GSAW 2014 Tutorial G:

A Model-Based Approach to Architecting Ground Data Systems

Length: Half Day

Overview:
The course will begin with an overview of our simple CubeSat mission and the capabilities that the ground system will need to provide.We will then provide an overview of ISO 42010 and how it is used in architecting software intensive systems such as our CubeSat Ground Data System. During this section we will identify:

1. Typical GDS Stakeholders: Who are the people/communities that care about the architecture and capabilities of the GDS, e.g., scientists/analysts, operators, network/communications providers, project management, system developers, etc.
2. Typical Stakeholder Objectives/Concerns: For each of these communities- what are the criteria they will use to assess the "goodness" of the architecture? e.g., inheritance/reuse, adaptability, data latency, external interfaces, security risk, etc.
3. Typical Architecture Artifacts (aka viewpoints) produced to address stakeholder concerns: What does the stakeholder need to see in order to have their concerns answered? e.g., network laydown, inter-system ICDs, allocation of systems to security containment zones, risk by system and function, etc. We'll use a series of common viewpoints provided by existing architecture description frameworks (DoDAF, ToGAF, RASDS, etc.) augmented with others as needed.
4. Approaches to working with stakeholders to verify that their concerns have been satisfied by the GDS architecture.

Next, we will select several of these areas and show how Model-based Systems Engineering techniques can be applied to:

1. Capture how stakeholders and concerns are related to architecture products and key system constraints.
2. Represent the information/relationships needed to support generation and analysis of each of the architecture artifacts.
3. Capture/model the information needed to generate the viewpoints.
4. Generate specific viewpoints and perform analysis, such as generating graphic or tabular viewpoints, performing an analysis of data latency on a network connection, etc.

After which we will briefly discuss how the models we introduced can be implemented or embedded using various modeling languages such as SysML, UPDM, etc.

Discussion is encouraged throughout the tutorial, but we will allot the last half-hour for questions and discussions.

Instructors: Elyse Fosse, Maddalena Jackson, Jet Propulsion Laboratory, California Institute of Technology

Biographies:
Elyse Fosse is a member of the Ground System Architecture and Systems Engineering group at the Jet Propulsion Laboratory. Her current tasks include being the lead Systems Engineer on the Chevron Cyber Resiliency task and being a Flight Systems Engineer and Model CogE for the Mars2020 mission. Previous to these tasks she was the Deputy Systems Architect for the Mission Operations System Architecture Framework (MSAF). Her main focus while at JPL as been on MBSE adoption and Model Based Architecture. She has been involved with the INCOSE challenge team's creation of the CubeSat Framework. Elyse earned her M.A. in Applied Mathematics from Claremont Graduate University and her B.S. in Mathematics from the University of Massachusetts Amherst.

Maddalena Jackson is a Software Systems Engineer in the Ground System Architecture and Systems Engineering group at the Jet Propulsion Laboratory. She currently designs and develops models for analysis of complex smart-grid applications and is involved with strategic efforts to infuse model-based systems engineering at JPL. She has previously worked as a Ground Data Systems Engineer for NASA's Juno mission to Jupiter and has developed models for many other JPL ground and space-based projects. Maddalena earned her B.S. in General Engineering from Harvey Mudd College in Claremont, CA.

Description of Intended Students and Prerequisites:
Participants should be personnel responsible for designing, deploying, testing, maintaining, and/or analyzing ground data systems. Familiarity with Model Based Systems Engineering (MBSE) is useful but not required. Familiarity with a specific modeling language (e.g., SysML) is not required.

What can Attendees Expect to Learn:
At the completion of this course participants should have an understanding of how to systematically architect a ground data system, the role of viewpoints, the types of information that need to be modeled and maintained, and the model-constructs that can be used to represent and analyze the GDS Architecture for a typical Cubesat mission. They should also understand, through examples shown during the tutorial, how to apply these techniques to a mission, and have an initial understanding of how to apply a MBSE tool/language of their choice to modeling selective portions of their systems.