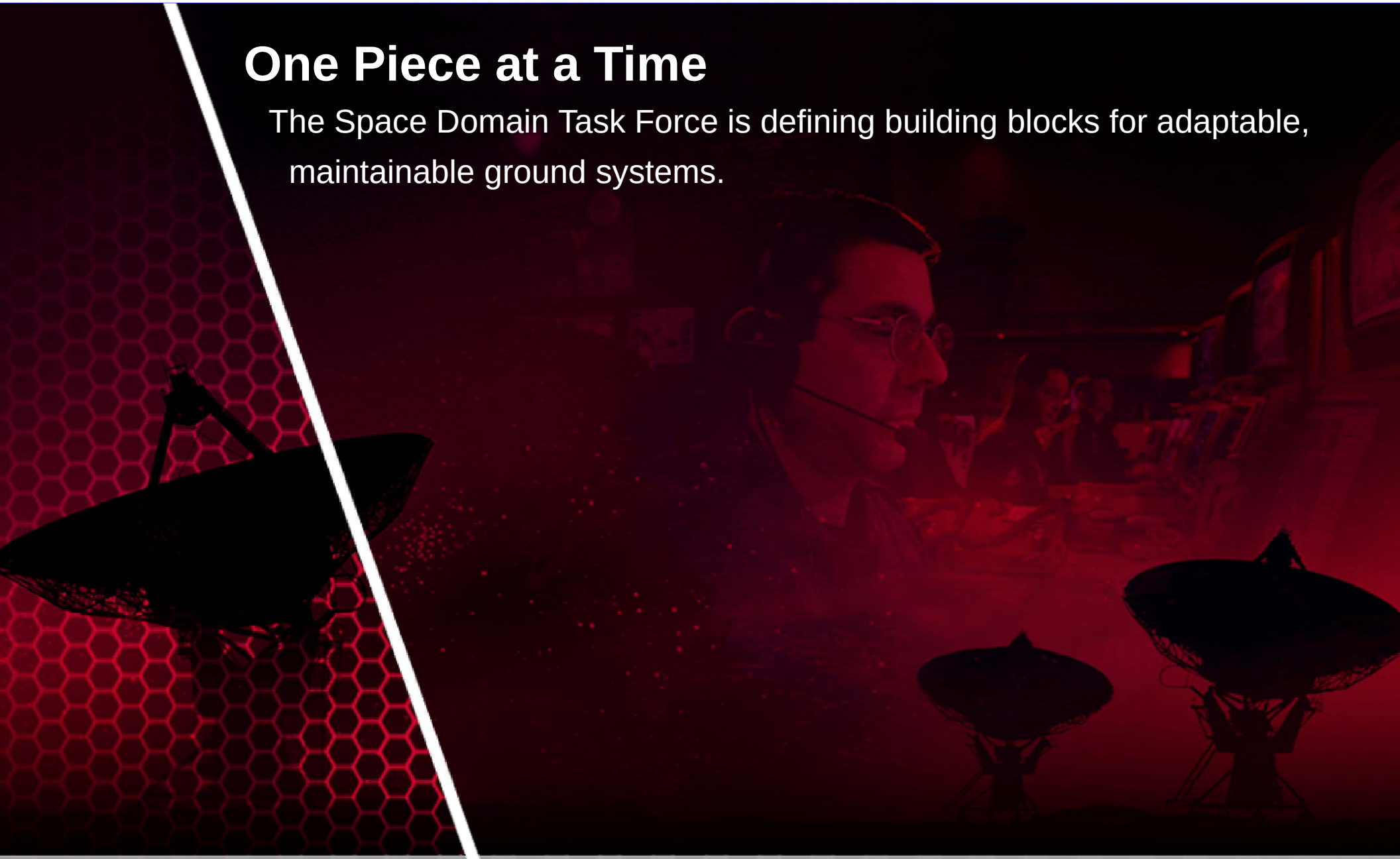
One Piece at a Time

The Space Domain Task Force is defining building blocks for adaptable, maintainable ground systems.



Ground System Architectures Workshop 2012

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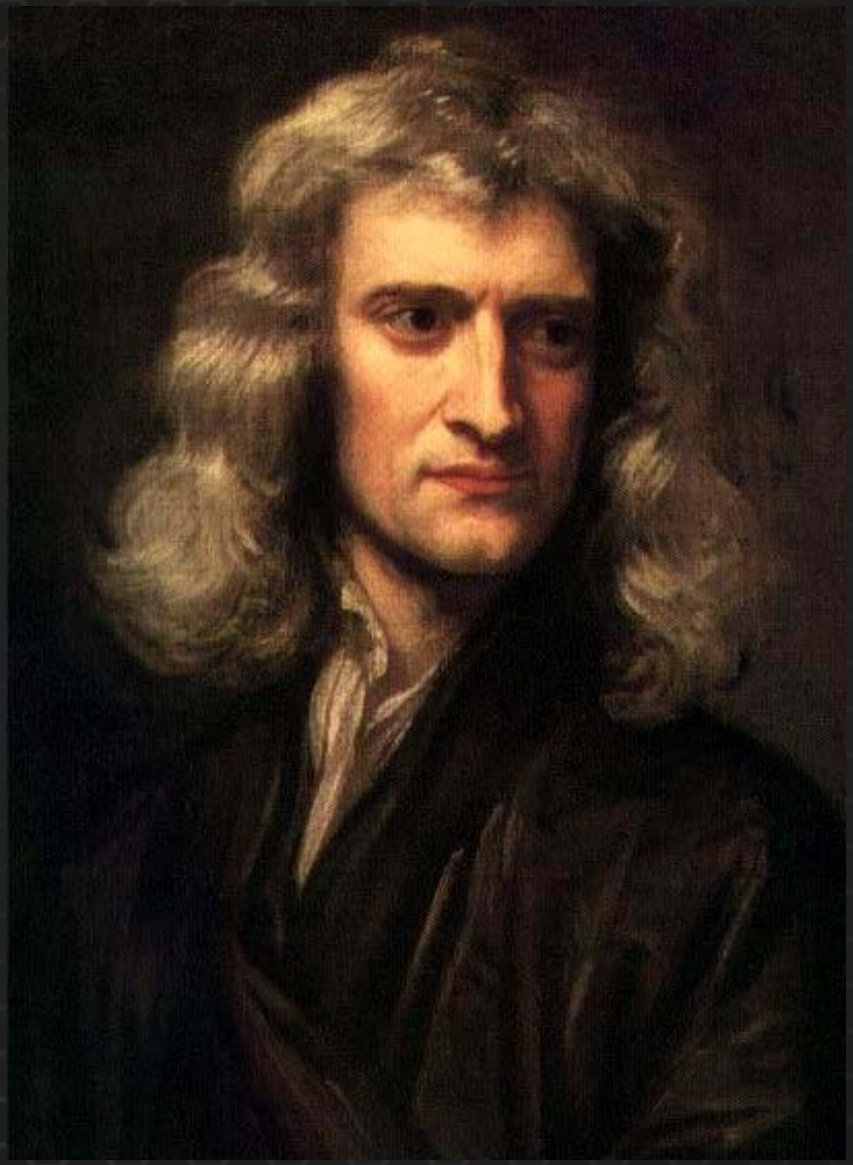
Co-Author: **Rob Andzik** Amergint Technologies

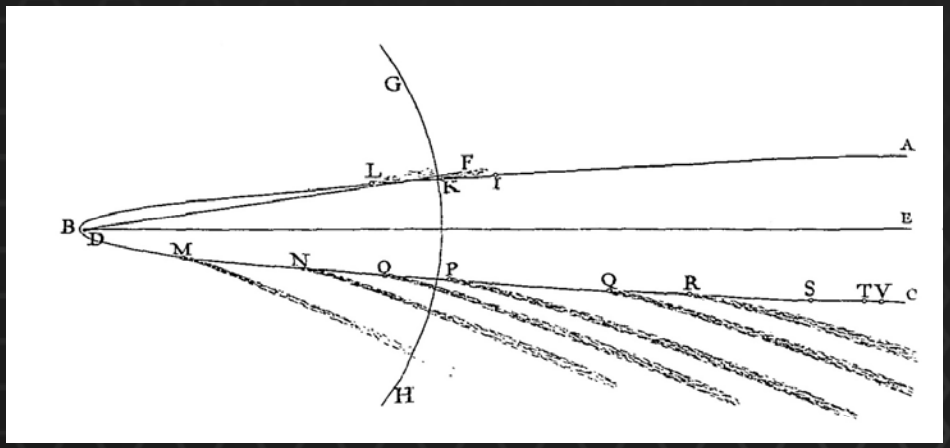
On the Shoulders of Giants

OS COMET

"If I have seen a little further, it is by standing on the shoulders of giants"

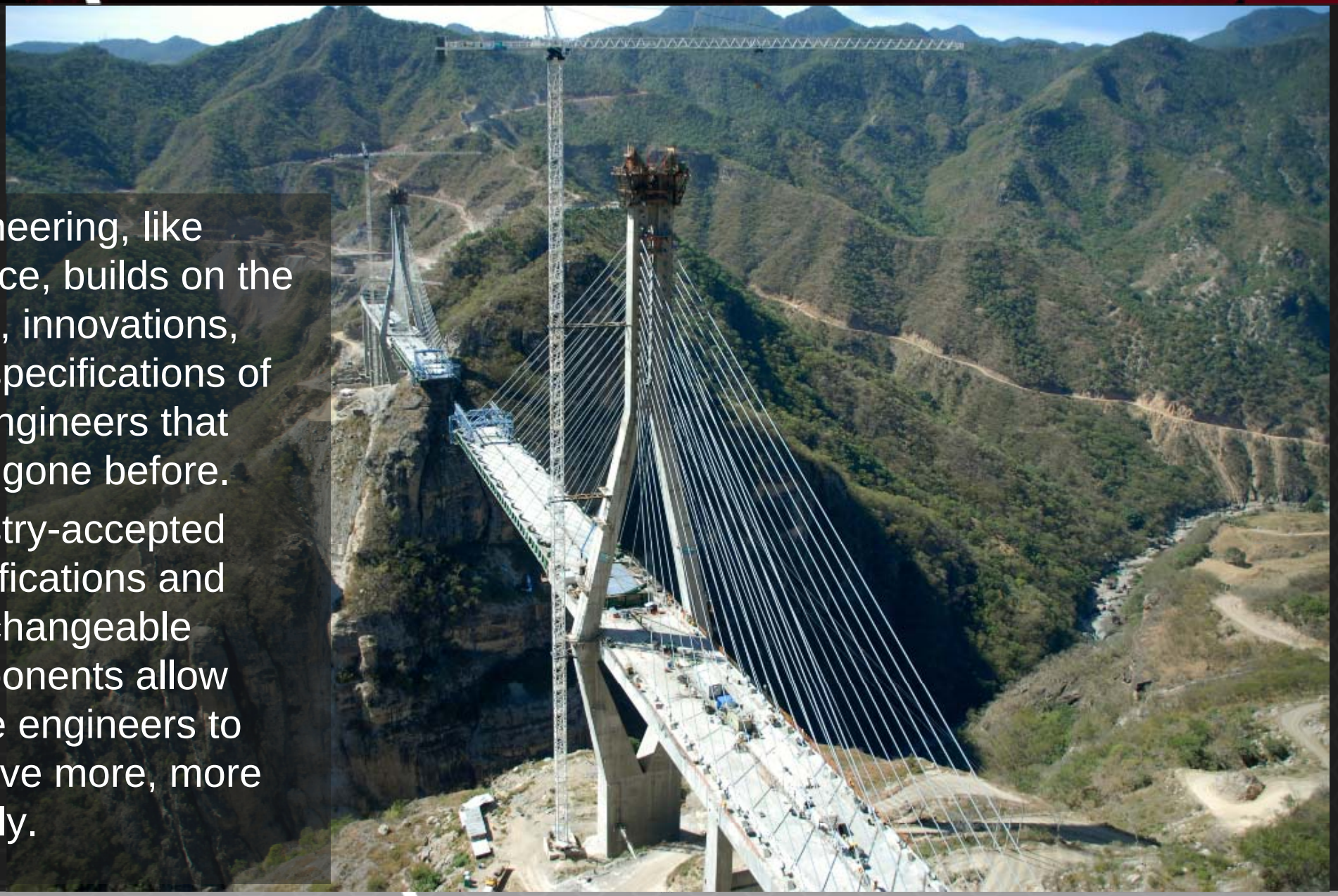
Isaac Newton





assuredcommunications

Specifications and Standards



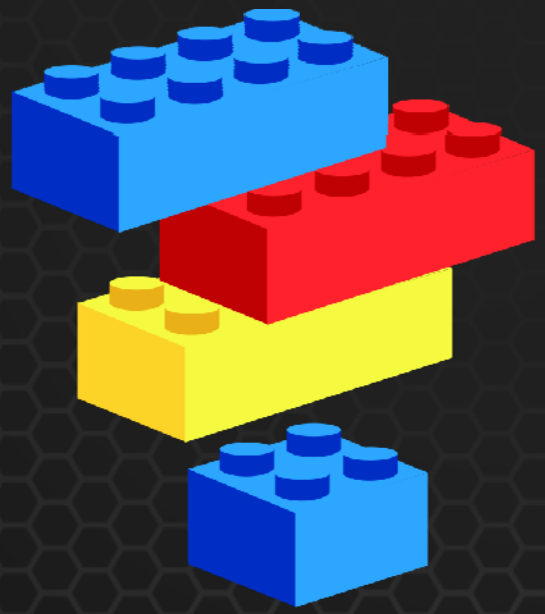
- Engineering, like science, builds on the ideas, innovations, and specifications of the engineers that have gone before.
- Industry-accepted specifications and interchangeable components allow future engineers to achieve more, more quickly.

Building on Specifications

- In 1993, Marc Andreesen created Mosaic, that initiated the Web explosion
- Google, Amazon, Yahoo
  - 0 to $324,800,000,000 in 20 years
- The Web was built on HTTP and some of the pioneering work by Tim Berners-Lee
- HTTP was built on TCP/IP & DNS

Bottom-Up vs. Top-Down

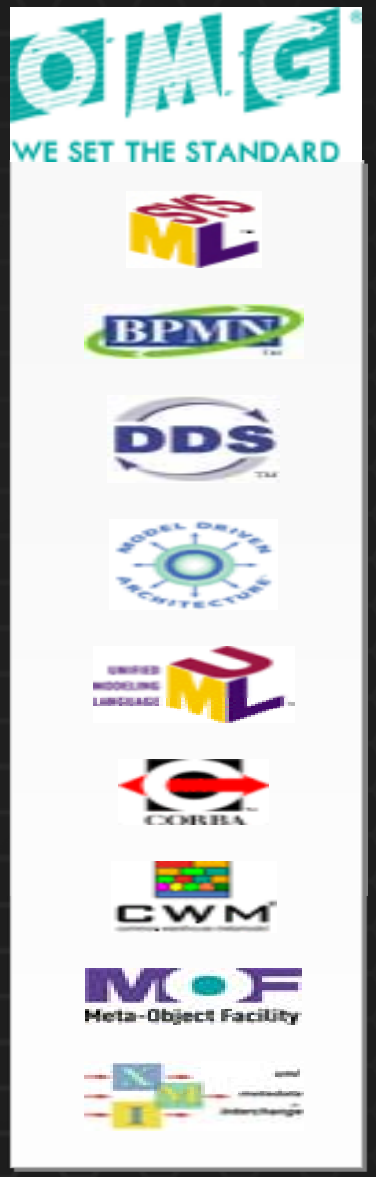
- The explosion of innovations that are the World Wide Web was enabled by relatively simple, low-level transport protocols and models for peer-to-peer, client-server, and information transfer, not a top-down “how we will network everything” architecture.
- This success can be attributed to designing enablers that facilitate innovation rather than systems that constrain it.



versus

OMG Space Domain Task Force

- The Object Management Group (OMG) Space Domain Task Force (SDTF) published its first specification in 2005, the XML Telemetric & Command Exchange (XTCE) format.
- OMG's "products" are specifications and models, enabling commercial vendors to produce innovative and interoperable software products rather than competing with them.



XTCE

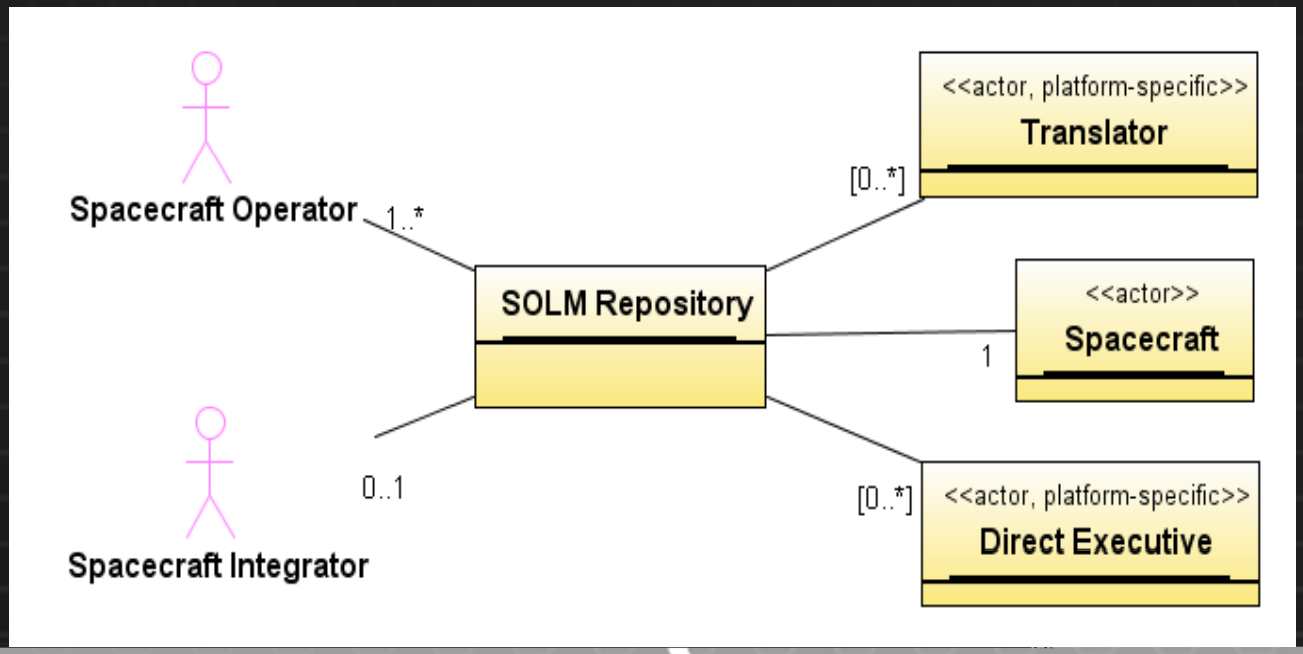
- XTCE 1.0 was revised after review by the CCSDS space agencies and use in a DARPA program; version 1.1 was published by the OMG in 2007 and also was adopted by CCSDS.
- Version 1.2 of XTCE is in progress
- XTCE provides a command and telemetry catalog for transfer between spacecraft integrators and operations centers.
- A command and telemetry catalog is also essential to many other ground system components, e.g. displays, procedures, archives, etc.

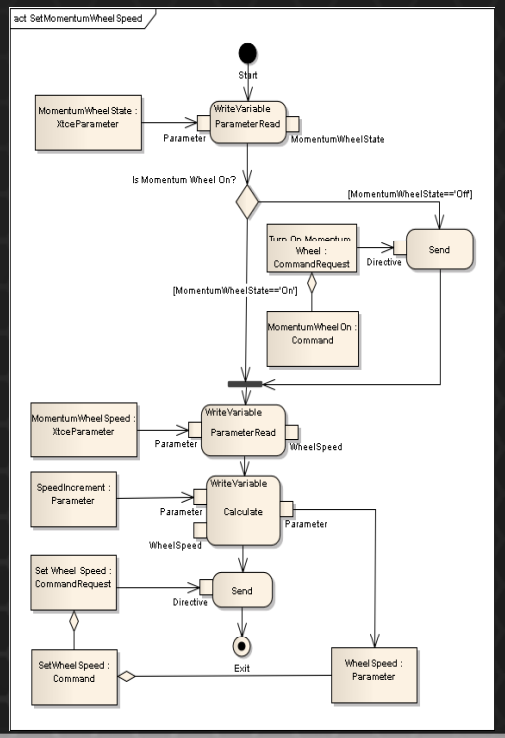
GEMS

- The Ground Equipment Monitoring Service (GEMS) specification was originally published in 2009 and is currently at revision 1.2.
- GEMS defines a model for interaction between ground equipment and the ground control system that is richer than SNMP.
- GEMS codifies a simple ASCII exchange mechanism, similar to many pre-existing company proprietary command/response protocols, and also defines an alternative XML format.
- Because it is a low-level interaction model, it can be applied to a variety of ground equipment, e.g. radios, antenna controllers, etc., and reduces the software requirements on the ground system to support a variety of devices.

SOLM

- The Satellite Operations Language Metamodel (SOLM) specification was adopted last year and is in finalization for publication.
- SOLM defines an operations procedure exchange format that will enable the exchange of procedures similar to the way that XTCE enables exchange of command and telemetry models.
- SOLM is compatible with both XTCE and GEMS, leveraging their definition of parameters in its model definition.





Operations Archive

- The next specification from SDTF will likely be an archive specification to provide greater interoperability and long-term maintainability for the operations history, once again leveraging the command and telemetry catalog provided by XTCE.
- The operations archive is at the requirements stage prior to issuing a request for proposals (RFP).
- Industry participants can respond to the RFP when it is published, or can join us now in the requirements phase.

Summary

- The purpose of this presentation was to:
  - Let you know what the SDTF has been doing over the past eight years
  - Describe our incremental approach, publishing small, cooperating specifications that any industry participant can implement.
  - Encourage you to join us in specifying the next set of building blocks for interoperable, maintainable space systems.