



Space Telecommunication Interface (STI) Submission Discussion

Secure Network Communications (SNC WG)
Middleware and Related Services (MARS PTF)

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Agenda

- Recap of the Space Telecommunication Interface (STI) RFP
- Overview of STI submission from NASA Glenn Research Center

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Space Telecommunication Interface RFP

- Published as OMG document mars/19-09-21
- The objective of this RFP is to expand the PIM and PSM for the Software Radio Components Specification to support space communications.
- Seeks to address areas where existing SWRadio specification does not address key communications and platform requirements imposed by the space domain sufficiently, for example:
 - Spacecraft Resource Constraints,
 - Radiation Suitable Processing,
 - Reliability and Availability,
 - Specialized Signal Processing Abstraction,
 - Static Deployment,
 - Long Mission Development Times,
 - Space-Specific Waveforms.



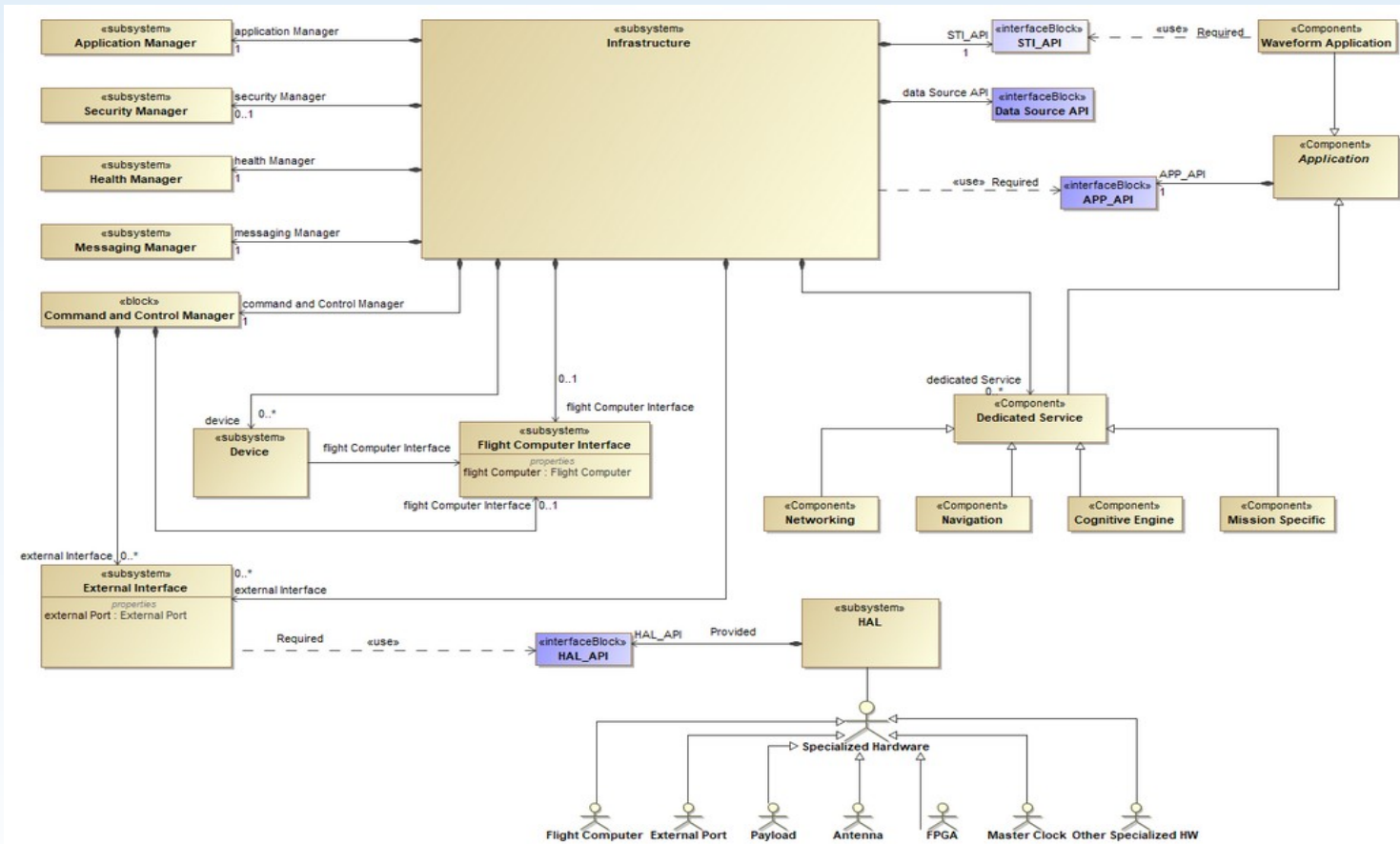
Space Telecommunication Interface (STI) Proposal

History

- A predecessor to this STI specification was developed by NASA as part of a technology demonstration of software-defined radio technology.
 - The intent was to improve the return on investment in software development by allowing the related components to be deployed in more than one project/mission without incurring significant additional development time
 - The predecessor itself was a “lightened” framework based on/inspired by SWRADIO (SDRP) and Software Communications Architecture Specification (SCA) and follows many of the same architectural patterns.
- NASA has performed significant testing/validation on real space applications
 - Deployed and tested on the SCaN Testbed on the International Space Station
 - Lessons learned over a decade of testing and waveform development was fed back into NASA-STD-4009A, on which this proposal is based



STI System Architecture Overview





System Architecture

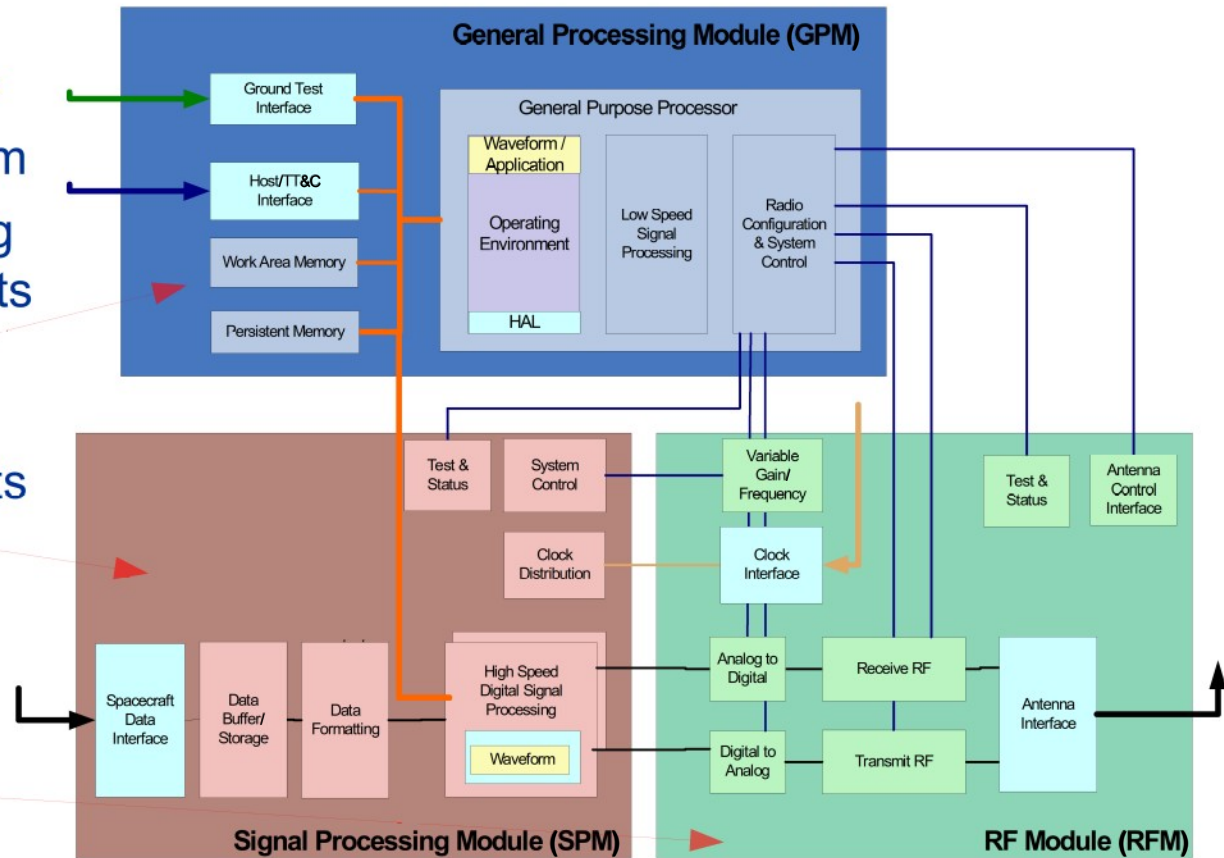
- STI defines the various roles and responsibilities of the stakeholders
 - Defined roles and integration points allows for more parallel development efforts, vendor independence
- Emphasis is different for different system roles
 - Some aspects focus on a specific interface (e.g. Software API) to ensure portability
 - Other aspects focus on documentation of system capabilities rather than prescribing a specific set
- This approach allows some component re-use while still allowing the overall system to be tailored to the specific deployment environment and requirements



STI Overview – Hardware Architecture

STI defines fundamental blocks of a generic SDR platform

- General Processing Module (GPM) hosts the control plane
- Signal Processing Module (SPM) hosts the data plane
- Radio Frequency Module (RFM) provides the radio interface





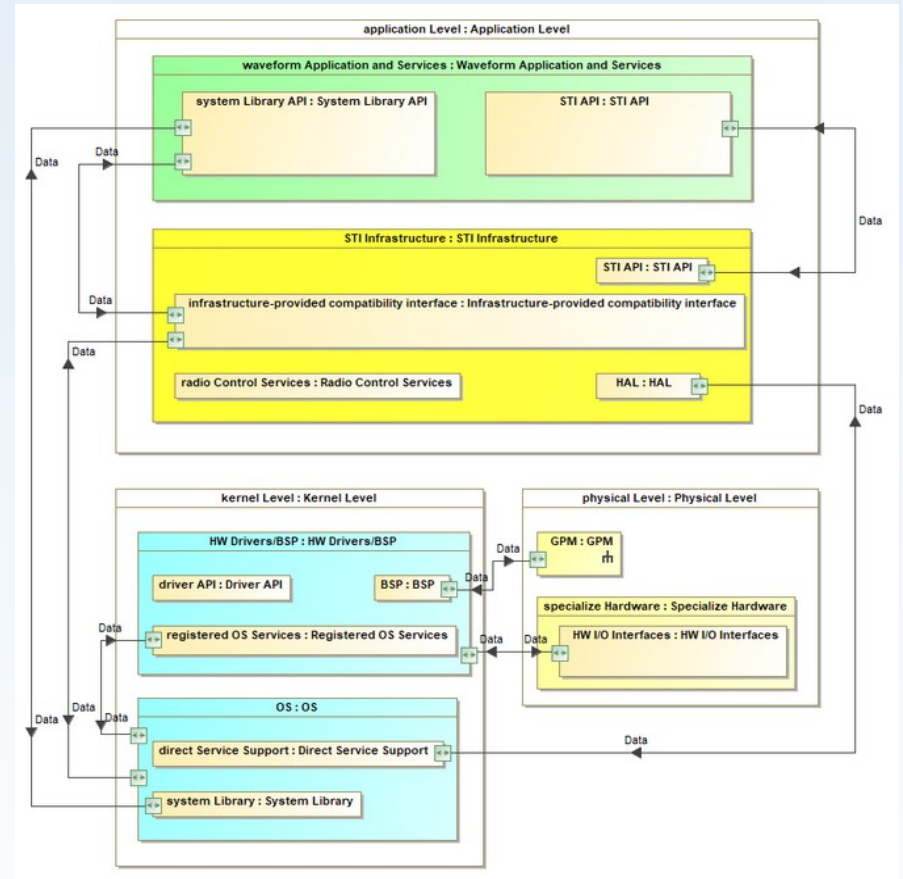
STI Software Operating Environment Model

Proposal prescribes specific API requirements for items between the STI Infrastructure and waveform/application services layers

- Allows portability of software elements between different OE implementations

Proposal prescribes documentation requirements for layers below the STI Infrastructure

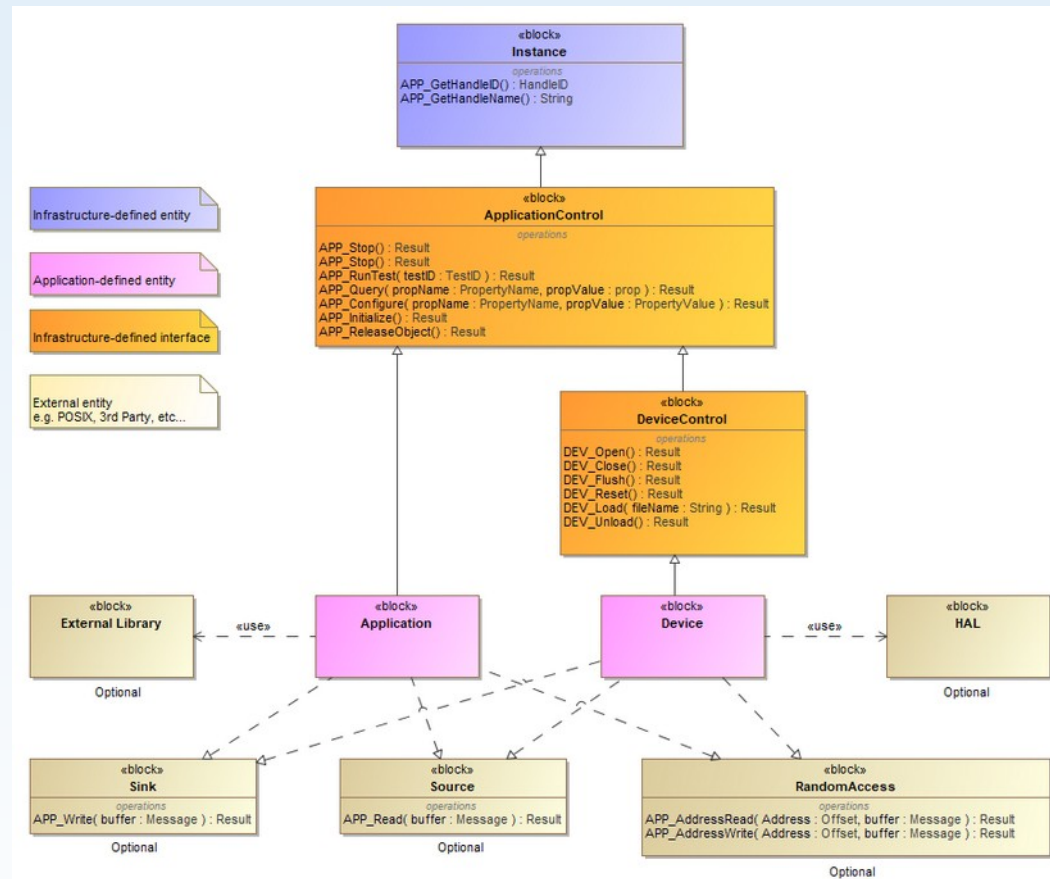
- Specialized hardware and hardware system limitations/capabilities defined in vendor-supplied documentation.





STI Application Software Interface Structure

- Proposes a SW Interface structure similar to existing SDR standards (NASA STRS, SWRADIO, SCA)
- Software written for these other environments should be usable without extensive rewrites or refactoring





Compliance Points (from RFP section 6.5.2)

- 1) Standard interfaces for control, management and status retrieval of the subsystems.
 - Provided in section 10.6 of proposal (STI API), Subsystem lookup APIs defined in 10.6.1.2, various control and management APIs defined in 10.6.2.
- 2) Control interfaces with functionality to control the synchronization of subsystems.
 - Specialized device control in section 10.6.3, Generic Messaging, Event Publish/Subscribe, Logging, Time sync APIs defined in sections 10.6.4 – 10.6.8
- 3) Interfaces that allow setting and querying parameters defined in the hardware abstraction of subsystem elements.
 - PropertySet interfaces defined in section 10.6.2.3
- 4) Application interfaces and related metadata defined separately for each subsystem.
 - Application interfaces defined in section 10.5 (Application and Device Control Interface)
 - Proposal dictates that each subsystem/instance has separate objects in memory, separate properties and property definitions



RFP Items not fully addressed in Proposal

Networking (RFP section 6.5.3)

- STI is primarily defining a system architecture and control plane and is agnostic to the data plane
 - Any type of underlying network routing/structure could be accommodated while still complying with the architecture
 - Scheduling, intermittent connectivity can all be handled via applications/waveforms running in the environment

Security (RFP section 6.5.4)

- A security manager is part of the overall architecture but the specific role is not defined in the PIM
 - Different SDR deployments have different security requirements
- Architecture does allow for each waveform to be executed in a “secure enclave”
 - OE may provide isolated/containerized environment, validate all I/O operations, etc.
 - Transparent to applications and does not change the general system architecture



Summary

- The STI proposal is based on a proven and deployed predecessor
 - Addresses the needs of real space SDR deployments
 - Clear upgrade path for existing software/hardware investments
- Utilizes an architecture similar to existing SDRP/SCA specifications
 - STI upgrades/updates these concepts/paradigms to SysML
 - Simplified for Space Domain where relevant
- Addresses main compliance points from the STI RFP



Questions and Answers