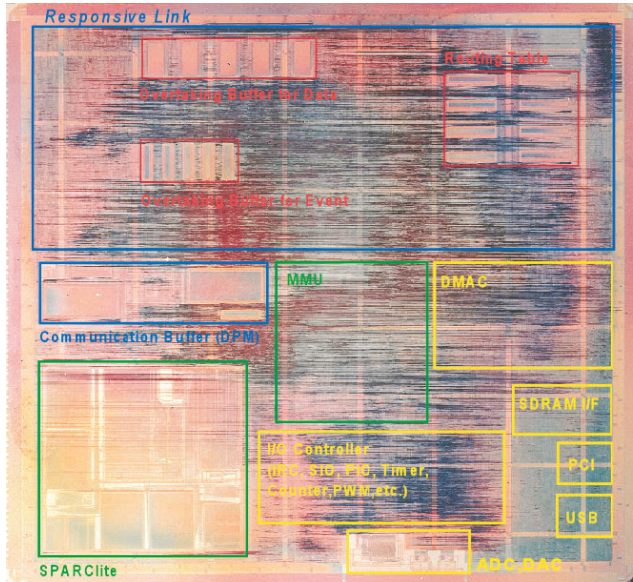
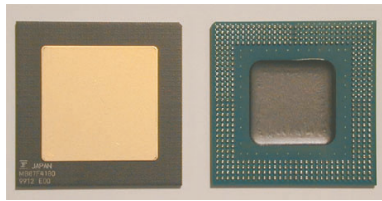


# Applications using *Responsive Link* for Parallel/Distributed Control

Japan's SC25 WG4 Responsive Link SG

<http://www.ny.ics.keio.ac.jp/>

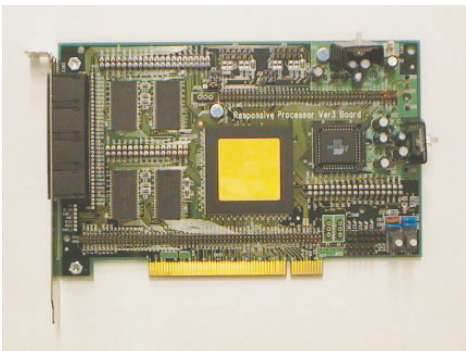
yamasaki@ics.keio.ac.jp



Responsive Processor integrates:

1. Processing Core: SPARC
2. Real-Time Communication: 4 pairs of *Responsive Links*
3. Computer I/O Peripherals:  
SDRAM I/Fs, PCI, USB, DMAC, SIO, PIO, etc.
4. Control I/O Peripherals:  
ADCs, DACs, PWM Generators, Pulse Centers, etc.

Responsive Processor including *Responsive Link* IP was designed by AIST, and fabricated by FUJITSU.



PCI Board for Responsive Processor

Performance of *Responsive Link* on Responsive Processor

Clock (MHz)	200	100	50	25
Max. Speed (Mbaud)	100	50	25	12.5
Speed of Data (Mbps)	67	33	17	8
Latency of Event ( $\mu$ sec)	3.1	6.2	12.5	25
Power (W)	0.2	0.1	0.05	0.02

Latency of Event (Worst) @ 100Mbaud =

$$1.0 (\mu \text{ sec}) + 2.1 (\mu \text{ sec/hop}) \times n (\text{hop})$$

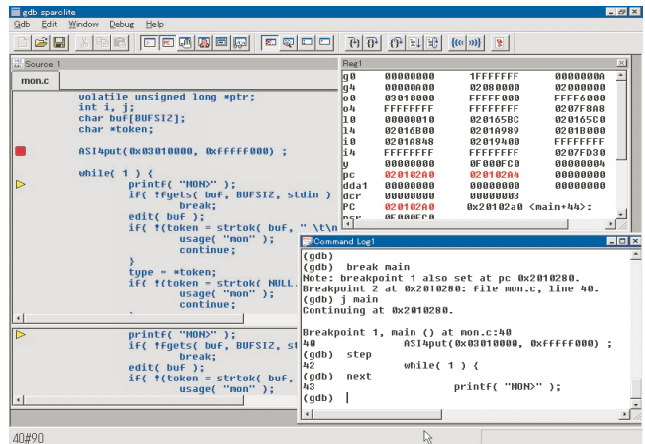
Ex. Latency of 1000BaseT is about 10  $\mu$  sec.

Responsive Link guarantees **hard/soft real-time communications**.

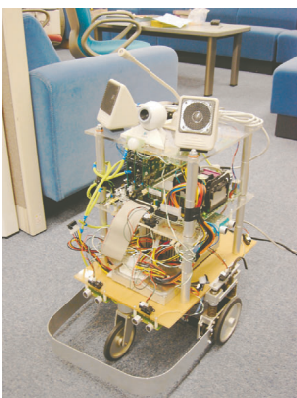
- Separation of data transmission for soft real-time and event transmission for hard real-time
- Priority based packet overtaking (The packet with higher priority overtakes other packets at each node.)
- 256 level priority (8-bit)
- Packet acceleration/deceleration using priority replacement (Packet priority can be replaced with a new priority level at each node to accelerate/decelerate packets under distributed control.)
- Prioritized routing (When multiple packets with different priority levels are sent to the same destination, the different route can be set to realize exclusive communication lines or detours.)
- Variable link speed (800, 400, 200, 100, 50, 25, 12.5[Mbaud])

Development Environment:

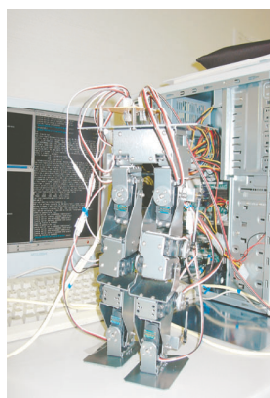
1. Cross development tools based on GNU tools (GNU C, C++, gdb, make, etc.)
2. Host machine: PC, UNIX Workstations
3. Host OS: Linux, FreeBSD, Windows, Solaris, etc.



WinGDB Debugger based on GNU gdb



Wheel Robot



Walking Robot



Responsive Link Network Switch