

# Introduction

In 1965, when computer science was still a new academic discipline, the first department of computer science was formed in the IBM Research Division at the Thomas J. Watson Research Center (Yorktown Heights, NY). The department's stated mission was "to create and test new concepts and techniques in computer systems design, and to identify and provide a first inroad into new areas of computer applications." Since then, computer science has established itself across all the IBM Research labs worldwide: Almaden, Austin, China, Haifa, India, Tokyo, Watson, and Zurich. In the ensuing years, IBM Research has helped create important new areas of computer science research and to bring those research results to the marketplace. These include compiler optimization (FORTRAN), relational database (SQL and DB2®), speech recognition (ViaVoice™), Reduced Instruction Set Computer (RISC) architecture (RS/6000® and PowerPC®), data encryption (DES), fractals, and scalable parallel systems (RS/6000® SP™). Our research is fundamental to IBM's products, solutions, and services.

Our goal is to help create the future of computing. This includes inventing, developing, and applying technologies that will be vital to IBM's future success and obtaining fundamental results that influence the direction of computer science research. The strong partnerships we have established throughout IBM, the projects we conduct with IBM's customers, and the work we do in standards organizations enable us to be vital to IBM. Our interactions with the research community outside IBM as well as our participation in key conferences and publication in leading journals allow us to influence and to be influenced by the community at large.

Our research program is broad and deep, covering twenty different areas of computer science and the related discipline of operations research. In this brochure, we have grouped these areas into five broad themes: Foundations, Systems, Software, Internet, and Interaction.

**Foundations** covers algorithms and theory, security, operations research, performance modeling and analysis, and computational biology. Also included is the Deep Computing Institute that was established to explore the application of very large computing power to very large amounts of data in order to solve challenging business and scientific problems.

**Systems** includes VLSI systems, computer architecture, operating systems, storage systems, and distributed and fault-tolerant computing. Here, we describe Blue Gene™, a five-year \$100 million research program to design and build a petaflop computer capable of simulating protein folding. Blue Gene is being undertaken by a team of computer scientists, computational biologists, and electrical engineers. It is the kind of grand challenge, interdisciplinary research program that is possible only in a large and diverse organization such as IBM Research.

**Software** encompasses how software is developed (programming languages and software engineering), how data is managed (data management), how knowledge can be extracted from data (knowledge discovery and data mining), and how software can appear to possess intelligence (artificial intelligence). We also discuss our use of and our contributions to Open Source.

**Internet** spans the enabling communications and networking infrastructure, the technology aspects and uses of mobile computing, the evolution of Web technologies, and Internet-enabled electronic commerce. We also discuss the Institute for Advanced Commerce that we founded to promote e-commerce research and to provide a forum for understanding the societal implications of e-commerce.

**Interaction** covers the behavioral and interface technology aspects of human-computer interaction, natural language processing, multimedia, graphics, and visualization. In this context, our Planet Blue team of behavioral and computer scientists is addressing a future of pervasive computing that is part of everyone's life and so easy to use that it becomes invisible.

For more information on computer science research at IBM, please visit [www.research.ibm.com/compsci](http://www.research.ibm.com/compsci).

