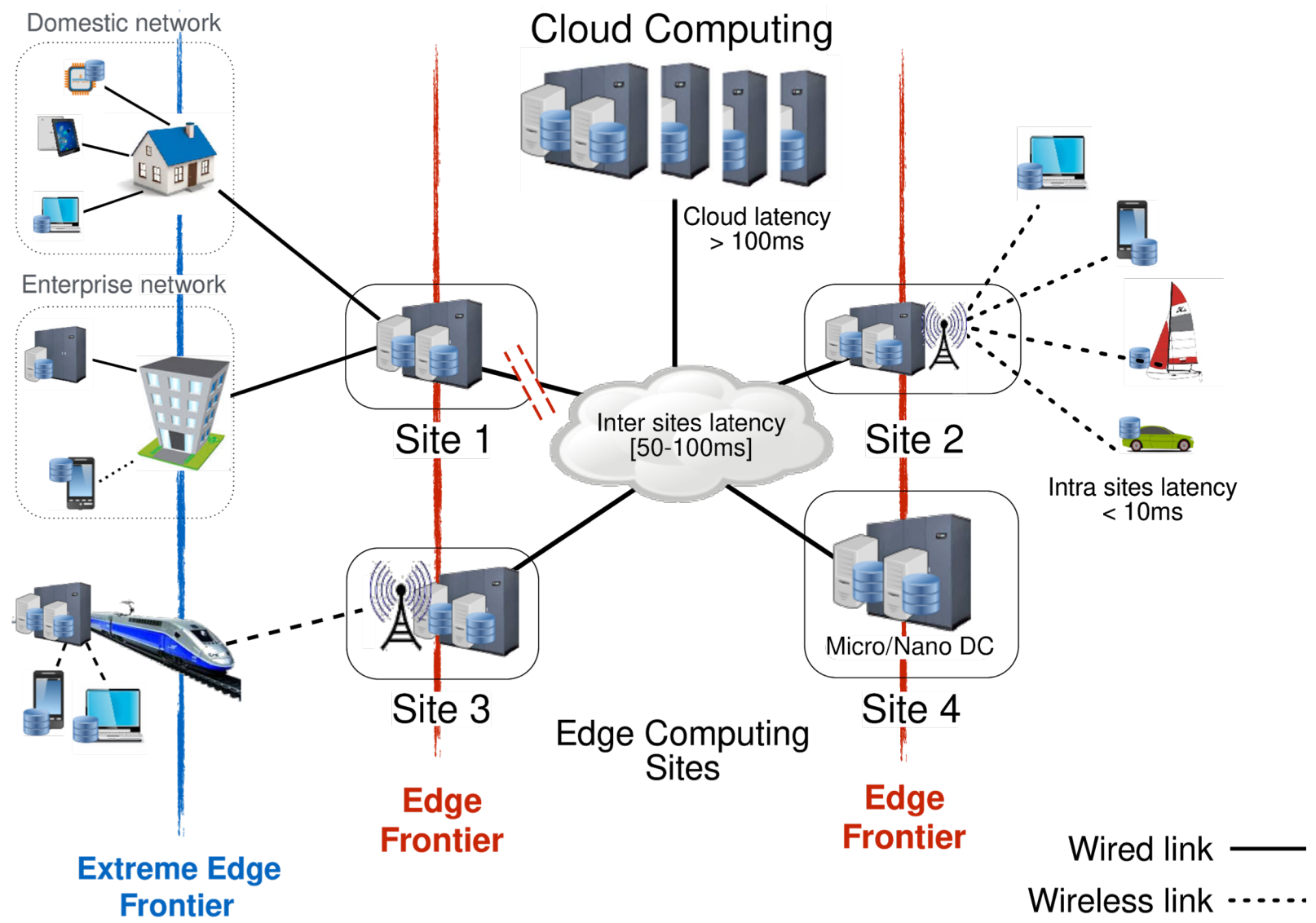# Edge Computing Resource Management System: a Critical Building Block!

Initiating the debate via OpenStack

Ronan-Alexandre Cherrueau, Adrien Lebre, Dimitri Pertin, Fetahi Wuhib, João Monteiro Soares

Which Edge?

Domestic network

Enterprise network

Cloud Computing

Cloud latency
> 100ms

Inter sites latency
[50-100ms]

Intra sites latency
< 10ms

Site 1

Site 2

Site 3

Site 4

Micro/Nano DC

Edge Computing
Sites

**Extreme Edge
Frontier**

**Edge
Frontier**

**Edge
Frontier**

Wired link ——
Wireless link ------

What do we seek?

- A resource manager with Admin & DevOps' requirements in mind

  - Admin/Operator - aggregate, supervise and expose massively distributed infrastruture resources

  - DevOps - implement new kinds of services that may be deployed/managed on-demand
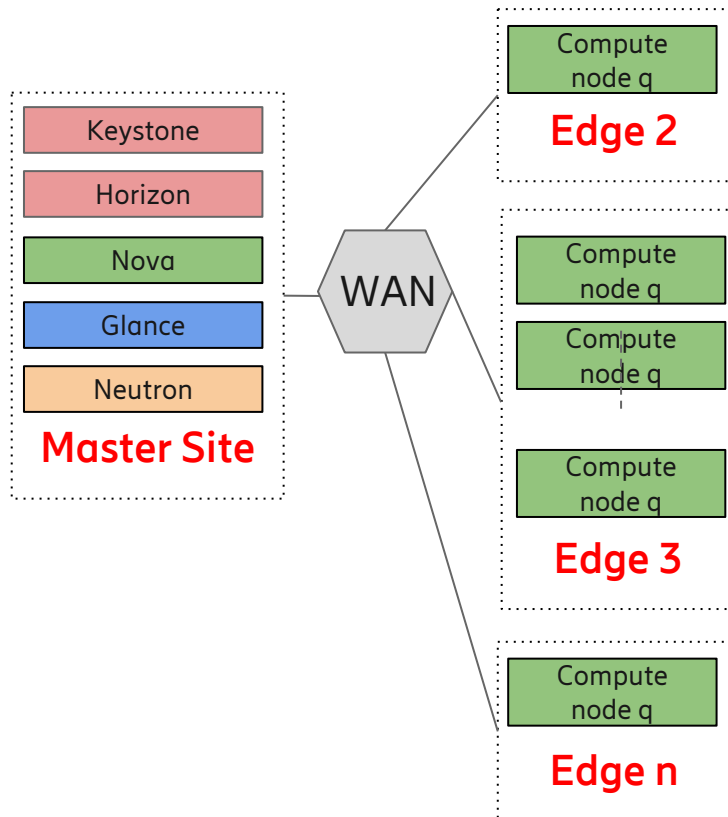
Requirements Classification

- Features expected by Admins & DevOps

- Classified into 5 levels (from L1, to L5)
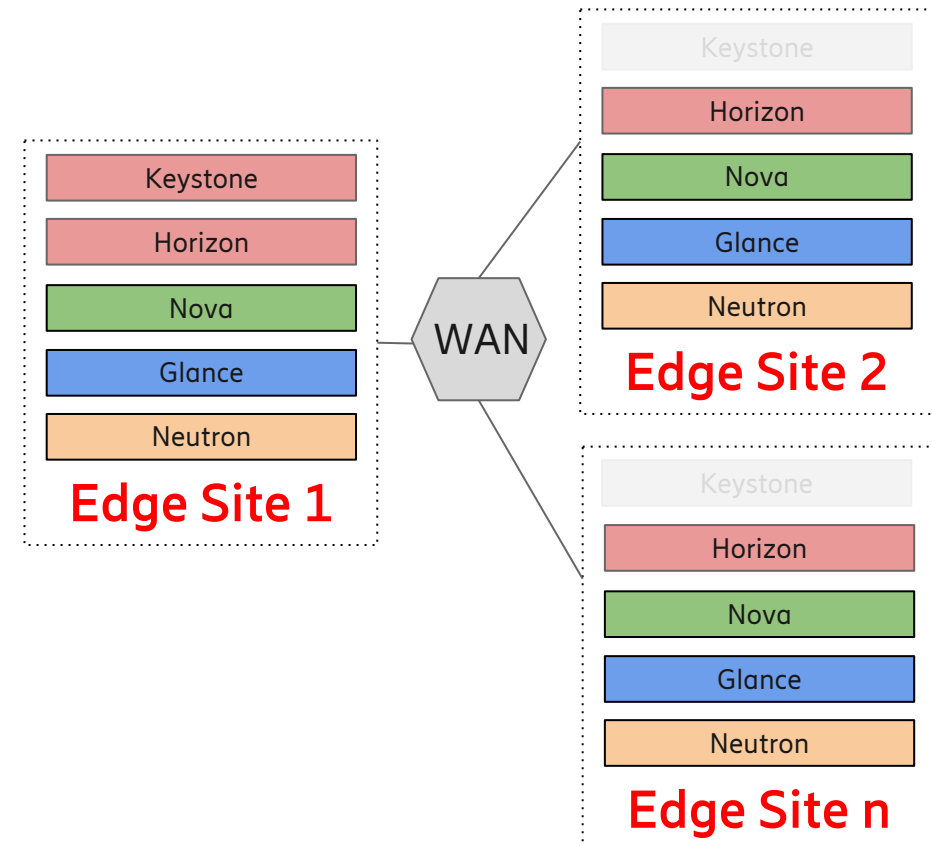
- From simpler aspects (L1) to more complex ones (L5)
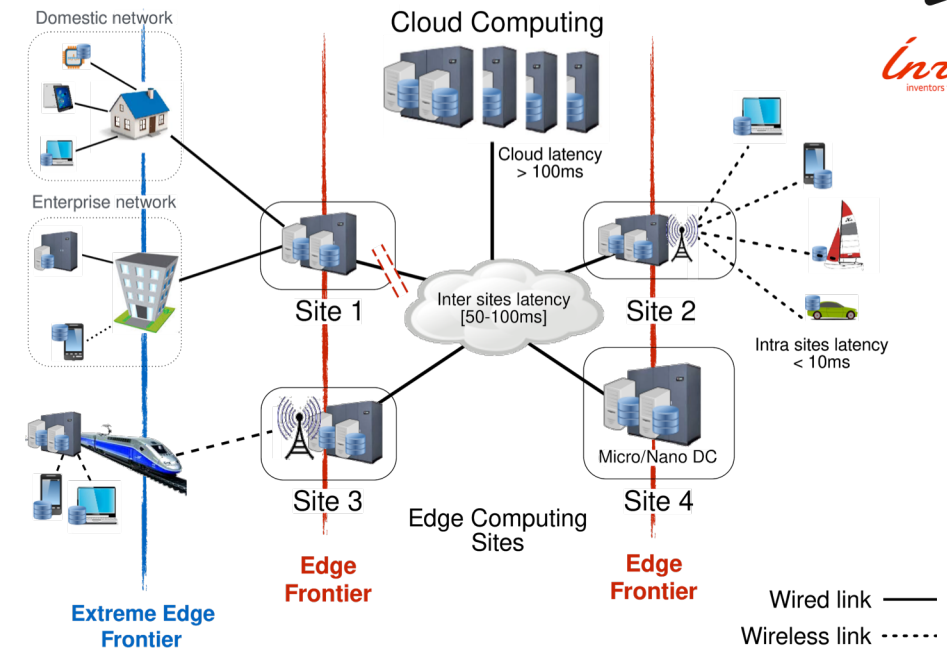
Levels	Admin	DevOps	Both
L1: Operate/use any site			
L2: Operate/use several sites			
L3: Robustness *w.r.t.* split brains			
L4: Multiple VIM environments			
L5: Multiple operators			

OpenStack at the Edge
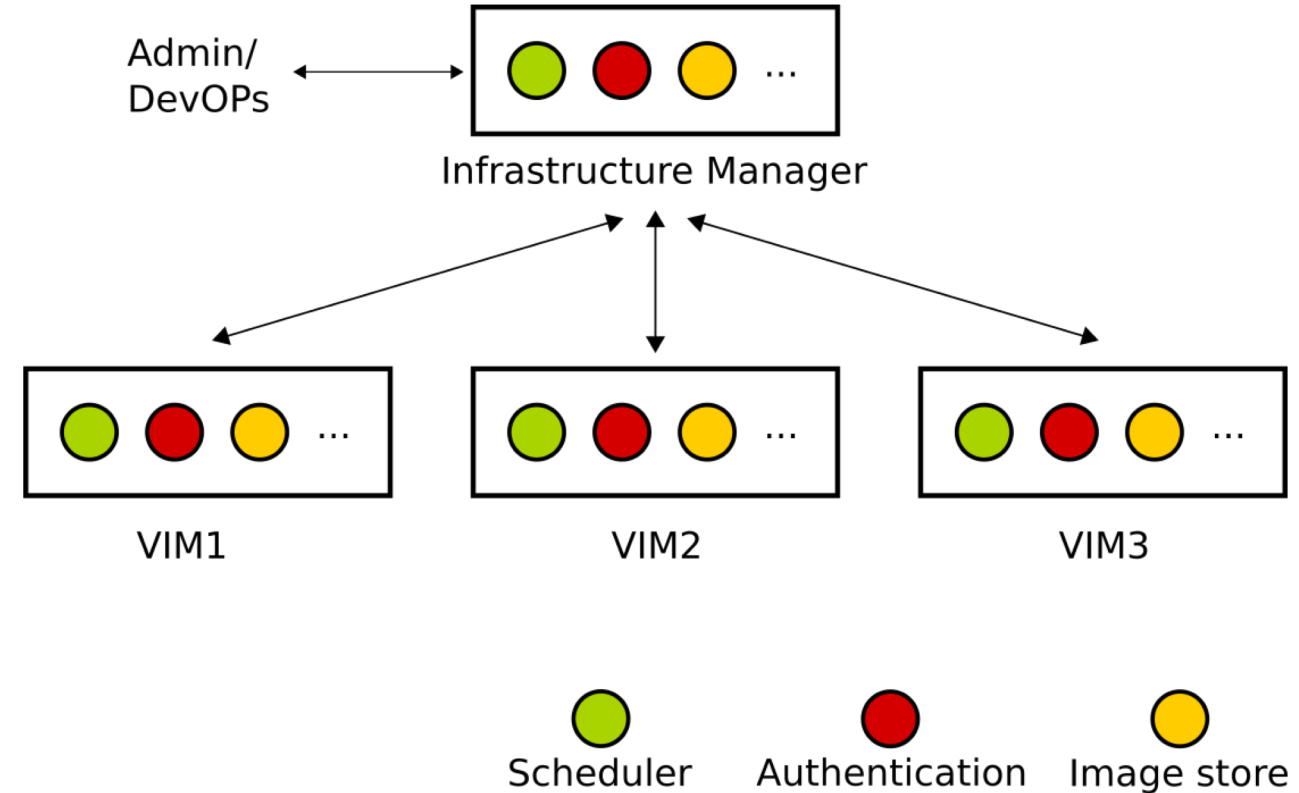
Single OpenStack

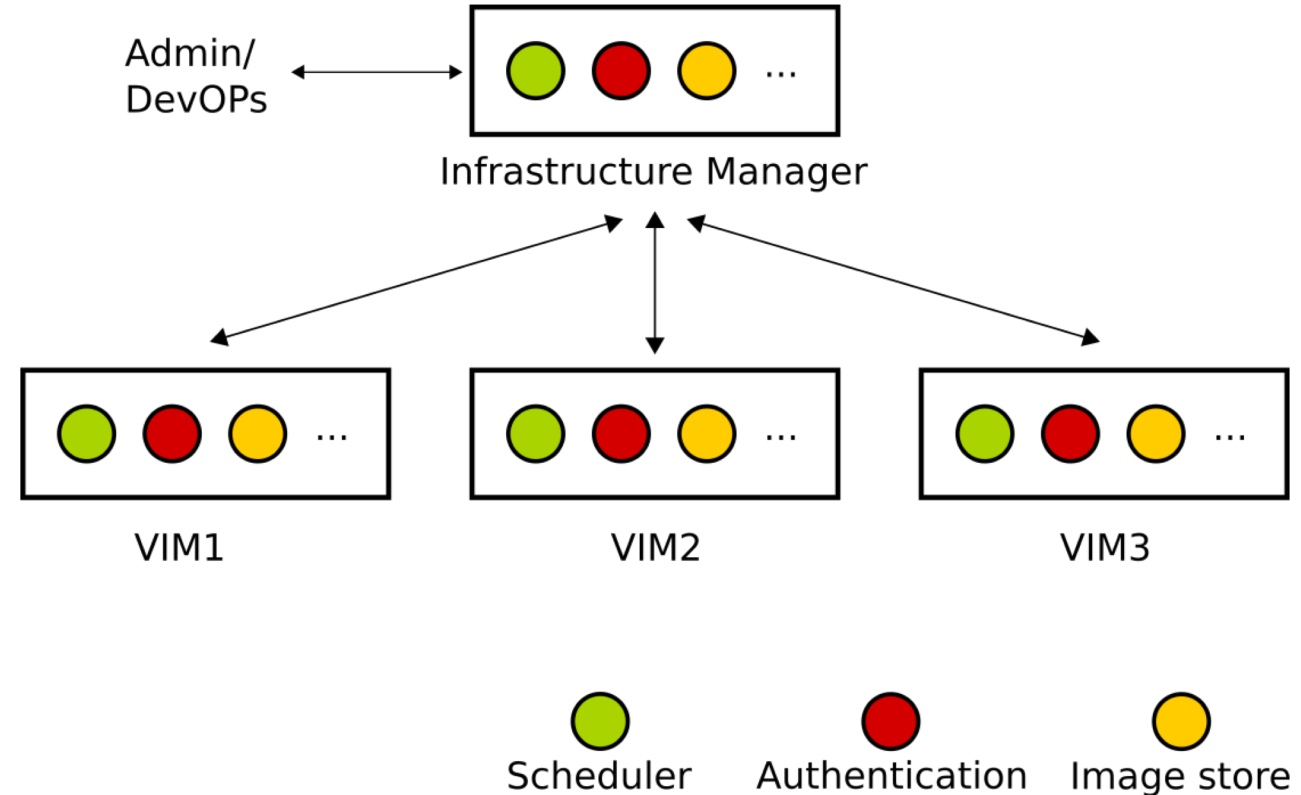## Multiple OpenStacks (Regions)

Design Discussion

Top-down Approach

- Most existing solutions follow this approach

- A set of overlay components that interact with VIMs through existing APIs

- Expose own APIs to Admins/DevOPs

Top-down Approach

+ Often simpler to get started with
+ Independent VIM and overlay development
+ Faster time to market and faster adoption

- Duplication of VIM functions, state and/or data at the overlay level (and between sites)
- Current APIs may not allow you to do low level operations (e.g. L2)

Admin/
DevOPs

Infrastructure Manager

VIM1   VIM2   VIM3

Scheduler   Authentication   Image store

Bottom-up Approach

- Native collaboration is baked into VIMs

- Any VIM can act as an entry point to the edge infrastructure

- Only academic proposals up to now

Admin/DevOPs ←→ VIM2

VIM1

VIM3

Scheduler Authentication Image store

9
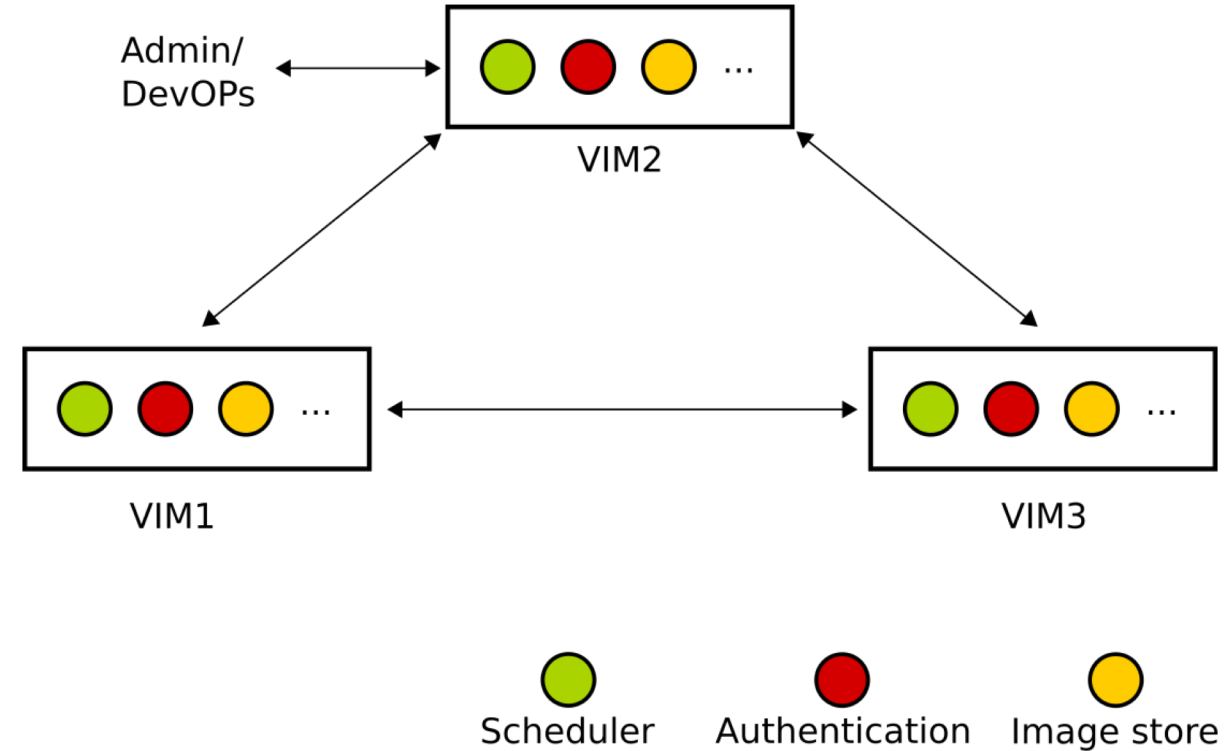
Bottom-up Approach

+   Minimal duplication of functions
+   Potential to fulfill all requirements

-     Not easy
  - Needs to deal with data consistency challenges in a WAN environment
  - Requires an excellent expertise of the whole ecosystem
  - L4/L5 challenges on abstraction, data exposure policy, etc
  - Convince the community
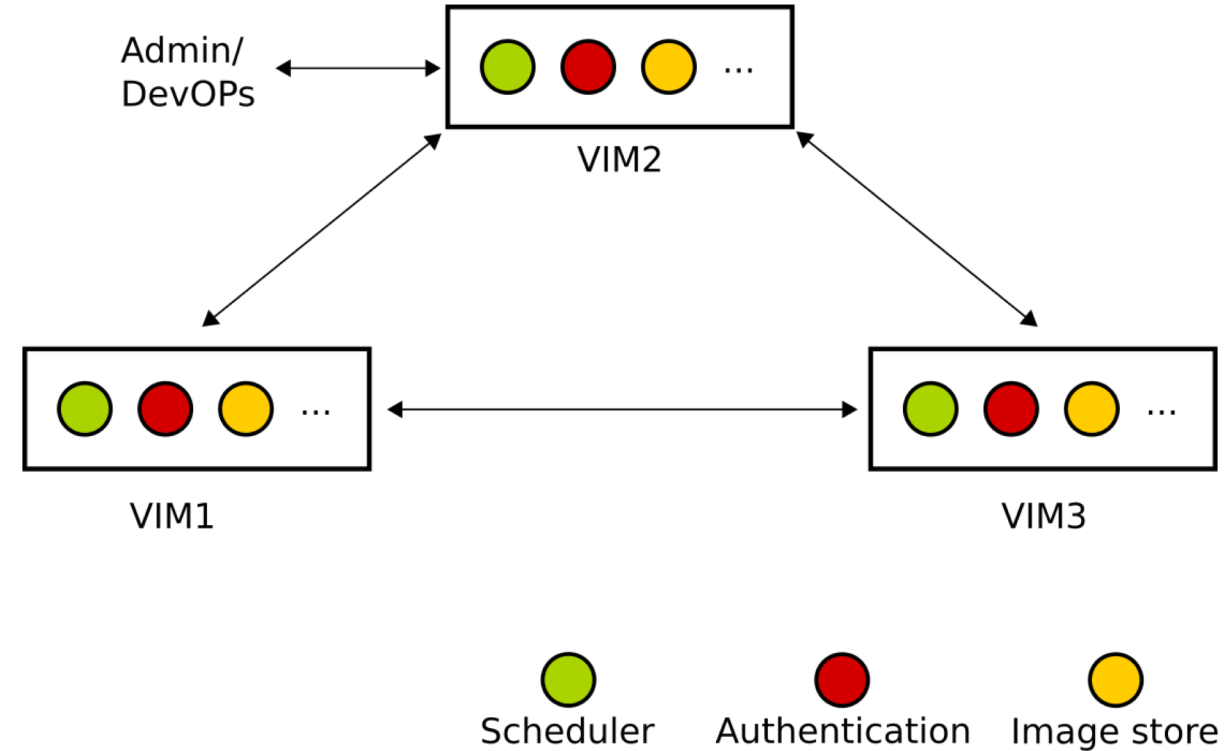
Summary

The tip of the iceberg

- Requirements: classification at various levels
- OpenStack: unable to fulfill (today) all identified requirements
- Design options: a Top-Down vs Bottom-Up dilemma
  - Hybrid approach = Bottum-Up up to L3 + Top-Down for L4 and L5

Moving foward

- More requirements?
  - Beyond IaaS
  - Integration with Core and Mobile Networks
- Propose an architecture that mitigates development efforts
- ...

THANKS!

Ronan-Alexandre Cherrueau, Adrien Lebre, Dimitri Pertin, Fetahi Wuhib, João Monteiro Soares