Advanced HPC systems

How is built a mOSAIC of Clouds

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HPC @ UVT/IeAT

- IBM Blue Gene/P with 1024 cores, 13 TFlops
- Parallel computing since '94, in:
  - Diff. Eqs & CFD
  - Non-linear eqs.
  - Evolutionary computing
  - Image processing
  - Expert systems
  - ...

Grid @ UVT/IeAT

- Cluster 400 cores, 13 TFlops connected to EGEE/EGI, SEE-Grid/HP-SEE
- Grid computing since '02
- Grid services for:
  - Earth observation: ESA – GiSHEO, EGEE- ESIP
  - Symbolic computing: SymGrid
  - Multi-objective optimization: DEMO-G
- Web/Grid/Cloud service management
  - Scheduling: OSyRiS
  - Workflow: SiLK
  - Composition: VISP

UVT/IeAT @ FP6/FP7

- HPC
  - HP-SEE: SEE PRACE
  - ComplexHPC (COST)
  - HOST: HPC in Cloud (starts in Jan '12)
- Grid
  - EGEE-II/-III/EGI
  - SEE-Grid-2/-SCI
  - SCIEnce (SymGrid)
  - RoGrid
- Software services
  - SPRERS – workshops

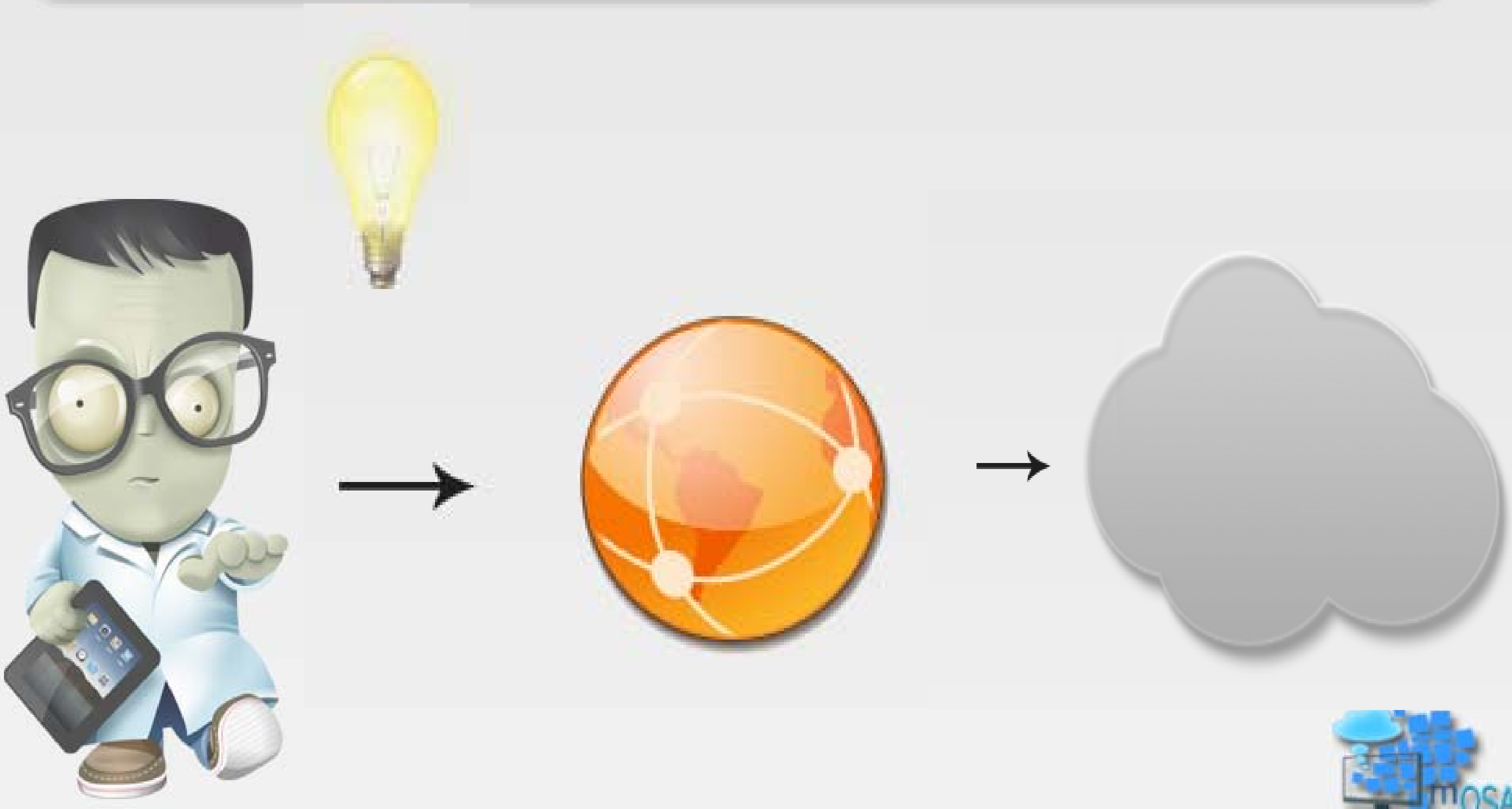
  e.g.Cloud (prj) 2nd WoSS
  - AVANTSSAR – security
  - VISP – composition
- Cloud
  - mOSAIC

mOSAIC motivation

Application Developer

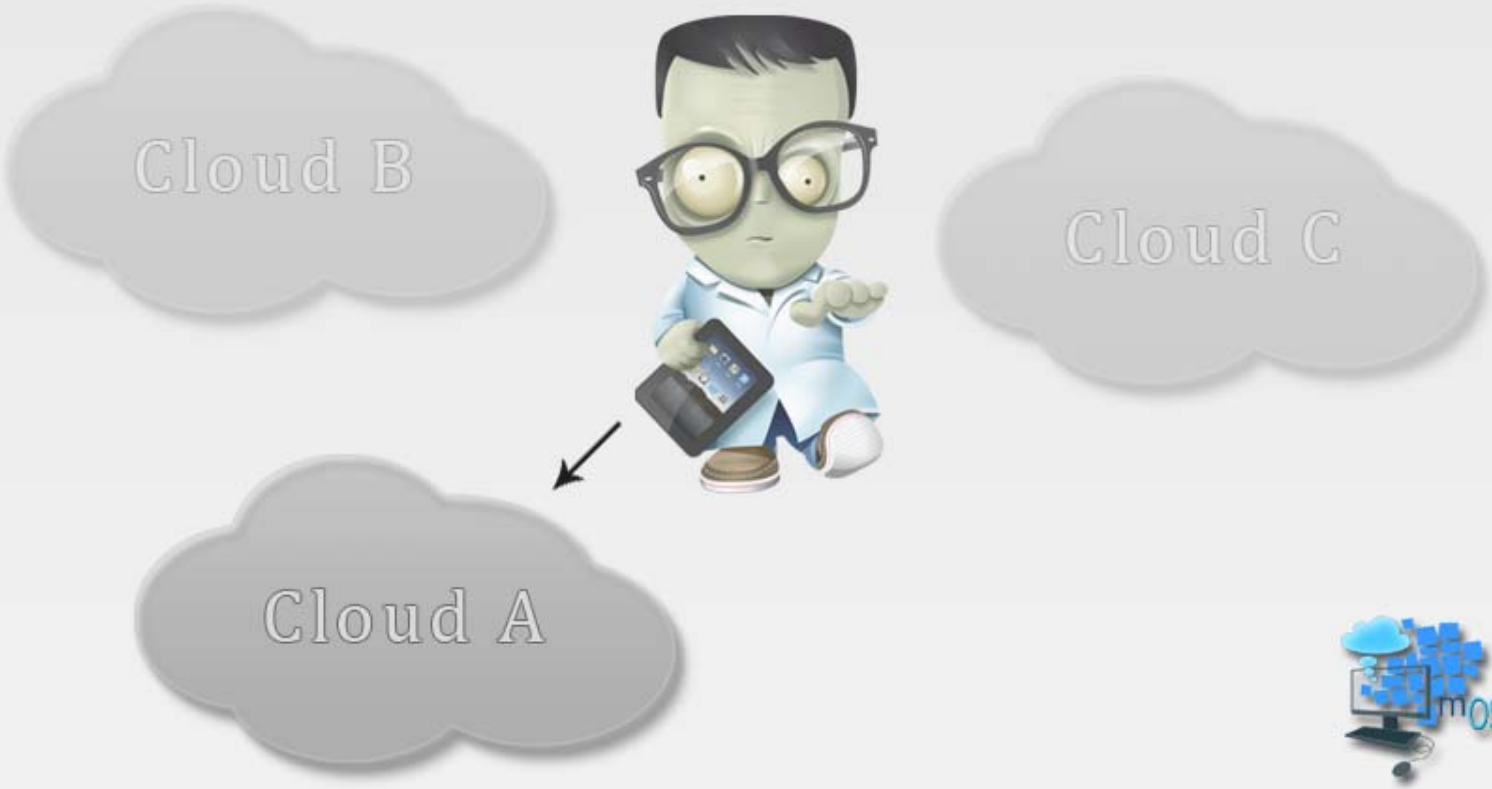
Go to the Cloud

Want to develop an application

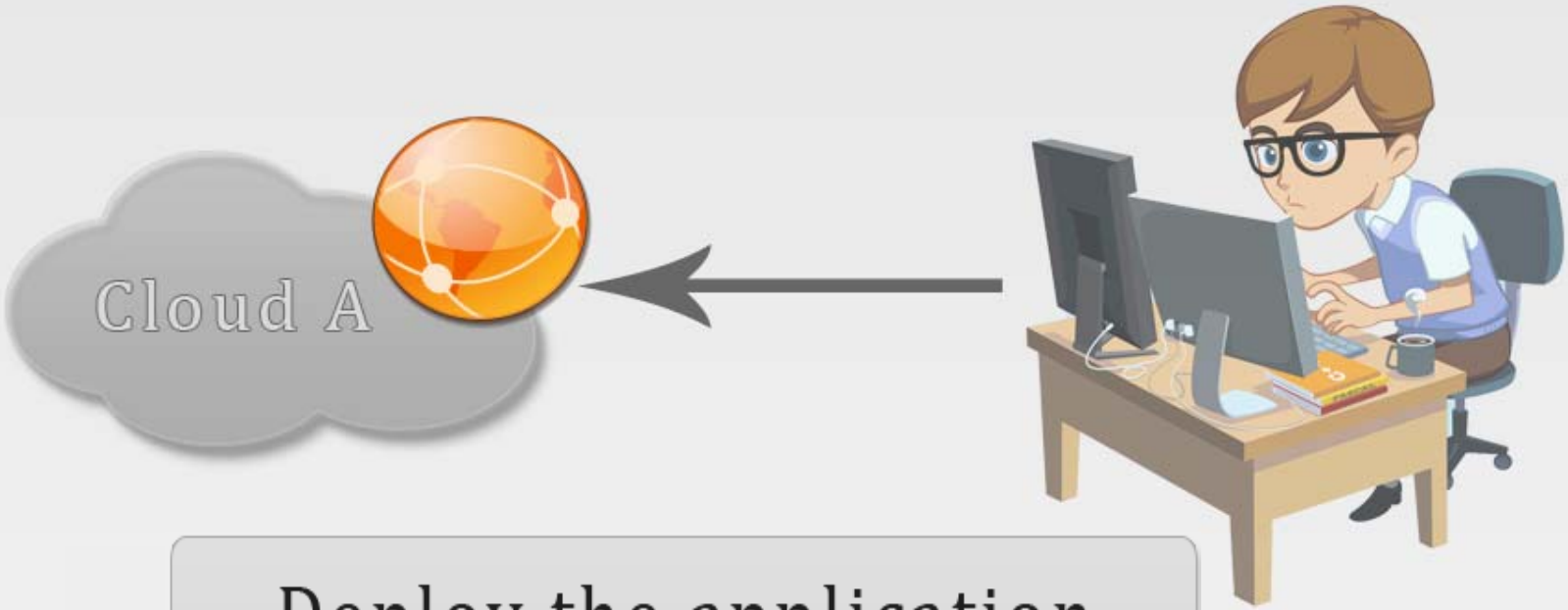


So many options!

Pick “a” Cloud!



Write application for Cloud A

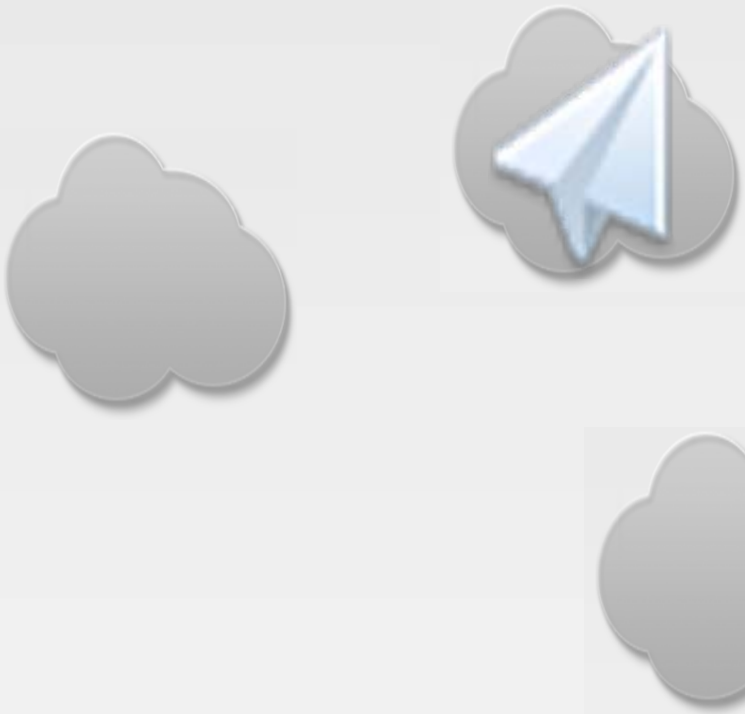


Deploy the application
in Cloud A

After a while
a new feature is needed …
and only Cloud B has it…

Now you'll **need** to refactor the application! :(

mOSAIC promise

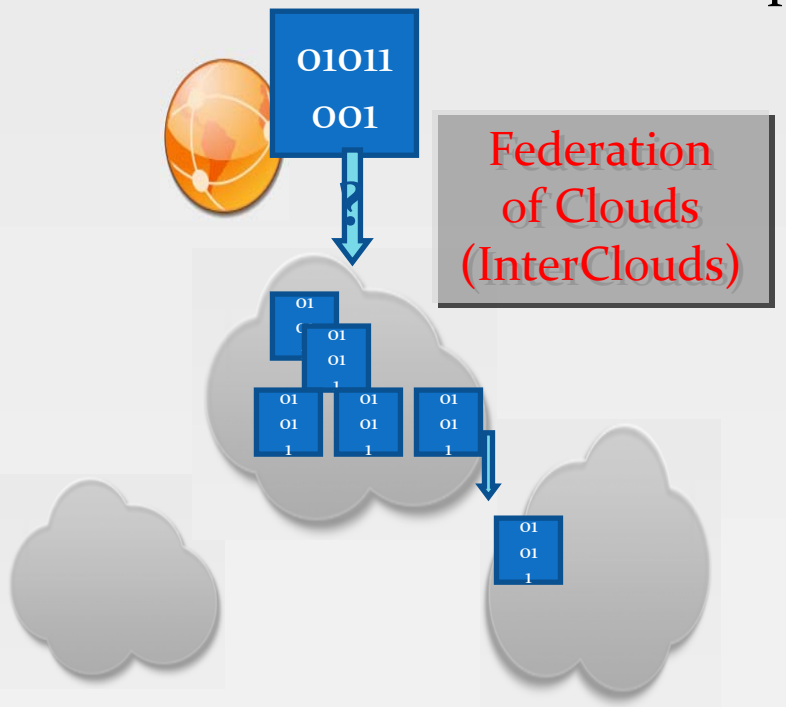


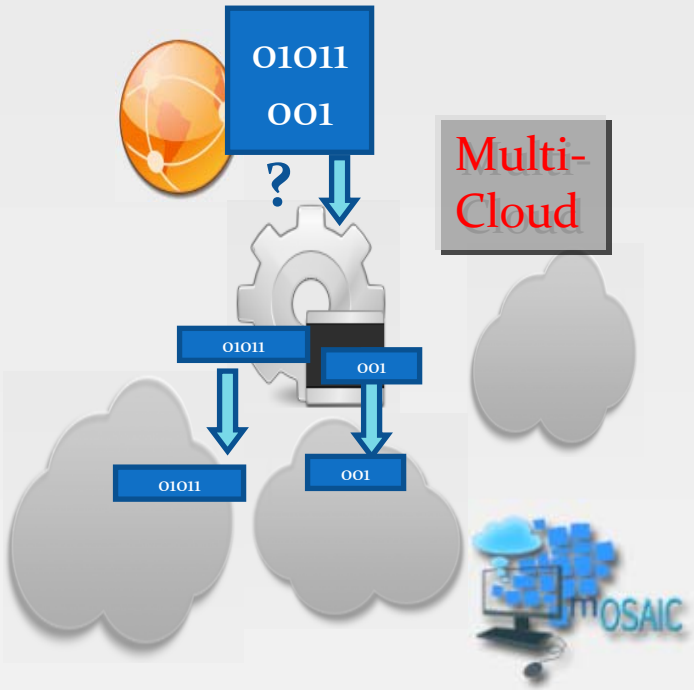
Flying through the Clouds

WHAT IS THE PROBLEM?

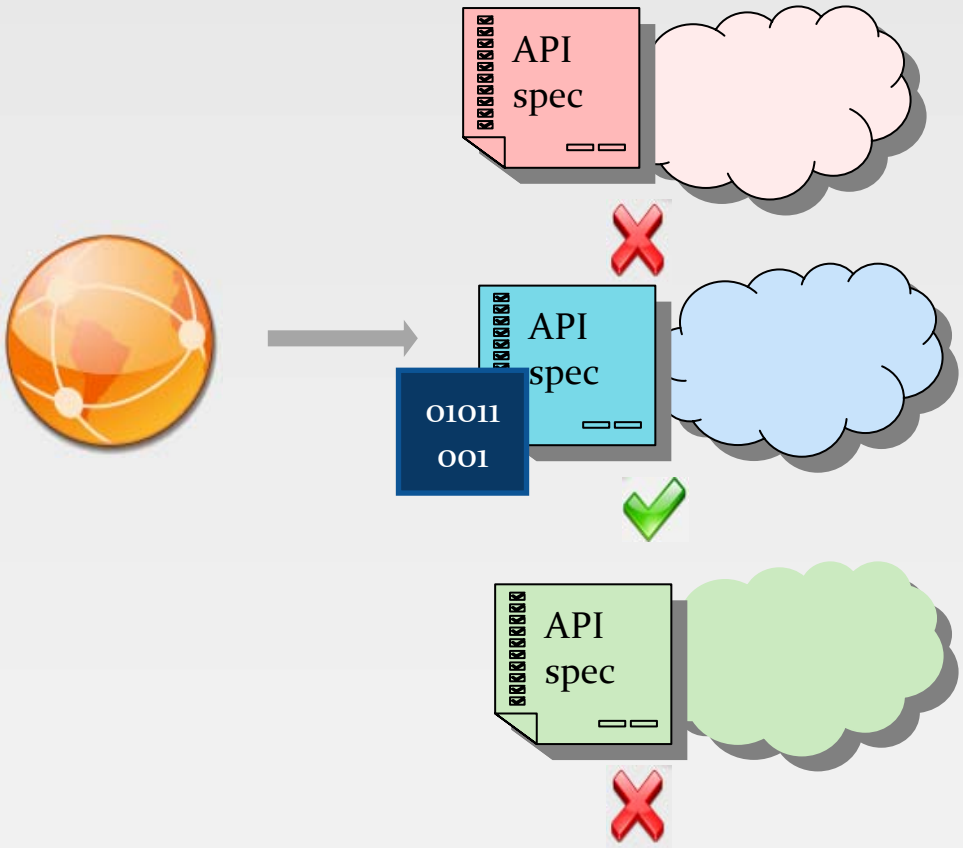
What is Sky computing?

Interconnection & provisioning of Cloud services from multiple domains





The Sky problem: different APIs



Vendor agnostic code?

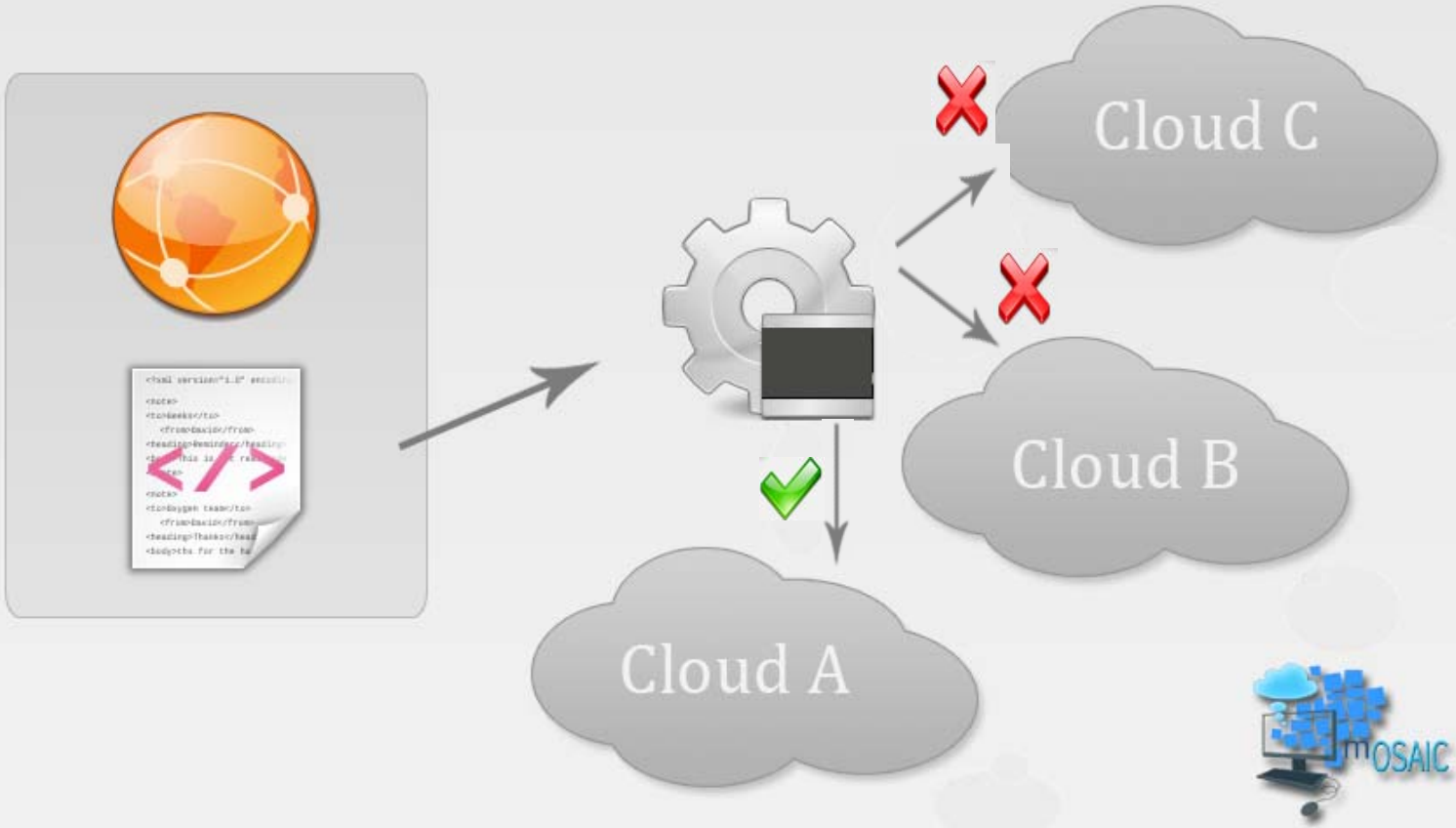
mOSAIC

Code

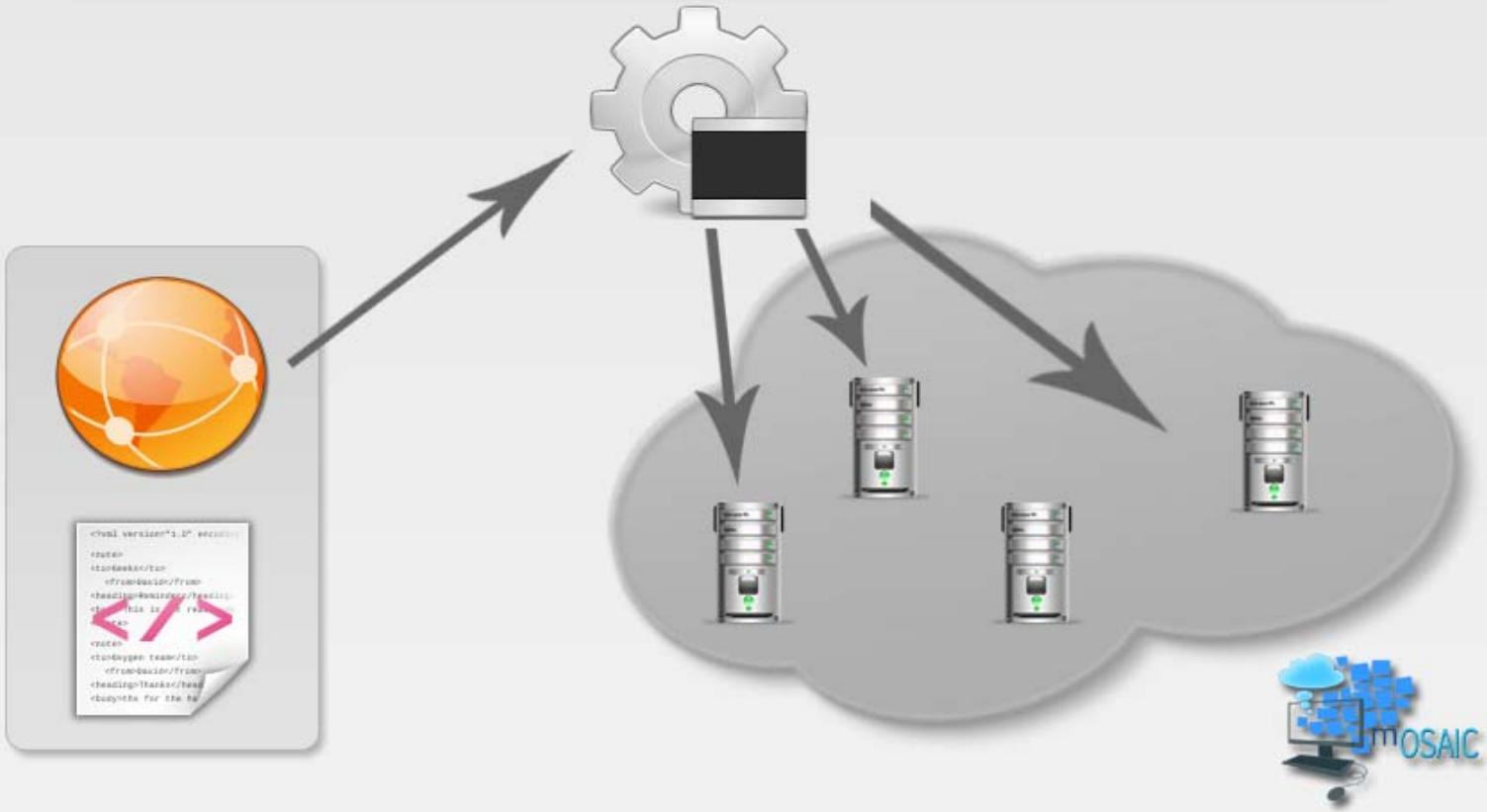
Descriptor

Write once, deploy anywhere!

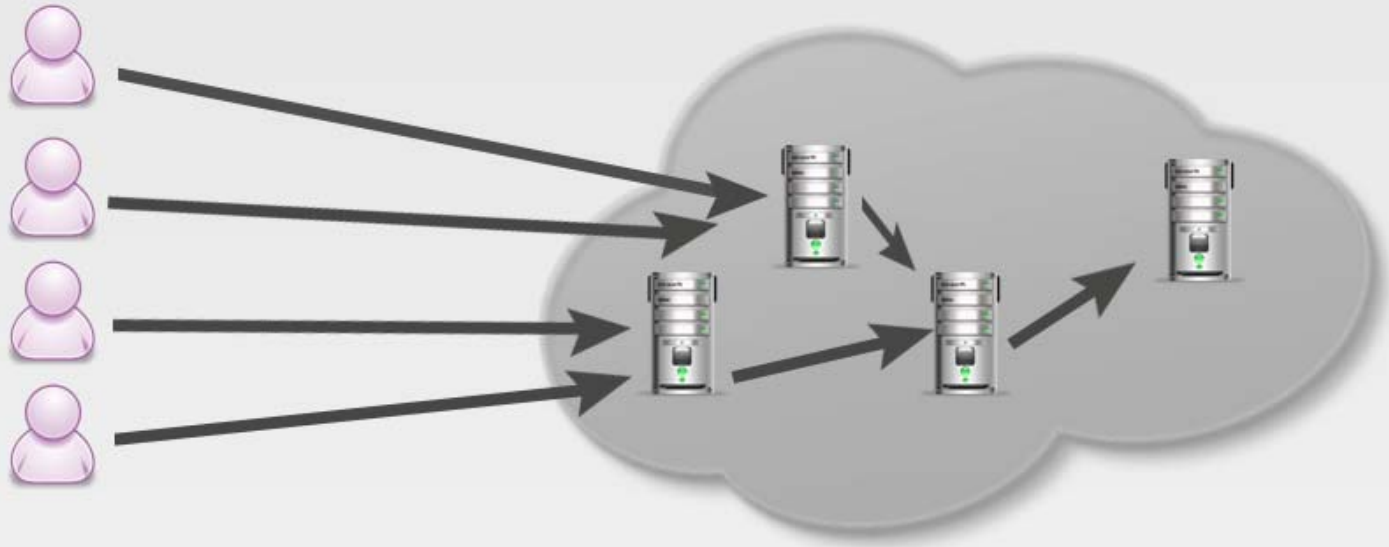
mOSAIC broker acquires resources



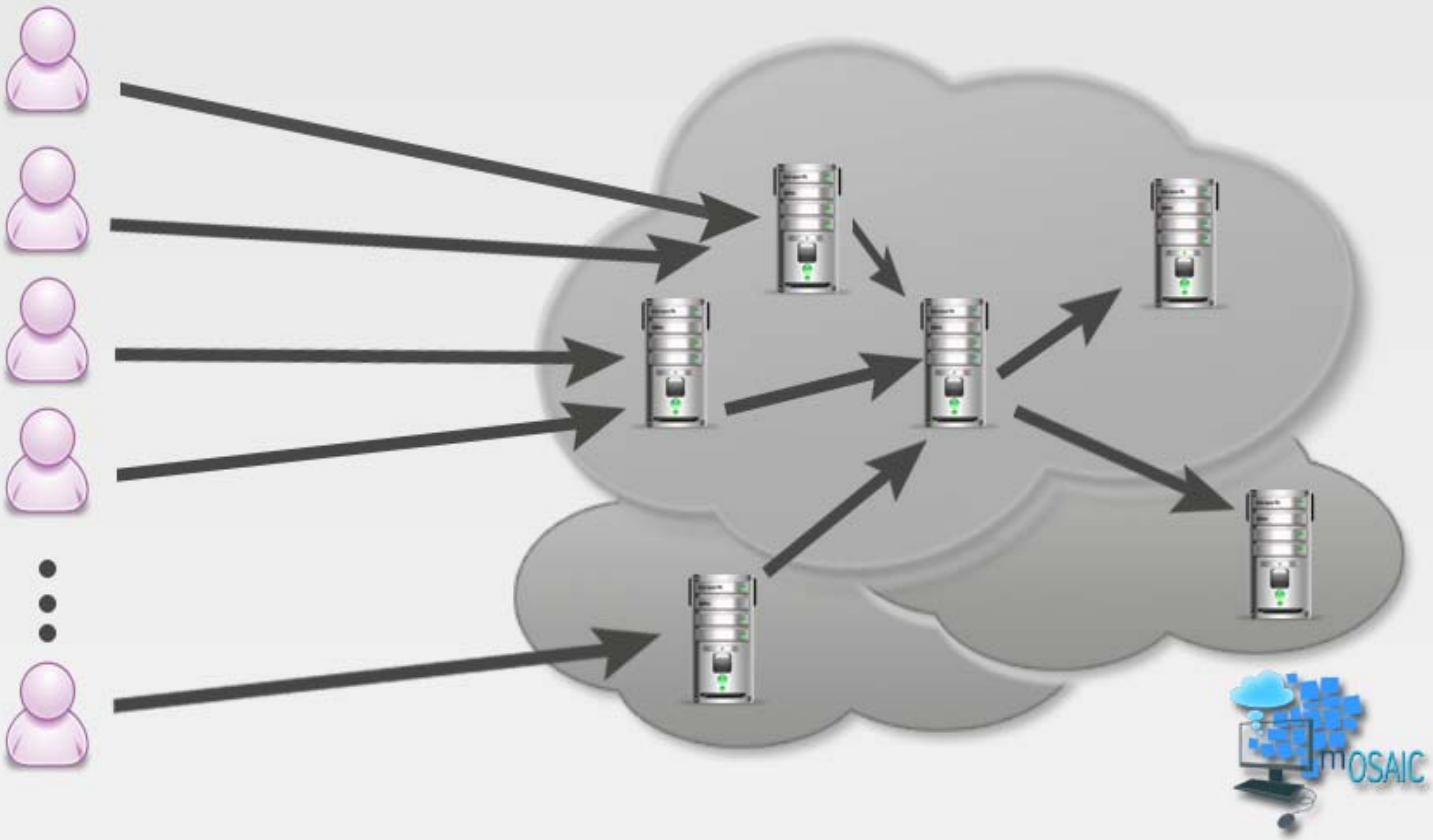
mOSAIC platform deploy resources



Application is shared



Application is scaling



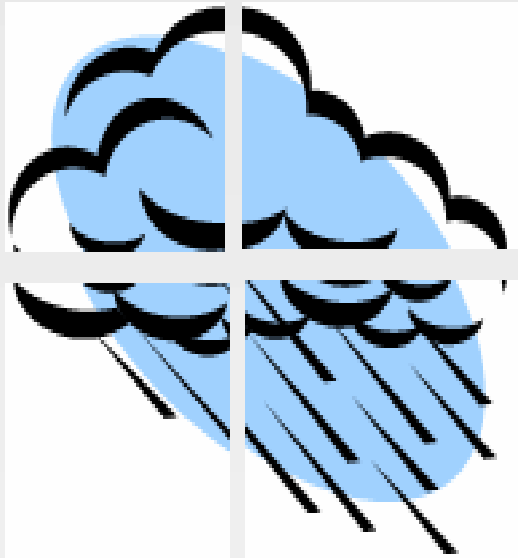
What is mOSAIC?

Open-source
API
and Platform
for multiple Clouds

Keywords

- Vendor agnostic API
- Platform as a Service
- Multi-Cloud and Cloud broker
- Multi-agent technologies
- Semantic processing
- Component-based long time running appls
- Auto-scaling [and self-adaptation]
- Event driven, asynchronous

HOW mOSAIC WORKS?

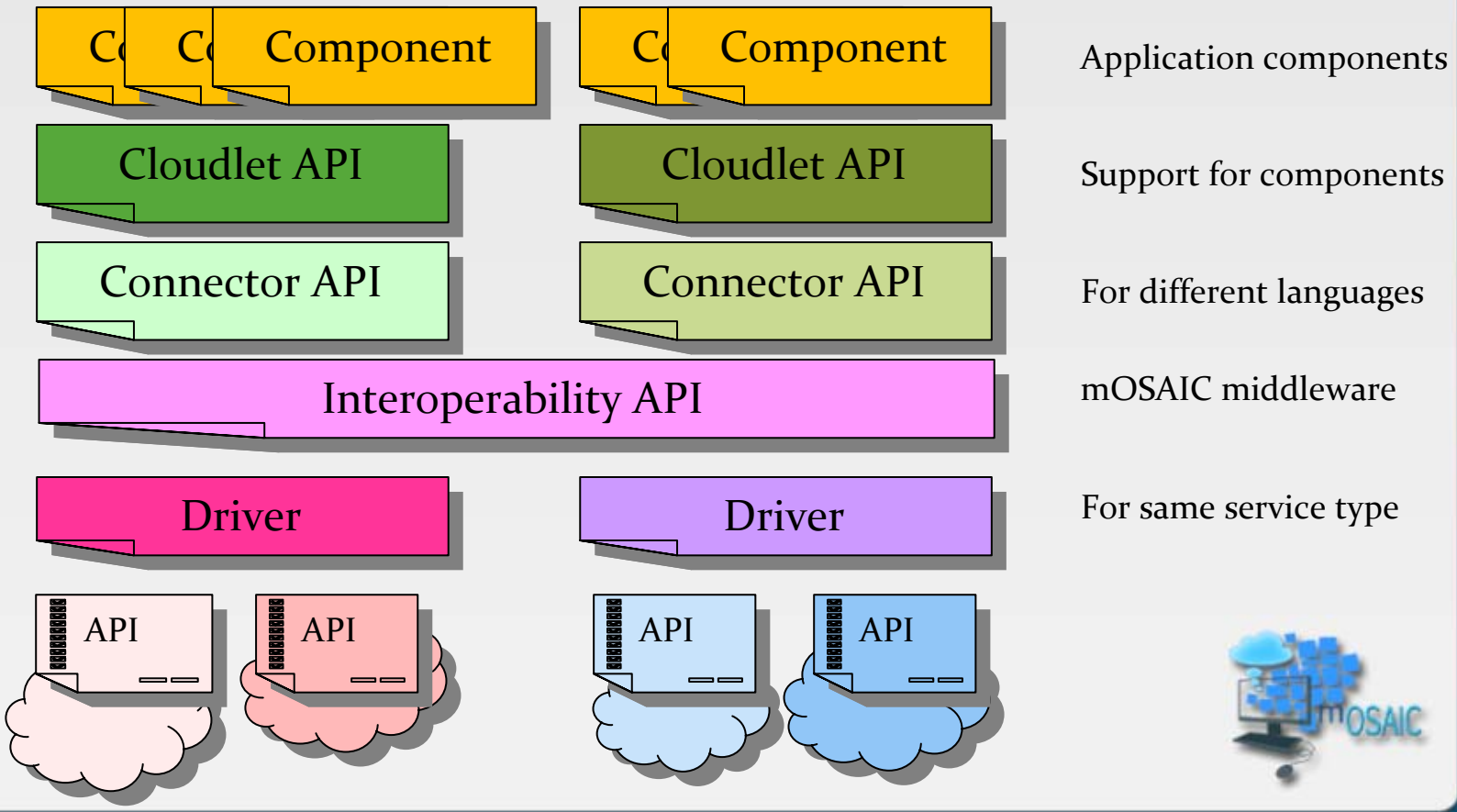


Applications are built from scalable components

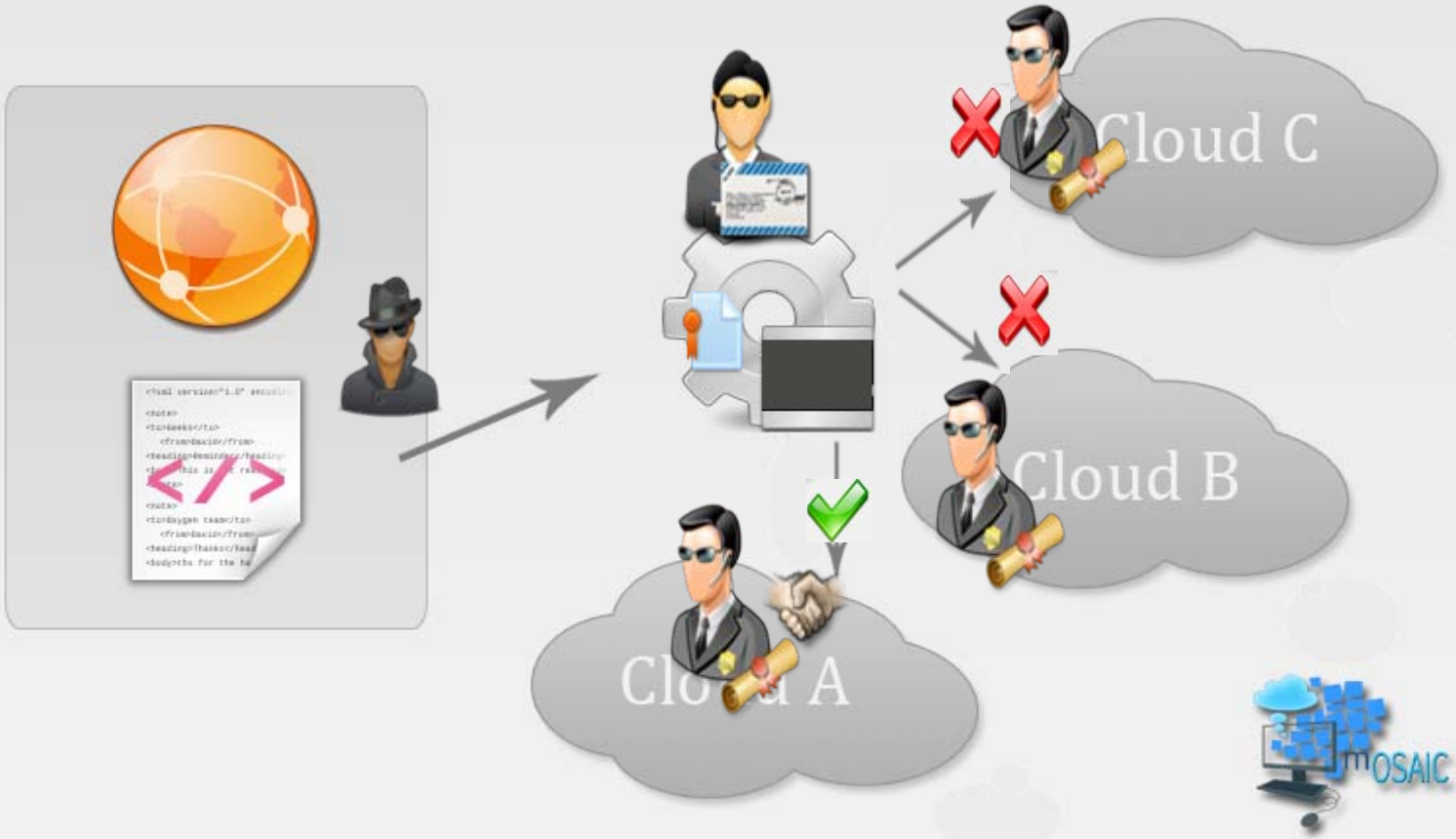
SOTA of portability

- At PaaS? *NO!*
  - *Use services from different Clouds*
- At IaaS? Ongoing task!
  - OCCI /OGF
  - UniCluster, OpenStack, jClouds, DeltaClouds…
  - Migration of VMs between Cloud providers: OpenNebula
  - Agreements between Cloud providers (federation)
  - Communications between Clouds

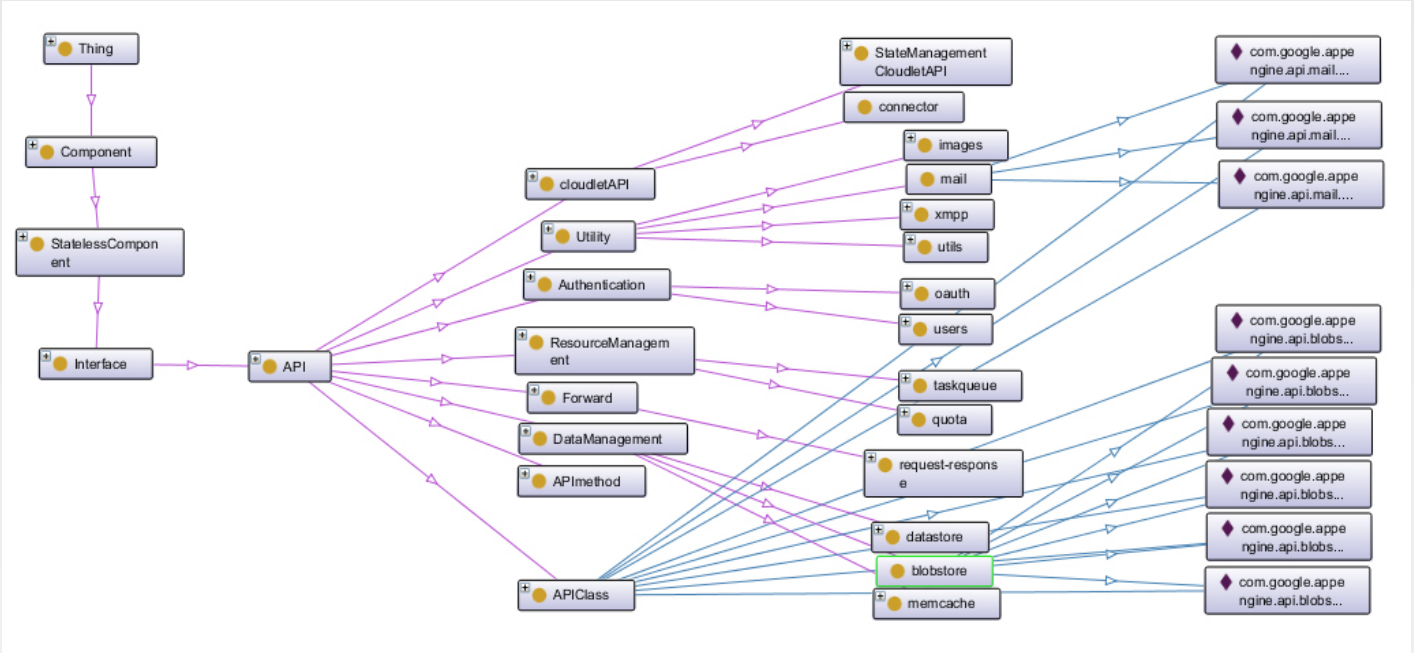
mOSAIC's APIs



Provisioning by a Cloud Agency



Use a common language



Use a Cloud Ontology

Proof of the concept appls

Type	Title
Data intensive	Storage and data distribution in Earth Observation
	Earth Observation mission reprocessing
	Routine production of Earth Observation products
	Fast data access for crisis situations
	Distributed intelligent maintenance
Compute	Cloud-distributed parameter sweep

mOSAIC promises

September 2011: **API available**

September 2012: **Platform available**

March 2013: **Full software package**

Current status

- Architecture & concepts & use cases
  - See project site – deliverables from last Feb
- API
  - Specifications to be released in September
  - First implementation in Java (Sept), next in Python (March)
  - Based on the “Cloudlet” notion
- Platform
  - Currently (non-integrated) components for agent system/provisioning, deploying, semantic processing
  - mOS – small OS with mOSAIC basic components
- Applications
  - Build from scratch: a Twitter watcher
  - Rebuilding legacy appls: GiSHEO training platform

Twitter watcher

- Components: Http gateway, servlet, fetcher, indexer, scavenger, message queues
- Use the drivers for open-source Cloud techs: Riak, RabittMQ,Eucalyptus
- Use classical appl development tools: Jetty
- Running example: mOS installed in 2 VMs, several components in these VMs
- Studies on the response time of the appl according to the no. users (appl scalability)
- Interested? Ask me for the video in breaks

Technical details in papers

- **Overview:** *Building a Mosaic of Clouds*, EuroPar 2010 - workshops, Springer, LNCS 6586, 529-536
- **API design – layers:** *Towards a cross-platform Cloud API*, CLOSER 2011, May 2011.
- **API design – interop:** *Building an Interoperability API for Sky Computing*, InterCloud, July 2011
- **SLA management:** *A Cloud Agency for SLA Negotiation and Management*, EuroPar '10, LNCS 6586, 547-554
- **Patterns:** *Identifying Cloud Computing Usage Patterns*, 2010 IEEE Cluster,
- **Platform services:** *Architecturing a Sky Computing Platform*, ServiceWave 2010 - workshops, LNCS
- **Cloud ontology:** *An Ontology for the Cloud in mOSAIC Cloud*. In Cloud computing: methodology, system, and applications. CRC, Taylor & Francis group, 2011,
- **Cloud agency:** *Agent based Cloud provisioning and management*, CLOSER 2011, May 2011.
- **Use case:** *From Grid Computing Towards Sky Computing. Case Study for Earth Observation*, 10th CGW 2010,
  Scheduling agents: *Self-Healing Distributed Scheduling Platform*, CCGrid 2011, May 2011

mOSAIC partners

Second University of Naples, Italy
Institute e-Austria Timisoara, Romania
European Space Agency, France
Terradue SRL, Italy
AITIA International Informatics, Hungary
Tecnalia, Spain

www.mosaic-cloud.eu

SEVENTH FRAMEWORK PROGRAMME

mOSAIC