Autonomic Computing 2: Implications for IT services

Executive Summary -- Autonomic computing has vast implications for information technology (IT) services. Its technologies are already being applied to business recovery and continuity. Outsourcing firms are predicted to be the primary market for autonomic computing because of the potential for flexibility and cost savings. Services personnel -- including architects, consultants and practitioners -- will need to adapt to include people in the system designs more effectively and to provide improved ease-of-use, knowledge management and security features for the purpose of meeting the requirements for hiding complexity from the user. Ultimately, autonomic computing promises to automate many of the assessment, integration, configuration and deployment tasks performed by IT services today. As this automation increases, design, planning and architecture will become even more critical, albeit at a higher, conceptual level.

Background
The theory behind autonomic computing is to create systems that self-regulate, self-repair and respond to changing conditions. Based on this fact, it may appear to be a contradiction to say that IT services will play a crucial role. After all, one of the big selling points for taking on the challenge of developing autonomic computing is the reduction in labor costs. But one of the most attractive reasons for improving IT services is to make the technical capabilities of systems valuable to people and businesses. In fact, one of the first uses of autonomic computing is in the realm of disaster recovery and business continuity, and many of the characteristics that help define autonomic computing depend on the focused and creative work of architects, consultants, practitioners and other services personnel for their success.

Characteristics of autonomic computing
Services will be needed to provide the characteristics of autonomic computing. The paper, Autonomic computing: IBM’s perspective on the state of information technology, lists the characteristics of autonomic computing. For instance, one characteristic is "an autonomic computing system must configure and reconfigure itself under varying and unpredictable conditions." A prerequisite for this characteristic is an abundance of modular software and a strict adherence to standards. In addition, there is also a requirement for careful planning of the systems architecture. Information design, particularly taking full advantage of Extensible Markup Language (XML), is needed so that new combinations are efficient and make sense. Just as important as the software and standards, a thorough analysis and understanding of human factors and the possibilities for personalization will be critical. For example, many companies have redesigned their sites to allow significant customization by visitors. The return on that investment theory is that when users can personalize sites, they are more inclined to pay for subscriptions, use online bill payment services and promote products to friends.
Another characteristic of autonomic computing is that "an autonomic computing system never settles for the status quo -- it always looks for ways to optimize its workings." If that is true, then people need to be considered as part of the overall system. Real optimization must be considered in terms of current human needs, not just algorithms. This means that, from time to time, experts will need to be identified and -- though they might take advantage of decision support -- their analysis of the situation and its opportunities and challenges will be essential. The underpinnings of this decision support and analysis are human-centered knowledge management systems. These systems will need special attention paid to training, roles and ease-of-use. Given the variations in communities, this area of optimization will require the efforts of consultants who understand both tools and human motivations.

A third characteristic of autonomic computing is that "an autonomic computing system must be an expert in self-protection." While the spirit of this statement can be true, no system can deal with wily humans by itself. The world of security is particularly dynamic, with new approaches to intrusion being developed and harmful code being created constantly. While immune systems and pattern recognition can help deal with novel situations, ultimately, the system must include human judgment because the trade-offs are rarely clear cut. People must weigh the risks, balancing the opportunities of openness against the potential threats. People also must analyze the situation to understand what is at stake and take responsibility for their choices. Services personnel need to provide environmental assessments, training and customized rules and policies. In short, they need to do everything from surveying business opportunities to thinking like a hacker -- the types of tasks that can not be handled entirely by systems.

Consider this next characteristic... “An autonomic computing system knows its environment and the context surrounding its activity and acts accordingly.” If a computer system can know its environment, and more importantly, its context, it has the potential to significantly increase its value to us. The practical application of some of this -- such as optimizing storage capacity due to changes in the distribution of users -- is primarily technical. But consider how the value to users may extend if data is adjusted for a new interface in a way that is appropriate to each individual. It may include prioritizing information so that the messages that are the most important to users are presented in a way that is most likely to attract their attention. Collaborative filtering, ease-of-use, personalization and affective computing are all important tools for helping to realize higher value, and they all rely on making value judgments, including valuable insights on the preferences of individuals and useful assessments of their responses. People are integral to the context.

Finally, "an autonomic computing system will anticipate the optimized resources needed while keeping its complexity hidden." This characteristic is not only highly dependent on taking user needs into account, it must anticipate those needs. In order to anticipate user
needs; user preferences, authorization limits and patterns of use must be understood. In addition, the system designer must understand and anticipate the many ways people interact with each other. Attention to social computing is particularly important when the system is called upon to support or even participate in online groups -- commonly called communities. People can belong to a variety of communities. Examples include: practitioners engaged in similar lines of work; employees across various functions that support a common product line; or students from different schools all interested in chemistry. All of this requires intense evaluation of, and sensitivity to, differences between individuals and communities. Even as the needs of the individual are detected, they must be balanced against the actual or potential needs of the community as a whole. For instance, optimizing solely based on whoever is first in line is not a good model.

The services industry will be challenged
If the full vision of autonomic computing is to be realized, the IT services industry will need to evolve. If the system becomes more modular and standardized, lower-level tasks in deployment and configuration will be handled by the system. This can make people available for more challenging and interesting tasks. If systems are able to improve their reliability and to handle dramatic changes in capacity requirements automatically, the challenge will become building new types of IT services contracts and learning to manage service levels differently.

Probably the greatest benefit for companies that take advantage of autonomic computing will be realized in improved dealings with very large and dynamic systems that are designed to accommodate people of differing skill levels, priorities and goals, as well as those that vary in type and rate of change. Planning, strategy and applied imagination will be at a premium. A deeper understanding of the value, uses and support of community within a more complex technical environment will be in demand. Those employees involved with helping to develop autonomic computing systems will need to be expert listeners who can adapt to new situations and find creative ways to satisfy the needs and demands of users.

Here are some considerations for the future:

- **Who will be involved?** For individuals and businesses alike, this will mean a greater dependence on teaming.
- **Who is responsible?** With a much larger, more complex and more connected system, someone will need to take responsibility for glitches when they occur.
- **Who knows the answer?** Increased complexity will require that people in different organizations work together to solve problems, so both the tools and the environment for knowledge management will need to be strong.
- **How can an avalanche of new options created by autonomic computing and inventive uses for it be realized?** Those companies that create environments that set the standard for being flexible and creative will be the winners in this new world. Social challenges, rather than technical ones, may be the most daunting elements of the "Grand Challenge" of autonomic computing.
References

Other sites of interest
Affective computing
http://www.ibm.com/services/insights/etr_affective.html

Autonomic computing
http://www.ibm.com/services/insights/etr_autonomic.html

Collaborative filtering
http://www.ibm.com/services/insights/etr_collaborative.html

Communities of practice

O’Reilly and Associates, Inc.
http://www.xml.com/

Personalization
http://www.ibm.com/services/insights/etr_personalization.html

Pervasive computing
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**Knowledge Management:** capturing a company’s collective expertise wherever it resides -- databases on paper, in people's heads -- and distributing it to where it can produce the big payoffs

**Pervasive Computing:** combining communications technologies and an array of computing devices (including PDAs, laptops, pagers and servers) to allow users continual access to the data, communications and information services

**Realtime:** "a sense of ultracompressed time and foreshortened horizons, [a result of technology] compressing to zero the time it takes to get and use information, to learn, to make decisions, to initiate action, to deploy resources, to innovate" (Regis McKenna, *Real Time*, Harvard Business School Publishing, 1997.)

**Ease-of-Use:** using user-centric design to make the experience with IT intuitive, less painful and possibly fun

**Deep Computing:** using unprecedented processing power, advanced software and sophisticated algorithms to solve complex problems, and derive knowledge from vast amounts of data

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