vgES Demonstrations

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VGrADS Site Visit

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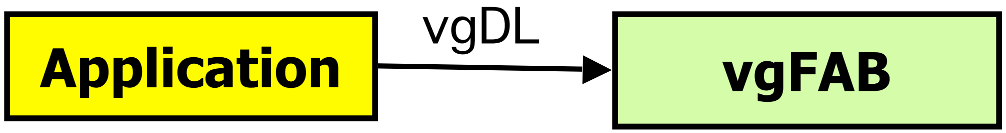
VGrADS
Virtual Grid Application Development Software Project

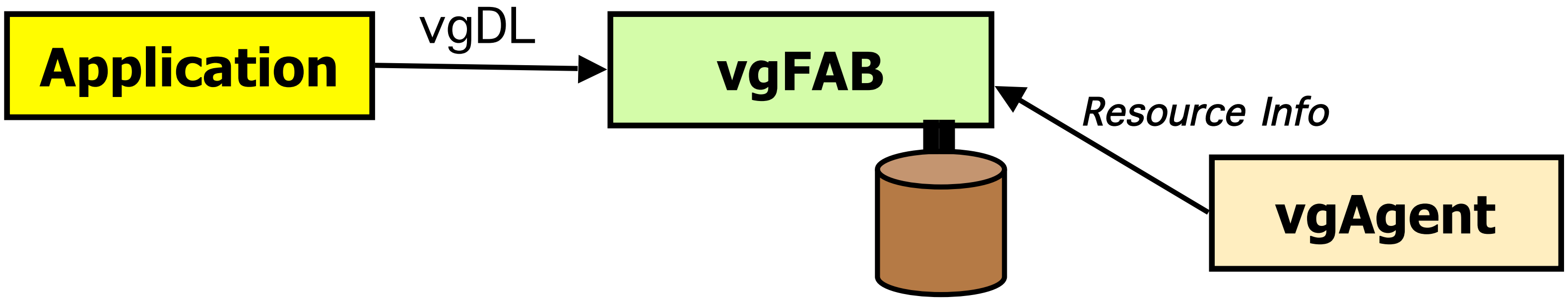
vgES: Prototype Research Infrastructure

- We have developed a functional prototype of vgES
  - vgES 0.7, March 2005
- Two demonstrations:
  - vgFAB: Finding and Selecting Resources
  - vgES: Full application run on the VGrADS testbed

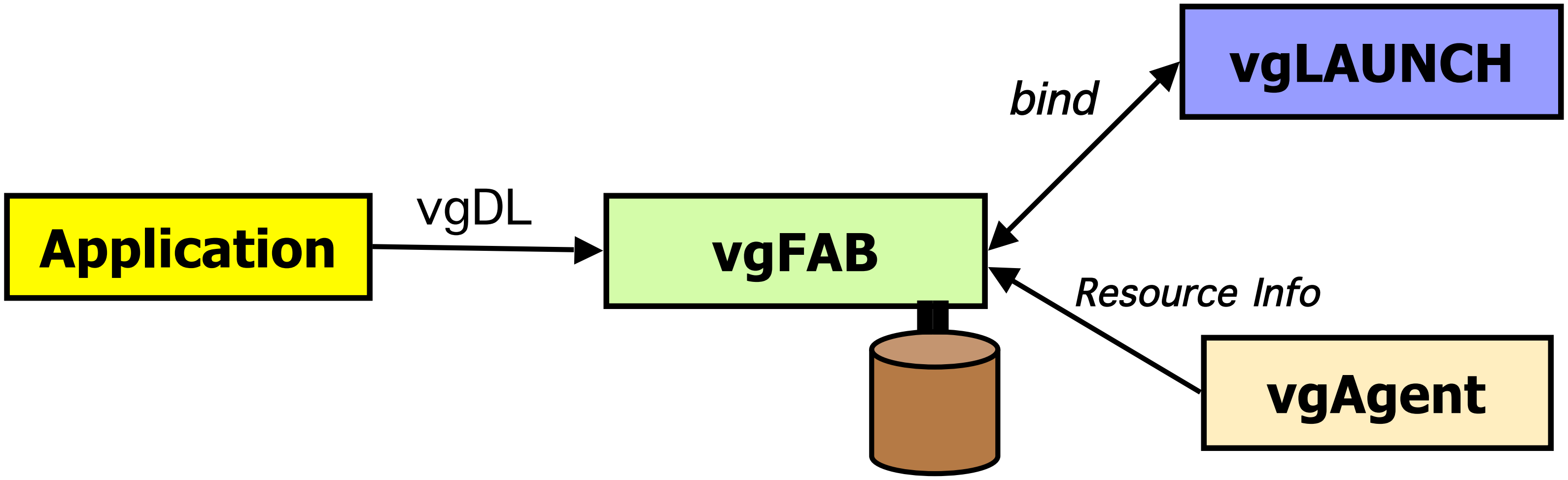
The vgES Research Prototype



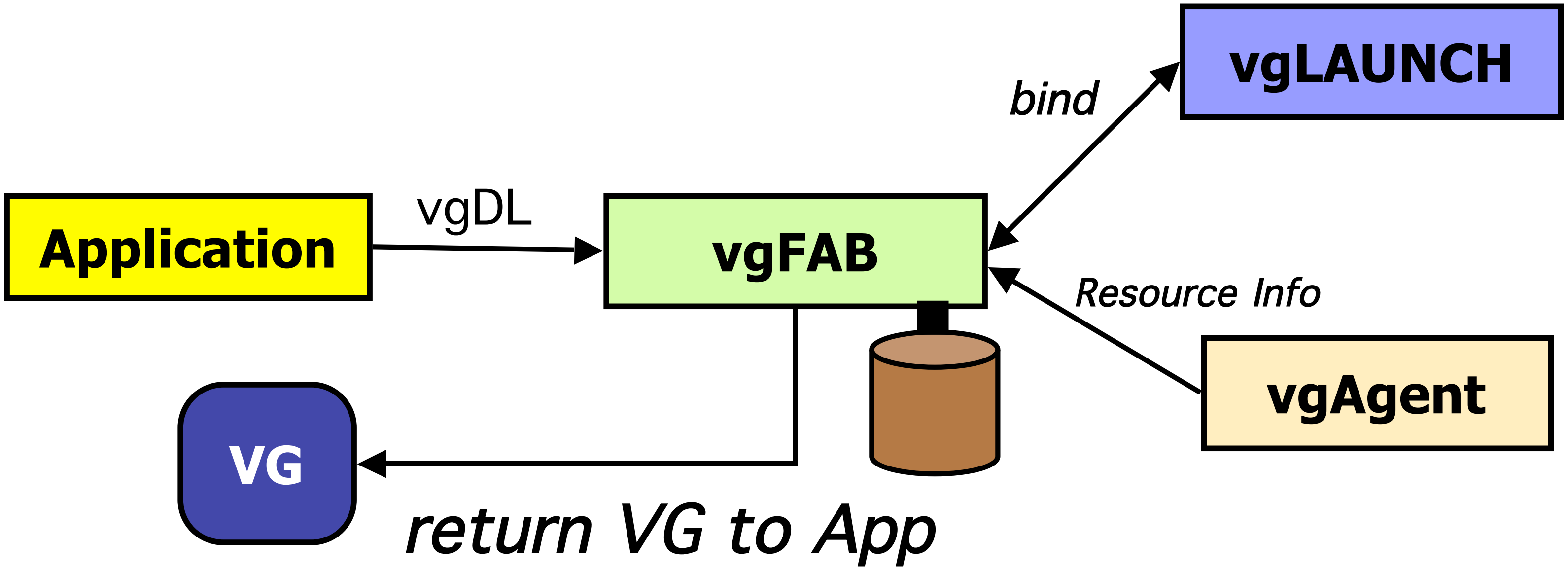
The vgES Research Prototype



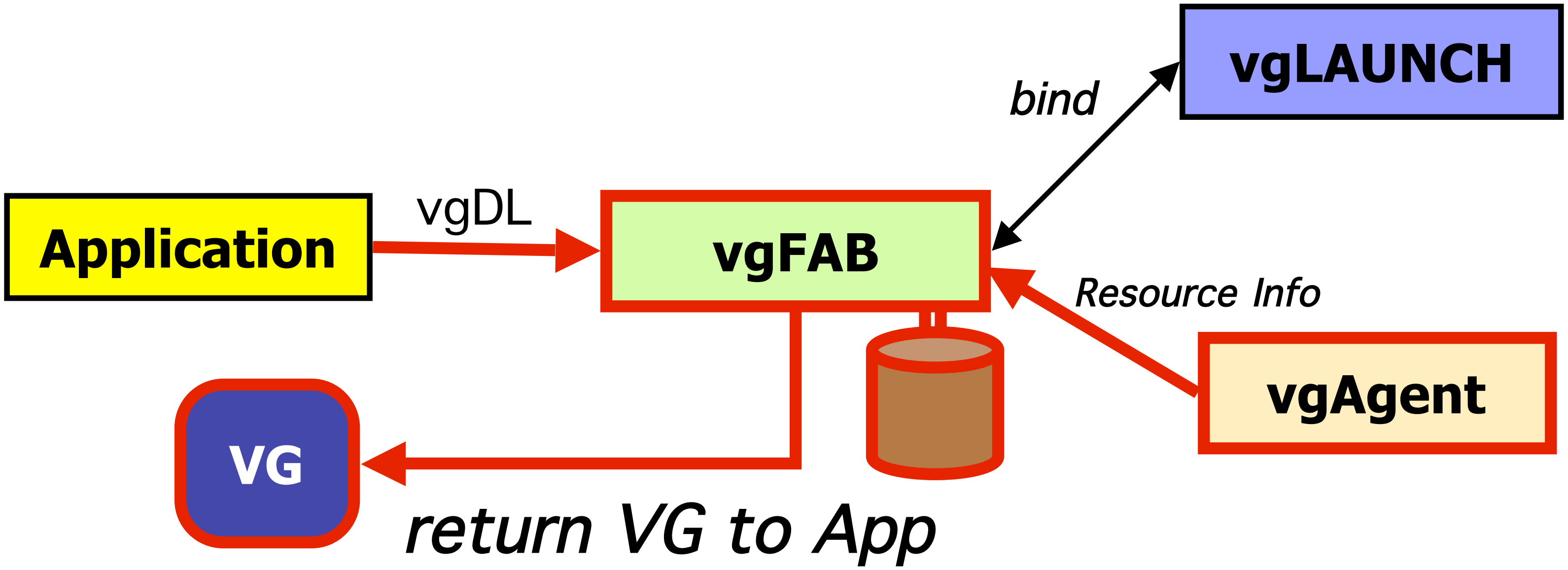
The vgES Research Prototype



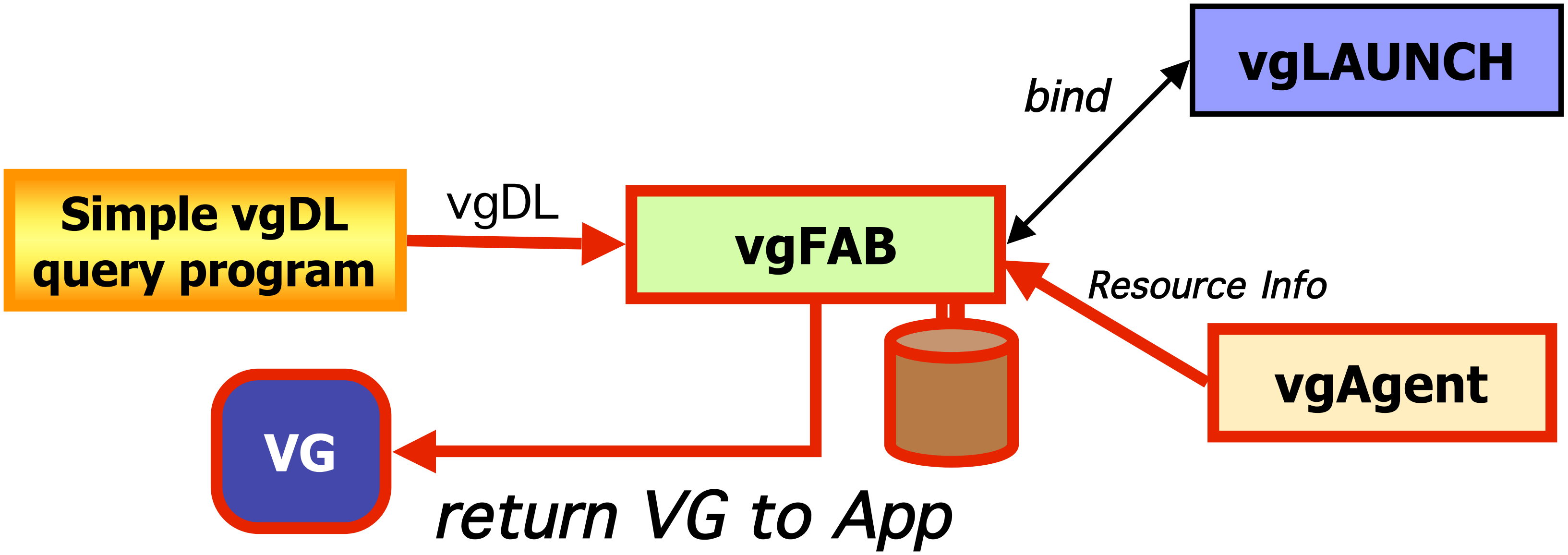
The vgES Research Prototype



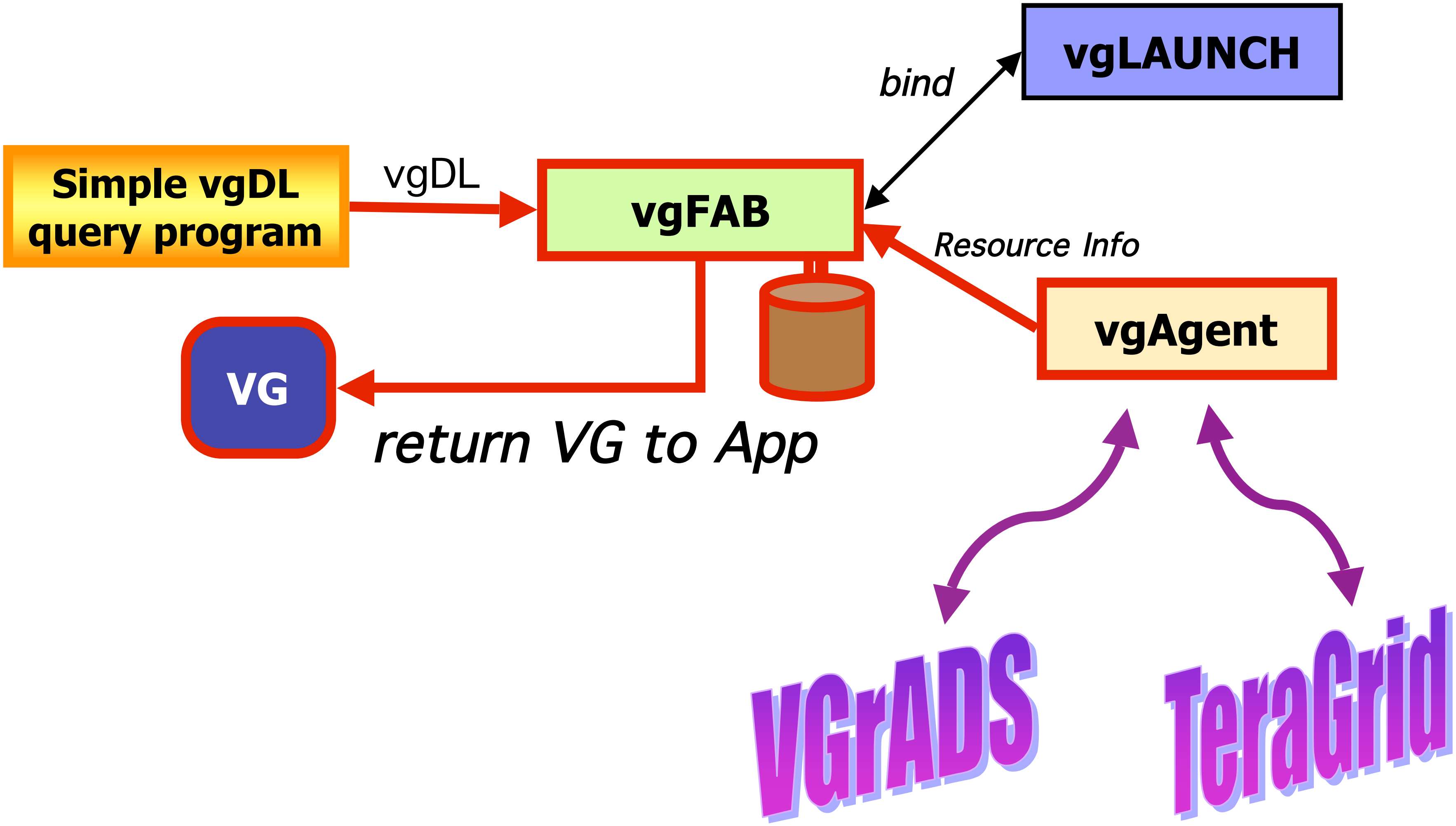
Demonstration #1: vgFAB



Demonstration #1: vgFAB



Demonstration #1: vgFAB



Simple vgDL query program

vgDL

vgFAB

bind

vgLAUNCH

Resource Info

vgAgent

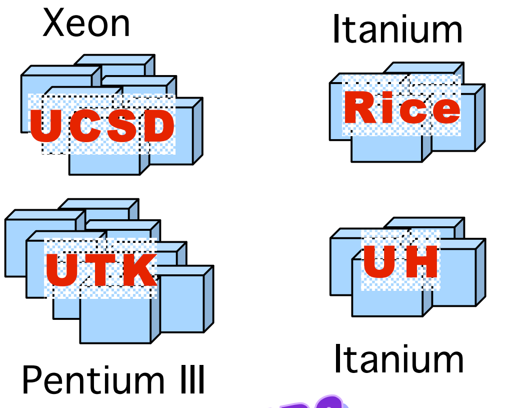
VG

return VG to App

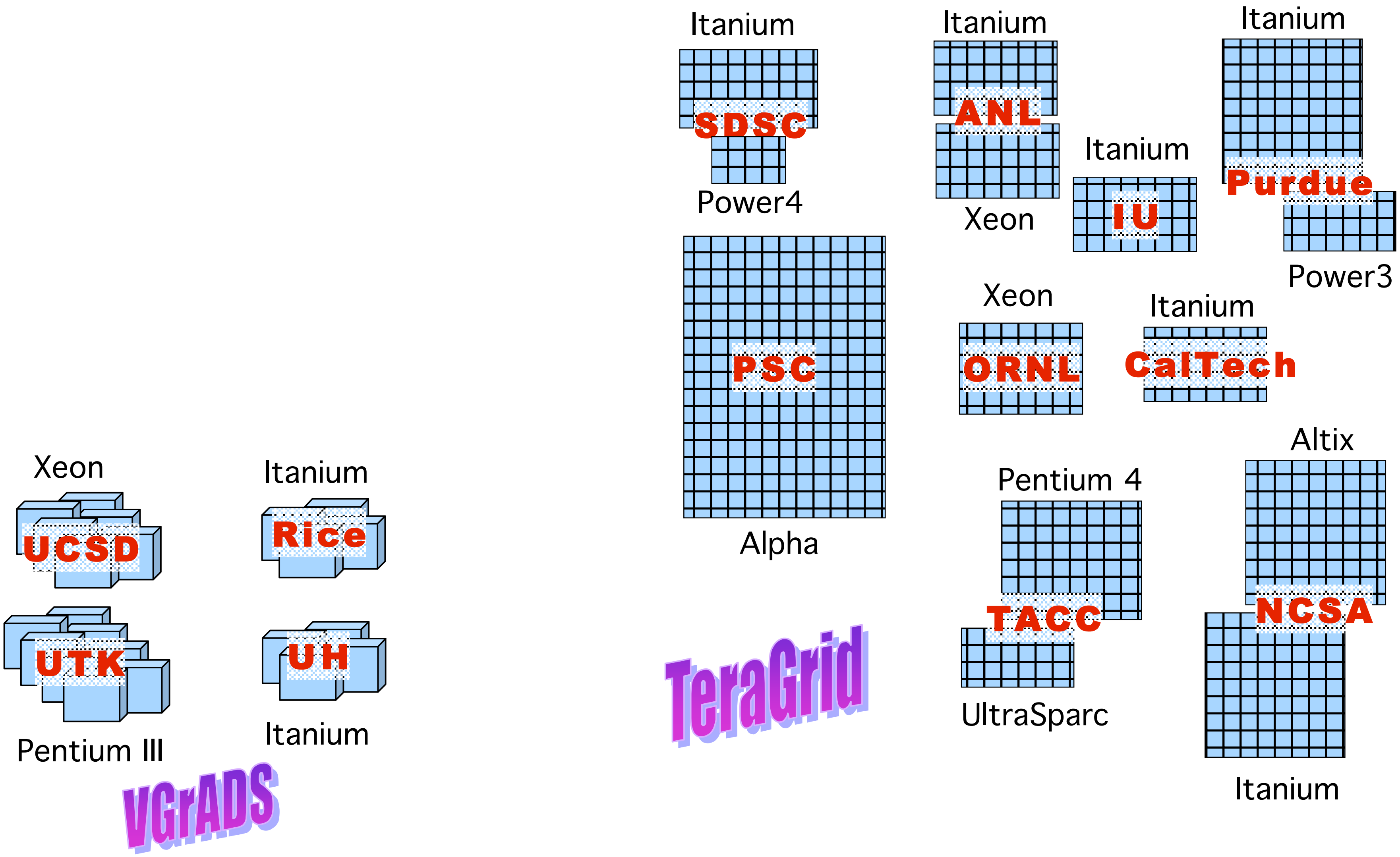
VGrADS

TeraGrid

VGrADS and TeraGrid Resources

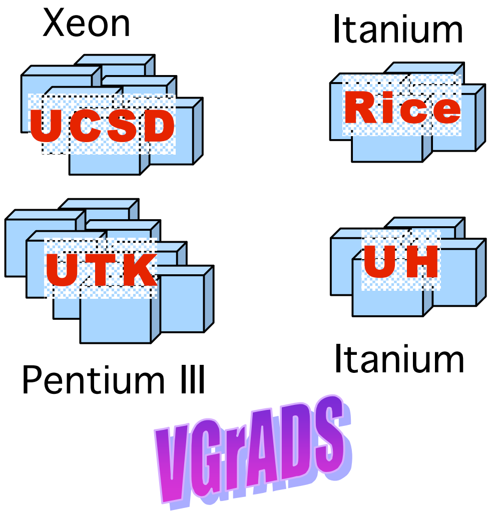


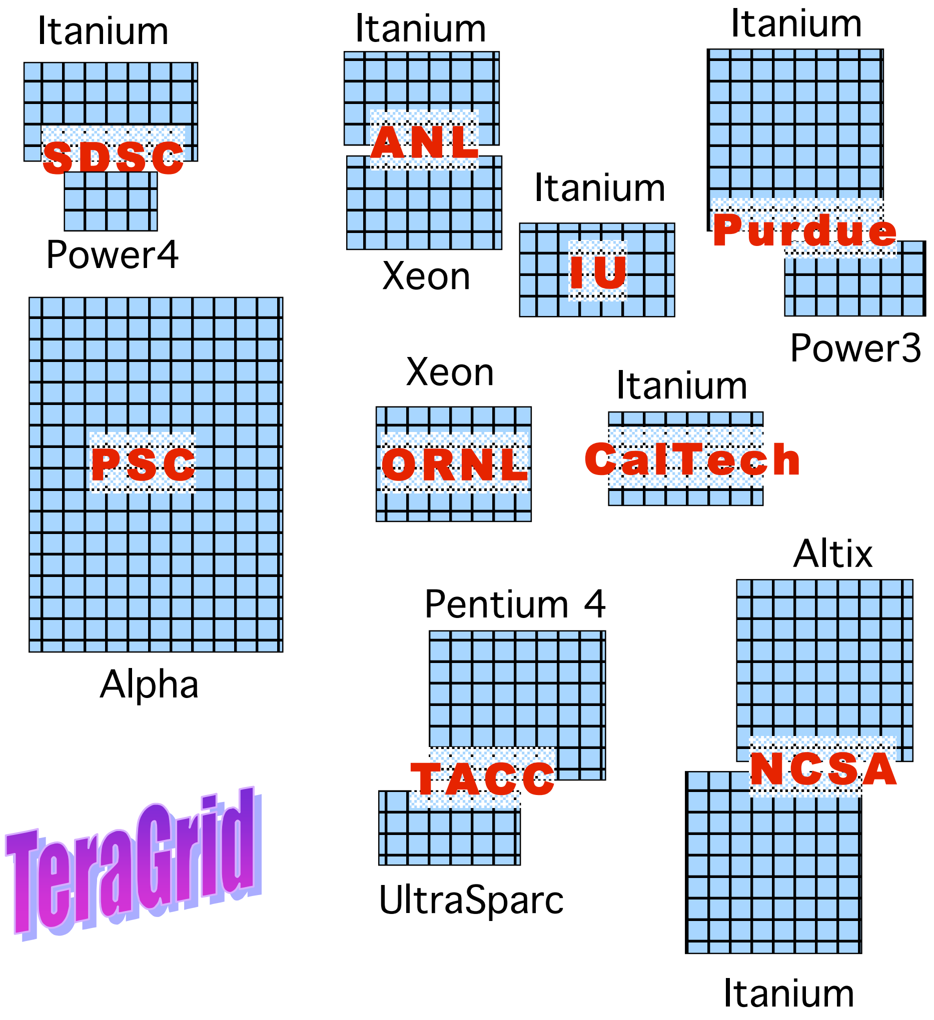
VGrADS and TeraGrid Resources



A simple vgDL query

```
VG1 = ClusterOf(node) [4:64]
   {
       node =[
           (Processor == Xeon) &&
           (Clock >= 1000) &&
           (Memory >= 1000)
       ]
   }
```





Switch to live demo

A simple vgDL query

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VG1 = ClusterOf(node) [4:64]
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       node =[
           (Processor == Xeon) &&
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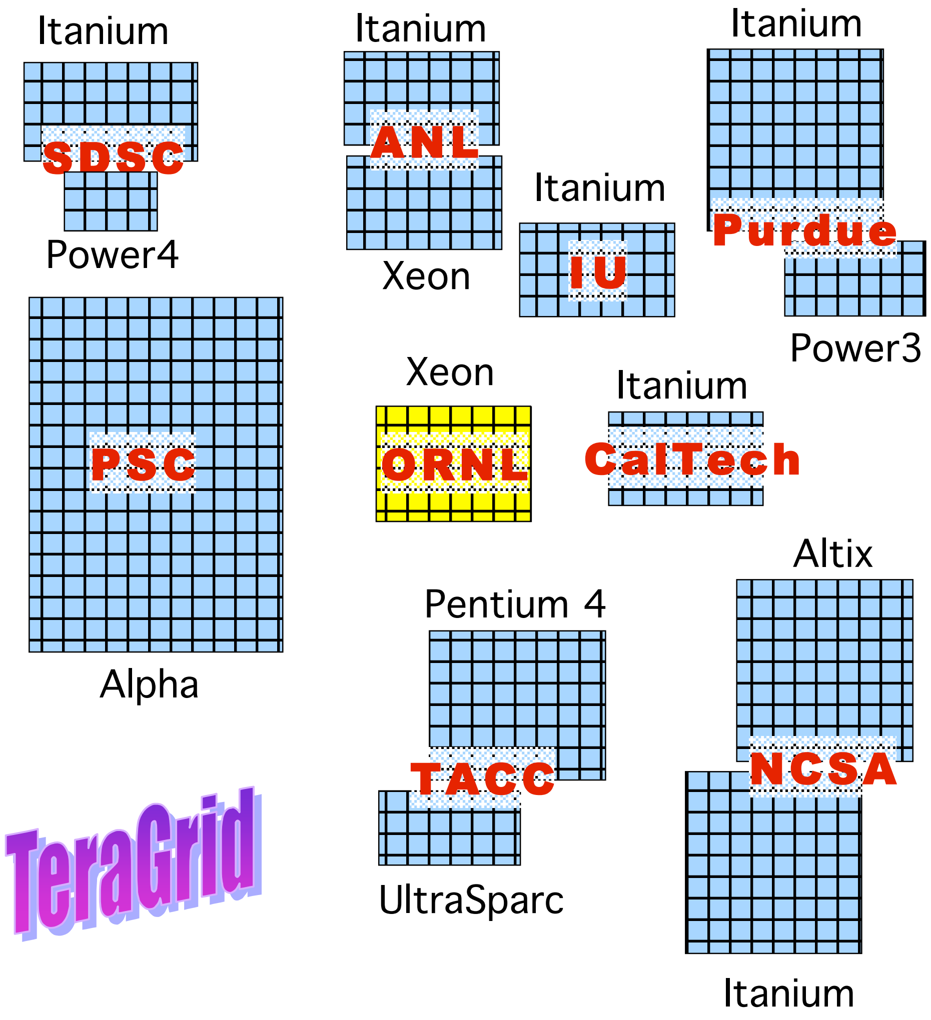
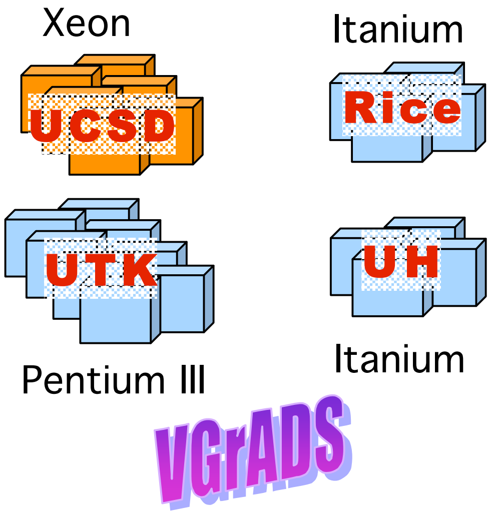
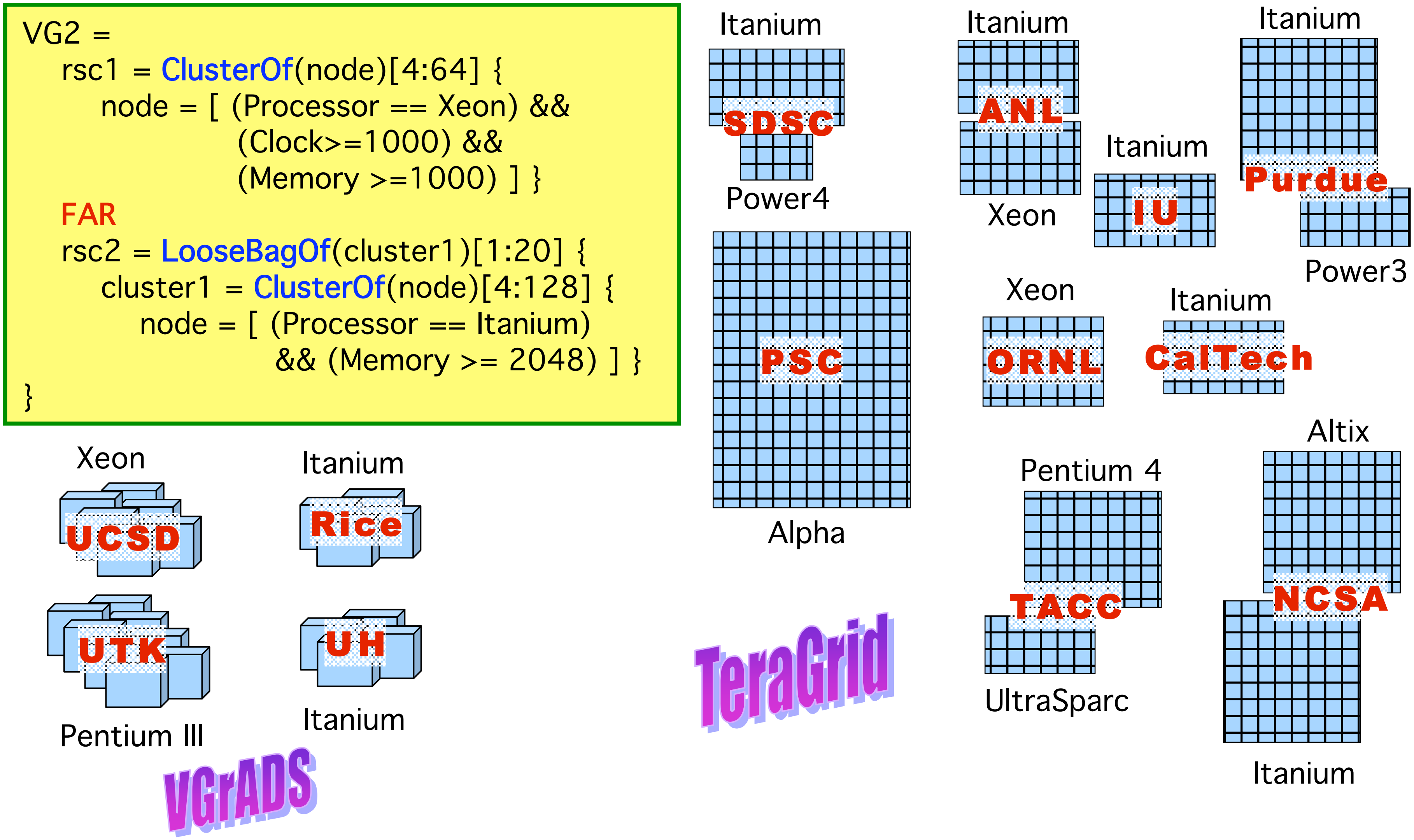
       ]
   }
```





A more complex vgDL query

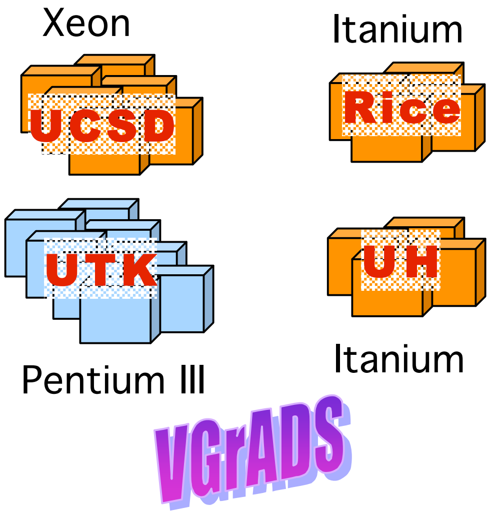
```
VG2 =
    rsc1 = ClusterOf(node)[4:64] {
        node = [ (Processor == Xeon) &&
                     (Clock>=1000) &&
                     (Memory >=1000) ] }
    FAR
    rsc2 = LooseBagOf(cluster1)[1:20] {
        cluster1 = ClusterOf(node)[4:128] {
            node = [ (Processor == Itanium)
                         && (Memory >= 2048) ] }
}
```

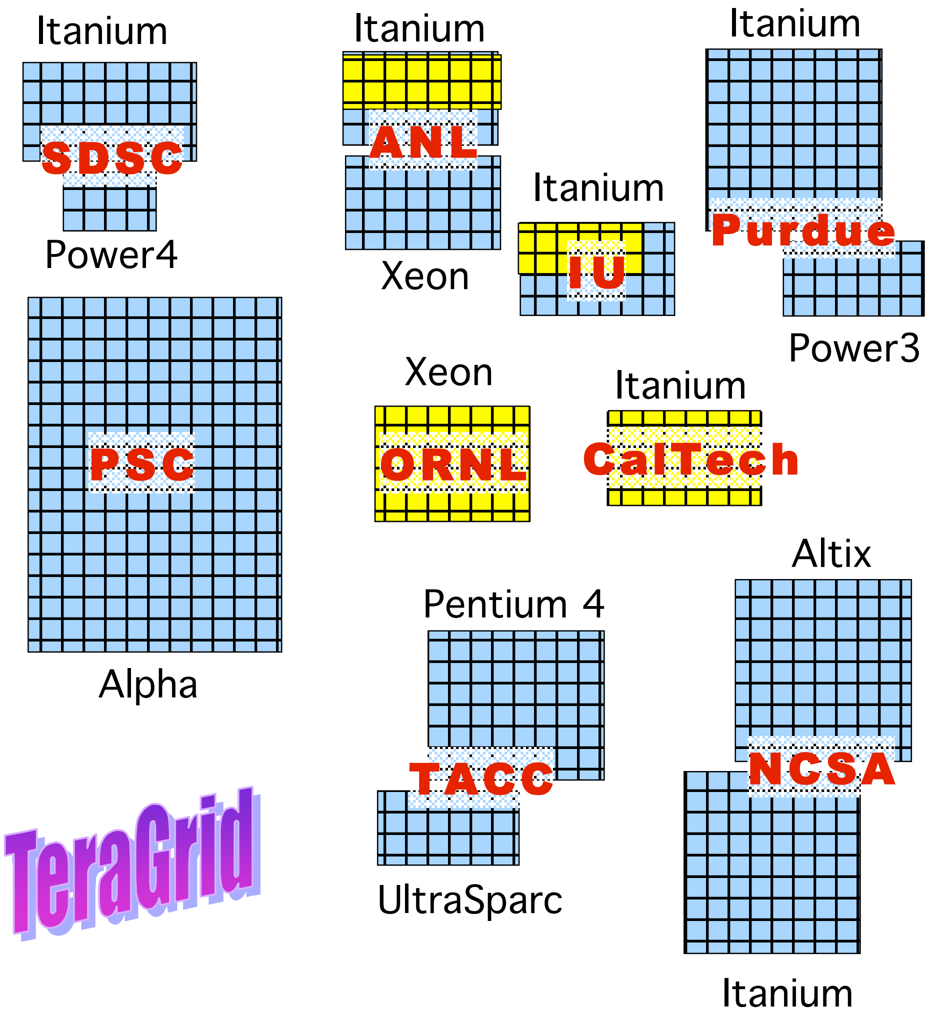


Switch to live demo

A more complex vgDL query

```
VG2 =
    rsc1 = ClusterOf(node)[4:64] {
        node = [ (Processor == Xeon) &&
                     (Clock>=1000) &&
                     (Memory >=1000) ] }
    FAR
    rsc2 = LooseBagOf(cluster1)[1:20] {
        cluster1 = ClusterOf(node)[4:128] {
            node = [ (Processor == Itanium)
                     && (Memory >= 2048) ] }
}
```





Synthetic Resource Environments

- **Resource selection is a difficult problem**
  - It's NP-hard
  - We have a heuristic and a prototype implementation
- **Research: result quality, scalability, response time, contention, ...**
  - What is needed: Simulation studies in large and realistic environments
- **We have developed a "resource environment generator"**
  - Based on survey of existing systems and analysis of technology trends
  - Kee, Casanova,Chien, Realistic Modeling and Synthesis of Resources for Computational Grids, SC2004.
- **A sample synthetic environment**
  - 1 million hosts, 10,000 clusters, Pentium 2-4, Itanium, Opteron, Athlon.
  - VG3 = rsc1= **ClusterOf** (node) [4:64] { node = [(Processor==Pentium4) && (Clock>=2000) && (Memory>=4096)] } **FAR** rsc2 = **LooseBagOf** (nest_cluster) [1:20] { nest_cluster = **ClusterOf** (node) [4:128] { node = [(Processor==Itanium) && (Memory>=8192)] } }

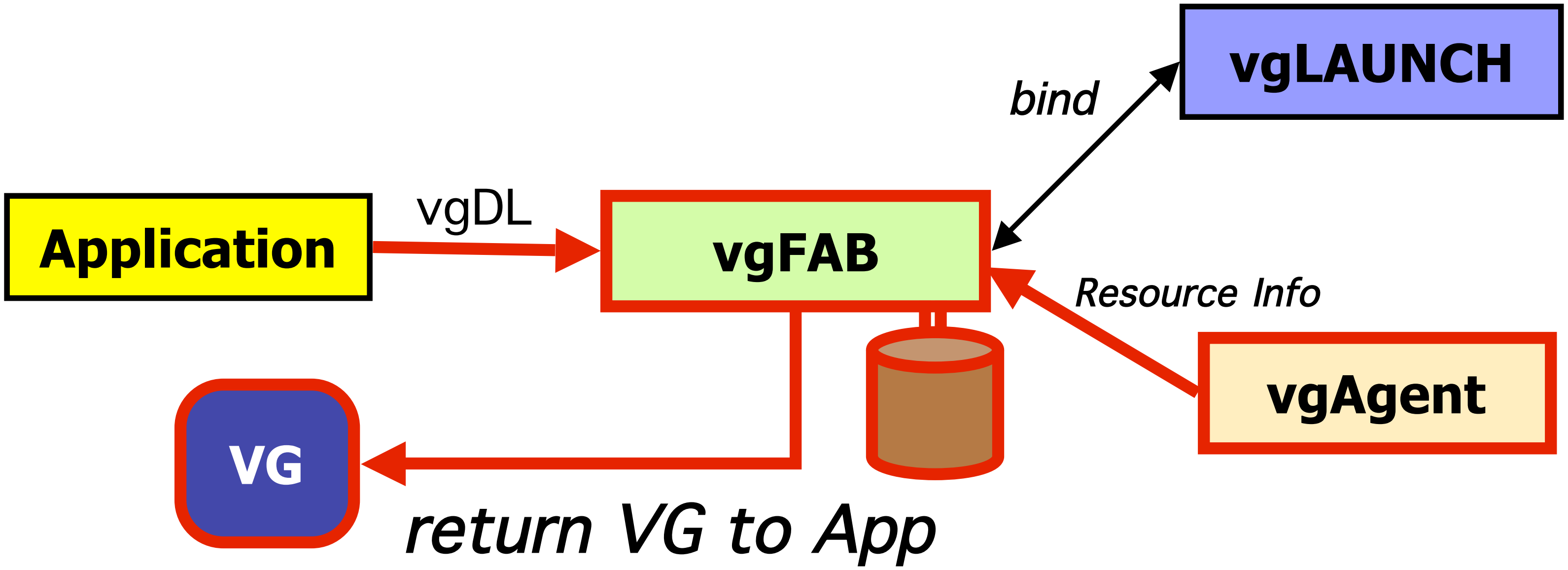
Switch to live demo

Take-away from Demonstration #1

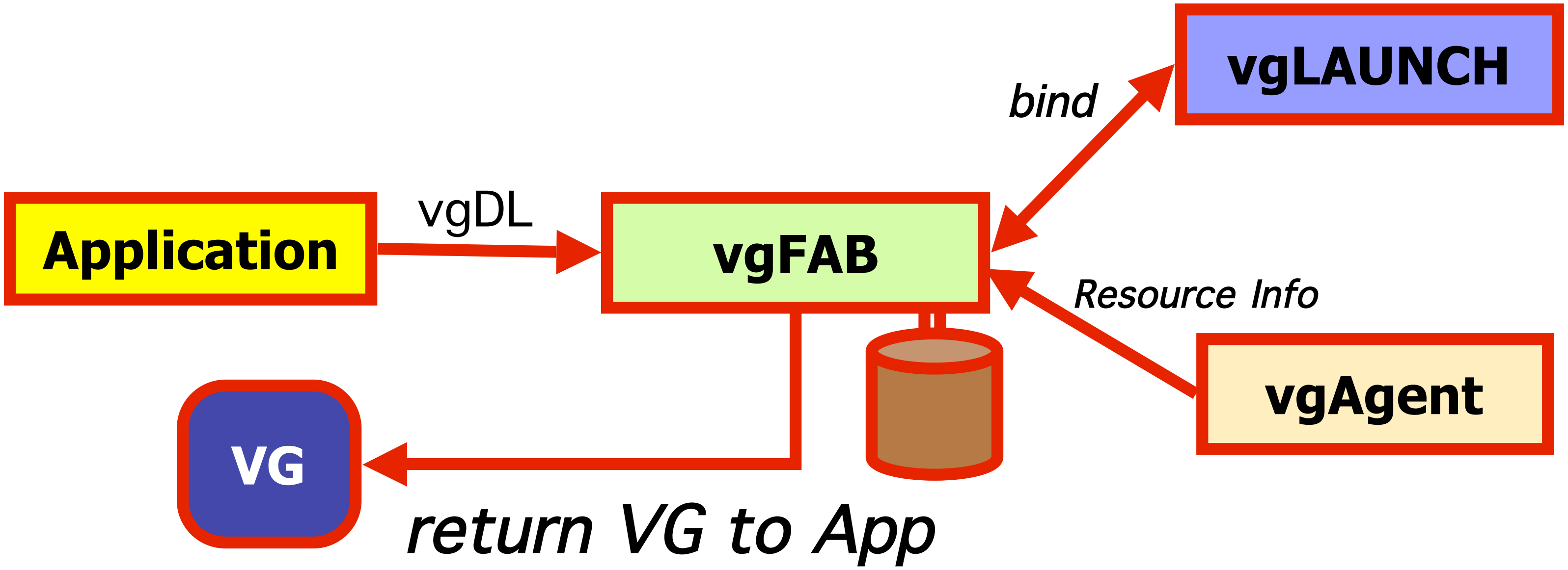
- We have a working research prototype for vgFAB within vgES
  - interfaces with the application via vgDL
  - interfaces with resource information systems
  - returns sets of matching resources
- Makes it possible to use a high-level description of resource requirements
- Makes it possible to find resources over different resource environments
- Research
  - evaluating scalability, result quality, etc.

[CCGrid'05] [SC'05 submission]

Demonstration #2: vgES

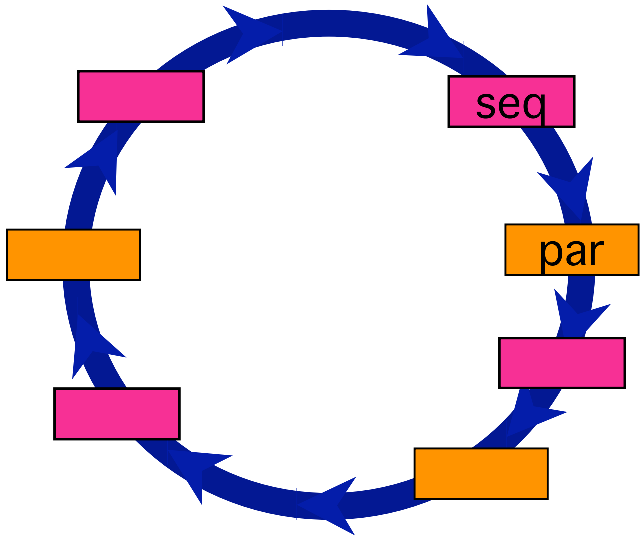


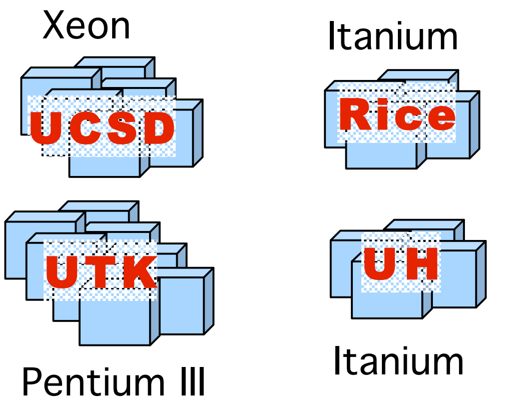
Demonstration #2: vgES



Application: EMAN

- EMAN: Electro Micrograph ANalysis
  - Performs 3-D reconstructions
  - Workflow Application
  - See Chuck Koelbel's talk this afternoon, and the EMAN poster
- Demonstration: Run EMAN on the VGrADS testbed with vgES





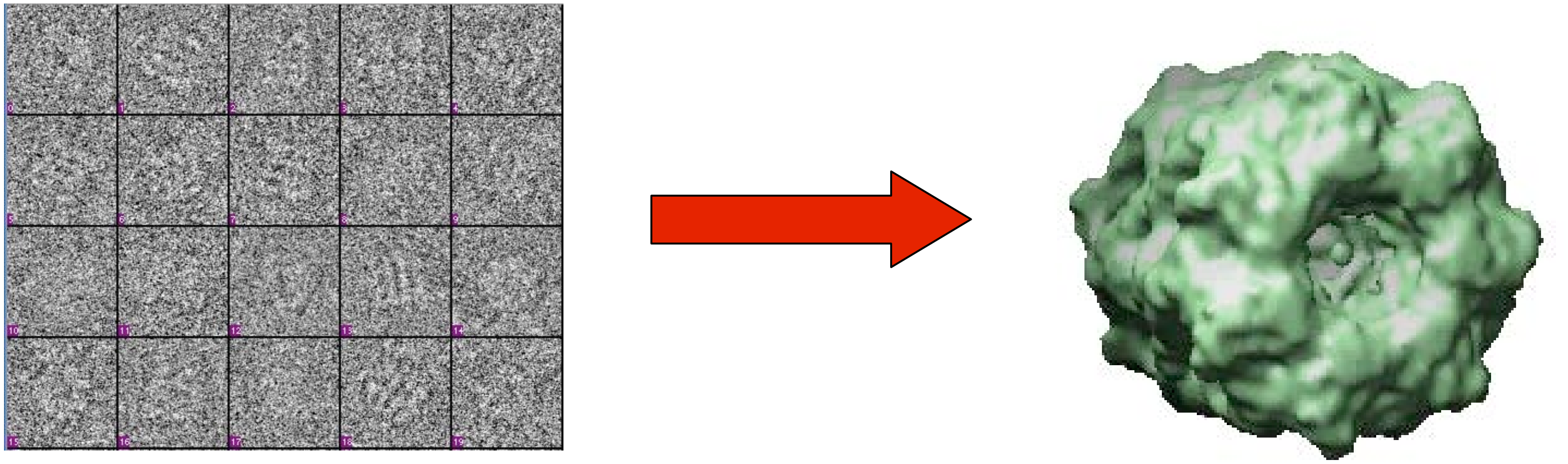
EMAN and the Virtual Grid

```
VG = LooseBagOf (cluster) [1:4] {
          cluster = ClusterOf (node) [4:10] {
                 node = [Clock >= 900]
          }
     }
```

```
VGES myVGES = new VGES()                    // new vgES instance
myVG = myVGES.createVG( vgDL_string )       // found & bound VG
vgRoot = myVG.getRoot();
...   // Traverse VG tree to find resource information
vgES.copyToNode(someNode, “input1”);        // Send input files
vgES.runCmd(someNode,”command”);            // Start command
vgES.copyFromNode(someNode, “output1”);     // Get output files
vgES.terminateVG(myVG);                     // Destroy VG
```

Switch to live demo

Take-away from Demonstration #2



2-D images

3-D model

- **The vgES prototype is functional for a real-application**
- **VG provides a simple abstraction that integrates**
  - access to resources (Globus)
  - access to resource information (MDS, Ganglia, NWS, etc.)

VGrADS and the Virtual Grid

- The VG abstraction and its runtime implementation are the focal point of the VGrADS multi-team collaboration
  - see afternoon presentations and posters

VG

- Interface to applications (vgDL + VG)
- Program preparation and optimization
- Application scheduling
- Monitoring, fault-tolerance, and adaptation
- Resource Management
- Single access/interface to various resource information sources
- Research platform for all the above