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Research Challenges in Cloud Infrastructures to Provision Virtualized Resources

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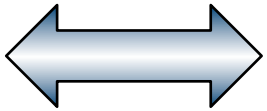
Comparing RESERVOIR with Amazon EC2

Research Challenges in Cloud Infrastructures to Provision Virtualized Resources

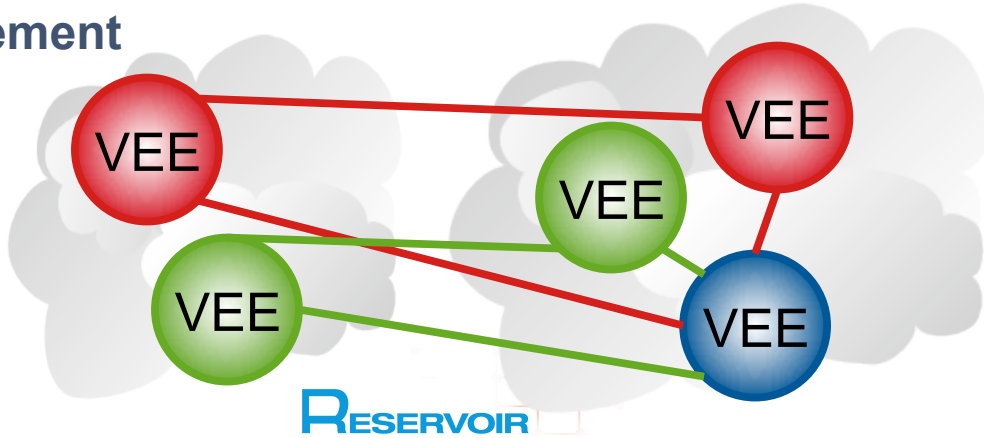
Amazon Elastic Computing Cloud

- **Service** that offers **virtualized server (VM)** instances within **Amazon's proprietary infrastructure**
- **Functionality for VM Management**
  - Definition
  - Lifecycle
  - Billing/accounting



Resources and Services Virtualization without Barrier

- **Open source technology** to enable deployment and management of **complex IT services** across **different administrative domains**
- **Functionality for Service Management**
  - Definition
  - Lifecycle
  - Billing/accounting
  - Elasticity/SLAs



RESERVOIR is not only about Cloud Infrastructure

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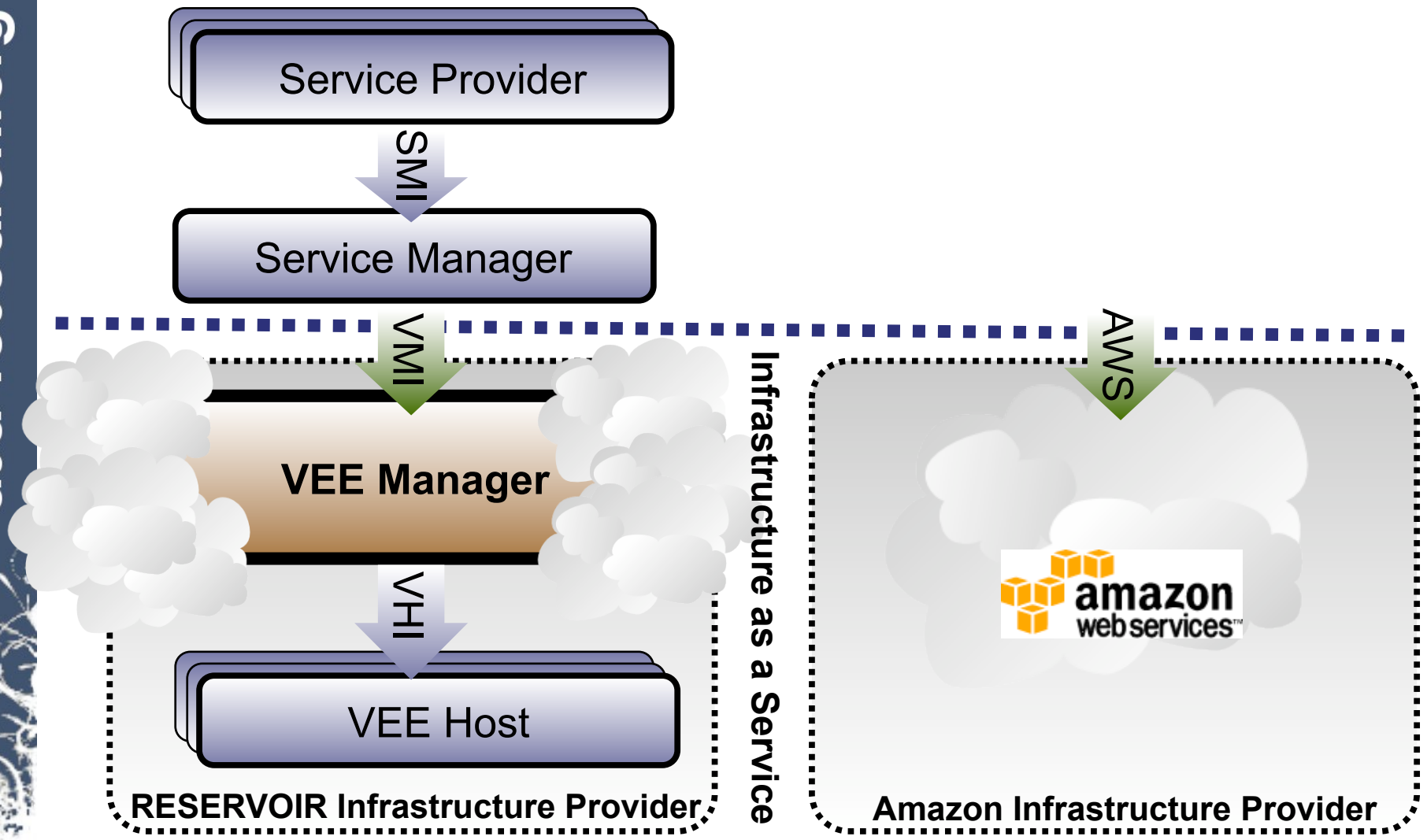
VEE Manager as Cloud Infrastructure Layer



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RESERVOIR Research in Cloud Infrastructures

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VEEM as Open Engine for the Infrastructure Provider

- Allowing any organization to **build its own local cloud infrastructure**, and additionally to offer infrastructure as a service
- Supporting the **definition of open standards for cloud computing**, to break the lock-in imposed by vendors today

Research in Dynamic and Scalable Management of VMs

- Management of services (**groups of VMs**) with inter-connection relationship and placement constraints within and across sites
- **Dynamic and scalable management of VMs** and physical resources and **elasticity support** to meet variations in service workload
- **Advanced placement algorithms** with policies for SLA commitment…
- Architectures for **federation of sites and** heuristics for **capacity provision across infrastructure sites**
- **New Cloud interface** exposing advanced functionality

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Research Challenges List for Future Internet

Research Challenges in Cloud Infrastructures to Provision Virtualized Resources

Topics for Further Research

Applications of Cloud Computing

- **Performance and reliability** running scientific and business applications in Clouds
- **Content distribution** systems using Clouds
- **Grid, HPC and data-intensive computing** in Clouds

Technologies to Enable Cloud Computing

- **New architectures** for Cloud infrastructures
- **Cloud interfaces, programming models and tools**
- **Integration with infrastructures** for Grid Computing
- **SLA, privacy, security and pricing**
- **Management of network capacity**
- Heuristics for **energy efficiency** and **high availability**
- **Advance reservation of capacity**
- **Integration with "standard" management tools**

Federation of Cloud Providers

- **Interoperability and portability** between Cloud providers
- **Open business policies framework** for infrastructure providers relationship management
- Higher value **self-awareness, self-knowledge, and self-management capabilities**

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You can create now your local cloud infrastructure

OpenNebula VM Manager 1.2 Beta (VEEM core) incorporating enhancements by RESERVOIR is available for download

More info, downloads, mailing lists at www.OpenNebula.org

RESERVOIR

www.reservoir-fp7.eu/

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Grid and Cloud are Complementary

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Grid is a Technology for Interoperability

- Grid technology enables the **integration, virtualization, and management of services and resources in a distributed, heterogeneous environment**
- Cloud offerings should **take advantage of the research and development conducted by the grid community**:
  - Adoption of standard grid interfaces and functionality for federation
  - Components for SLAs, accounting, billing…

Compute Grid Infrastructures (EGEE, TeraGrid…)

- Compute Grid infrastructures use Grid technology to **federate computing resources** spanning multiple sites for job execution and data processing
- As any service infrastructure, a Grid site could run on virtualized resources running in Clouds => **Solve obstacles to adoption**

My Vision

- Cloud and Grid are **complementary technologies** and will coexist and cooperate at different levels of abstraction in future IT infrastructures