Sky Computing

Challenges, Large-Scale Experiments and Research Directions

Pierre Riteau
Université de Rennes 1, IRISA
INRIA Rennes – Bretagne Atlantique
Rennes, France

Outline

- Introduction
- Problems and Challenges
- Large-Scale Experiments
- Network-Transparent Live Migration
- Conclusion

INTRODUCTION

Cloud Computing

- No single definition of cloud computing…
- Hosted resources
- Features
  - Elastic resources (request more at any time)
  - Pay As You Go model
- Multiple abstractions: IaaS, PaaS, SaaS
- Technical points:
  - Strong usage of virtualization for IaaS

Infrastructure-as-a-Service

- Features
  - Create VM from image
  - Modify + save image
  - Terminate VM
- Big player: Amazon EC2
- Business model
  - Pay for CPU time + network data in/out
- Open source IaaS toolkits

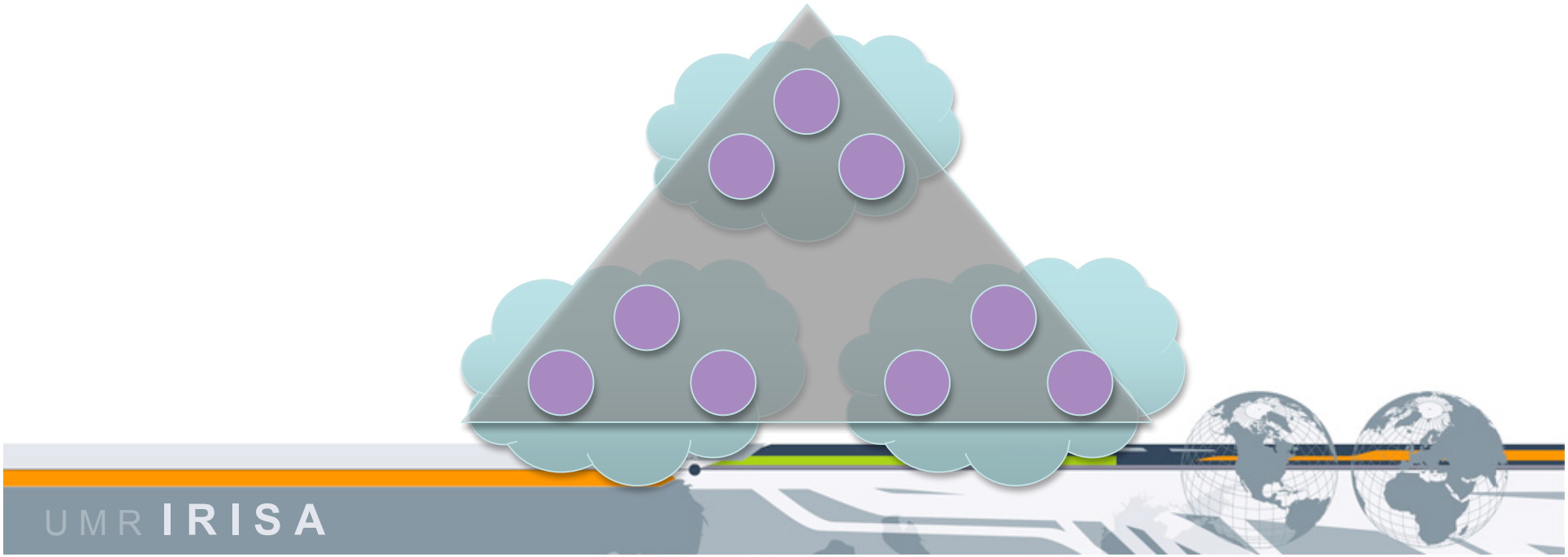
NIMBUS

Eucalyptus

OpenNebula

Sky Computing

- Federation of multiple clouds
- Creates large scale infrastructures
- Allows to run software requiring large computational power



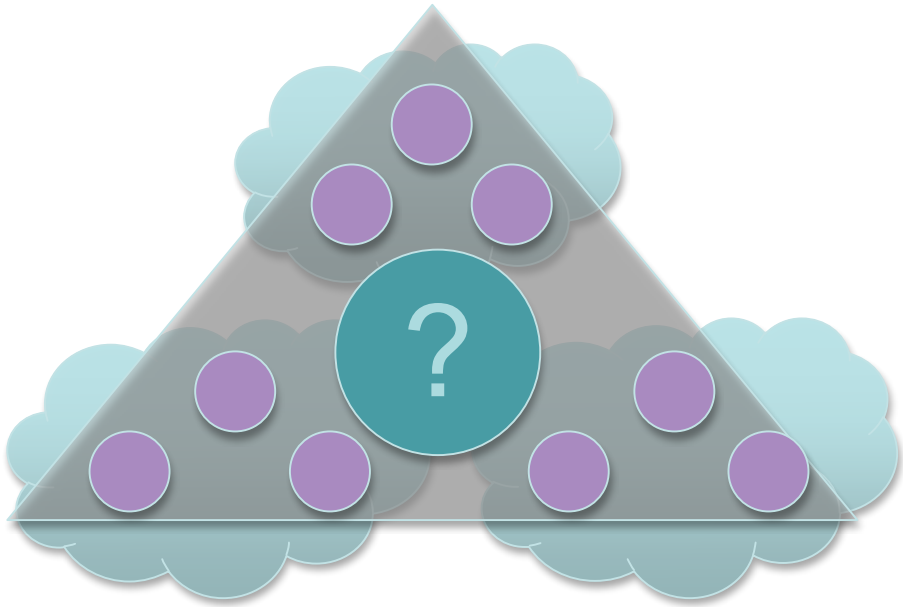
Sky Computing Benefits

- Single networking context
  - All-to-all connectivity
- Single security context
  - Trust between all entities
- Equivalent to local cluster
  - Compatible with legacy code

PROBLEMS AND CHALLENGES

Problem

- How to build a system that creates such infrastructures in an **efficient** way?

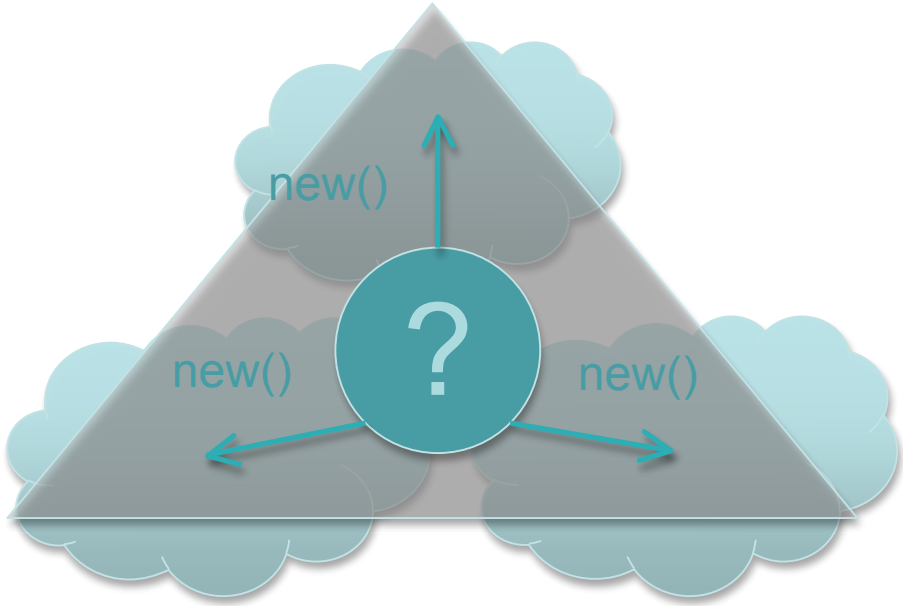


Challenges

- Inter-cloud resource creation & management
- Efficient inter-cloud communication
- Efficient distribution of tasks
- Fault-tolerance
- Adaptability to resource dynamicity

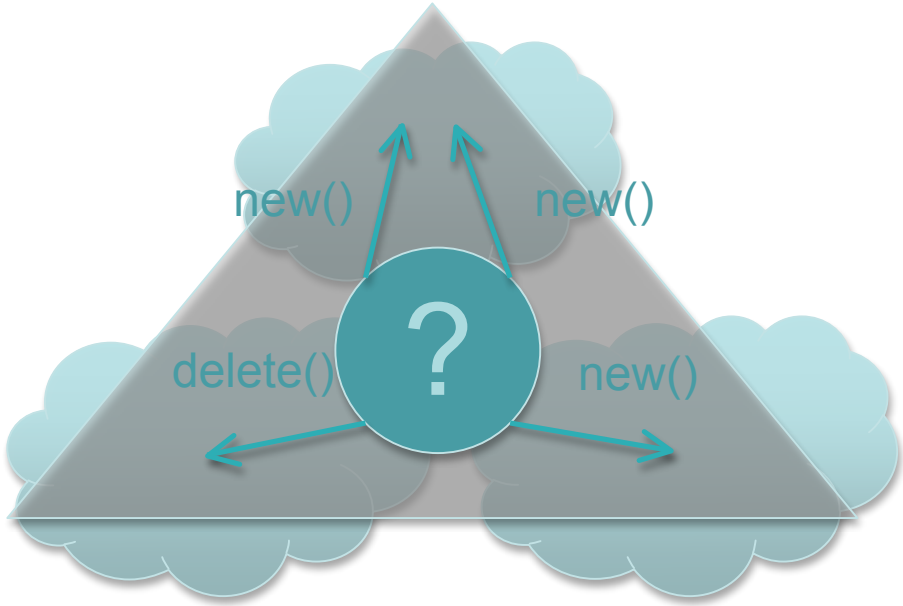
Inter-cloud resource creation & management (1/3)

- Virtual machine provisioning
  - Basic step when creating a Sky Computing infrastructure…



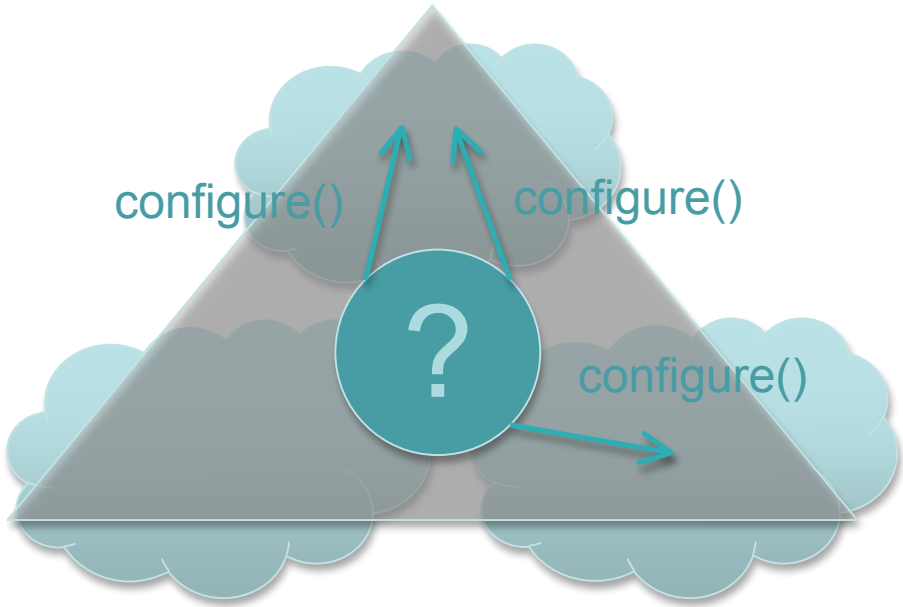
Inter-cloud resource creation & management (2/3)

- … but also useful later!
  - Application resource requests
  - Load-balancing



Inter-cloud resource creation & management (3/3)

- Contextualization
  - Each VM has a specific role in the environment
  - Apply configuration to the VM to adapt it to its role



Cloud Standards

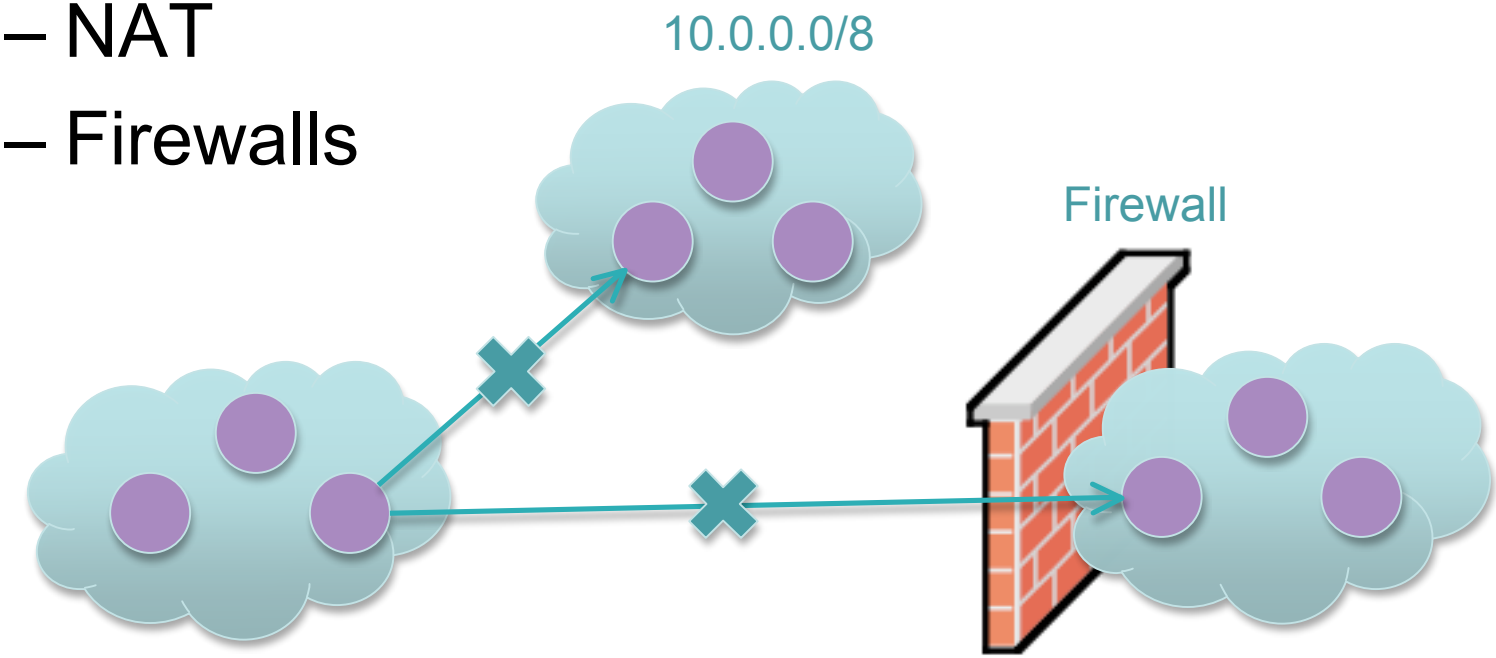
- OCCI
  - Provisioning & monitoring of virtual infrastructures
- OVF
  - VM image format specification
- CDMI
  - Data access & management

De-facto Cloud Standards

- Resource management: EC2 interface
  - Nimbus, Eucalyptus, OpenNebula
- Data management: S3 interface
  - Nimbus (Cumulus), Eucalyptus (Walrus)
- Image format: raw partitions/disks… ☹

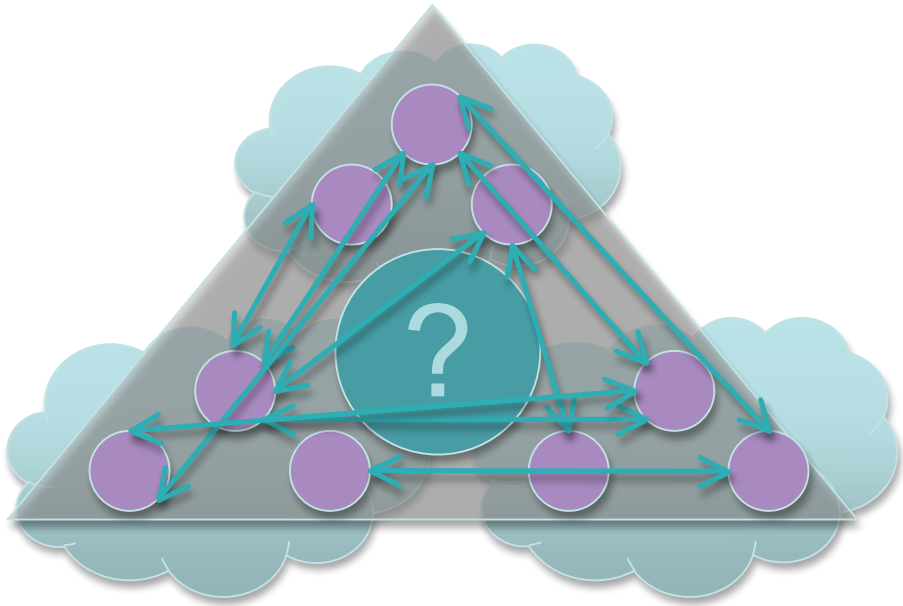
Inter-cloud connectivity

- Connectivity problems when using
  - private IPs
  - NAT
  - Firewalls



Efficient inter-cloud communication

- Allow all-to-all communication
- With minimal performance overhead



Efficient distribution of tasks

- How to distribute work to virtual nodes?