Introduction to Slotted Virtual Grid

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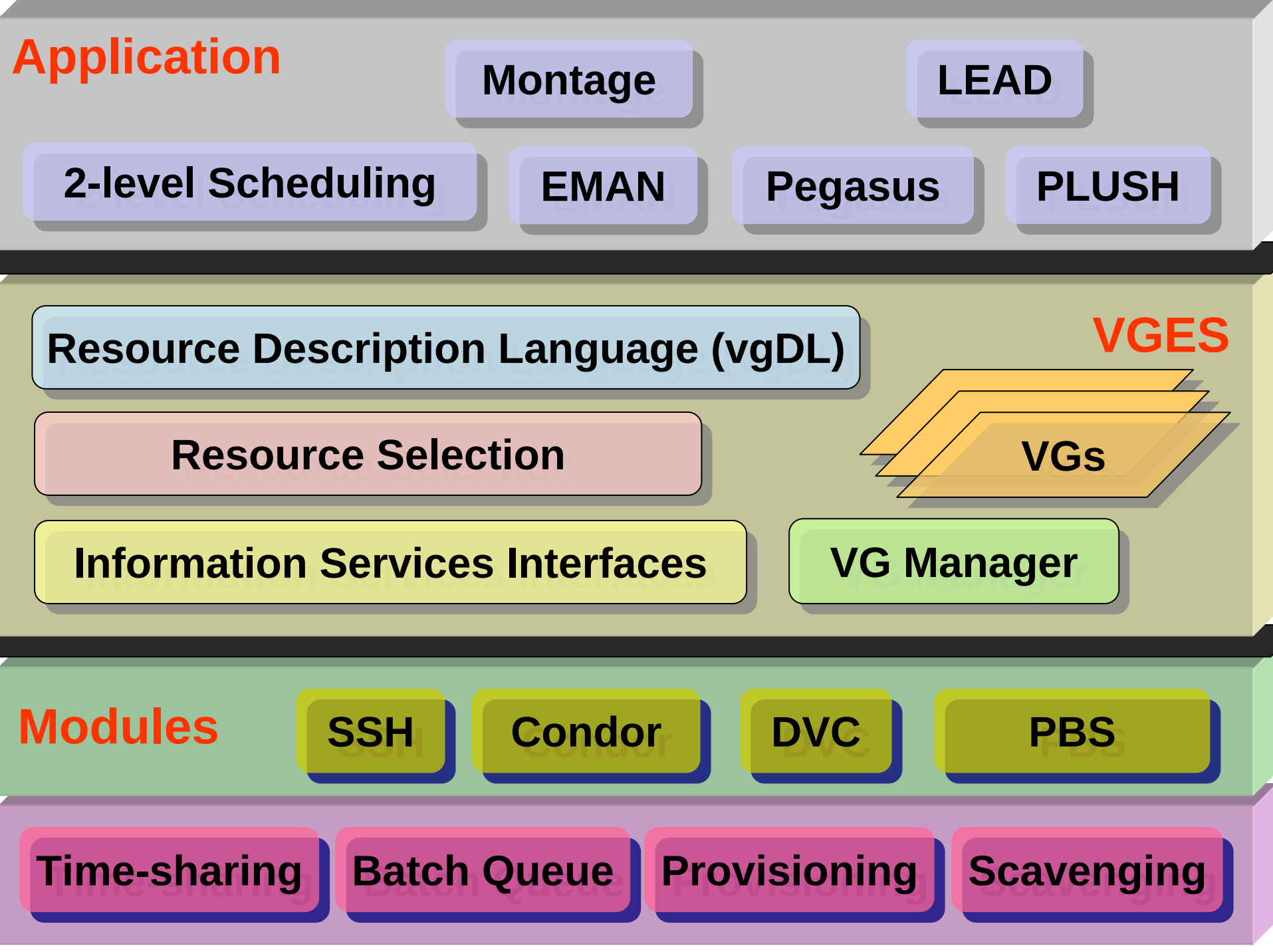
Virtual Grid Execution System

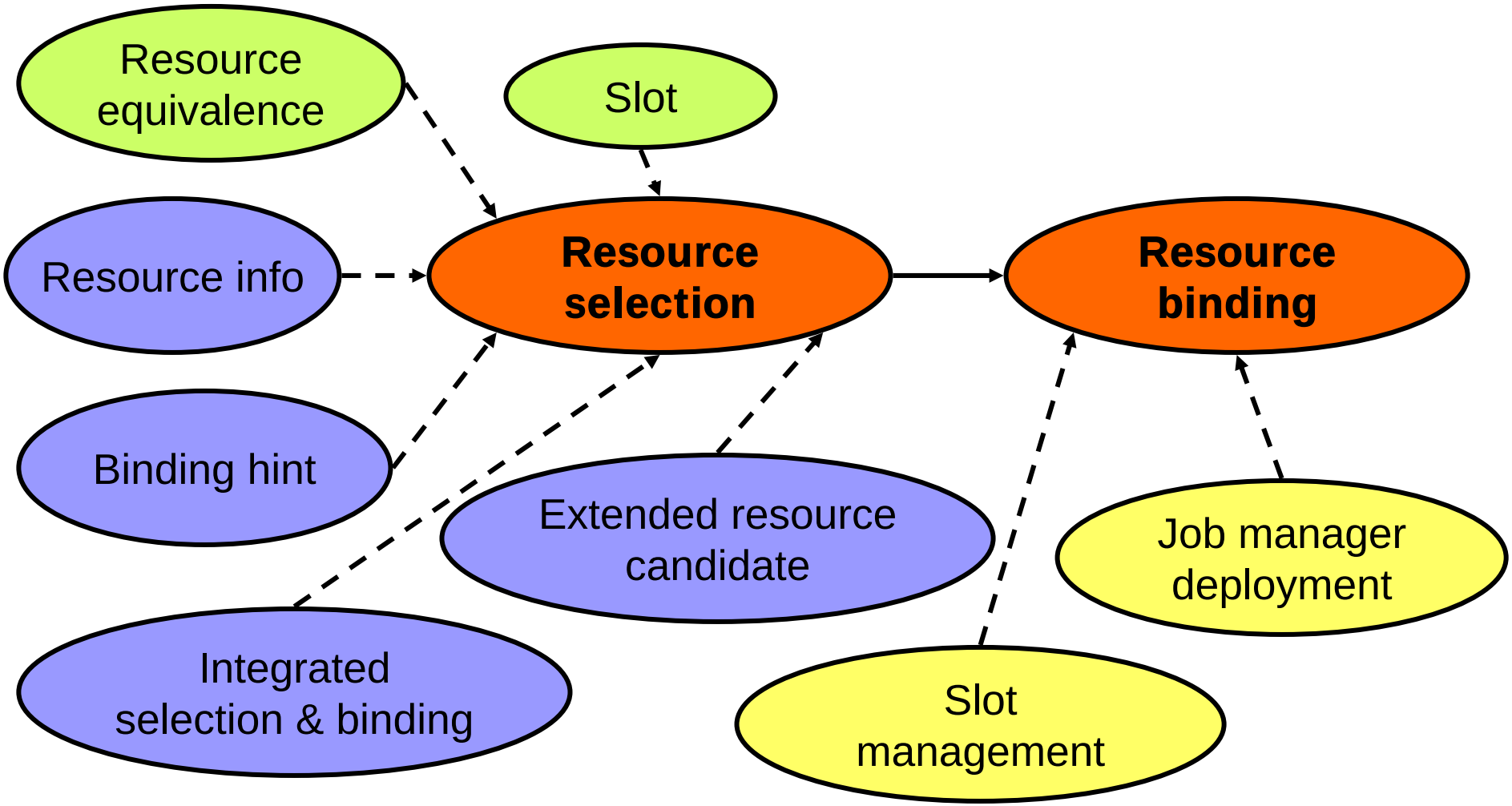
- **A Framework for …**
  - Resource space exploration
    - Via binding aware selection
  - Resource allocation
    - Via slot management independent of local resource managers (PBS, SGE, etc)
  - Job management
    - Deploying personalized job managers (PBS, DVC, etc)


Application
Montage
LEAD
2-level Scheduling
EMAN
Pegasus
PLUSH
Resource Description Language (vgDL)
VGES
Resource Selection
VGs
Information Services Interfaces
VG Manager
Modules
SSH
Condor
DVC
PBS
Time-sharing
Batch Queue
Provisioning
Scavenging

New VGES Features

- **VGDL Extension**
  - Slotted Virtual Grid
  - Resource equivalence
- **Architecture**
  - Integrated selection & binding
  - Binding hint
  - Extended resource candidate
  - Slot management
  - Personalized job manager

Resource Space Exploration & Allocation



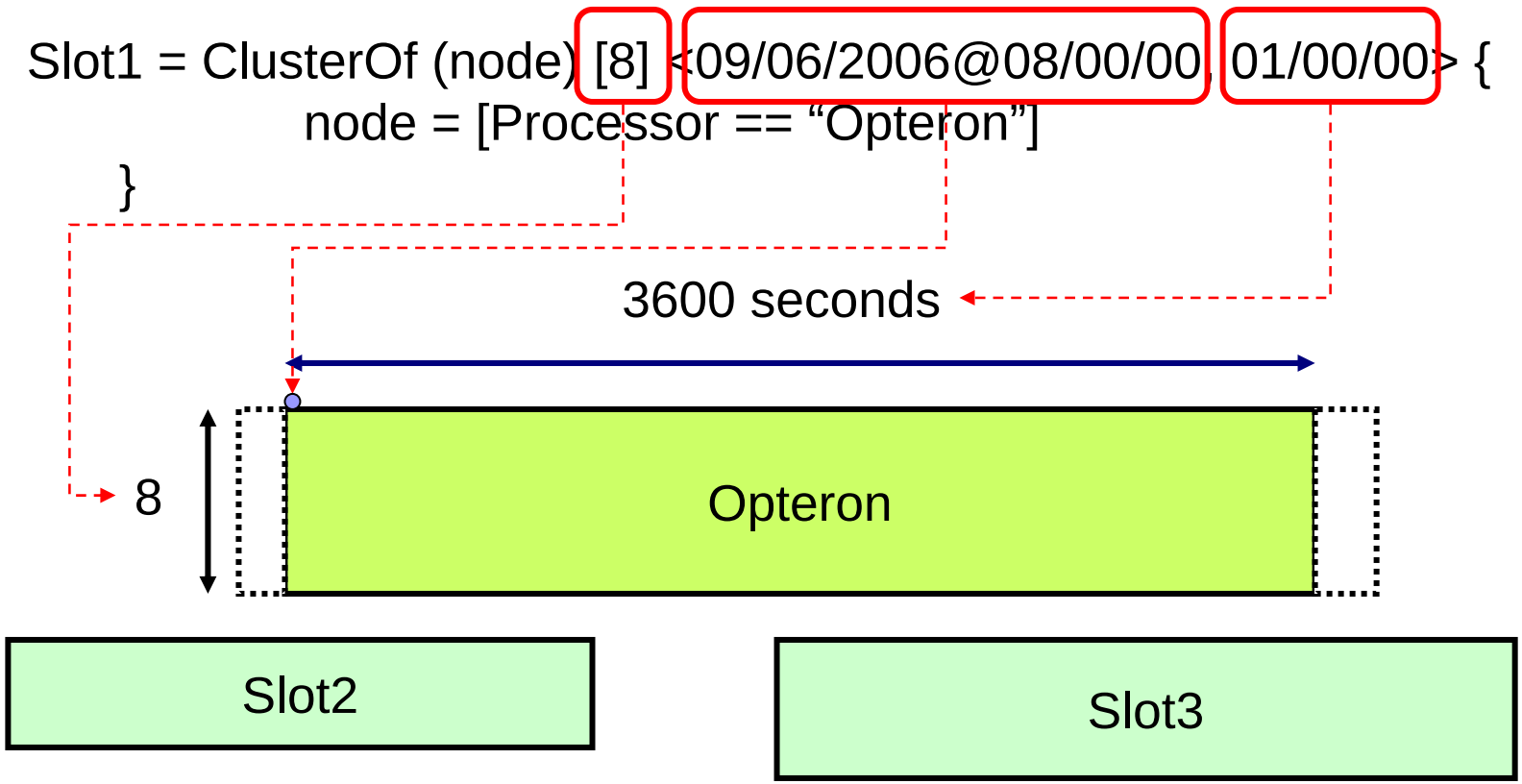
VGDL Extension

- **Slot**
  - Specifies time and duration constraint for resources
- **Resource Equivalence**
  - Defines resource constraints for equivalent resources

Slotted Virtual Grid (SVG)

- **Slot**
  - A set of resources specified in time and space
    - I want to access to a set of resources satisfying certain constraints from “start time” for “duration”.
- **VGDL**
  - <mm/dd/yyyy@hh/mm/ss, hh/mm/ss> (,<mm/dd/yyyy@hh/mm/ss , hh/mm/ss>)*

SVG Specification



Resource states before the “start time” or after the “duration” are undefined.

Resource Equivalence*

- **Resource Equivalence in Node Constraint**
  - Provides flexibility in resource selection
- **VGDL**
  - Identifier “=“ Arith_logic_expr (“<>” Arith_logic_expr)*;
- **Equivalence Specification**
  - PE = “Opteron” <> 4 * “Itanium”;

    vgdl = ClusterOf (node) [4] { node = [Processor == PE] }
  - Could be extended to …
    - PU = “Opteron” && (Memory >= 2024) <> 4 * “Itanium” && (Memory >= 1024);

      vgdl = ClusterOf (node) [4] { node = [PU] }

VGES Logical Components

- **Resource Finding**
  - Integrated selection & binding
  - Binding hint
  - Extended resource candidate
- **Resource Binding**
  - Slot management
  - Job manager deployment
- **Job Launching**
  - Personalized job submission

Binding Awareness

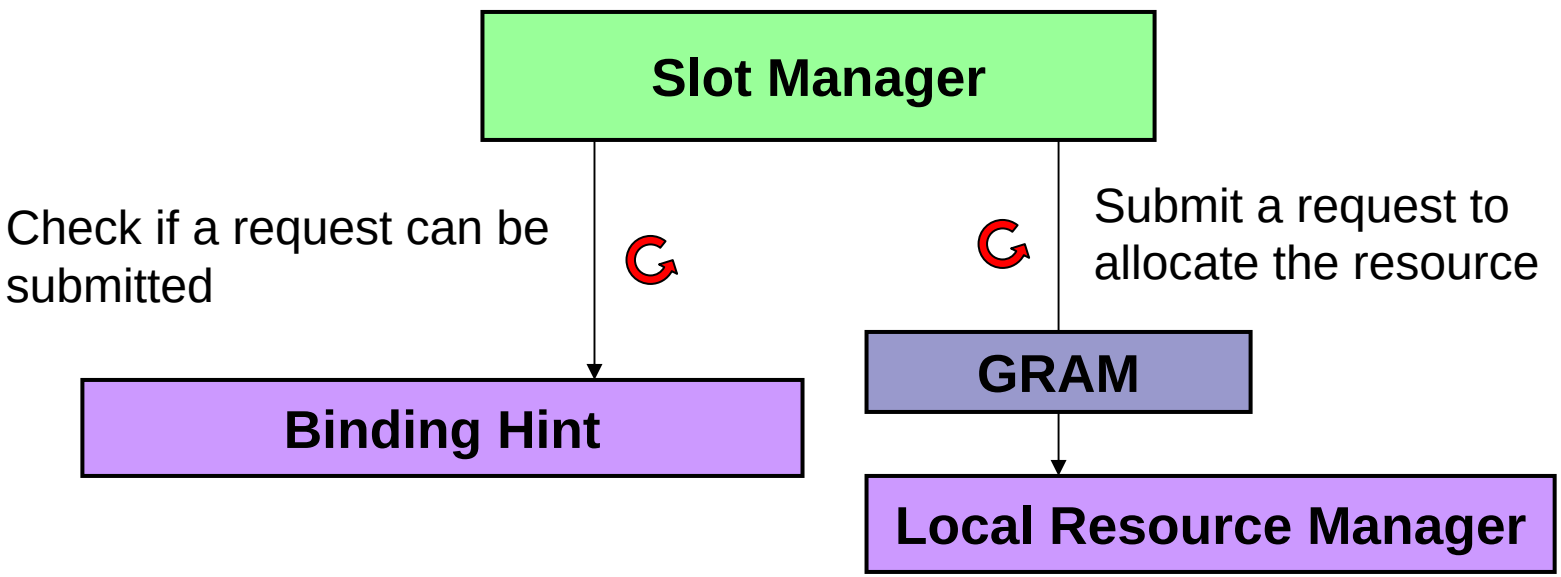
- **Integrated Selection and Binding**
  - Increases success probability of the whole request
  - Decomposes a user request into a set of components that can be bound independently
- **Binding Hint**
  - Increases success probability of individual resources (managers) at the binding stage
  - E.g.) Q prediction

Extended Resource Candidate*

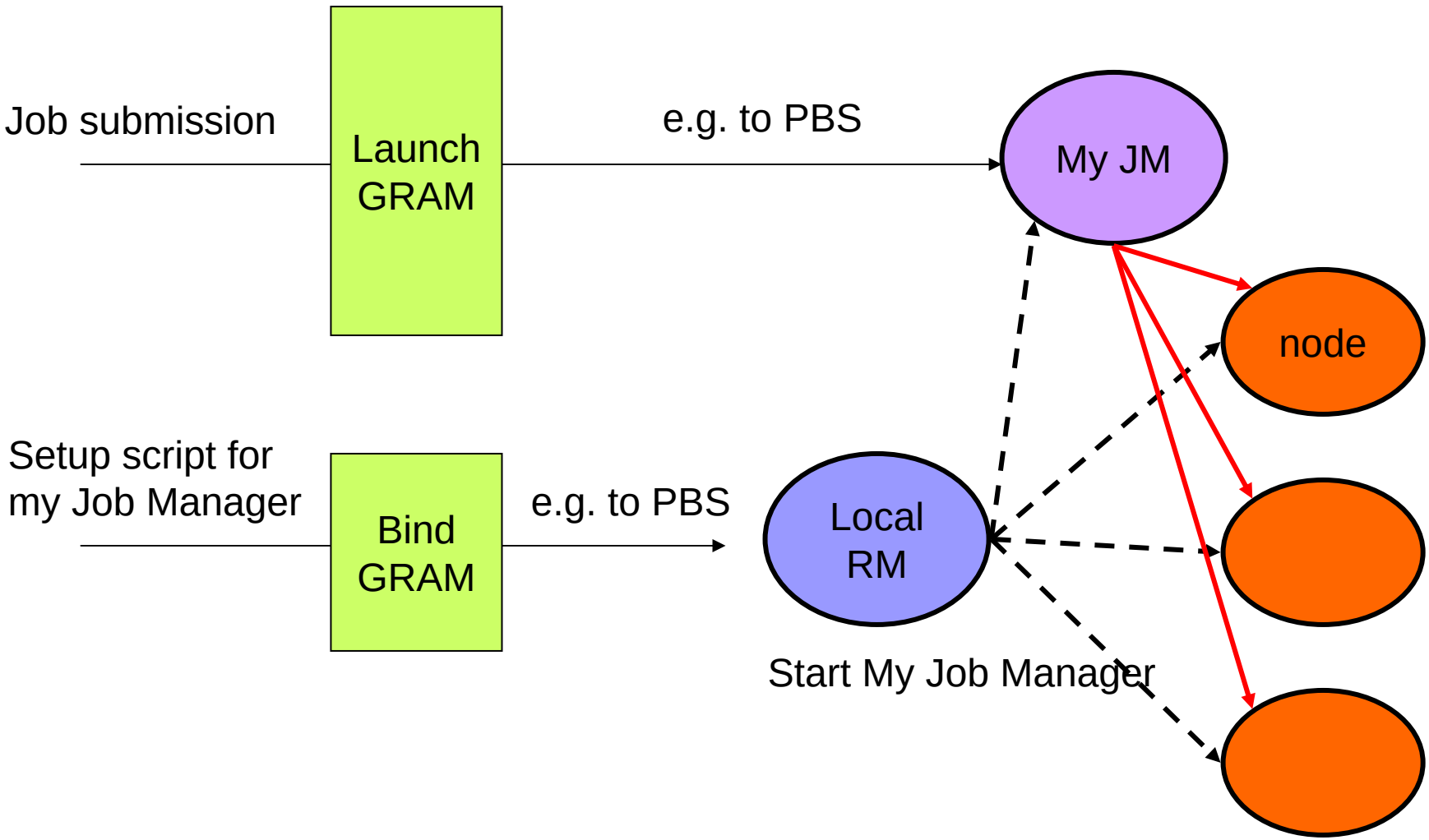
- **Resource Candidate**
  - Select multiple candidates for given resource request
- **How does VGES react at selection failure?**
  - Need clues to resource exploration
- **Extended Resource Candidate**
  - Find resources that are likely to satisfy the user specification
  - e.g.) smaller slot in space or time, relaxed resource constraints

Slot Management

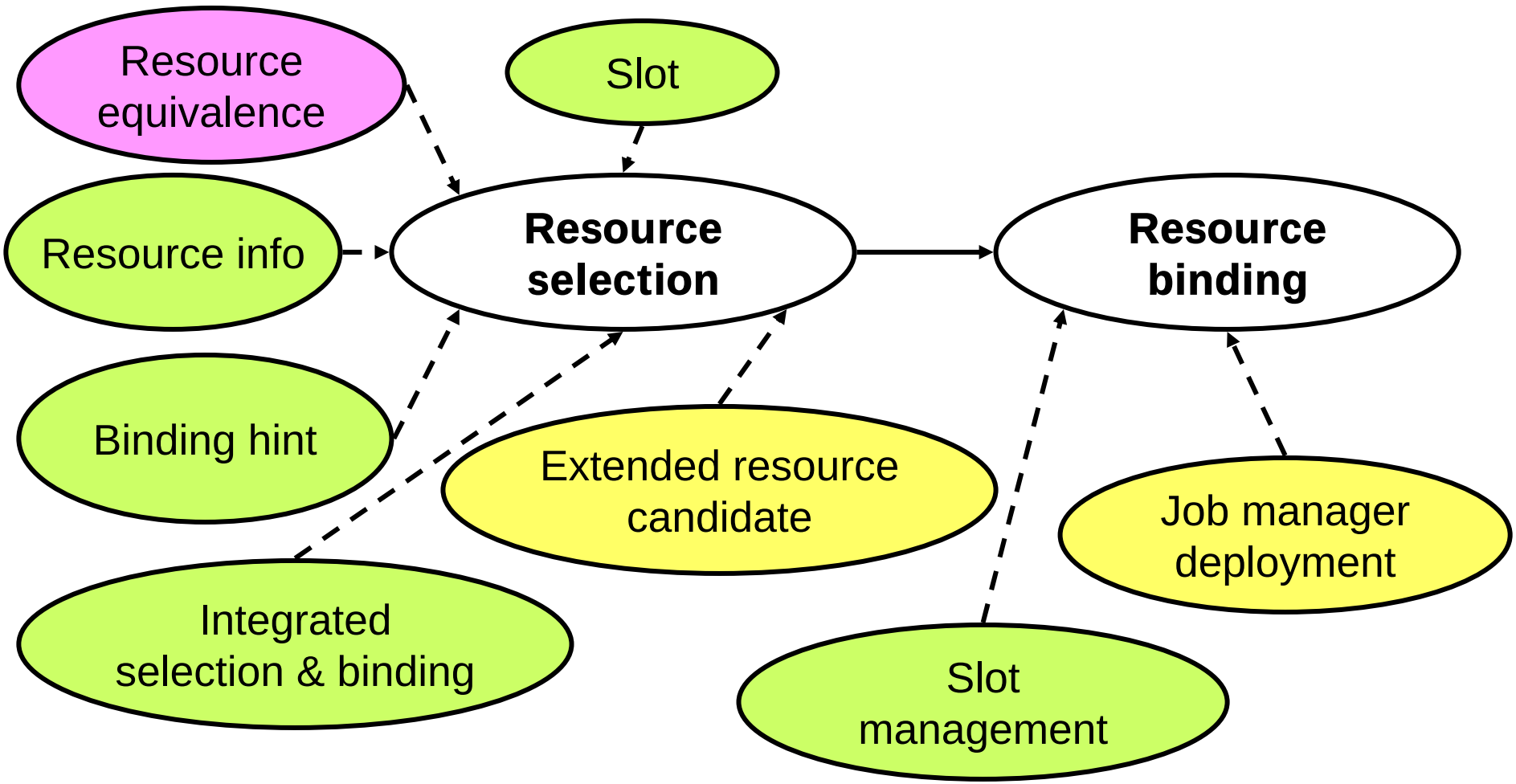
- **Slot Manager**
  - Fills a slot with the resources that successfully arrive
  - Analogy to test, test & set



Job Manager Deployment



Status


Resource equivalence
Slot
Resource info
Resource selection
Resource binding
Binding hint
Extended resource candidate
Job manager deployment
Integrated selection & binding
Slot management