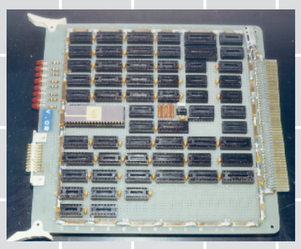
Center for Computational Sciences, University of Tsukuba
www.ccs.tsukuba.ac.jp

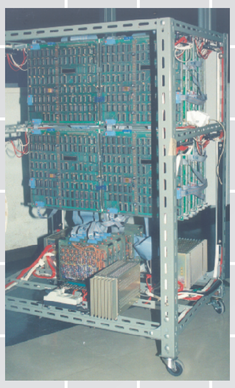
Development of Parallel Computers at Tsukuba
from PACS-9 (1978) to PACS-CS (2006)

PACS/PAX Computers (1978 - 1989)

University of Tsukuba is one of the pioneering institutes in the development of parallel computers in Japan. In 1977, Tsutomu Hoshino and Toshio Kawai started constructing parallel computers at Tsukuba, adopting a two-dimensional torus network as the fundamental architecture. The first computer, "PACS-9", was constructed in 1978 and achieved a speed of 7000 operations/sec. Since then, a series of parallel computers have been developed and used for simulations of physical systems such as modeling nuclear matter in a reactor.



PACS-9 (1978)



PAX-32 (1980)

Year	Machines	# PU	Performance	Memory
1978	PACS-9	9	7 KFLOPS	
1980	PAX-32	32	0.5 MFLOPS	0.5 MB
1983	PAX-128	128	4 MFLOPS	5 MB
1984	PAX-32J	32	3 MFLOPS	4 MB
1989	QCDPAX	480	14 GFLOPS	3 GB
1996	CP-PACS	2048	614 GFLOPS	128 GB
2006	PACS-CS	2560	14 TFLOPS	5 TB

History of PACS/PAX computers

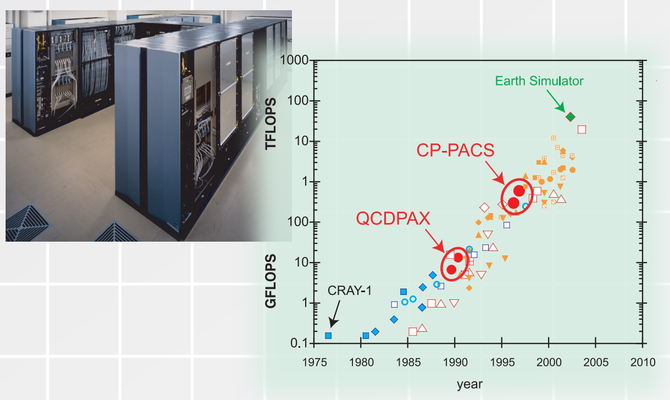


QCDPAX (1989)

QCDPAX, developed in 1989 as the fifth computer of the series, is dedicated to simulating Quantum Chromodynamics, the fundamental theory of quarks. QCDPAX consists of 480 processing units. With a peak speed of 14 GFLOPS, QCDPAX carried out simulations of quarks at zero and finite temperatures.

CP-PACS (1996 - 2005)

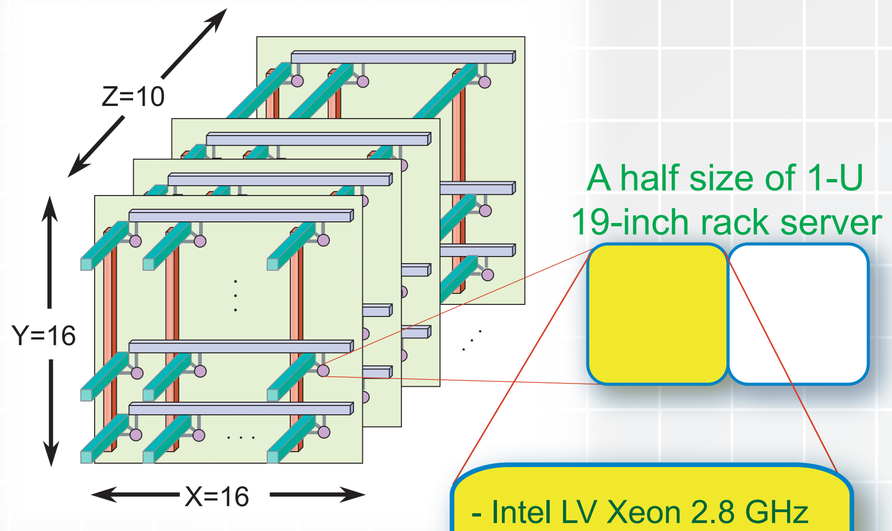
CP-PACS is the sixth of the PACS/PAX parallel computers. With 2048 processing units and 128 I/O nodes interconnected by a three-dimensional Hyper-Crossbar network, CP-PACS achieved a peak speed of 614 GFLOPS and was ranked No.1 in the TOP 500 list for supercomputers in November 1996. CP-PACS has been intensively applied for simulations in the Physics of Fields ranging from quarks to the universe. CP-PACS was shut down in September 2005.



Development of high performance computers

PACS-CS (2006 - 2011)

PACS-CS with 2560 CPUs



PACS-CS is the seventh generation of the PACS series, a PC-cluster with 2560 CPUs and a peak performance of 14.3 TFLOPS. The building block is a specially designed 1-U size board which contains two independent systems, each running its own copy of the single CPU Linux kernel. Since each CPU on the board accesses its own private memory and network interface, the potential performance is significantly higher than standard dual-CPU SMP servers while maintaining the same density. PACS-CS is also equipped with a specially designed 3-D Hyper-Crossbar Network based on Gigabit Ethernet's channel-bonding technology to provide high bisection bandwidth with low cost. PACS-CS started operation in July 2006, and was shut down on September 30, 2011.