Inria Project Lab Discovery MidTerm Review Sept 27. 2017

Adrien Lebre

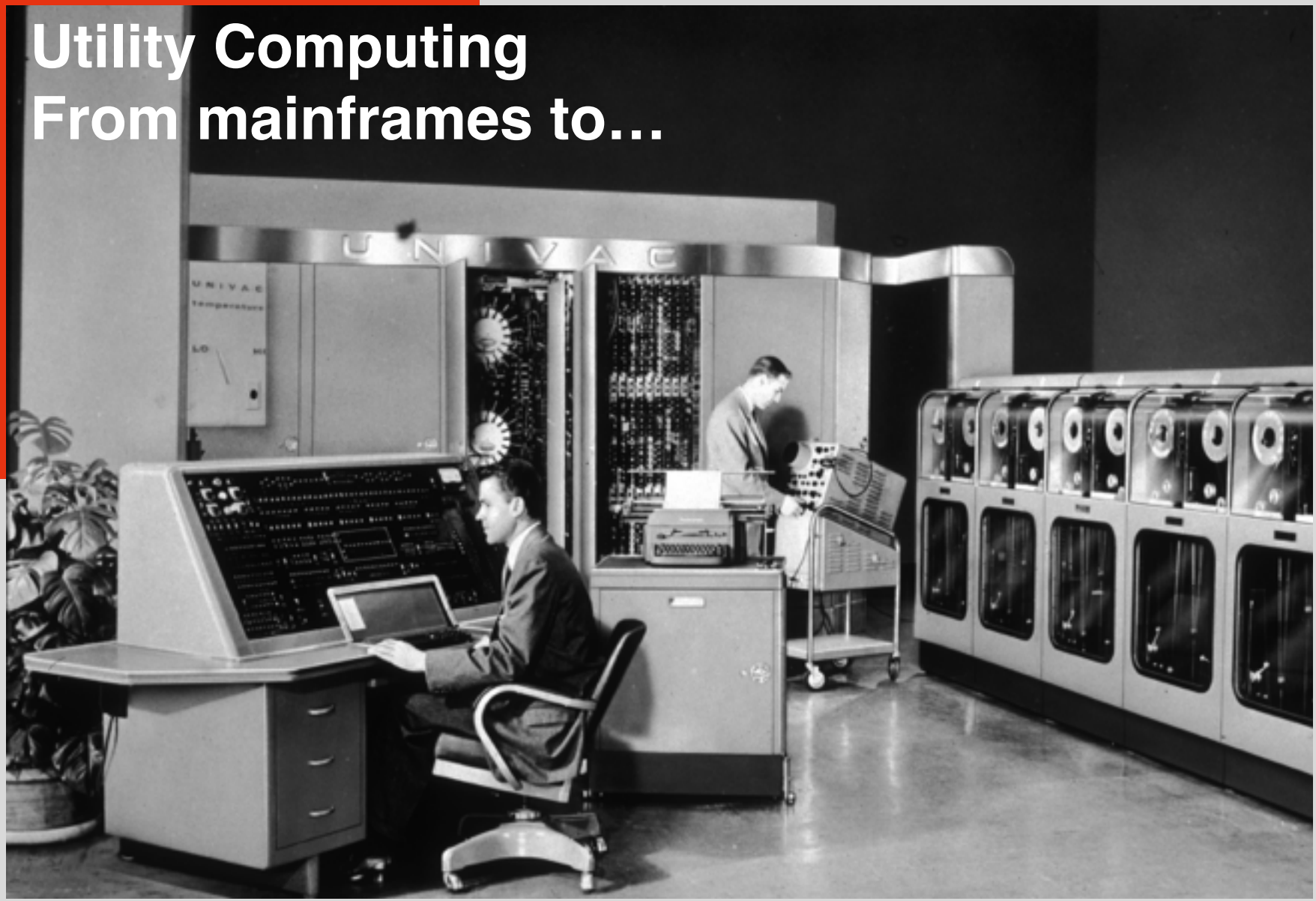
https://pad.inria.fr/p/RUrAg0rkj8e8tavv_midterm-discovery

Contents

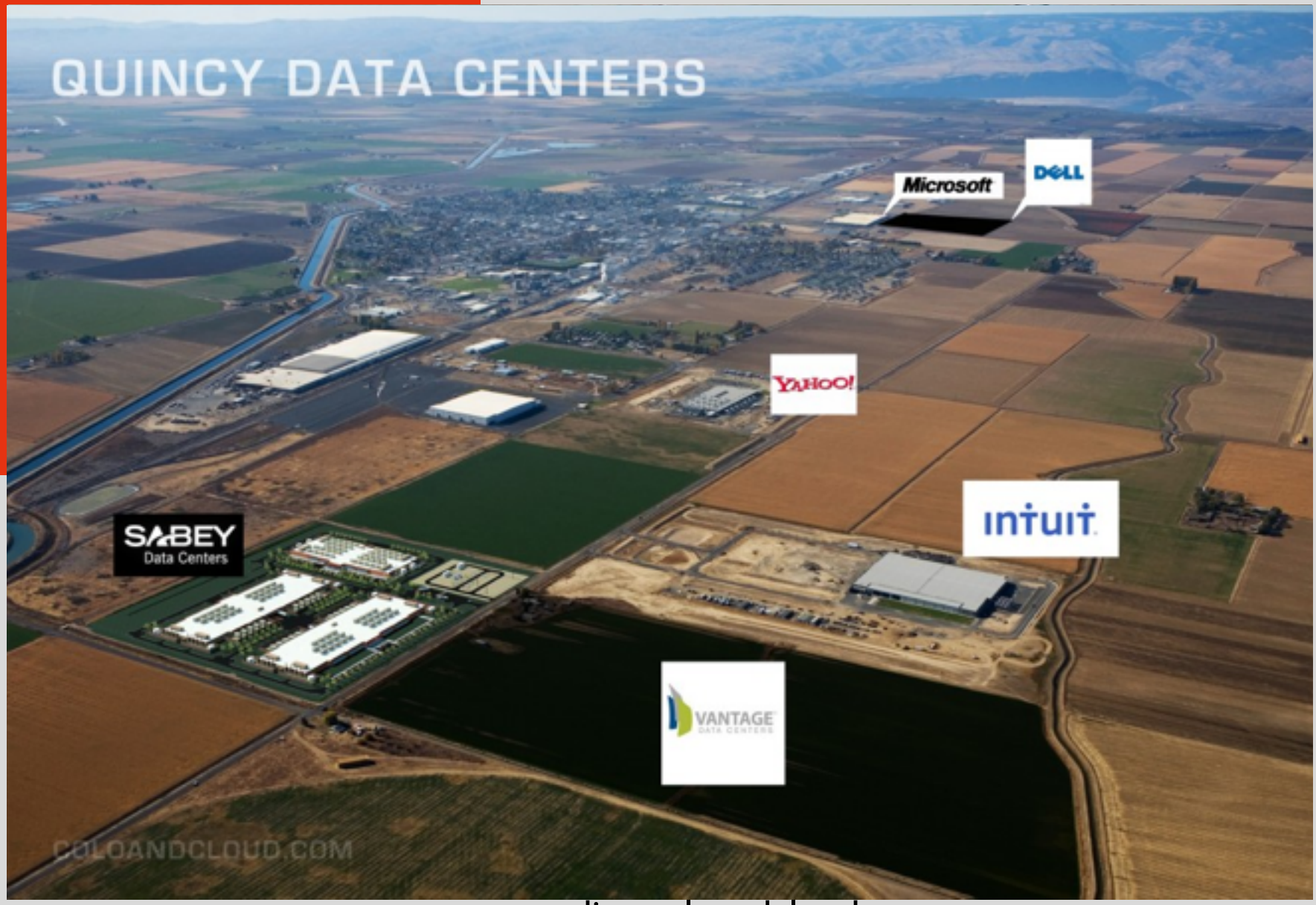
01

Overview

Utility Computing
From mainframes to…



Utility Computing
From mainframes to… larger “mainframes”



credits: coloandcloud.com

2012-2014
Major brakes for the adoption of the CC model

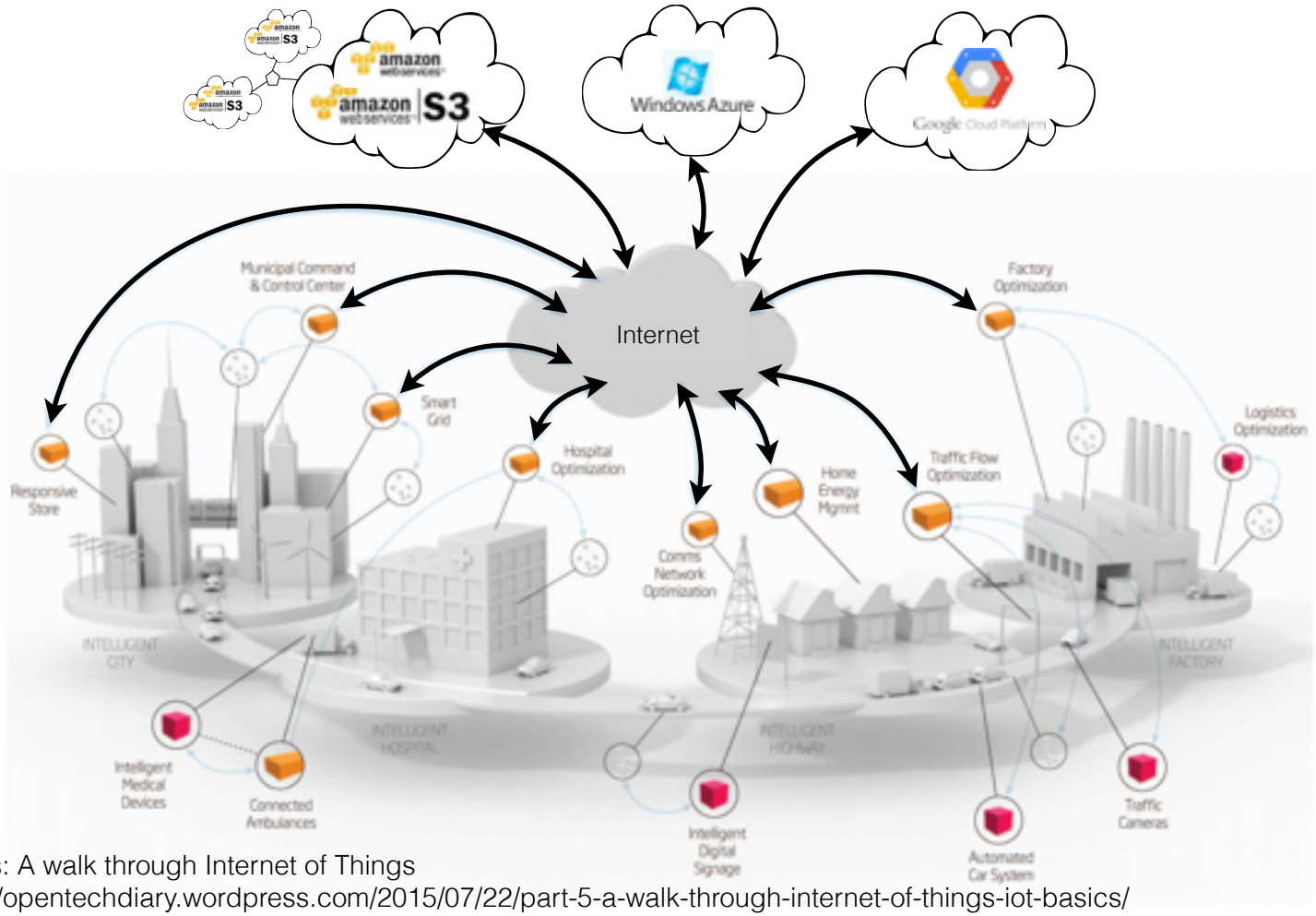
Juridisction concerns

Reliability

CC distance (network overheads)

2012-2014
Major brakes for the adoption of the CC model

Industrial Internet - Internet of Skills



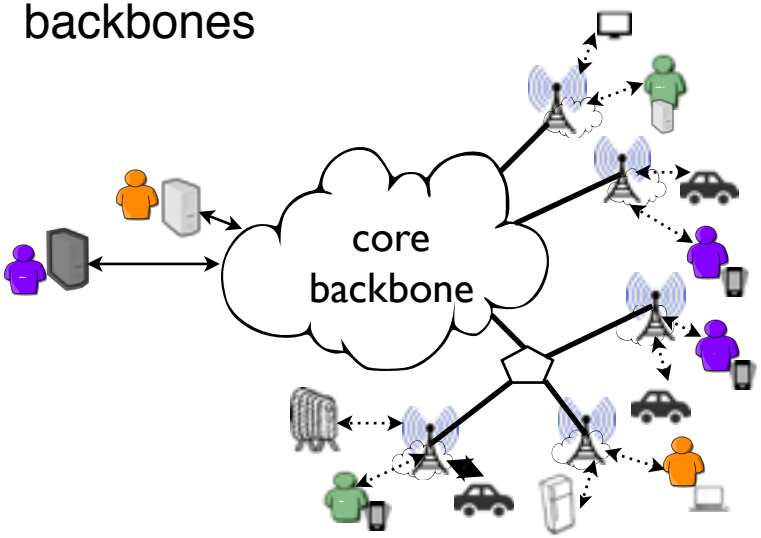
credits: A walk through Internet of Things
https://opentechdiary.wordpress.com/2015/07/22/part-5-a-walk-through-internet-of-things-iot-basics/

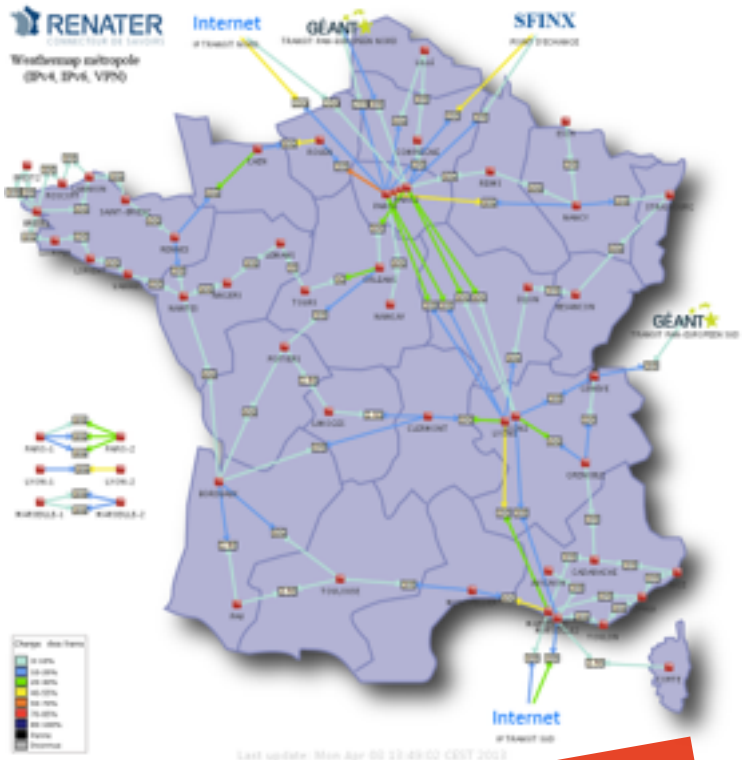
DISCOVERY VISION

Bring Clouds back to the cloud

- Leverage the concept of µDC/nDC to extend any point of presence of network backbones (aka PoP) with servers

- Extend to the edge by including wireless backbones





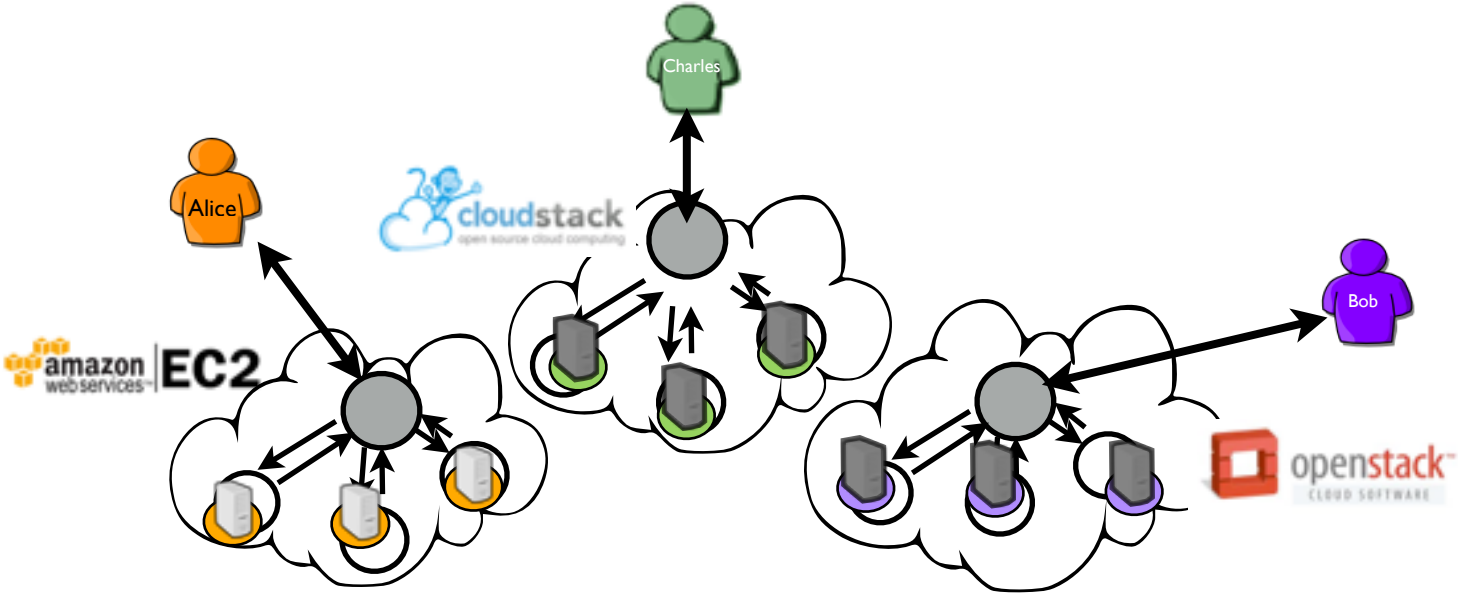
How operating such a WANWide Cloud?

inria
inventors for the digital world

The Broker Approach

Sporadic (hybrid computing/cloud bursting) almost ready for production

Broker are rather limited to simple usages and not advanced administrated operations

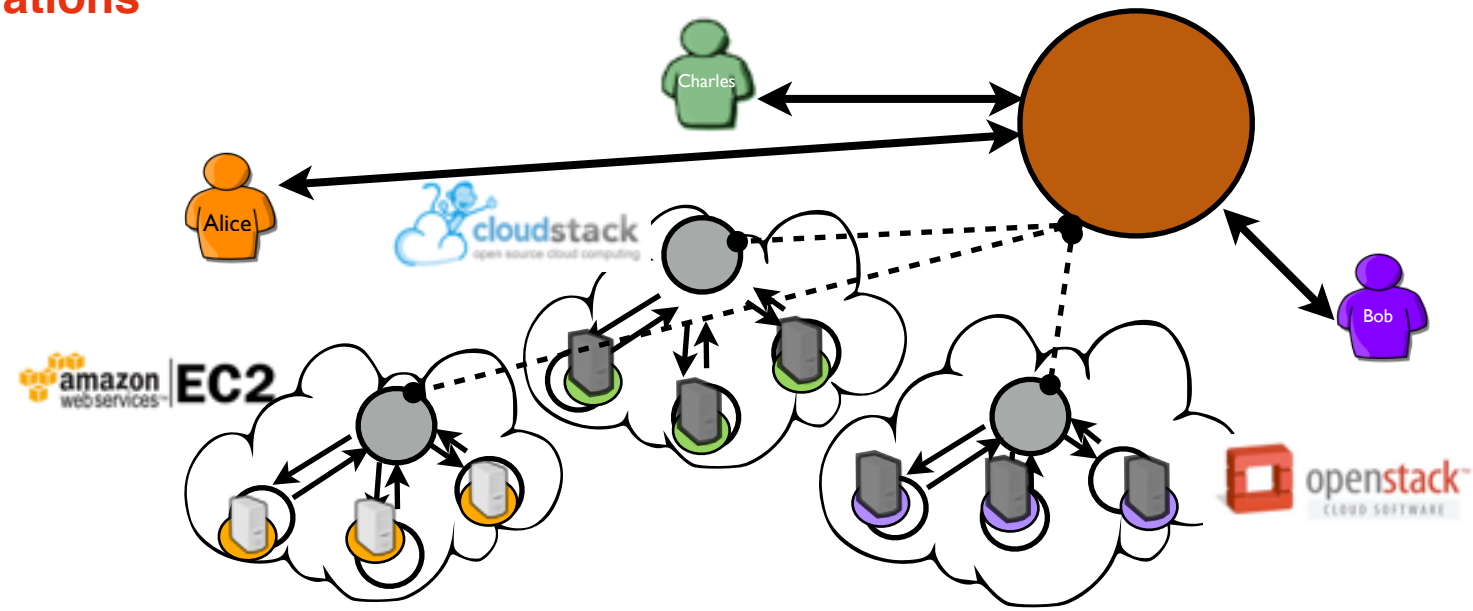


Advanced brokers must reimplement standard IaaS mechanisms while facing the API limitation

The Broker Approach

Sporadic (hybrid computing/cloud bursting) almost ready for production

Broker are rather limited to simple usages and not advanced administrated operations



Advanced brokers must reimplement standard IaaS mechanisms while facing the API limitation

A New Resource Management System

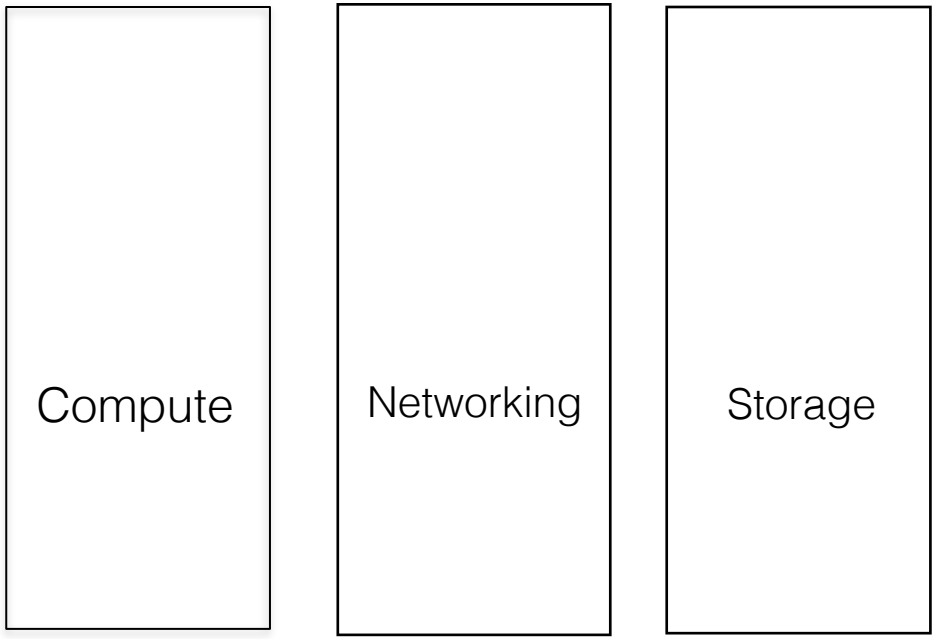
Designing a tightly-coupled software stack to operate and use massively geo-distributed ICT infrastructures.

Delivering appropriate system abstractions, from low (system) to high-levels (applications), and by addressing cross cutting dimensions such as energy or security, to operate massively geo-distributed infrastructures

A New Resource Management System

Designing a tightly-coupled software stack to operate and use massively geo-distributed ICT infrastructures.

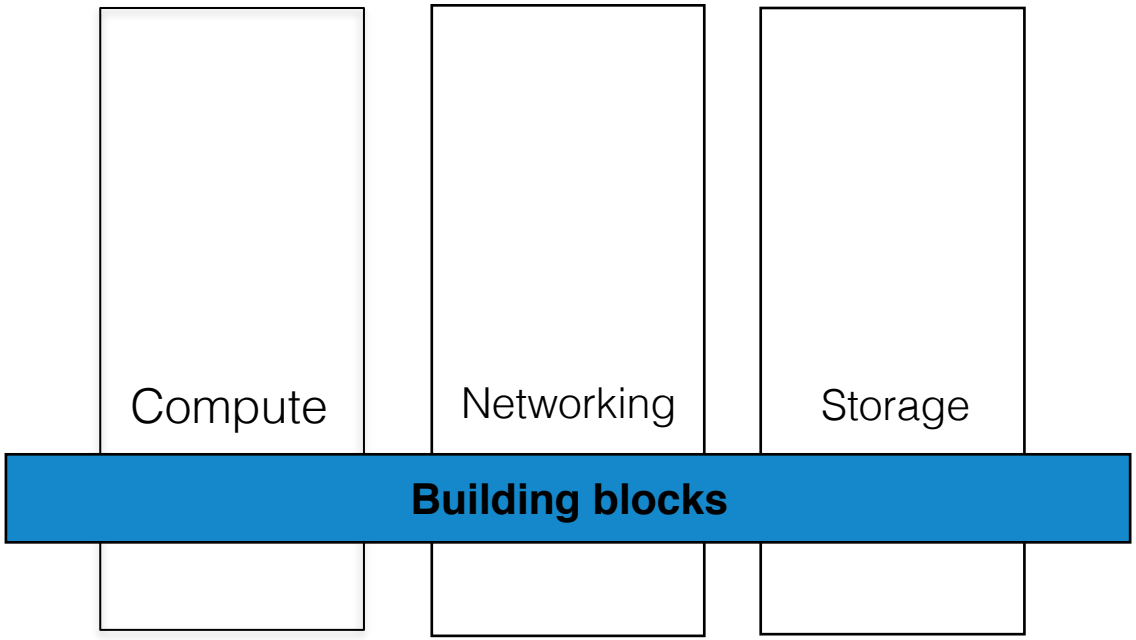
Delivering appropriate system abstractions, from low (system) to high-levels (applications), and by addressing cross cutting dimensions such as energy or security, to operate massively geo-distributed infrastructures



A New Resource Management System

Designing a tightly-coupled software stack to operate and use massively geo-distributed ICT infrastructures.

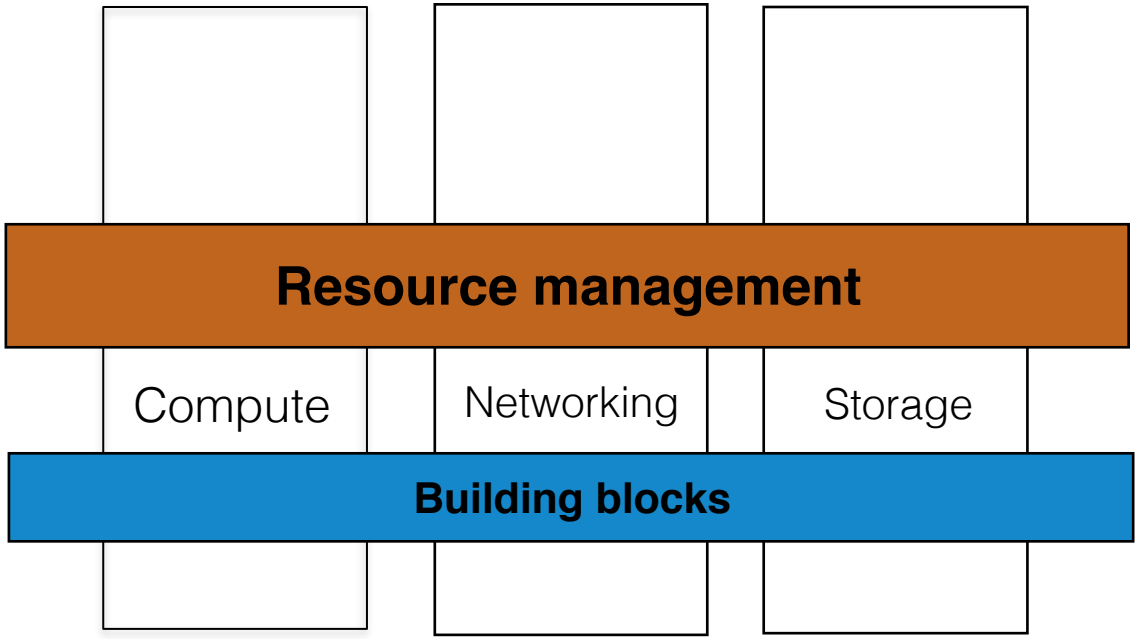
Delivering appropriate system abstractions, from low (system) to high-levels (applications), and by addressing cross cutting dimensions such as energy or security, to operate massively geo-distributed infrastructures



A New Resource Management System

Designing a tightly-coupled software stack to operate and use massively geo-distributed ICT infrastructures.

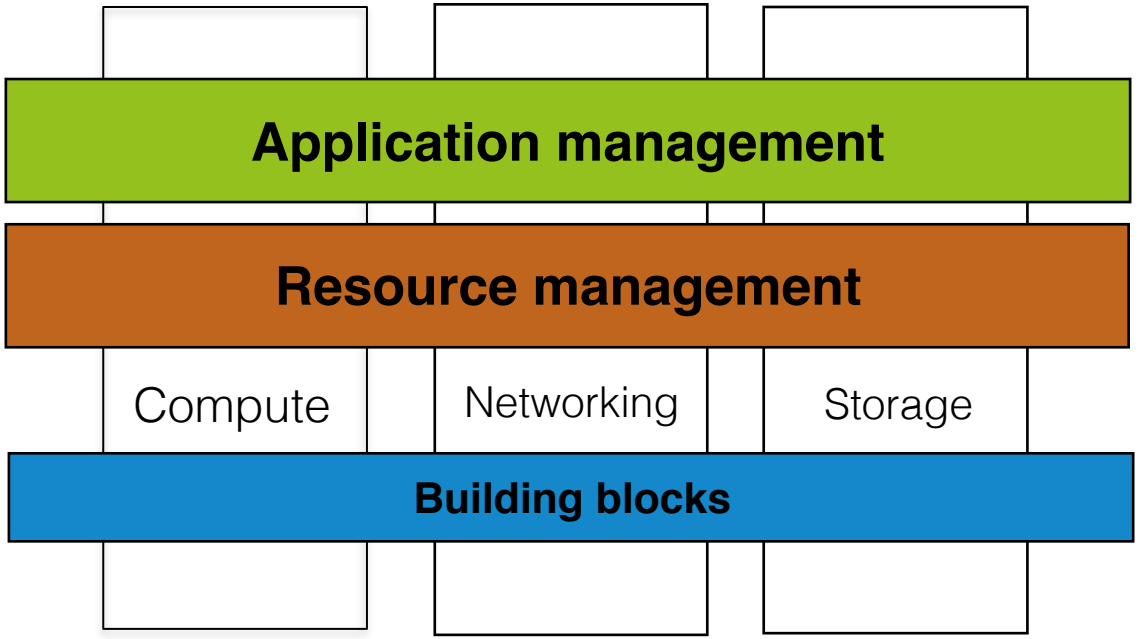
Delivering appropriate system abstractions, from low (system) to high-levels (applications), and by addressing cross cutting dimensions such as energy or security, to operate massively geo-distributed infrastructures



A New Resource Management System

Designing a tightly-coupled software stack to operate and use massively geo-distributed ICT infrastructures.

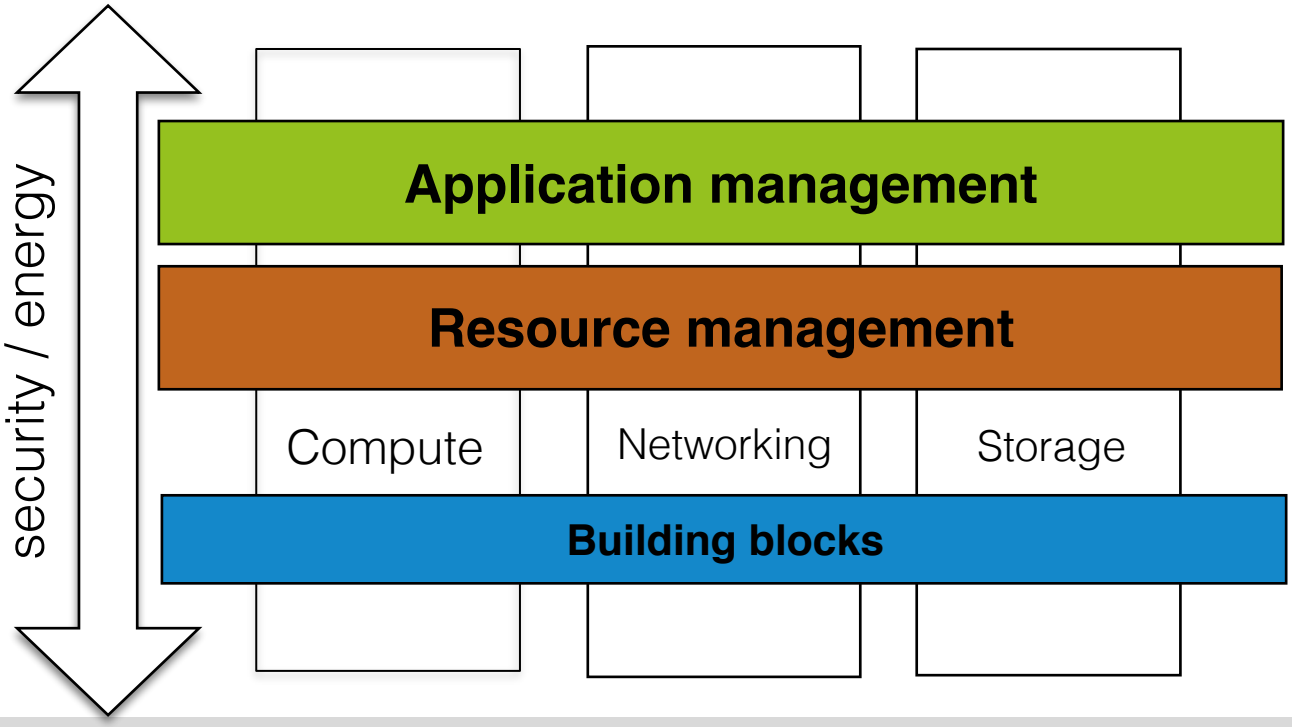
Delivering appropriate system abstractions, from low (system) to high-levels (applications), and by addressing cross cutting dimensions such as energy or security, to operate massively geo-distributed infrastructures



A New Resource Management System

Designing a tightly-coupled software stack to operate and use massively geo-distributed ICT infrastructures.

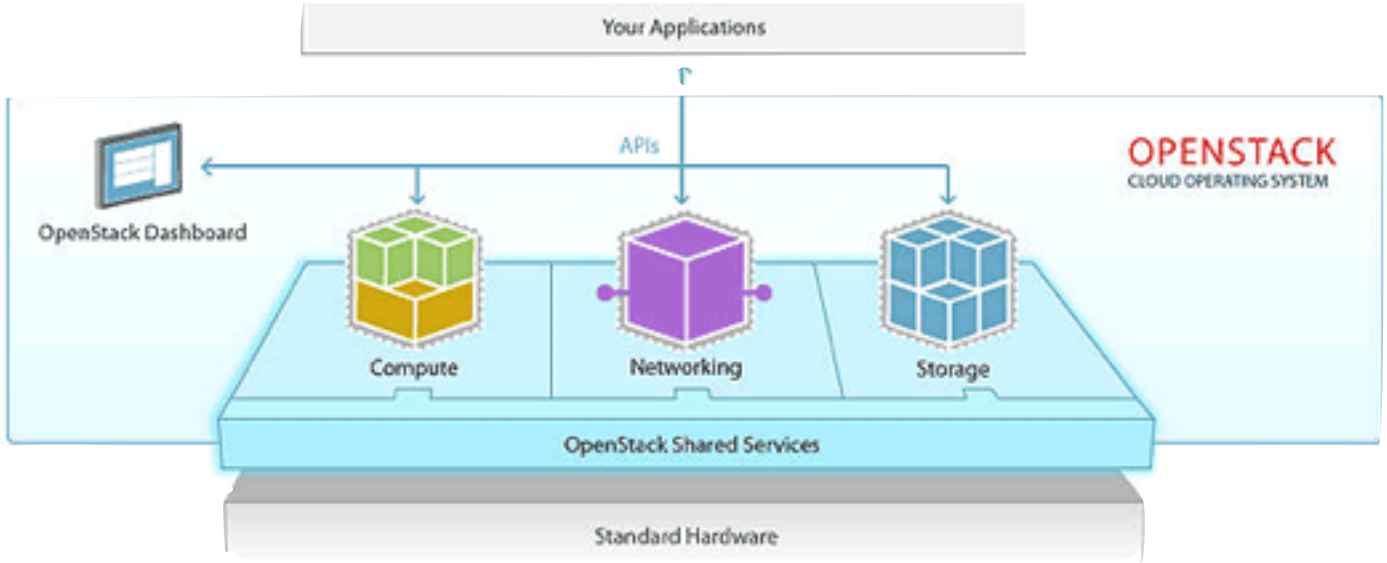
Delivering appropriate system abstractions, from low (system) to high-levels (applications), and by addressing cross cutting dimensions such as energy or security, to operate massively geo-distributed infrastructures



A New Resource Management System

Designing a tightly-coupled software stack to operate and use massively geo-distributed ICT infrastructures.

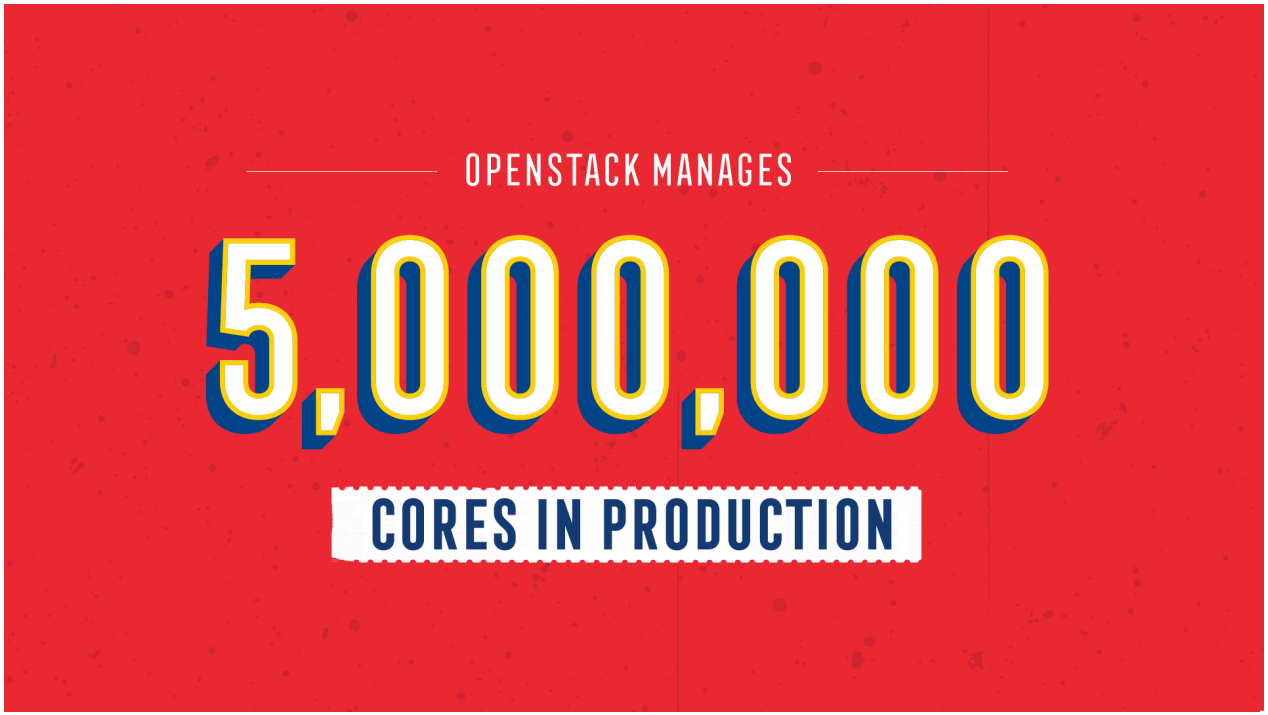
Delivering appropriate system abstractions, from low (system) to high-levels (applications), and by addressing cross cutting dimensions such as energy or security, to operate massively geo-distributed infrastructures



Would OpenStack be the solution ?

OpenStack, de-factor OpenSource Solution

OpenStack provides one platform to orchestrate bare metal, containers, and virtual machines on a single network, allowing private users to optimize for their application without creating more silos in their datacenters, and giving service providers more delivery options.



OpenStack, de-factor OpenSource Solution

OpenStack provides one platform to orchestrate bare metal, containers, and virtual machines on a single network, allowing private users to optimize for their application without creating more silos in their datacenters, and giving service providers more delivery options.

OpenStack, de-factor OpenSource Solution

OpenStack provides one platform to orchestrate bare metal, containers, and virtual machines on a single network, allowing private users to optimize for their application without creating more silos in their datacenters, and giving service providers more delivery options.

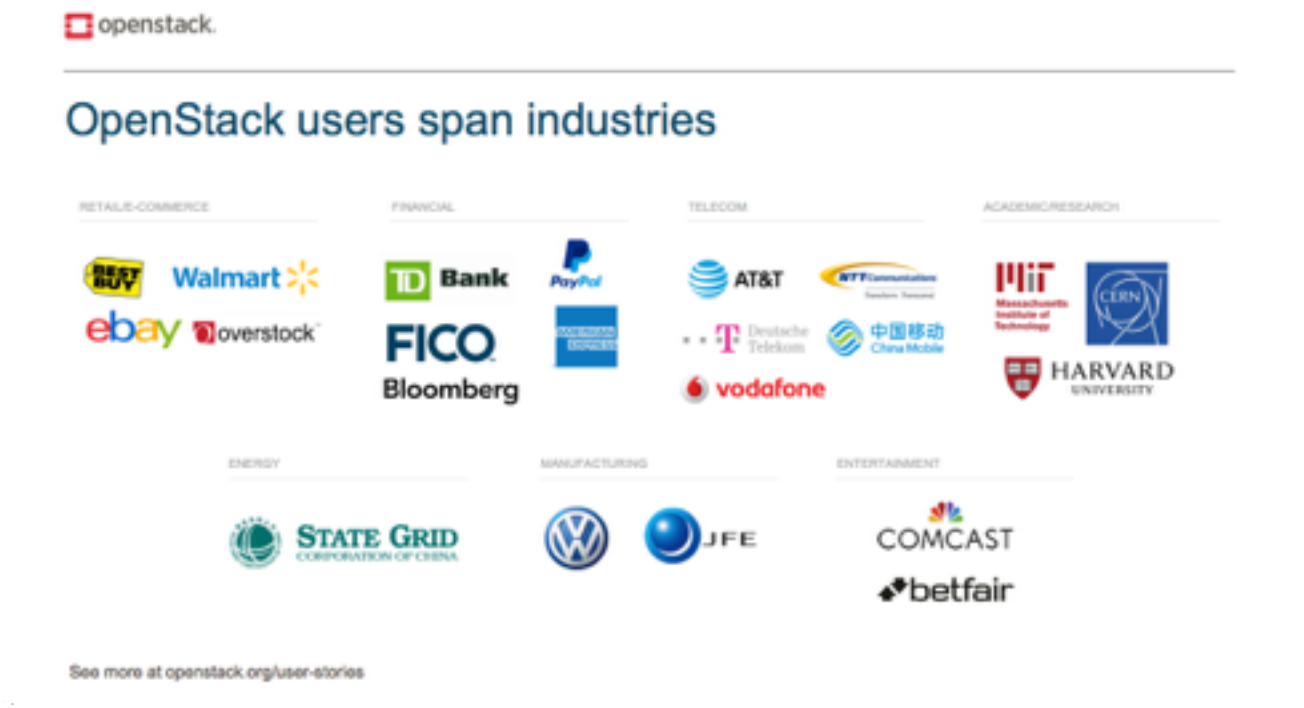
openstack.

More than 70,000 registered community members

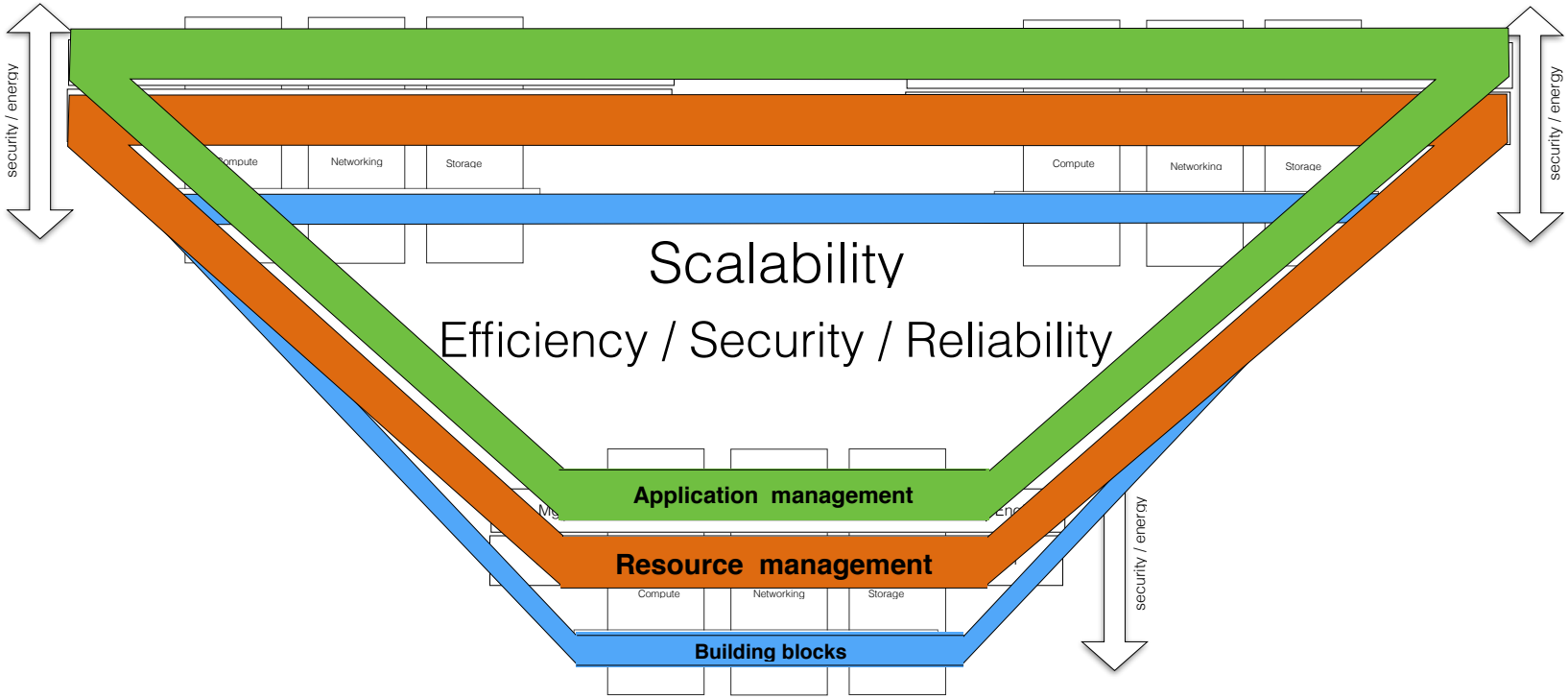
- 649 supporting organizations
- 181 countries represented
- 116 global user groups

OpenStack, de-factor OpenSource Solution

OpenStack provides one platform to orchestrate bare metal, containers, and virtual machines on a single network, allowing private users to optimize for their application without creating more silos in their datacenters, and giving service providers more delivery options.

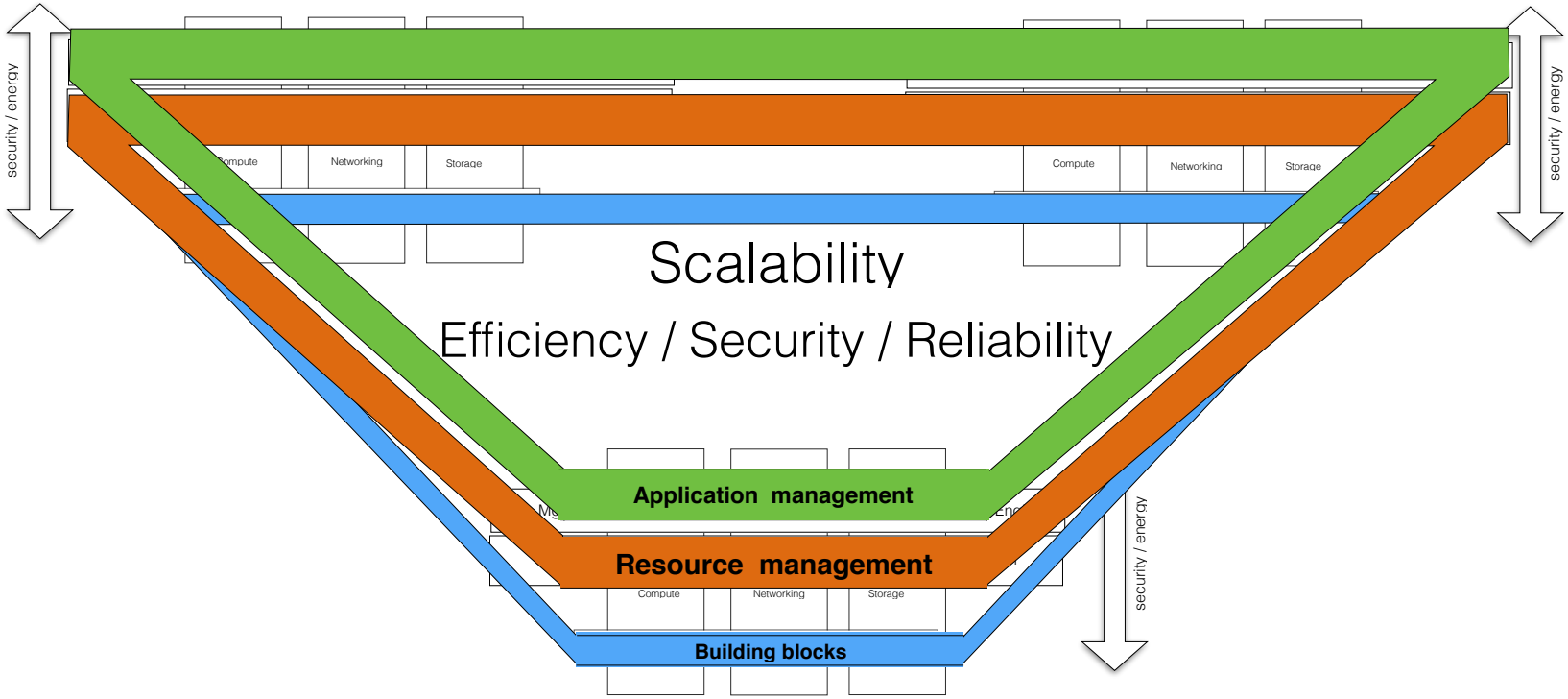


Toward a Fog/Edge Compliant OpenStack



inria
inventors for the digital world

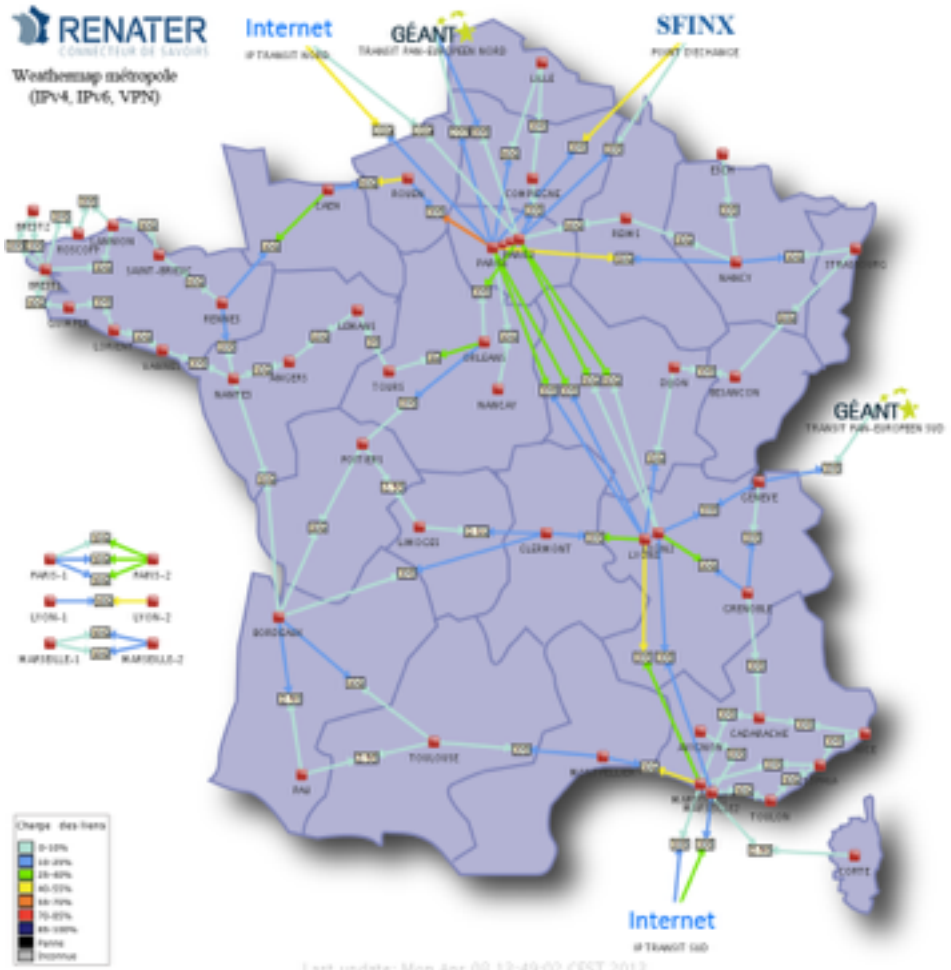
Toward a Fog/Edge Compliant OpenStack



"Just" a distributed resource management system?

inventors for the digital world

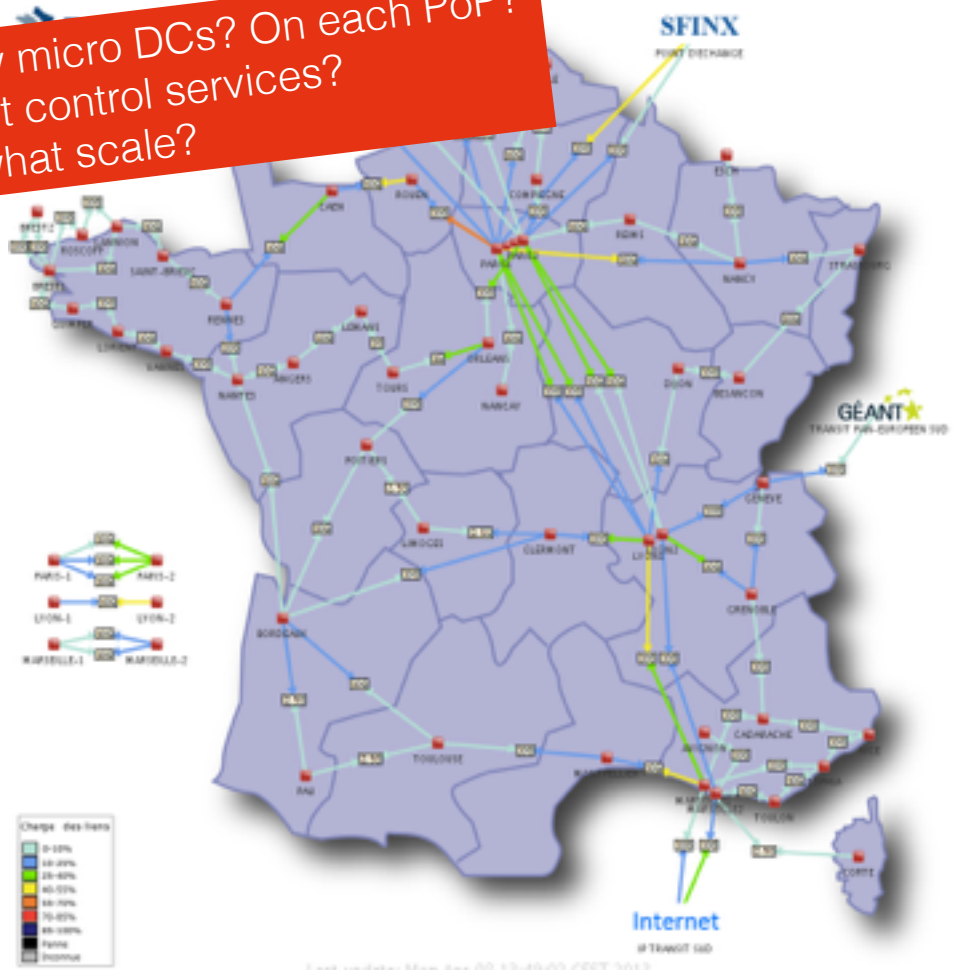
“Just” a Dist. Resource Mgmt System ?



inventors for the digital world

“Just” a Dist. Resource Mgmt System ?

Where should I deploy micro DCs? On each PoP?
What’s about control services?
at what scale?

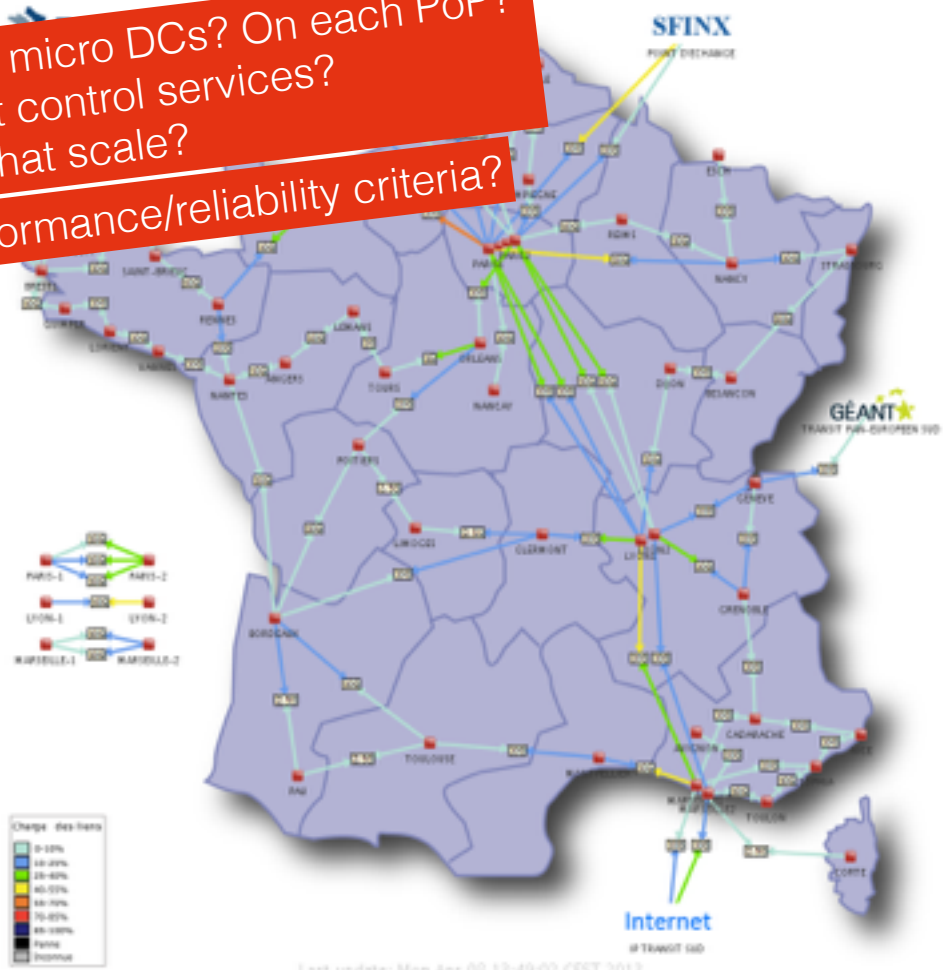


inventors for the digital world

“Just” a Dist. Resource Mgmt System ?

Where should I deploy micro DCs? On each PoP?
What’s about control services?
at what scale?

What’s about the performance/reliability criteria?



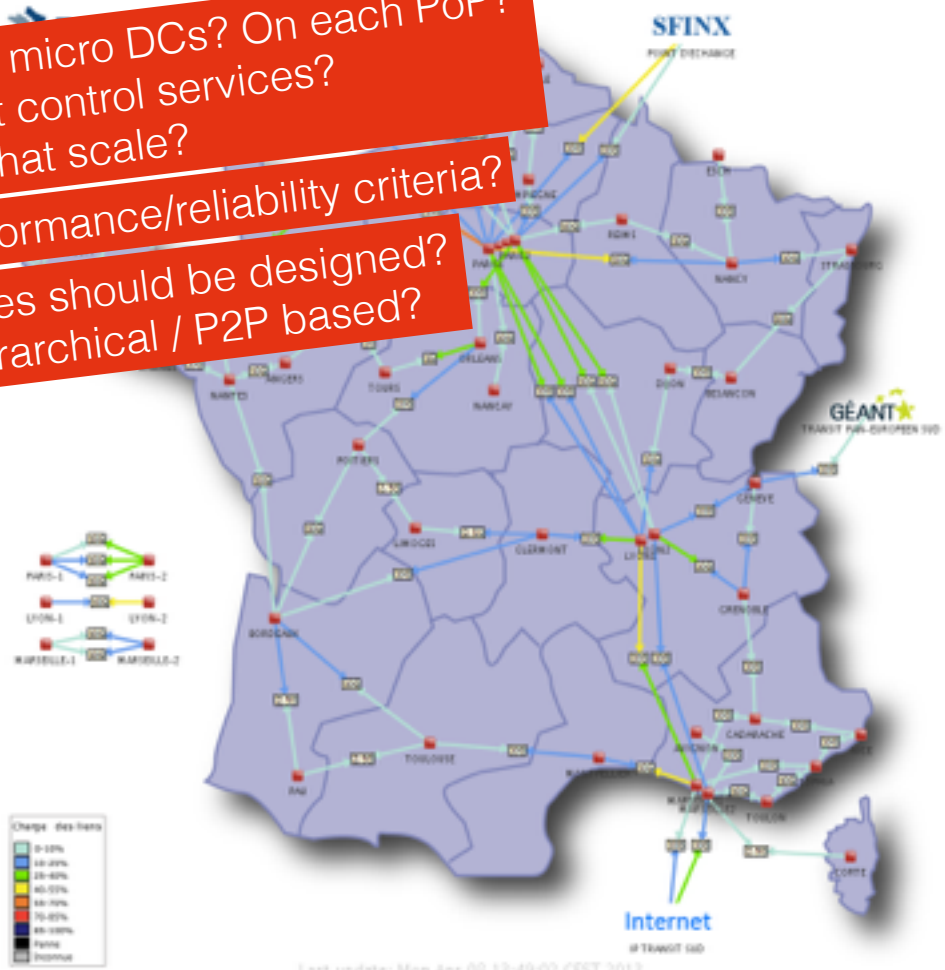
inria
inventors for the digital world

“Just” a Dist. Resource Mgmt System ?

Where should I deploy micro DCs? On each PoP?
What’s about control services?
at what scale?

What’s about the performance/reliability criteria?

How control services should be designed?
Centralised / Hierarchical / P2P based?



inria
inventors for the digital world

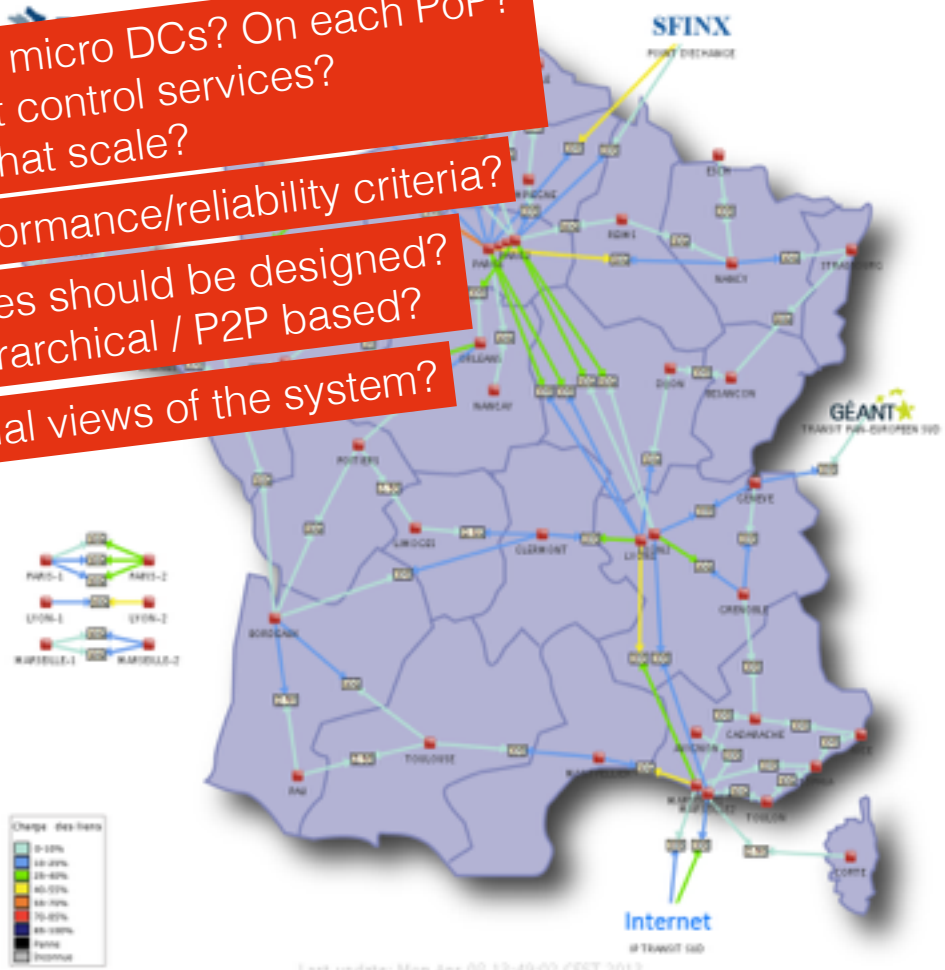
“Just” a Dist. Resource Mgmt System ?

Where should I deploy micro DCs? On each PoP?
What’s about control services?
at what scale?

What’s about the performance/reliability criteria?

How control services should be designed?
Centralised / Hierarchical / P2P based?

Global vs partial views of the system?



inria
inventors for the digital world

“Just” a Dist. Resource Mgmt System ?

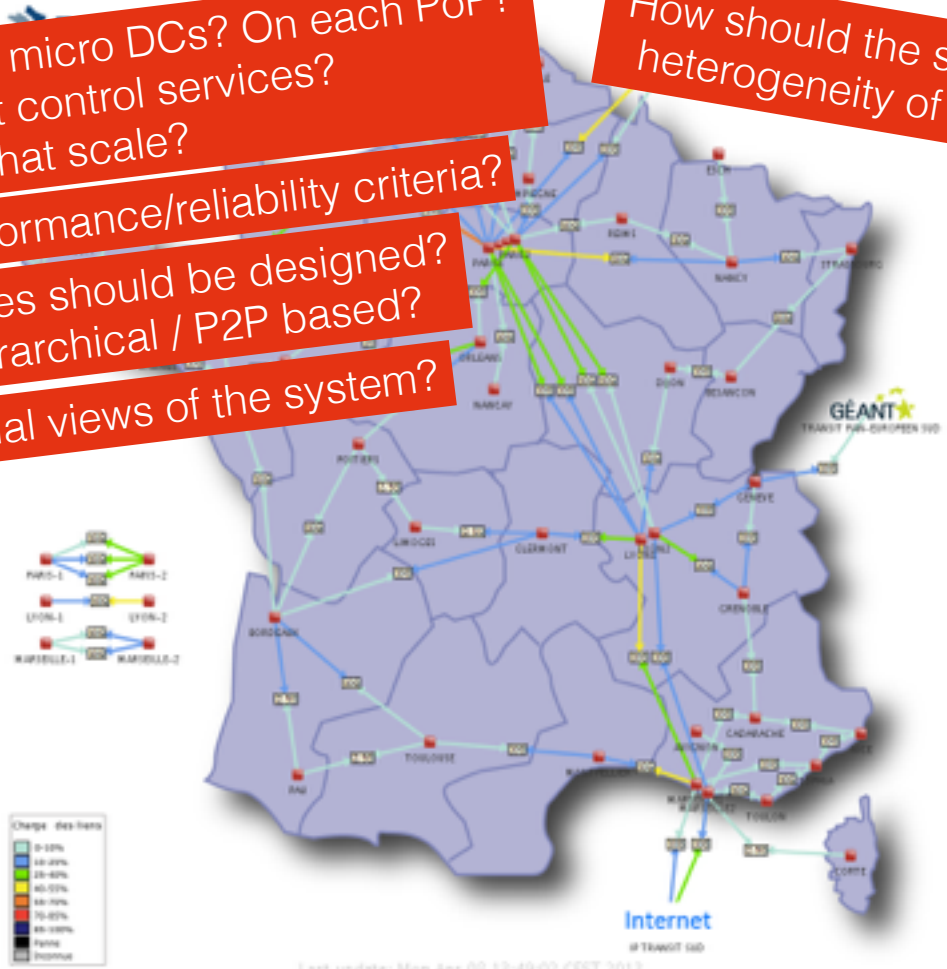
Where should I deploy micro DCs? On each PoP?
What’s about control services?
at what scale?

What’s about the performance/reliability criteria?

How control services should be designed?
Centralised / Hierarchical / P2P based?

Global vs partial views of the system?

How should the system deal with the heterogeneity of the infrastructure?



inventors for the digital world

“Just” a Dist. Resource Mgmt System ?

Where should I deploy micro DCs? On each PoP?
What’s about control services?
at what scale?

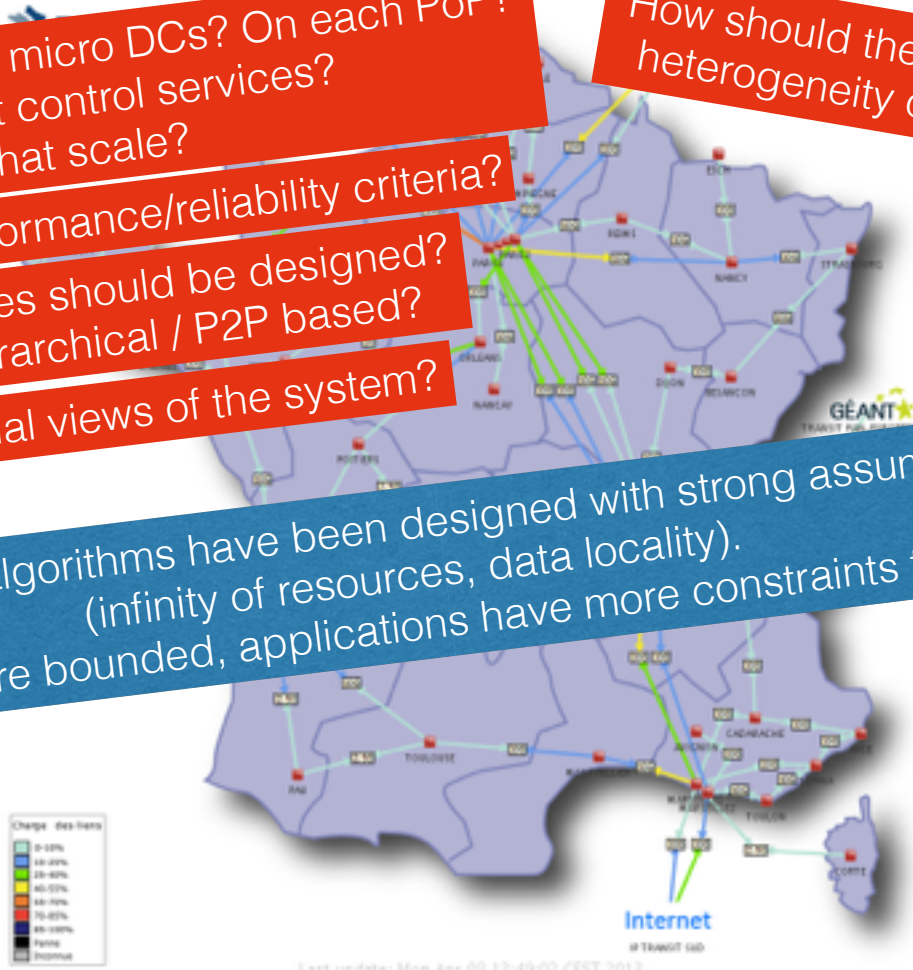
How should the system deal with the heterogeneity of the infrastructure?

What’s about the performance/reliability criteria?

How control services should be designed?
Centralised / Hierarchical / P2P based?

Global vs partial views of the system?

Placement algorithms have been designed with strong assumptions
(infinity of resources, data locality).
Here resources are bounded, applications have more constraints to deal with…



“Just” a Dist. Resource Mgmt System ?

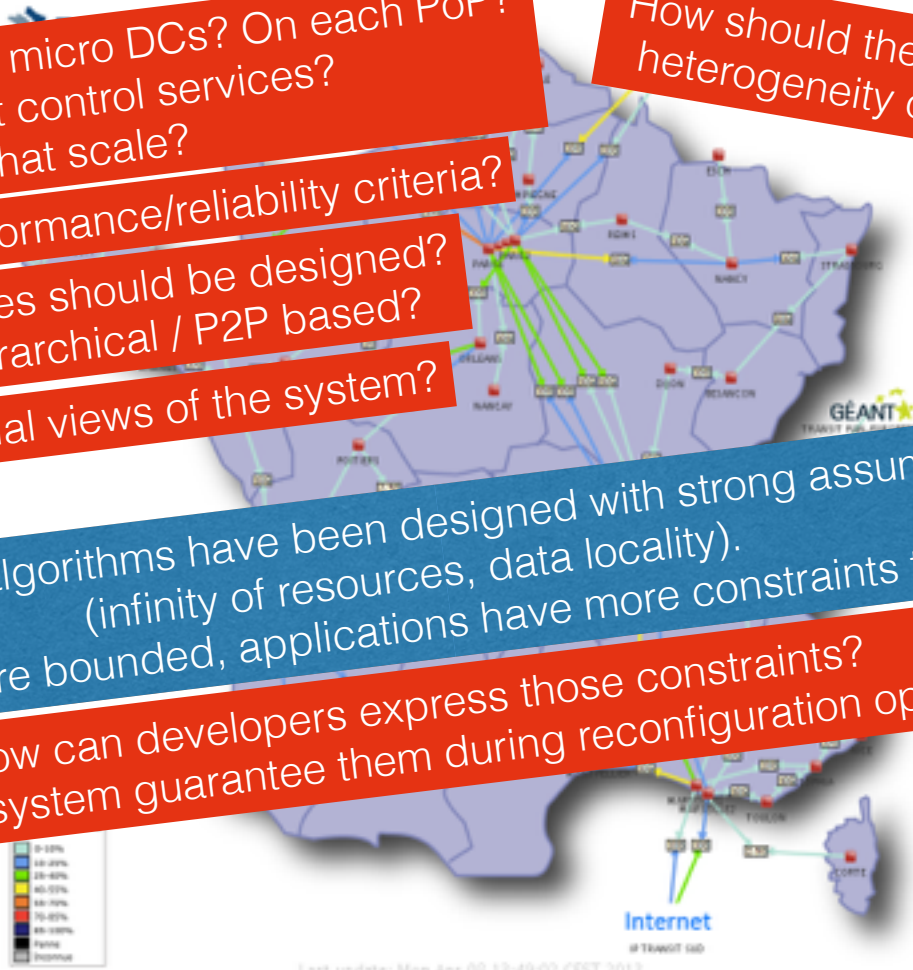
Where should I deploy micro DCs? On each PoP?
What’s about control services?
at what scale?

How should the system deal with the heterogeneity of the infrastructure?

What’s about the performance/reliability criteria?

How control services should be designed?
Centralised / Hierarchical / P2P based?

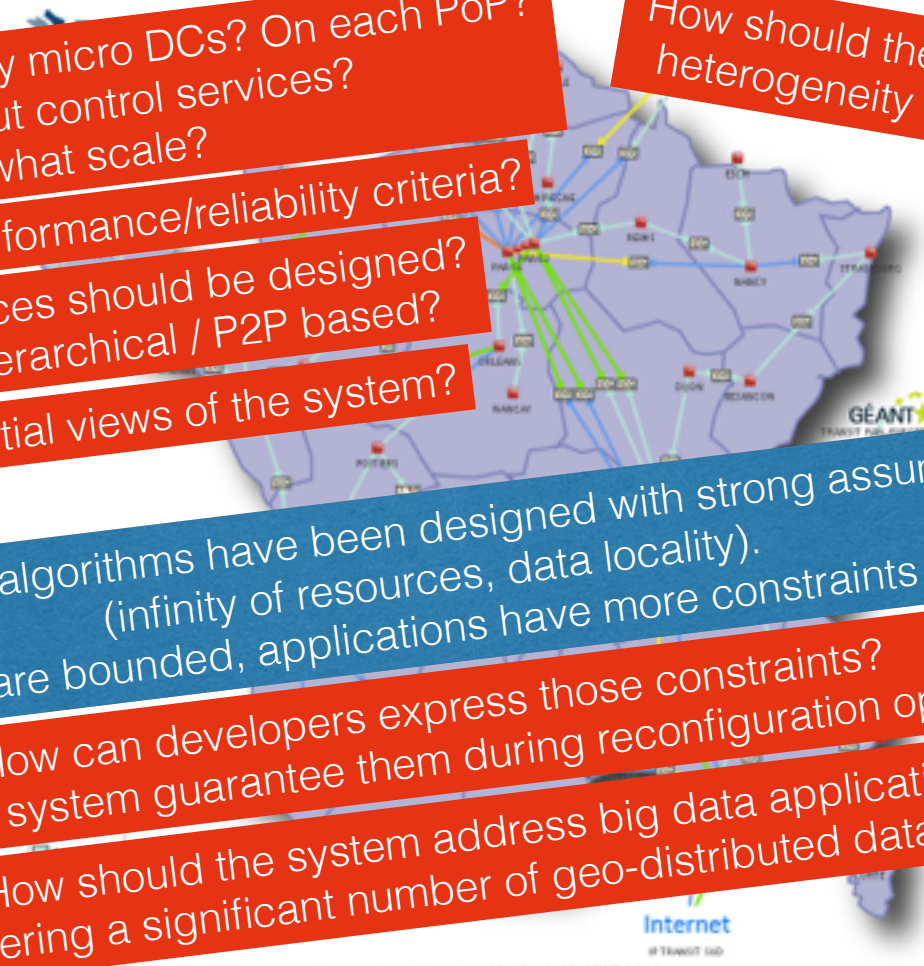
Global vs partial views of the system?



Placement algorithms have been designed with strong assumptions
(infinity of resources, data locality).
Here resources are bounded, applications have more constraints to deal with…

How can developers express those constraints?
How can the system guarantee them during reconfiguration operations?

“Just” a Dist. Resource Mgmt System ?



Where should I deploy micro DCs? On each PoP?
What’s about control services?
at what scale?

How should the system deal with the heterogeneity of the infrastructure?

What’s about the performance/reliability criteria?

How control services should be designed?
Centralised / Hierarchical / P2P based?

Global vs partial views of the system?

Placement algorithms have been designed with strong assumptions
(infinity of resources, data locality).
Here resources are bounded, applications have more constraints to deal with…

How can developers express those constraints?
How can the system guarantee them during reconfiguration operations?

How should the system address big data applications
(considering a significant number of geo-distributed data sources)?

“Just” a Dist. Resource Mgmt System ?

Where should I deploy micro DCs? On each PoP?
What’s about control services?
at what scale?

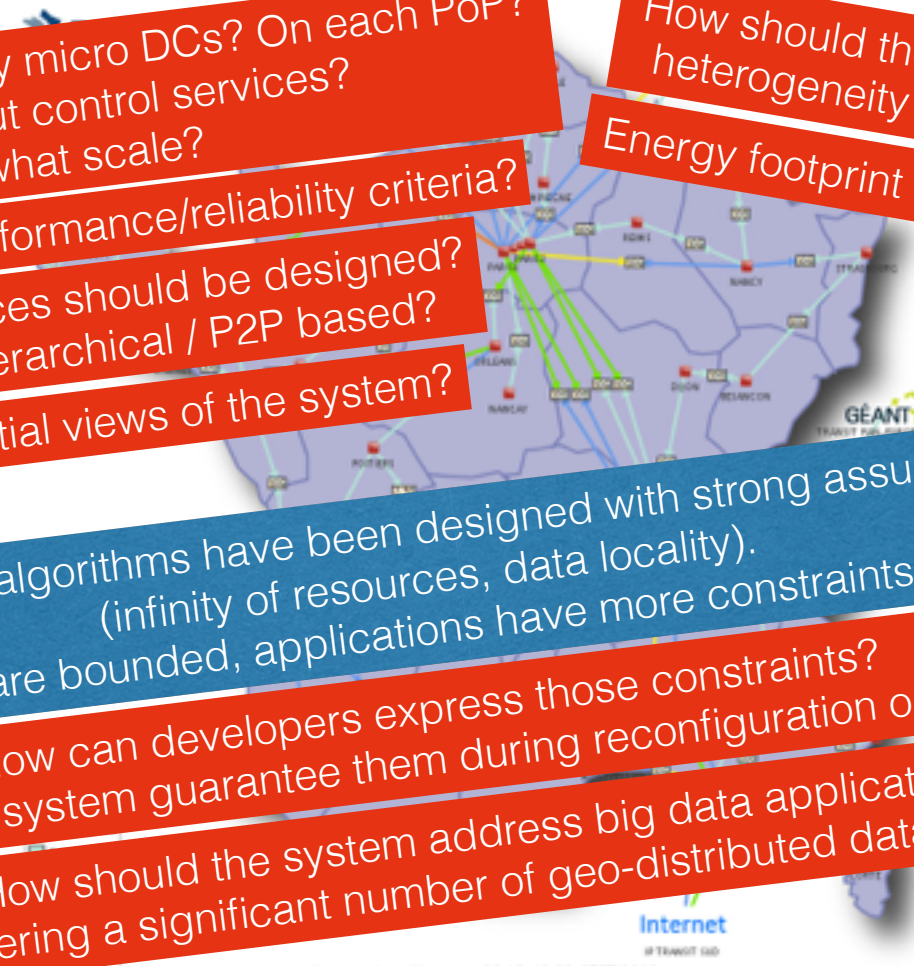
How should the system deal with the heterogeneity of the infrastructure?

Energy footprint of such infrastructures?

What’s about the performance/reliability criteria?

How control services should be designed?
Centralised / Hierarchical / P2P based?

Global vs partial views of the system?



Placement algorithms have been designed with strong assumptions
(infinity of resources, data locality).
Here resources are bounded, applications have more constraints to deal with…

How can developers express those constraints?
How can the system guarantee them during reconfiguration operations?

How should the system address big data applications
(considering a significant number of geo-distributed data sources)?

“Just” a Dist. Resource Mgmt System ?

Two kinds of activities

Investigate Fog/Edge Computing challenges in general

- Overlay and routing protocols
- Application life cycle management (deployment/reconfiguration)
- Energy footprint and opportunities (renewable energies)
- Security
- Placement
- Data Management

Study to what extent the current OpenStack mechanisms can handle Fog/Edge infrastructures and propose revisions/extensions when appropriate

- Understanding OpenStack internal mechanisms through automatised experiments
- From SQL to NoSQL and NewSQL backends
- AMQP Communication bus alternatives

Two kinds of activities

Investigate Fog/Edge Computing challenges in general

- Overlay and routing protocols G. Tatoo, (ASAP, MYRIADS)
- Application life cycle management (deployment/reconfiguration)
- Energy footprint and opportunities (renewable energies)
- Security
- Placement I. Fajjari (Orange/ASCOLA)
- Data Management J .Darrous (AVALON/KERDATA)

H. Coullon (AVALON/ASCOLA)
A-Orgerie (ASCOLA/MYRIADS)

Study to what extent the current OpenStack mechanisms can handle Fog/Edge infrastructures and propose revisions/extensions when appropriate

- Understanding OpenStack internal mechanisms through automatised experiments M .Simonin (ASCOLA/MYRIADS
- From SQL to NoSQL and NewSQL backends
- AMQP Communication bus alternatives

Knowledge base (July 2015)

Topic	ASAP	ASCOLA	AVALON	KERDATA	MYRIADS	OL	RENATER
Distributed Algorithms	++				+		
Resource Management System (OpenSack)		++	+		+		
Network						++	+
Data Management		+	+	++			
Application life cycle management			++				
Energy		+	+		++		
Security		+				++	
Use-cases						++	+

Network aspects

- We expected DIANA to join our consortium soon

Knowledge base (July 2017)

Topic	ASAP	ASCOLA	AVALON	CORSE	MADYNES	MYRIADS	OL	RENATER
Distributed Algorithms	++					+		
Resource Management System (OpenSack)		++	+			+		
Network					++		+	+
Data Management		++	+					
Application life cycle management		+	++	+				
Energy		+	+			++		
Security		+					++	
Use-cases							++	+

What has Changed

- H. Coullon joined ASCOLA in Oct 2016 (formerly postdoc in AVALON)
- S. Ibrahim joined ASCOLA and F. Desprez joined CORSE in 2017
- RENATER cannot allocated sufficient amount of resources (due to strategic changes)
- MADYNES joined the consortium in 2017 according to its participation in the I/O lab.

Organization (How Do We Work?)

Plenary meetings

- Twice a year, face-to-face, 2 consecutive days
- 1 day of presentations (update of ongoing activities) / 1 day of brainstorming sessions (what's next)
- Generally one guest speaker (BT, IRT B-Com, OpenStack core-devs)

Working Groups (mainly telcos)

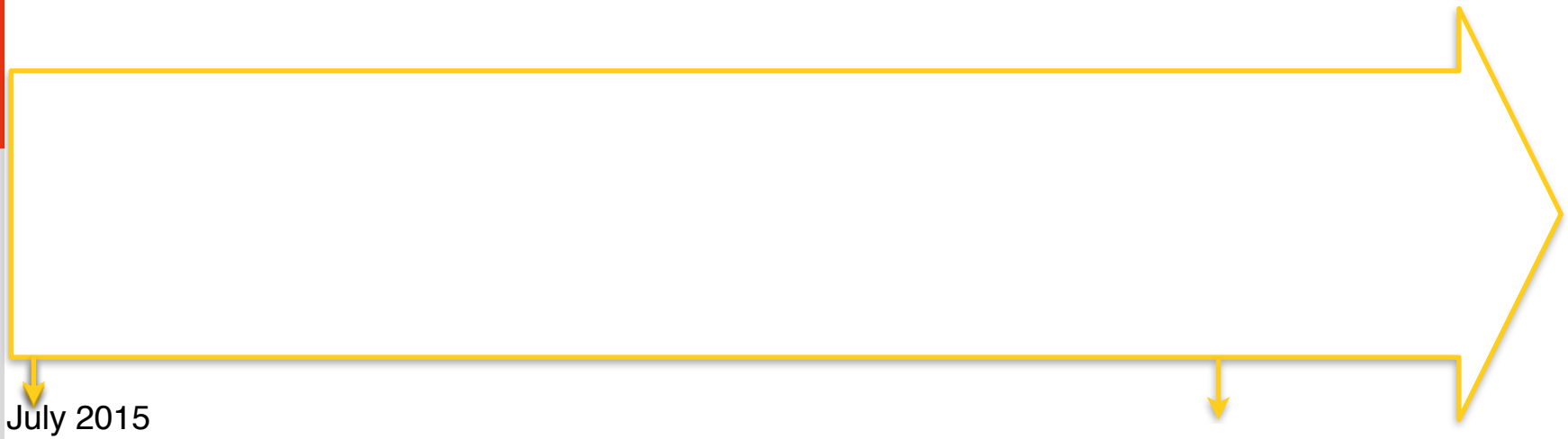
- Placement (ASCOLA/AVALON/MYRIADS/Orange)
  - How should developers express applications' requirements?
  - Placement algorithms (Constraint programming, heuristics…)
- Building blocks (ASCOLA/MYRIADS)
  - Routing protocols/Communication bus
  - database backends (Key/Value stores, NoSQL/NewSQL)
- Data Management (ASCOLA/AVALON/MADYNES)
  - Baremetal/VM/Container Image management
  - BigData challenges and Fog/Edge infrastructures

Organization (cont'd)

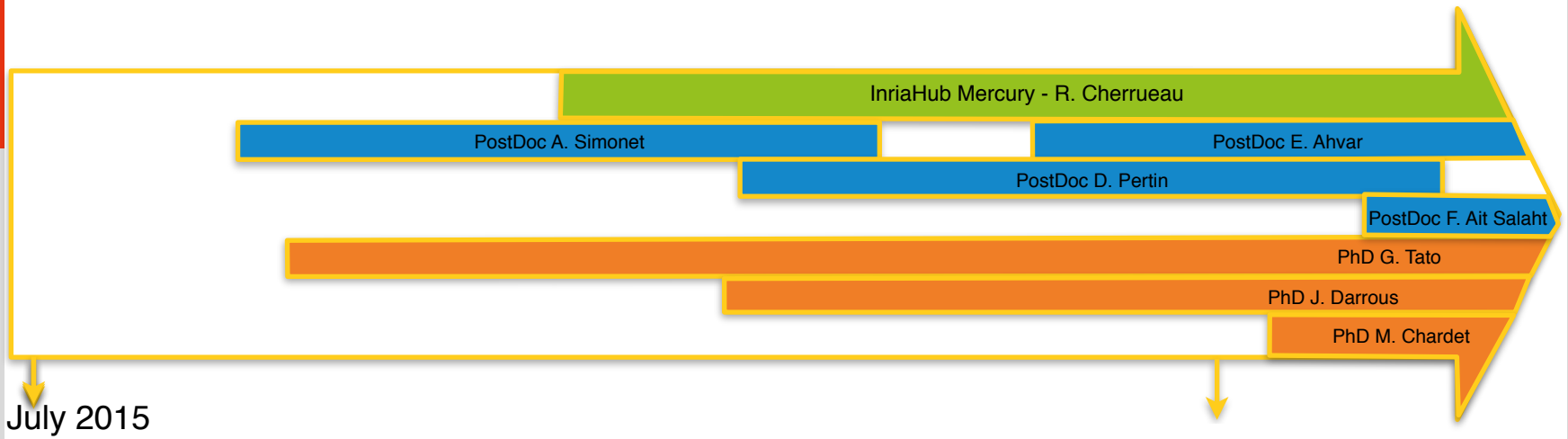
Fog/Edge/Massively Distributed Clouds WG

- OpenStack Working Group, founded and chaired by Inria
- IRC Meeting twice a month
- Active members: AT&T (USA), Redhat (USA), FBK (Italy), Ericsson (Sweden), B-Yond (USA)
- Face-to-face meeting twice a year during the summit
- On-going actions
  - Evaluations of OpenStack at WAN Scale (understanding network exchanges and DB access patterns (Inria/FBK)
  - AMQP alternatives (Inria/Redhat)
  - Use-cases definitions (a lot ! B-Yond, AT&T, Verizon…)
- Interesting but definitely quite time-consuming (a lot of meetings, working with such a large open-source community is definitely different than doing research activities).

Highlights 2015/2017



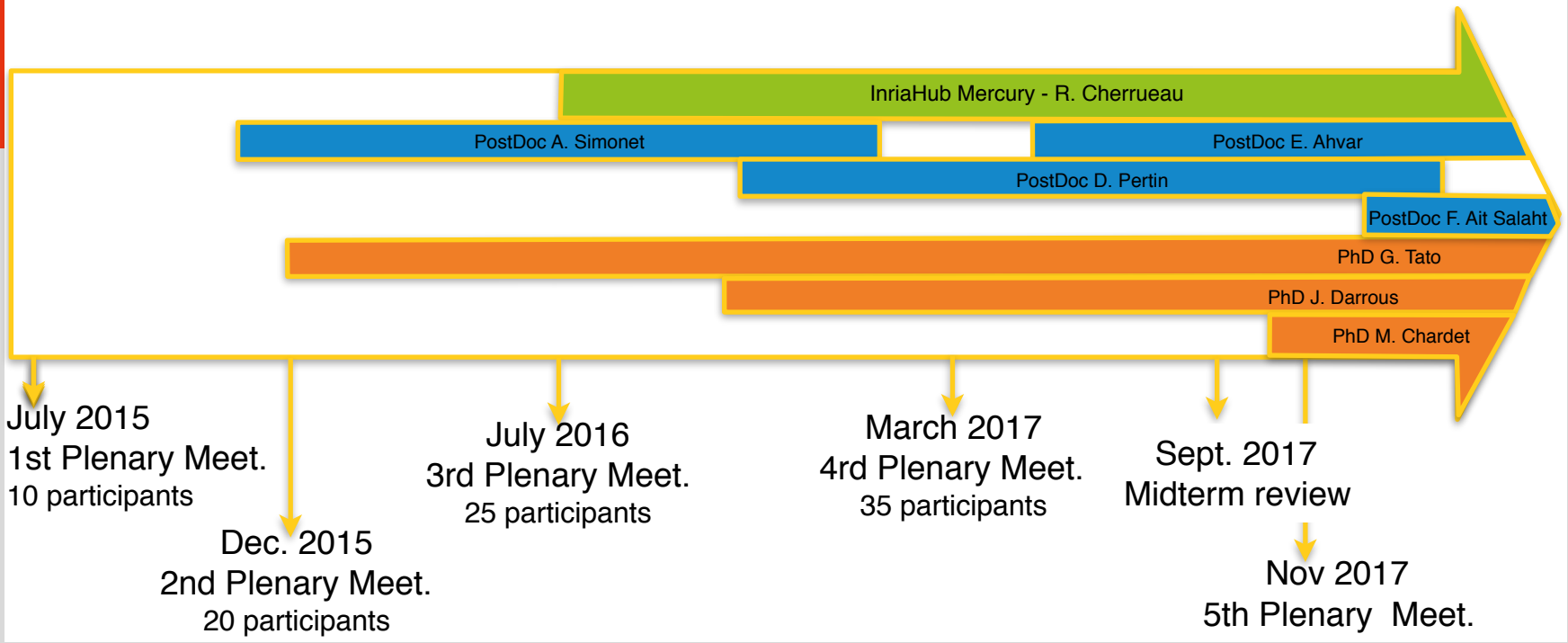
Highlights 2015/2017



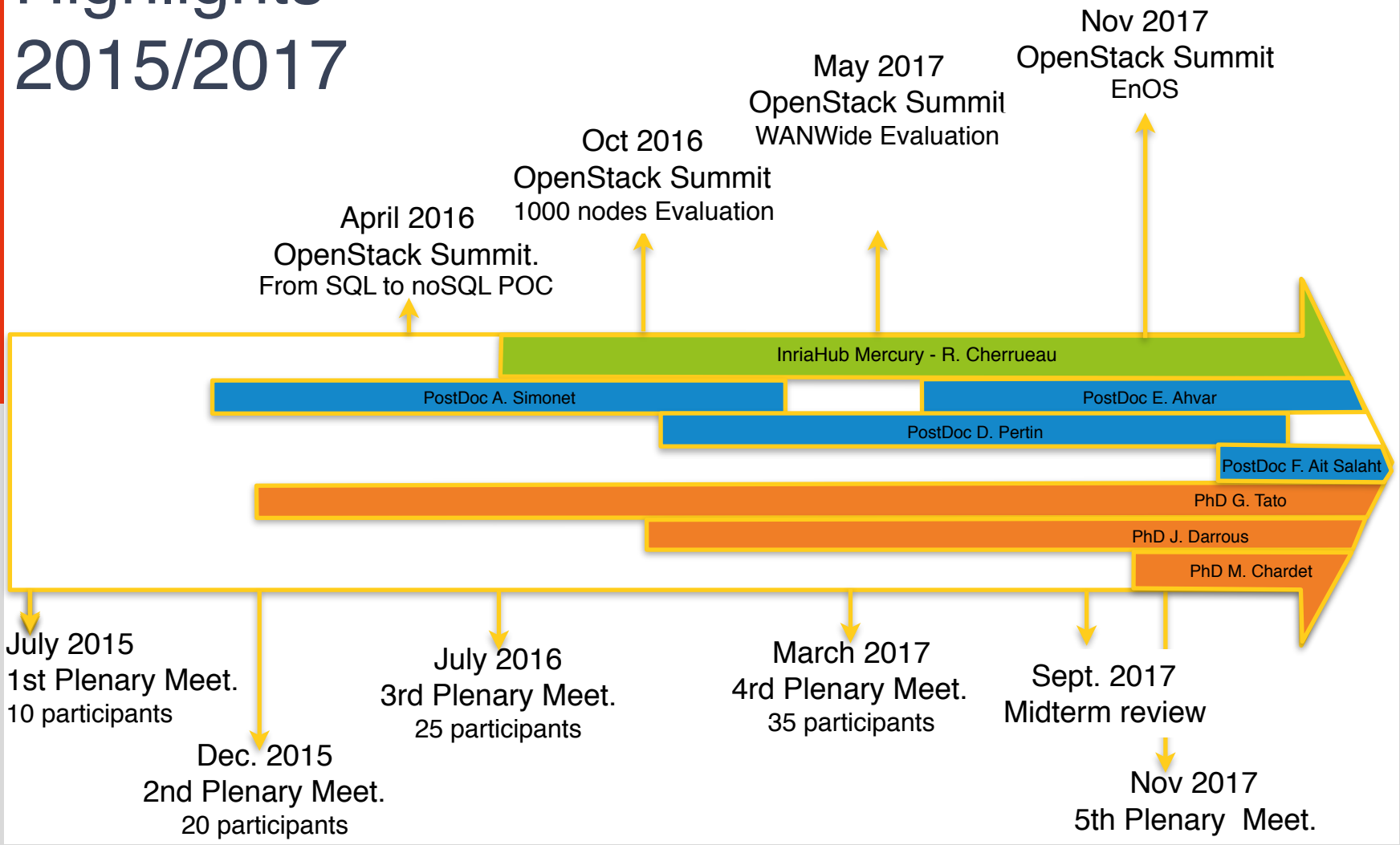
July 2015
1st Plenary Meet.
10 participants

Sept. 2017
Midterm review

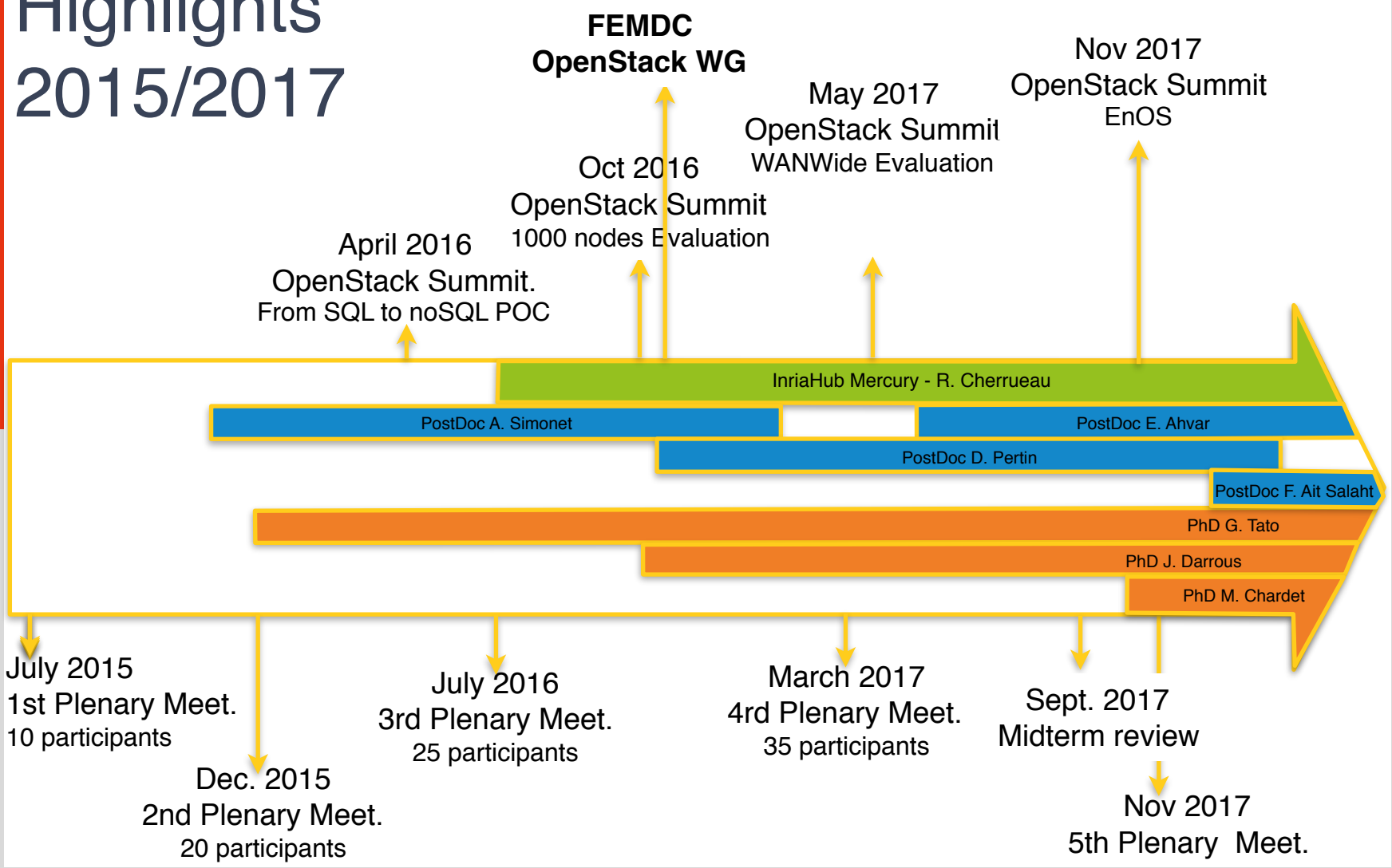
Highlights 2015/2017



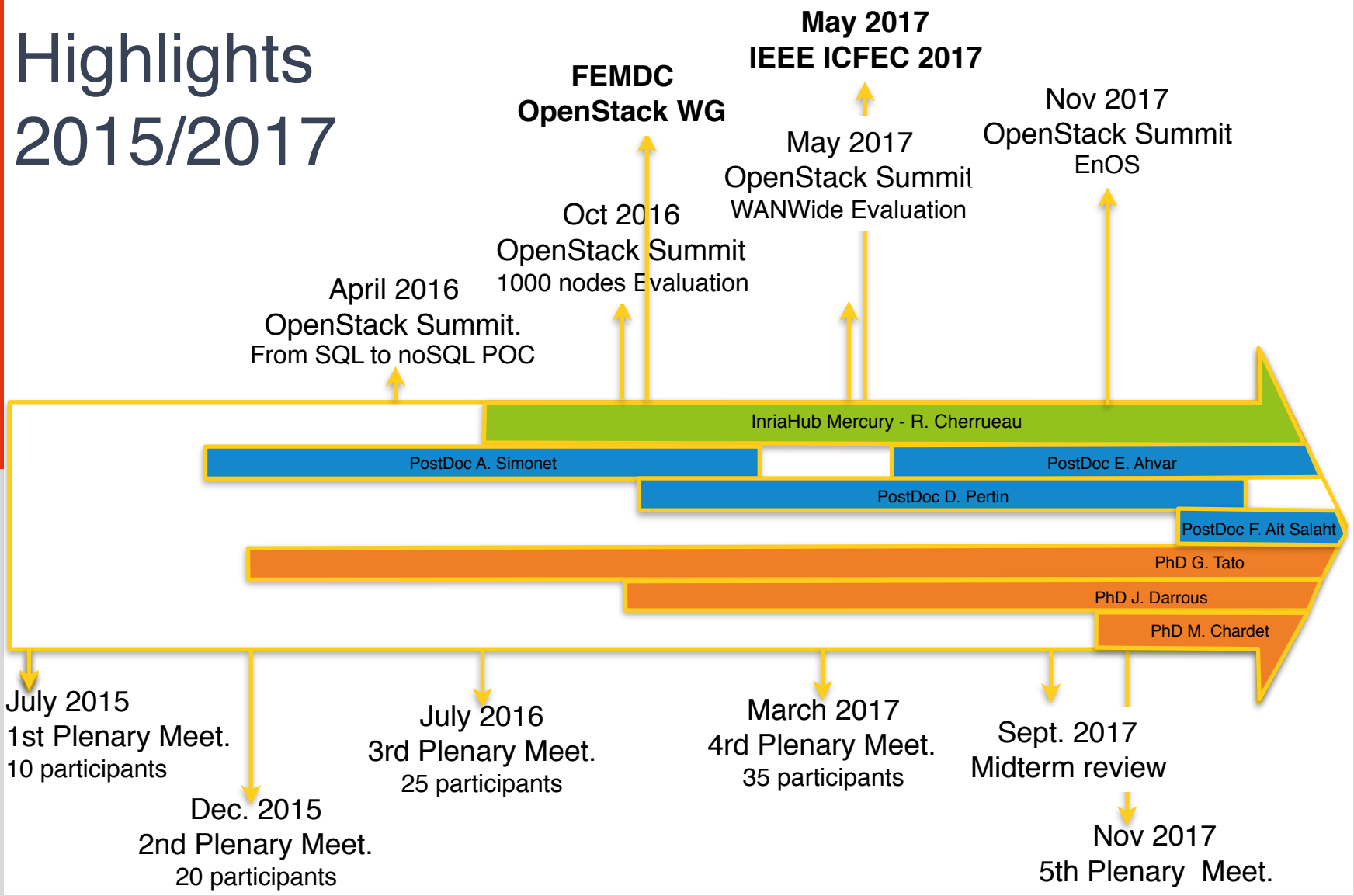
Highlights 2015/2017



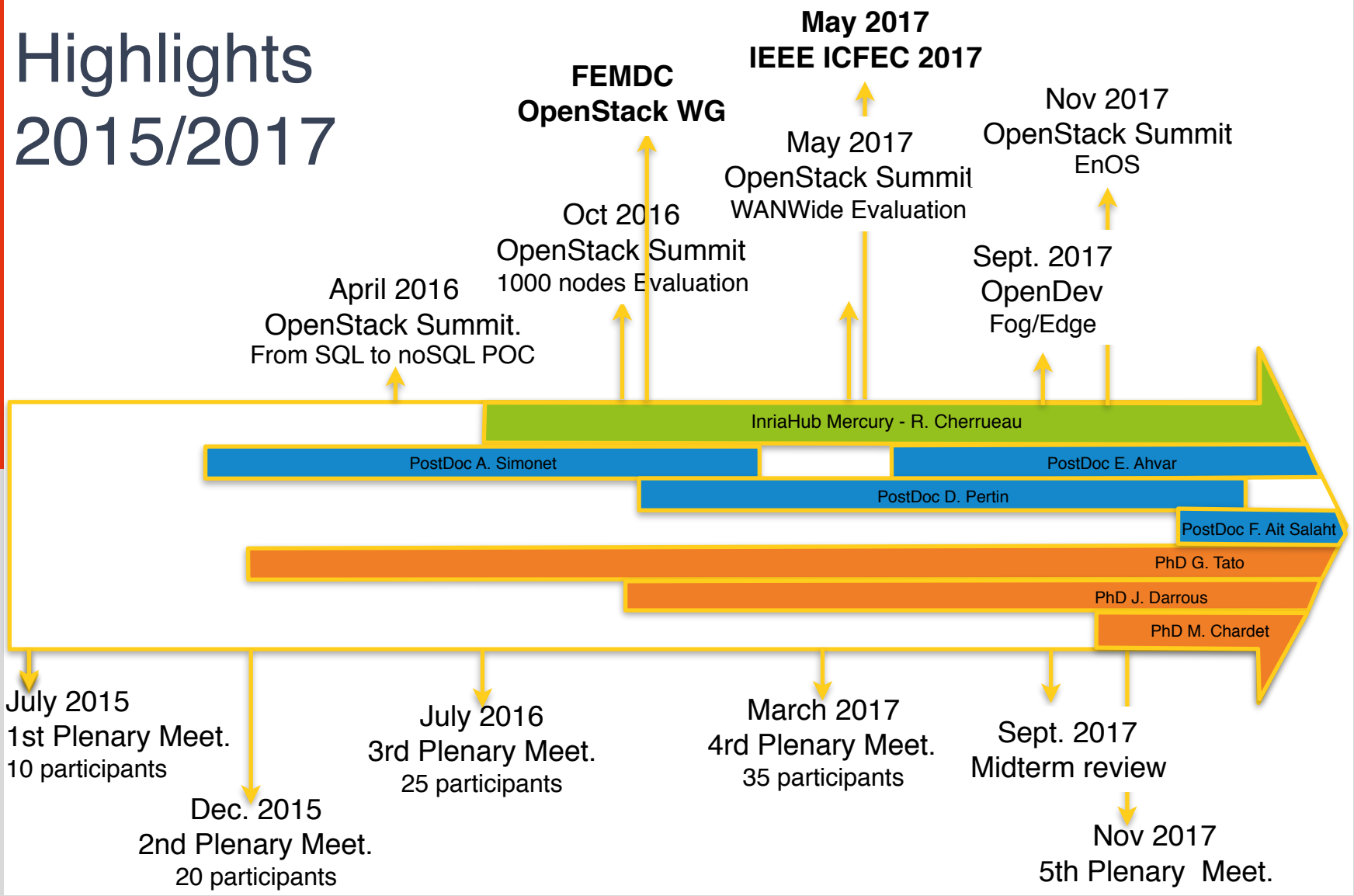
Highlights 2015/2017



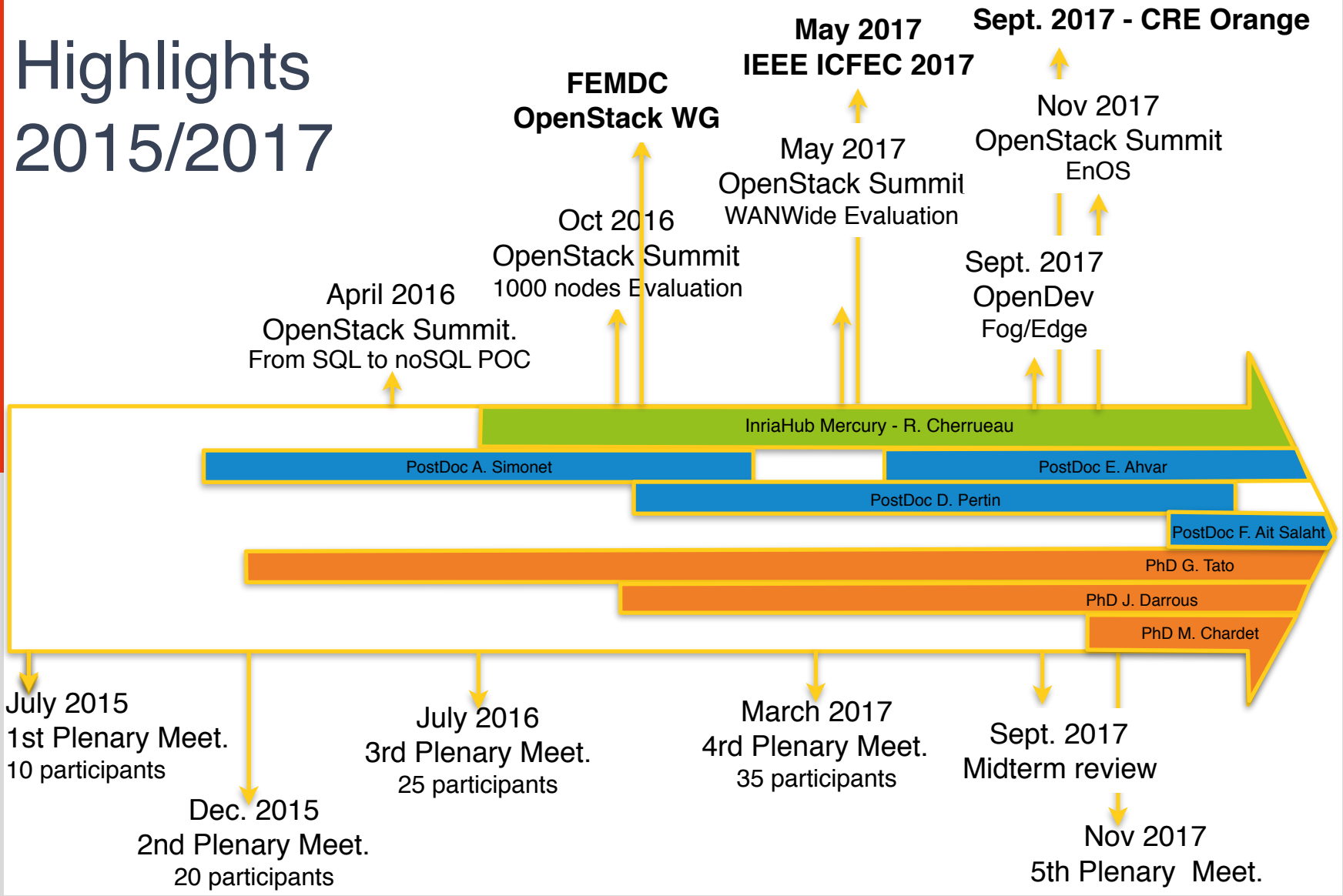
Highlights 2015/2017



Highlights 2015/2017



Highlights 2015/2017



Highlights 2015/2017

Scientific visibility

- IEEE ICFEC co-founder (co-located with ACM/IEEE CCGRID)
- Fog/Edge computing track-chairs in IEEE CloudCom 2016/2017
- Members of several PC committees of conferences dealing with Fog/Edge's challenges
- Several presentations in international workshops (Dagstuhl, 2 * CloudControl WS…)
- Publications: 7 conferences (1 short paper), 1 workshops, 1 poster (under review: 1 journal submission, 1 conference)

Projects / Valorisation

- Submission to the H2020 ICT-06-2016 call: EOLE: Blow the clouds to the edge (8 partners, Inria was the coordinator of this proposal)
- ANR GRECO (Qarnot Computing, LIG, Inria)
- Bilateral contrat with Orange (100K CRE, 4 Phd Grants)

02

Focus on Allocated Resources

Resources (Jan 2017)

Person	ASAP	ASCOLA	AVALON	KERDATA	MYRIADS
Phd G. Tatoo	0,5				0,5
Phd J. Darrous			0,5	0,5	
PostDoc A. Simonet		0,5			0,5
PostDoc D. Pertin		0,5	0,5		
Total	0,5	1	1	0,5	1
Permanent*	0,25	1	1,5	0,5	0,75

* 0,25 Ass. Prof
0,5 Researcher

Resources (Jan 2017)

Person	ASAP	ASCOLA	AVALON	KERDATA	MYRIADS
Phd G. Tatoo	0,5				0,5
Phd J. Darrous			0,5	0,5	
PostDoc A. Simonet		0,5			0,5
PostDoc D. Pertin		0,5	0,5		
Total	0,5	1	1	0,5	1
Permanent*	0,25	1	1,5	0,5	0,75
IR M. Simonin					0,5
IR R-A. Cherrueau		1			
Total	0,75	3	2,5	1	2,25

* 0,25 Ass. Prof
0,5 Researcher

Expected Resources (end of 2017)

Person	ASAP	ASCOLA	AVALON	CORSE	MADYNES	MYRIADS
Phd G. Tatoo	0,5					0,5
Phd J. Darrous		0,5	0,5			
Phd M. Charvet		0,5	0,5			
PostDoc E. Ahvar		0,5				0,5
PostDoc F. Ait Salaht		0,5		0,5		
Total	0,5	2	1	0,5	0	1
Permanent	0,25	1,25	0,5	0,5	0,25	0,75
IR M. Simonin						0,5
IR R-A. Cherrueau		1				
Total	0,75	4,25	1,5	1	0,25	2,25

Expected Resources (end of 2017)

Person	ASAP	ASCOLA	AVALON	CORSE	MADYNES	MYRIADS	OL
Phd G. Tatoo	0,5					0,5	
Phd J. Darrous		0,5	0,5				
Phd M. Charvet		0,5	0,5				
PostDoc E. Ahvar		0,5				0,5	
PostDoc F. Ait Salaht		0,5		0,5			
Total	0,5	2	1	0,5	0	1	
Permanent	0,5	1,25	0,5	0,5	0,25	0,75	
IR M. Simonin						0,5	
IR R-A. Cherrueau		1					
Total	1	4,25	2	1,5	0,25	2,25	
Orange PhDs		2*0,25+1*0,5		0,5	2*0,25		4*0,5
Orange Permanent							5
Orange CRE		0,5				0,5	
Total	1	5,75	2	2	0,75	2,75	7

Financial Resources (2017)

Budget 2017		**33.5k+5k**	**38.5k**
Committed (EPIBUD 22 Sep.)			24k
Committed but not visible	PC		1.5k
	Internships		4.5
Total			**30k**
Expected expenses	MidTerm review		.5k
	Plenary meeting		4k
	OS Summit Sydney		4k
	PC		2.5k
	Conference (TBC)		2.5k
Total			**43.5k**

03

What’s next?

Short/Mid Term Objectives

OpenStack-related

- Vancouver Summit (May 2018)
  - Cockroach DB validation
  - AMQP Alternatives

Research activities

- Energy model
- Placement challenges

Collaborative Projects

- Some discussions for ANR/FUI submissions (Thales, UPMC, Inria, IMT and SNCF)

Current State / Open discussions

A key actor in the OpenStack ecosystem

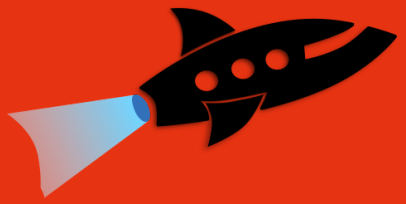
- We lead (or take part to) most discussions.
  Credibility/visibility to our action (bilateral contract, H2020 program…)
- But it takes times and efforts … Should we continue in this direction? Should we act as the leader of Fog/Edge Computing challenges within the OpenStack ecosystem?

Research activities

- Focus on research results (i.e. publications)
  - Focused research activities (competition w.r.t other teams) vs general vision of a resource management system.
  - An important gap between academic proposals and current issues faced by resource management systems of production infrastructures.

Collaborative Projects

- A H2020 submission in 2016 as coordinator…
  H2020 ICT-15-2019-2020: Should we keep the same consortium?
- ANR/FUI Industrial Internet (Digital Factory, e-health services…)



Thank you!

Follow us on http://beyondtheclouds.github.io

orange

Inria
inventors for the digital world

inventors for the digital world

Inria Project Lab Discovery
Ongoing activities
Sept 27. 2017

Adrien Lebre

Ongoing activities

Inria's PhDs

- Genc Tato (2015-2018, MYRIADS/ASAP, Fog/Edge overlays)
  - Integration in the communication bus
- Jad Darrous (2016-2019, AVALON/ASCOLA, VM Image management)
  - A new storage backend
- Maverick Chardet (2017-2020, ASCOLA/AVALON, reconfiguration/application life cycle)
  - OpenStack as a use-case

Inria's PostDocs

- Ehsan Ahvar (2017-2018, MYRIADS/ASCOLA, Energy)
  - Scaling of Fog/Edge infrastructures, Indicators for placement policies
- Fara Ait Salaht (2017-2018, CORSE/ASCOLA , Placement)
  - Scaling of control plane services

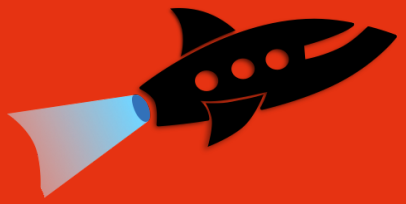
Ongoing activities (cont'd)

Orange's PhDs

- Mohamed Abderrahim (ASCOLA/MADYNES, Monitoring)
  - Revising Monasca distribution (efficient placement of Monasca building blocks)
- Ye Xia (2016-2019, CORSE, placement)
  - Placement of Fog/Edge applications, taking into account network flows
- Mohammad-Mahdi BAZM (2016-2019, ASCOLA, security)
  - Threat and opportunities of Fog/Edge infrastructures + Side attack channels
- David Espinel (2017-2020, ASCOLA/MADYNES, Network)
  - Software Defined Networks for Fog/Edge infrastructures

OpenStack focused

- Cockroach DB: From SQL to noSQL to newSQL (Inria,Cockroach Labs)
- AMQP Alternatives: network footprint, network partitioning (Inria, Orange, Redhat)
- Cells V2: segregation of control plane services (discussion with the OpenStack foundation to find external support)



Thank you!

Follow us on http://beyondtheclouds.github.io

orange

Inria
inventors for the digital world