Advances in Space Plug-and-Play Avionics (SPA) – An open source bus for Space

CubeSat Workshop

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What is CubeFlow

- Under sponsorship by the Operationally Responsive Space (ORS) office, the Air Force Research Laboratory (AFRL) developed a modular nanosatellite approach where hardware and software “black-box” elements can be combined very quickly (possibly less than an hour) to form simple, but functional spacecraft.

- They are fully compliant with the Stanford/CalPoly CubeSat and Poly-Picosatellite Orbital Dispenser (PPOD) standards, but extend these standards by permitting interchangeability of components.

- As such, distributed groups can create individual component parts that can be brought together and quickly assembled using plug-and-play (PnP) mechanisms, similar to those in personal computers.

What is SPA?

- Space Plug-and-Play Avionics (SPA) is an open source bus architecture for rapid satellite development
  - SPA-U
  - SPA-1
  - SPA-O
  - SPA-S

What are the CubeFlow parts?

- XTEDS – eXtended Transducer Electronic Datasheets. This is the datasheet for all hardware modules. A food processor has a datasheet, for SPA, the datasheet is an XTEDS.
- ASIM – Applique Sensor Interface Module. This holds the XTEDS. For SPA-U, this is usually modeled after an AT90USB device
- SDM – Satellite Data Module. This is the Linux OS that runs the CDH of the satellite and communicates with the ASIMs

Current status on ASIMs

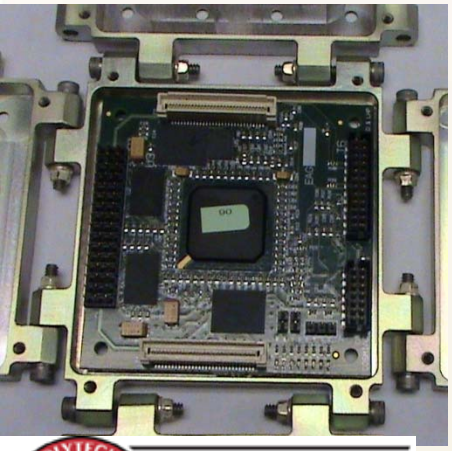
- There are a wide variety of different ASIM platforms. Here are some examples:
  - Soft Core processor on FPGA (could go to SIRF)
  - Small Low Power ASIC (first silicon 2010)
  - Rad Hard version
  - Training versions based on AT90USB device

SPA

- SPA = Space Plug-and-Play Avionics
  - SPA-S = Spacewire
  - SPA-S(LV) = low voltage (5V) spacewire
  - SPA-U = similar to USB
  - SPA-1 = similar to I2C

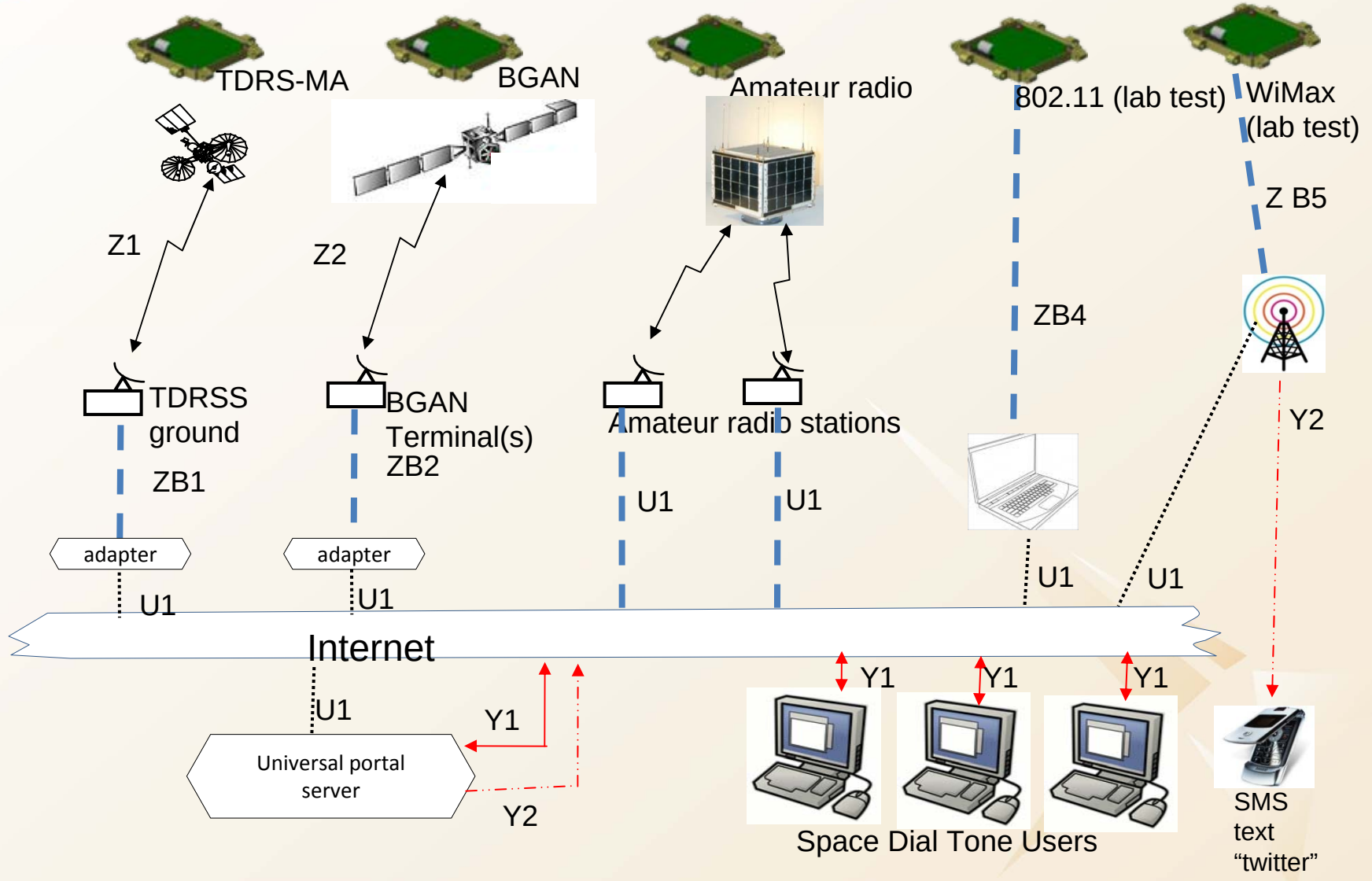
COSMIAC FPGA and SDR

- COSMIAC is taking an existing SPARTAN-3A FPGA board and modifying it from it's configuration for image processing into a SPA Software Defined Radio Platform

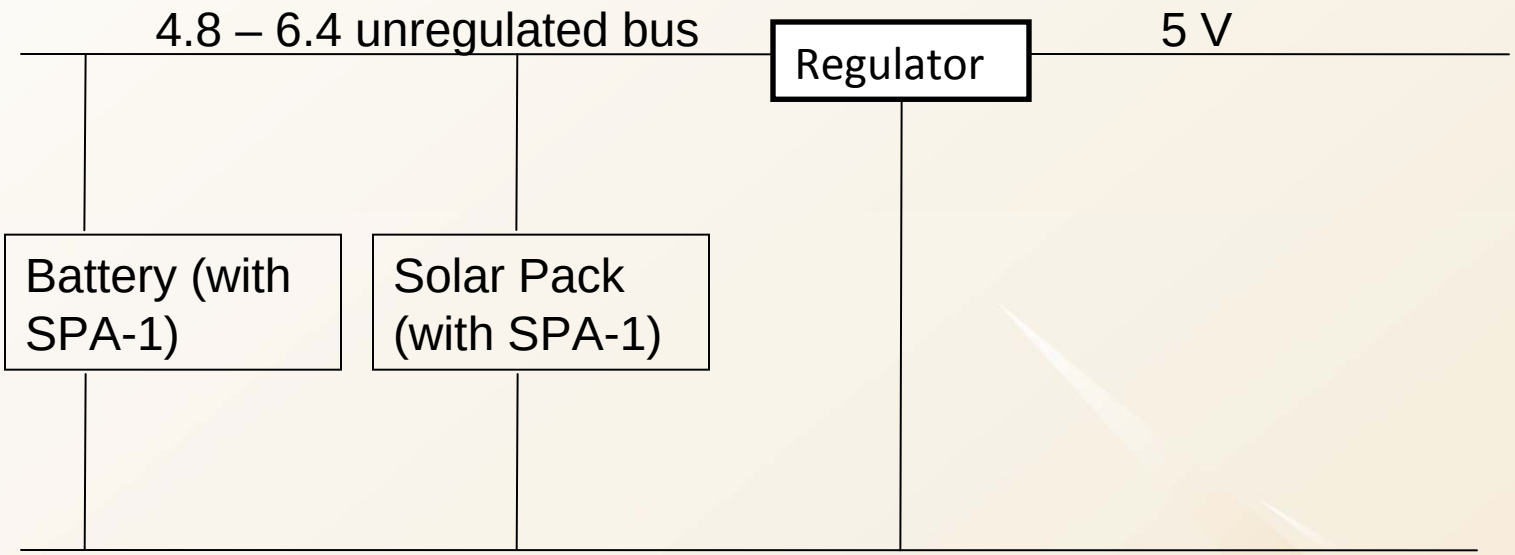


Project is modeled after USRP platform

Space Dial Tone



Lego Power

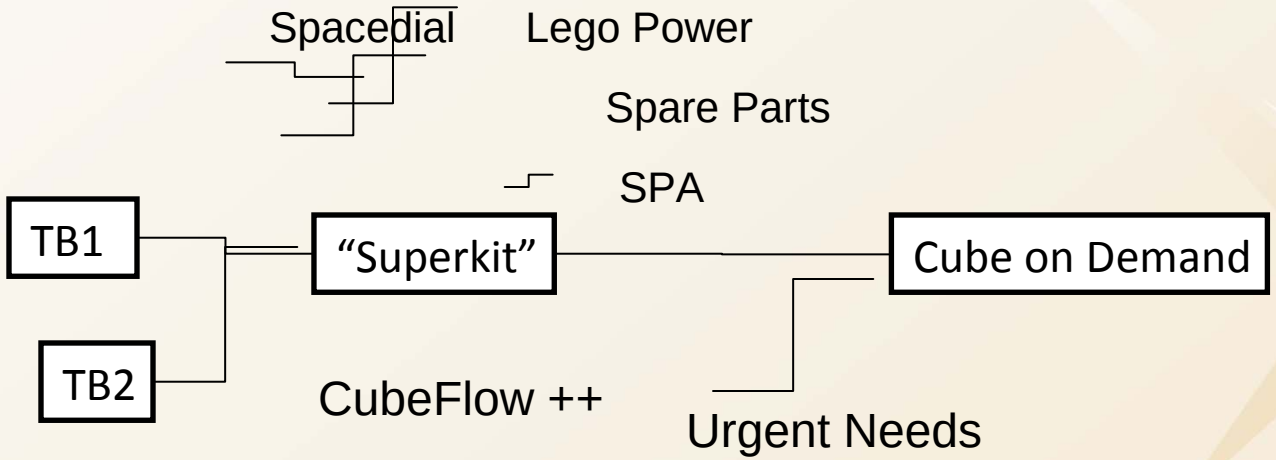


Solar Pack <= Solar Cells + SAR

n Battery + m Solar Packs = PMAD (1W – 100W)

TrailBlazer

- AFRL is building a series of CubeSats called TrailBlazer
- Launches have become more affordable so AFRL is just planning on buying two of them for 2U launches for SPA assets
- What AFRL is desperate for is not folks that can build entire satellites, but that can build single modules (sensor, power, comms) that are SPA compatible



CubeFlow Demo Night

- We are doing a series of non-stop 30 minute CubeFlow short courses on Wednesday evening at SDL starting at 5pm.
- Come by for a quick training and see the equipment running
- Come by the AFRL booth for more information

ReSpace 2010 Conference Overview

- What commercial electronics components can be effectively used in space systems NOW? The Revolution of PnP!

- What does this do to our subsystems – can I make better cameras, IMUs, etc in a small package?

- How does this change missions?

Albuquerque, New Mexico

Come by the AFRL booth at SmallSat for the Call for Posters and more information

Dates: 1-4 November 2010

Sponsorship and Exhibitor Opportunities