Roadmap for Space Application
(for Science Mission)
in JAXA

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JAXA

Japan Aerospace Exploration Agency

Space Wire UG in Japan (as of Oct. 2005)
Future Space Observation and Exploration (Image)

Next generation technologies for interplanetary cruise and for solar system explosion

Observations/Fundamental Science
First galaxies and black holes
Some trails of lives on Earth-type planets beyond the solar system
Revealing the Dark Energy

Reaching the entire area within the solar system
Sample return from mainbelt asteroid
Reaching Jupiter; polar orbit; detailed explorations
Venus balloon; a spacecraft to Mars; and unveiling planetary climates

Space telescope developed at L.P with technologies of multiple fly-bys and observation in formation
Headache!

based on the experiences of making AstroE2 and others

• Hand crafted to specific missions

• Different culture among different missions or even in one mission (sometimes spoken-technical-language is different : Beautiful Mis-understanding due to a lack of common understanding)

• Complex interface between different companies : Takes time : Difficult to locate hidden troubles

• High cost just for interface testing
First Trial (2003)

We have tested “Space Wire” to know whether it matches our requirement for the use in “real” application in science.
Now we have decided to adopt Space Wire for a series of future missions.

- Venus Climate Orbiter


X-ray Mission - NeXT - (proposed for 2011)
One more “Key Tech”

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

(*3) Some T-Engine Development Kit products do not include the T-Kernel Extension.
(*4) Some T-Engine Development Kit products do not include a touch panel LCD.
(*5) Available separately as the PMC T-Shell Development Kit.
Space Cube®

SpaceWire based computer developed by ISAS/JAXA & Shimafuji.

We are working on the standard SpW test system which allows us to skip interface testing of onboard equipments:

- Send SpW commands
- Access by using RMAP
- can be used as a standard EGSE

**Specification**

<table>
<thead>
<tr>
<th>CPU</th>
<th>VR5701 200MHz/250MHz/300MHz</th>
</tr>
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<tbody>
<tr>
<td>FlashROM</td>
<td>16M Byte</td>
</tr>
<tr>
<td>DRAM</td>
<td>DDR SDRAM 64M Byte</td>
</tr>
<tr>
<td>INPUT/OUTPUT</td>
<td>IEEE1355 (SpaceWire), RTC, CF (True IDE), XGA (1024 x 768), USB1.1, LAN (100BASE), Audio (Stereo) RS232C, JTAG I/F (Debug)</td>
</tr>
<tr>
<td>POWER</td>
<td>+5V</td>
</tr>
<tr>
<td>SIZE</td>
<td>52mm x 52mm x 55mm</td>
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</table>
Concept (2)

DHU/MDP simulator
(SpaceCube)

Sensor-A
Development
Test (Com/TLM)
Calibration …

Emulate for Sensor-A
(SpaceCube)

Emulate for Sensor-B
(SpaceCube)

Emulate for Sensor-C
(SpaceCube)

Development software
Testing for DHU
Space Cube II

First Prototype for DHU (Data Handling Unit) for Space

Objective: to establish “Reference Architecture” for science missions

propose small mission for technical verification

100 kg
Industrial Application

Space Wire is very attractive

1. High Speed
2. Simple Interface
   (can be implemented in FPGA)
3. RMAP makes hardware simple

   gamma-ray module
   for medical/inspection system
   (ISAS/JAXA, MHI, ACRORAD)

NEC/NEC-Toshiba/ISAS-JAXA
Summary

• We have recognized that
  • Space Wire is a way to go (RMAP is useful)
  • Real Time OS is important
    • The concept of T-Engine is what we like
• Need more discussion to establish the concept of future satellite architecture in JAPAN