How NASA Built an Expertise-Matching Service Using Knowledge Graphs

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How NASA Built an Expertise-Matching Service Using Knowledge Graphs

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“

Knowledge is every company’s most valuable asset, but it remains hard to grasp at the same time, because it is scattered across different systems and human minds…”

Deloitte

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Creating a talent marketplace allows you to move away from the unstructured database.

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Speakers

Greg Ladd

VP, North America Enterprise Sales, Stardog

Andrew Schain

Data Integration Lead, Human Space Flight (retired), NASA

Agenda

- The Need for Expertise Matching
- Key Challenges
- Consequences if Overlooked
- Optimizing the Organization for Success
- The NASA Use Case
- Q&A

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Why the Need for Expertise Matching?

“Knowledge, however, is **not just data thrown into a database**. It is a complex, dynamic model that puts every piece of information into a larger frame, builds a world around it and **reveals its connections and meaning in a specific context**.”

Deloitte

Key Challenges

- Employee profile information typically is stored in disparate databases across the enterprise.
- HR professionals need to run several discrete queries to find what they are looking for
- Rolodex culture is time consuming and can return no results — and is impossible to scale

Consequences if Overlooked

- Resources wasted on time-consuming searches
- Mismatch between employee and project, resulting in:
  - Lost productivity when work does not get done
  - Wasted resources when unnecessary headcount is hired
  - Turnover when employees' skills are not used
- Degradation of institutional knowledge

Consequences if Overlooked

- Money wasted developing and maintaining employee profiles
- Lack of trust in results of ad-hoc queries
- Increased operational, regulatory and revenue risk
- Degradation of institutional knowledge

Optimizing the Organization for Success with Stardog

Our Enterprise Knowledge Graph helps you make better decisions with data.

We help our customers and partners:

- Build innovative new products
- Create efficient, data-driven operations
- Unlock access to data

Headquartered
Washington, DC

50++
Global Customers

Venture-backed
With $20M in funding

Trusted by global leaders with their toughest data challenges

FINRA
Morgan Stanley
Pfizer
Roche
DOW JONES
BAYER
BNY MELLON
National Cancer Institute
BOSCH
ELSEVIER
NASA
NIH
QIMR Berghofer Medical Research Institute
SIEMENS
Boehringer Ingelheim
NOKIA
SPRINGER NATURE
Schneider Electric

Optimizing the Organization for Success with Stardog

- Quickly respond to changing economic conditions
- Move talent to the areas of the business that need it most
- Optimize your talent allocation at scale in a time of remote and globally distributed work
- Help your employees develop new skills
- Reduce the need for third-party consultants
- Preserve the high-value legacy of institutional knowledge across the organization

Helping NASA's missions to the Moon and Mars

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It started with a public challenge.

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The Problem

How do you Identify Expertise?

- **Instructions from NASA's Chief Engineer:**
  - Purchase an "Expertise Location" system to support strategy planning and new projects
- **Implementation questions:**
  - Who is going to fill out forms? How to ensure honesty?
  - Are there authoritative data sources that can be leveraged?
  - How will information be kept up to date?
- **Assertion:**
  - NASA has all the information needed and a single-purpose application not required

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Requirements

Starts with User Stories

- **Jorge** is responsible for staffing a new NASA project which requires a programmer with zero gravity materials science experience and willingness to work in California
- **Lucinda** is putting together a Tiger Team for which Bob, a flight engineer on STS-51L, would be a good fit; but since he's retired she needs to find someone who worked with him instead.
- **Jeff** is a new thermal engineer at JSC and wants to use the same testing methods that were used on the Mars Rover. He needs to find people who worked on this project and see have experience with the Space Shuttle.

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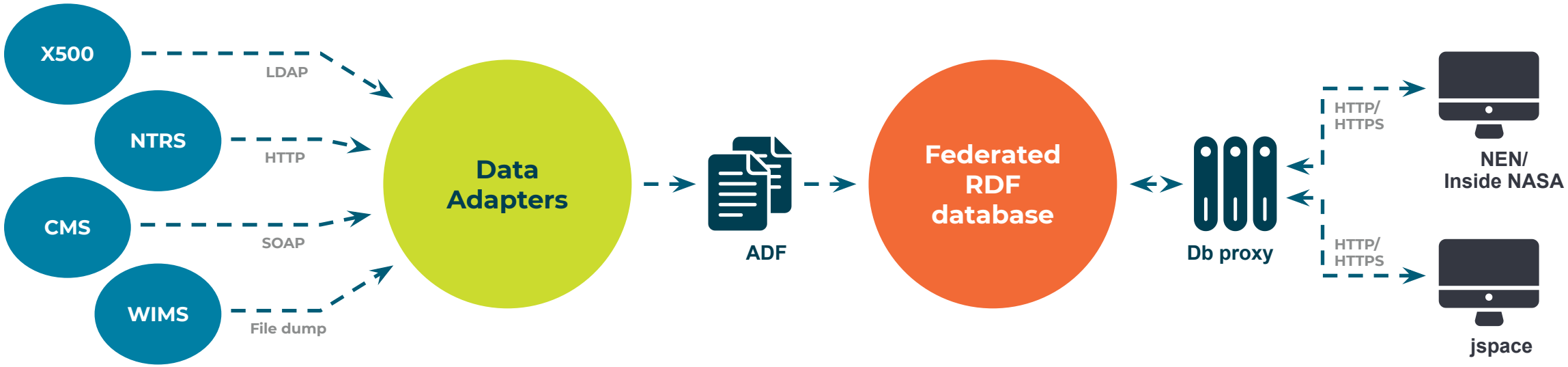
Building the System



Data is spread across different data services and geographically – dispersed data centers with different policies for access.

“POPS” - Creating an Ontology

NASA Center	→	People who worked at the same space center
Building	→	People who worked in the same building
Office	→	People who worked for the same organization and had an office close to one another
Your job category	→	People who were aeronautics engineers and worked in the same department
Project	→	If you worked on the same project and had the same skills was higher probability than if you worked in the same office

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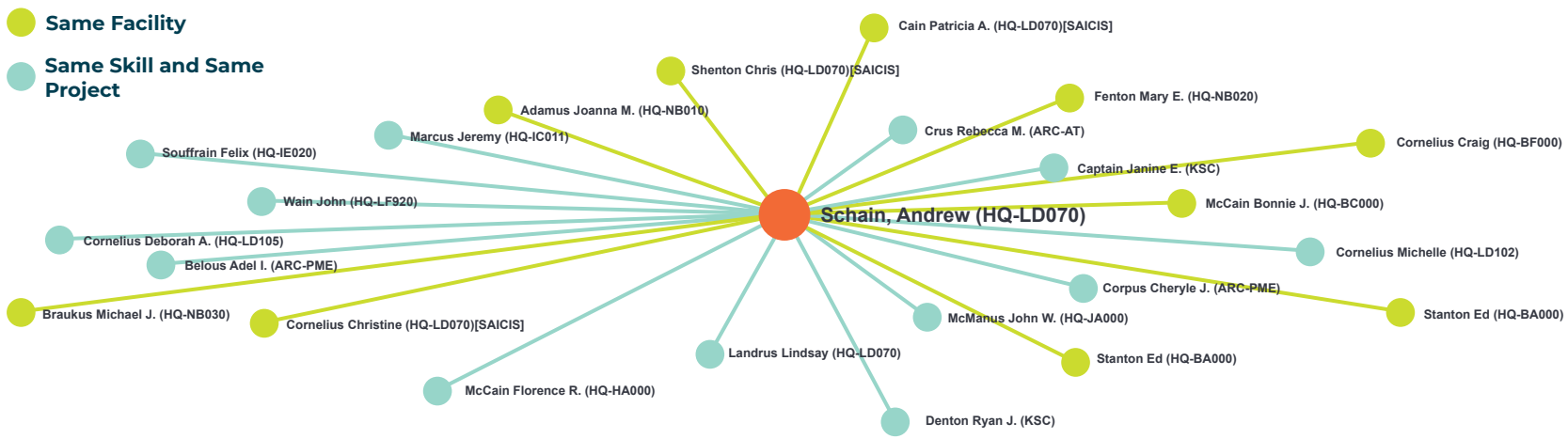
Recognizing Existing Human Processes

- Like many organizations, NASA is a rolodex culture where managers turn to people they know for recommendations.
- With POPS, combining Directory, Time & Attendance, Competency, and Publication systems wasn't enough; we needed to show likely human relationships.
- We added annotation to help document query results but also to help "lay bread crumbs" for the next customer.

Clearing Away Clutter to See Data Clearly

NASA Center (Source: LDAP)	Project (Source: WIMS)	Competency Sub-Category (Source: CMS)	Competency Category (Source: CMS)	Person (Source: LDAP)
ARC	Center G&A – B&TD – Available for New W	**Business Operations Competency Suite**	Business Knowledge Domain	McManus, John W. (HQ-JA000)
DFRF	**Corporate Labor**	Computer Sci & Info Technology Competen	**Engineering & Technology Knowledge**	**Schain, Andrew (HQ-LD070)**
GRC	ESMD-HSR&T-Human Systems Integration	Engineering of Systems Competency Suite	Leadership & Management Knowledge Do	
HQ	Education HQ Labor	Financial of Systems Competency Suite		
JSC	Exploration Mission Directorate	Institutional Operations $ Support Compete		
KSC	Function to Another Center	Management Competency Suite		
LARC	ISS – ISS Launch and Mission Objectives	Mission Operations Competency Suite		
SSR		Professional Development Competency Sui		
		Workforce Operations & Support Competen		



Polyarchical query browser allowed for easy searches without the use of SPARQL

Not so much blazing a trail of new data, rather clearing clutter away so you can see the data you more clearly

POPS: The Results

- Efficient expertise location at half the initial investment and significantly lower operational costs
- UI for navigating trusted data sources without disruption to source system policies or operations
- Mind blowing customer response

Infrastructure for Information Integration

- POPS: Not an expertise locator but is an **infrastructure for information integration**
- Federate query and browse through data **leveraging trusted sources and existing data relationships**
- Applicable to **hundreds of integration problems** at NASA

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What was Next? Business Impact Analysis

- BIANCA - a system for analyzing assets within a datacenter.
- Built reusing infrastructure from expertise matching system.
  - A completely different UI conforming with the actual human experience
- Integrated existing monitoring systems, not just traditional databases.

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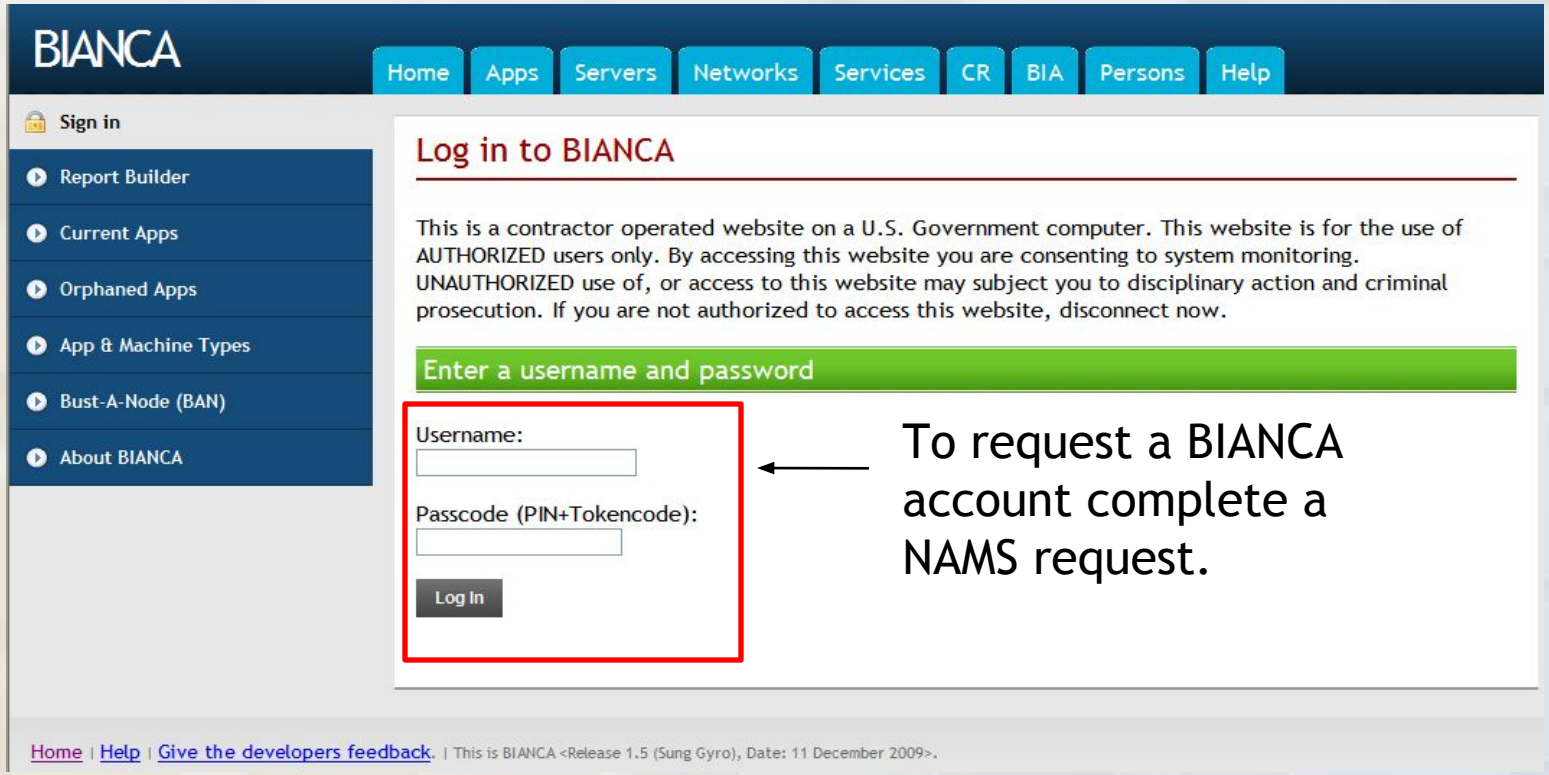
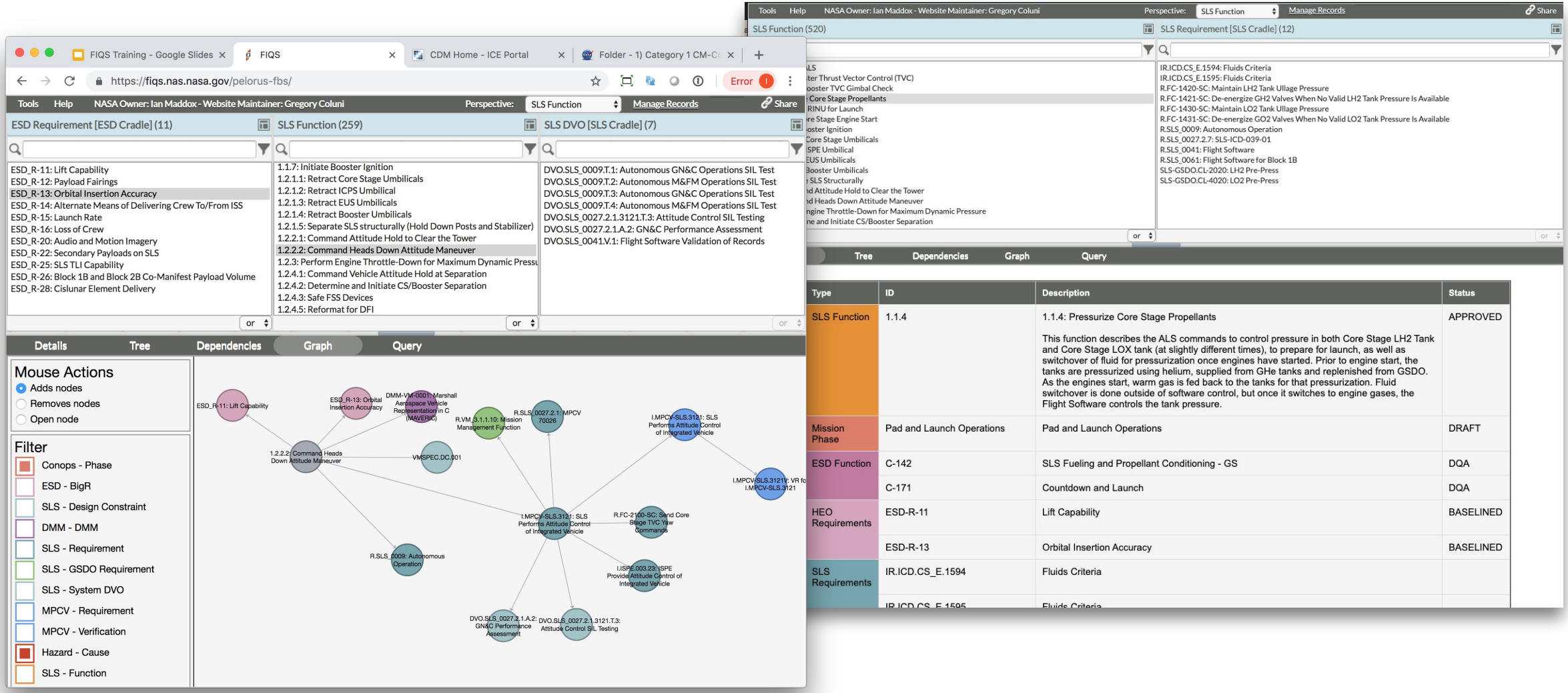
BIANCA

- Business Impact Analysis for Networked Computer Assets (BIANCA) is a web application for browsing and quarrying information about NASA HQ, including business impact analysis data. It contains information about Applications, Servers, Network Services, Networks, and Change Requests. LINK TO BIANCA



And Now: Back to the Moon and on to Mars



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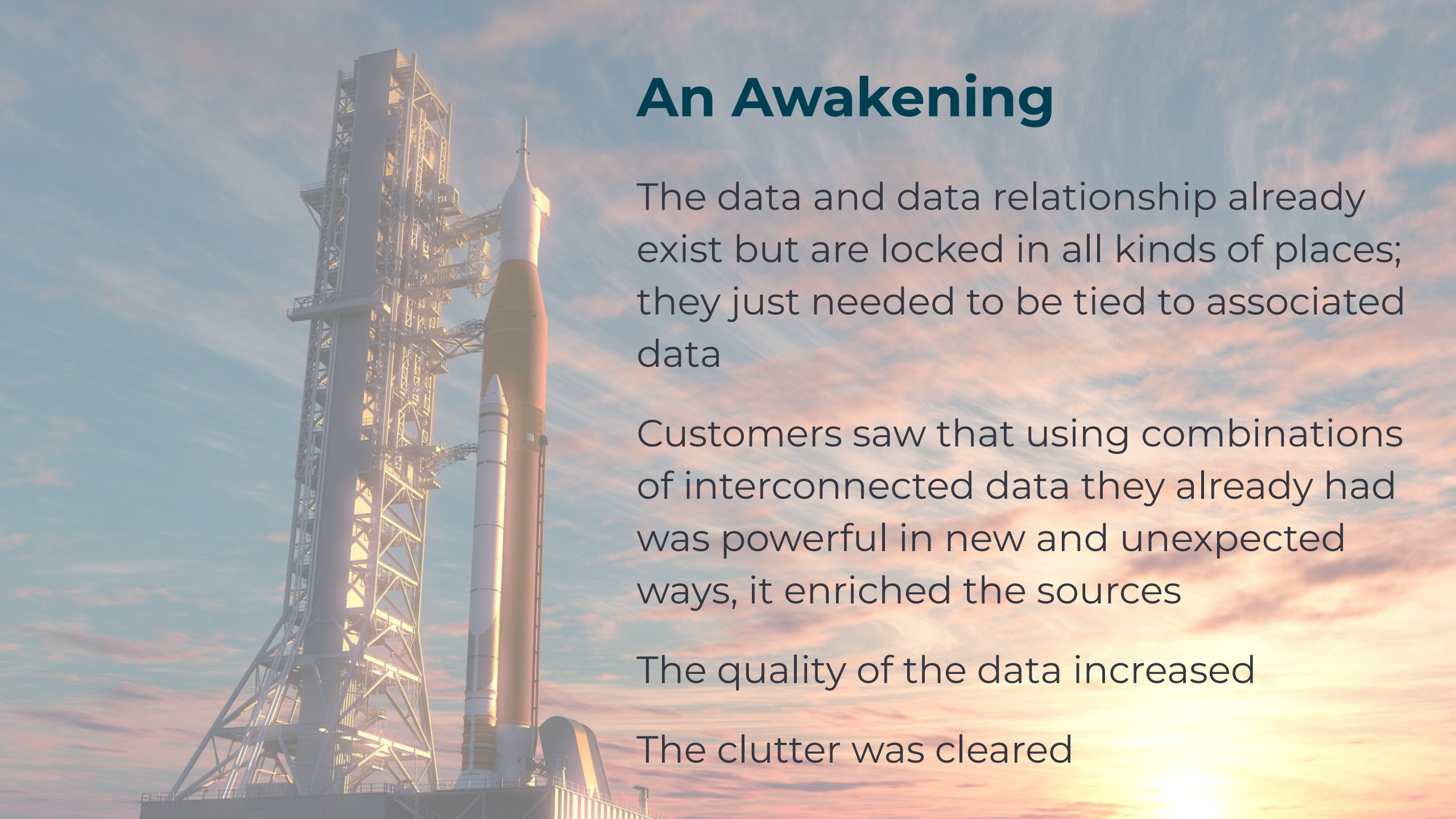

An Awakening

The data and data relationship already exist but are locked in all kinds of places; they just needed to be tied to associated data

Customers saw that using combinations of interconnected data they already had was powerful in new and unexpected ways, it enriched the sources

The quality of the data increased

The clutter was cleared

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Q&A.

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Thank you.

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