Cloud Computing (III)
an Overview of the Contrail Project

SPD Course
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Massimo Coppola

Cloud Computing: Overview of the Contrail Project Vision

Adapted from a presentation by Christine Morin, INRIA
Contrail Project Coordinator

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http://contrail-project.eu

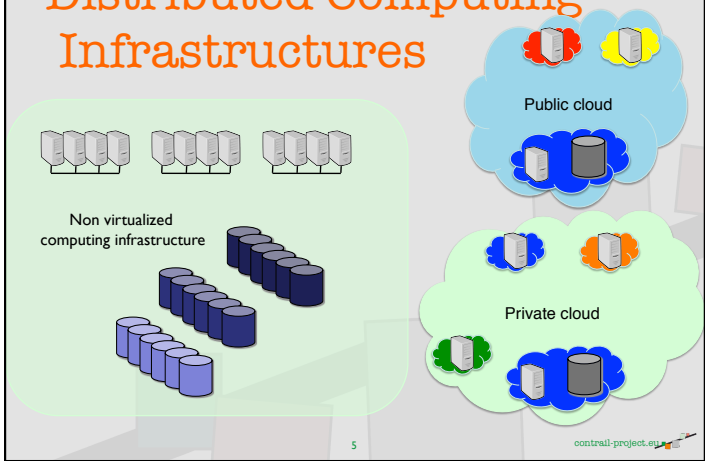
Contrail Partners

Consiglio Nazionale delle Ricerche Italia
Constellation Technologies Ultimate Virtualization
GENIAS Benelux bv
hp
INRIA
petalslink
Science & Technology Facilities Council
tiscali:
vrije Universiteit amsterdam
XLAB NOT IDLE
ZIB

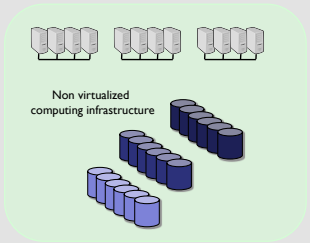
Contrail Consortium

Country/Partner	Research	SME	Industry
France	INRIA	EBM WebSourcing	
Germany	ZIB		
Italy	CNR		
			Tiscali
			HP-IIC
the Netherlands	VUA		
		GENIAS	
Slovenia		XLAB	
United Kingdom	SFTC		
		CONST	

Distributed Computing Infrastructures



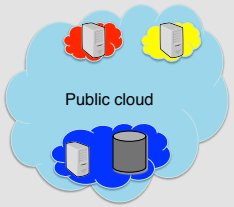
Non-virtualized



- The user buys its own infrastructure
- Sized to withstand usage peaks
- Design, configuration, management, maintenance burdens are on the owner = the user
- Hard to share the costs / exploit the investment

Main reasons behind the concept of Virtual Organization

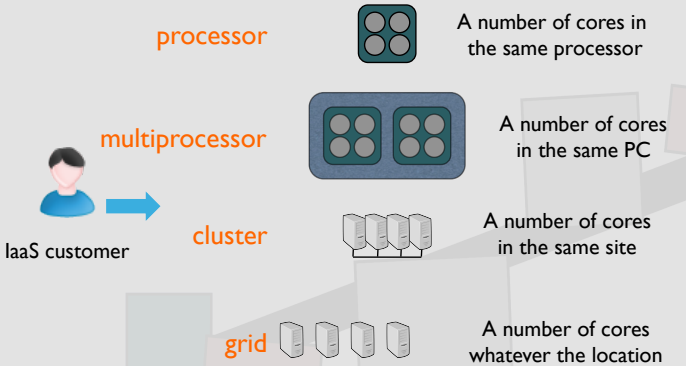
Public Cloud



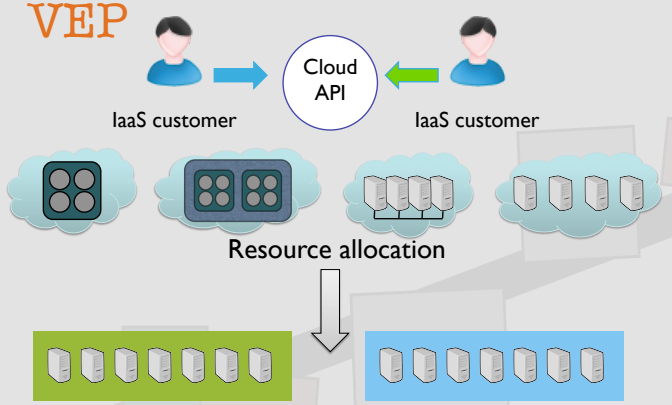
VM enabled selling computation:
app. configuration is on the user, +flexibility
HW management is on the owner, +security and availability

- The user buys IaaS : infrastructure is rented
- Flexibly sizeable → low initial cost to start up an ITC service
- Only the design and configuration *of the set of virtual resources supporting the application* are on the user
- HW investment easily exploited

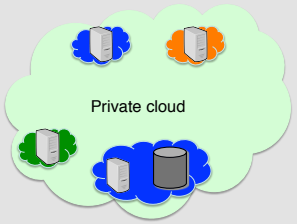
Virtual Execution Platform



Allocating resources to VEP



Private Cloud



- The user buys its own infrastructure (initial cost, planning issues)
- HW management is separated by application management
- Internal Elasticity
- Easier option to Cloudburst

Intermediate solution
Good for large users who have several independent sub-users working
Easier to reconfigure
Clod infrastructure eases merging in new resources

Classifying Clouds

App Model for Utility Computing

Amazon EC2	Windows Azure	Google AppEngine	*Something New*
Close to Physical Hardware	.NET and CLR... ASP.NET Support	App Specific Traditional Web App Model	???
User Controls Most of Stack	More Constraints on User Stack	Constrained Stateless/ Stateful Tiers	???
Hard to Auto Scale and Failover	Auto Provisioning of Stateless App	Auto Scaling and Auto High-Availability	???

Constraints on App Model Offer Tradeoffs... Lots of Ongoing Innovation...

← Lower-level, Less managed *"flexibility/portability"*

Higher-level, More managed *"more built-in functionality"* →

- Instruction Set VM (Amazon EC2, 3Tera)
- Managed runtime VM (Microsoft Azure)
- Framework VM (Google AppEngine, Force.com)

This Slide from Prof. Anthony D. Joseph

Contrail Objectives

- Design, implement, validate and promote an **open source software stack for cloud federations**
  - Develop a comprehensive Cloud **platform integrating a full IaaS and PaaS offer**
  - Allow Cloud providers to **seamlessly integrate resources from other Clouds** with their own infrastructure
  - Provide **trusted Clouds** by advanced SLA management
  - **Break the current customer lock-in** situation by allowing live application migration from one cloud to another

Integrated IaaS & PaaS in Open Source

PaaS

Scalability & dependable performance

Contrail: an open source technology for private, public clouds

Contrail IaaS

- Processor, network and storage virtualization
  - Virtual Execution Platform (VEP)
  - Virtual Infrastructure Network (VIN)
  - Global Autonomous File System (GAFS)
- Advanced resource allocation strategies for VEP

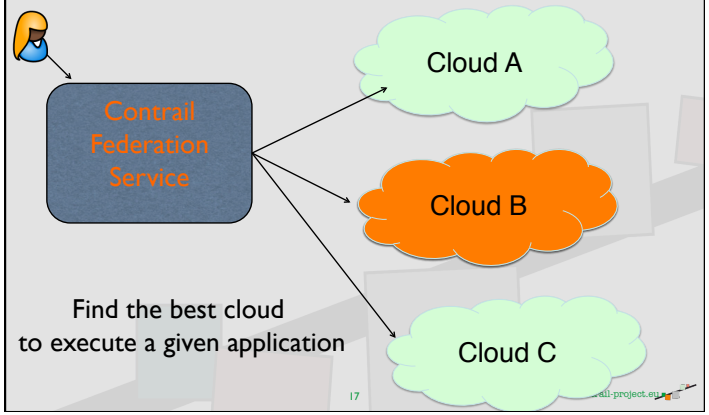
Contrail PaaS: ConPaaS

- Application runtimes
  - Elastic web services
  - Map/reduce
  - Bag of tasks
- Database as a Service
  - SQL & non SQL storage services based on Scalarix

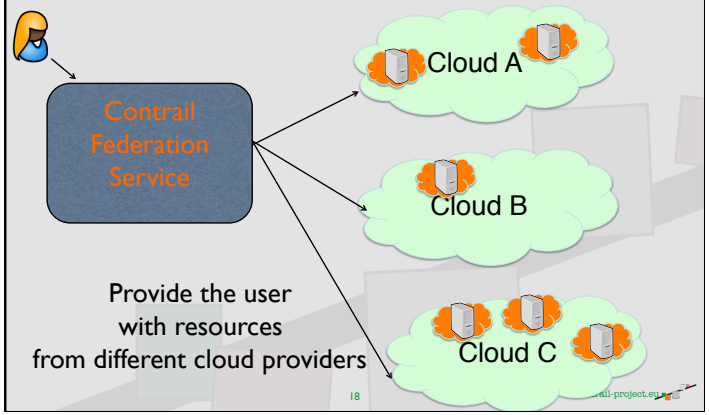
Cloud Federations

- Cloud federation for users
  - Cloud brokering
  - Cloud aggregation
- Cloud federation for providers
  - Cloud bursting

Cloud Brokering

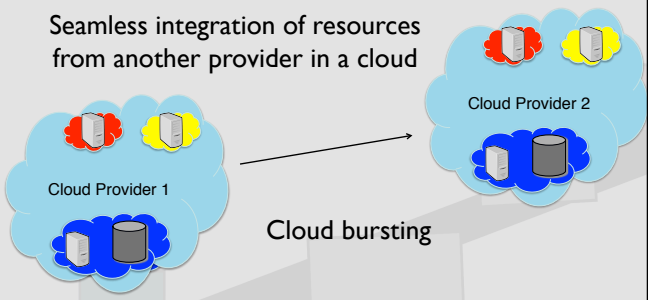


Cloud Aggregation



Cloud Federation for Cloud Providers

Seamless integration of resources from another provider in a cloud

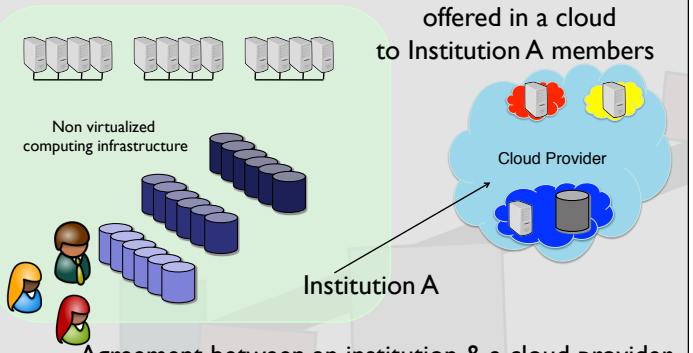


Cooperation over Clouds

- Resources, services shared by user communities using clouds as computing infrastructure
  - Members of an institution
    - Virtual data center
  - Members of a virtual organization
    - Grid computing over clouds

Virtual Data Center

IT infrastructure services offered in a cloud to Institution A members



Agreement between an institution & a cloud provider

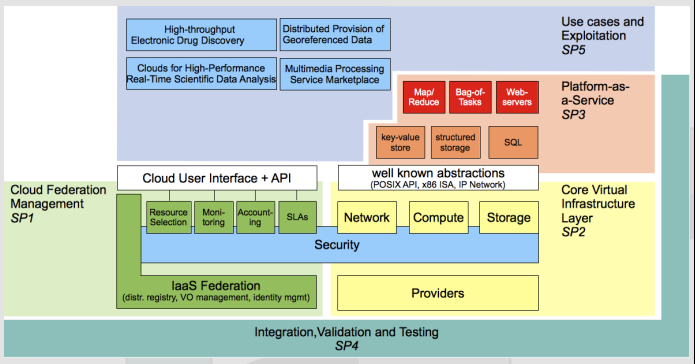
Contrail: Bringing Trust in Clouds

- Advanced SLA management
  - QoS enforcement, monitoring
- Quality of Protection
  - Data privacy, location
- Cloud security
- Dependable application execution on top of clouds and cloud federations

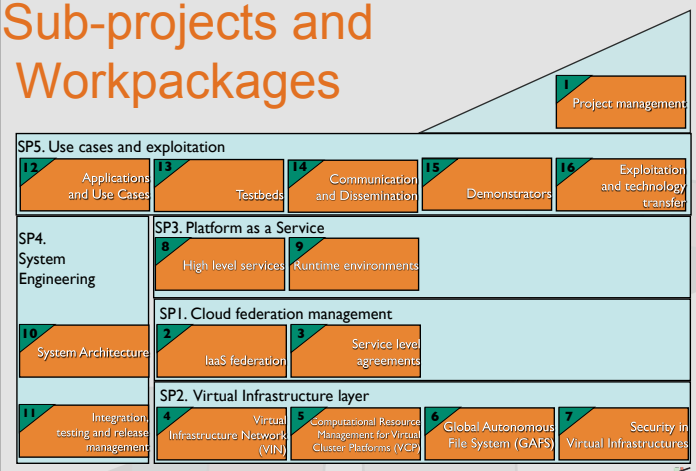
Contrail Software

- Leverage existing open source software
  - SLA@SOI – framework for SLA management
  - OpenNebula – IaaS
  - XtreemFS – wide-area distributed file system
  - Scalarix – scalable key value store
- Rely on cloud standards
  - Participate in standardization groups
- Interoperate with other cloud technologies
  - Federate Contrail & non Contrail clouds

Contrail in a Nutshell

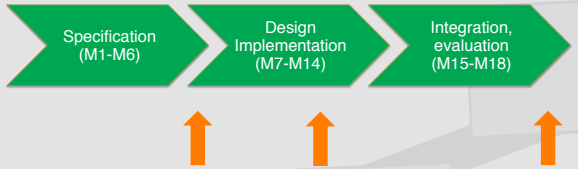


Sub-projects and Workpackages



Project Timeline

2 cycles: **basic** & advanced features



M10-milestone
First GA/SAB Meeting

First release

Project Timeline

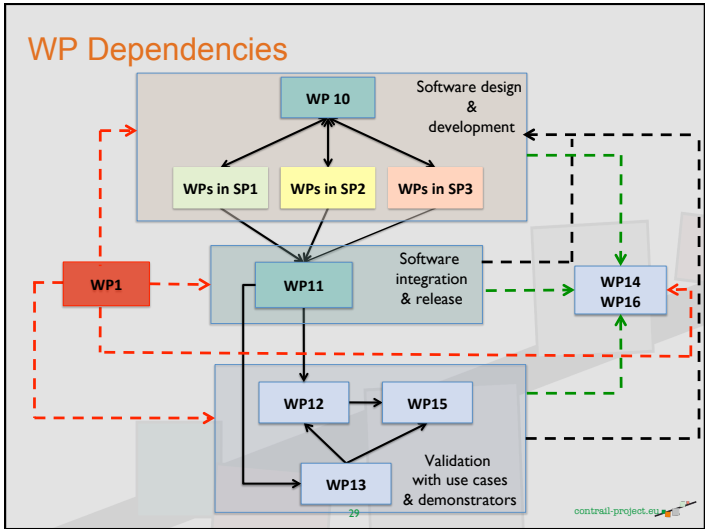
2 cycles: basic & **advanced** features

Second major release

contrail
open computing infrastructures for elastic services

contrail is co-funded by the EC 7th Framework Programme

Funded under: FP7 (Seventh Framework Programme)
Area: Internet of Services, Software & virtualization (ICT-2009.1.2)
Project reference: 257438
Total cost: 11,29 million euro
EU contribution: 8,3 million euro
Execution: From 2010-10-01 till 2013-09-30
Duration: 36 months
Contract type: Collaborative project (generic)


WP Dependencies
WP 10
Software design & development
WPs in SP1
WPs in SP2
WPs in SP3
WP1
WP11
Software integration & release
WP14
WP16
WP12
WP15
WP13
Validation with use cases & demonstrators
29
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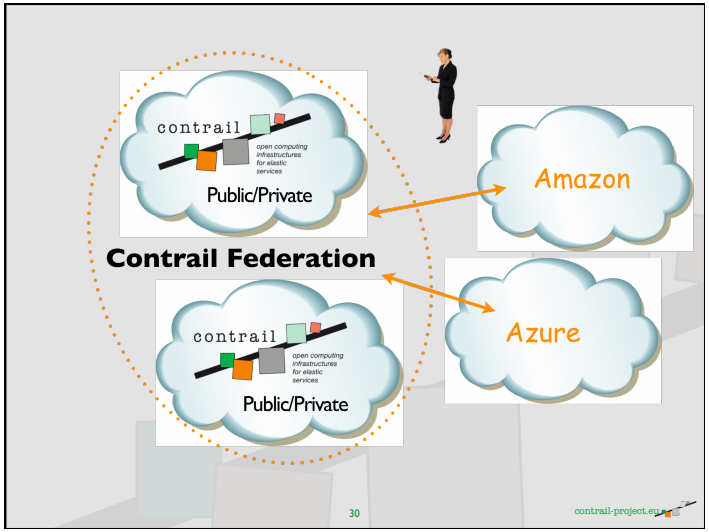
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