Multiparameter resource selection for next generation HPC platforms

Master Research Thesis

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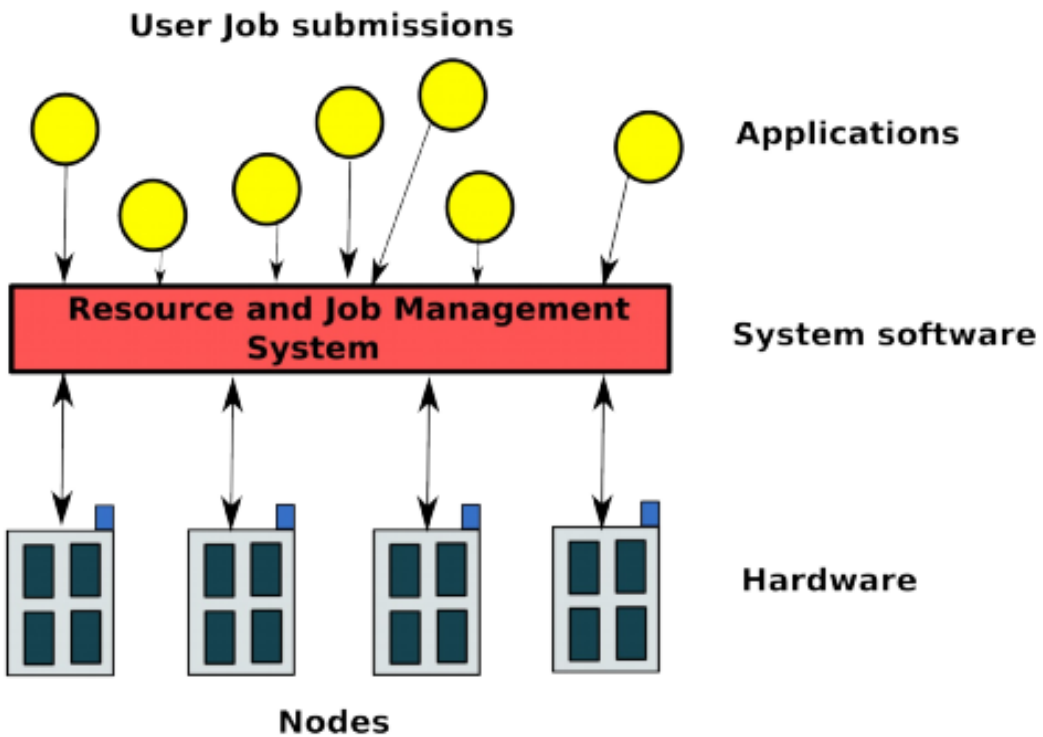
1. RJMS
   - Basic concepts of RJMS
2. SLURM
   - SLURM architecture and entities
   - Consumable resource selection
3. LAYOUTS Framework
   - Internal architecture
   - LAYOUTS APIs
4. Resource Selector and Improvements
   - LAYOUTS based consumable resource selection
   - Energy efficient consumable resource selection
5. Performance Evaluation
   - Experiment environment
   - Performance analysis
6. Conclusion and Future Work

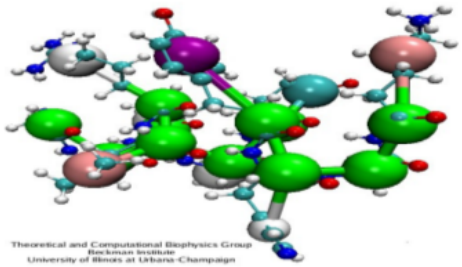
Basic concepts of RJMS

1. The goal of a **Resource and Job Management System (RJMS)** is to satisfy users demands for computation and **assign resources to user jobs** with an efficient manner
2. **RJMS** is the system software between jobs and resources. It knows the complete details about the HPC system

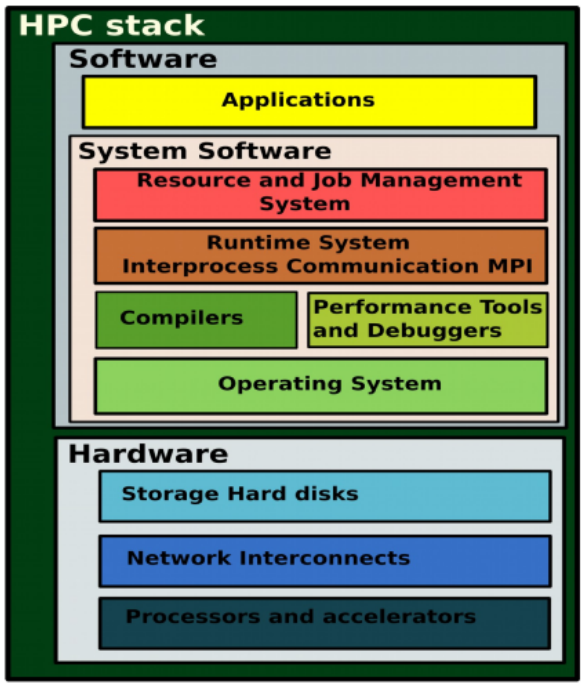


HPC system software stack

1. RJMS is called as **workload manager, loadleveler, batch scheduler, etc**
2. RJMS's strategic position in the HPC system software stack

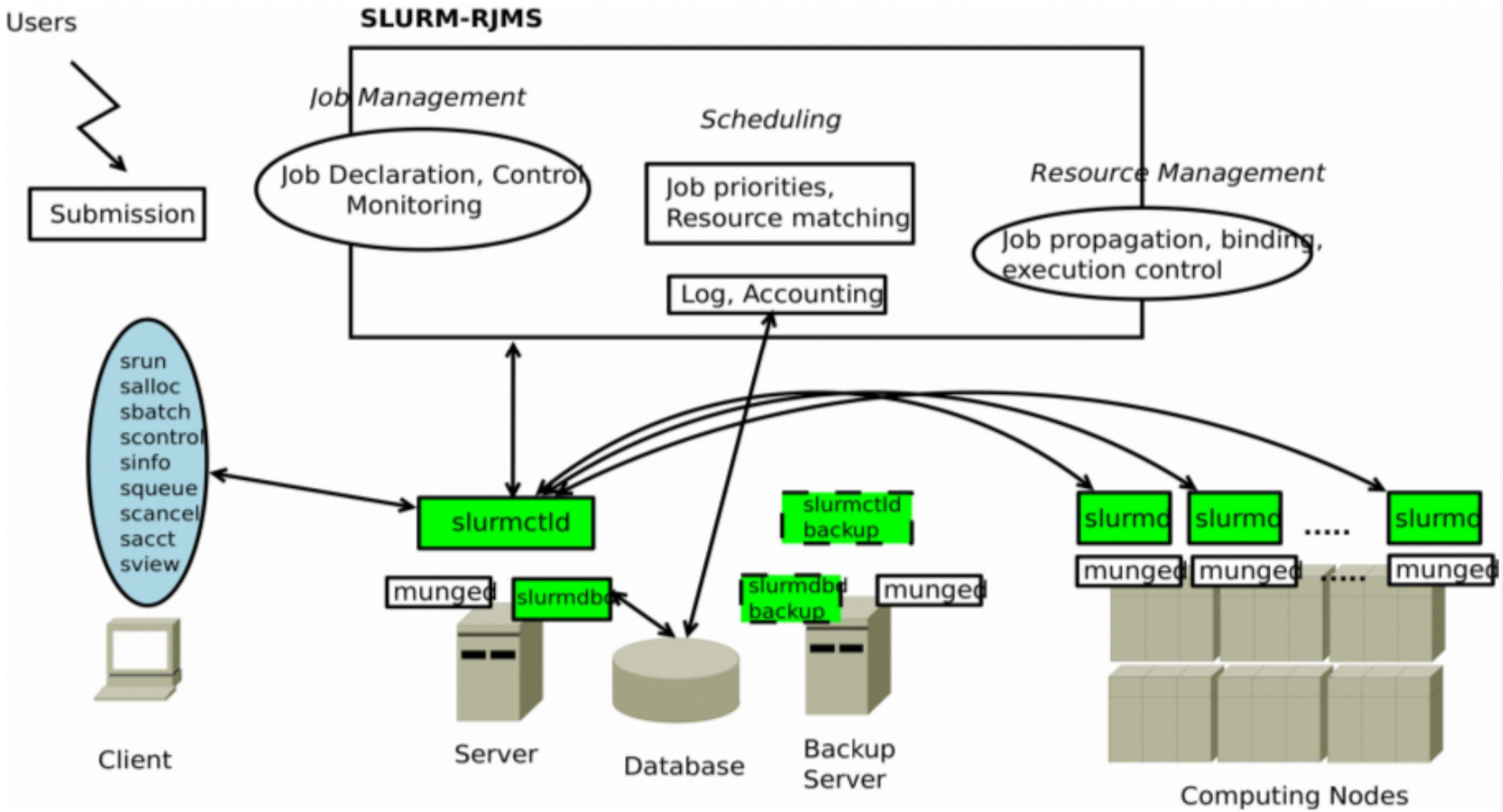


System Software:
Operating System, Runtime System, Resource Management, I/O System, Interfacing to External Environments



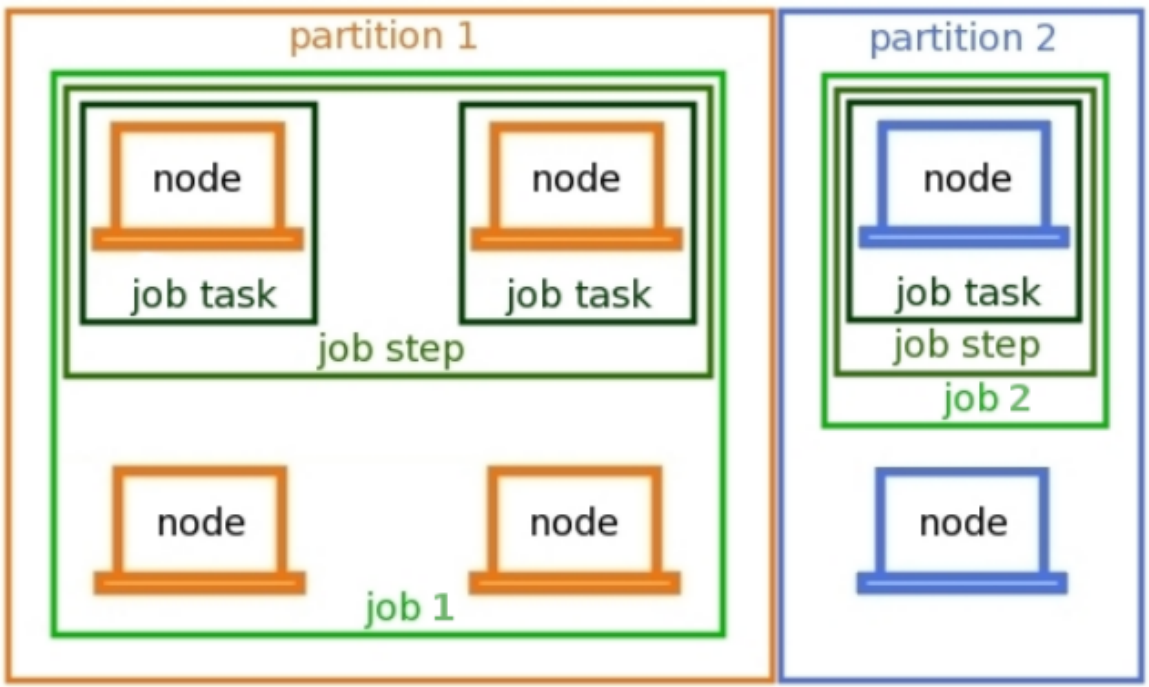
SLURM architecture

1. SLURM's high level components architecture and daemon program



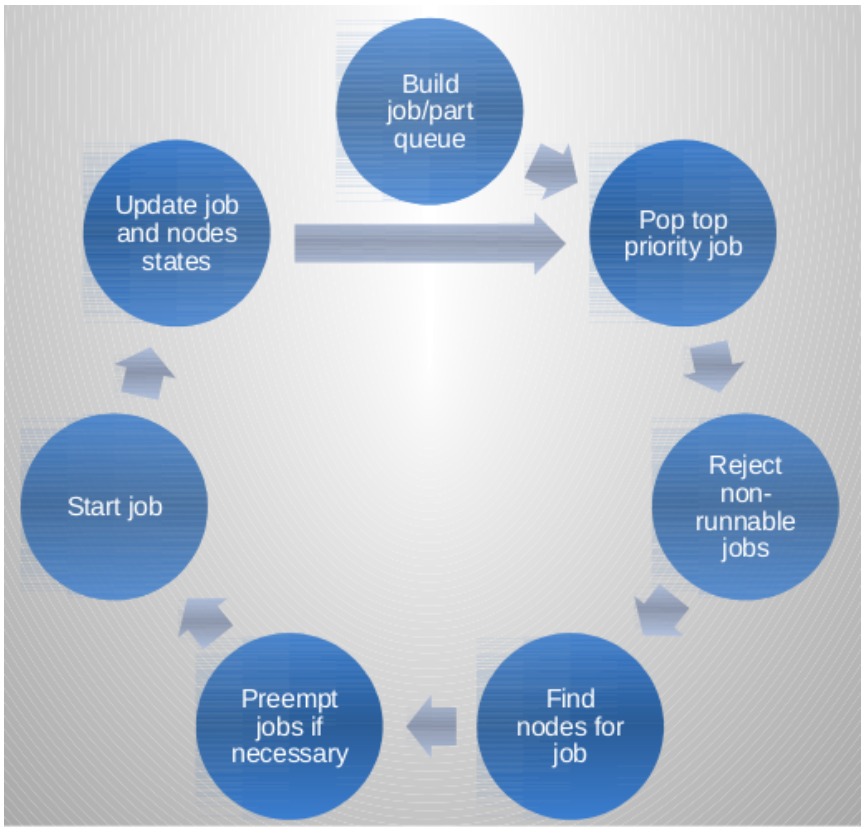
SLURM entities

1. SLURM resource and job management entities



Consumable resource selection cycle

1. **Cons_res** plugin implemented the following algorithm
2. States(**Reject non-runnable jobs, Find nodes for job, Preempt jobs if necessary**) are the selection algorithm



Consumable Resource Selection Algorithm

1. **Bestfit** to reduce fragmentation
2. **Topology aware** to increase the user application performance
3. **Algorithm 1** in the **section 3.1** of the **report** discussed the algorithm step by step

LAYOUTS Framework

1. LAYOUTS is the resource management framework in SLURM
2. **Terminology:**
   - LAYOUTS - Framework
   - Layout(s) or layout(s) - Resource management plugin
3. **Physical and logical** entities can be manageable
4. Entity relation is **tree**
5. Entity attributes are called **keys**
6. Entity and immediate entities keys relation are defined
7. **Key relations** are aggregate functions(Sum, Avg, etc) following **tree relations**

LAYOUTS internal architecture

LAYOUTS entity data management

LAYOUTS entities key and key relations

LAYOUTS aggregate key options

LAYOUTS APIs

LAYOUTS new APIs

LAYOUTS plugin for cons_res_layout

Resource selection policy of cons_res_layout

LAYOUTS plugin for cons_res_power

Resource selection policy of cons_res_power

Experiment environment

LAYOUTS plugin for cons_res_layout

Resource selection policy of cons_res_layout

Conclusion

Future work

Thank you ..

Any questions?