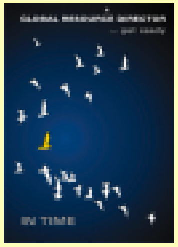

Genias Global Resource Director

Customer Scenarios for Large Multiprocessor Environments

F. Ferstl, GENIAS Software GmbH - http://www.genias.de

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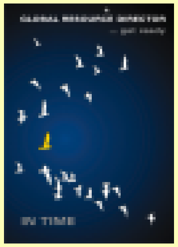

Customer Scenarios

Content Overview

- GRD - What is it?
- How GRD helps BMW
- How GRD helps ARL
- Conclusions

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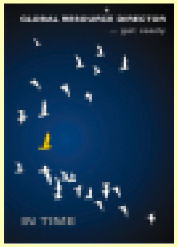

Global Resource Director
GRD

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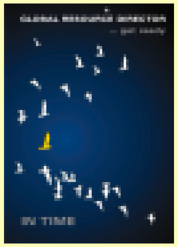

Unique Capabilities

- Share-based control (vs priority)
- Global resource model
- Dynamic control
- Usage-based management
- Deadline capabilities
- Modular approach
- Operational controls

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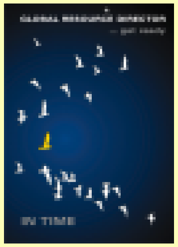
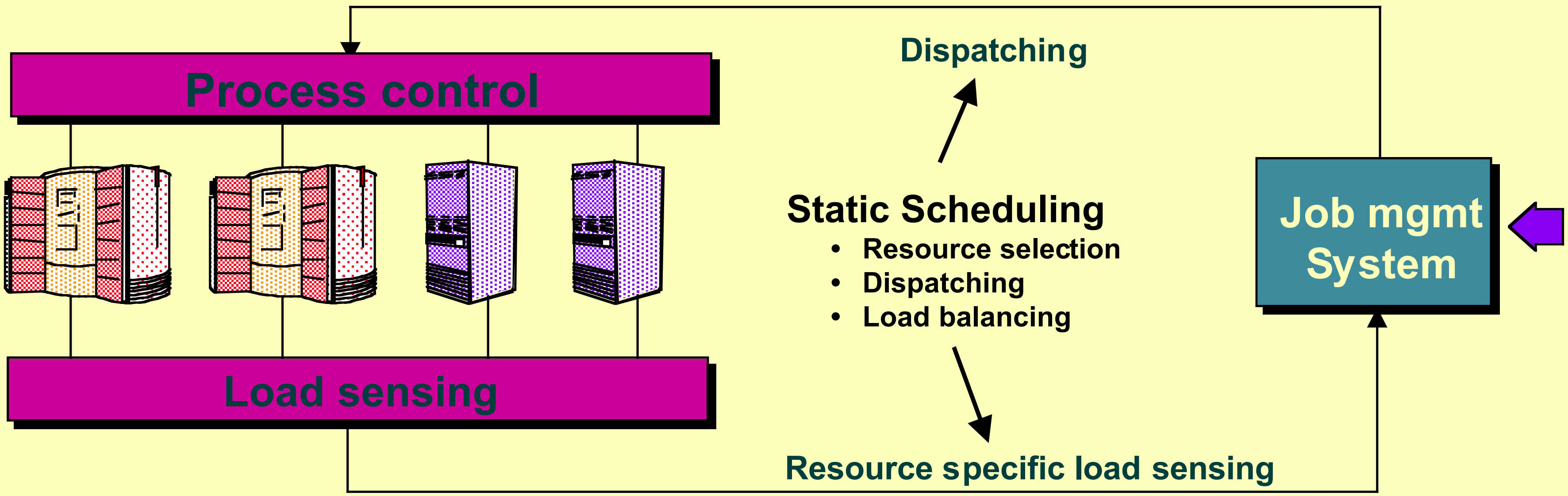


Current Tools



No reprioritization after dispatching

- **Resource utilization by individual processes deviates from intent**
- **Doesn’t adapt to changing needs**
- **Limits execution control policies**

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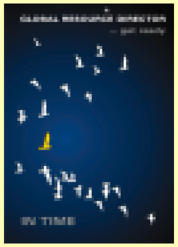
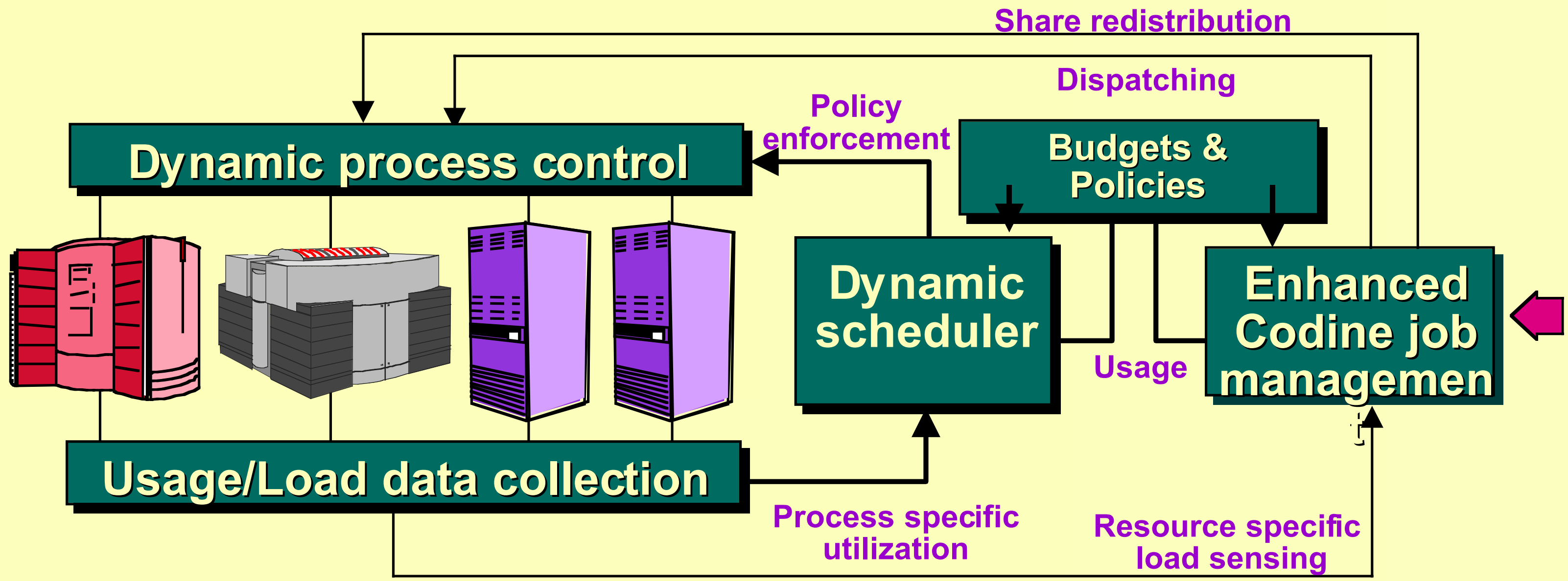


GRD with Global Dynamic Scheduler



Maintains active low level control of workload during execution

- Supports multiple policies (functional priority, share-based, urgency)
- Correlates all workload elements
- Keeps resource utilization aligned with policies
- Responds to ad hoc needs

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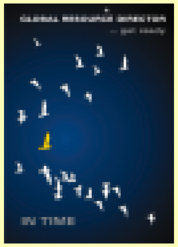

GRD Policy Capabilities

Functional Priority
- User
- Job Class
- Department
- Project

Share-based Usage
- User share tree
- Project share tree

Urgency-based Priority
- Initiate Time
- Deadline

Override System
- User
- Job Class
- Job
- Department
- Project

Global Dynamic Scheduler
- Correlates & tracks workload elements
- Dynamically enforces policies
- Manages global resource utilization

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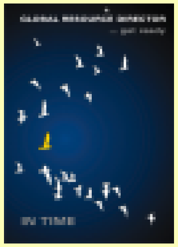

Technical Approach

GRD

Ì Develop/integrate advanced scheduler (GDS)

- 4 Multiple policies (Functional priority, share-based, urgency-based)
- 4 Highly customizable
- 4 Automated policy enforcement
- 4 Global dynamic resource management
- 4 Advanced load balancing
- 4 Centralized control
- 4 Flexible override system
- 4 Flexible user interface
- 4 Low overhead implementation

Ê Start with proven foundation (Codine)

- 4 Defacto standard in Europe
- 4 Independently rated as top tier JMS
- 4 Multiple job types (scalar, parallel, interactive, etc.)
- 4 User access controls
- 4 Load balancing
- 4 Checkpointing & automigration
- 4 X-window/motif-based GUI
- 4 www client
- 4 Job dependencies
- 4 Multiple clusters
- 4 Extensible load sensors
- 4 POSIX 1003.2d
- 4 NQS command support
- 4 Interoperation with other JMSs

Ë Integrate low overhead dynamic data collector

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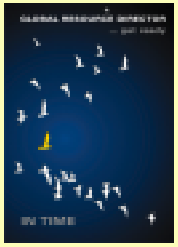
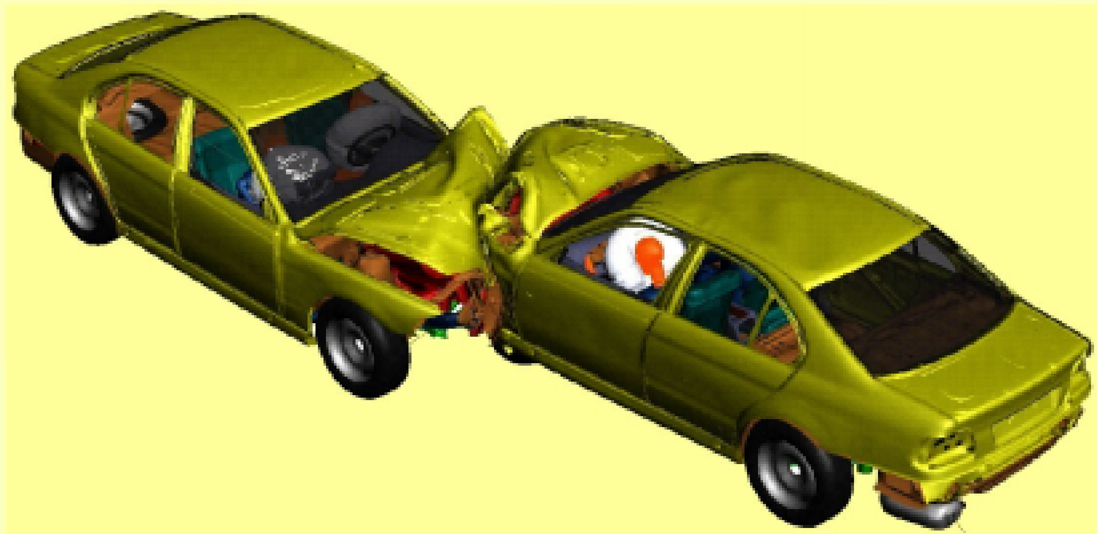


BMW – CODINE/GRD installation



Crash simulations with PAM-CRASH

Department EK-20, Dr. Holzner

SGI multiprocessor environment with 350+ CPUs

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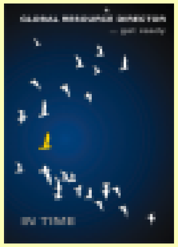
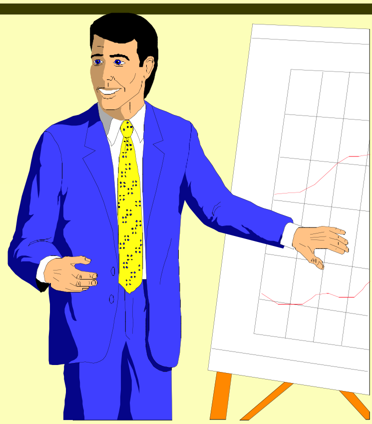


BMW – Planning



Situation:

- No information on total utilization

- No capacity planning

CODINE:

- **Full utilization of workstations**
- **Facilitates hardware upgrades**

Result:

- **CODINE made growth possible:**
  1994: 32 CPUs
  1998: 350+ CPUs
- **Million DM savings**
- **83% utilization through CODINE jobs**

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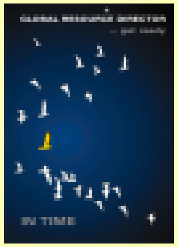

BMW – End-User

Situation:

- Crash simulations with PAM-CRASH
- Number of computations has doubled since 1994
- Size of 3D models has increased by factor 3

CODINE:

- **Short turnaround times**
- **Better computational performance by optimized scheduling**
- **Standardization, complexity is reduced/avoided**

Result:

- **Productivity boost**
- **End-user can focus on engineering tasks**

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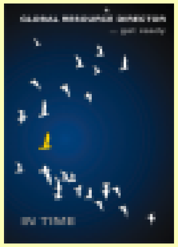

BMW – System Administration

Situation:

- Scheduling by phone calls
- Number of users increased from 3 to > 45
- Growth of computing environment

CODINE:

- **Automatization**
- **Global system view and control**

Result:

- **Reduced time needed for administrative tasks**
- **Increase in availability**

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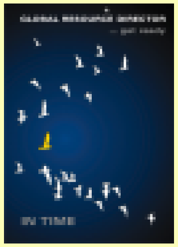

BMW – Application Services

Situation/Requirements:

- grant resource shares for users
- jobs with different priorities
- several applications with different usage profiles

GRD:

- **granted resource shares**
- **dynamic control of resource usage**
- **automated response to priority work**

Result: (planned)

- **high quality supercomputing services**
- **shorter product cycles through integration**
- **increase in utilization to over 90%**

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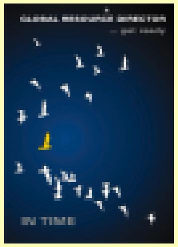
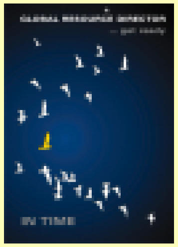


GRD at Army Research Laboratory (ARL)

Aberdeen, MD, USA



ARL Configuration

Unclassified System

- 1 Cray T90 8 IEEE processors
- 4 x 64 processor Origin 2000
- 1 x 32 processor Origin 2000

User Profile

- Approx. 500 engineers, developers & researchers from ARL and other DoD agencies
- Parallel jobs (mainly MPI) on Origins
- Defined resource share entitlements for a range of departments (Army, Navy, Air Force, ...)

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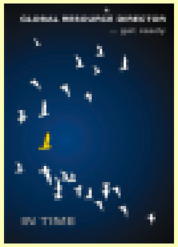

ARL Resource Management Goals

- Fair distribution of resources over a sliding time window
- Short term over-commitment of resources for the price of later compensation
- Express & dead-line jobs
- Automatic enforcement of policies
- Manual override capabilities

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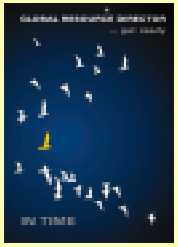

GRD at ARL
Customer Quote

Denice Brown - Mgr. of Operations & Customer Services

*The user can be assured of getting his or her job run in the most **fair and efficient** manner according to set **sharing policies**;*

*... **the system administrator** has the benefit of having the resource allocation done **automatically** as well as being able to **monitor resources** at both the site and individual job level."*

Previously, resources were **degraded** for everyone when a few users **"overused"** the system.

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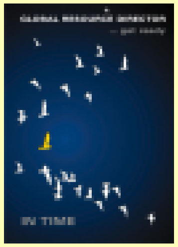

Conclusions

- GRD targeted for
  - HPC centers
  - Enterprise or large department computing facilities
  - Application/Computing service providers
- Unique capabilities:
  - Support for heterogeneous environments
  - Utilization policies across an enterprise computing environment
  - Flexible administration
- GRD helps to
  - Gain overview on resource utilization profile
  - Distribute resources fairly
  - Implement level-of-service agreement

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