



Research activities related to Cloud computing

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Why Cloud at HOST?



- Which are the most communalities of Clouds with Clusters, HPC, and Grids?
 - E-infrastructure services
 - Trends towards on-demand
 - Which is the novelty?
 - Shorter time to access in Clouds
 - Lower the accessibility level
 - E-Infrastructure is „programmable“ and „elastic“
- => HOST intends to build a HPC [as a] Service



Back in the future...



- Starting points:
 - Early involvement in developing middleware and applications for Cluster, Grid and HPC computing
 - Recent deep involvement in the hot topics of building “Clouds of Clouds”
[Re: “Clusters of Clusters” = Grids]



ICT R&D in the last 10 years at UVT & IeAT



Level	Programme	Subprogramme	Periods	RO-Associate State to EC Progs.										RO-Full member of EC Progs.		Topics					
				2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012		Forecast				
EC	FP7	Cooperation	ICT	VISP										AVANTSSAR DEHEMS		Web services Secure services ICT for Energy Software services Cloud computing (PaaS) Secure services Cloud computing					
														SPRERS mOSAIC SPaCoS							
		Capacities	Res. Infra Res. e-Infra	SCIENCE										EGEE-2 SEE-Grid-II EGEE-3 SEE-Grid-Sci		Grid for maths Grid supply Grid tools Grid supply Grid tools & appls Grid supply HPC tools & appls HPC & Cloud					
				Reg.potential										EGI-Inspire HP-SEE							
		Peoples	ERG IRG	SysteMaThEx										PhaseTrans		Formal verification Algs & physics					
				Structural funds (SF)										InfraGrid ICAM							
		Research Infra	e-Infra Instutional supp											GISHEO		Cluster/Grid/laaS(Cloud) HPC for computational problems Grid for Earth Observation					
		ESA	PECS											Formal Verific							
		INTAS	ICT											Complex HPC Agreement techs		Formal verification Cloud for e-Citizens HPC/Cloud/Grid/Cluster Artificial Intelligence					
		CIP	ICT											SEED							
COST	ICT																				
Bilateral	RO-Austria	Austrian Progs.	IeAT start-up										AEMTIA		Distributed comp & AI & Soft.Eng. Formal verification & AI Computational problems Formal verification Computational Mathematics						
	RO-Swiss RO-Ukraine	RO-Austrian Prj. Swiss Progs. RO-Ukraine Prj.	NOREX										SciCom								
	NATO		Event										CobUrDIS		Formal verification						
	Industry	IBM A/D/F companies	Know-how transfer										OCR Know-how tr.		HPC						
																Software engineering					
National	CEEX/PNII	Cooperation	MedioGrid GridMOSI NanoSim FORMOL										SIPADOC PEGAF NatComp		Grids for Earth Observation Grid for computational problems Simulations for material sciences Simulators for bio computers Parallel comp, CFD, optimization Grids for librarians Grids for document management Grid for computational problems Natural Computing Web services & AI Sensor networks & AI EC Info Days, visibility Grid & AI Grid for computational problems Artificial Intelligence Optimization Automation in Cloud computing Cluster for computational files HPC & Grid Simulators for bio computers						
			SIAPOM SINRED										SCIPA ASISTSYS								
			Capacities										ProWest								
			People										GRAI								
			Ideas										CompGrid MindSoft								
			Others										C-OPTIM AMICAS								
			InfoSoc										DistEnv HPC&Grid								
			Academy										P-Systems								
			IT Park										IT Cluster								
			Companies																		
Regional	IT Park Companies	IT Cluster Multinational Local	Acatel, Siemens Eta-2U, Lasting												Knowledge transfer Knowledge transfer & trainings Infrastructure						
Colors legend:				Stages										Pre-EC/Pre-CEEX		CEEX/Pre-SF		SF/Lead EC prj			
UVT				IeAT										Subcontract		e-Infras		Cluster & Grid		& Cloud & HPC	



Btw...



- 2 positions free for PostDocs in the frame of HOST:
 - Cloud & HPC
 - Image processing & HPC
- Next workshops /UVT/September 2012:
 - HOST: <http://host.hpc.uvt.ro/wohs/>
 - AMICAS: <http://amicas.hpc.uvt.ro/first-workshop-in-september-2012/>

mOSAIC consortium



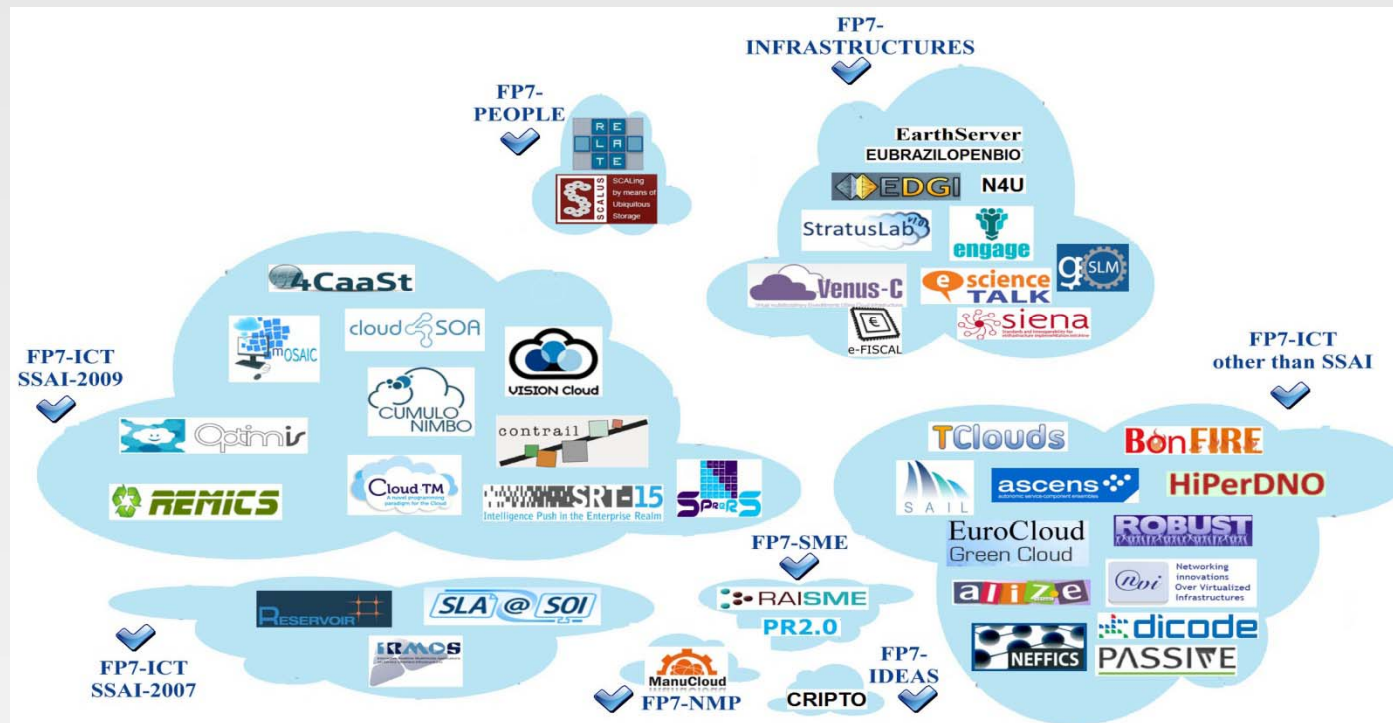
- Second University of Naples, Italy
- European Space Agency, France
- Terradue SRL, Italy
- Tecnalia, Spain
- Institute e-Austria Timisoara, Romania
- AITIA International Informatics, Hungary
- Xlab, Slovenia
- University of Ljubljana, Slovenia
- Brno University of Technology, Czech Republic



www.mosaic-cloud.eu



FP7 context before 2012

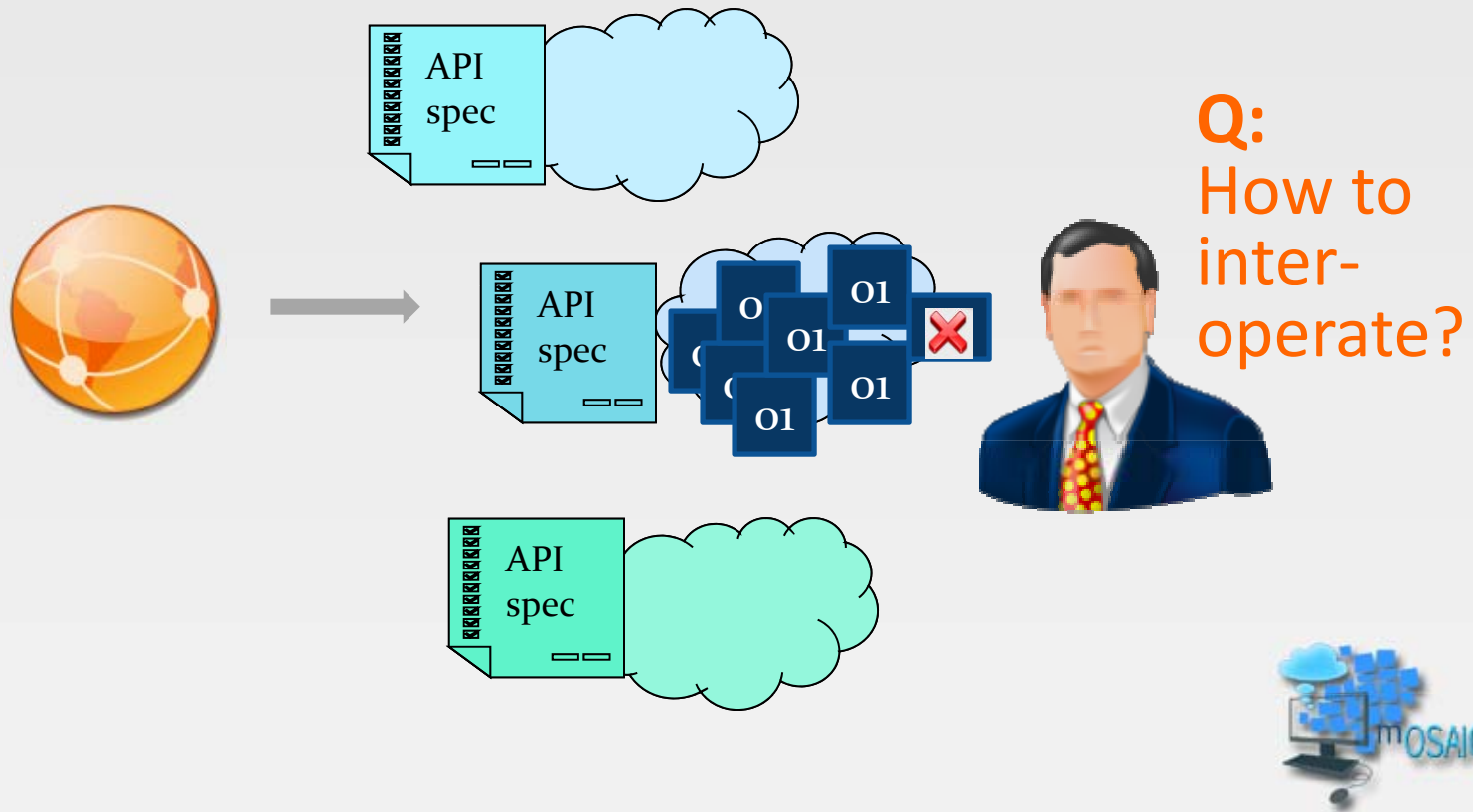


Content

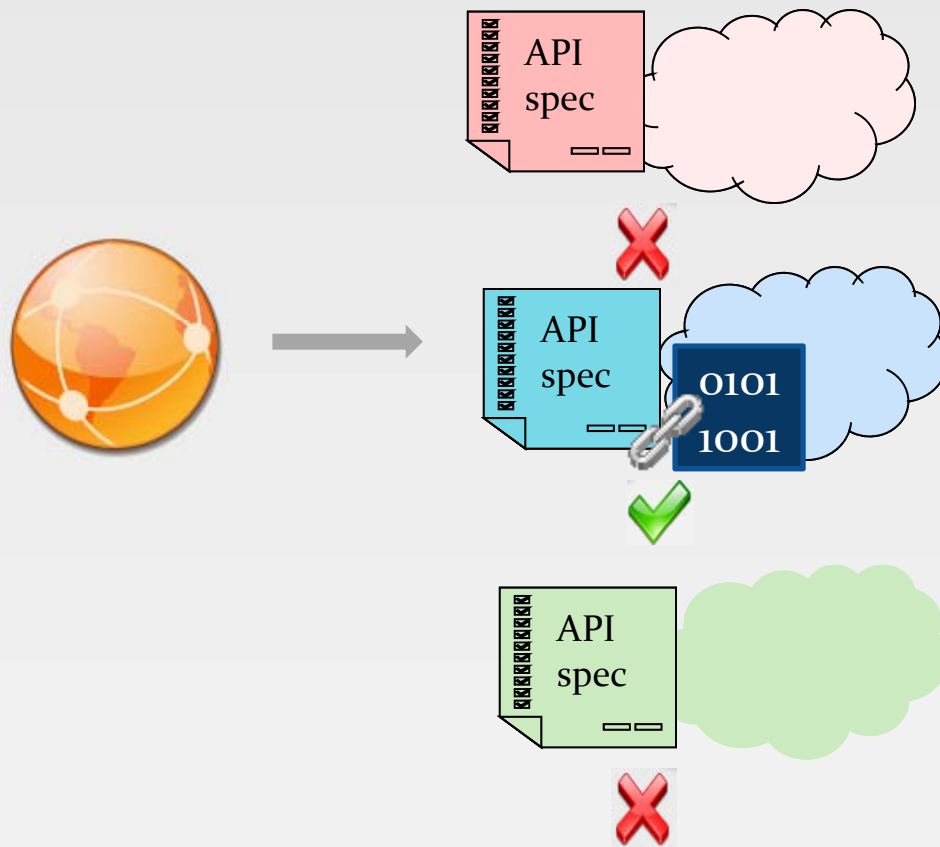
- Problem definition
- General approach



Interoperability in Clouds?



Portability in Clouds?



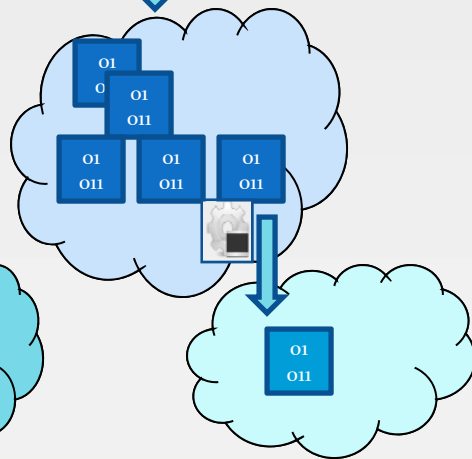
Q:
How to
port the
appl?



Scenarios for multiple Clouds

Federation
of Clouds:

Horizontal
or
InterClouds



**Main
issue:**

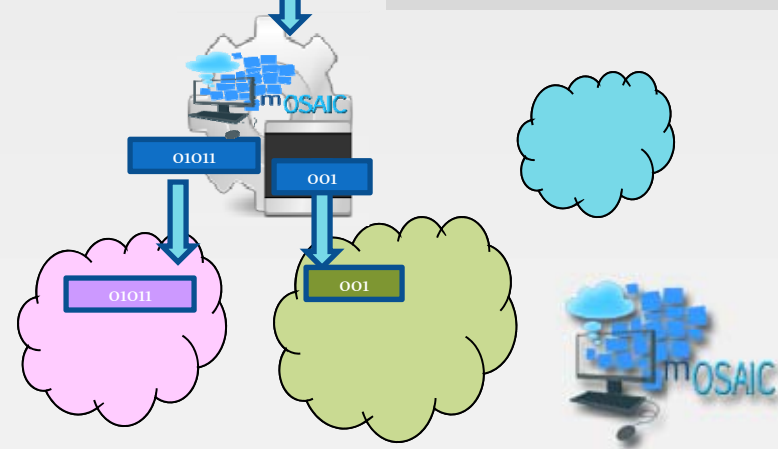
**Inter-
operability**

**Main
issue:**

Portability

On-the-fly
Multiple Clouds:

Cross-Cloud
or
Sky computing



Current approaches

1. **Open APIs**
2. Open protocols
3. Standards
4. **Abstraction layers**
5. Semantic repositories
6. Domain specific languages

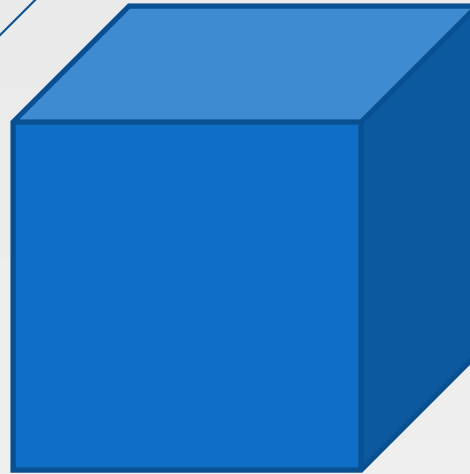


Interoperability/Clouds-dimensions

POLICY:

Federate, communicate
between providers

RUNTIME:
Migration support

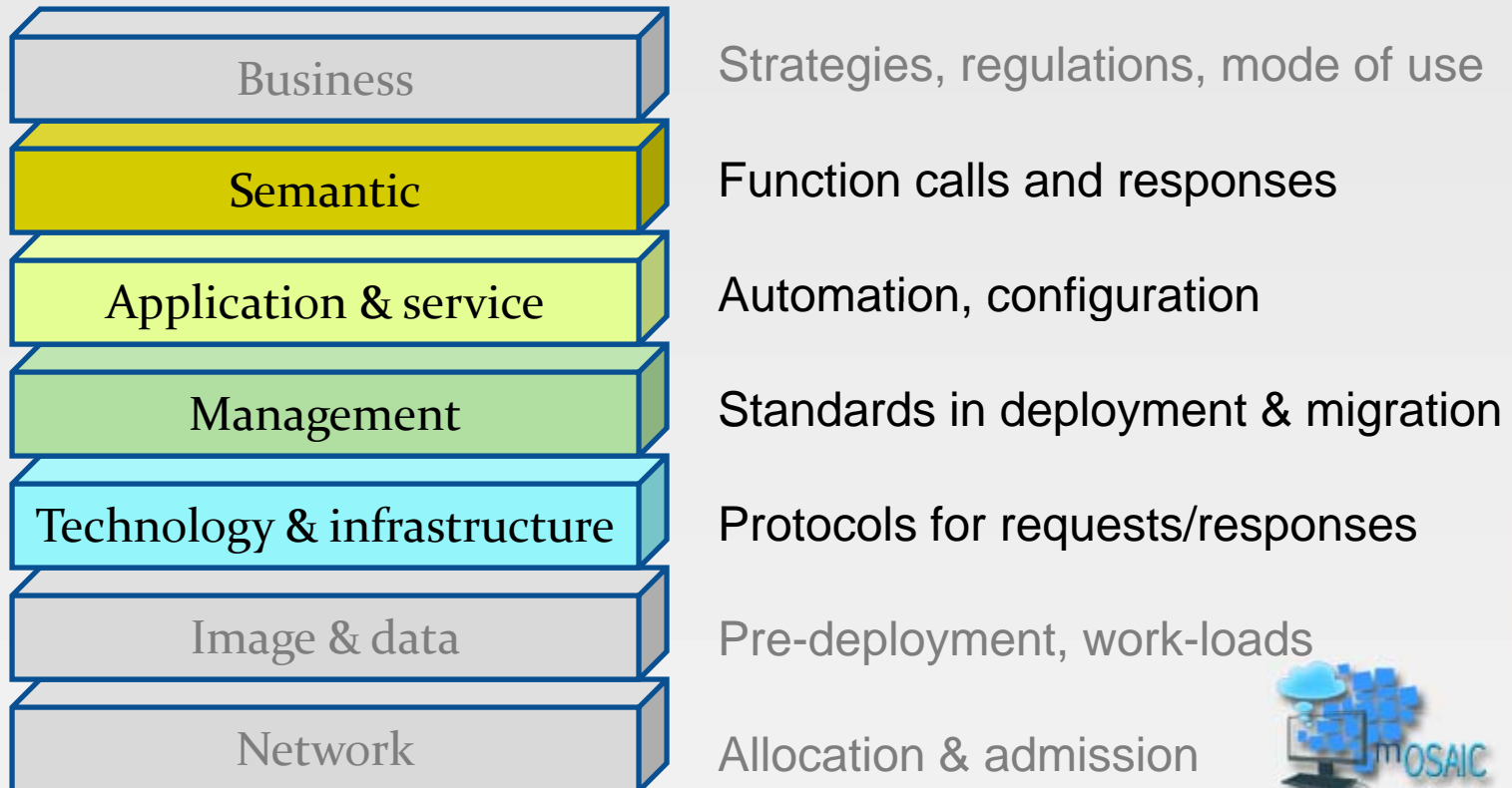


DESIGN:

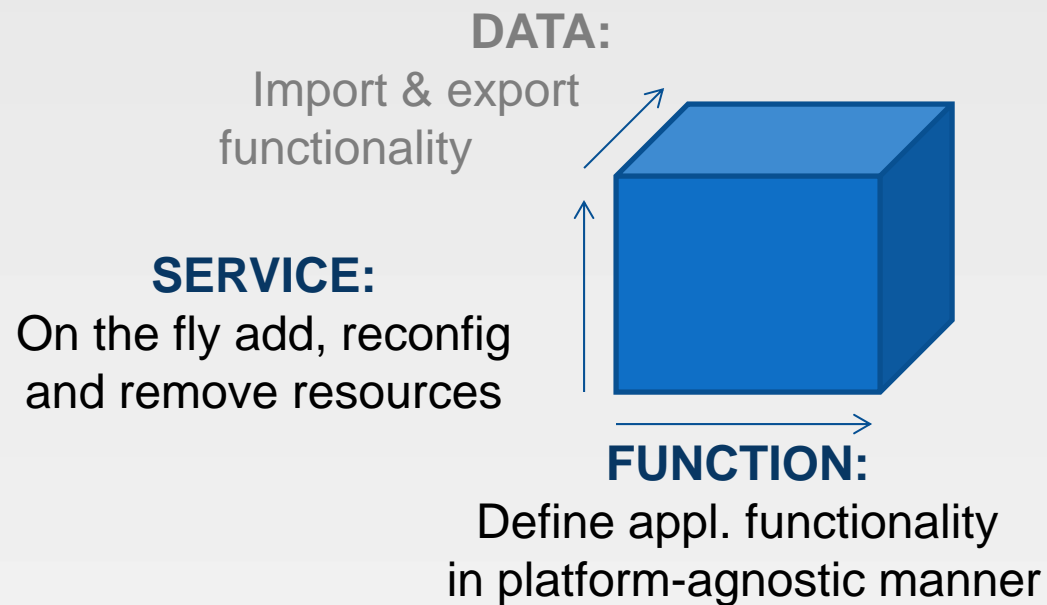
Abstract the programmatic differences



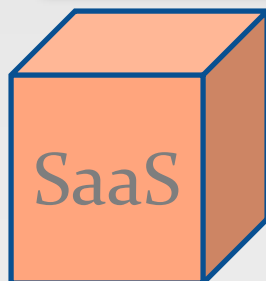
Interoperability/Clouds-targets



Portability between Clouds

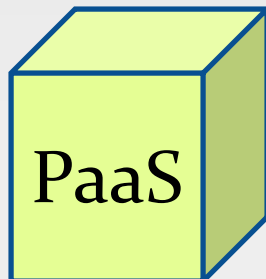


Portability at XaaS level



Preserve/enhance functionality when substitute softw
Measures:

- open source; proprietary/open formats;
- integration techs; appl server/OS



Minim.appl.rewriting while preserve/ enhance control
Measures:

- proprietary vs. open APIs, progr.languages, data formats
- tight vs. loose coupled services
- abstract layers for queuing & messaging



Appls and data migrate and run at a new provider
Measures:

- ability to port VMs and data
- underlying configurations across providers



Requirements

Market

Economic models, cost-effectiveness, license flexibility, negotiated SLAs, leasing mechanisms

Application

Data portability and exchange, scale-out, location-free, workflow management

Programming

Minimal reimplementaion when move, standard APIs, same tools for cloud-based & entreprised-based apps

Monitoring

SLA and performance monitoring, QoS aware services, service audit, sets of benchmarks

Deployment

Deploy in multiple clouds with single management tool, navigation between services, automated provisioning, resource discovery and reservation, behavior prediction

AA & Security

Single sign-on, digital identities, security Standards, trust mechanisms, authentication

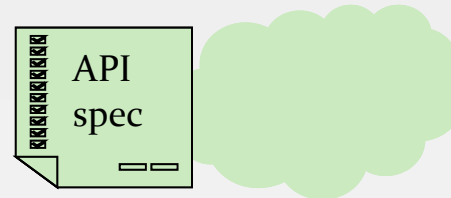
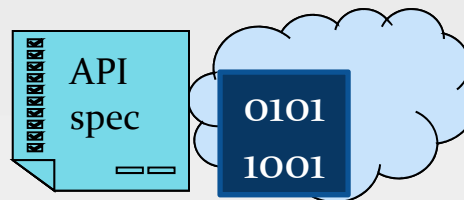
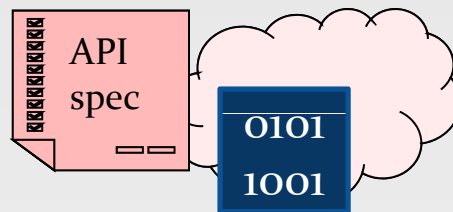


mOSAIC approach

**Open-source
API and Platform
for multiple Clouds**



Motto: Fly through the Clouds



mOSAIC promises

- September 2011: 1st implementation of API**
- September 2012: Platform available**
- March 2013: Full software package**

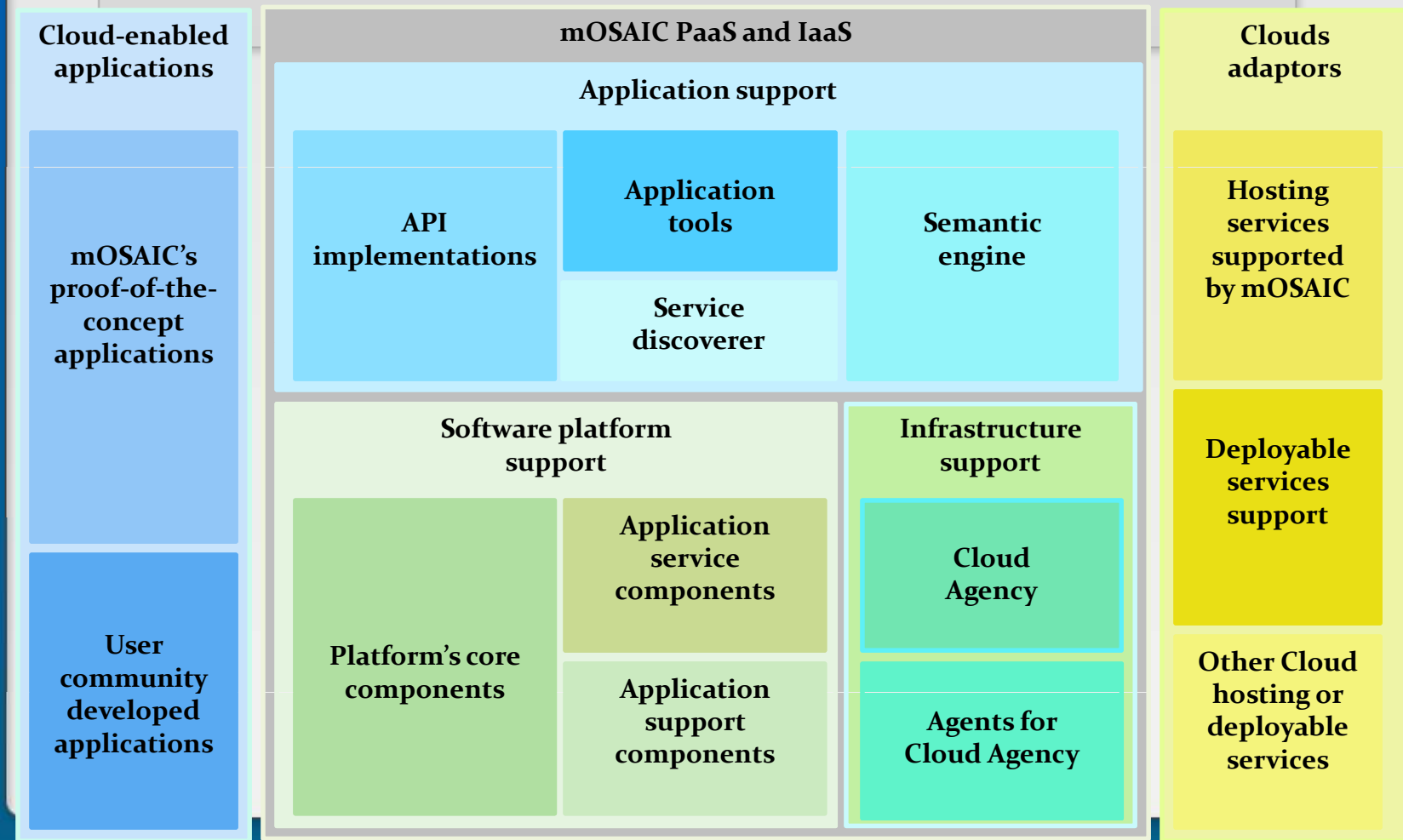


Promises kept?

- All links: <http://www.mosaic-cloud.eu>
 - Code: <http://bitbucket.org/mosaic>
 - Video: <http://youtu.be/ctO9fqadMBc>
 - Documentation for PaaS:
<http://developers.mosaic-cloud.eu>
 - Example of sci. paper:
<http://dx.doi.org/10.1016/j.future.2012.01.009>



Architecture (Copyright 2012: mOSAIC Consortium)



Other similar initiatives

- VMWare CloudFoundry
- Redhat OpenShift
- ...



What's next? / IeAT

- [EC-FP7 HOST] Customization for HPC as a Service
- Techs to sustain the on-the-fly usage of multiple Clouds
 - [RO-PNII AMICAS]
Automated management of resources in Cloud and Sky
 - Scheduling
 - Auto-scaling
 - ...
 - [EC-FP7 xxxx]
Model-driven architectures for multiple Clouds
- [EC-CIP SEED] Applications on top of the PaaS

