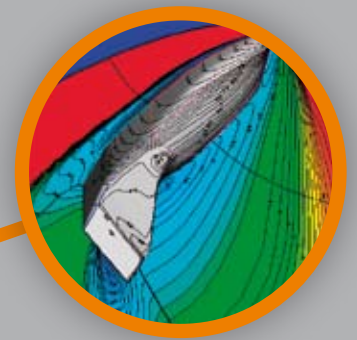
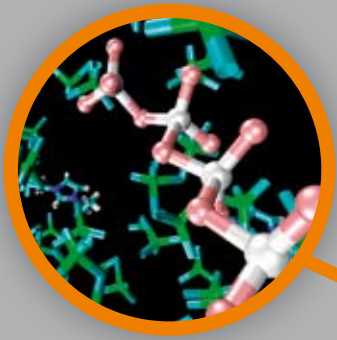
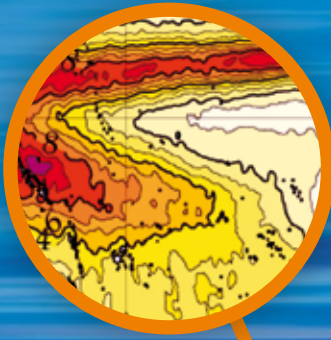


Imagine...

...completely new dimensions
of supercomputing.



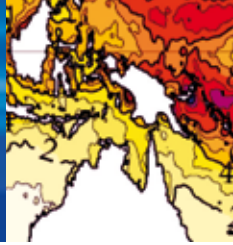
NEC SX-9: The world's fastest vector processor –
providing new levels of performance.



Empowered by Innovation

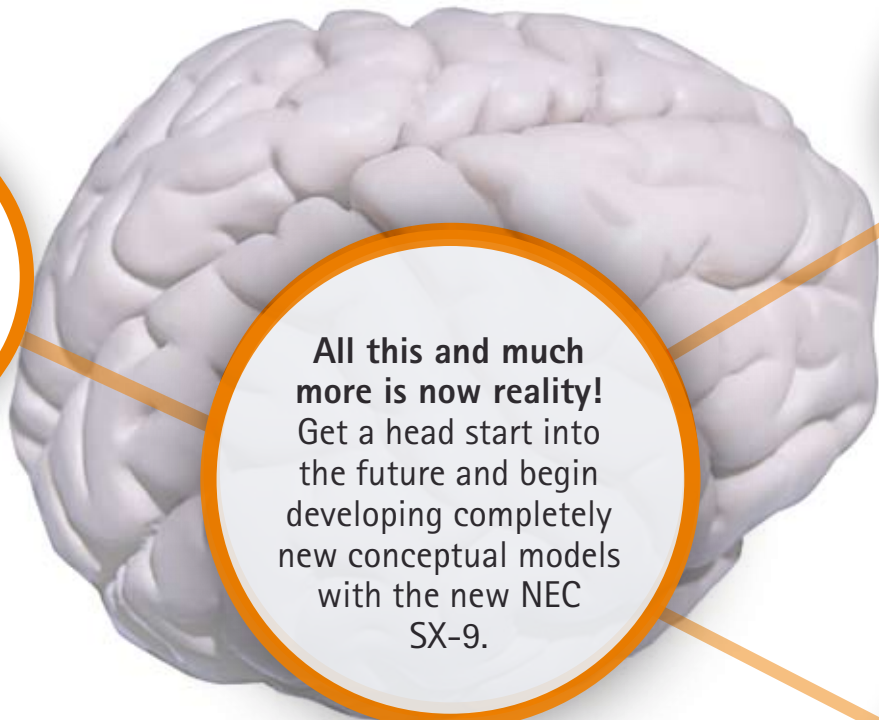
NEC

NEC SX-9: Supercomputing for the future – continuous innovation for your visions.



NEC has long been the leader of groundbreaking concepts that advance scientific research and development. We created the Earth Simulator, which for the first time in the history of computational meteorology enabled running climate models with over 10 km mesh size. NEC's SX-8R established new standards for scientific work. The extremely important relationship between sustained performance and TCO is one aspect that makes SX-9 a clear choice.

We don't just think ahead, we work to make your visions of supercomputing performance the foundation for your daily professional activities. The new NEC SX-9 provides you with opportunities which have perhaps been conceivable, but not achievable – until now. Welcome to a world of new perspectives!



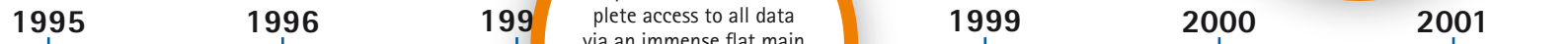
Imagine...
...you need 50% less power for the same sustained performance as the NEC SX-8R, but your computing processes still run with the highest degree of reliability.

Imagine...
...your simulations now run with up to four times the sustained performance of the NEC SX-8R, due to the SX-9's enhanced memory bandwidth and strong single CPU.

All this and much more is now reality!
Get a head start into the future and begin developing completely new conceptual models with the new NEC SX-9.

Imagine...
...you can now work even more flexibly because your applications run on the world's first vector system with a software-controlled assignable data buffer.

Imagine...
...you have fast, complete access to all data via an immense flat main memory with 1 TB capacity per node – and worldwide unparalleled bandwidth of 4 TB/s per node.



SX-4
Multi node (> 10 nodes) processor with CMOS and air-cooling

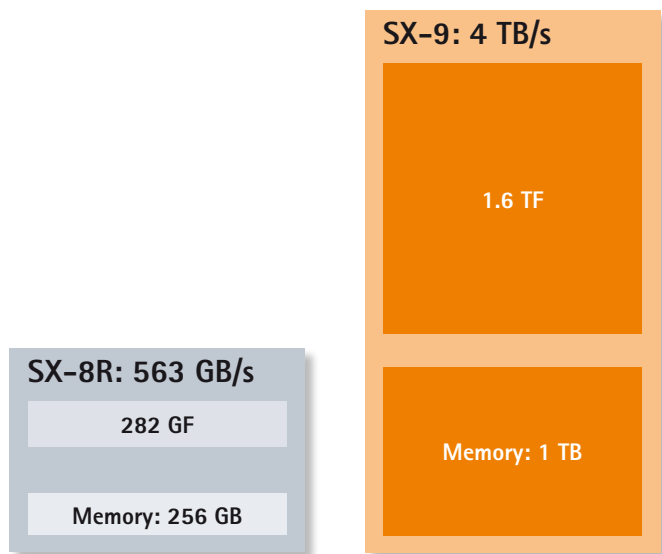


SX-5

perspectives

Attainable now: Completely new options and possibilities.

The new NEC SX-9 puts the next generation of our highly successful vector systems at your service. Not only is the SX series the perfect choice for computing climate and environmental simulations. It is also the most successful supercomputer series in the world, with unique, long-term and proven experience in many other scientific areas, like computational chemistry and fluid dynamics.



The SX-9 offers a flat uniform memory of up to 1 TB

NEC's new SX-9 supercomputer represents the new generation of vector systems:

- Performance of over 100 GFLOPS per CPU on 64-bit precision
- Strong SMP-node with 16 CPUs into one node for 1.6 TFLOPS per node
- More than 7 times higher bandwidth per node than the SX-9's predecessor, the NEC SX-8R.

Opening up completely new horizons.

The NEC SX-9 gives you completely new options for simulations in science, research and development. This supercomputer's performance revolutionizes the quality and quantity of your results.

The strong processor helps you to run applications with the highest sustained performance, even with a relatively low number of CPUs. You will benefit even more from the mixture of MPI and shared memory parallelization.

NEC SX-9: Outstanding performance with many benefits:

- Extremely high efficiency and unrivaled unique sustained application performance
- Flat huge main memory for your SMP applications
- Unsurpassed combination of incomparably low latency and high bandwidth
- Fast buffering/Assignable Data Buffer (ADB)
- Hybrid parallelization with multi node configuration
- High Density Packaging
- Optimized for low footprint and low power consumption
- Excellent price-performance ratio
- Easy installation, implementation and use

2002

2003

2004

2005

2006

2007

2008



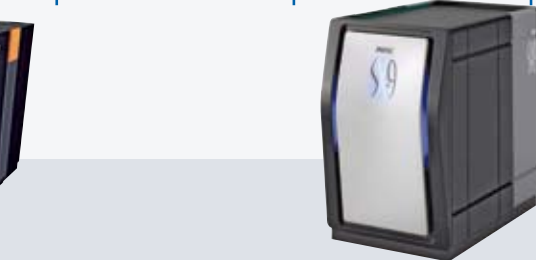
SX-6/7

Large cluster (> 100 nodes) supercomputer; World's first single-chip vector processor



SX-8

Super-large cluster (> 500 nodes) supercomputer



SX-8R

Maximized peak performance of 281.6 GF per node



SX-9

World's first supercomputer of over 100 GF per CPU

innovation

Experience the fascination of performance available for the first time.



With the new NEC SX-9, you can explore unimaginable potential. We offer the ideal supercomputing platform for new challenges. Take the next evolutionary leap with NEC's proven high-performance computing SX architecture.

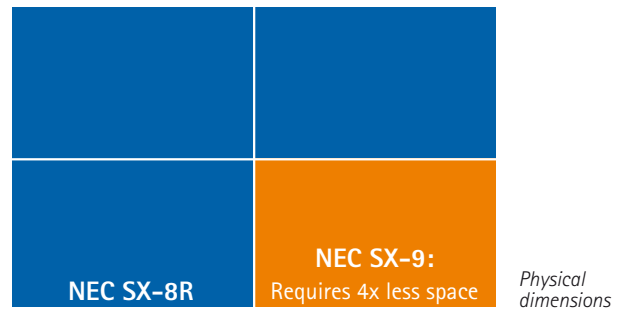
We now provide the highest-performance CPU in the world, which uses a new vector chip with over 100 GFLOPS peak on 64-bit precision. With 16 CPUs in one node and a maximum configuration of up to 512 nodes, the peak vector performance achieves more than 819 TFLOPS.

The NEC SX-9 also has a huge memory capacity of over 1 TB per node, or 512 TB with the maximum configuration. Its excellent sustained performance is complemented by outstanding bandwidth between processor and memory, which is due to the 10 Gbps serial interface. This unique ratio makes it the only perfectly balanced system on the market.

One of the main innovations of the NEC SX-9 is its newly designed vector processor. It contains 4 independent vector units, with each vector pipeline delivering 8-way results.

The compact physical dimensions of the NEC SX-9 will impress you.

To reach the application performance of the NEC SX-9, about 6 nodes of its predecessor, the NEC SX-8R, would be necessary. These have a footprint of approx. 8 sqm (without additional equipment), while the SX-9's footprint is only 1.6 x 1.2 m. The benefit is clear: NEC's new, even more powerful SX-9 requires four times less space than its forerunner!

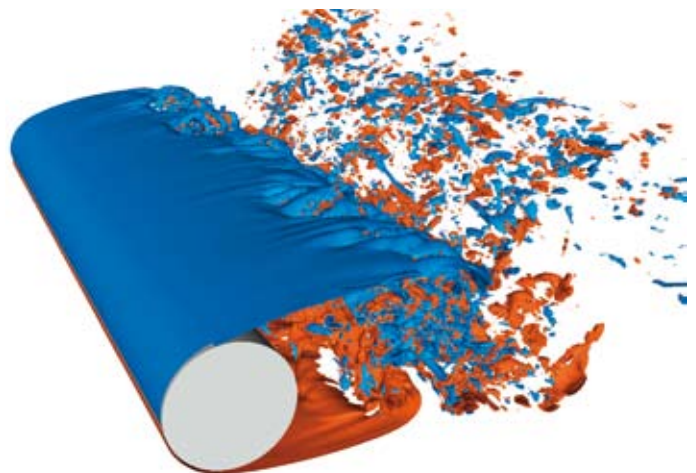


Designed for lowest energy consumption.

The SX-8R already set standards in low power consumption in the HPC market as well as in TCO. Despite the massive increase of memory capacity and bandwidth, the new SX-9 system is about twice as energy-efficient as the SX-8R vector computer. By utilizing leading-edge CMOS LSI and LSI design technologies, High Density Packaging and outstanding efficiency we achieve up to 50% of peak performance on real application codes. The SX-9 reduces power costs significantly as well as CO₂ emissions.

	NEC SX-8R	NEC SX-9
Performance per CPU	35.2 GF	Over 100 GF
Machine cycle (clock)	2.2 GHz	3.2 GHz
Memory bandwidth	563 GB/s	4 TB/s
Memory capacity per node	128/256 GB	512 GB/1 TB
CPUs per node	8	16
Performance per node	281.6 GF	1.6 TF
I/O Data rate	12.8 GB/s	64 GB/s
Internode bandwidth	8 GB/s x 2	128 GB/s x 2

NEC SX-9 compared to the NEC SX-8R



efficiency

Prepare for a multitude of new possibilities in science and research!

Market segments of the NEC SX series.

Meteorology, climate, environment
(41%)

Computer centers with various applications
(35%)

Air and space industry/energy
(12%)

Automotive industry
(7%)

Materials research
(4%)

Chemical industry
(1%)

Research institutes, computer centers or R & D departments in major companies: The new NEC SX-9 enables these and similar institutions to explore new levels of performance.

This innovative, powerful supercomputer offers a very high sustained performance in combination with its demonstrated high reliability. The basic concept of high memory bandwidth and strong single processor performance helps users in many disciplines to achieve their results within the shortest time.

Imagine how the NEC SX-9 could enable you to advance your applications...

Some of our successful projects:

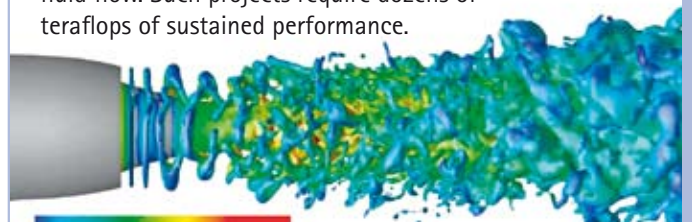
APPLICATION SCENARIO 1:

HLRS and NEC bundle their know-how in the Teraflopp Workbench Project.

NEC and the High Performance Computing Center Stuttgart (HLRS) at the University of Stuttgart work together in a Public Private Partnership for the advancement of supercomputing. The goal of this initiative is to support complex research projects in Germany. This includes projects in engineering, aerodynamics, structural mechanics, bioinformatics, medicine, nanotechnology and more.

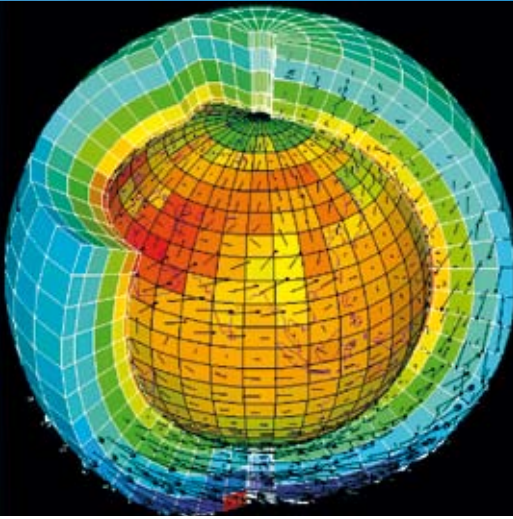
Fascinating future perspectives:

The scalability and outstanding performance of this new generation of supercomputers provides scientists with completely new perspectives. Much higher magnitudes of complexity can now be investigated, independent models can be coupled. This enables, for example, better study of interactions between structures and fluids, or chemical reactions in fluid flow. Such projects require dozens of teraflops of sustained performance.



applications

Come with us and focus on scientific progress – both now and in the future.



APPLICATION SCENARIO 2:

NEC's technology for weather forecast and environmental research.

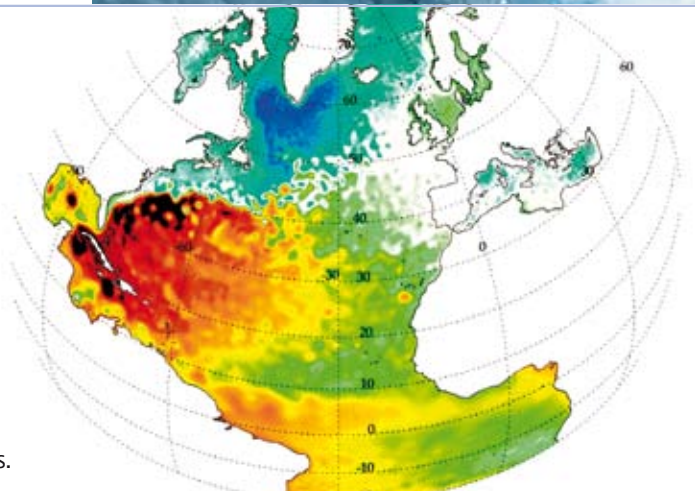
The earth sciences research community is one of the main customers of NEC vector technology. The NEC-SX series is a well known system in this segment – stable, reliable and highly efficient. Many simulation results from scientists, executed on NEC SX systems throughout the world, were published in the latest report of the Intergovernmental Panel on Climate Change (IPCC). Amongst those are complex and coupled models describing the global atmosphere and the oceans.



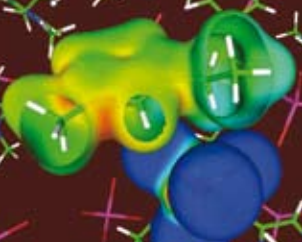
Fascinating future perspectives:

Most climate change simulations are created with models using coarse grid sizes with dozens of kilometers. But to understand how global warming will affect humankind, regional simulations with higher resolution and impact studies are needed. This requires greater computing power and longer time to run a simulation.

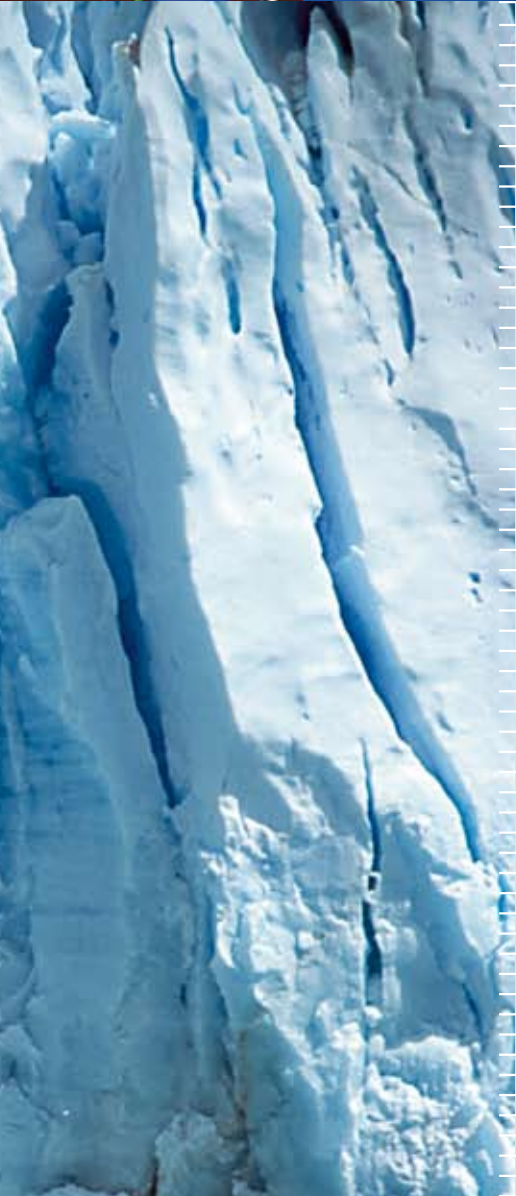
SX-9 systems will aid scientists in running coupled models of the earth system with higher resolution than ever before. Even adding new components to a coupled climate model will be feasible. By including explicit descriptions of physical processes and applying ensemble prediction, meteorologists will be able to create simulations with higher accuracy levels.



applications



Let our references and renowned customers inspire you!



NEC's customers have always been enthusiastic about our exceptionally beneficial combination of technological innovation, outstanding processor performance, remarkable cost-effectiveness and low TCO. This combination is the crucial factor why NEC SX supercomputers are increasingly successful.

Beyond that there's another benefit for you: NEC's reputation for professional support of research institutes and operational sites throughout the world. We always deliver what we promise, when we promise.

Here is a selection of our renowned customers:

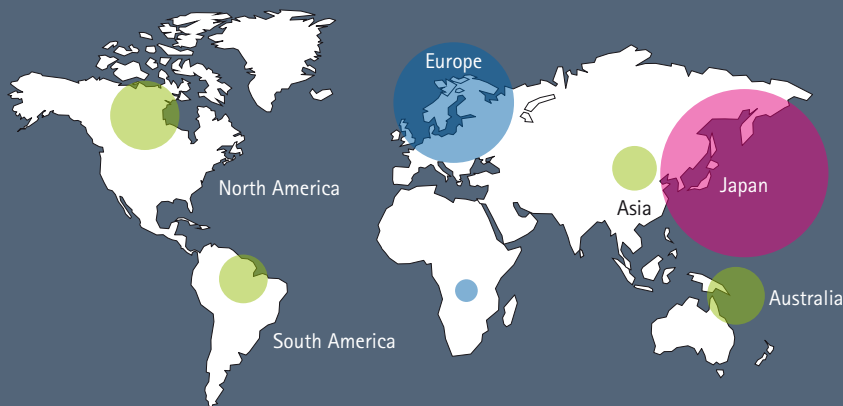
- Met Office, Exeter, United Kingdom
The Met Office is one of the world's leading authorities on weather and climate. Its remit is to provide essential information and advice on weather and climate change to the public, the government and industry, which means people can make better decisions today and for the future.
- High Performance Computing Center Stuttgart (HLRS) at the University of Stuttgart, Germany and NEC have founded a Public Private Partnership in order to actively promote science and technology in Germany: the Teraflop Workbench Project.
- Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany
- Christian-Albrechts-University Kiel, Germany
- Central Institute for Meteorology and Geodynamics, Vienna, Austria
- Central Research Institute of Electric Power Industry, Japan
- CHMI, Prague, Czech Republic
- High Performance Computer and Communications Center, Melbourne, Australia
- Institut du Développement et des Ressources en Informatique Scientifique, Paris, France
- Météo-France, Toulouse, France
- National Institute for Environmental Studies, Japan

Sales (units) by region

Japan

Europe

Others



More than 1,000 systems worldwide

- Cybermedia Center, Osaka University, Japan
- Forschungszentrum Karlsruhe, Germany
- National Institute for Fusion Science, Japan
- Office National d' Etudes et Recherches Aérospatiales, Paris, France
- Tohoku University, Japan

references

Your scientific imagination is no longer constrained by technology.



Our supercomputer of the latest generation meets the highest demands for performance, availability and scalability. It must also have functionalities that effectively support the most committed researchers in the world. The new system comes with three major innovations.

Data parallelizing has been increased even more.

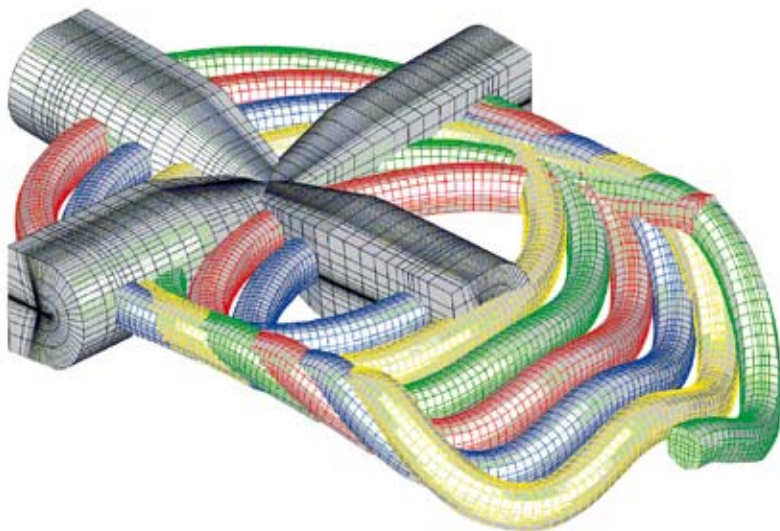
With processor performance of more than 100 GFLOPS per CPU, the NEC SX-9 is incredibly fast. Data have unrivaled fast access to the main memory: 256 GB/s per CPU, with the main memory being directly connected to the processor. As a user, you profit from an exceptional balance of computational power and bandwidth.

Unbelievably large main memory.

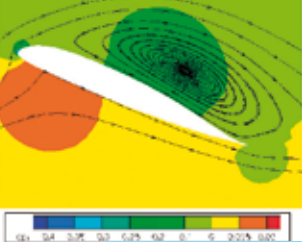
The NEC SX-9's main memory has been expanded to a maximum capacity of 1 TB per node. The memory access concept of the NEC SX series nodes is based on Uniform Memory Access (UMA). This means that the main memory, as flat memory, has no hierarchical steps and levels. The application performance is not affected by data locality issues.

Highly flexible through fast intermediate data buffer.

The NEC SX-9's innovative configuration also includes an Assignable Data Buffer (ADB). This new, high-performance feature is similar to a high-speed cache. It contributes to increasing sustained performance and can be controlled by software.



hardware



Consider perspectives that can now become reality.



Scalability in line with your needs.

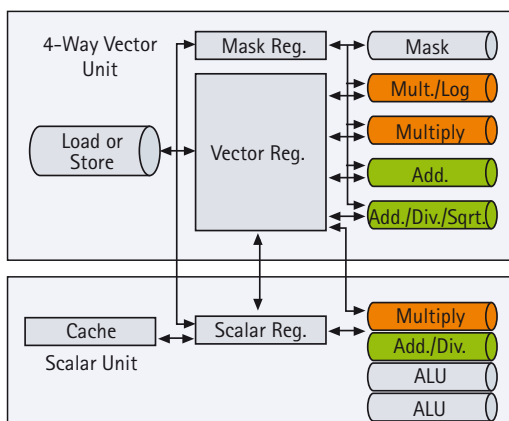
The NEC SX-9's IXS High-Speed Interconnect Switch ensures increased bandwidth of 2 x 128 GB/s. This bandwidth is even higher than the intra-node bandwidth of systems made by other manufacturers. This proprietary network, developed by NEC, enables applications in the NEC SX-9 to be distributed over many nodes. The combination of an MPI-2 Library, developed by NEC itself, and short latencies make your system extremely scalable – throughout many nodes.

NEC developed this proprietary MPI solution through years of close cooperation with its own research laboratories in Europe. NEC supports the full MPI-2 standard – and that since 2000!

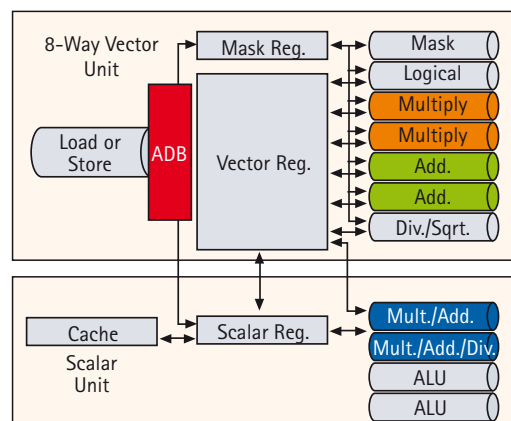
Leading in efficiency and environmental friendliness.

The new NEC SX-9 is manufactured based on advanced 65 nm-technology (CMOS). This enables High Density Packaging of the system, with the goal of not only reducing the power needed for operation and cooling, but also the physical size of the devices. After all, we want to offer a resource-saving system-solution. In comparison to the NEC SX-8R, the NEC SX-9's power consumption has been substantially reduced. It uses about 50% less power than the NEC SX-8R when handling a comparable application.

Many customers know that the NEC SX-8R delivered already an excellent TCO ratio. Nevertheless, we have continued to improve this advantage in the NEC SX-9.

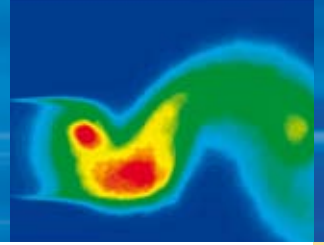


SX-8R CPU



SX-9 CPU

Take the time to calculate the exceptional benefits for your projects.



The NEC SX-9's technological superiority is reflected equally by its software and rich application environment.

Superb basis: the Super-UX operating system.

Users of the NEC SX-9 can have every confidence in the Super-UX operating system developed by NEC especially for supercomputing. The Super-UX is a proprietary high-performance OS that has proven itself since 1991 (NEC SX-2). It ensures not only extreme reliability, but also fast, uncomplicated maintenance during running operations. Your processors can run continuously.

Schedule and run time-critical applications.

Super-UX NQSII (Network Queuing System II) is a proprietary batch processing system for maximum utilization of high-performance cluster system computing resources. It comes with a comfortable Graphical User Interface for easy resource management.

One of the comfortable features is its absolutely reliable checkpoint/restart function, which is closely coupled to the Network Queuing System (NQSII). This feature provides robust implementation for checkpointing parallel applications that communicate through MPI. It runs reliably even when your applications are distributed over several nodes. Migration between nodes is possible as well.

Compilers and development environment.

NEC SX-9 compilers comply with the most recent standards:

- The Fortran compiler is fully compliant with Fortran 77/ Fortran 90/Fortran 95 standards and supports selected Fortran 2003 features.
- The C/C++ compiler supports ISO/IEC 9899:1999 programming language C standard and ISO/IEC 14882: 1998 programming language C++ standard.

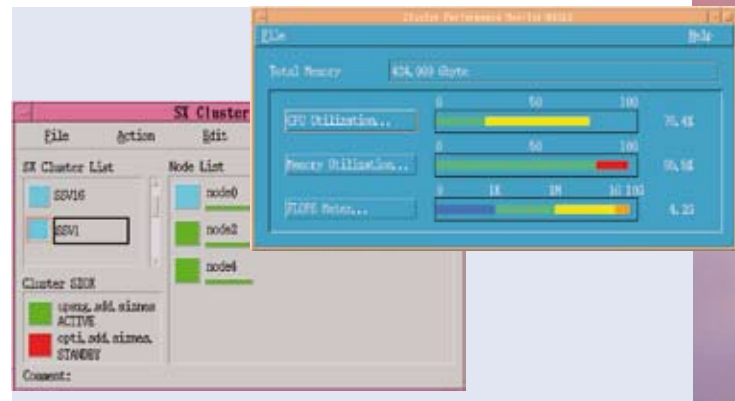
- For both compilers, Fortran and C++ full OpenMP2.5 support is available.
- Full MPI-2 standard support.
- The TotalView debugger enables easy and efficient development of complicated parallel and distributed applications.

New Job Scheduler and Job Manipulator.

Both functions run automatically and ensure that resources are utilized at the highest efficiency. New features include backfill scheduling and preemption control. In addition, a new scheduler can handle different priorities of jobs.

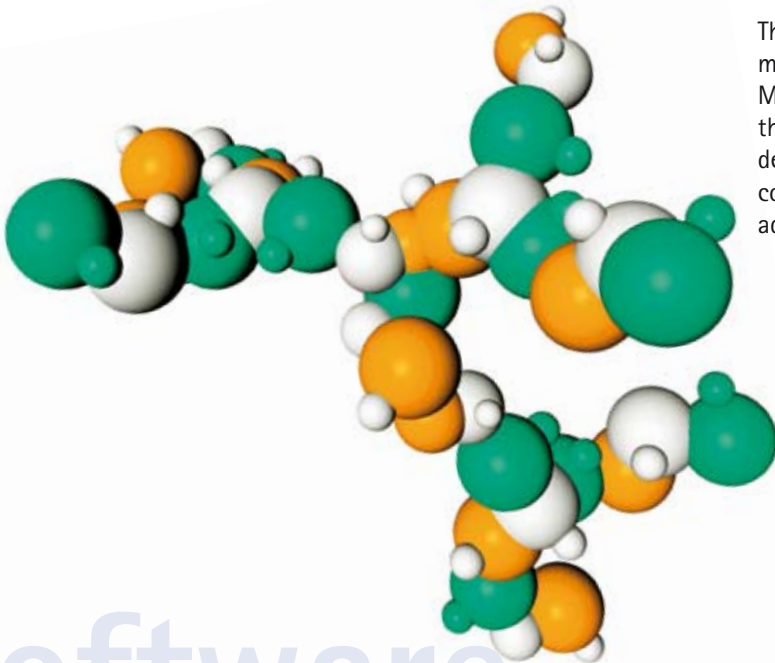
New Global File System: gStorageFS.

This solution, typically configured as FC-SAN with the NEC SX-9, has also been developed to ensure reliable 24-hour operation. All maintenance tasks can be performed during operation – even addition of new data capacity.



Comfortable operation and management.

The status of your NEC SX-9 in a cluster configuration can be monitored in real-time using the special MasterScope GUI. MasterScope is a unified X-window/motif-based interface that activates management tasks and instructions. The detailed operational status of each node can be centrally controlled, substantially reducing the management load of administrators.



These specifications detail the quantum leap enabled by the new NEC SX-9.



SINGLE NODE MODEL

SX-9

CPU Specifications

Max. Number of CPUs	16
Max. Peak Performance	1.6 TF

Main Memory Unit

Memory Architecture	Shared Memory
Capacity	512 GB - 1,024 GB
Memory Bandwidth	4 TB/s

I/O Features

Max. I/O Data Rate	64 GB/s
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MULTI NODE MODEL

SX-9

Number of Nodes	2 - 512
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CPU Specifications

Number of CPUs	32 - 8,192
Peak Performance	> 3.2 - > 819 TF

Main Memory Unit

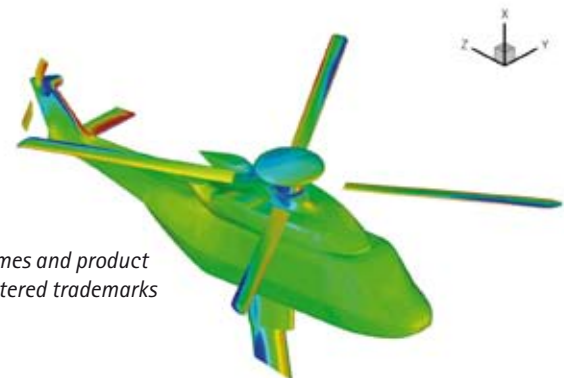
Memory Architecture	Distributed Memory
Capacity	1 TB - 512 TB
Max. Memory Bandwidth	2,048 TB/s

I/O Features

Max. I/O Data Rate	32 TB/s
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Interconnect

Max. Interconnect Bandwidth per Node	2 x 128 GB/s
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