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Advanced System Monitoring in PTP

September 14, 2013 | Carsten Karbach and Wolfgang Frings

Content

1. PTP System Monitoring – status quo
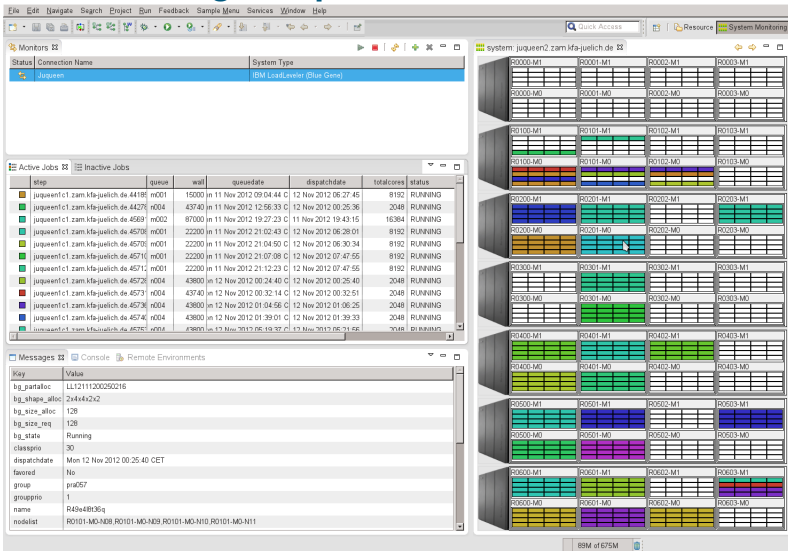2. Short term enhancements
3. Long term enhancements

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Part I: System Monitoring – status quo

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PTP Monitoring Scope

- job and system monitoring of **large-scale** supercomputers
- examples for large-scale systems monitored with PTP:
  - BG/Q system JUQUEEN (JSC), LoadLeveler, 458K cores
  - Cray XT Jaguar (ORNL), TORQUE+ALPS, 299K cores
  - Kraken (NICS), Moab+PBS, 112K cores
  - Yellowstone (NCAR), LSF, 72K cores
- monitoring of **multiple target systems** in one perspective
- support for **many batch systems** (Grid Engine, LoadLeveler, Open MPI, PBS, Slurm, Torque, LSF)
- overview of the system on a **single screen**
- uniform interface to supercomputers
- based on monitoring application **LLview**

PTP Monitoring Perspective

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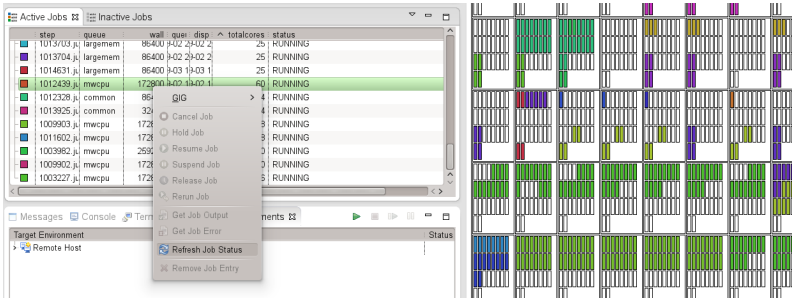
Monitoring Views

- **Nodes View** renders target system architecture, maps jobs to compute resources
- **Active Jobs View** lists running jobs
- **Inactive Jobs View** lists queued jobs
- **Monitoring View** selects active target system, starts/stops monitoring
- **Message View** shows message of the day

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User interaction

- **job management**: cancel, get output/error
- **filtering**: show only user jobs, flexible filtering dialog
- linking information: click on job → highlight its nodes in Nodes View, show detail information in Message View
- change level of detail

Part II: Short term enhancements

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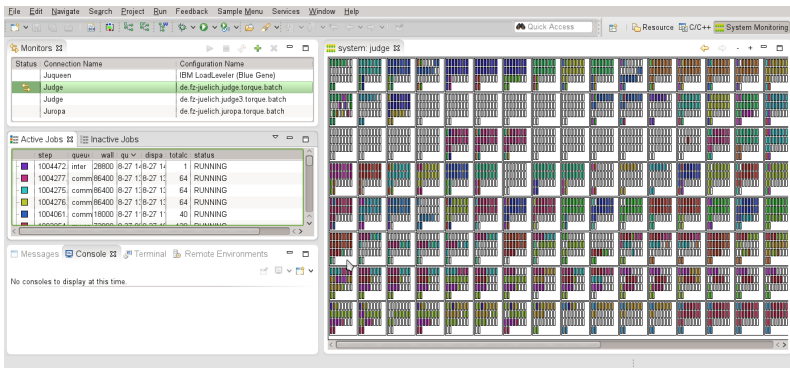
Job selection

- raised in bug <u>403060</u>
- allow selection of **multiple** jobs
- keep selected job selected until it is de-selected
- mark entire **connected area** of each job

Source: `https://bugs.eclipse.org/bugs/attachment.cgi?id=228316`

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Improved job localization

- **adjustable** minimum rectangle size
- currently set to 7 px
- ensure, that rectangle width/height are at least 7 px large, if possible take more space

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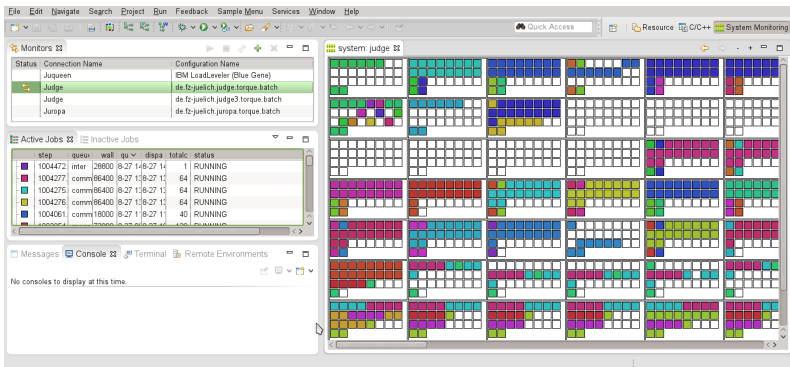
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Provide customized LML layouts

- get familiar with system architectures of supported target systems
- map system **topology** into LML layout
- great potential in **customized layouts**: level of detail, job filtering, showing node names

- define own grid

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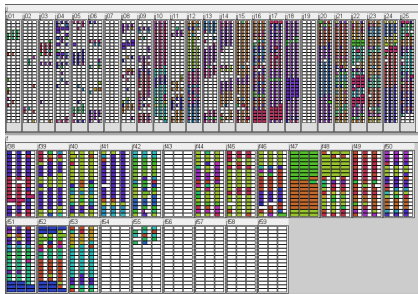
- hierarchy
- level of detail

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Job handling and additional job list

Completed jobs

- jobs submitted externally disappear when completed
- if batch system does not list them, the job entries are lost
- **idea**: keep track of user's running jobs,
  which are removed on update

New job list

- currently: active and inactive jobs
- better: submitted, active and completed jobs

Part III: Long term enhancements

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Caching LML files

- **multiple users** on the same target system
- currently each user triggers separate LML_DA workflow
- **cache** LML file in public directory (e.g. /tmp), use LML cache as data source

Current workflow
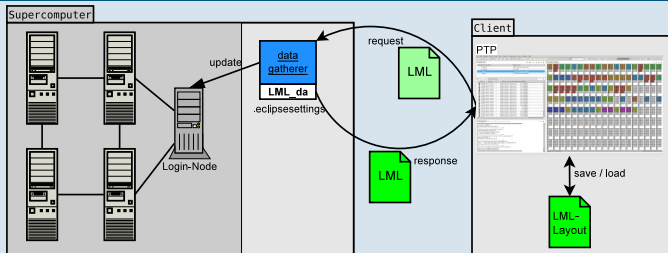
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Cache workflow

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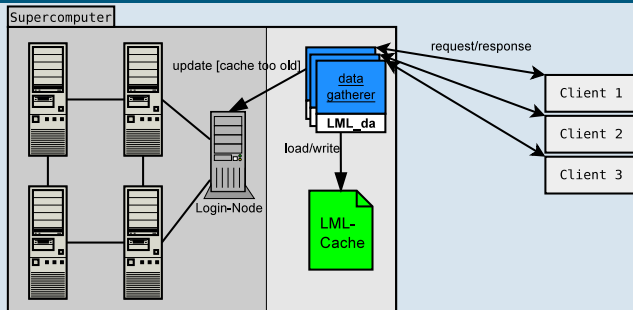
New monitoring views

- derived from LLview, new monitoring types are possible
- fast overview on system statistics, history and prediction
- data description is **already included** in LML
- todo: data generation and visualization for new diagrams

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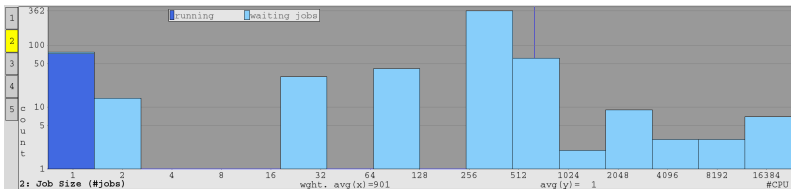
Histograms

- statistical data rendered as histograms
- visualization of job parameter distribution:
  queue, size, waiting time

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Load history

- **usage history** of the target system (e.g. last 3 days)
- extendable for power/memory/accelerator usage
- requires **LML log**, switch to **stateful** server

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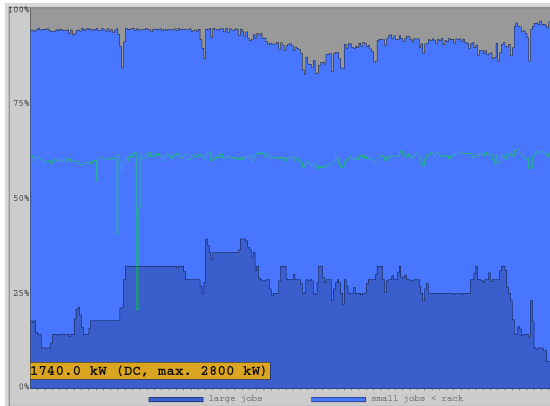
Prediction diagram
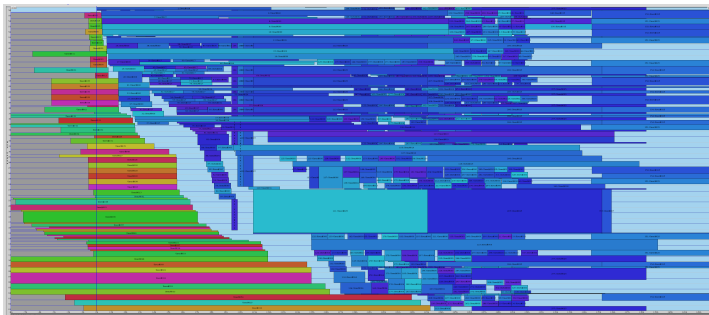
- Gantt chart visualization of **future workload**
- each rectangle represents one job,
  x-axis → time, y-axis → resources
- requires **JuFo** integration (see next slides) for
  simulation of future schedule

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JuFo – Overview

- **configurable** simulator for global job schedulers for **on-line prediction** of job dispatch dates
- based on analysis of JSC batch systems **Moab** and **Loadleveler**
- **integrated** with monitoring system **LLview**
- **LML** as configuration and communication data format
- **use-cases**:
  - **user** predicts start dates of submitted jobs
  - **administrator** simulates job scheduler performance with various input parameters, verifies scheduling rules

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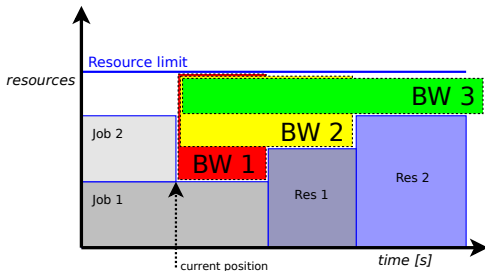
JuFo integration
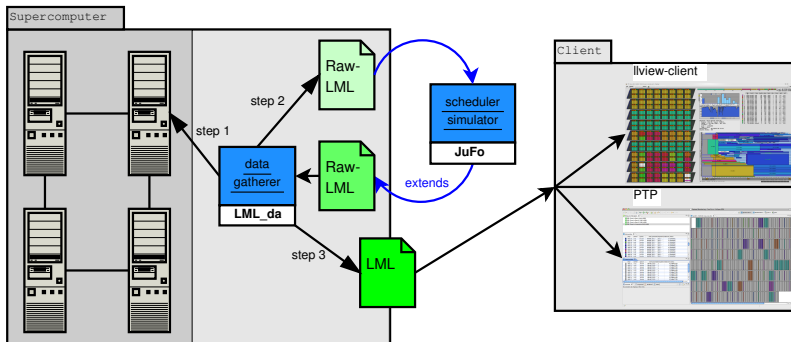
- implemented in C++, additional installation step required
- simulation duration: 1-90 seconds ⇒ caching

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JuFo – Features

- supported **scheduling algorithms**
  - First-Come-First-Served
  - List-Scheduling
  - Backfilling
- available **simulation parameters**
  - generic job **prioritization**
  - advanced **reservations**
  - jobs can request CPUs, GPUs, memory
  - **nodesharing**
  - **queue** constraints
- test framework for evaluating JuFo's accuracy

Part IV: Conclusion

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Conclusion

- PTP provides monitoring system for large-scale supercomputers
- monitoring views: job lists, nodes view
- short term enhancements:
  - adjust job **selection**, multiple jobs
  - simpler **detection** of small jobs
  - create **customized LML layouts**
- long term enhancements:
  - LML file **caching**
  - new monitoring views: histograms, history, prediction
  - integration of **JuFo**

Your ideas?

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- **LML** → `http://llview.zam.kfa-juelich.de/LML`