

Autonomic Computing: Our Hopes, Dreams, and Fears

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Agenda

- ▶ Briefly, what is Autonomic Computing (AC)?
- ▶ How will AC impact me and my job?
- ▶ What can I do to prepare myself for AC?

Autonomic Computing Defined

- ▶ IBM was first to back a cogent, corporate vision for autonomic computing (AC):

- 60% ● Self-Configuring: deployment of new components or changes with minimal human intervention
- 25% ● Self-Healing: detect improper operations and initiate corrective action without disrupting system applications
- 10% ● Self-Optimizing: automatically maximize resource allocation and utilization to meet end-users' needs
- 40% ● Self-Protecting: detect hostile behavior and take autonomous actions to mitigate attacks and general failures

- ▶ Source:
http://www.ibm.com/autonomic/pdfs/Autonomic_Computing_Overview.pdf

Levels of AC Maturity

www.ibm.com/autonomic/pdfs/Autonomic_Computing_Overview.pdf

- ▶ **Basic:** Manual analysis and problem solving
- ▶ **Managed:** Centralized tools, manual actions
- ▶ **Predictive:** Cross-resource correlation and guidance
- ▶ **Adaptive:** System monitors, correlates and takes action
- ▶ **Autonomic:** Dynamic business policy-based management

*“Autonomic computing is not an overnight revolution in which system-wide, self-managing environments suddenly appear. Rather, it is a gradual evolution in which **new technologies, methodologies and best practices** are implemented using IT Infrastructure Library (ITIL)-aligned flows.”*

The Future is Certain, But the Path is Unclear

- ▶ Demand for IT professionals outstrips supply 18:1
 - Implication: More jobs and higher salaries?
 - See: “If there's an IT skills shortage, where's my job?”
<http://www.itworld.com/Career/1827/070904/job/pfindex.html>
- ▶ Growth of IT infrastructure is exponential
 - Implication: Market demand drives unsustainable rates of increase in computing power and complexity
 - Software crisis: Over budget, beyond schedule, buggy, unmaintainable
 - Hardware crisis: Volume overtakes reliability: Death by Moore's Law (http://www.scidac.gov/Conference2007/presentations/gibson_pres.pdf)
 - Education crisis: Few qualified people for high-tech jobs; overseas workers are disproportionately well-educated
- ▶ Cost of IT personnel is prohibitive
 - Implication: Automate, outsource, or die
 - Thousands of able-minded Asians want your job!
 - And they'll do it cheaper (see automotive industry)



State of the Art: Autonomics in use today

▶ Autonomics is currently in the research stage. Current work falls primarily into two categories:

- Vertical systems that are autonomous but narrow
 - Port Scan Attack Detection (PSAD)
 - Automatic software updates
 - Linux-HA

HORIZONTAL

- Horizontal systems that provide broad automation without real autonomy
 - IBM Tivoli Intelligent Orchestrator (TIO)—Tivoli is an actuator for AC
 - cfEngine, Puppet, etc.—Automation for system administration

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Autonomics: Our Hopes and Dreams

▶ High-Level

- Junior sysadmin able to handle open-ended tasks
- Let humans stay at the policy level
- Programming language for systems
- Just enough (and not too much) detail in reports
- Natural language processing for instructions and reports

▶ Low-Level

- Have it learn to automate what I do repeatedly (high-tech macro recorder/player)
- Build and share best practices
- No downtime!

Autonomics: Our Fears

- ▶ Will AC systems know when to ask for help?
- ▶ How do you verify self-configuration is good?
- ▶ Is there really a one-size-fits-all AC solution?
- ▶ If we can't get something as simple as automatic spell checking right, what business do we have designing autonomics?
- ▶ Will AC dumb-down new generations of admins so they won't know how to fix anything?
 - Has this already happened???
 - Does it matter?
- ▶ Will AC hide so much information that investigation will be impossible?
- ▶ Will AC systems be OS agnostic, or will they force new levels of vendor lock-in?

What about my job?

- ▶ There will always be a need for human system administrators because:
 - The complexity of systems is growing faster than the complexity of software solutions to manage them
 - With autonomics to take care of the well-defined problems, only the difficult ones remain
 - There will always be ill-defined technical problems that require human intervention
 - Autonomics save work but cannot handle every case
 - More automation will be needed, implying probably no net job loss
 - Someone will still have to verify that the system is working correctly

What about my job? But AC will change the profession

- ▶ System administration is tied to ever-changing technology—change is the only constant
 - Evolutionary changes can cause revolutionary tipping points
 - Computers will be trusted with more kinds of work
- ▶ Overall effects of AC:
 - Fewer tedious jobs (+)
 - More time to help human users (+/-)
 - More complexity per case requires greater specialization (-)
 - **Generalists** might work for AC consumers (Nurse Practitioner model)
 - **Specialists** would work for AC vendors (MD Specialist model)
 - **Super-generalists** might be independent contractors (MD General Practitioner model)
 - AC will impact IT specialists (DB, storage, etc.) more than system or network admins (+/-)

Preparing for an AC Future

- ▶ Stay informed
 - Magazines, web sites, etc
 - Professional societies (SAGE, LOPSA)
- ▶ Contribute to the community
 - User lists for Puppet, cfEngine, bcfg, etc.
 - Get to know the luminaries among us: Mark Burgess, Alva Couch, Andrew Hume, Luke Kanies, and a host of others
- ▶ Embrace change
 - Keep a positive attitude
 - Be willing to learn
- ▶ Deliver great value to your employer
 - Use autonomics to improve your job performance
 - Be part of the revolution—use and develop new tools
- ▶ Don't Panic! 😊

Conclusions

- ▶ AC is coming, but slower than you might think
- ▶ Outsourcing is probably a greater job threat
- ▶ Read my paper in April 2007 ;login:
<http://www.usenix.org/publications/login/2007-04/openpdfs/fink.pdf>
- ▶ Please come to my invited talk at 4PM today!
- ▶ Don't panic! 😊

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Please contact me if you would like to participate in my AC survey!

<http://surveyext.pnl.gov/cgi-bin/autonomic/ezs.exe?database=autonomic>