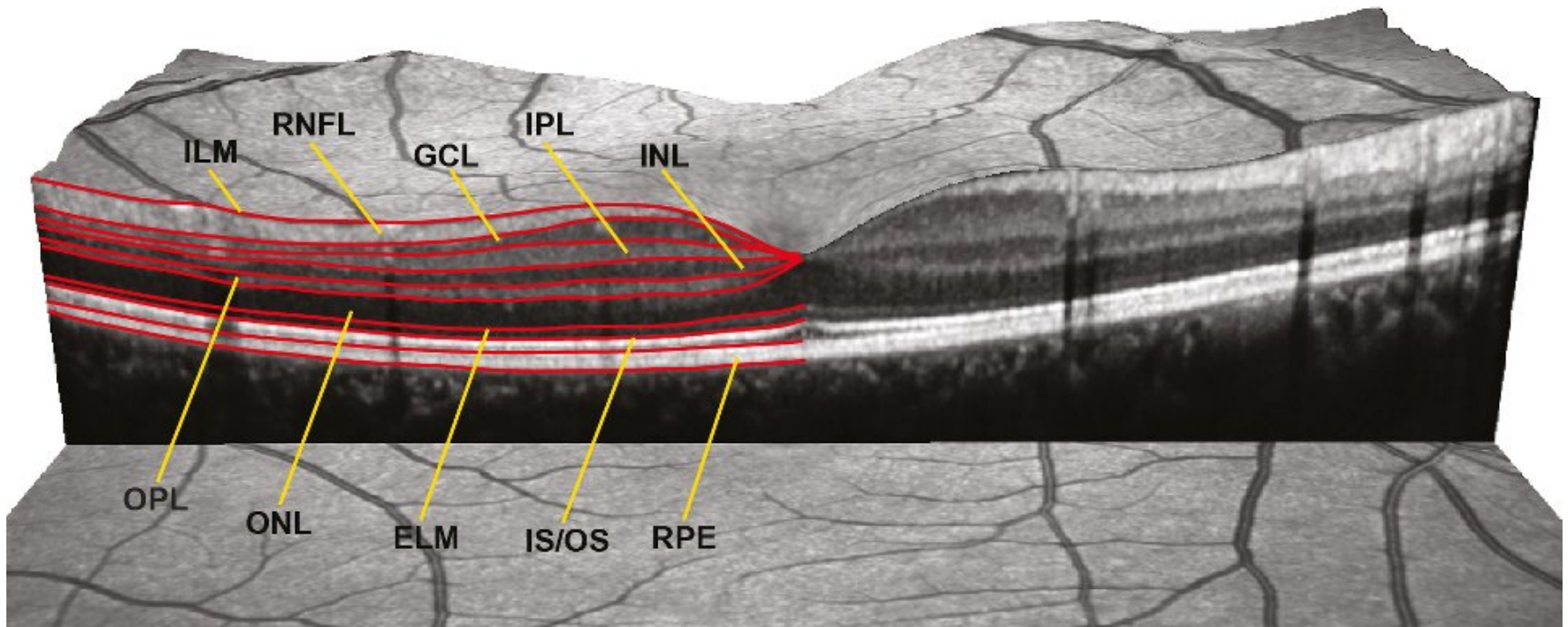# Cloud-based Quality Assessment Platform for Neuroscientific Imaging

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Berlin, Germany

QMROCT - Project

Quality Management for Retinal Optical Coherence Tomographies

QMROCT - Interdisciplinary Collaboration

Medicine:

OCT

Quality measures

Math & Physics:

Image analysis

Algorithms

Computer Science:

Infrastructure

Platform

My Position - Christoph Jansen

htw.

Hochschule für Technik und Wirtschaft Berlin

University of Applied Sciences

- Graduate Student in *International Media and Computing*
  - Computer Science

- Research Assistant
  - Backend programming for QMROCT platform

Quality Assessment Platform

- Requirements:
    - **Secure storage of patient data**
    - **Secure processing of algorithms**
   - **Scalable processing for huge amounts of data**
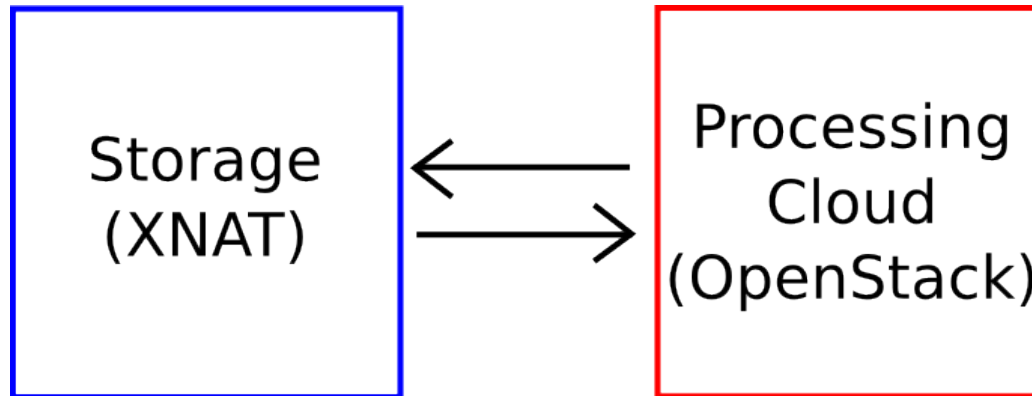
- Encrypted communication (HTTPS) between components

XNAT - Secure Storage

- Storing medical image data (and meta data)

- Fine-grained user access control per project

- Extensible data types
  - We improved OCT support
  - Custom data types for results

- Pipeline engine: run external programs

- Web interface: upload / download and manage data
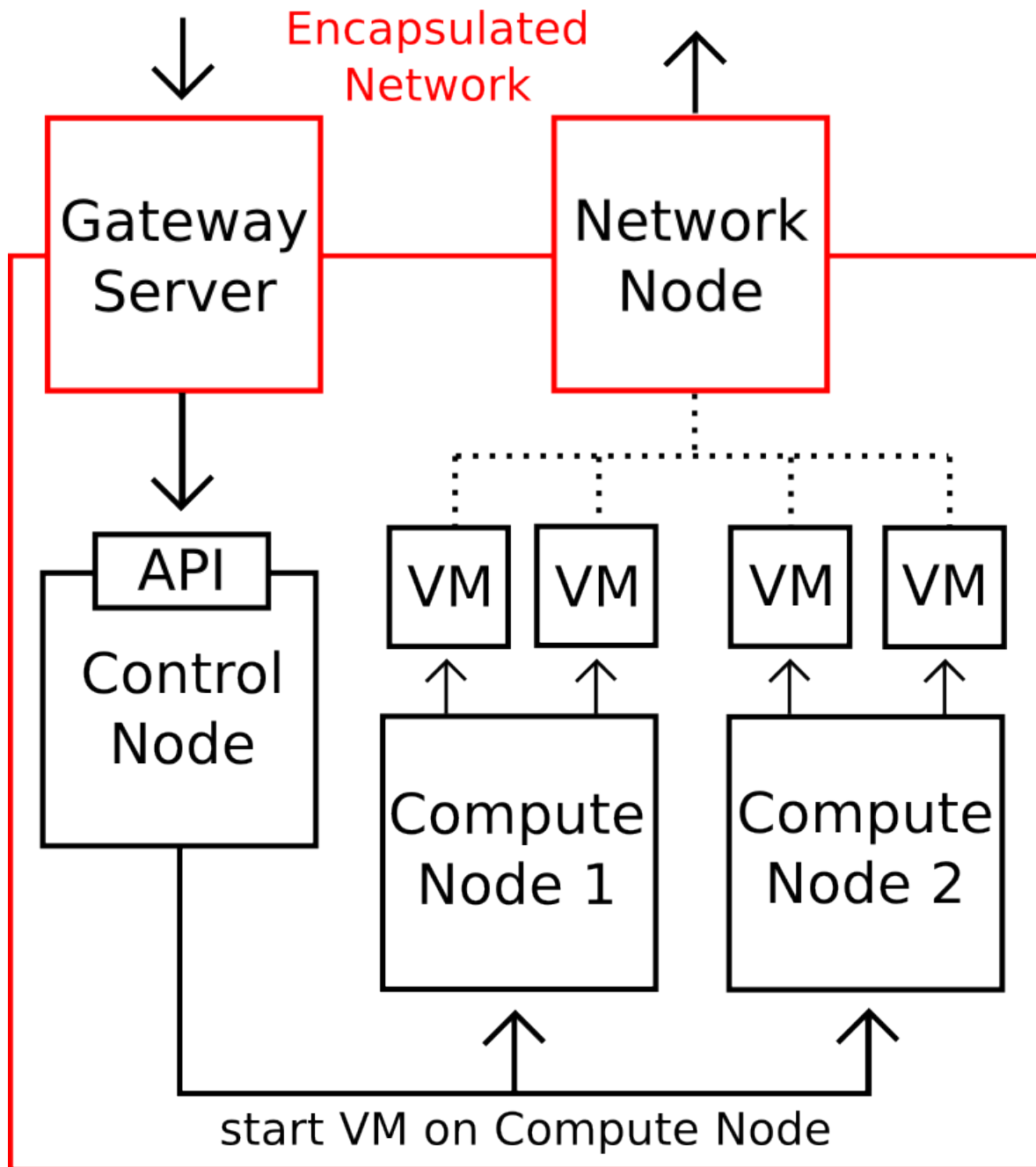
Architecture
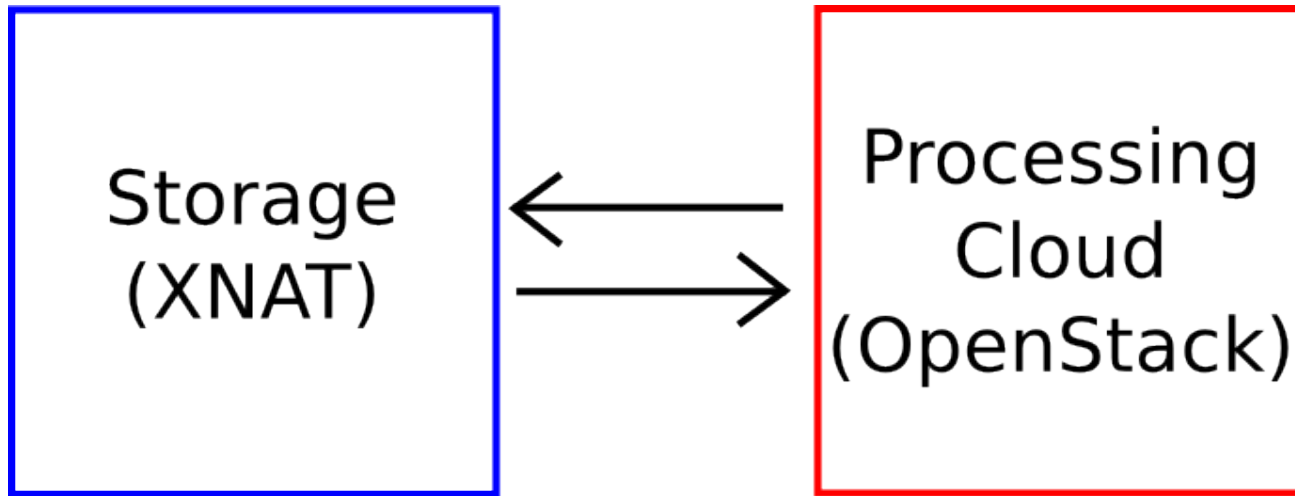
OpenStack - Cloud Computing
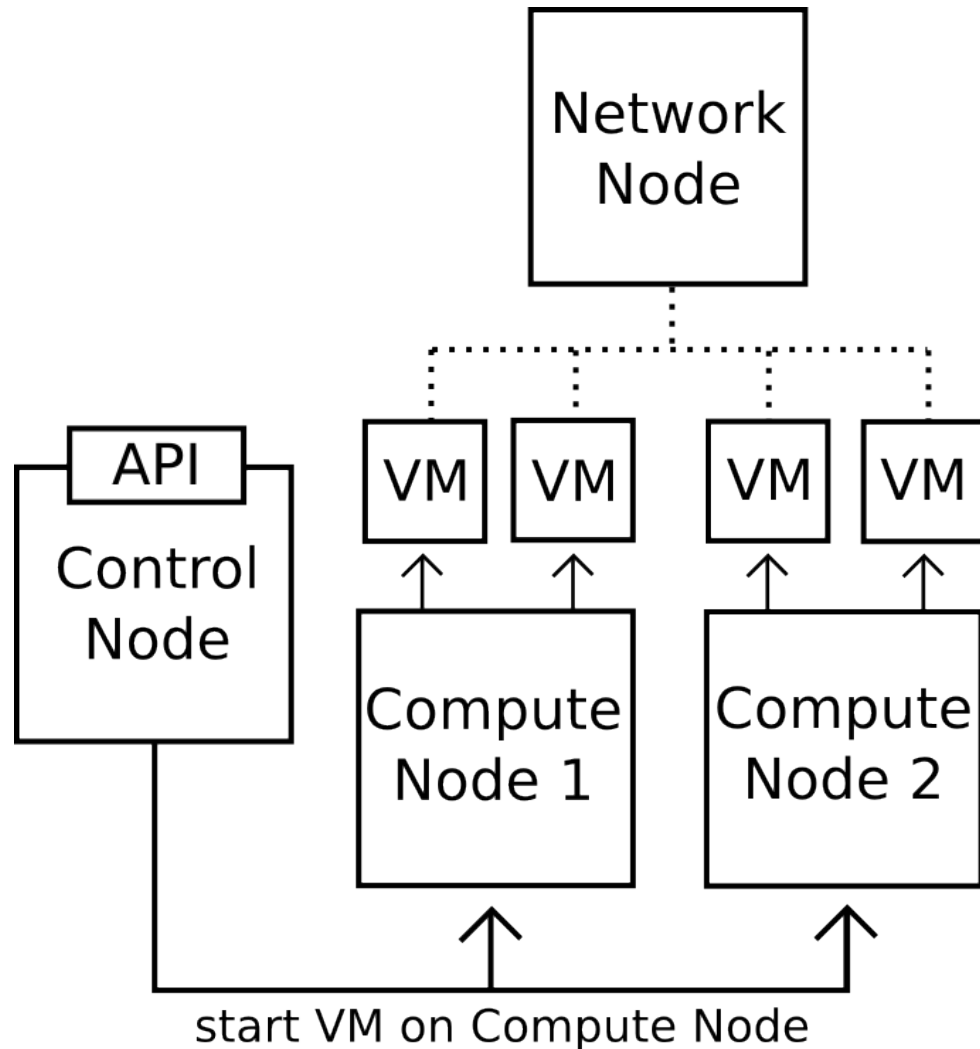
Virtual Machines (VM)

- Virtualized Hardware
  - CPUs
  - Memory
  - Abstraction of physical hardware

- Run full operating system from VM image
  - contains algorithms for processing

- OpenStack can boot and delete VMs
  - No traces of data left after deleting a VM

Encapsulated Network

Gateway Server

Network Node

API

Control Node

VM VM VM VM

Compute Node 1

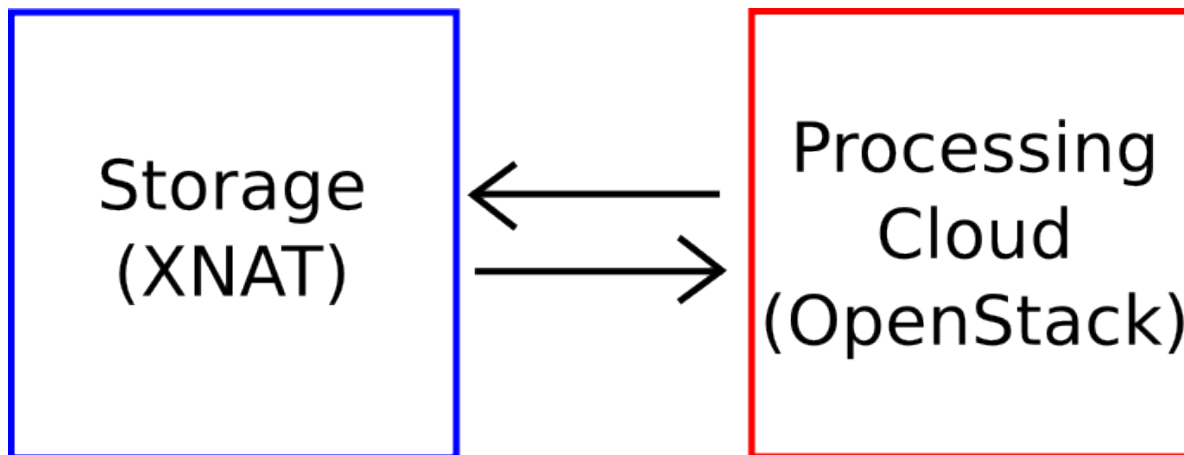Compute Node 2

start VM on Compute Node

Processing

- XNAT sends job parameters to Gateway

- Gateway:
  - Start new VM
  - Forward job to VM
- VM:
  - **Download** data from XNAT
  - **Process** data
  - **Upload** results to XNAT
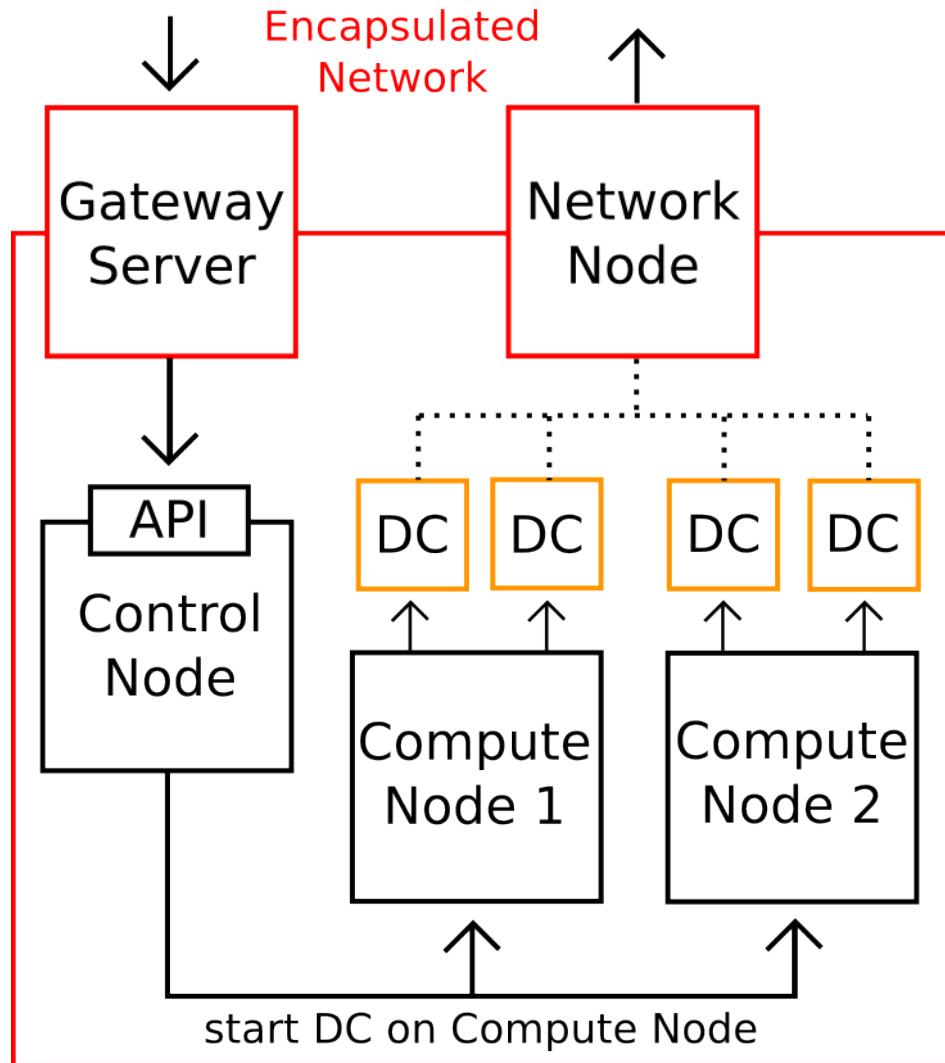- Gateway:
  - Delete VM

Problem

- Virtual Machines are big and slow
  - need lots of physical resources
 - long start up times

- Bad for scalability

Docker

- Virtualized operating system kernel
  - Run encapsulated processes on kernel (container)
  - With its own root file system

- Concepts (Docker is fairly new)
  - Based on Linux cgroups + namespaces
  - But easier to use

- Docker Container (DC)
  - Security advantages of VM
  - Smaller and faster

Docker driver for OpenStack

Encapsulated Network

Gateway Server

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API

Control Node

DC DC DC DC

Compute Node 1

Compute Node 2

start DC on Compute Node

Improvements

- ## Startup times (sequential and parallel)
  - ### VM starts in 5 - 6 minutes
  - ### Docker starts in 30 seconds
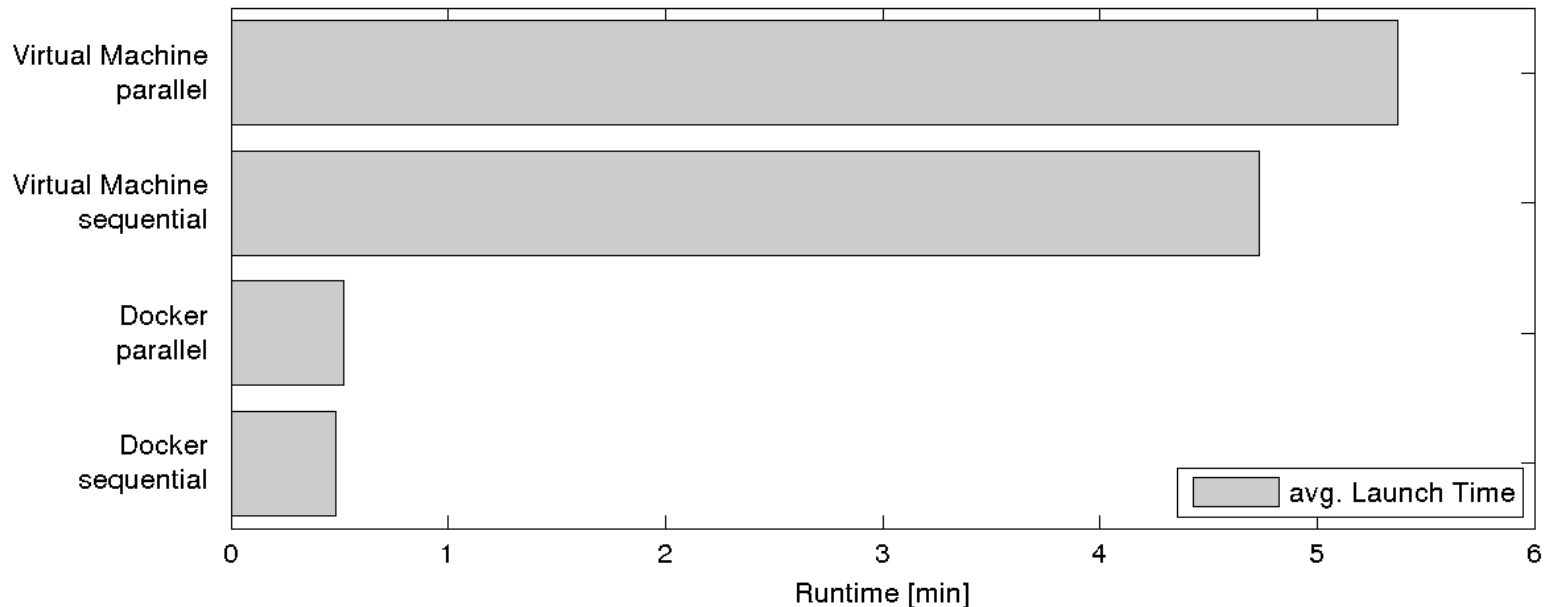
Resources

- github.com/QMROCT/ISAC
  - Presentation slides
  - Conference paper
  - Publications
  - Links