

Dependable Multiprocessor: An Application Approach

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Presentation Overview

- The Team
- The Dependable Multiprocessor
- The CubeSat Host
- Conclusion

Presentation Overview

- The Dependable Multiprocessor Team

- Morehead State University

- Kevin Brown, Ben Malphrus, et al



- Honeywell

- John Samson, et al

Honeywell

- Radiance Technologies

- Kathy Byrd, et al

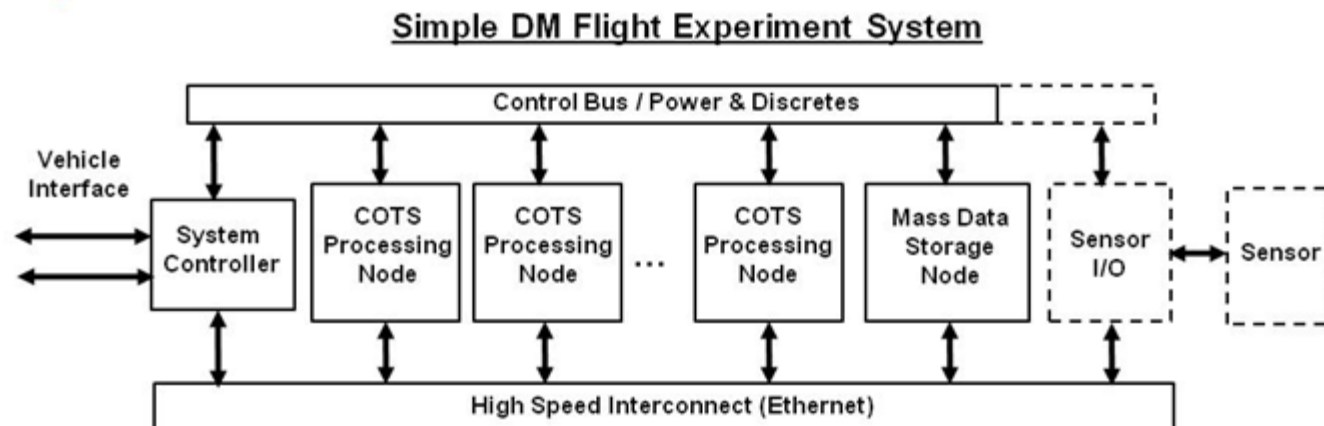
- Funders: NASA, Army, Honeywell, MSU

The Dependable Multiprocessor

- NASA Sponsored Dependable Multiprocessor (DM) Technology
- Cluster of high performance COTS processors are grouped to mitigate space environment effects
- DM Technology is a middleware package. It is Flexible, Scalable, Low Overhead, Easy to Use

The Dependable Multiprocessor

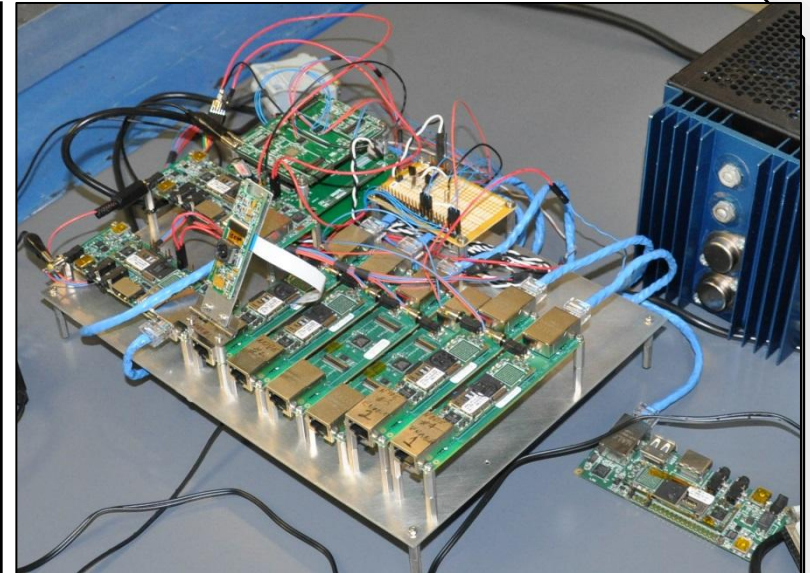
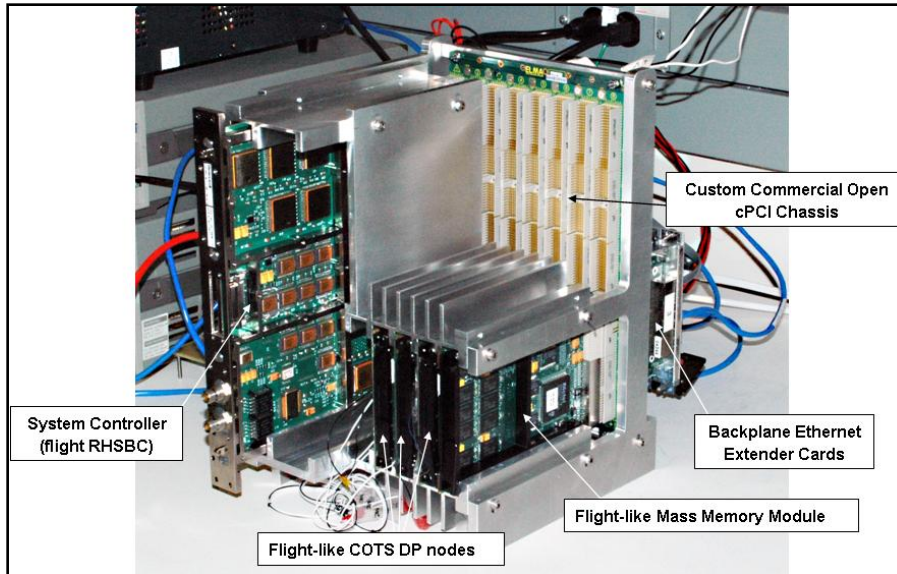
- DM is NOT the hardware – DM is a hardware independent set of middleware and management system for a set of processing nodes



The Dependable Multiprocessor

- Provides more payload processing capability within given size, weight, power & cost constraints
- Supports easily programmable, adaptable, scalable, parallel processing
- Software-enhanced SEE tolerance for COTS
 - rapid autonomous recovery from SELs, SEFIs, & SEUs
 - high Availability & Reliability (Computation Correctness)
- Offers 10X – 100X higher throughput density compared to software programmable rad hard processing solutions

The DM: Hosts



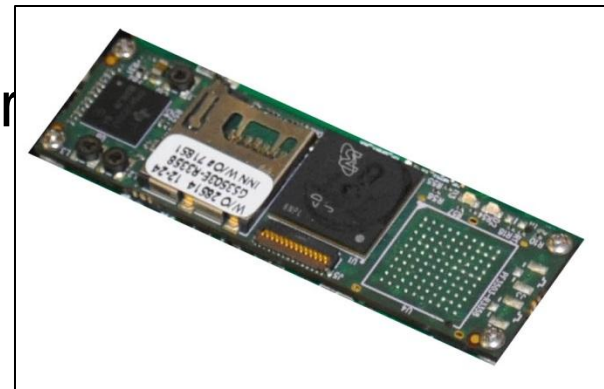
NASA ST8

Honeywell

Gumstix

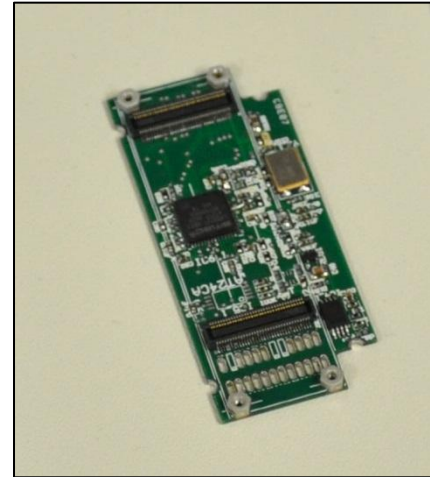
Building a CubeSat Host

- First a host processor must be selected
 - Gumstix – Earth
 - Reasonable price, COTS
 - Small to fit in within CubeSat
 - Demonstration boards
 - Established Linux software



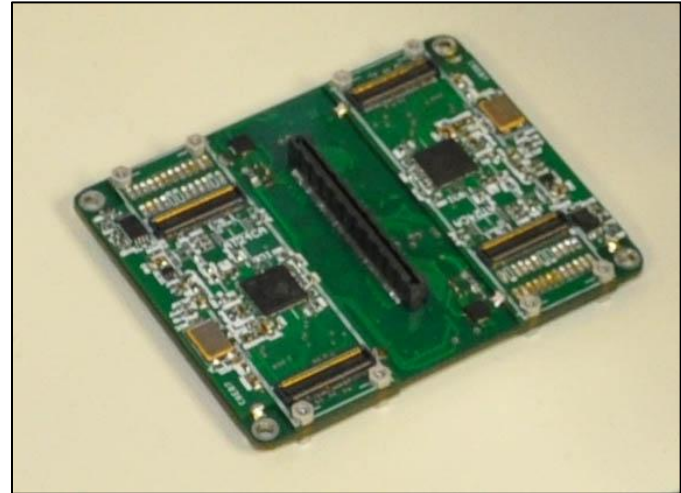
Building a Host

- A Node
 - Nodes must communicate
 - Ethernet network
 - 100 Mbps LAN
 - Gumstix Processor module does not contain a PHY layer
 - Gumstix has high density low profile connector



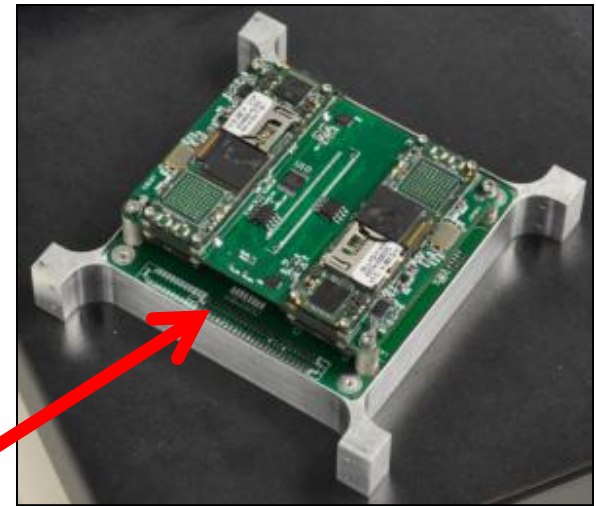
Building a Host

- Subsystem board
 - Mechanical
 - Retain each node
 - Interface to each node
 - Thermal management
 - Independent node management
 - Power sensing (I/V)
 - Power switching
 - Reset



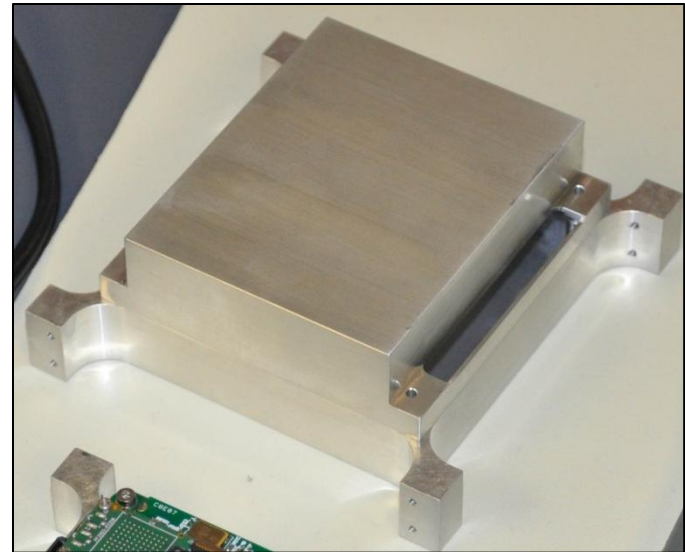
Building a Host

- Backbone
 - Central Ethernet switch
 - 100 Mbps satellite connection to cluster
 - Power Regulation
 - Power Distribution
 - Telemetry UART
 - Node UARTs, Reset, etc



Building a Host

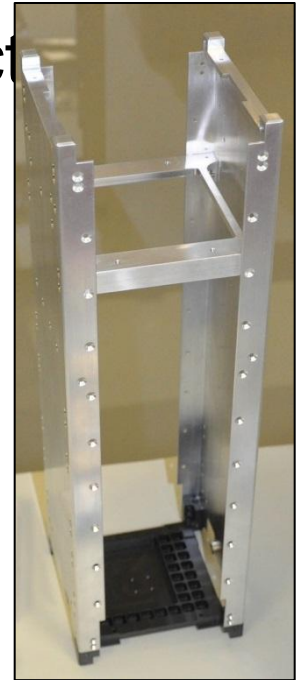
- Mechanical
 - Core 75mm x 75mm x 35mm
 - Legs to 97 mm
 - Legs conduct all heat to exterior faces then to satellite frame



Building a Host

- The Cluster
 - Installation by exterior screw
 - Interface by Samtec SFSD connectors

4 Months!



Conclusions

Host system successfully demonstrated DM system with a 5 MP imager.

Compressed images were sent as telemetry in different compression sizes.

System is sized for the CubeSat form factor for future mission needs

Contacts:

John Samson - Honeywell

Ben Malphrus - MSU

QUESTIONS