

Preface: Technologies for a Smarter Planet

Many of today's systems—the global economy, man-made systems, nature's systems, human organizations, and supply chains—are becoming interconnected, instrumented, and intelligent. These systems involve complex interactions that depend on systems of policies, models, and information technology (IT) infrastructures. Our vision is to bring a new level of smartness to how the world works and how every person, business, organization, government, natural system, and man-made system interacts. Each interaction represents a chance to do something better, more efficiently, and more productively, but it is more than that. As the systems of our planet become smarter, we have a chance to open up meaningful new possibilities for progress. For example, in Singapore, a high-performance automated fare-collection system, which can be exploited across modes of transportation, will provide convenience for commuters while ensuring accurate financial settlement to the Land and Transport Authority. As an additional benefit, end-to-end travel patterns will be available to planners for future transportation systems.

Whether the goal is to impact the environment by understanding and improving how we consume and conserve energy, to enable predictive business insight through the instrumentation of our corporate systems, or to support the development of a dynamic enterprise that can swiftly adapt to thwart threats and to generate new value, a new class of innovative technical solutions will be required. New approaches to technology development are possible as we globally connect our teams. Sensor networks are lighting cities and enabling smarter use of resources and improvements in the quality of life of their inhabitants. In Dublin, Ireland, researchers from IBM and the Marine Institute, Ireland, have completed the pilot phase of a project to develop a research infrastructure of sensors and computational technology interconnected across Galway Bay, collecting and distributing information on coastal conditions, pollution levels, and marine life. Beneficiaries will range from the tourist industry and aquaculture to the environment as the project is fully executed. Similarly, through a wide variety of programs, IBM technical leaders are addressing everything from core technologies to initiatives focused on natural resources across the globe.

The first paper in this issue on technologies for a Smarter Planet™ addresses the broad vision of a Smarter City and explores the technology that will be needed to support it. Harrison et al. describe the defining characteristics, requirements, and immediate and foreseeable applications of a new information-systems-based platform for the design, planning, and operation of Smarter Cities™. They also establish the key roles that these newly enabled cities

will play in addressing a growing number of societal challenges.

In his paper, Jennings notes that, along with the enormous opportunities that are proffered by an interconnected and instrumented world, there are challenges that must be addressed. One of the key areas to be explored involves managing risk in an environment that seemed impossible just a few years ago. This paper addresses specific examples of emerging threats and risks, analyzes the root causes associated with the risks, and describes some measures that are being implemented in order to mitigate these threats and risks for the future.

In the next paper, Spangler et al. tackle the issue of analyzing and rationalizing the unstructured information that has grown exponentially with the rapid acceleration of Internet use. Text-mining algorithms are not sufficient. They propose a unified approach to addressing a variety of information space analytics problems and describe how their method has been implemented within organizations to enable decisions that have produced measurable business value.

Molloy and Iqbal examine the challenges of designing and running data centers as the focus on energy consumption and the need for green solutions becomes urgent. The “green data centers” that they describe make use of facilities and IT integration to lower energy costs, reduce carbon footprint, and reduce demand for power, space, and cooling resources. They review energy-efficiency strategies that have been incorporated in IBM's own data centers, and they describe the integration of key strategies that are being exploited to create a class of leading-edge IBM data centers.

Stanford-Clark and Wightwick consider the opportunity provided by applying IT to the understanding and management of large complex manufactured and natural systems. Because these systems can involve large-scale environmental, monitoring, and control systems that must be integrated and coupled with more traditional core business applications and their underlying infrastructure, a pervasive messaging infrastructure is required to enable intercommunication of applications and devices. In this paper, they explore applying the publish-subscribe messaging paradigm and programming model to these complex systems.

The next two papers consider the application of “smart principles” to design and development problems in the IT space. Interconnections, intelligence, and instrumentation can enrich our thinking about creating an enterprise architecture that is flexible, efficient, and productive. These notions can also inform the development of software, especially through the use of Agile techniques.

Isom et al. describe Intelligent Enterprise Architecture (IEA) as an architectural style and technique that is designed to make systems more efficient and productive. The IEA that they envision has four entry points: 1) cloud computing, 2) social computing, 3) Green & Beyond, and 4) information

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intelligence. After considering several sample applications, they discuss the potential economic benefit that can be derived from IEA.

Ganis et al. consider Agile software development from a new perspective. By enriching the techniques with the right approaches to team interconnections, instrumentation, and intelligent designs, Agile development methods can leverage geographically distributed development teams and address rapidly changing market requirements. The authors provide a brief survey of the adoption of these practices and methods across IBM, which is an example of their potential in large enterprises.

In the final paper, Eckman et al. consider a huge challenge in the management of natural resources—water, in particular. This type of problem requires an intelligent infrastructure that can integrate technology with business, government, and the everyday lives of citizens in order to maximize the use of scarce resources. They posit an integrative modeling framework to enable the integration by nonexpert users of diverse sensor-based data, related business data, and complex cross-disciplinary mathematical modeling. They describe a research prototype that applies mashup automation with runtime invocation and orchestration in a specific application area in water management. Although the focus is on water management, the technology can be generalized to other intelligent infrastructure applications.

The concepts associated with the Smarter Planet initiative—instrumented, interconnected, and intelligent—are yielding advances in areas ranging from software development and enterprise architecture, data center design and management, and design and operation of cities that can exploit technology to improve the service provided to their citizens, to the management of scarce natural resources. As these ideas are further developed, systems and processes will be enhanced to improve productivity, generate economic and societal benefits, and enable businesses to run more efficiently. The IBM Academy of Technology is the community of IBM’s technical leadership—800 global technical leaders from every part of the technology spectrum. These leaders are guiding new projects within IBM, working with clients to achieve new business value, and conducting exploratory research to understand the potential benefits of realizing the Smarter Planet vision. This issue highlights the technology that is being developed and the challenges that must be overcome as Academy members, i.e., IBM technical leaders, continue to address the question “How does IBM need to apply its technical prowess to generate radical new value in an increasingly instrumented, interconnected, and intelligent world?”

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