SAVOIR

space avionics open interface architecture

Communications Standards Status

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ADCSS 2011

Estec

Recap

- Recap – why a layered communication system
- Application to Space avionics
- Where we are today
- Future studies
- Challenges

RECAP

- All successful communications systems are all based on two fundamental aspects:
  - A layered architecture with well defined user interfaces
  - A well specified and tested protocol suite
- There are numerous examples:
  - CCSDS TM/TC, CANopen, IMA, wireless, GSM, ……..
- And many advantages:
  - supplier independence
  - increased efficiency and decreased cost of integrating standards-compliant systems
  - increased knowledge and best practice among cooperating entities
  - improved product quality via repeated use and testing

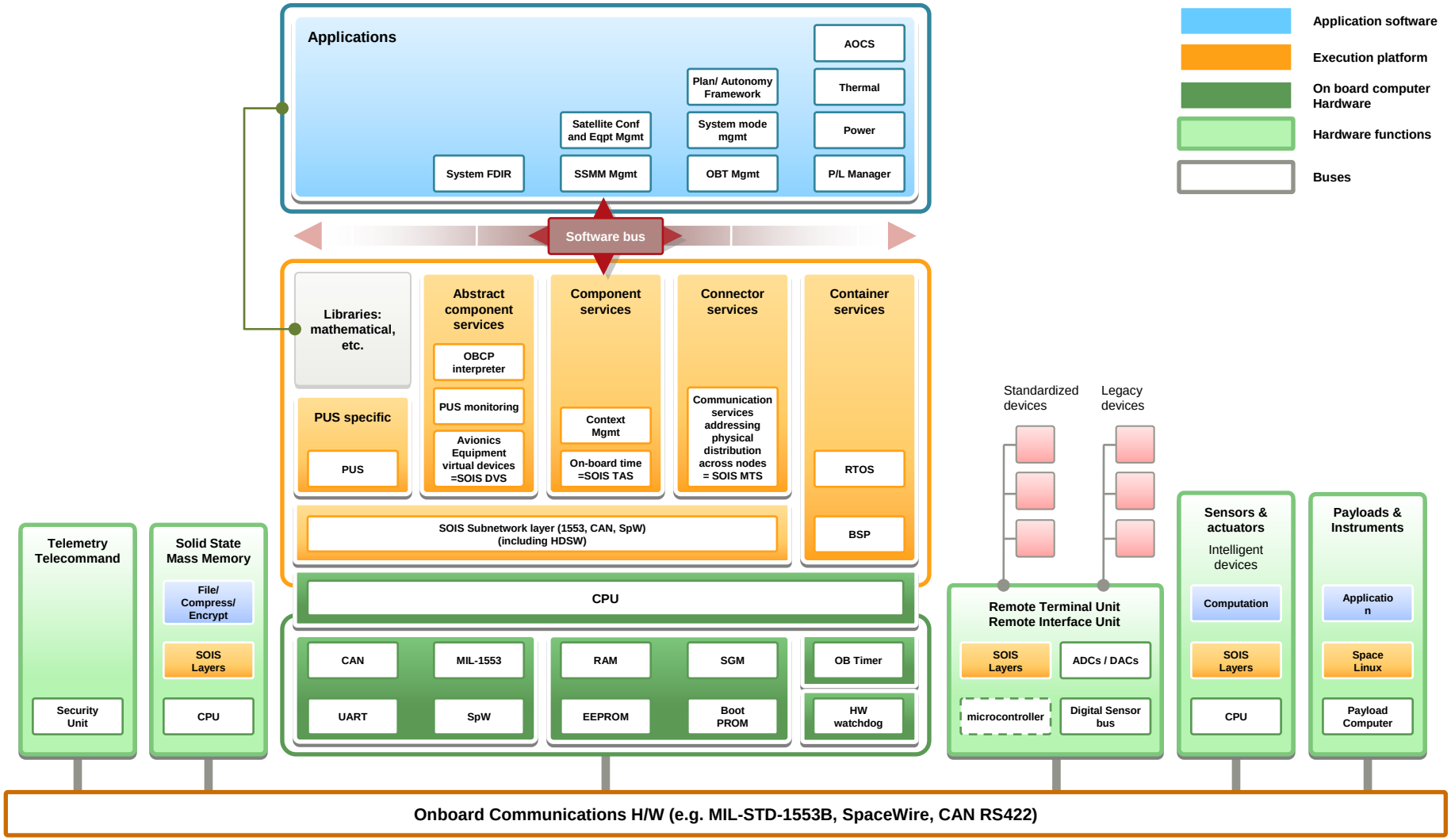
- It should therefore be no surprise that SAVOIR are proposing to adopt a layered communication model for the flight avionics

Overhead – What Overhead

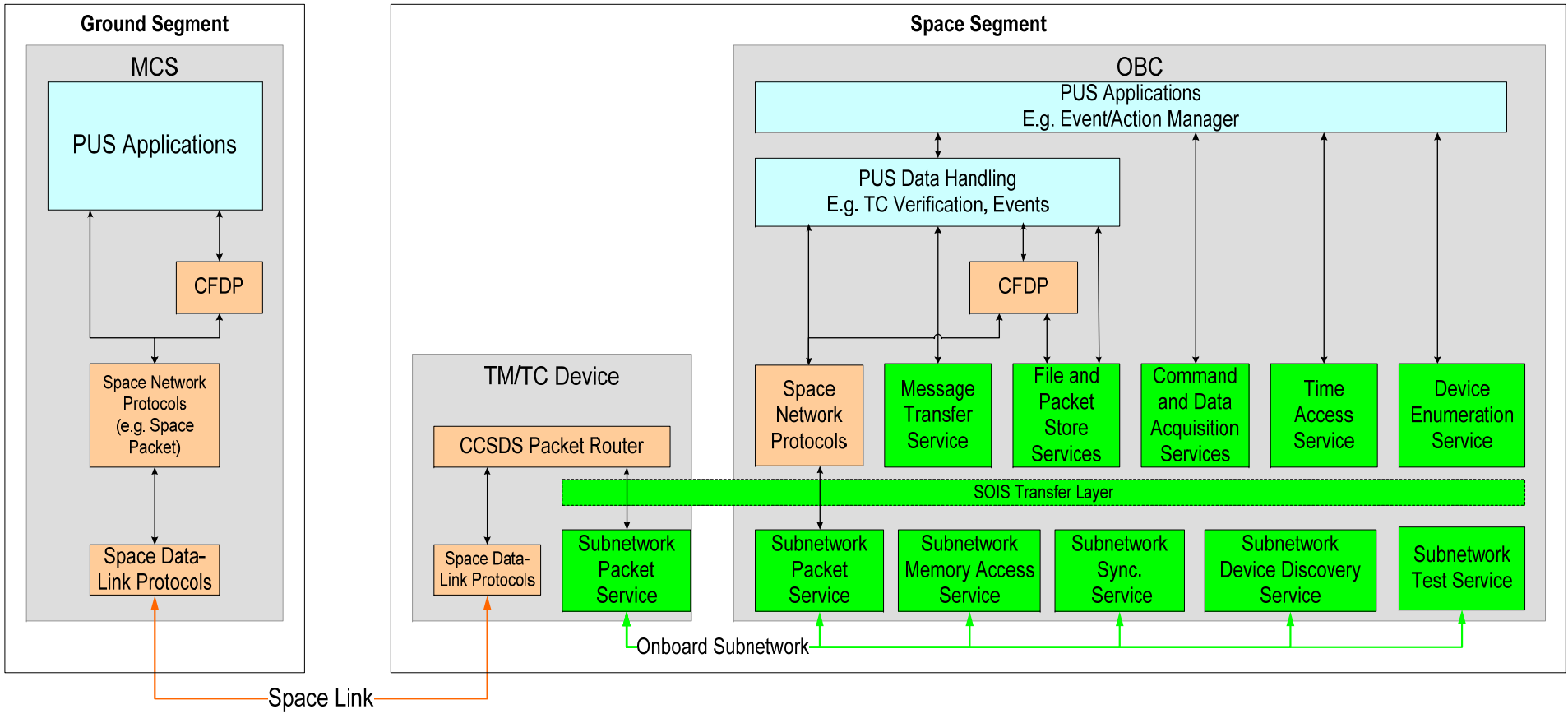
- There is still a perception (among some) that a layered architecture introduces overhead – it does not
- Any communication interface that is described as a “monolithic block” or “driver” can be described in two or more layers. *This does not change the interface or the code but it does make it easier to understand*:
  - What the protocol does for the user (service specification)
  - How it does it (protocol specification)
- The service specification can also define what is assumed from underlying layers making it easier to build protocol stacks

- As an example, some years ago the CCSDS TM/TC stack was redefined as a series of layered service and protocol standards but the implementations (IP cores, Asics, software) did not need to change

The avionics reference architecture (HW + SW)



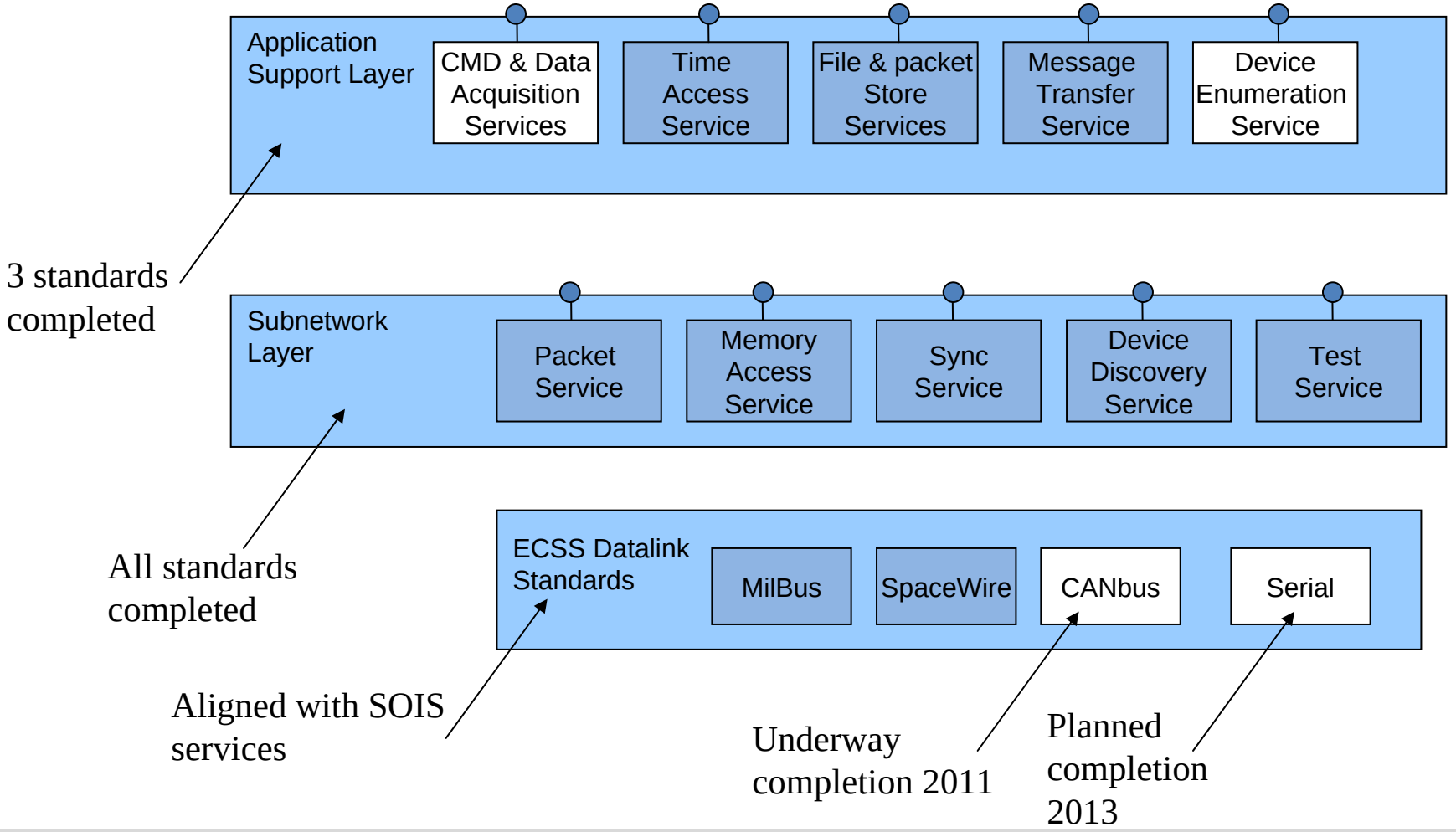
End-to-end Communications View



Where we are today

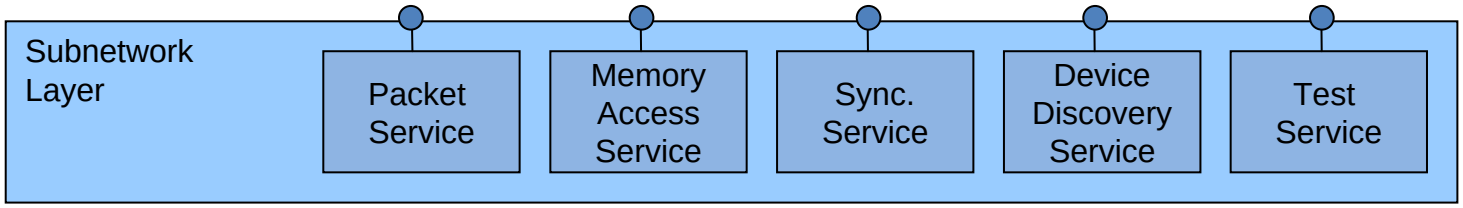
- CCSDS
  - Most SOIS standards have been published or are under finalisation
  - SOIS Work has now shifted to the definition of virtual interfaces and the use of electronic data sheets
  - Delay Tolerant Networking (DTN) standards on-going
  - The Mission Operation services series of standards emerging
  - Many other working groups, security, wireless, ……..
- ECSS
  - The CANbus Standard is nearing completion
  - The SpaceWire standard planned update in 2012 (clean-up)
  - Packet utilisation standard under update
  - A serial interface standard will be developed following a TRP activity (2013)
- Savoir
  - Functional architecture under publication, more to follow

CCSDS SOIS and ECSS - Standards Availability



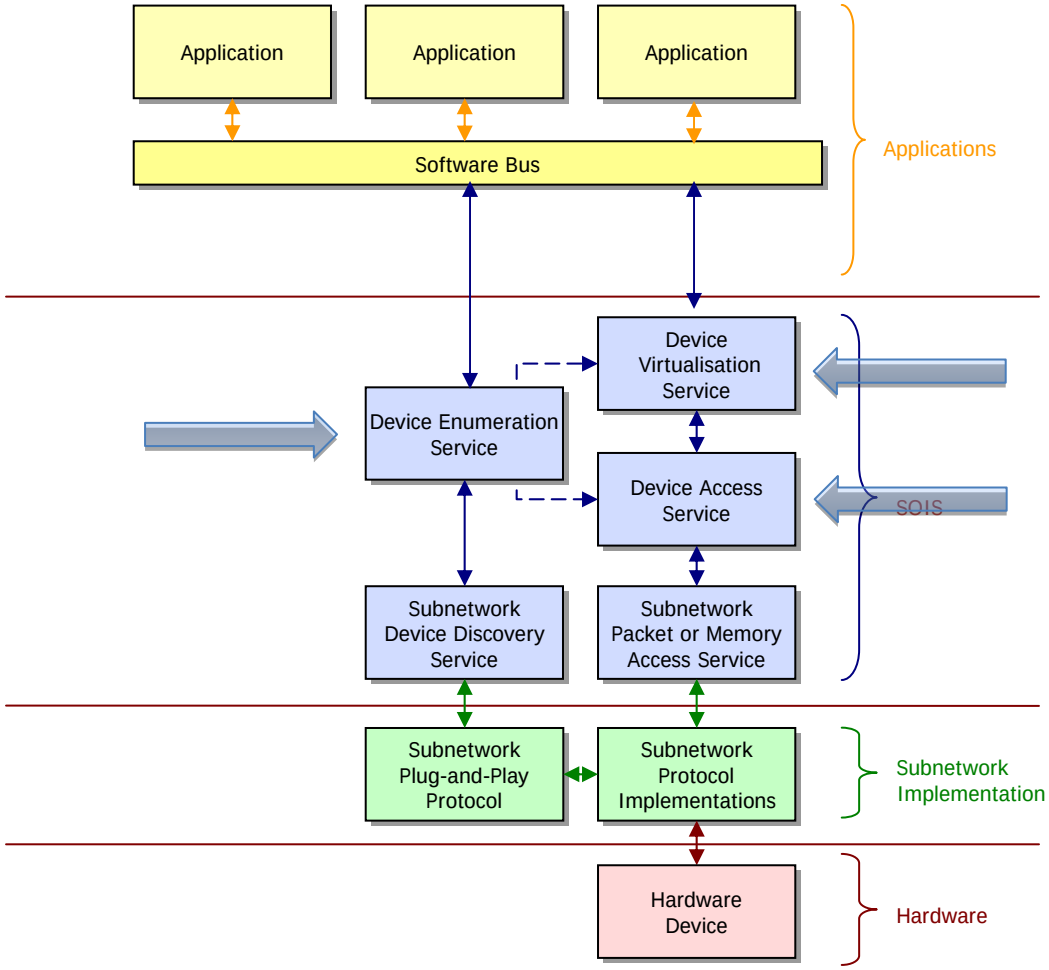
SOIS Subnetwork services

- An ambitious attempt to define a single set of services to which all subnetworks should comply, the goal - same services to users regardless of datalink protocol
- Generally successful but some compromises as we are dealing with existing protocols
- Nevertheless, all ECSS datalink protocol specifications are fairly well aligned with the SOIS services and any new developments will use SOIS services as applicable documents

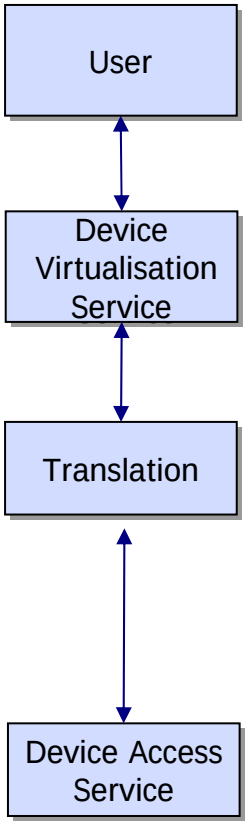


C&DA service breakdown

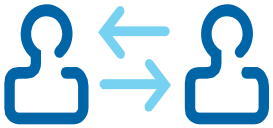
- DAS used to access individual devices using device specific protocols
- DVS used to access classes of devices using a standardised interface
- Enumeration service, essentially a registration service to identify available devices



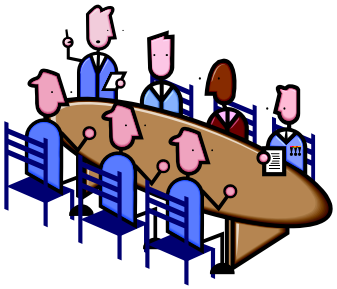
Device Virtualisation – An Analogy



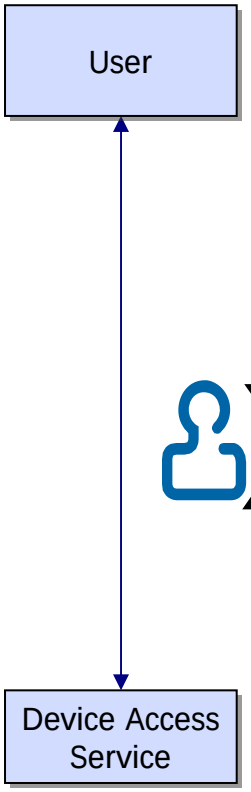
But I only speak English



Don't panic, we will translate for you (for a price)

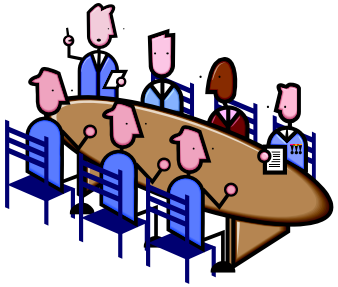


We want to speak our native languages



Thank you so much

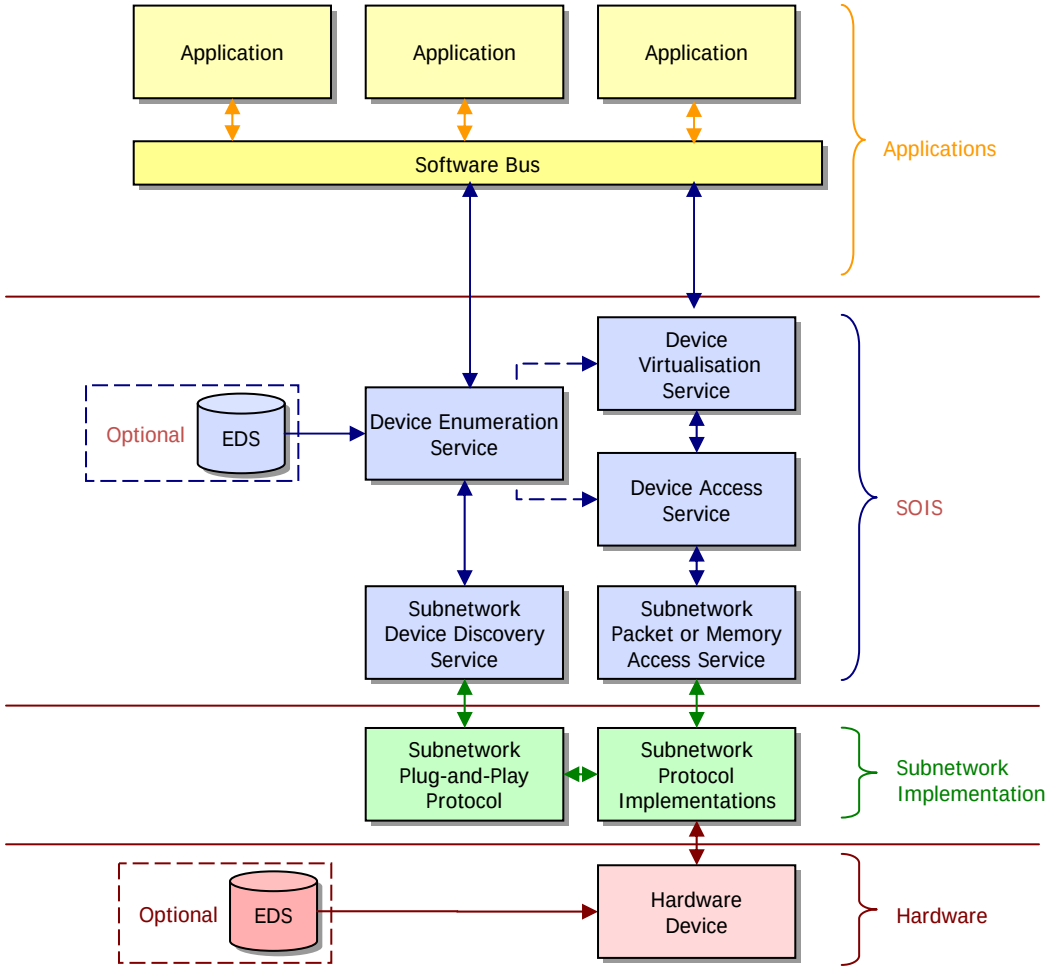
We're Redundant!



OK, we will all speak English

Electronic data sheets (EDS)

- AOCS devices typically described in paper ICDs but could migrate to EDS
- EDS are not necessary and we could continue with the paper ICDs of today
- But having information ICD information in electronic form brings many advantages – see next presentations



SOIS File and Packet store Services

- Previously, the main use of onboard storage was for science and HK data in the form of simple Packet Stores
- We are now moving to an era where the data will be stored and accessed as it is on the ground – as files
- This is mainly being driven by two factors:
  - The need to automate, as the amount of data that needs to be transferred moves beyond what can be managed manually
  - The general trend to move files to and from the flight segment (patches, OBPs, schedules, relay scenarios)
- The SOIS file and packet stores services standard define what is available to onboard applications for managing files
- It does not define the access protocol to the hardware or the filing system to be used (maybe it should)
- It has been intensively reviewed by ESOC in view of the PUS update and the pending use of the CCSDS file transfer protocol CFDP

Future TRP

- We have a number of Savoir related activities planned in the are of communication:
  - SOIS - Use of Electronic data sheets
  - SpaceWire Device discovery protcols
  - SOIS - Plug and play
  - File based operations
  - Rasta upgrades
  - Serial interface (UART) protocol
  - ….

Challenges

- It's not easy:
  - No single, rigid hardware and software architecture as target, rather we must cater for existing solutions and a smooth transition to more standardised implementations (a layered communication architecture really helps here)
  - Large number of parallel activities which must be coordinated and brought together in a uniform result (SAVOIR role)
  - Need to coordinate across different disciplines that have different views and opinions (PUS in sensors!!)
- Nevertheless, we have made significant progress and more will come

Following presentations

- Now that your appetite is wetted, the following presentations provide a more in-depth treatment of:
    1. The SOIS architecture and the use of electronic data sheets
    2. The definition of standardised interfaces for AOCS equipment based on the SOIS DVS and DAS service architecture
    3. The future standardisation of mission operations services

Contact

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On-going SOIS work

- The final SOIS services: Command and Acquisition service and Enumeration service are progressing slowly but should arrive in 2012
- These services are related to standardising access to onboard devices, typically AOCS sensors and actuators
- IEEE 1451 and the AFRL (Air Force Research Labs) SPA related standards released by the AIAA, are being assessed for the use of Electronic data sheets

- The CCSDS SOIS WG is well populated with communication and (some) software engineers but lacks detailed knowledge on AOCS devices
- Fortunately, the SAFI group has the necessary AOCS related knowledge
- A cooperative effort is therefore underway in this area