YORK UNIVERSITÉ UNIVERSITY

ASRL
Adaptive Systems Research Lab

Containers and Microservices

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Your turn

- **Can you explain these terms?**
  - IaaS, PaaS, SaaS, Hybrid Cloud, Private Cloud, EC2, OpenStack
  - HDFS, MapReduce, Hbase
  - YAML, HEAT, Terraforms, JSON
  - Ceilometer, Cloudwatch, Grafana
  - Drools

Summary so far: Clouds – Everything as a Service

- **The computing infrastructure is programmable, as a service**
  - Publish, discover, bind
  - Tune, migrate, dispose, etc.
- **The network is programmable**
- **The COST is first class citizen**
- **Cloud is not a centralized data centre**
  - Has “edges” and cores
  - Locality is important for applications and cloud

Challenges in cloud….

- **Autonomic Management**
- **Migration to cloud**
- **Performance**
- **Cost**
- **Security**
- **Privacy**

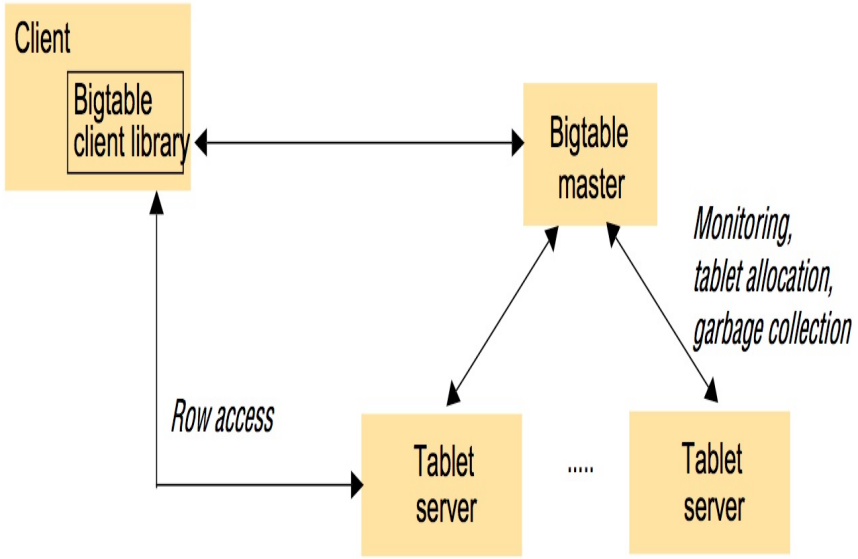
File, Big Data, Analytics As a Service

- **Provided on demand (on deployment)**
  - in a customizable format (size, structure)
  - with some quality of service (throughput, latency)
  - highly scalable: for example, A Big Table is split into many tablets residing on many VMs
- **Price per in/out data, storage, CPU, etc…**
- **A small set of operations (put, get, scan…)…NoSQL**
- **Plenty of offerings to choose from: Hbase, Cassandra, MongoDB, Hadoop, Spark**

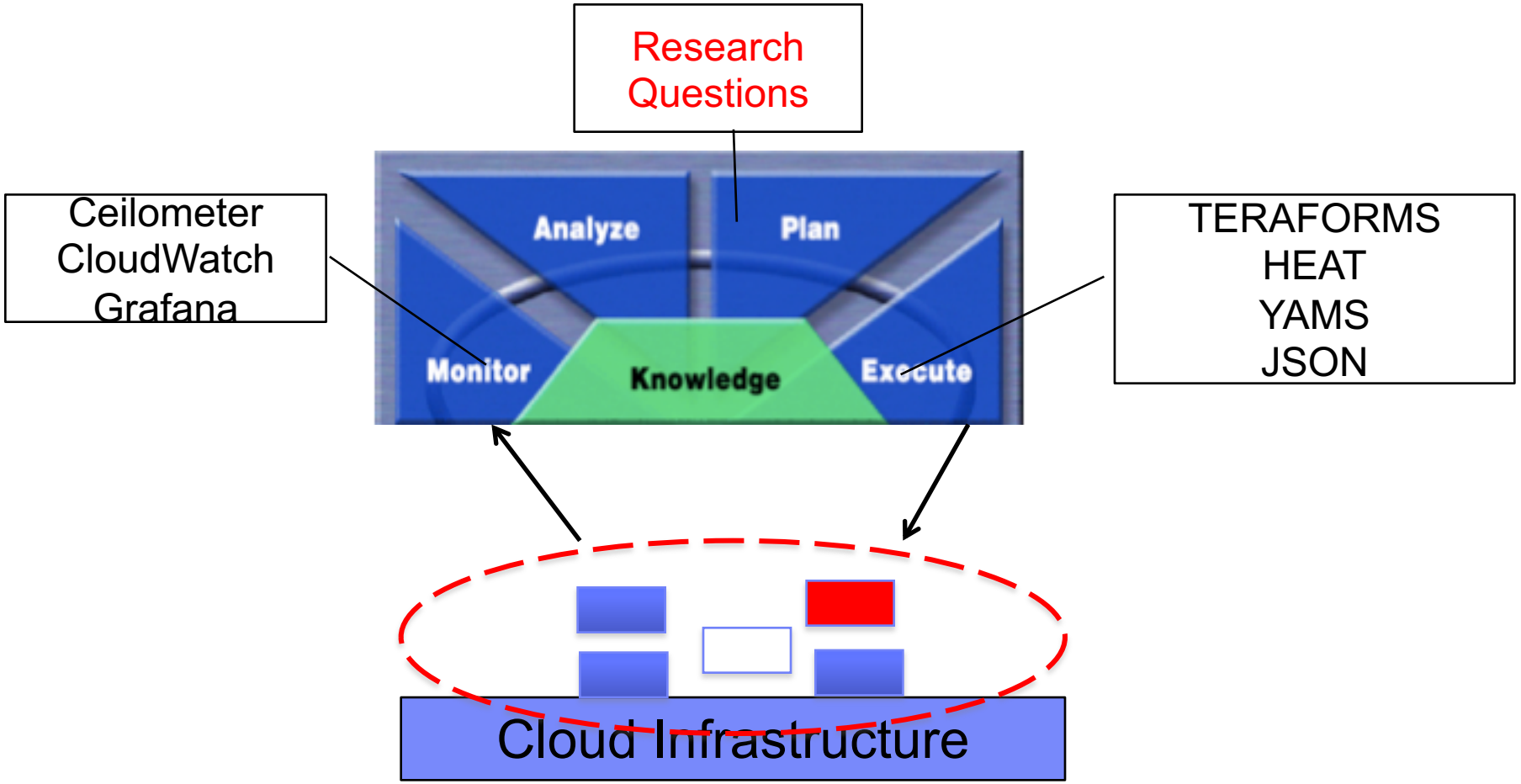
Which platform to use?
How to autoscale?

Autoscaling is still a research question

- **Analysis and planning?**
- **Execution?**
- **Challenges?**



Adaptive Applications on Clouds



Cloud software provides initial building blocks…not the whole feedback loop

Containers

doc.docker.com

- **Highly portable units of software**
- **Independent and scalable**
- **Analogy with the transportation containers**

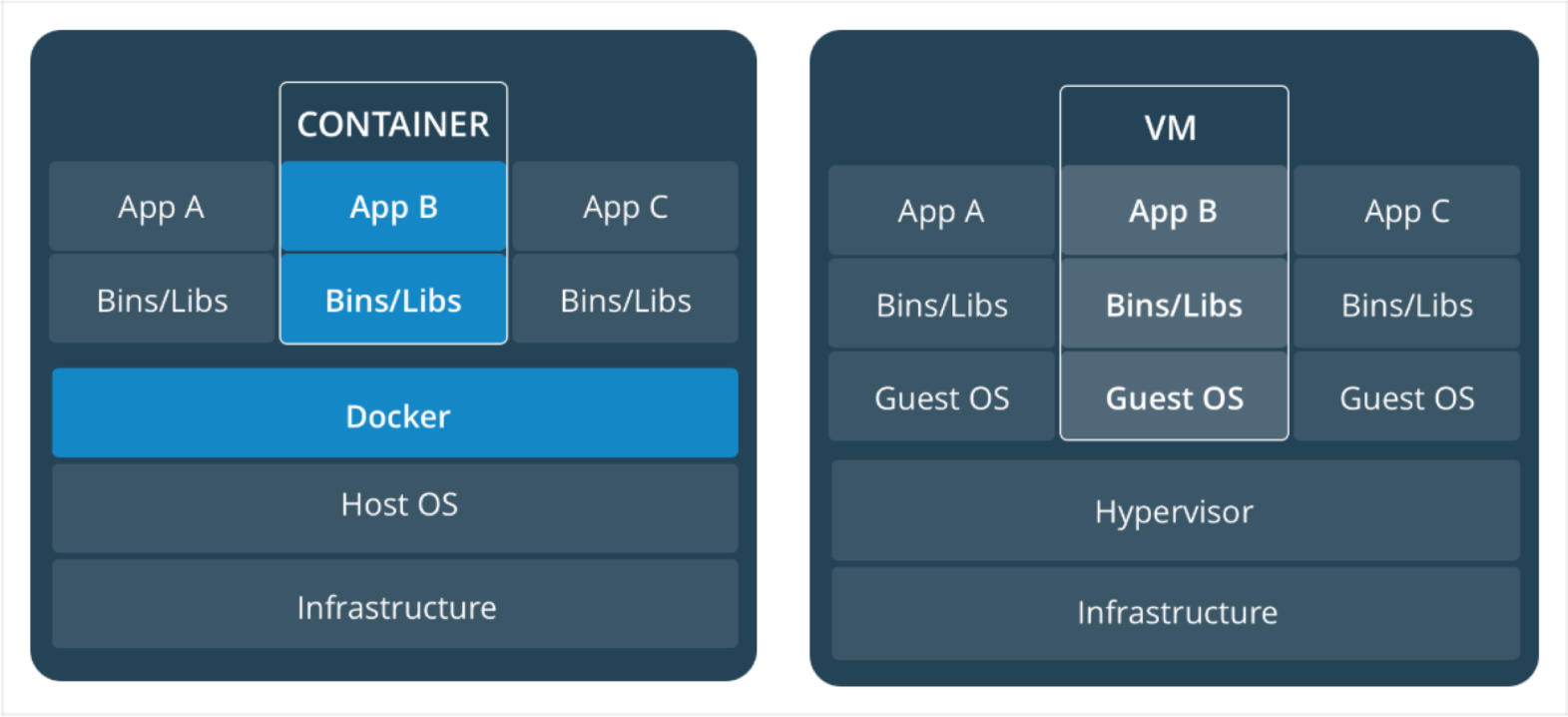
Containers

- **Address the limitations of hardware virtualization**
  - Coarse granular sharing
  - Include the entire operating system
  - if you have two versions of the same application, you need to run two VMs
  - Latency in provisioning/deprovisioning (that is creating/deleting VMs) is large
  - Expensive

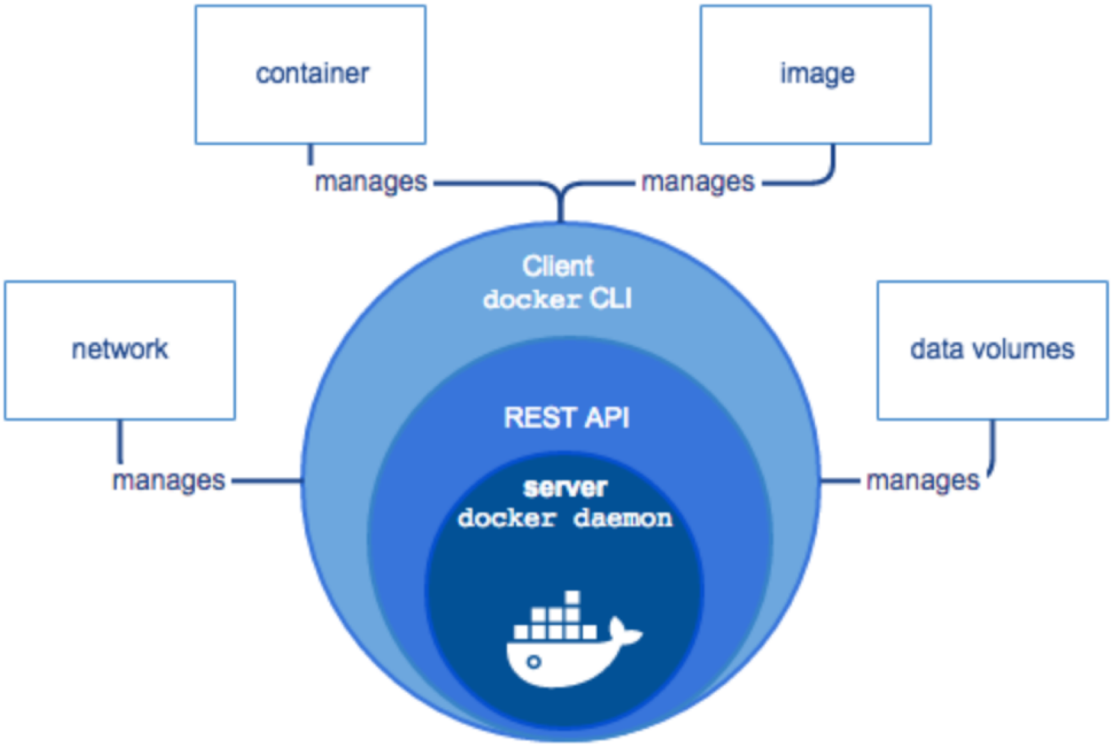
Containers

- **Advantages**
  - Fine granular virtualization
    - Of VMs or hardware
  - Package the application and its libraries
  - You can run two versions of the same application in the same VM/on the same operating system
  - Still provide isolation
  - The latency of provisioning/deprovisioning is low

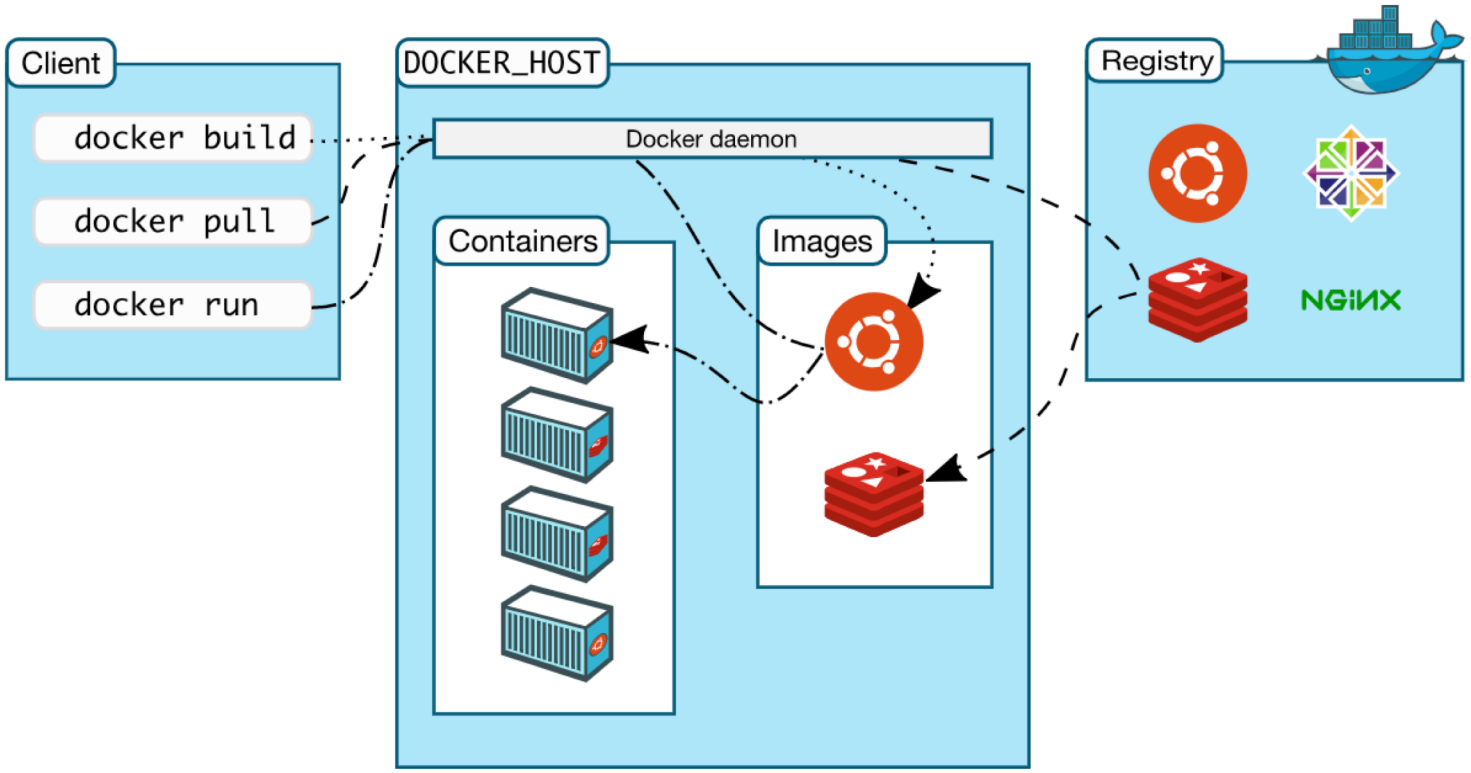
Containers technologies: Docker, doc.docker.com



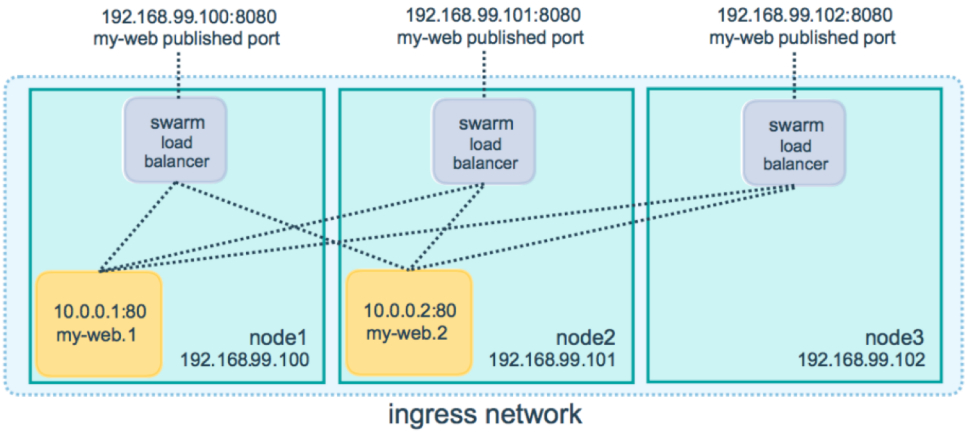
Docker Engine (doc.docker.com)



Docker Architecture (doc.docker.com)



Swarm: orchestrates containers across many VMs



- **Swarm cluster**
  - Part of Docker (you need to enable it)
  - Manages networks
  - Manages services (scaling)

But what are microservices?

- **Microservices is an architecture style, similar to Service Oriented Architecture**
  - Applications are made of fine granular independent services
  - Services are self-contained (web server, dbms, noSQL, etc..)
  - Services are language independent, accessible over web (REST APIs)
  - Services are mapped into containers..

About Container Tutorial..

- **Self-directed and self-paced**
- **Helps create the sandbox for Assignment 2 and (eventually) project**
  - Check the Assignment and Project template
- **You can use alternative tutorials/platforms to get to the same end (see docs.docker.com)**
- **Ask questions on Moodle; anybody can answer**
- **Good luck..**

Upcoming dates

- **Papers presentations**
  - Check the Papers to read and present on Moodle
  - Each student will be involved in two paper presentations
  - We will have 1-2 papers/lecture
  - Papers are mandatory for all, the Tests will ask questions about paper content, most specifically on the research questions, methodology and results.
- **Oct 18, first draft of Project Teams and Abstracts**
  - Important to decide if your paper is on adaptive software or adaptive IoT. Note that the course is focused on adaptive software.

Upcoming dates

- **Oct 6-12 Reading Week ☺**
- **Oct 25 Test 1, in class (<40 min)**
  - multiple choice, short essays, cover all material presented up to that point
- **Oct 29-31, CASCON**
  - Free registration; check the events, register, attend
  - Presentations, demos, keynotes
  - Aug 30, 3:15-5:15pm: Cloud computing and IoT Workshop
    - No class on that date, you are invited to attend CASCON in that afternoon.

And now paper presentations..

- ...