

Autonomic Computing in Action

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chnology

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Agenda

- Putting the pieces together
- Autonomic Computing system examples
 - Building a self-healing system
 - A self-configuring system
- Autonomic Computing research
 - Self-configuring devices
 - Self-optimizing web servers
 - Utility functions
 - >Autonomic Computing Storage
 - Ethnographic Studies









Problem Determination todayrrow





Autonomic computing self-healing systems



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In a basic problem bypass and resolution service flow, most tasks and information exchanges are performed manually





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Self-healing Vision



IBM Global Services



In a more autonomic workflow, the infrastructure can detect and bypass many problems and the tools help automate the information exchange between tasks







A self-configuring system: Think Dynamics





Focus on Autonomic Computing Research



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Autonomic Computing Research <u>PCE</u> - Personal Software Configuration Engine

- Automate SW maintenance & migration on personal devices
- "Upgrade all my applications"
- "Make my new laptop work like the old one"
- "Migrate most valuable Palm apps to my PC"

ACTI '02





An important scenario: Workload surge

Systems can go from steady state ...





Autonomic Computing: Dynamic Surge Protection



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Utility Functions and Autonomic Computing

- Utility functions can guide autonomic decision making
 - Self-optimization: natural way to express optimization criteria

 Declarative: preferable to implicitly hardcoded in special purpose algorithms
 - Derivable from business objectives (e.g. optimize total profits)
 - •Can translate to computing metrics at different levels
 - Exploring applications in Workload
 Management, other areas



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IBM IceCube Server

10 Gbit/s

capacitive

"Coupler"

(6) per brick



- Fail-in-place policy: bad bricks are left in place
- 7 x smaller than equivalent standard systems
- Fast, power-hungry components (CPU etc) ok
- Includes resource allocation software
- First Application : Petabyte-class Storage Server
 intended to be managed by one person



Full IceCube System blue: Storage Bricks yellow: Compute Bricks 3D mesh @ 10 Gb/s per link



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Ethnographic Field Studies of Middleware Admins

What tasks do Autonomic Systems need to simplify for Sys Administrators?



DB2 Poughkeepsie, IBM IGS SDC



WAS/Middleware Southbury, IBM IGS SDC



WAS Boulder, IBM IGS SDC



WAS/Middleware Southbury, IBM IGS SDC



DB2 Charlotte, Belk

Study and Analysis methods used to study Sys Administrators at work





Task Time Charts



Video Analysis Lab

> Early finding: Collaboration compensating for system complexity and simple tools

"Let's do it together"





What do those admins do? (Video Analysis)



21

- ~90% time collaborating
- Main topics
 - collaboration
 - configuration
 - strategies

- ~60% time collaborating
- Main topics
 - commands
 - strategies
 - collaboration
 - configuration

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Preliminary findings for AC Console UI designs



- Collaboration is a vital part of admin practice
 - Help establish trust among participants
 - Support side-by-side exploration of system events, configurations, etc.
 - Enable ready, shared access to all relevant information

Troubleshooting depends on information access

- Need clear and consistent naming conventions for system objects
- Support easy correlation of log data and config settings
- Make logs browsable, visualizable, query-able, annotatable
- Place events in the context of end-to-end systems rather than of components

Admins build their own tools, configure their own environments

- Support "tools built by admins for admins"
- Provide composable components and appropriate combination methods
- Enable widespread sharing of admin developed tools



Summary



- Autonomic Computing architecture components and interfaces come together to form a system
- Today's IT processes can be improved through Autonomic Computing
- IBM Research is working on some of the hard problems in Autonomic Computing, but there is still a lot of work to do!

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