



## Forschungszentrum Jülich reveals new insights into the human condition

*With supercomputing solution based on IBM Blue Gene*

---

### Overview

#### The need

Forschungszentrum Jülich (FZJ) is one of the largest supercomputing centers in the world. New research breeds further questions, and FZJ needed to find a slim, slick, smart way to deploy and manage new capacity.

#### The solution

IBM designed, sized and delivered a new supercomputing and storage environment, based on IBM Blue Gene architecture with IBM PowerPC processors, IBM Power 570 servers running IBM AIX, IBM Power 550 Express servers running Linux, IBM System Storage DS4700 Express storage, and IBM Tivoli Storage Manager and IBM General Parallel File System.

#### The benefit

The solution delivers peak performance of 1 petaflop/s and a sustained performance of 0.8 petaflop/s, which makes the system the fastest supercomputer available for non-classified research in Europe. The system is in the top 30 of the Green500 ranking of energy-efficient supercomputers, enabling the organization to address infrastructure and financial constraints while cutting energy consumption and costs.

---

Forschungszentrum Jülich GmbH (FZJ) is one of the largest supercomputing centers in the world, and helps scientists solve some of the most challenging problems. The organization employs around 4,500 staff and has a total budget of approximately €400 million. The center uses supercomputing to drive advanced research into energy, environment, health and information technology, and makes processing capacity, tools and expertise available to academic researchers across Europe.

### Business Challenge

FZJ is one of the largest supercomputing centers in the world, and helps scientists solve some of the most challenging problems. New research breeds further questions, and FZJ is always hungry for greater capacity within the same budget. Given the limited availability of personnel, implementing and operating a large, high-performance supercomputing system would potentially over-strain the center's capabilities. With a plan to quadruple existing processing power, Forschungszentrum Jülich needed to find a slim, slick, smart way to deploy and manage new capacity.

### Solution

Forschungszentrum Jülich GmbH turned to IBM for the design, sizing and delivery of a new supercomputing and storage environment, using new and re-using existing systems.

The new supercomputing platform follows the IBM Blue Gene architecture and utilizes 294,912 IBM PowerPC 450 core 850 MHz processors to offer peak performance of 1 petaflop/s and sustained performance of 0.826 petaflop/s, with 144 TB main memory. The system is housed in 72 racks, and consumes approximately 2.2 MW.

Two new IBM Power 550 Express servers running the Linux operating system operate as front-end nodes for the Blue Gene supercomputer, and are used to access the system and perform interactive work. Two further Power 550 Express servers, running the Linux operating system, operate as service nodes. An IBM System Storage DS4700 Express disk array provides shared storage for the front-end and service nodes.



---

#### Designed for Data

- FZJ analyzes massive quantities of data to discover new insights, collating, processing and managing information on an unprecedented scale in ways that were not possible before.

#### Tuned to the Task

- Different workloads are assigned to the processor platform most appropriate for the task: simulation on Blue Gene, interactive on Power 550 servers, data and metadata tasks on Power 570 servers.

#### Managed in the Cloud

- Blue Gene provides compute services to the academic community without researchers possessing any knowledge of underlying systems, delivering access to a 1 petaflop/s solution that would otherwise be out of reach of an individual research institution.

#### Driving Innovation

- FZJ is one of the largest supercomputing centers in the world, and helps scientists solve some of the most challenging problems. For example, results of simulations have influenced a new blood pump design that promises to permanently replace a damaged heart.
- 

Twenty-eight new IBM Power 570 servers running the IBM AIX operating system function as data and metadata servers in the storage system, running IBM General Parallel File System (GPFS). The Power 570 servers are attached to 18 IBM System Storage DS5300 devices. Eight existing Power 550 servers running AIX host IBM Tivoli Storage Manager software to provide automated backup and archive services for the GPFS storage system. Two existing IBM System Storage DS4800 devices provide shared storage for the backup and archive servers. In total, the system has 4.2 PB disk capacity and 71 GB per second aggregated disk bandwidth.

Three new and one existing Force10 E1200 10 Gigabit Ethernet switches, each with 224 ports, connect the Blue Gene supercomputer and the GPFS storage system.

IBM Global Technology Services team completed the implementation and delivered project management services, and will also provide operational support during the lifetime of the system. This includes installation of new software, configuration, optimization and problem analysis, as well as user and application support, such as porting and tuning applications.

Engaging IBM Global Technology Services allowed Forschungszentrum Jülich to meet important internal deadlines and make its infrastructure available to users in the shortest possible period of time.

IBM Global Technology Services - Maintenance and Technical Support will provide hardware maintenance, including microcode analysis and updates, and software maintenance. IBM Comfort Line service is included to support the Linux operating system on the Blue Gene front-end and service nodes. Services are provided on a per-project basis.

### Enjoying the benefits

The solution delivers leading levels of performance to the European research community. A peak performance of 1 petaflop/s and a sustained performance of 0.8 petaflop/s with the industry standard benchmark Linpack, which makes the system the fastest supercomputer available for non-classified research in Europe. The solution deals with stupendous quantities of data that unlock insight and drive new scientific breakthroughs into some of nature's most fundamental areas

More computing power translates into the ability to run more complex simulations and run them faster, which yield insights that researchers use to better understand the physical world—an understanding they apply to solving problems that affect individuals and society as a whole.

---

## Solution Components

### Software

- IBM® General Parallel File System (GPFS™)
- IBM Tivoli® Workload Scheduler Loadleveler
- IBM Tivoli Storage Manager
- IBM AIX®
- SUSE® Linux Enterprise Server

### Servers

- IBM Power® 550 Express
- IBM Power 570
- IBM Blue Gene®
- IBM System Storage® DS5300
- IBM System Storage DS4700 Express

### Services

- IBM Global Technology Services
- 

*“Successes such as designing a scaled-down version of the blood pump for children aged 5 to 15 are only possible because engineers and computer scientists from universities and research institutions work hand in hand.”*

— Professor Felix Wolf, Jülich Supercomputing Centre

---

Researchers use Blue Gene to process more precise simulations more quickly, delivering benefits to patients faster. For example, results of simulations have influenced a new blood pump design that promises to permanently replace a damaged heart.

The rated power consumption is 2,268 MW, measured on a system fully loaded with the Linpack benchmark. The system is in the top 30 of the Green500 ranking of energy-efficient supercomputers, at 363.97 Mflop/s/W, enabling the organization to address infrastructure and financial constraints while cutting energy consumption and costs.

### For more information

To learn more about smarter computing from IBM and how we can help you integrate, automate, protect and transform your IT, contact your IBM sales representative or IBM business partner, or visit:

[ibm.com/smartercomputing](http://ibm.com/smartercomputing)



---

© Copyright IBM Corporation 2011

IBM Deutschland GmbH  
71137 Ehningen  
Deutschland  
[ibm.com/de](http://ibm.com/de)

IBM Österreich  
Obere Donaustrasse 95  
1020 Wien  
[ibm.com/at](http://ibm.com/at)

IBM Schweiz  
Vulkanstrasse 106  
8010 Zürich  
[ibm.com/ch](http://ibm.com/ch)

Produced in Germany  
June 2011  
All Rights Reserved

IBM, the IBM logo, [ibm.com](http://ibm.com), GPFS, Tivoli, AIX, Power, Blue Gene and System Storage are trademarks of International Business Machines Corporation, registered in many jurisdictions worldwide. A current list of other IBM trademarks is available on the Web at “Copyright and trademark information” at: [ibm.com/legal/copytrade.shtml](http://ibm.com/legal/copytrade.shtml).

Linux is a registered trademark of Linus Torvalds in the United States, other countries, or both.

References in this publication to IBM products, programs or services do not imply that IBM intends to make these available in all countries in which IBM operates. Any reference to an IBM product, program or service is not intended to imply that only IBM's product, program or service may be used. Any functionally equivalent product, program or service may be used instead.

All customer examples cited represent how some customers have used IBM products and the results they may have achieved. Actual environmental costs and performance characteristics will vary depending on individual customer configurations and conditions.

IBM hardware products are manufactured from new parts, or new and used parts. In some cases, the hardware product may not be new and may have been previously installed. Regardless, IBM warranty terms apply.

This publication is for general guidance only.

Photographs may show design models.



Please Recycle