Space Wire activities in Japan for science missions

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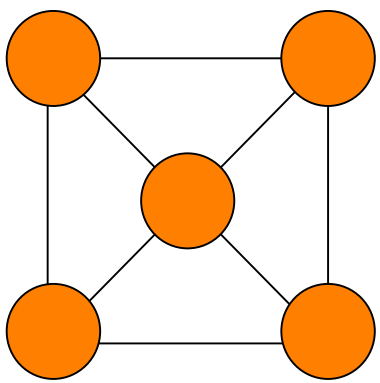


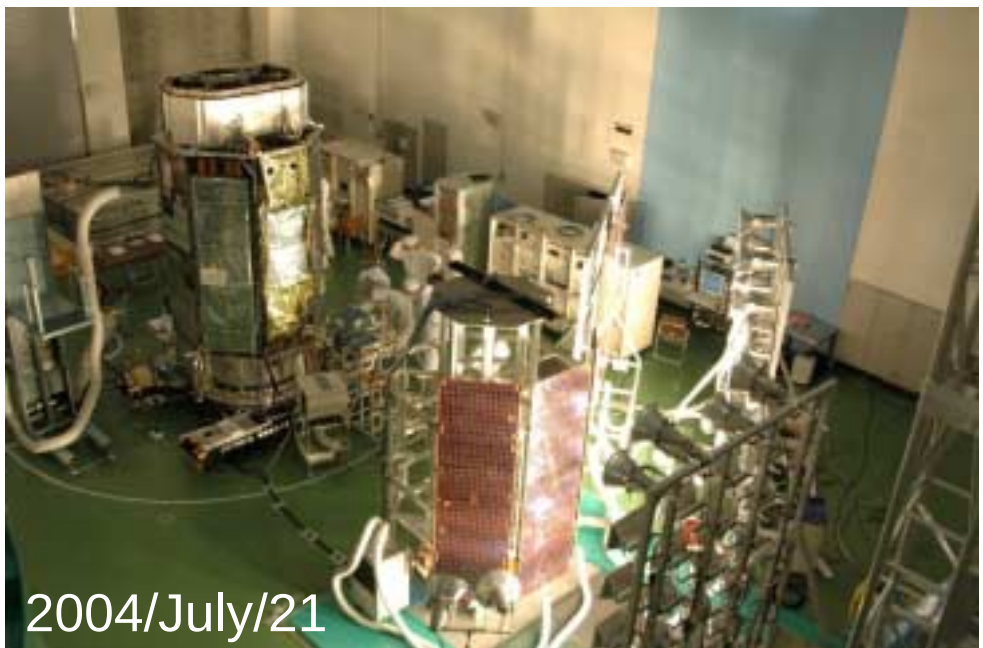
Astro-E2 will come soon.

5th Japanese X-ray Mission

International Collaboration with U.S.

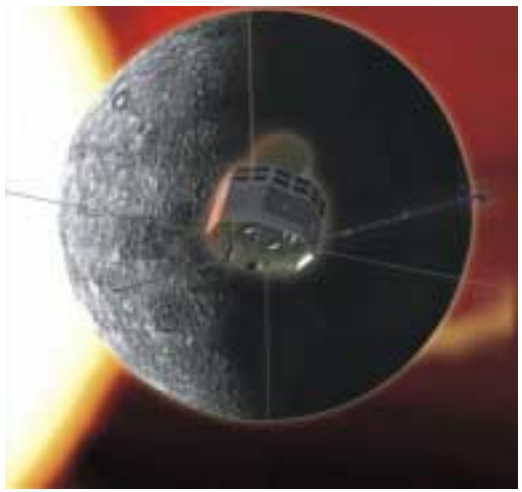
AO open for Europe

The role of scientists and students are very high in Japan, for designir constructing and testing the satellite

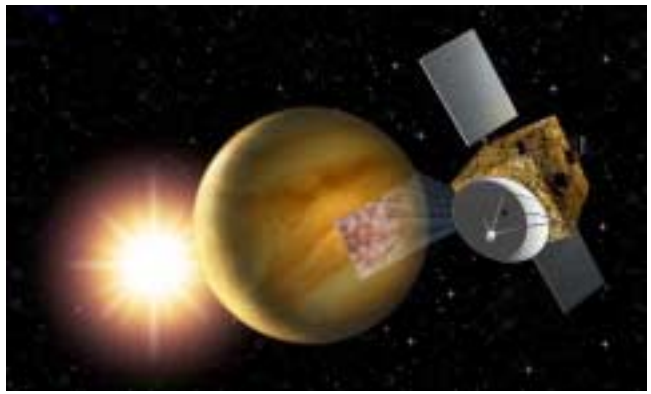


Future Scientific Missions in Japan

- Bepi-Colombo(2011)

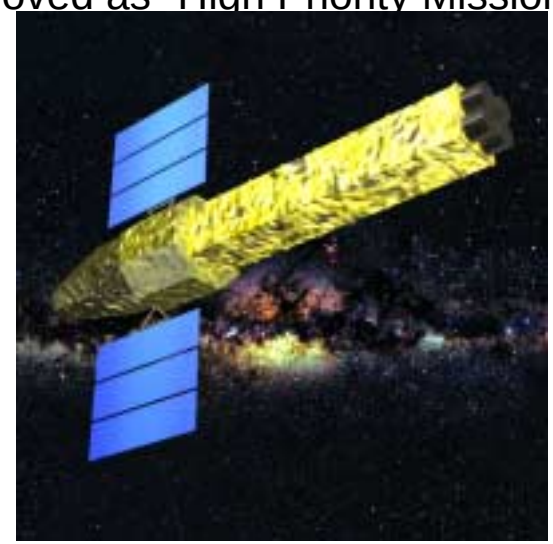


- Venus Climate Orbiter (2008)



- NeXT Mission (X-ray)

  (approved as “High Priority Mission”)



- Solar Sail Mission to Jupiter

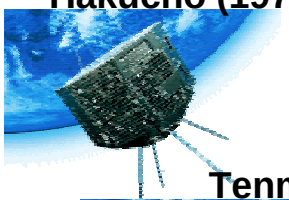
  (approved as “High Priority Mission”)

Long Term Road Map ?

The big progress (or jump) in science is often provided by "Unexpected Discoveries". To increase the chance of such discoveries, we need a way to create dis-continuity, in addition to big missions.

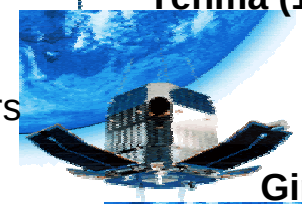
- We need more players (in addition to public supporters)
- For this, it is important to make "space" more accessible (speed is most important)
  - New strategies to support small but attractive projects.
  - New technologies for "smart and quick, and cheap" missions

Hakucho (1979-85)



4 years

Tenma (1983-89)



4 years

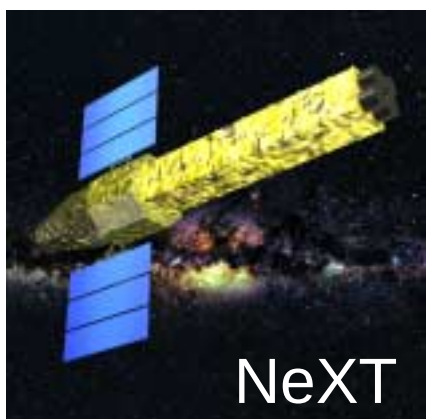
Ginga (1987-99)

6 years

ASCA (1993-01)

7 + 5 years

Astro-E2 (2005)

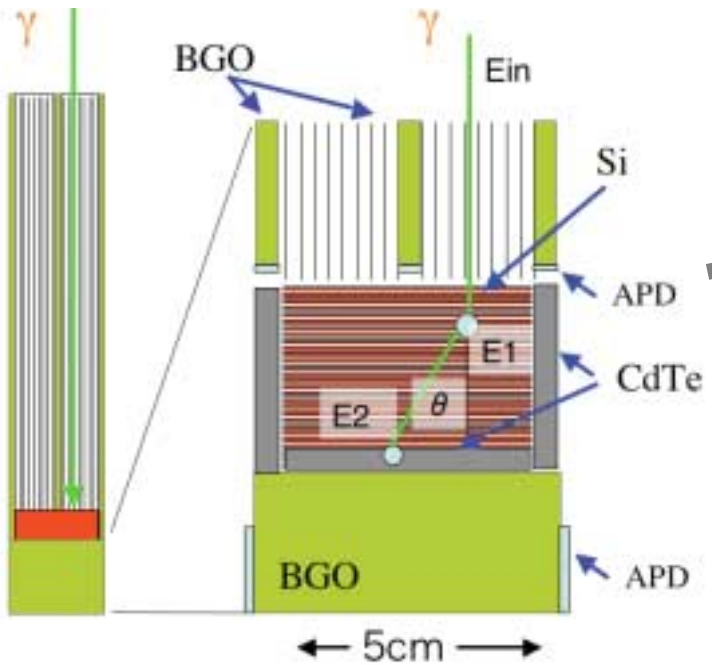


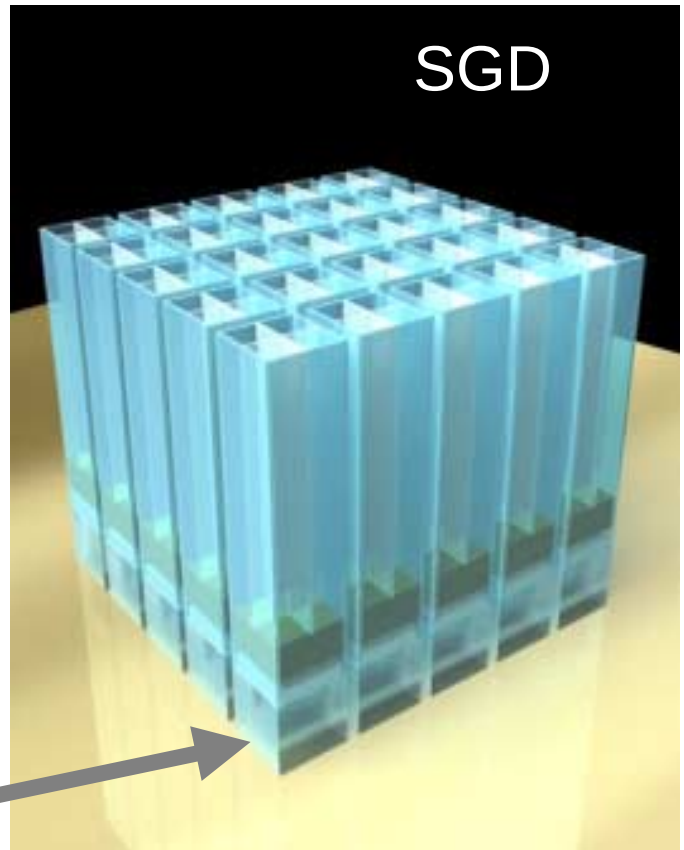
2011?

Requirements from Science

NeXT Mission

Soft Gamma-ray Detector





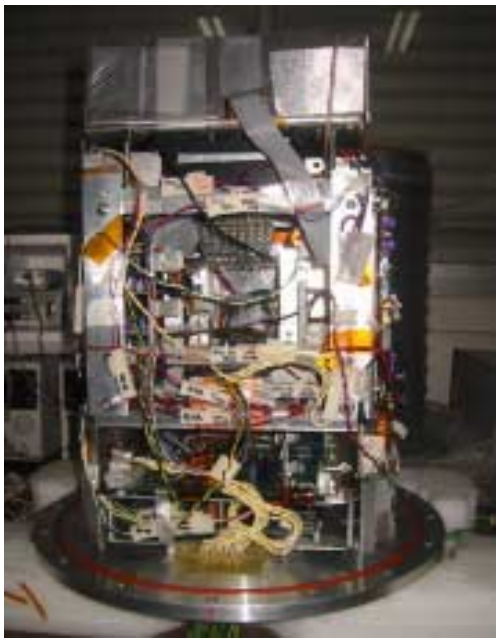
115,200 + 78,125 + 1,000 ~ 200,000 read out channels with triggers

(Takahashi et al. SPIE, 2002 & 2004, NIM 2005)

JAXA 大阪大学 Osaka University

In order to find solutions:

Next Generation Data Handling Unit based on Space Wire



Gamma-ray observation by Si/CdTe Compton Camera (ISAS/Osaka U./SLAC)

大阪大学
Osaka
University

Protocol Chip purely developed from the "written"specification

Passed
connectivity test @ Dundee U.
(the day before yesterday, Nov.9)
And checked with 4Links (Nov. 10)

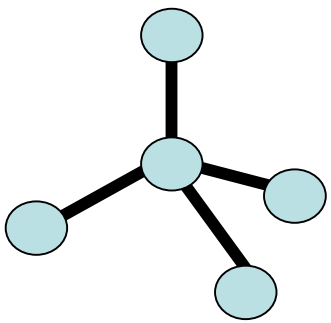
Nomachi (Osaka U.) & Ishii (MHI)

See presentation by Ishii on the web
and Nomachi et al. IEEE 2004
for more detail

Plans for New Frame Work for Data Handling

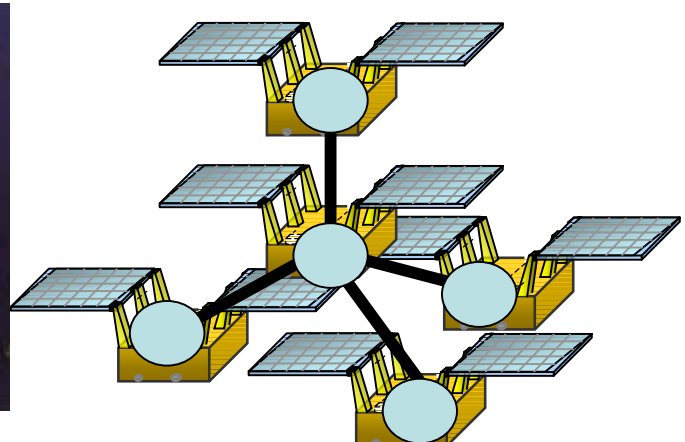
- Keywords
  - Modular Structure
  - Standard Interface between multiple onboard computers
    - For both software and hardware
  - Standard architecture to keep scalability/continuity
    - from small satellite
      to large-scale satellite / formation flight
    - from ground support electronics to mission electronics
  - Step by Step approach for MMO/Bepi, NeXT and other future missions

Define
Function
Link/Connection



From Big Satellite

To distributed satellites



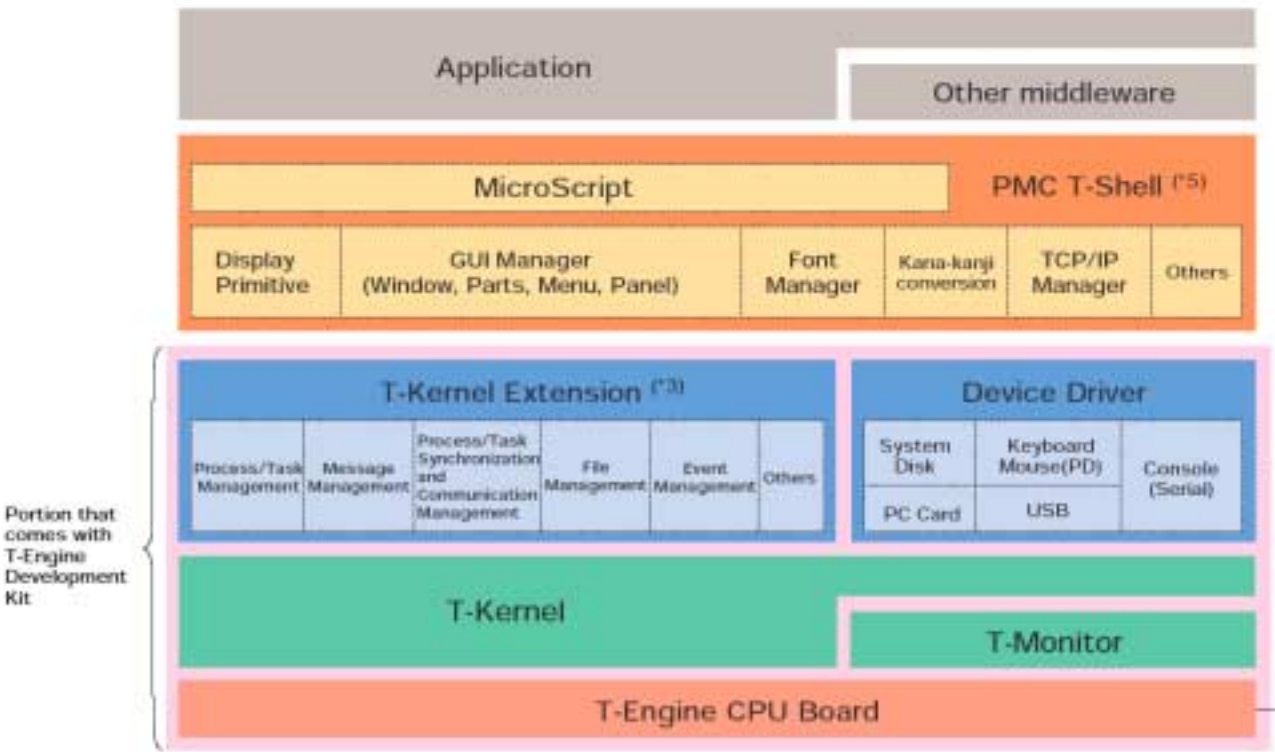
Space TRON (STRON) project

- A trial to establish an open platform for data handling/processing units for space missions
  based on the heritage from T-Engine
  - Use industrial standard (including real time OS)
  - Develop standard “middle ware”
    - Command & Telemetry
    - Data acquisition from scientific instruments
    - Attitude Control
    - Engine Control (Ion Engine)
    - Ground Support Electronics

      »etc…

T-Engine

An open platform for embedded system development
An open platform for standard middleware
with the standardized real-time kernel
royalty-free specification and not a commercial product



T-Kernel:
Real Time OS
>60 % share
For embedded system
world wide
car
cellular phone
CTV tuner
HD recorder

By T-Engine Forum

T-Engine:
The Real-time Processing Platform

to develop the software and the hardware simultaneously

Standard T-Engine

With a variety of CPU

micro T-Engine

Can be used
as real component
Or
as a reference

nano T-Engine

Lead by

Prof. Sakamura

U. Tokyo

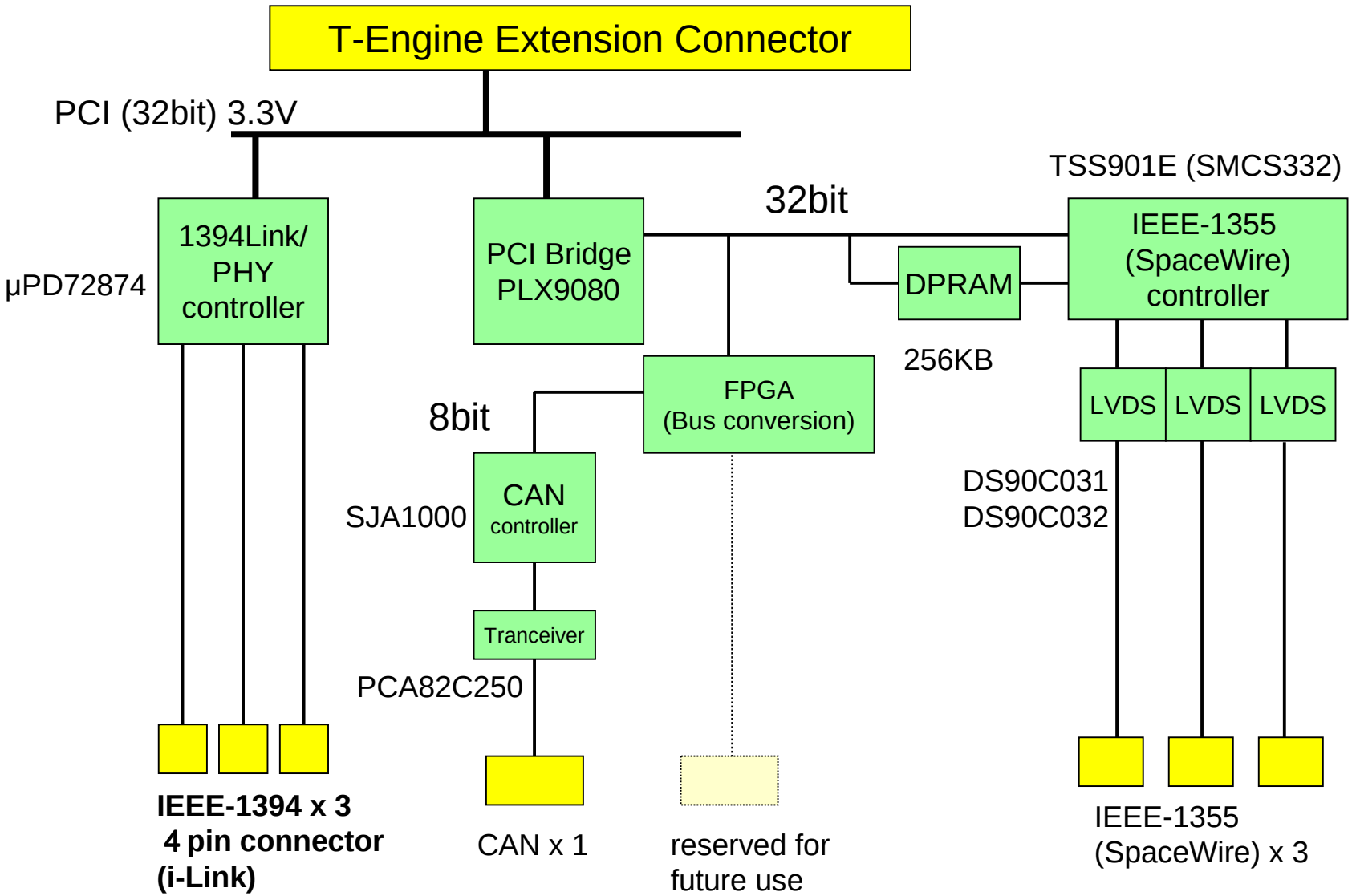
First Space Wire board for T-Engine

- 2 circuit card assemblies for CPU module and various data bus interface with PCI-bus connection, using TSS901E (SMCS332)
  - SpaceWire x 3ch、IEEE-1394 x 3ch、CAN x 1ch、Extension I/F x 1ch
- Can be used for industrial applications, right away (It's T-Engine)

Passed
connectivity test @ Dundee U.
(the day before yesterday, Nov.9)
Checked with 4Links (Nov. 10)

See Hihara(NTSpace)'s presentation on the web

Multi Interface I/O Extension Card



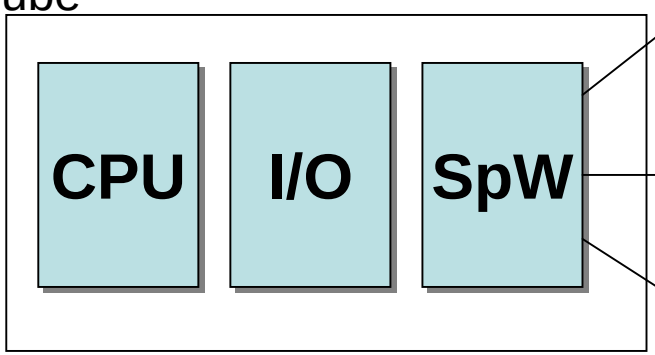
Space Cube for “Real” System

Space cube

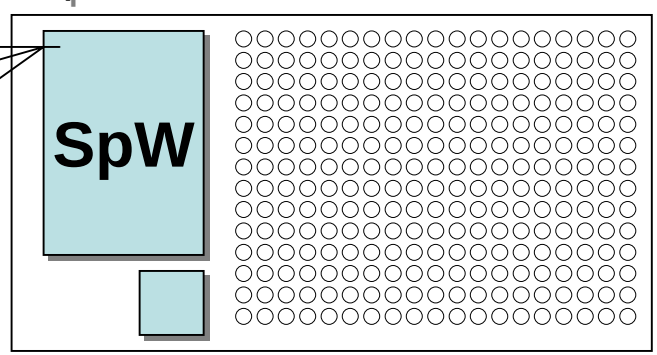
Enhanced version
of T-Cube (T-Engine Project)

- T-Engine Platform
- Real Computer
  - Linux
  - T-Engine (w Real Time Kernel)
- NEC VP5500 200-300 MHz
  (MIPS arch.)
- 16MB ROM/64MB SDRAM
- PCI/USB/Ethernet/Serial etc.
- 3 part Space Wire Link
  will be completed by Dec.

Space Cube



Space Wire Universal Board



Summary

- Data handling/acquisition is one of key issues to realize
  the next generation satellite
  with very advanced instruments
  We need a standard platform to minimize resources
- Ideas implemented in Space Wire (pass address, remote memory access, time code etc.) are very attractive for this..

- Real hardware (protocol FPGA, Space Wire Card for T-Engine, Space Cube with Space Wire) already exists
- Trial to establish an open platform for data handling in future missions has started in Japan under collaboration between JAXA, universities, and various industries.