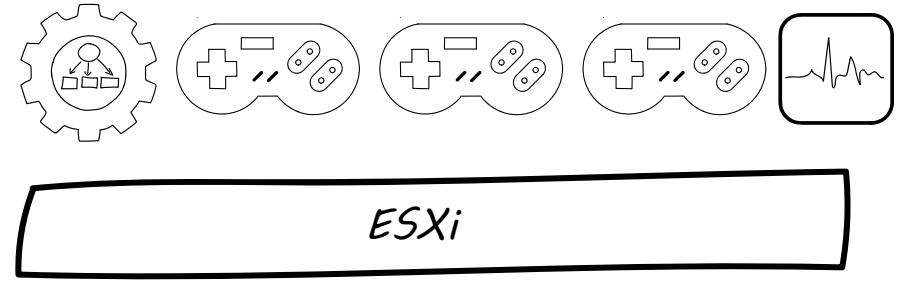
OpenStack

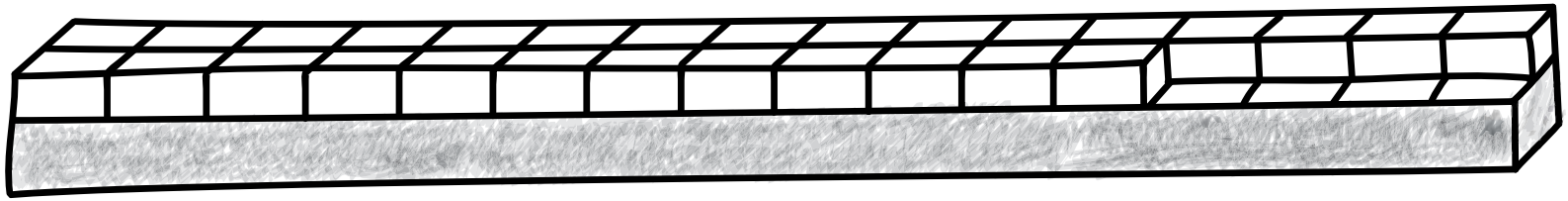
Server

- Deployment Server
- 3 Controller
- Monitoring Server
- X Compute Nodes

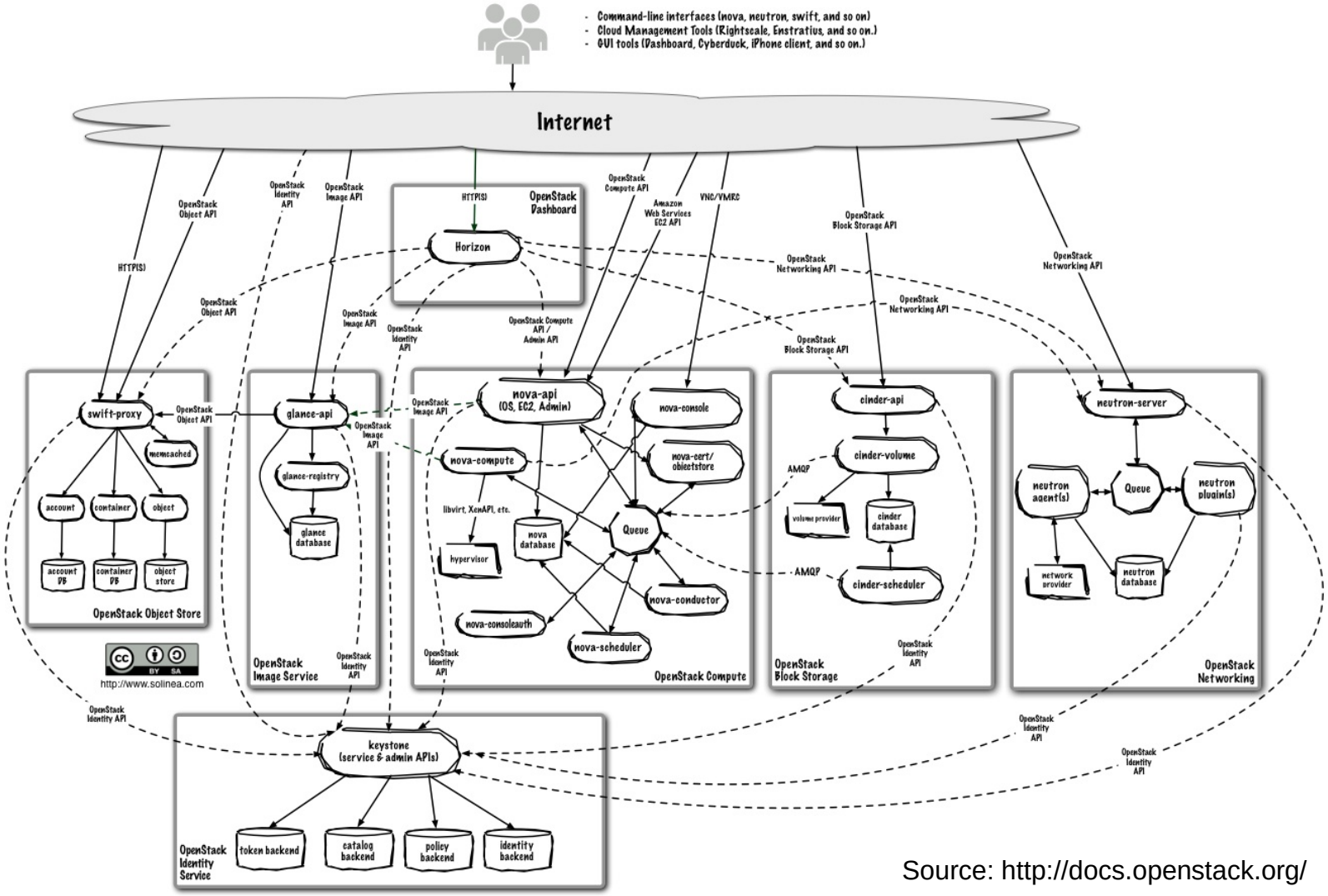
Network

- PXE Network (Deployment)
- Management
- Data
- Storage
- Public





Logical Diagramm OpenStack Icehouse

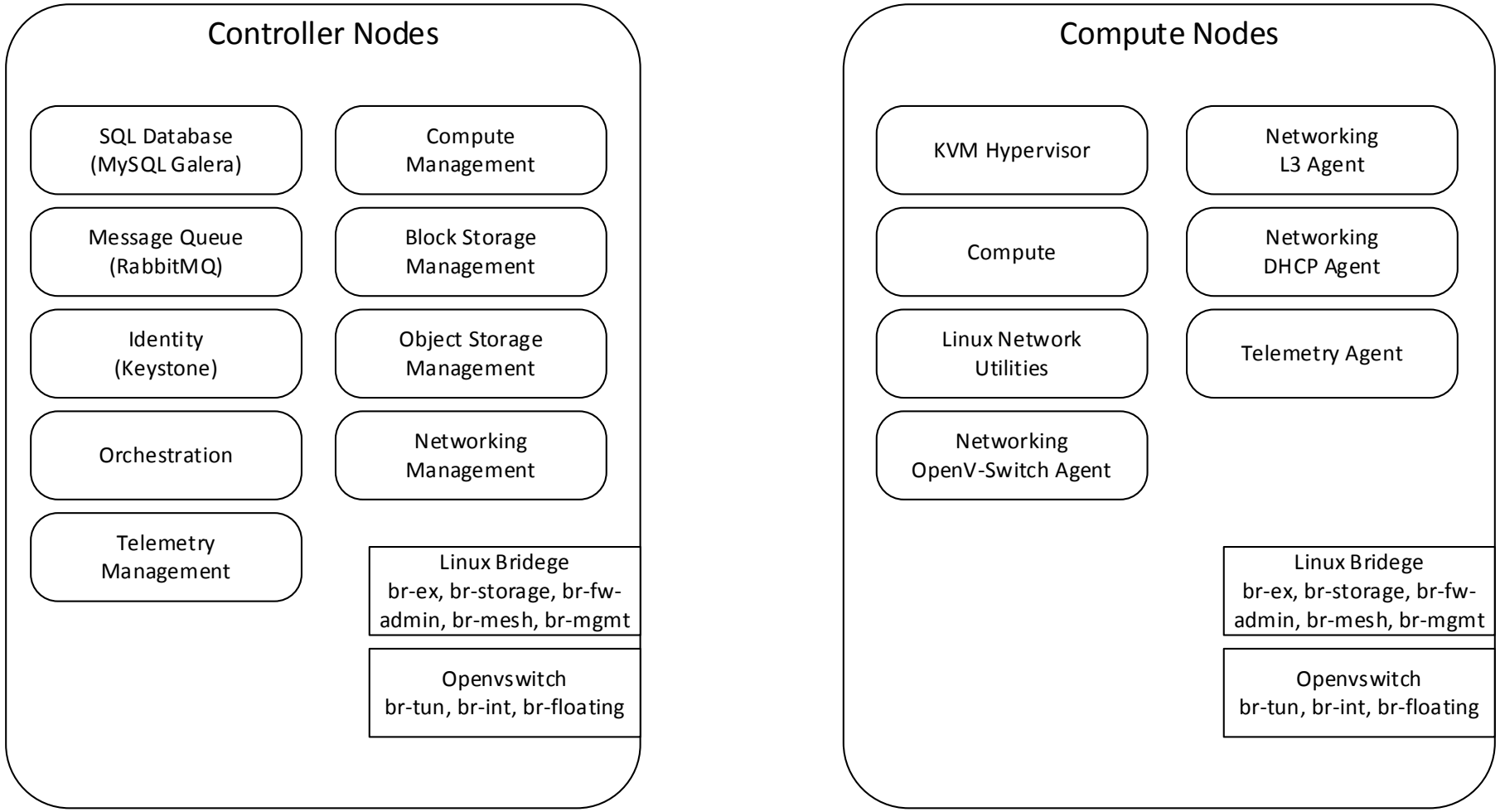


Source: http://docs.openstack.org/

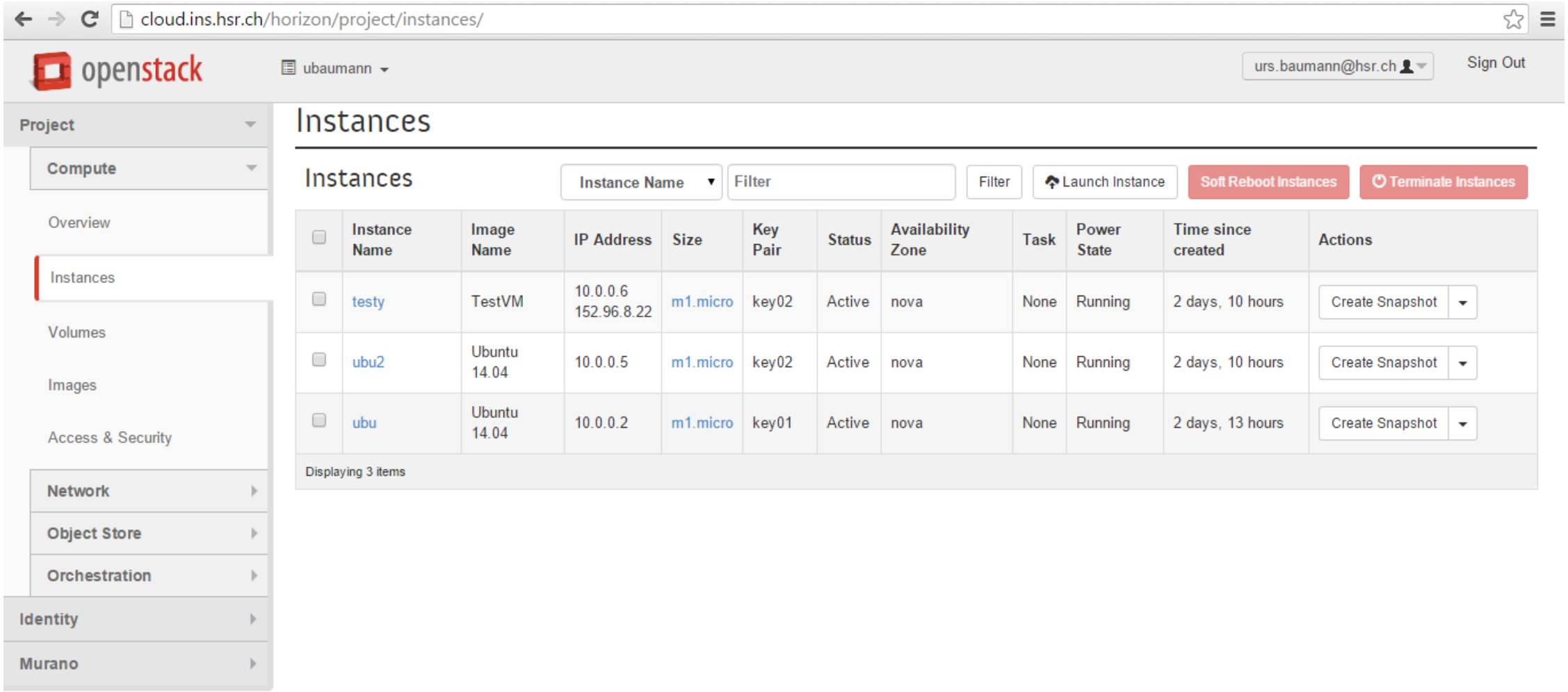
OpenStack services

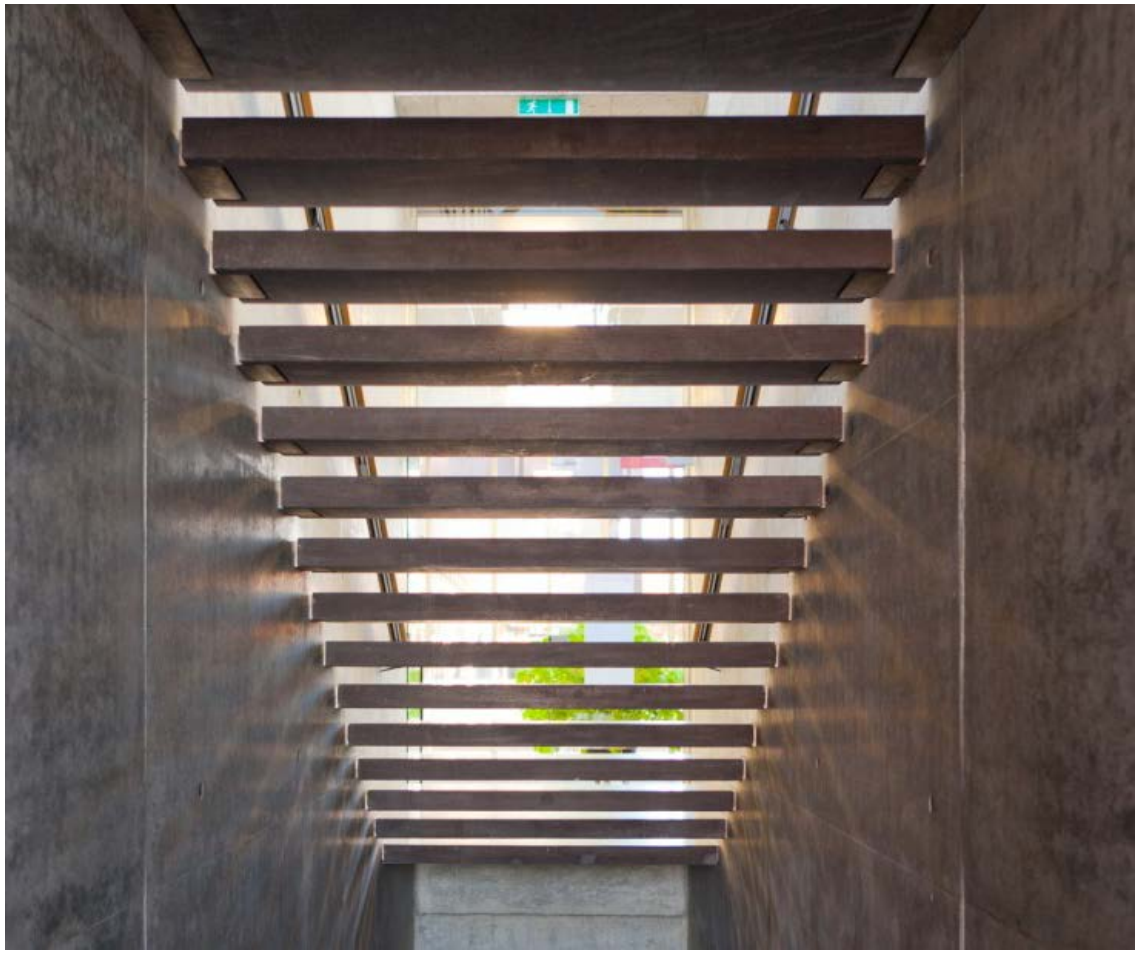
- Compute (Nova)
- Object Storage (Swift)
- Block Storage (Cinder)
- Networking (Neutron)
- Dashboard (Horizon)
- Identity Service (Keystone)
- Image Service (Glance)
- Telemetry (Ceilometer)
- Orchestration (Heat)

Service Layout



Self-Service



Present Topics

- **Bachelor thesis**
  - VMware NSX / Cisco ACI
  - SDDC – Generic API for easy integration in Business Application
- **Courses (mylearning.ch)**
  - SDN Fundamentals
  - Cloud Infrastructure Fundamentals
  - OpenStack
  - …
- **Projects**
  - SDN Orchestration
  - Zero Touch Provisioning