

Integrating Space Communication Network Capabilities via Web Portal Technologies

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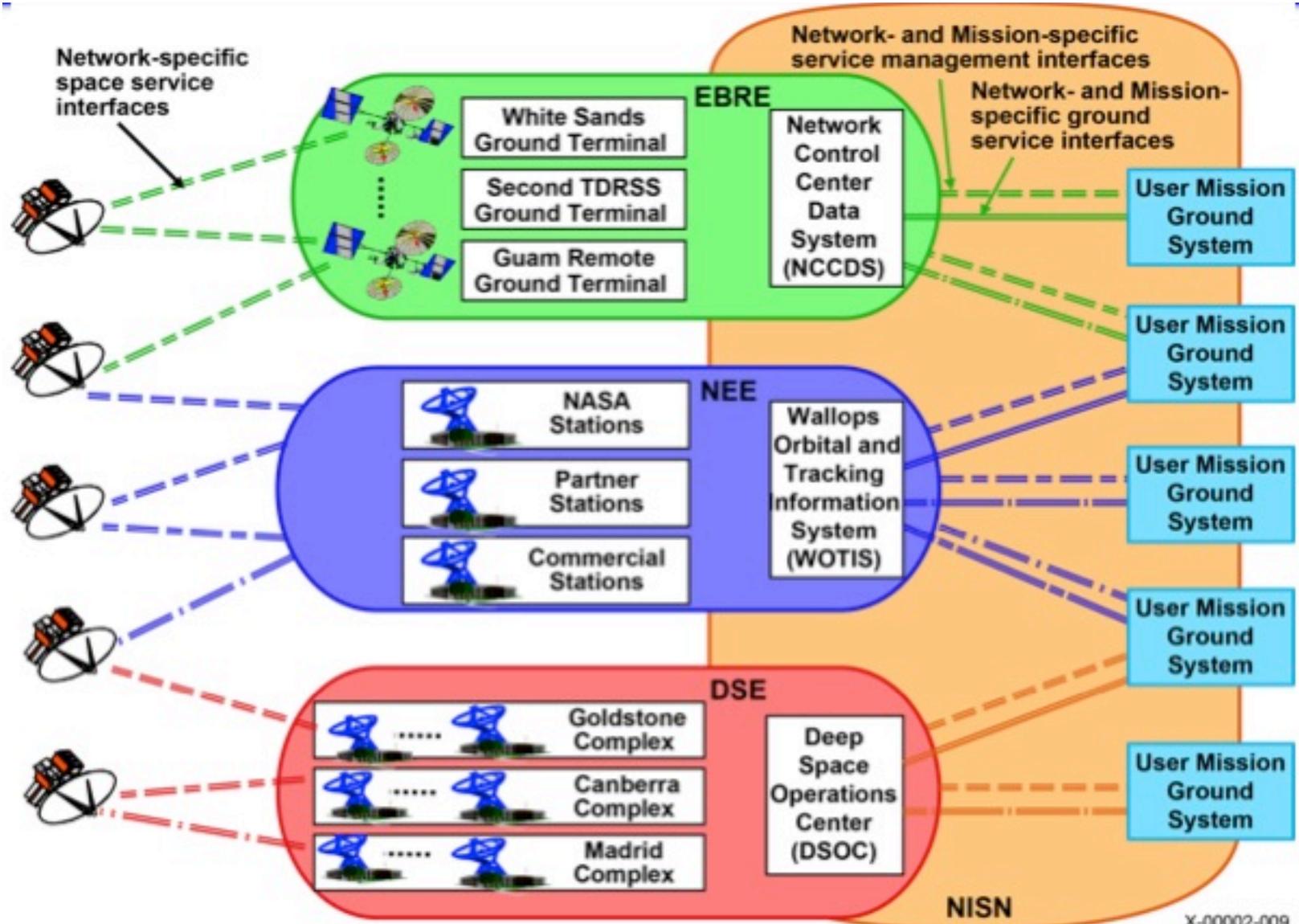
Butch Carruth, Adam Coffman, and Mike Wallace
Innovative Productivity Solutions, Inc.

Overview

- **NASA Space Communications and Navigation (SCaN) Networks**
 - Overview
 - Integrated Network Architecture (INA)
- **Web Portal Technology**
 - Applicability to SCaN INA objectives
- **Conclusions**
- **Next Steps**

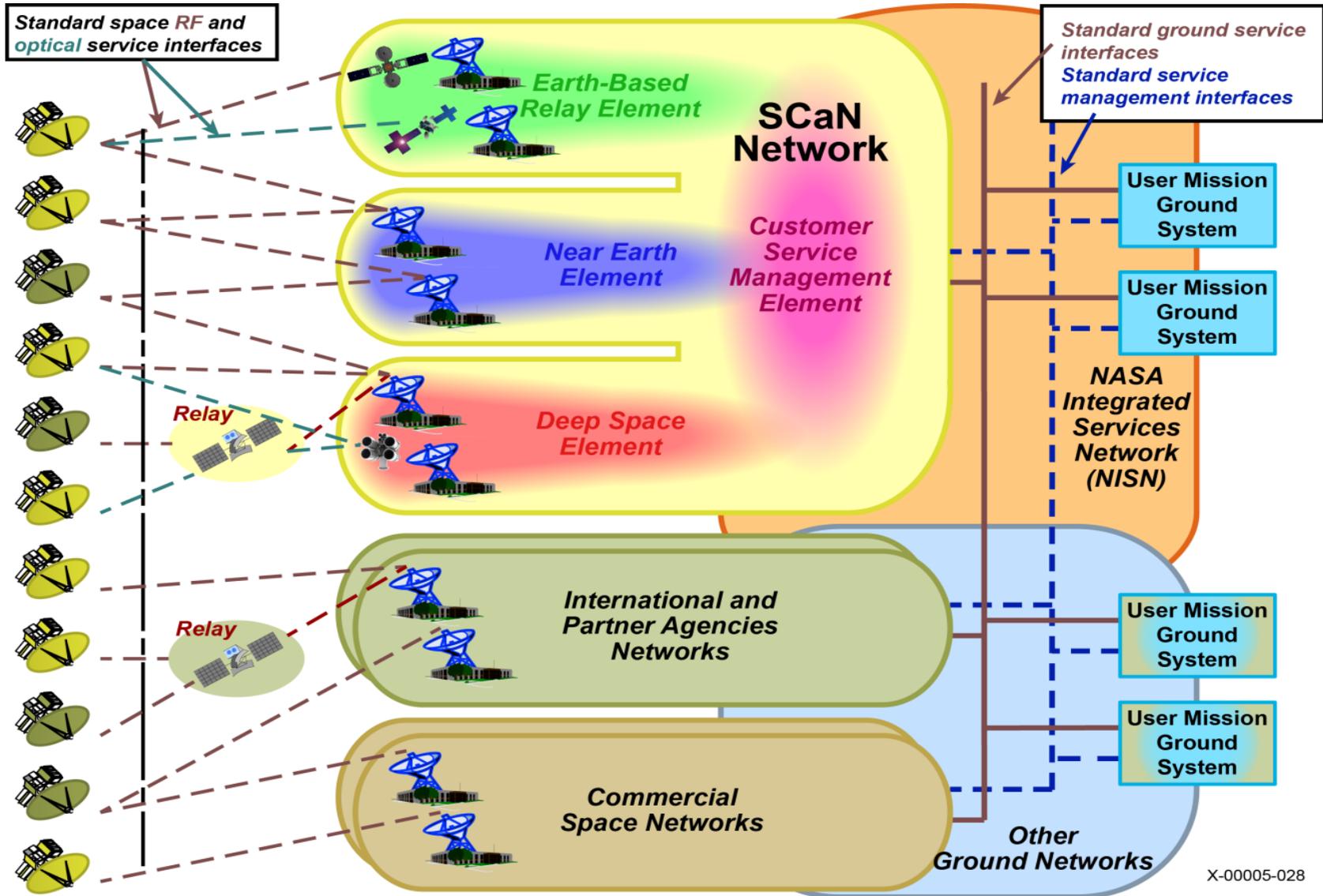


Current SCan Architecture



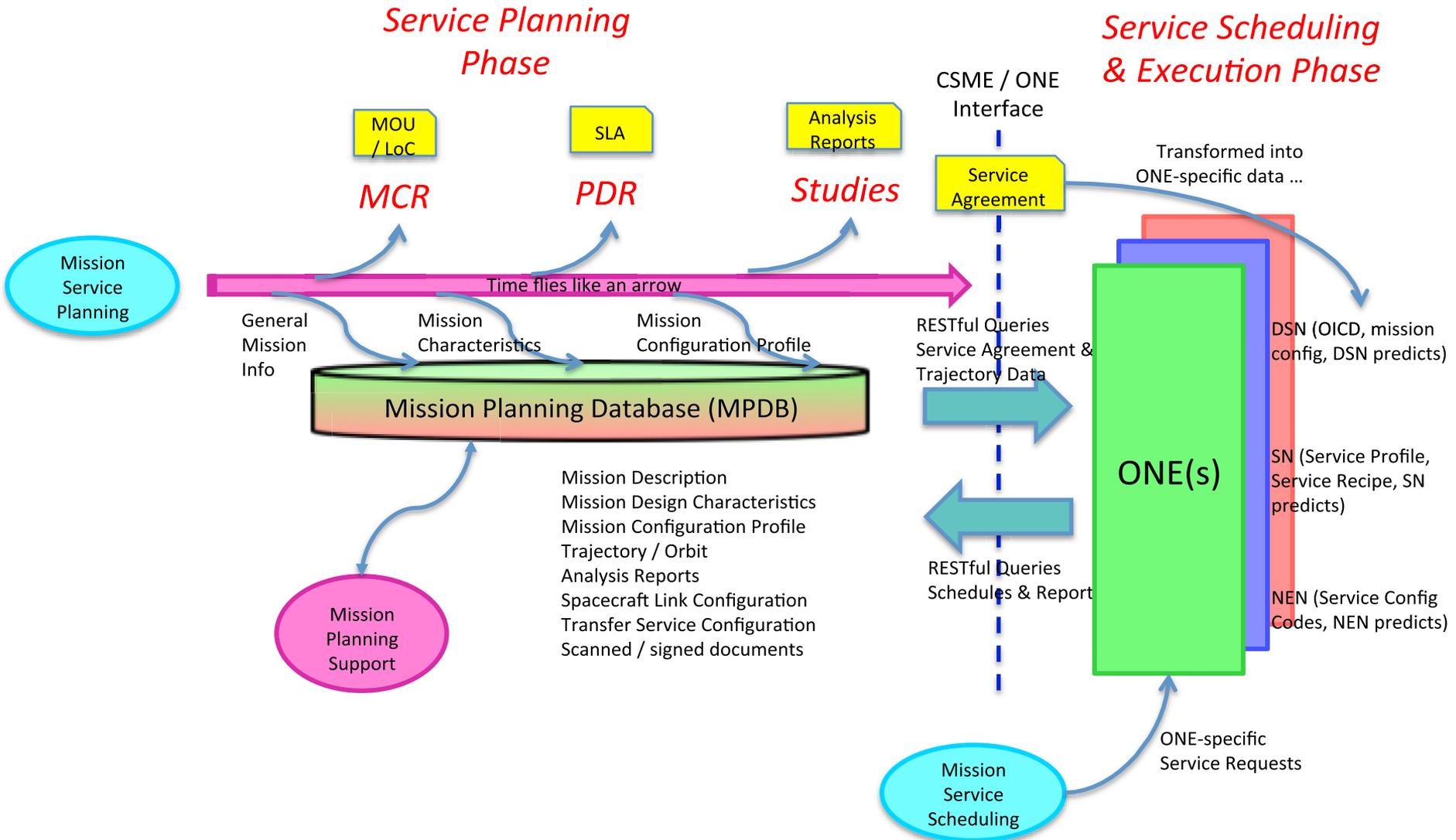


Future Integrated Network Architecture (INA)



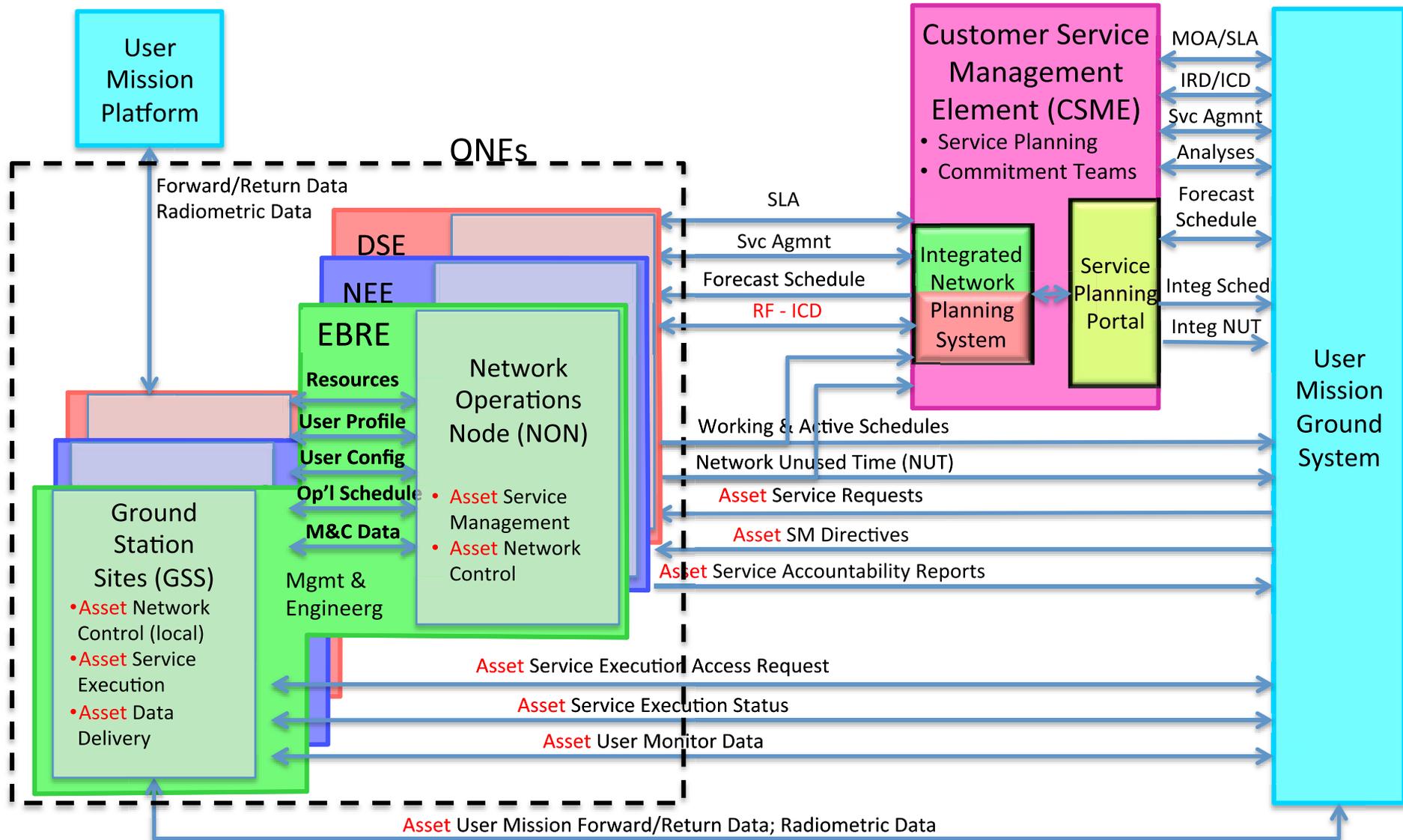


Integrating the Networks – Increment 1





Integrating the Networks – Interfaces (Incr. 1)



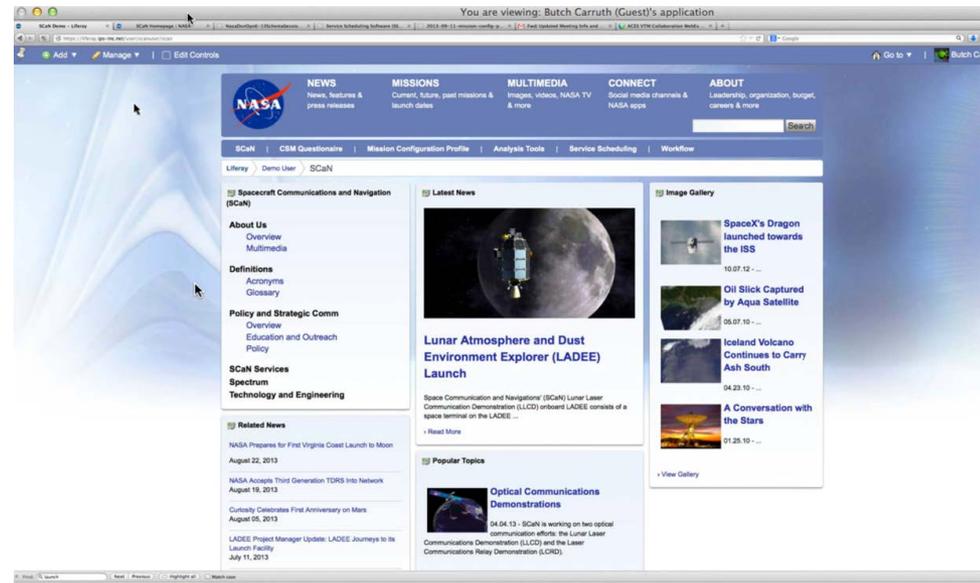
Service Portal Overview

- **The Customer Service Management Element (CSME) incorporates a Service Portal + Integrated Network Planning System (INPS)**
- **From the perspective of user missions, this is a web-based system facilitating service management activities such as:**
 - **access to the Integrated Network services catalog, services catalog for each network element, and user's guides for each network element**
 - **interfaces with the Integrated Network for submitting spacecraft trajectory files**
 - **interfaces with the Integrated Network for submitting spacecraft link configuration files**
 - **access to RF link analysis tool(s) for performing the link design**
 - **access to network schedule products**



Standardized Portlet Technology

- **There is a Java standard for web portal technology (JSR-168, JSR-286: Portlet Specification 2.0)**
 - Defines behavior and interfaces as extension of servlet functionality
 - Allows multiple independently-developed portlets to co-exist on the same web page
 - Also allows portlets to interoperate – mix and match to provide custom application behavior

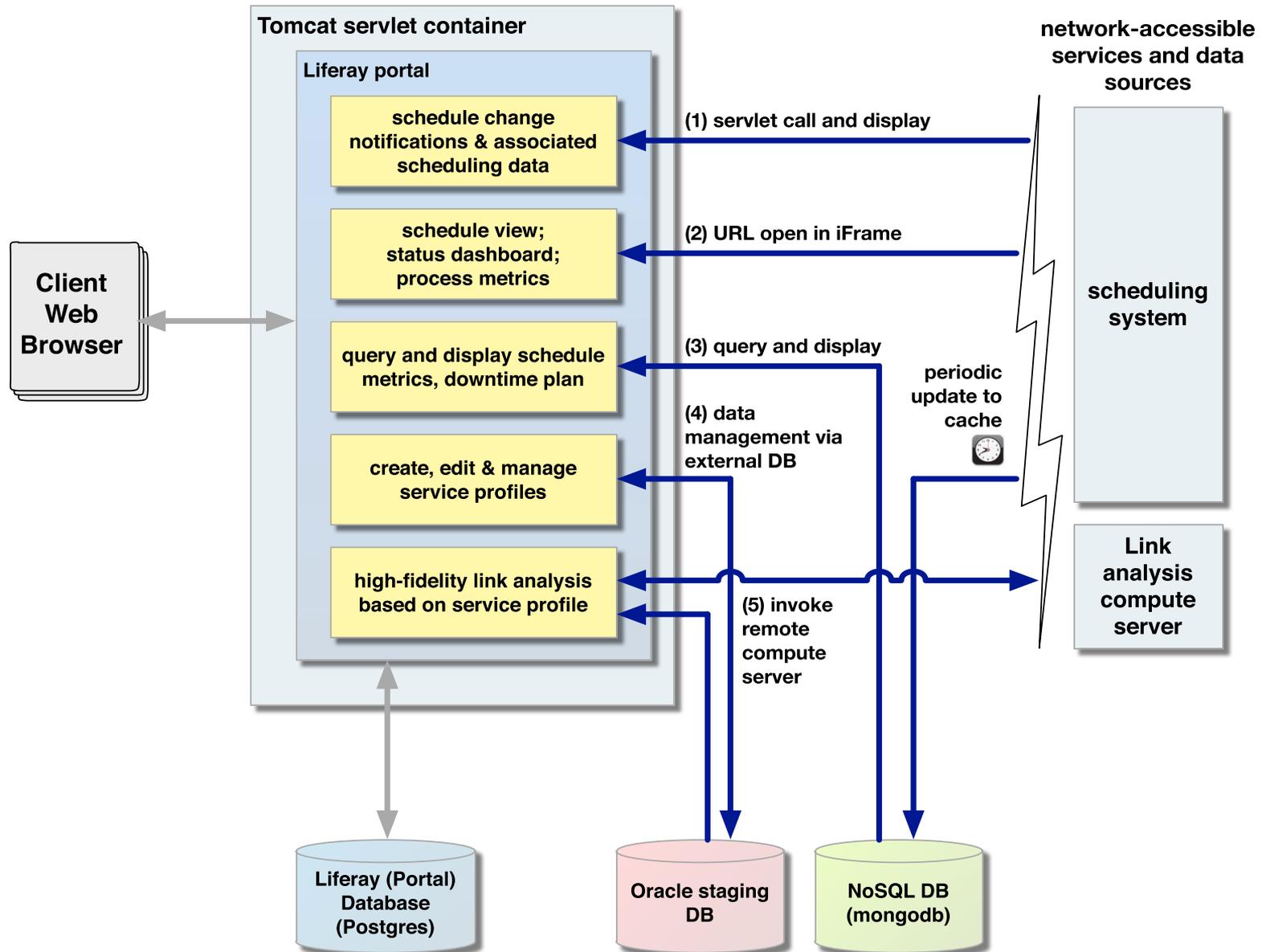


Portal Servers

- **Provided by a number of vendors**
- **Often incorporates building portlet applications that can be used to leverage development**
 - document management
 - wikis
 - message boards
 - blogs and news feeds (RSS)
 - announcements and alerts
 - calendars
 - navigation
 - search
- **Security capabilities can provide fine-grained management of authorization and access**
 - users, groups, roles etc.
 - single sign-on



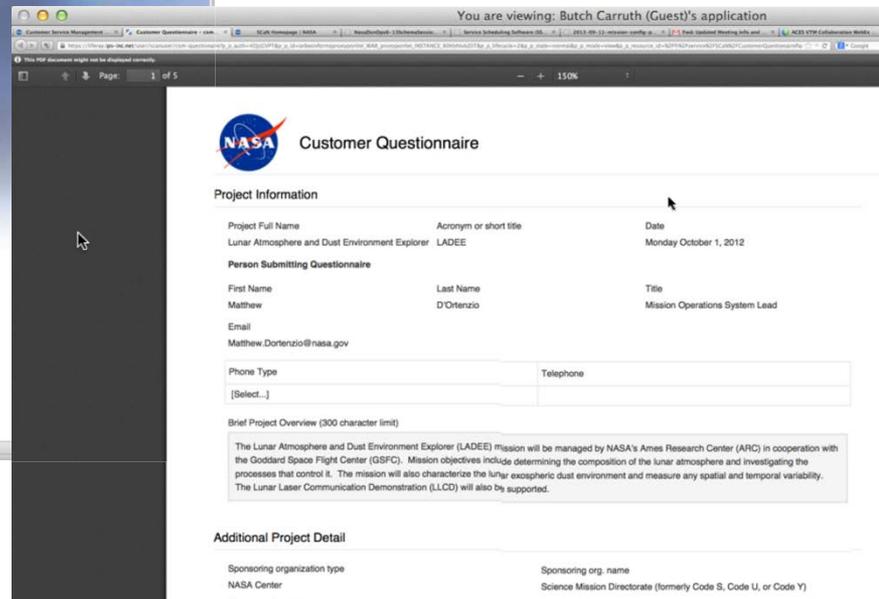
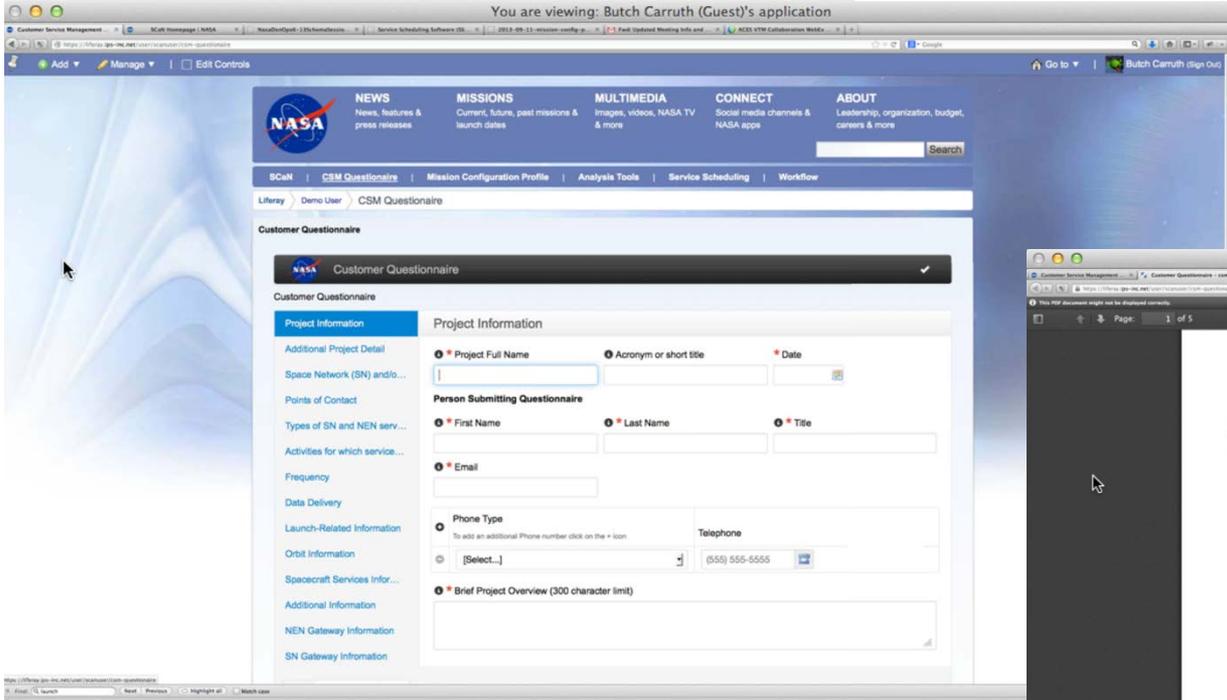
Some Data Flow and Presentation Options



Forms

Forms-based data entry

- wizards, validation, and tooltip help
- save/restore of partially filled forms
- jump-to-error diagnostics when forms do not validate
- PDF rendering



XML schema-driven editors

- Link configuration specified by XML schema
 - Editor, help text, and validation all automatically generated directly from schema

Mission Configuration Template Listing: All Missions

Detail	Copy	Delete	Profile	Mission	Session Profile ID	Last Edited	User	Approval
				CAS	CAS-BC-Test1	2013-06-24 09:37:01	bcarruth	★
				CLU2	b2	2013-06-25 15:21:24	acoffman	✔
				MEX	SP_e3410cc73bda	2013-06-25 11:15:03	bcarruth	★
				MEX	SP_e3410cc73bda2	2013-07-18 11:44:20	bcarruth	★
				MRO	BC-Test-Config-1	2013-09-09 14:13:04	bcarruth	★
				MRO	BC-Test-Config-2	2013-09-09 14:13:19	bcarruth	★

Mission Configuration Profile Listing: All Missions

Detail	Copy	Delete	Mission	Session Profile ID	Last Edited	User	Approval
			CLU2	ac-manual-test	2013-06-25 17:42:43	acoffman	✔
			MEX	NewProfile	2013-07-18 11:46:38		
			MEX	SP_e3410cc73bda	2013-08-05 15:51:22		
			MRO	BC-Test-Config-1	2013-09-09 14:16:01		
			MRO	BC-Test-Config-2	2013-09-09 15:14:04		
			VGR1	SP Y	2013-08-06 10:20:25		
			VGR2	SP Z2	2013-08-06 10:57:47		

Mission Configuration Template Editor

Space Link Session Profile

Spacecraft Id: MRO (74)
 Space Link Session Profile Id: BC-Test-Config-1

Forward Space Link Carrier Profile

Carrier Profile Id: CP_X_F1_e3410cc73bda

Forward Space Link Parameters

BAND	X
RNG	PN
RNG T1	60
RNG T2	8

Mission Configuration Profile Editor

Space Link Session Profile

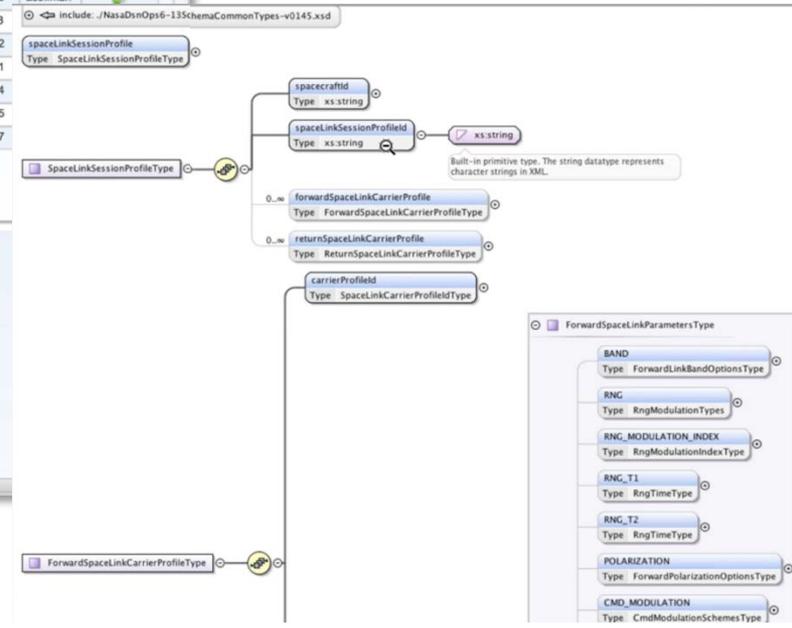
Spacecraft Id: VGR2 (32)
 Space Link Session Profile Id: SP Z2

Forward Space Link Carrier Profile

Carrier Profile Id: CP_S_F1_172bde021be5

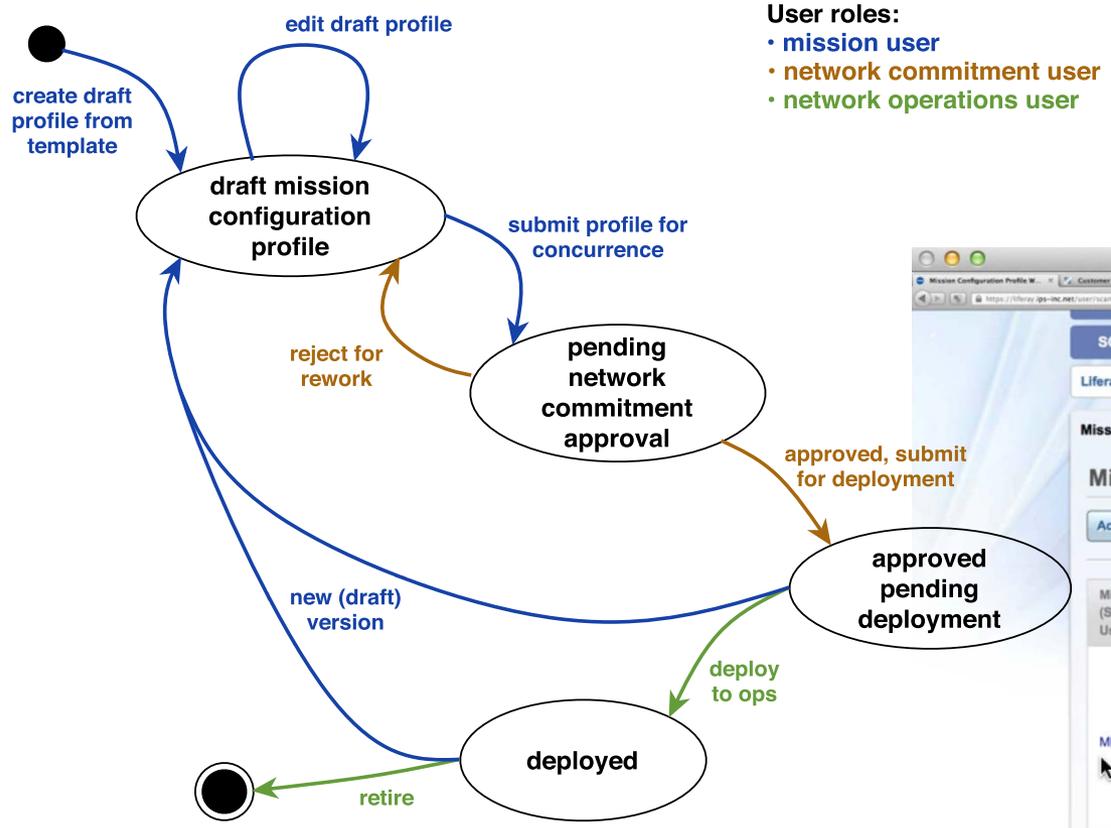
Forward Space Link Parameters

BAND	S
POLARIZATION	RCP
EIRP	99
ETX SC FILE ID	99



Workflow

Workflow – two-stage review and approval



- User roles:
- mission user
 - network commitment user
 - network operations user

Mission Configuration Profile Workflow

Add Record

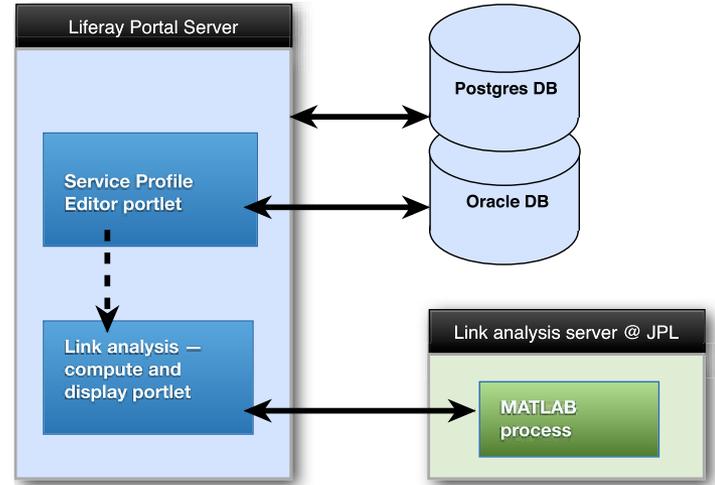
Mission (Service User)	Session Profile ID	Profile XML	Notes	Status
MRO	BC Test Profile Demo	Space Link Session Profile Spacecraft Id MRO (74) Space Link Session Profile Id BC-Test-Config-2 Forward Space Link Carrier Profile Carrier Profile Id CP_X_F1_e3410cc73bda Forward Space Link Parameters BAND X RING PN RING T1 60 RING T2 8 POLARIZATION RCP EIRP 99 TUNING TYPE BPSK TUNING RATE 99 ETX SC FILE ID 99 ETX TMPL FILE ID 99 Return Space Link Carrier Profile Carrier Profile Id CP_X_R1_e3410cc73bda Return Space Link Parameters BAND X TRK COH RING PN FORWARD COH REF CP_X_F1_e3410cc73bda POLARIZATION LIN EIRP 99 TLM MODULATION MODE RESIDUAL TLM MODULATION INDEX 72 TLM BITRATE 16000 TLM CODING RS CODE RATE 1/2 AUTOTRACK X-ACQ SC TRANSPONDER TRANS1 SC AMP TWT1 SC TRANSMITTING ANT HGA1		
MRO	BC-Test-Config-2	74 BC-Test-Config-2 CP_X_F1_e3410cc73bda X PN 60 8 RCP 99 BPSK 99 99 99 CP_X_R1_e3410cc73bda X COH PN CP_X_F1_e3410cc73bda LIN 99 RESIDUAL 72 16000 RS 1/2 X-ACQ TRANS1 TWT1 HGA1	Draft 2	An

Showing 2 results.

Link Analysis

Link Analysis —

- Create and manage link configuration profiles
- Remote invocation of high-fidelity link analysis tool and graphical display of results



The screenshots show the user interface of the Liferay application. The top section displays two tables for Mission Configuration Profile Listing. Below these are two Mission Configuration Profile Editor windows. The bottom right section shows a High Fidelity Link Analysis Tool with three graphs: Downlink Pt/No, Uplink Pt/No, and Elevation.

Detail	Copy	Delete	Profile	Mission	Session Profile ID	Last Edited	User	Approval
			CAS	CAS-BC-Test1		2013-08-24 09:37:01	bcamuth	5
			CLU2	is2		2013-06-25 15:21:24	acoffman	
			MEX	SP_a3410cc73bda		2013-06-25 11:15:03	bcamuth	
			MRO	BC-Test-Config-1		2013-07-18 11:44:20	bcamuth	
			MRO	BC-Test-Config-2		2013-08-09 14:13:19	bcamuth	

Detail	Copy	Delete	Mission	Session Profile ID	Last Edited	User	Approval
			CLU2	acmanual-test	2013-06-25 17:42:43	acoffman	
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			MRO	BC-Test-Config-2	2013-09-09 15:14:04	bcamuth	
			VGR1	SP Y	2013-08-06 10:20:25	bcamuth	
			VGR2	SP ZZ	2013-08-06 10:20:25	bcamuth	

Space Link Session Profile	Space Link Center Profile	Forward Space Link Parameters
Spacecraft ID: MRO (74) Space Link Session Profile ID: BC-Test-Config-1	Center Profile ID: CP_X_F1_a3410cc73bda	S BAND: X RNG: FN RNG T1: 80 RNG T2: 8

Space Link Session Profile	Space Link Center Profile	Forward Space Link Parameters
Spacecraft ID: VGR2 (32) Space Link Session Profile ID: SP ZZ	Center Profile ID: CP_B_F1_172b	S BAND: S POLARIZATION: RCP ERP: 99 ETX SC FILE ID: 99

Space Link Session Profile	Return Space Link Parameters
Spacecraft ID: MRO (74) Space Link Session Profile ID: BC-Test-Config-Demo Center Profile ID: CP_X_F1_a3410cc73bda	X: X CDH: CDH TRK: TRK RNG: RNG FORWARD COH REF: CP_X_F1_a3410cc73bda POLARIZATION: LIN ERP: 99 TLM MODULATION MODE: RESIDUAL TLM MODULATION INDEX: 72 TLM BITRATE: 30000 TLM CODING: 80 CODE RATE: 1/2 AUTOTRACK: 3-RAGC SC TRANSPONDER: TRANS1 SC AMP: TWT1 SC TRANSMITTING ANT: HGA1

Graph	Y-axis (dB-Hz)	X-axis (Time seconds)
Downlink Pt/No	38.5 to 50.0	20884.8 to 346020.0
Uplink Pt/No	76.7 to 78.4	20884.8 to 346020.0
Elevation	-1 to 2.0	20884.8 to 346020.0



Schedule Integration

■ Schedule graphical views (HTML5 canvas)

- notifications of updates
- RSS newsfeeds

The screenshot displays a web application interface for Service Scheduling. At the top, there is a navigation bar with sections for NEWS, MISSIONS, MULTIMEDIA, CONNECT, and ABOUT. Below this is a secondary navigation bar with links like SCAm, CSM Questionnaire, and Mission Configuration Profile. The main content area is divided into three panels:

- RSS:** Contains SSS Proposals and SPS Schedules. The SSS Proposals section lists various proposal statuses, such as "2013-46-CWS completed and pushed" and "2013-47-CWS completed and pushed".
- Notifications:** A list of recent events, including "Murray Boone created proposal Week 40", "Murray Boone withdrew proposal Week 40", and "Adam Coffman pushed to master proposal ac2014wk01".
- Master Schedule:** A Gantt-style chart showing resource allocation for various DSS tasks (e.g., DSS-14, DSS-15, DSS-24, DSS-25, DSS-26, DSS-27, DSS-34, DSS-43, DSS-45) over time. The chart is color-coded by task and resource.

Conclusions and Next Steps

- **Portal functionality such as that provided by the Liferay open source platform, and other vendors, can provide an effective basis for the infrastructure needs of the integrated network service portal**
- **Key requirements related to modularity and scalability can be addressed by the portlet architecture and the possibility to cluster and load balance large scale portal deployments**
- **Custom portlets can be developed that interoperate via inter-portlet communication, to improve the user's experience**
 - **All of the functionality of HTML5 and web applications are available to the portlet developer, along with a variety of powerful built-in portlet applications that support collaboration and information exchange**

Next Steps

- **The initial development phase of the Integrated Network Architecture Customer Service Portal is now in progress**
 - Joint effort involving NASA's Jet Propulsion Laboratory, Glenn Research Center, and Goddard Space Flight Center
 - Portlet-based approach will facilitate multi-center collaborative development

- **Initial increment is focused on**
 - service planning functionality
 - mission commitment processes and associated analyses and agreements