Forschungszentrum Jülich
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50 Jahre Zukunft

Towards Advanced Resource Brokering in UNICORE 6

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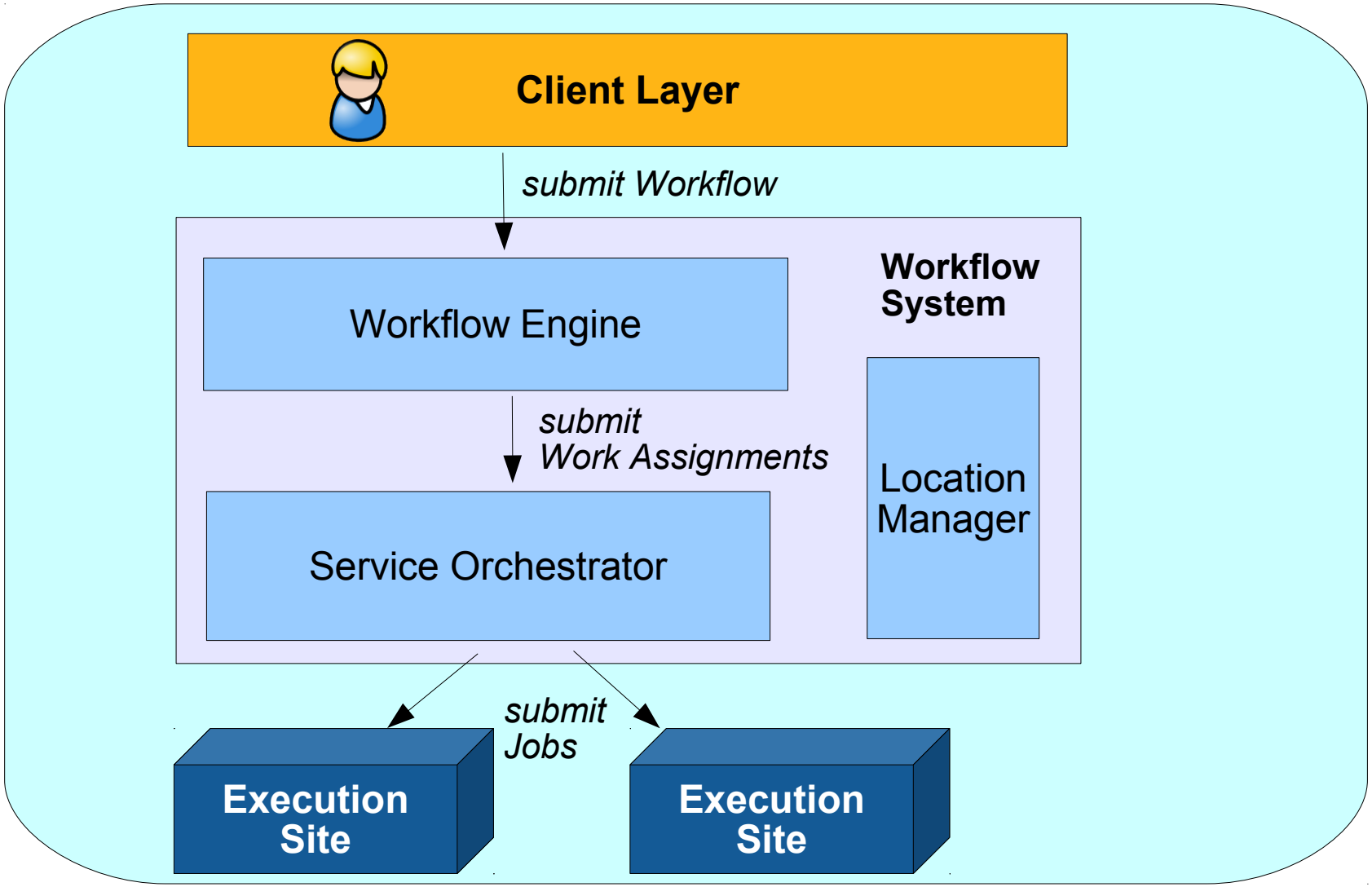
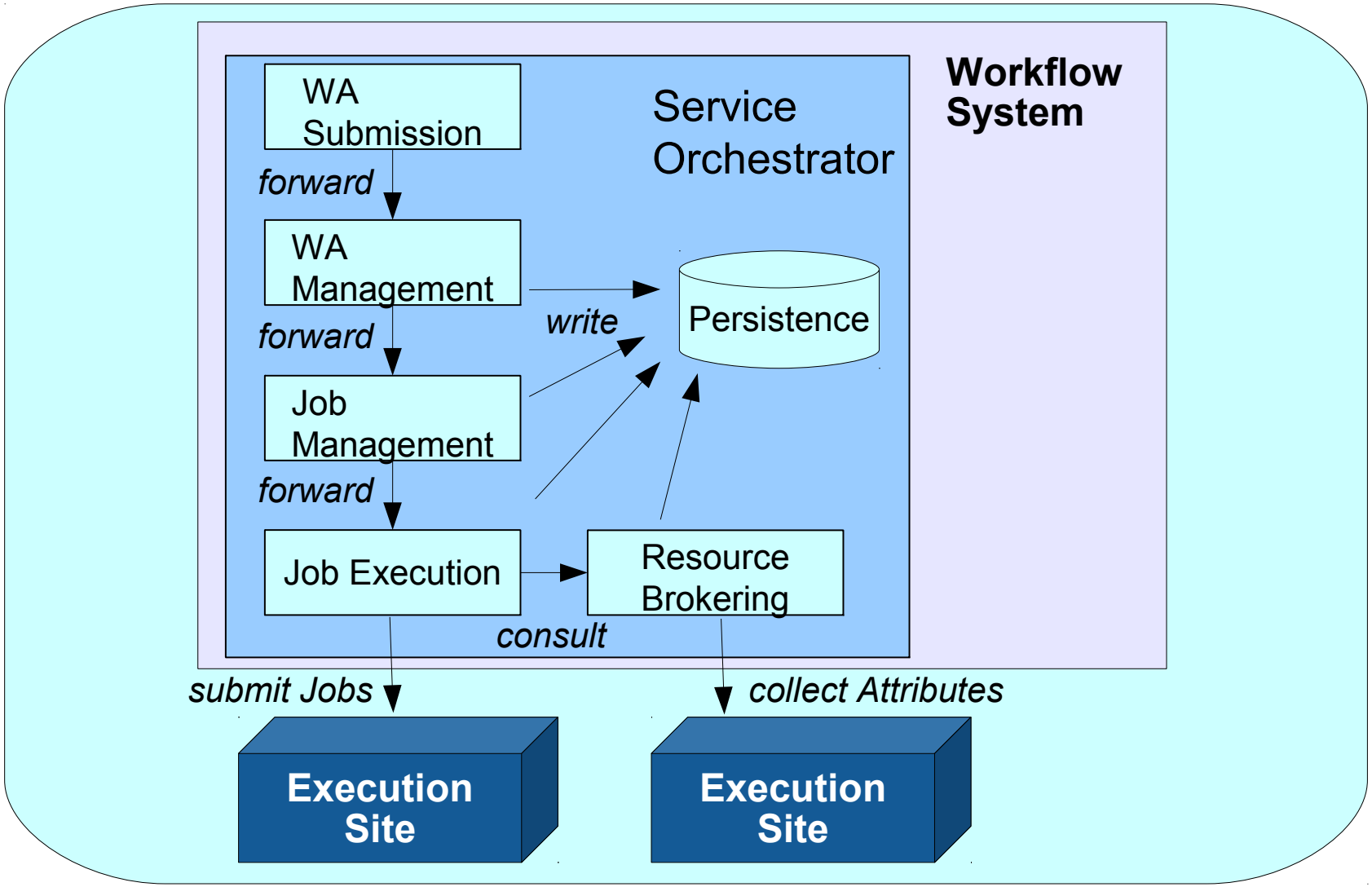
Overview: UNICORE Workflow System



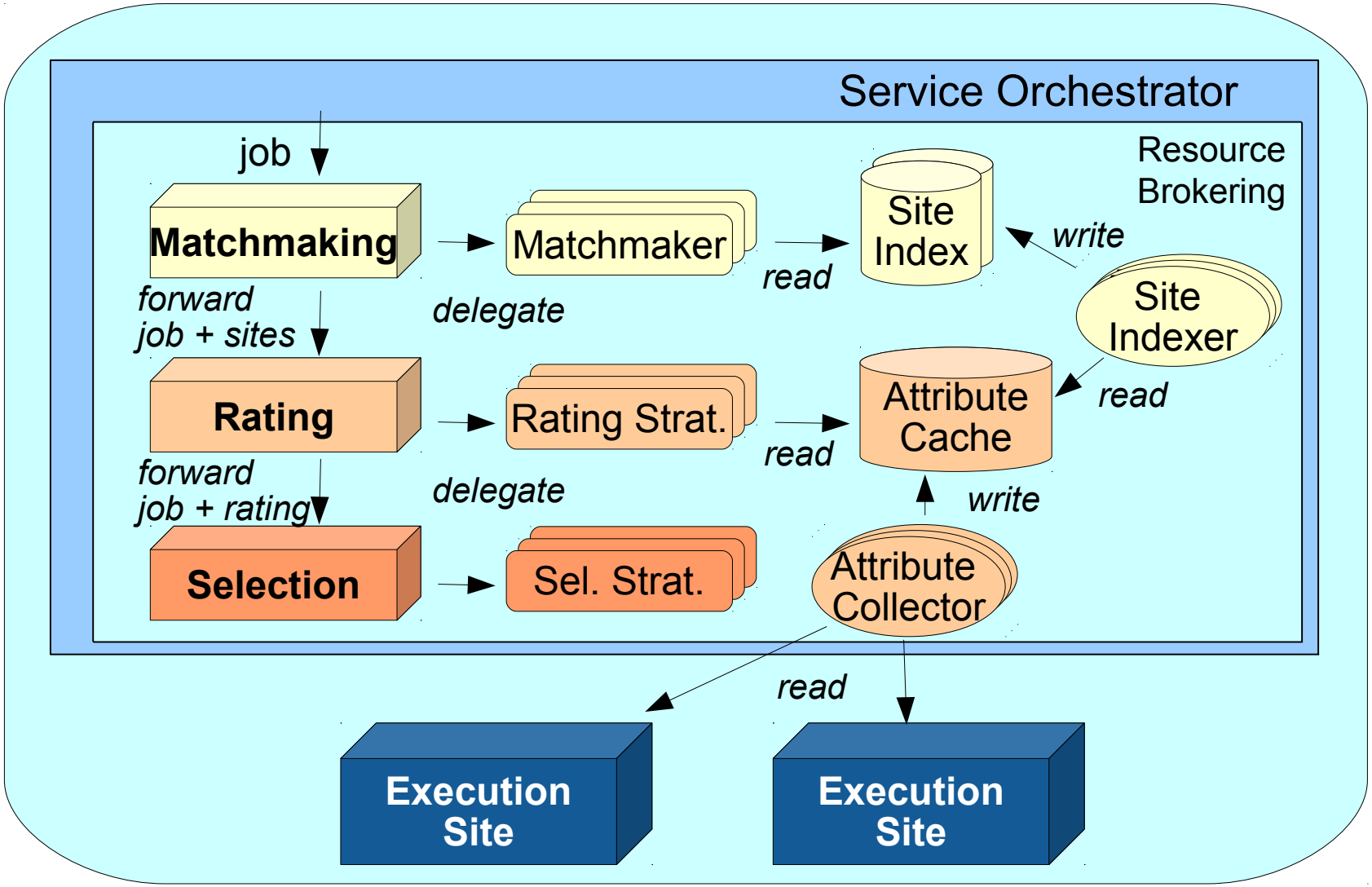
Goals

- Improve performance and brokering quality
  - Advocate indexing mechanisms
  - Strategies broker multiple incoming jobs at the same time
  - Deal with site failure more gracefully
  - Suppport job priority
- More flexibility and configurability
  - Re-usability of brokering as a library, e.g. for clients
  - Pre-defined brokering strategies, selectable by job
  - Hot deployment of strategies, Job defines strategy (scripting language)
  - Admin should be able to control this
- Improve reporting when matchmaking fails
- Better abstraction from UNICORE
- Use site specific resources during matchmaking

Zoom In: The Service Orchestrator



Zoom In: Resource Brokering



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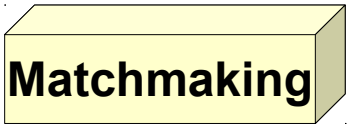
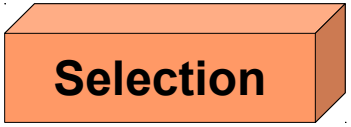
Explanation: Resource Brokering



- Removes unsuitable sites
- Delegates to multiple matchmakers
- Matchmakers query site indexes
- One index per job attribute (e.g OS, #CPUs)
- Indexes built previously => fast removal of invalid sites
- Supports white lists, black lists, grey lists

- Assigns normalized scores to sites
- Delegates to a rating strategy
- Different strategies correspond to different brokering criteria
  (e.g. data proximity, load balancing, cost-effectiveness)
- Relies on previously collected site attributes
- Ratings can be combined (weighted sums)

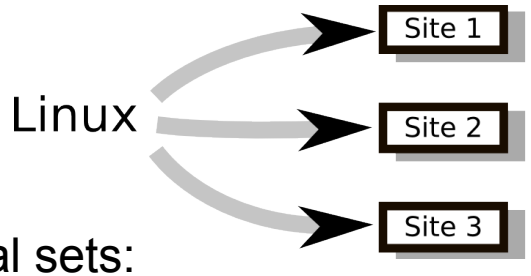


- Chooses a site per job by looking at the rating
- Delegates to a selection strategy
- Different flavours, e.g. highest score, stochastic
- Rather simple step

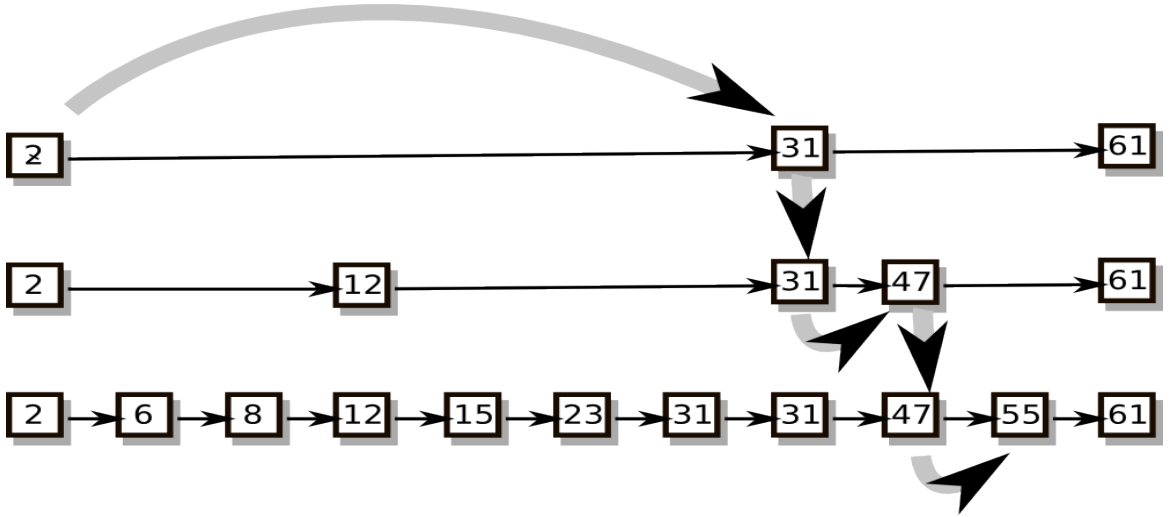
Attribute collectors and matchmakers can be hot-deployed
Rating/selection strategies can be hot-deployed and embedded in the job

Indexing

- Applications, OSes, CPU Arch:
  - Inverted indexes



- JSDL RangeValueTypes – Interval sets:
  - Interval skip lists => O(log n + k)



  - Naive approach is actually faster in practice up to very large n

New Web Services

- Resource Broker
  - Just find a target site, don't submit and monitor
- Component deployment (strategies, attribute collection, indexing)
  - Can be controlled by admin

Reusability and Configurability

- Abstract interfaces (e.g. no strict binding to JSDL => 2 modules)
- Things must be handled differently in different clients (e.g. site attributes)
- Dependency injection for all major components
- Spring framework
- Drawback: lot of configuration, hard to find relevant bits

Future work

- Sandbox groovy scripts properly
- Use library in URC, UCC
- Advanced brokering requires additional info about sites
- Strategy predicting job runtime at sites
    - Queueing time (difficult!)
    - Time for stage-ins (feasible, problem: data sparseness)
    - Runtime of the executable (from JSDL)
    - Time for stage-outs (similar to stage-ins)
- Strategy predicting energy consumption (Fit4Green)
    - Requires runtime prediction
- Systematic comparison of strategies
    - Larger test Grid
    - Simulation