Advanced System Monitoring in PTP

September 14, 2013 | Carsten Karbach and Wolfgang Frings
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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
1. System Monitoring – status quo

PTP Monitoring Perspective

[Image of a monitoring interface with various tables and graphs showing system monitoring data.]

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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
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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2. Short term enhancements

Job selection

- raised in bug 403060
- 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
2. Short term enhancements

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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**Improved job localization**

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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
Provide customized LML layouts

- get familiar with system architectures of supported target systems
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- hierarchy
- level of detail
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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3. Long term enhancements

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
3. Long term enhancements

**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

**Cache workflow**
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
3. Long term enhancements

Histograms

- statistical data rendered as histograms
- visualization of job parameter distribution: queue, size, waiting time
3. Long term enhancements

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
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
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
JuFo integration

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