"Potential collaboration" talk

Work in Progress on Cloud Computing in Myriads Team and Contrail European Project

Christine Morin, Inria

Myriads

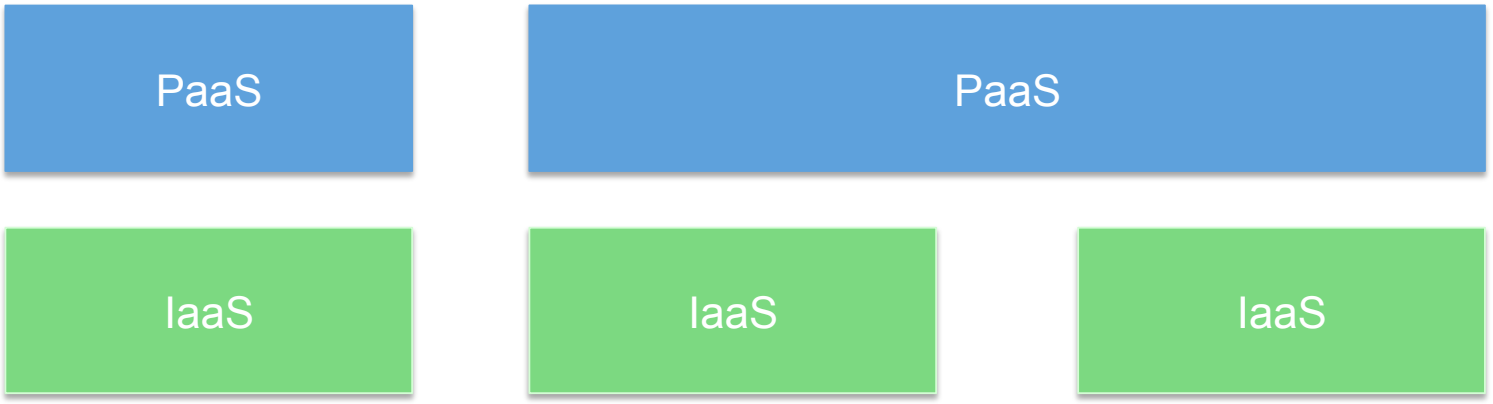
Design and implementation of autonomous distributed systems

Internet of Services & Clouds: Ideal candidates to benefit from autonomy

Cloud computing for scientific applications

Overview of Myriads Activities on Cloud Computing

Ease of application deployment
Automatic elasticity management
Application execution in the context of SLA
Application portability



Multi-cloud Environments

Efficient resource management
System support for VM management

Prototypes disseminated as open source software

Energy Management in IaaS Clouds

Snooze IaaS

Open source software
http://snooze.inria.fr/

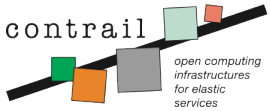
Energy-efficient resource management

Self-configuring & **self-healing VM management system**

Eugen Feller's PhD thesis [IEEE CC-Grid 2012 – Cloud 2012]

PaaS: Autonomous Management of Application Performance/Cost

PaaS



PaaS

ConPaaS: easy deployment of complex elastic applications in the cloud

(work started while Guillaume Pierre was at VU Amsterdam)

ConPaaS: a Platform for Hosting Elastic Cloud Applications, IEEE Internet Computing, 2012

IaaS providing heterogeneous resources

Application adaptation to IaaS heterogeneous resources (GPU, FGPA)

Harness European project (started in October 2012)

Themis: Market-based Automatic Resource and Application Management in the Cloud

- Resource sharing between competing applications with different QoS
- Improving resource utilization in the infrastructure

Autonomous application managers
- Horizontal & vertical scaling

Priority management between competing applications

Market-based resource allocation

Applications
- Molecular dynamics simulator
  - http://www.gromacs.org/
- Non-linear solver of a convection diffusion problem
  - https://github.com/kortas/ZEPHYR
- Condor & Torque frameworks

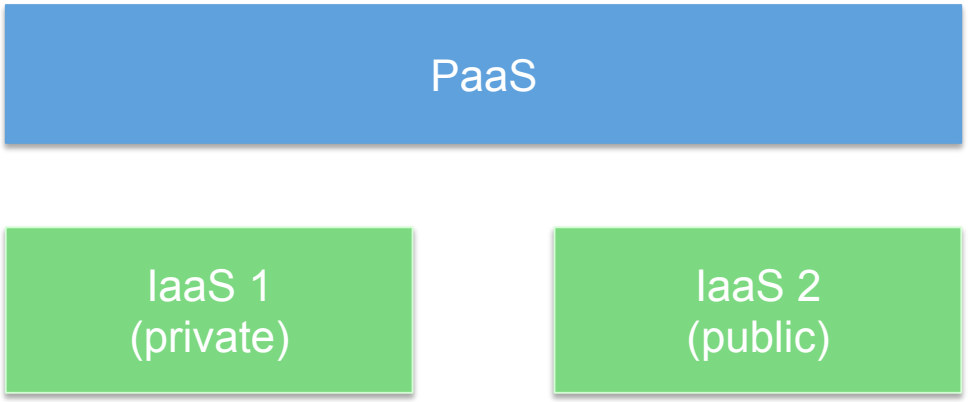
Stefania Costache's PhD

Themis: Economy-Based Automatic Resource Scaling for Cloud Systems, IEEE HPCC 2012.

PaaS in a Multi-Cloud Environment

Elastic frameworks (Batch, Hadoop clusters) over hybrid clouds

SLA management for jobs



Djawida Dib's PhD thesis

Application Life Cycle Management

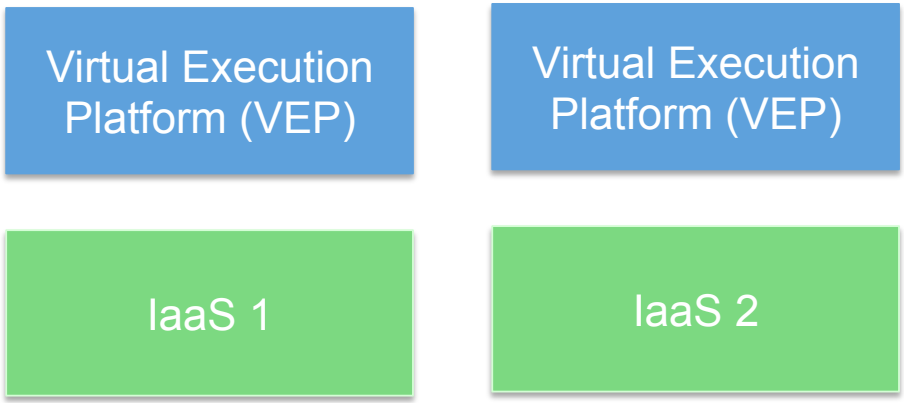
contrail
open computing infrastructures for elastic services

User

- Distributed application life cycle management
- Support for SLA management
- Portability, interoperability

Provider

- Resource management



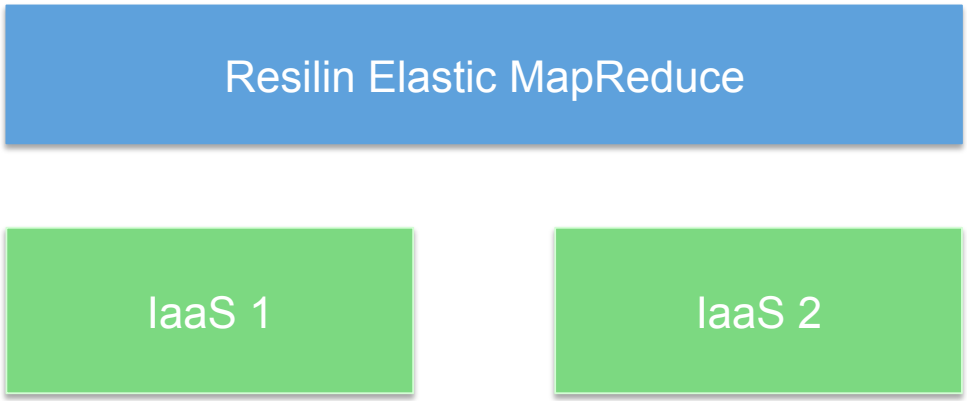
6th International DMTF Academic Alliance Workshop on Systems and Virtualization Management: Standards and the Cloud

- Using Open Standards for Interoperability - Issues, Solutions, and Challenges facing Cloud Computing
- Managing OVF applications under SLA constraints on Contrail Virtual Execution Platform

PaaS in a Multi-Cloud Environment

Elastic MapReduce over multiple private, community and public clouds

Flexible and easy MapReduce application deployment



Open source software: http://resilin.inria.fr

Inria Research Report, RR- 8081- 2012

RMAC activity

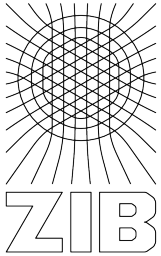
Contrail European Project

contrail
open computing infrastructures for elastic services

- FP7 Integrated Project
  - Build an open source cloud computing software stack for cloud federations
- Key Facts
  - 3 years, started in October 2010
  - 11.4 M€ budget & 8.3 M€ EC funding
- Consortium
  - 11 universities, research centers and companies
  - France, Germany, the Netherlands, U.K., Italy, Slovenia

http://www.contrail-project.eu

Contrail Consortium



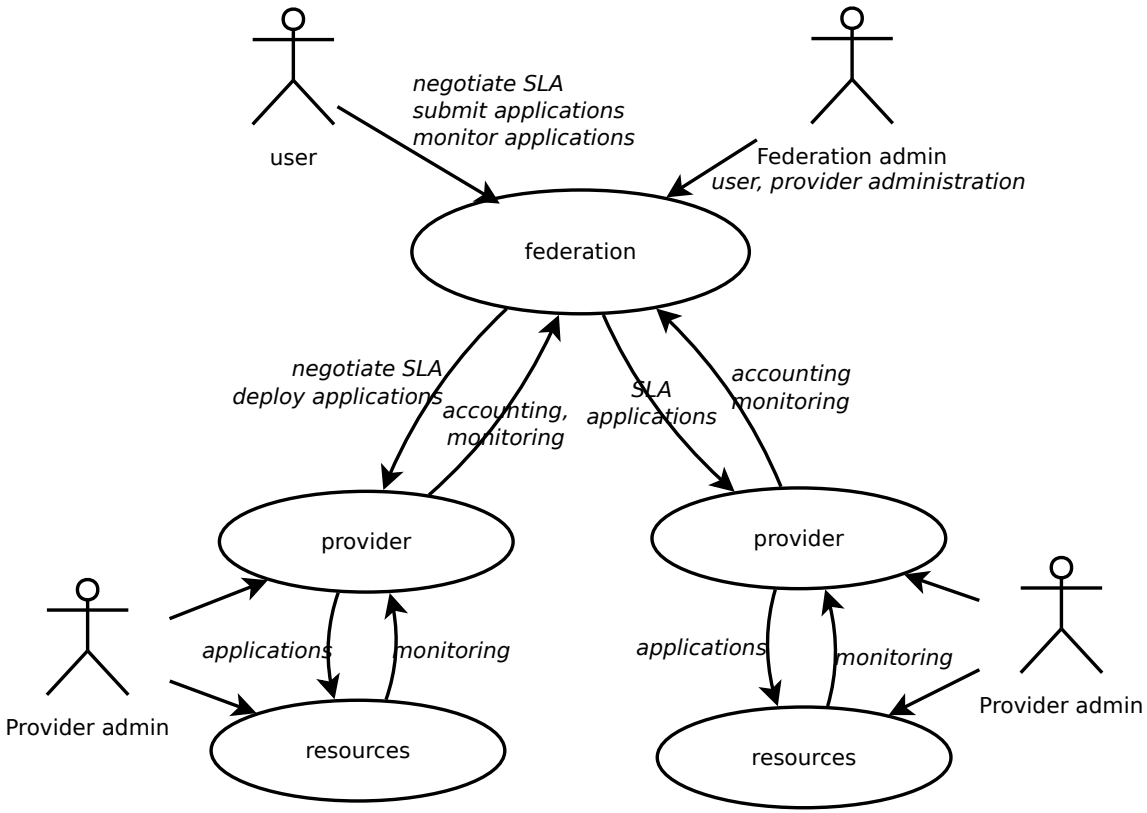
Goals of Contrail

- Facilitate the **deployment of distributed applications** in clouds
- Provide **seamless access to resources** provisioned by different IaaS cloud providers
- Provide **trusted clouds**
- **Break** the current customer **lock-in** situation
- Contribute to **application portability** and to **interoperability** in multi-cloud environments

Contrail Main Contributions

- **Federation service** interfaced with IaaS cloud providers
  - **Virtual Execution Platform** (VEP) for distributed applications lifecycle in an IaaS cloud provider
  - Advanced **SLA management** in cloud federations
  - Security framework: authentication, delegation, authorization
- **ConPaaS** runtime for hosting self-managed elastic applications in the cloud
- **XtreemFS** cloud storage system

Actors in Contrail



Contrail Federation Service

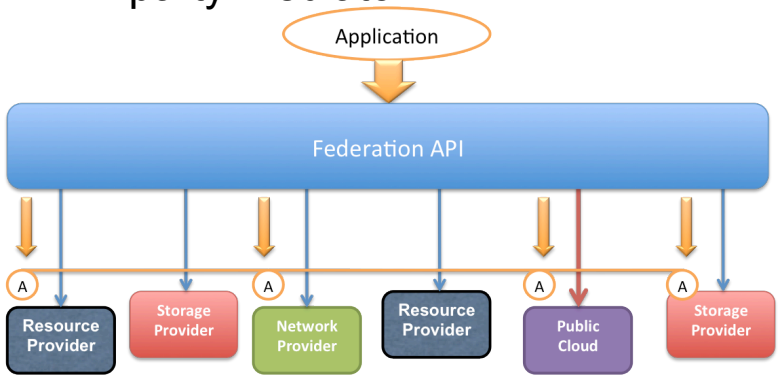
More than a simple broker

Some challenges

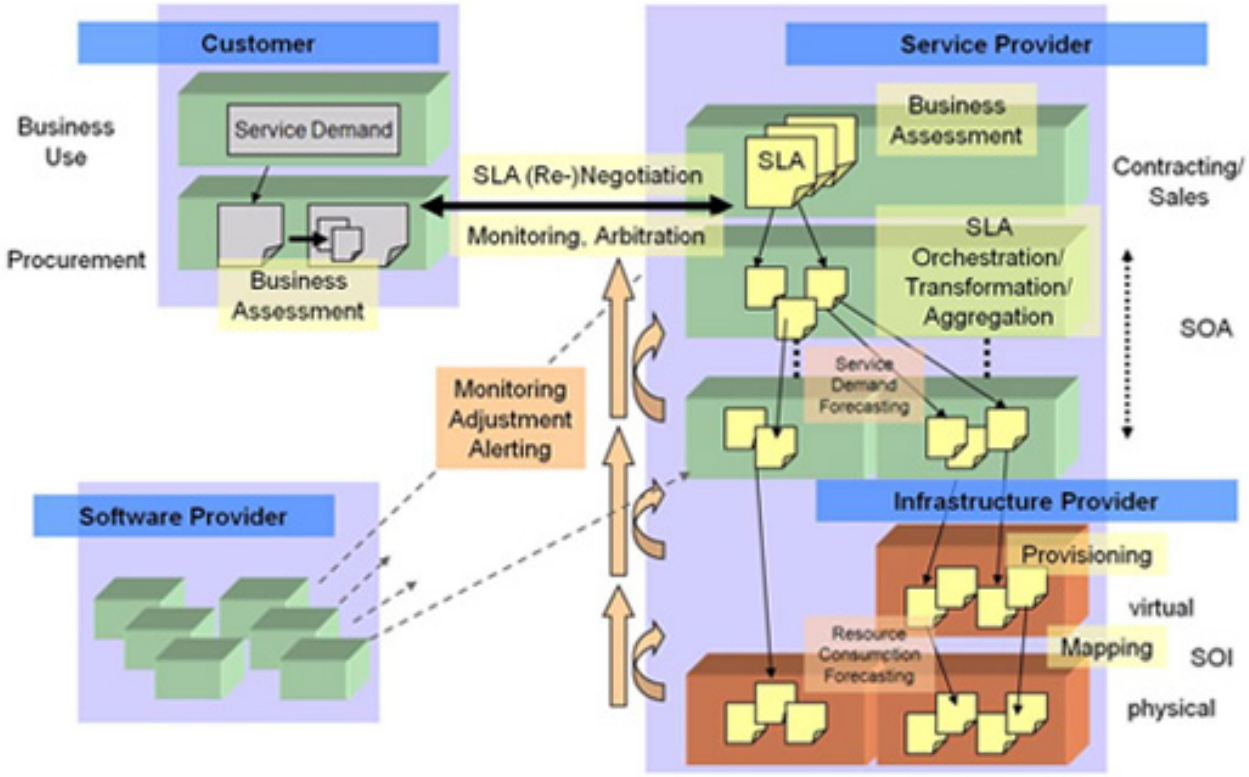
- Heterogeneous providers
  - Public, private
- Dynamically choosing best providers
- Combine providers for a single application
- Elasticity: add resources from extra providers
- Migration
- Security and privacy framework

QoS, QoP

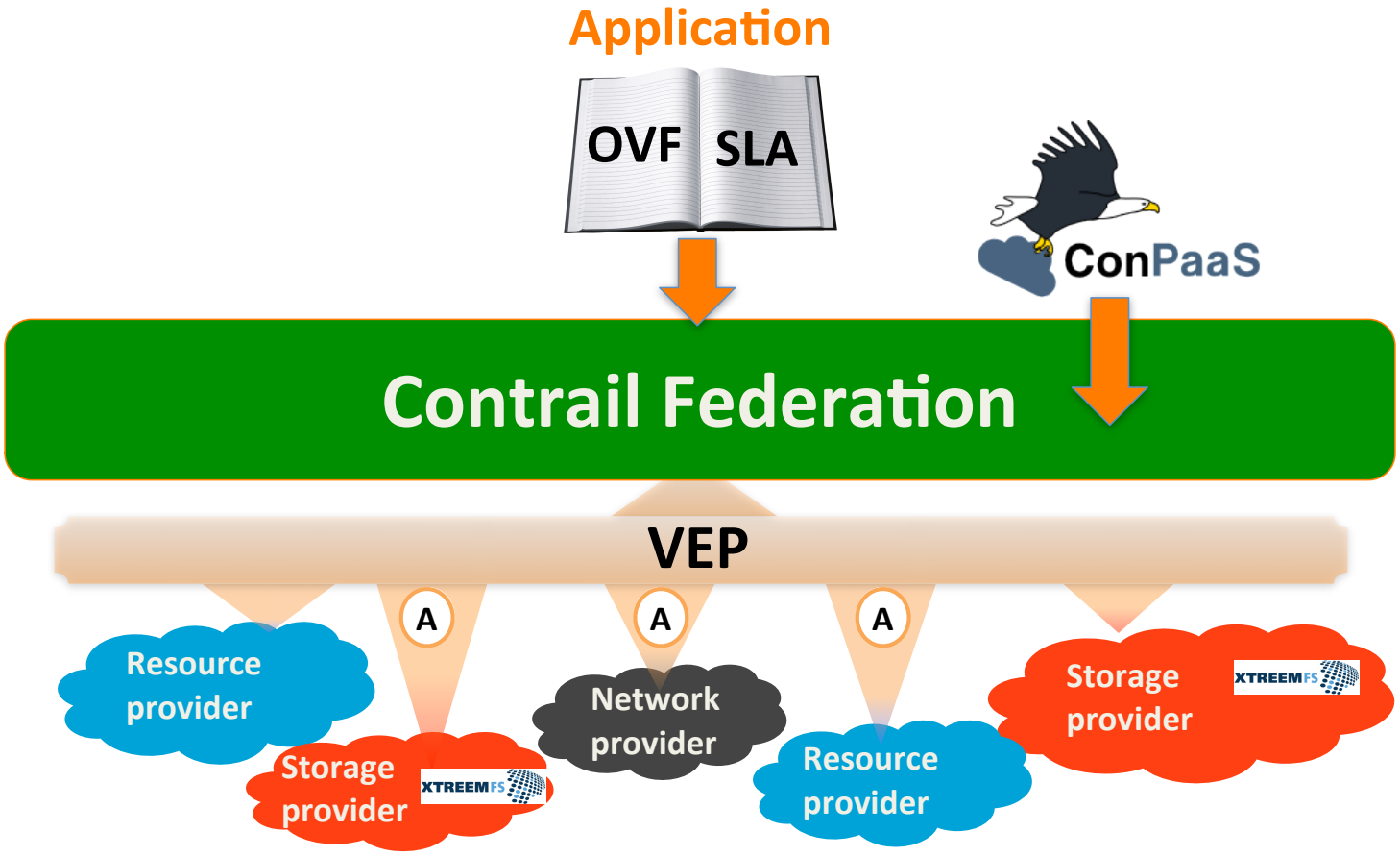
- Service Level Agreements
  - Via provider selection and integration
- Enforcement mechanisms at federation level
- Federation service as a 3rd party mediator



Use of SLA@SOI Framework for SLA Management in Contrail



Virtual Execution Platform (VEP)



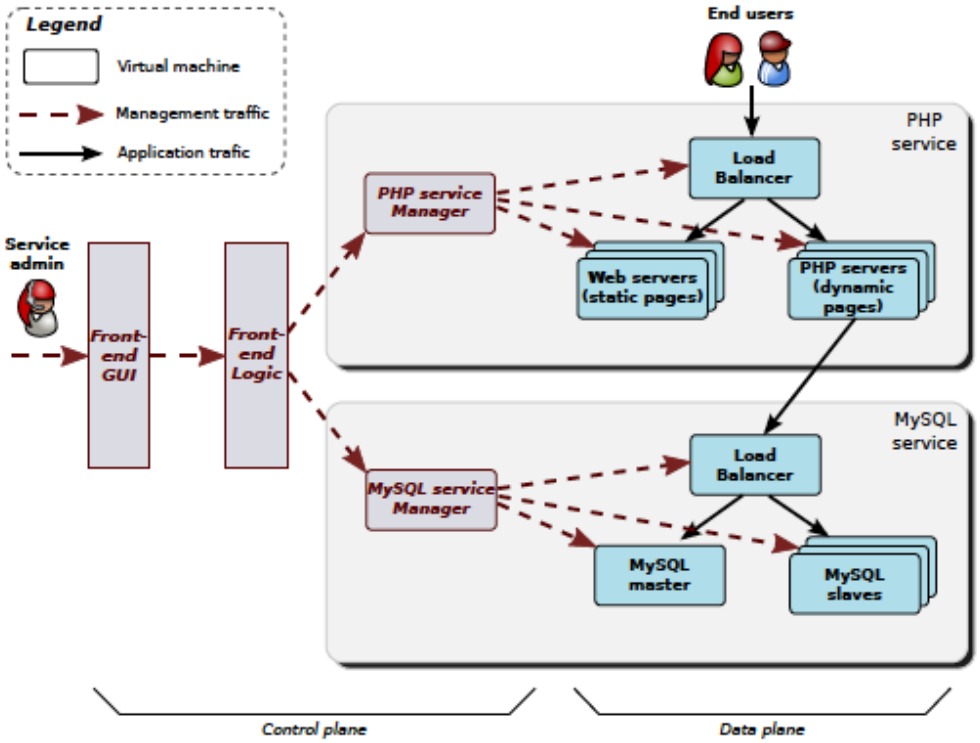
Virtual Execution Platform (VEP)

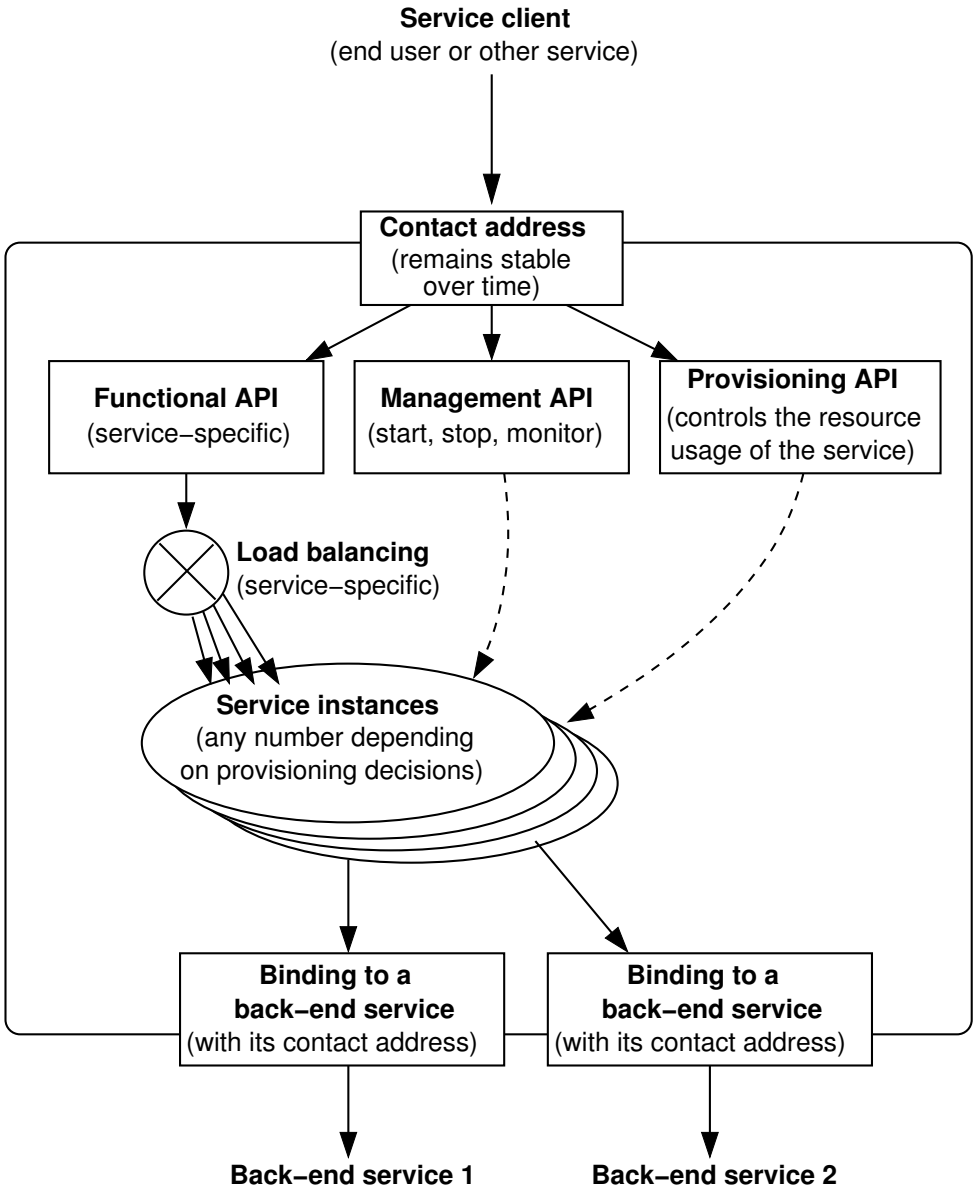
- **OVF distributed applications**
  - OVF: Open Virtualization Format, DMTF standard
  - Distributed applications made of virtual machines, disks, networks, shared storage
  - Integrate deployment and configuration rules
- **Application lifecycle**
  - Contextualization
  - Deployment
  - Elasticity
  - Checkpoints (OVF)
  - Support for partial deployment (from federations): deployment documents
- **Heterogeneous IaaS models**
  - VEP integrated to provider infrastructure (Contrail+OpenNebula)
    - Support for advanced resource reservation
  - Remote exploitation of IaaS Cloud from VEP (Amazon)

ConPaaS: A Platform for Hosting Elastic Cloud Applications

- **Broad range of functionalities**
  - Web application hosting (static files, PHP, Java, . . .)
  - Databases (SQL and NoSQL)
  - High-performance execution frameworks (MapReduce, TaskFarming)
- **Fully integrated**
  - Applications can compose any set of services together
- **Easy to use but also very powerful**
  - Simple Web GUI + powerful command-line tool
  - Services are highly customizable
- **Cutting-edge SLA enforcement technologies**
  - Elasticity and resource provisioning techniques to guarantee performance at the lowest possible cost

ConPaaS: A Platform for Hosting Elastic Cloud Applications

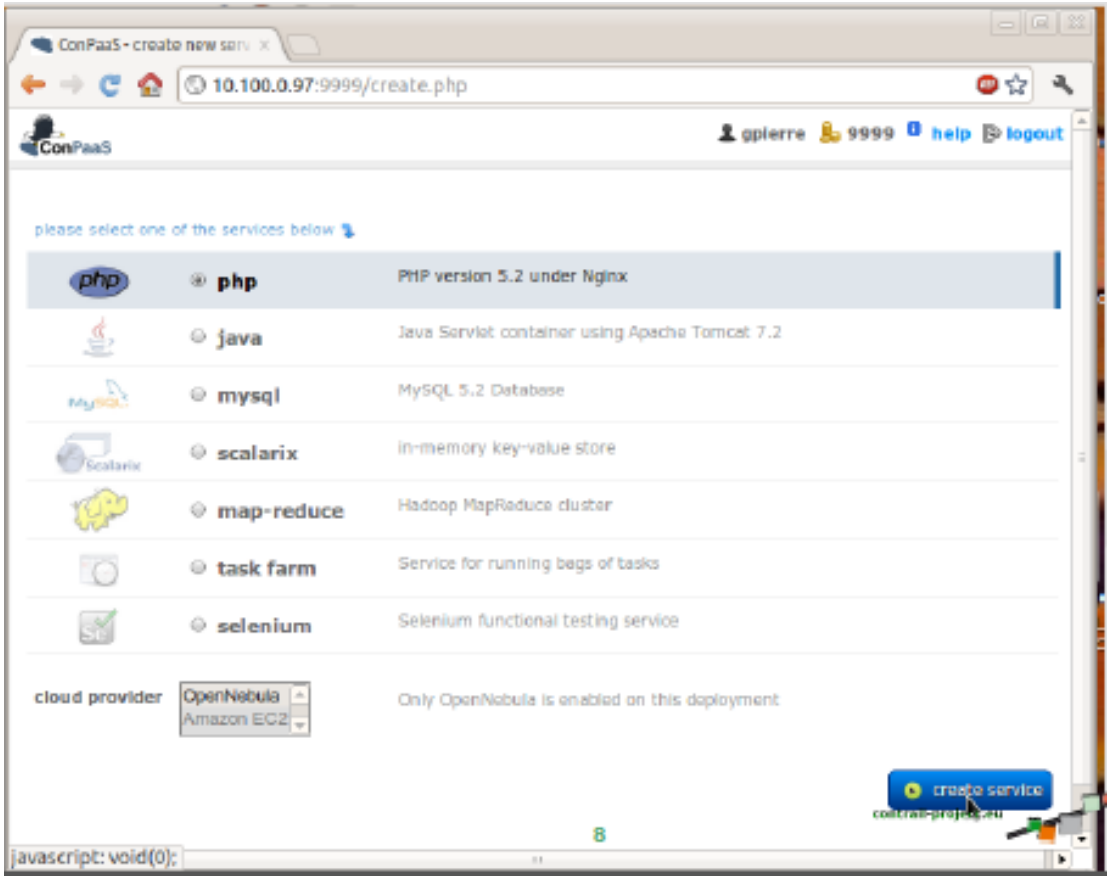



Service client
(end user or other service)
Contact address
(remains stable over time)
Functional API
(service–specific)
Management API
(start, stop, monitor)
Provisioning API
(controls the resource usage of the service)
Load balancing
(service–specific)
Service instances
(any number depending on provisioning decisions)
Binding to a back–end service
(with its contact address)
Binding to a back–end service
(with its contact address)
Back–end service 1
Back–end service 2

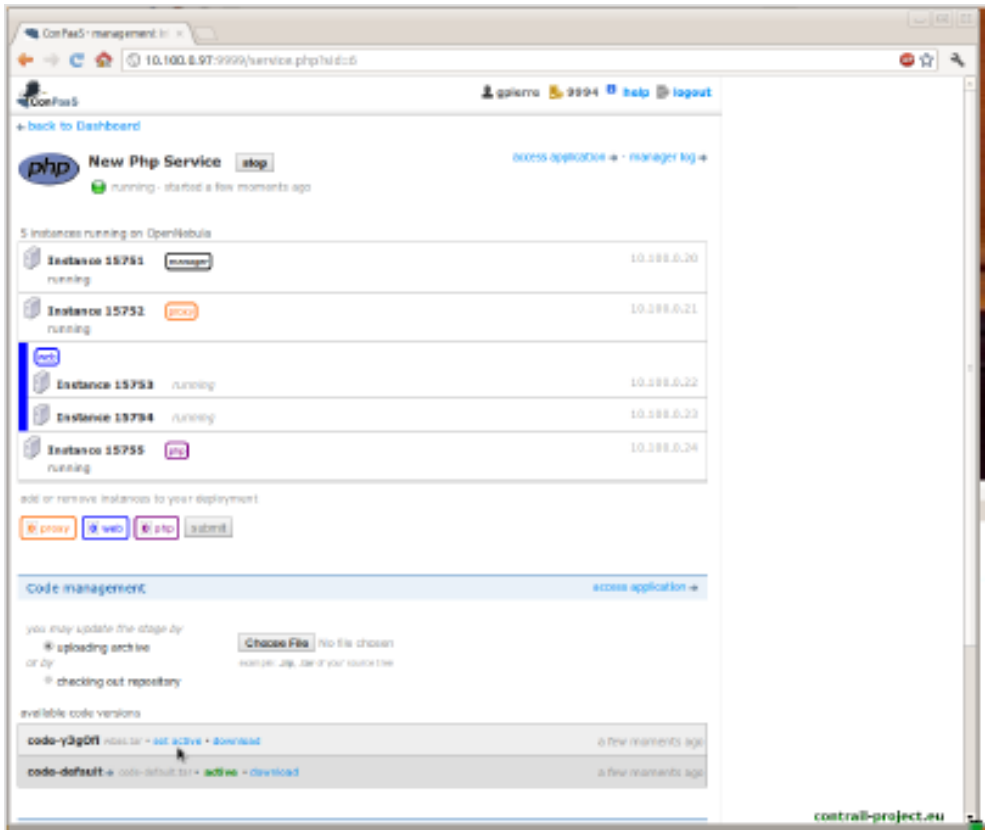
ConPaaS Front-End

Public testbed
https://online.conpaas.eu

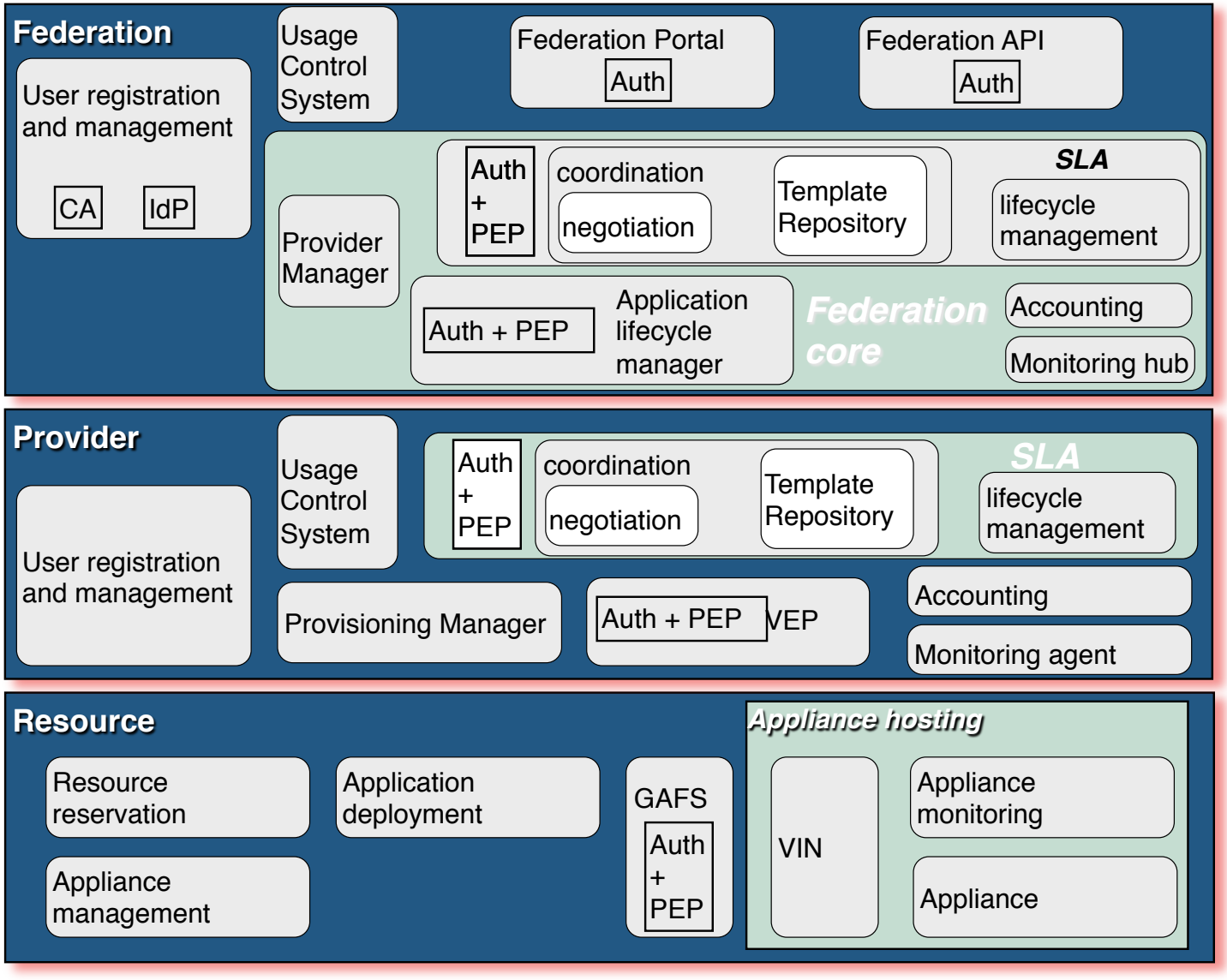
ConPaaS Front-End



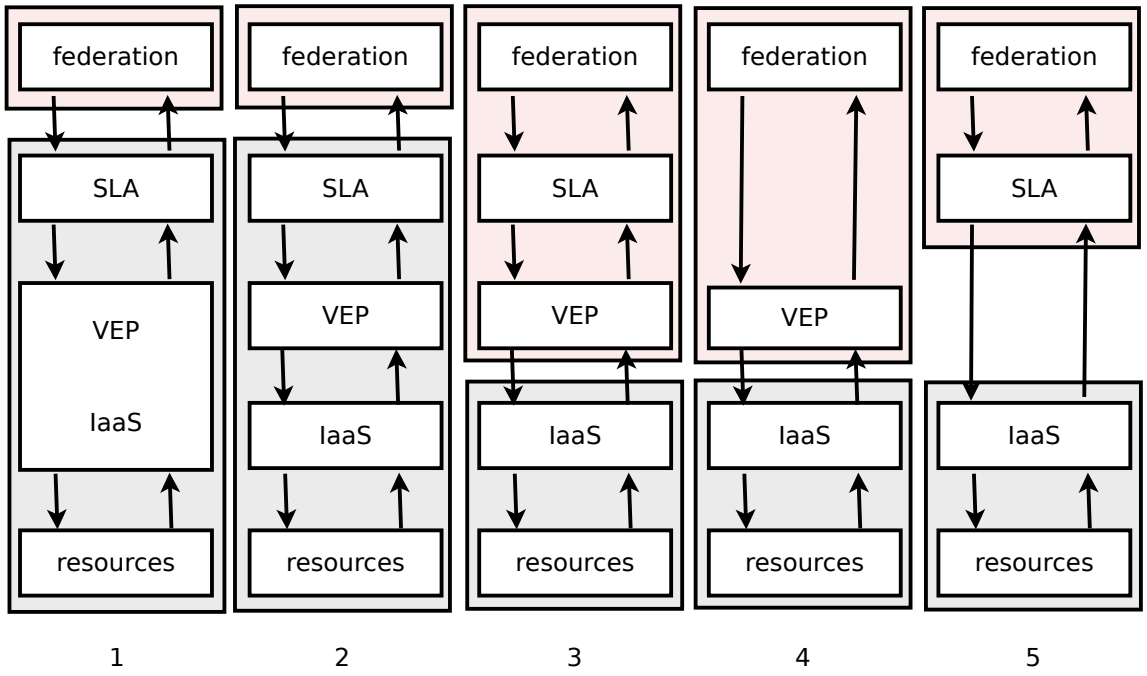
ConPaaS Front-End



Contrail Architecture



Exploitation of Contrail Software Stack



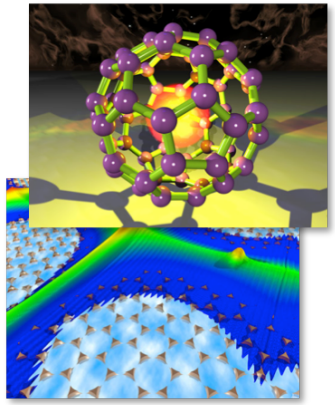
Contrail Open Source Software

- **Contrail stack release available** (v1.2)
  - Open development in OW2
    - http://ow2.org/view/ActivitiesDashboard/Contrail
  - BSD/Apache licence
- **Standalone components**
  - ConPaaS free public testbed
    - www.conpaas.eu
  - XtreemFS cloud storage - www.xtreemfs.org
  - Virtual Execution Platform (VEP) - http://vep.gforge.inria.fr
- OpenNebula/EC2 as underlying IaaS systems
  - OpenStack and OCCI compliant IaaS in the future

Scientific Use Cases

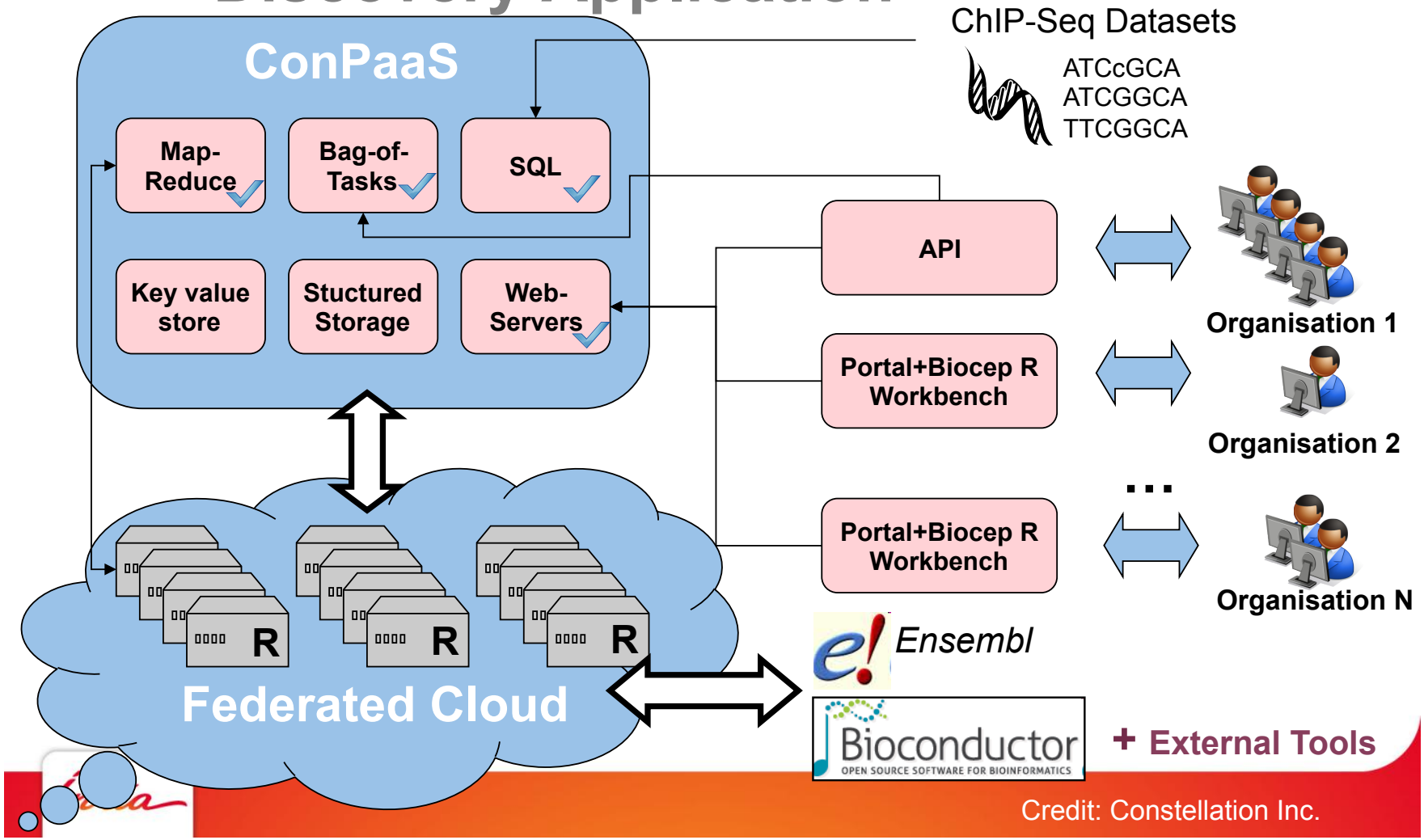
– Clouds for high-performance real-time scientific data analysis

– High throughput electronic drug discovery



Images © 2011 STFC

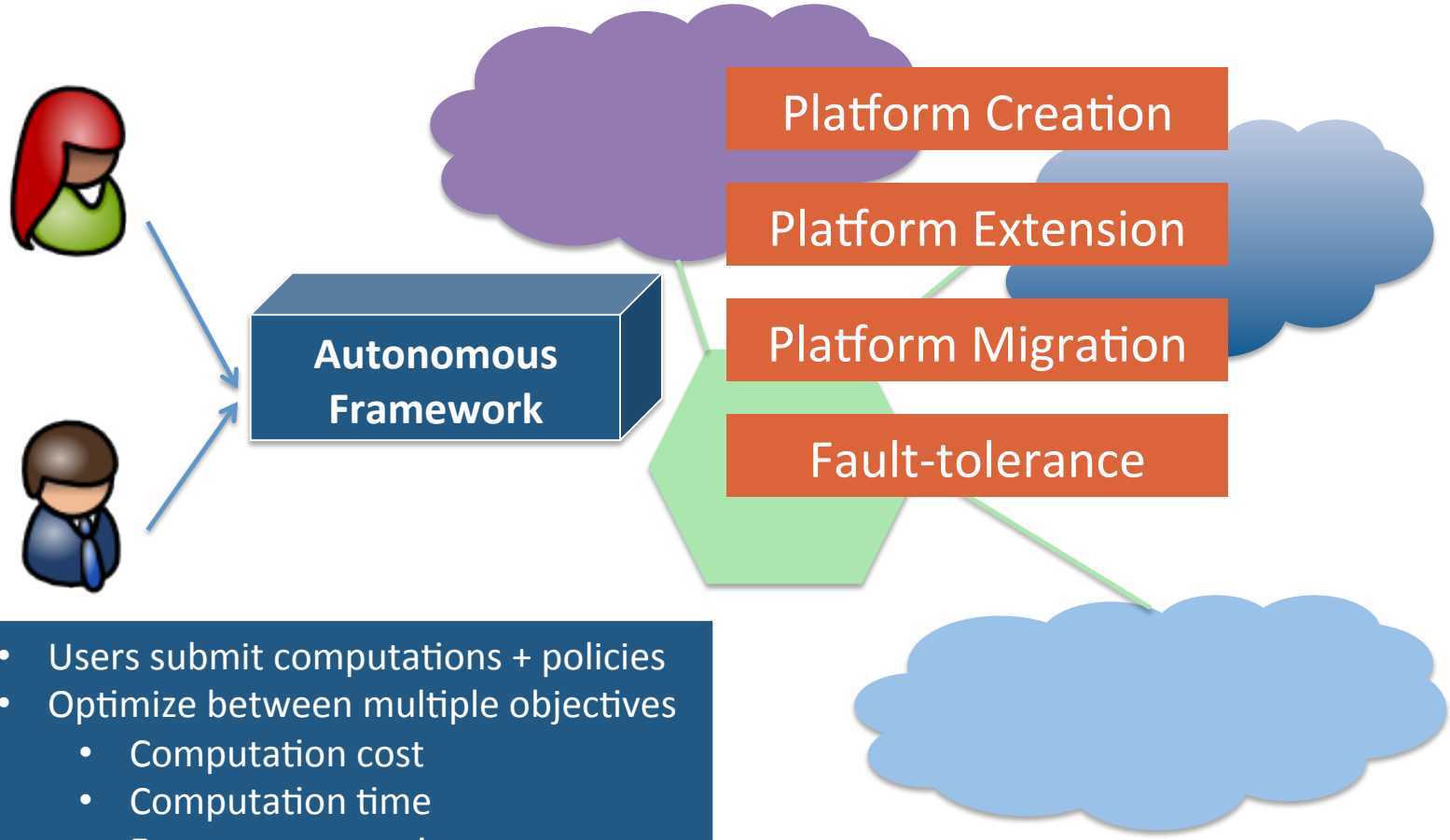
Deployment of an Electronic Drug Discovery Application



Credit: Constellation Inc.

Concluding Remarks

- Potential topics for collaboration
  - Scientific data-intensive & workflow applications in the cloud
    - Automated resource selection in multi-cloud environments
    - SLA enforcement – reliability, performance, cost
    - Automated elasticity management by PaaS runtimes
    - Portability, interoperability
  - Green cloud computing
    - Energy efficiency and awareness



- Users submit computations + policies
- Optimize between multiple objectives
  - Computation cost
  - Computation time
  - Energy consumption

Joint work with

- **Yvon Jégou**
- **Anne-Cécile Orgerie**
- **Nikos Parlavantzas**
- **Guillaume Pierre**
- Roberto Cascella
- Stefania Costache
- Djawida Dib
- Florian Dudouet
- Eugen Feller
- Filippo Gaudenzi
- Pyiush Harsh
- Ancuta Iordache
- Pierre Riteau (until end of 2011)
- Matthieu Simonin
- Contrail consortium members

Thank you for your attention

Standards in Contrail

Contrail exploits open standards and open protocols

- OVF for distributed application description
- CDMI for storage (partial support)
- OCCI/CIMI for IaaS providers
- libcloud,
- SLA management compatible with WS-Agreement
- VEP based on CIMI API
- User attribute management based on SAML
- Identity management: OAuth and Shibboleth
- AMQP for monitoring