



National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California



Architecture-Centric Evolution (ACE) Working Group Session

SOA (Service Oriented Architecture) based approaches for architecting satellite ground systems in a net-centric environment – where are we today

Magdi Carlton

*Program Element Manager for Advanced Multi-Mission
Operations System (AMMOS), Jet Propulsion Laboratory,
California Technology of Institute*

*Ground System Architectures Workshop
March 25, 2009*



© 2009 California Institute of Technology. Government sponsorship acknowledged.



National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

MDAS SOA Activities



- NASA Multimission Ground System and Services (MGSS) includes six program elements, one of them is the Mission Control, Data Management & Accountability, Spacecraft Analysis (MDAS)
- MDAS-Deep Space Information Services Architecture (DISA) Registry and Repository Service is a development task. Its purpose is to procure and install an enterprise class registry and repository service for all future Deep Space Network (DSN) and Advanced Multi-Mission Operations System (AMMOS) SOA implementations
 - Architecture specification is in progress; It will be deployed as part of the Enterprise Infrastructure Service Architecture by end of this calendar year
- MDAS-DISA Accountability Service is a development task. Its purpose is to port Mars Reconnaissance Orbiter's end-to-end Accountability Software to a multimission environment and make it a full SOA service
 - Expected gains are platform independence, language independence, and database independence
- Usage of Other Service-Related Technologies
 - Mission data Processing and Control Subsystem (MPCS) is using JAVA, XML for messages, and a SOA message bus for communication



National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

SOA Standards



- Development uses DISA specifications as they become available
 - DISA Specification, Enterprise Specification, Security Specification, Information Architecture and Management Specification, Technology Specification, Infrastructure Services Architecture, Application Services Reference Architecture and Service Development Specification, Governance Framework, etc.
- Participate in development of DISA specifications and standards under the direction of the DISA Chief Software Architect
 - DISA Service Analysis and Design Methodology (Refer to presentation at GSAW09 Tutorial J)
 - Service Modeling (Definition, Surveys, and Techniques), Service Analysis (AS-IS Process Model Analysis, Business Service Identification, Business Service Gap Analysis, Business Service Realization Analysis), Service Design (Service Description, Business Process Specification, Business Service Policy Specification, Service Integration Model), Service Modeling Phase Deliverables
 - DISA Service Portfolio Plan (Refer to presentation at GSAW09 Tutorial J)
 - Service Portfolio Plan Definitions, Service Portfolio Plan Workflow, Architecture background, Service Policies, Domain-Specific Steps (Scope & Domain Overview, Quality Requirements, Conceptual Service View, Service Implementation View, Service Deployment View, Service Descriptions, Development schedule)



National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

SOA Training



- GSAW Education
- Training programs offered at JPL
 - Hands-On Unified Modeling Language (UML) by Learning Tree
 - SOA Governance by Everware-CBDI
 - Guest Speakers on SOA Technologies (12 one-hour sessions)
 - Guest Speakers on Information Technology (12 one-hour sessions)
 - Introduction to Software Architecture by David Garlan CMU/SEI
- Developing DISA Education Plan



National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

References (1)



[Arsanjani04]	Service-oriented modeling and architecture, Ali Arsanjani, November, 2004 http://www.ibm.com/developerworks/webservices/library/ws-soa-design1/
[Arsanjani07]	Design a SOA solution using a reference architecture, Ali Arjanjani, Liang-Jie Zhang, Michael Ellis, Abdul Allam, Kishore Channabasavaiah, March 2007, www.ibm.com/developerworks//library/ar-archtemp/
[Arsanjani08]	SOMA: A Method for developing service-oriented solutions, A. Arsanjani, S. Ghosh, A. Allam, T. Abdollah, S. Ganapathy, K. Holley, IBM Systems Journal, Vol 47, No. 3, 2008
[Artus06]	SOA Realization: Service design principles, David J. N. Artus, February 2006, www.ibm.com/developerworks/webservices/library/ws-soa-design1/
[Bass03]	Software Architecture in Practice, Second Edition, Len Bass, Paul Clements, Rick Kazman, Addison-Wesley, Copyright © 2003, 12th Printing February 2008
[Bell08]	Service-Oriented Modeling, Service Analysis, Design, and Architecture, Michael Bell, 2008 John Wiley & Sons, Inc.
[Brown09]	SOA Governance, Achieving and Sustaining Business and IT Agility, William A. Brown, Robert. G.Laird, Clive Gee, and Tilak Mitra, IBM Press 2009
[Clements03]	Documenting Software Architectures, Views and Beyond, Paul Clements, Felix Bachmann, Len Bass, David Garlan, James Ivers, Reed Little, Robert Nord, Judith Stafford, 2003 Pearson Education, Inc.



National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

References (2)



[Dodd05]	Practical Service Specification and Design Part 1: Planning the Services, John Dodd, CBDI Journal 2005-03
[Dodd05a]	Practical Service Specification and Design Part 2a: Refining Service Requirements for Customers, John Dodd, CBDI Journal 2005-04
[Dodd05b]	Practical Service Specification and Design Part 2b: Refining Service Requirements, John Dodd, CBDI Journal 2005-05
[Dodd05c]	Practical Service Specification and Design Part 3: Specifying Services, John Dodd, CBDI Journal 2005-06
[Dodd05d]	Practical Service Specification and Design Part 4: Delivering Services, John Dodd, CBDI Journal 2005-07/08
[Dodd05e]	The Service Lifecycle, John Dodd, CBDI Journal 2005-11
[Erl04]	Service-Oriented Architecture, A Field Guide to Integrating XML and Web Services, Thomas Erl, 2004 Pearson Education, Inc.
[Erl05]	Service-Oriented Architecture, Concepts, Technology, and Design, Thomas Erl, 2005 Pearson Education, Inc.
[Erl08]	SOA Principles of Service Design, Thomas Erl, Pearson Education, Inc. 2008
[Erl09]	SOA Design Patterns, Thomas Erl, Pearson Education, Inc. 2009



National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

References (3)



[ITIL07]	Foundation of IT Service Management Based on ITIL V3, Jan van Bon, et al. van Haren Publishing, Zaltbommel, itSMF-International 2007, September 2007
[Khoshafian07]	Service Oriented Enterprises, Setrag Khoshafian, Auerbach Publication, 2007
[Marks06]	Service-Oriented Architecture, A Planning and Implementation Guide for Business and Technology, Eric A. Marks & Michael Bell, 2006 John Wiley & Sons, Inc.
[OASIS08]	OASIS Reference Architecture for Service Oriented Architecture (SOA-RM) Version 1.0, Jeff Estefan, Ken Laskey, Francis McCabe, Danny Thornton, April 2008, http://docs.oasis-open.org/soa-rm/soa-ra/v1.0/soa-ra-pr-01.pdf
[OMG08]	Service oriented architecture Modeling Language (SoaML) - Specification for the UML Profile and Metamodel for Services (UPMS), OMG document ad/2008-08-04
[Papazoglou08]	Web Services: Principles and Technology, Michael P. Papazoglou, Pearson Education Limited 2008
[Wilkes04]	Establishing a Service Lifecycle, Lawrence Wilkes, CBDI Journal 2004-01
[Zimmermann04]	Elements of Service-Oriented Analysis and Design, Olaf Zimmermann, Pal Krogdahl, Clive Gee, June 2004, www.ibm.com/developerworks/library/ws-soad1/
[Zimmermann07]	Leveraging Reusable Architectural Decision Models as a Design Method for Service-Oriented Architecture Construction, ECOWS Keynote, November 28, 2007, Olaf Zimmermann, IBM Zurich Research Lab
[Zimmermann09]	Service-Oriented Analysis and Design a.k.a. SOA Decision Modeling (SOAD) IBM Project by Olaf Zimmermann http://soadecisions.org/soad.htm