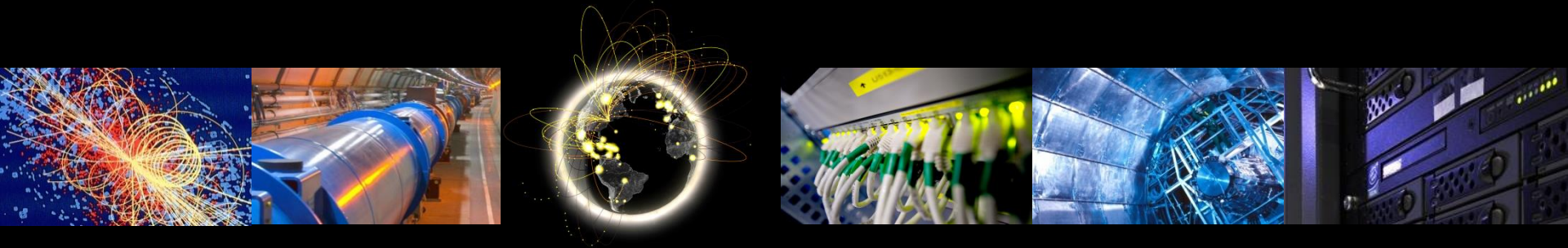# Resource Provisioning Overview

Laurence Field
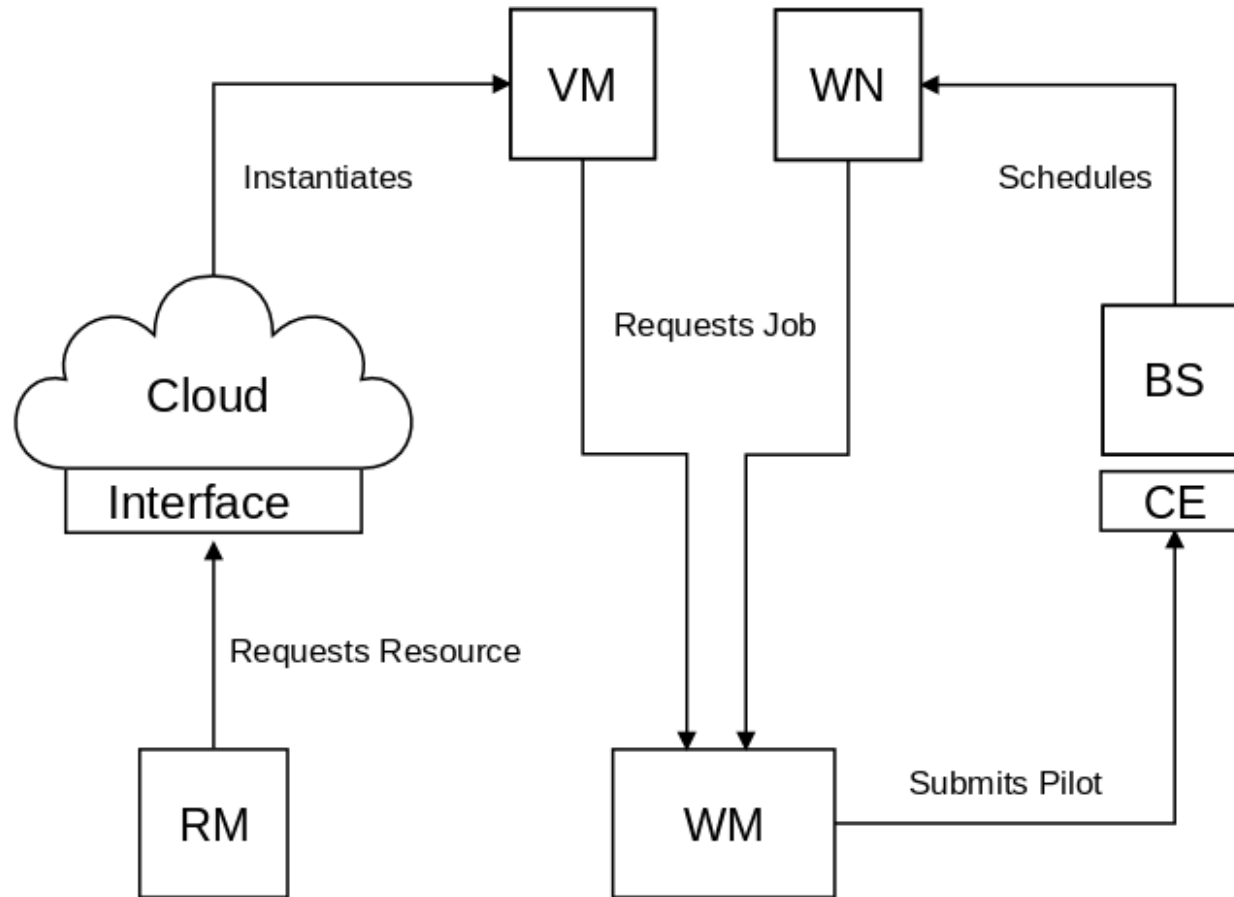
12 April 2015

Overview

- Architectural Model
  - Focus Areas
  - Resource Groups
- Area Details
- Commercial Cloud Activities

From Pilot Jobs to Pilot VMs

Focus Areas

- Image Management

- Capacity Management

- Monitoring

- Accounting

- Pilot Job Framework

- Data Access and Networking

- Quota Management

- Supporting Services

Resource Groups

- WLCG Tier 0/1/2
- HLT Farms
- Commercial Providers
- Volunteer Computing
- HPC

- Parameter space contains 160 possibilities
  - 5 resource groups, 8 areas, 4 VOs
  - Need consolidation of solutions
- The cloud paradigm
  - The adoption of generic solutions
    - Reducing our total cost of ownership

Image Management

- Image provides the job environment
  - PilotJob
    - Pilot VMs
  - Software
    - CVMFS
- Contextualization
  - Balance pre- and post-instantiation operations
    - Simple or Complex
    - Frequency of Updates
    - Data Transferred
- Transient
  - No updates of running machines
    - Destroy (gracefully) and create new instance

CernVM

- The OS via CVMFS
  - HTTP replication of a reference file system
    - Stratum 0
- Why?
  - Because CVMFS is already a requirement
    - Reduces the overhead of distributed image management
      - Manage version control centrally
- CernVM as a common requirement
  - Parameter space reduction
    - 20 possibilities => 1 CernVM
      - 5 resource groups, 4 VOs
    - Availability becomes an infrastructure issue
  - Potentially 20 different contextualizations
    - Responsibility of the VO
- The goal is to start a CernVM-based instance
  - There are exceptions where this is not possible

Capacity Management

- Pilot Jobs => Pilot VMs
- Ensure there are enough resources (capacity)
  - Scale Up/Down
    - Managing the VM life cycle isn't the focus
- Requires a specific component with some intelligence
  - Do I need to start of VM and if so where?
  - Do I need to stop a VM and if so where?
  - Are the VMs that I started OK?
    - Detection of the not ok state maybe non-trivial
- Existing solutions focus on deploying applications in the cloud
  - Difference components, one cloud
  - May not be appropriate for the resource group
  - May manage load balancing and failover
    - Is this a load balancing problem?
  - One configuration, many places, enough instances?

Vacuum Model

- Pilot VMs appear spontaneously out of the vacuum
  - Robust generic approach
    - Can choose whether or not to use the resource
- Pilot Job framework parameter space reduction
  - 20 possibilities => 4 approaches
    - 1 per experiment

- Stimulating resources via framework
  - Optimization
  - Adds complexity
  - Requires additional communication
    - No parameter space reduction

- Area for discussion

Monitoring

- Fabric management
  - The responsibility of the Capacity Manager
  - Basic monitoring is required
- The objective is to triage the machines
  - Invoke a restart operation if it not ok
    - Detection of the not ok state maybe non-trivial
- Other metrics may be of interest
- Spotting dark resources
  - Deployed but not usable
- Can help to identify issues in other systems
  - Discovering inconsistent information through cross-checks
- A common requirement for all
  - Potential for 20 => 1 parameter space reduction
- Jobs monitoring is VO specific
  - Should be no difference with Grid jobs

Provider Accounting

- Commercial suppliers send invoices
  - They have their own (proprietary) accounting systems
- WLCG sites are suppliers
  - Cloud accounting generates monthly "invoices"
    - We trust sites and hence their invoices
- Need to method to record usage
  - To cross-check invoices
  - Detect issues and inefficiencies
- No abstraction of job concept in IaaS layer
  - Job activities are in the domain of the VO
- A job is the VOs measurement of work done
  - i.e. value for money

Consumer Accounting

- Monitoring and recording resource usage
  - What, where, when for VM resources
    - And whatever else is billed for
  - Course granularity acceptable
- Report generation
  - Mirror invoices
    - Use same metrics as the invoice
- Needs a uniform approach for all the VOs
  - Require 20 => 1 parameter space reduction
  - Provide the same information to the budget holder
- Job information is not considered
  - But could potentially be repurposed
- Both monitoring and job information could be used
  - An area for discussion

WLCG
Worldwide LHC Computing Grid

Other Considerations

- Data access and networking
  - Have so far focus on non-data intensive workloads
- Quota Management
  - Currently mostly fixed limits
    - Leading the partitioning of resources between VOs
      - How can the sharing of resources be implemented?
- Supporting Services
  - What else is required?
  - Eg squid caches in the provider
  - How are these managed and by who?
- Non-Virtualized approaches
  - Instantiation of a pilot job
    - Without CE

Commercial Clouds

- **Helix Nebula**
  - A public-private partnership
    - Between research organizations and IT industry
- **Microsoft Azure Pilot**
  - Preliminary discussions with CERN OpenLab
- **Amazon**
  - BNL RACF for ATLAS and CMS
  - With new Scientific Computing group at AWS
- **Deutsche Börse Cloud Exchange AG**
  - Beta testing platform
  - Will go live beginning of May
- **PICSE**
  - Procurement Innovation for Cloud Services in Europe
- **European Science Cloud Pilot**
  - Pre-Commercial Procurement (PCP) proposal
    - Buyers group public organizations that are members of the WLCG collaboration

Next Steps

- **Define and publish contextualizations**
  - For each VO
    - For the different resource groups
- **WLCG Resource Accounting**
  - No significant capacity from Tier 1/2 sites without it
- **Commercial Resources**
  - Have gained experience for a number of initiatives
  - Who pays?
    - No significant capacity without a budget
  - Need to be ready to integrate commercial resources
- **Capacity Management**
  - Multiple solutions
    - Continue to experiment
  - Consolidate

Summary

- Resources in many places
  - Not just traditional Tier 0/1/2 sites
- Common approaches
  - To avoid an explosions in our parameter space
- The vacuum model as the generic approach
  - Centered around contextualizing a CernVM
    - To run a pilot job
- Have to consider specializations
  - Commercial clouds
  - Volunteer Computing
  - HPC
- But keep just the special bits special
  - And have common things everywhere else