Digital Space Strategy

Airbus Visit

January 27, 2016

Jet Propulsion Laboratory
California Institute of Technology

The Global Data Opportunity

$3T annual value annually

Open data

INTERNATIONAL SPACE APPS CHALLENGE

Data-driven decisions

DATA.GOV

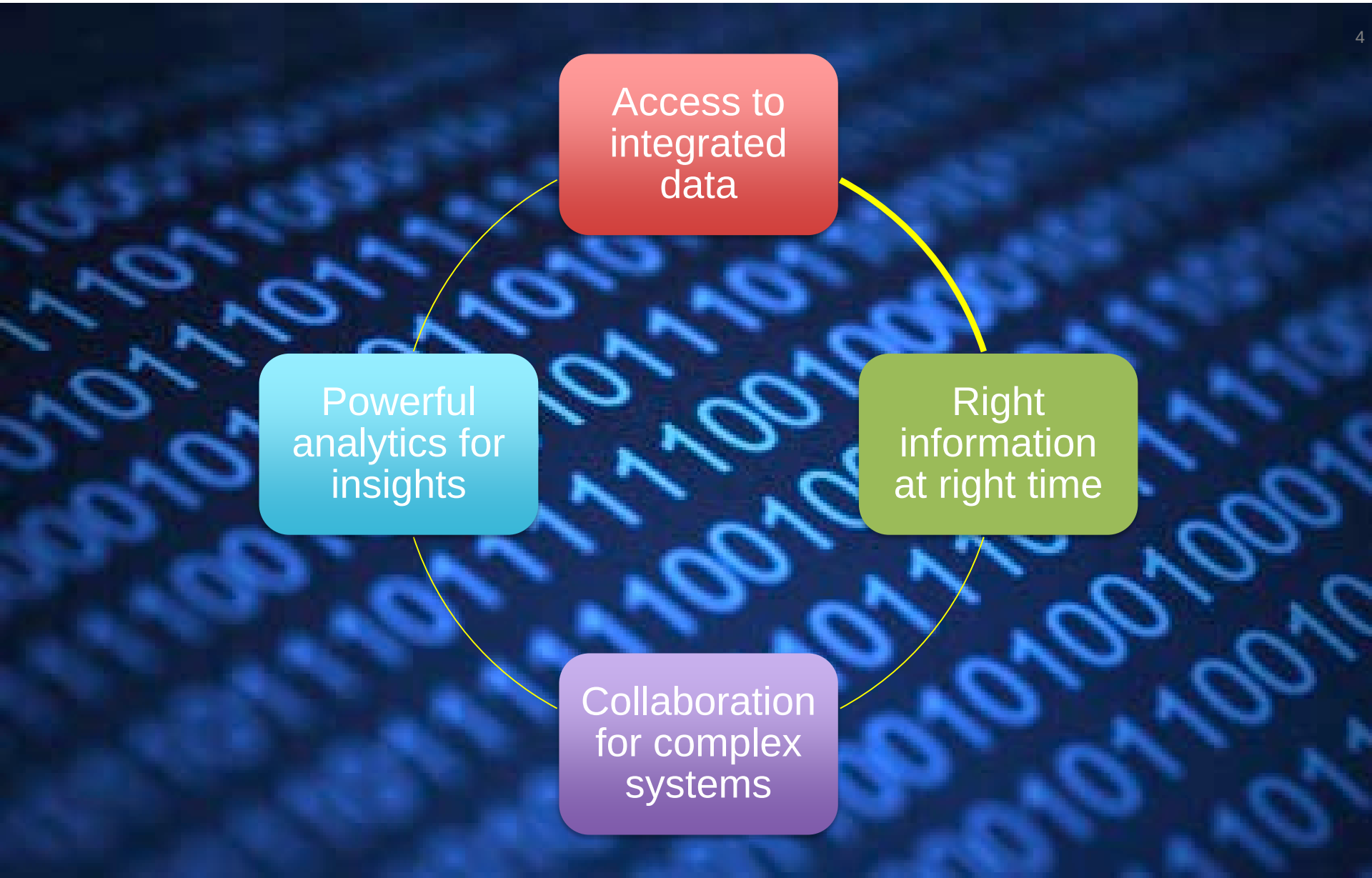
Open innovation

PLANET LABS

Employees Want Powerful, Simple Access to Diverse Data

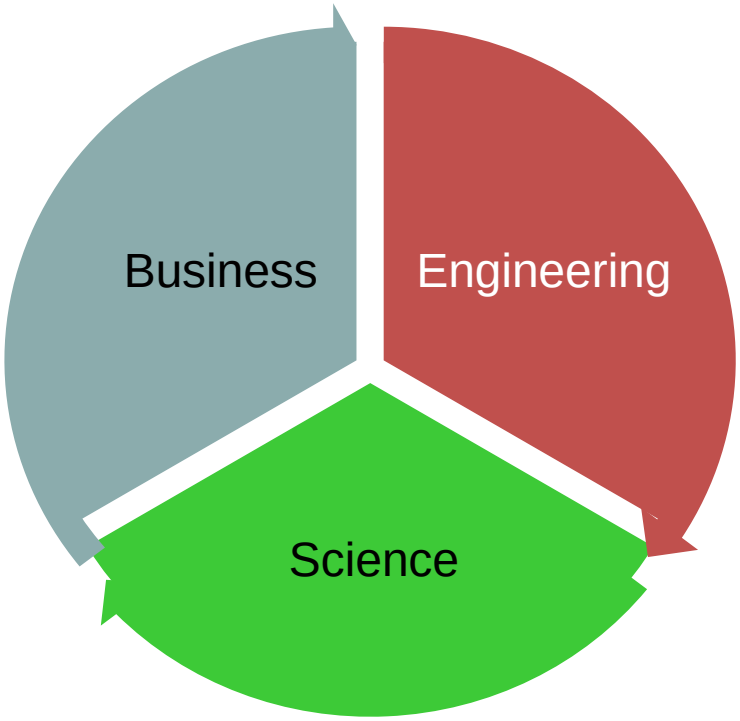
- Easy data access and discovery
- Share data collaboratively with partners
- Integrate large data from multiple sources
- Assure data quality and dependability
- Analyze complex data quickly with simple tools
- Guided search and inquiry

JPL's Digital Space Supports



Connects Data Across Lifecycle and Domains

- Manage data across engineering, business, and science
  - Engineering: analytics, models, process
  - Business: business intelligence, analytics, process, modernization
  - Science: Data-intensive, visualization, predictive analysis



Start With Data Governance and Collaboration

Management

- Steering Groups
- Project and Engineering Management
- Line organizations
- Cybersecurity Council
- More…

Policies

- JPL
- NASA
- Caltech
- Federal
- International standards (ISO, W3C, AIAA, …)

Teams

- Open Access
- Data analytics
- Ontology Group
- Search Team
- Specific project and engineering teams

FY16 Data-Centric Plans

Data Discovery

- Discipline search
- Metadata-powered search
- Ontology-driven search

Datacademy Training

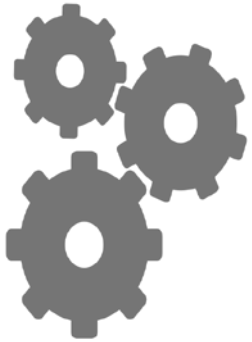
- Marking and handling
- Data publishing
- Visualization
- API
- Metadata 101

Service Discovery

- Top 30
- Service registry → 30
- JPL metadata standard
- JPL ontology

Applied Use Cases

- Engineering anomalies
- Innovation investments
- Climate predictions

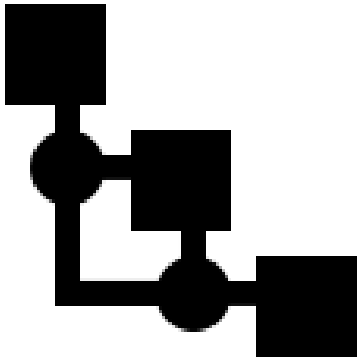


Building Digital Space Services

- Encourage publishing of all services, events, and data to allow separation and simplification of data, applications, functionality, and interfaces
- Integration already occurs in cross-mission areas like the Deep Space Network and Entry, Landing, and Descent
- Utilize the Enterprise Service Bus, but allow federation with MBSE, Foundry, PDM, and other services

Describing an Ontology

- Building a federated JPL Ontology
  - Connect content, data, and services amongst JPL, contractors, NASA, international partners, and public
  - Building blocks
    - JPL mission- and discipline-specific
    - JPL science (such as Planetary Data System, Distributed Archives, and SWEET)
    - NASA Taxonomy developed by JPL
    - U.S. Government Data Reference Model
    - International (such as IEEE, AGU, W3C, United Nations)
  - Led by Ontology Working Group from across the Lab



Forming a JPL Data Community

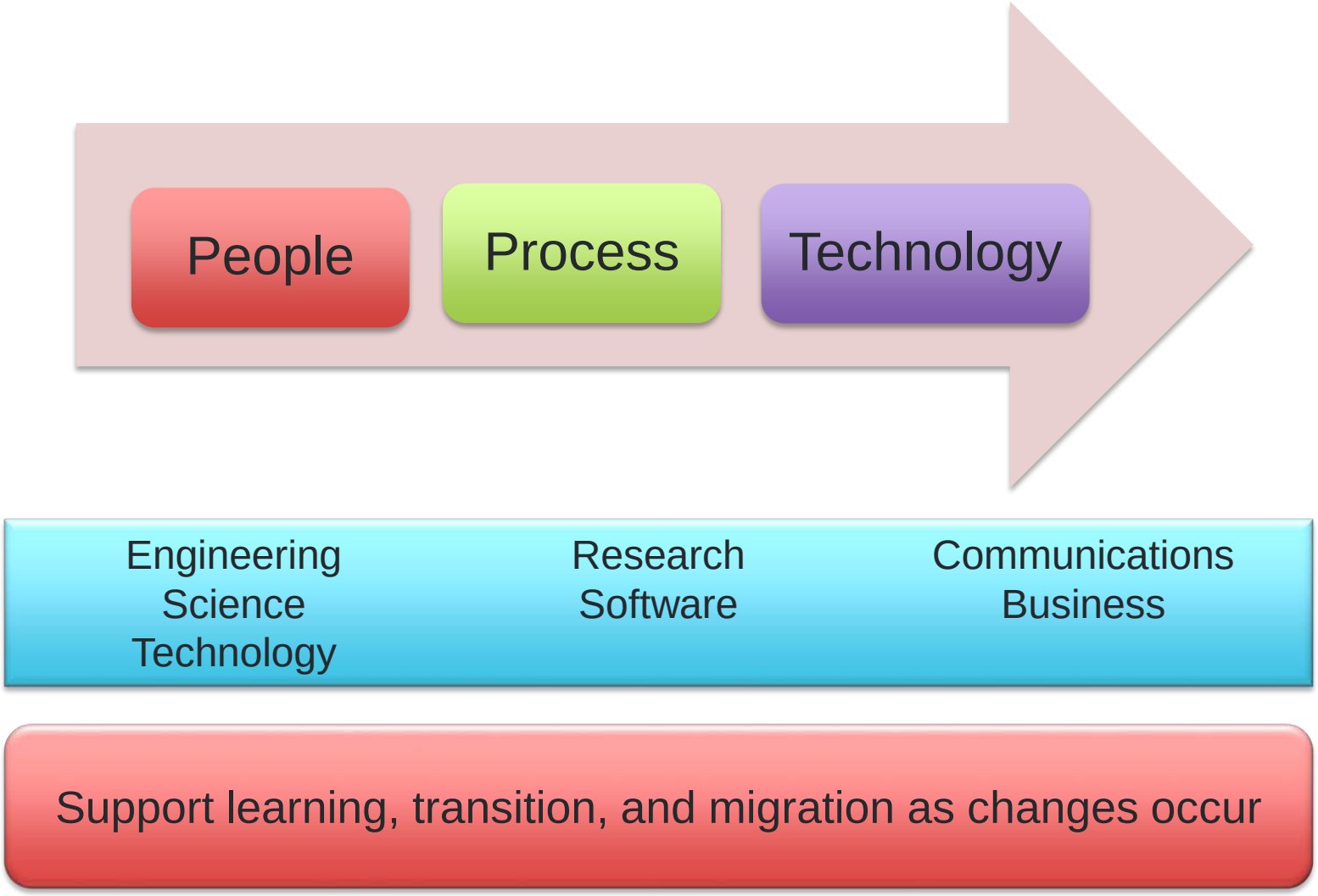
- Building a data community of practice across disciplines
  - Science Engineering Business
  - Technology Software Communications
- Builds on existing and emergent groups and services
  - Open source, hackathons, and data science (OCIO)
  - Open Developer MeetUp
  - JEDI (JPL Engineering Data Interchange)

Learning New Data Science Skills

- Create a Datacademy that connects developers, data scientists, and system engineers in all organizations
  - Build on open source material from Code Academy and others
  - Create virtual challenges and code builds for projects
  - Add to the knowledge base (create an API, publish data, post a visualization, share a model)
  - Partner with other NASA centers

Center for Data Science and Technology

Managing Change



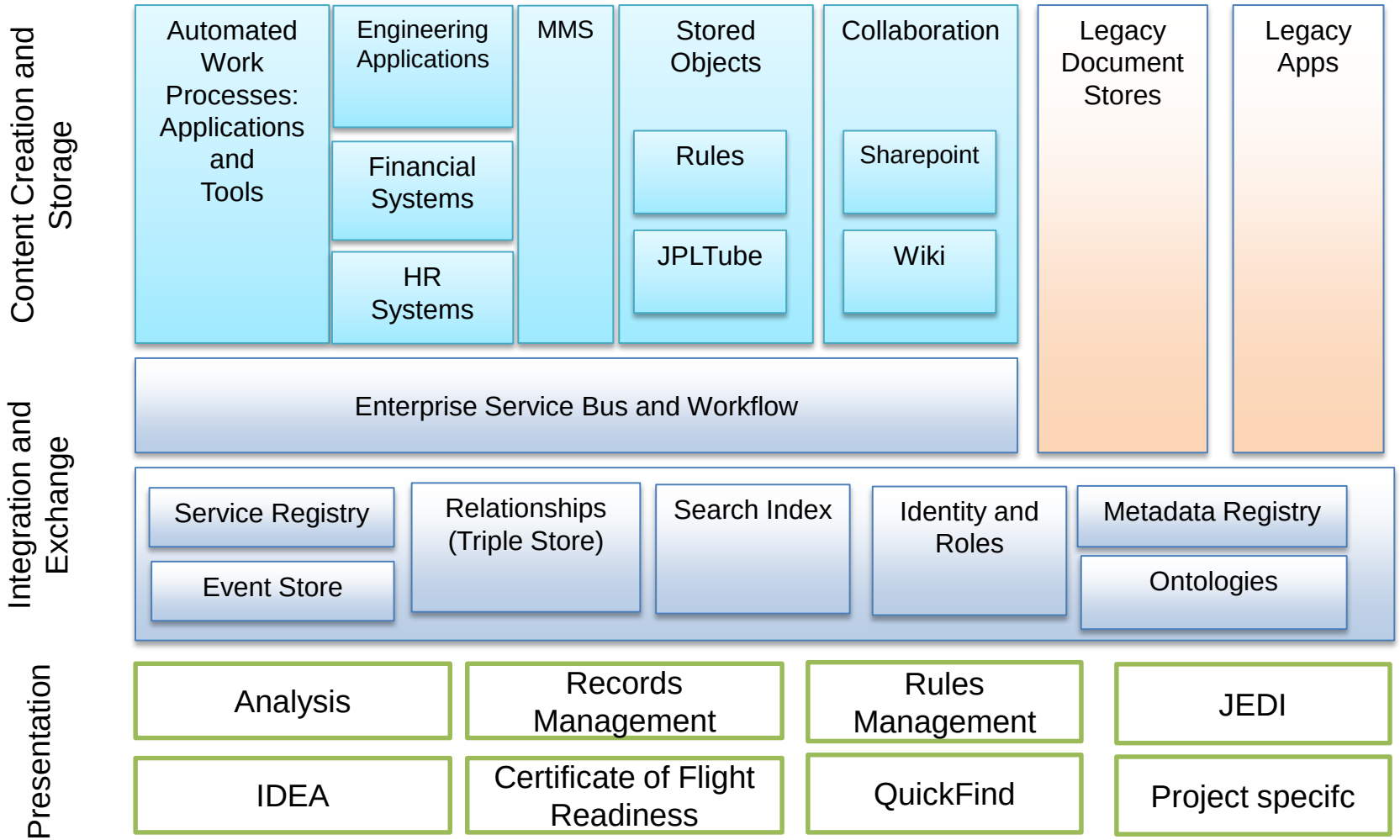
Creating Digital Value

Applied Use Cases

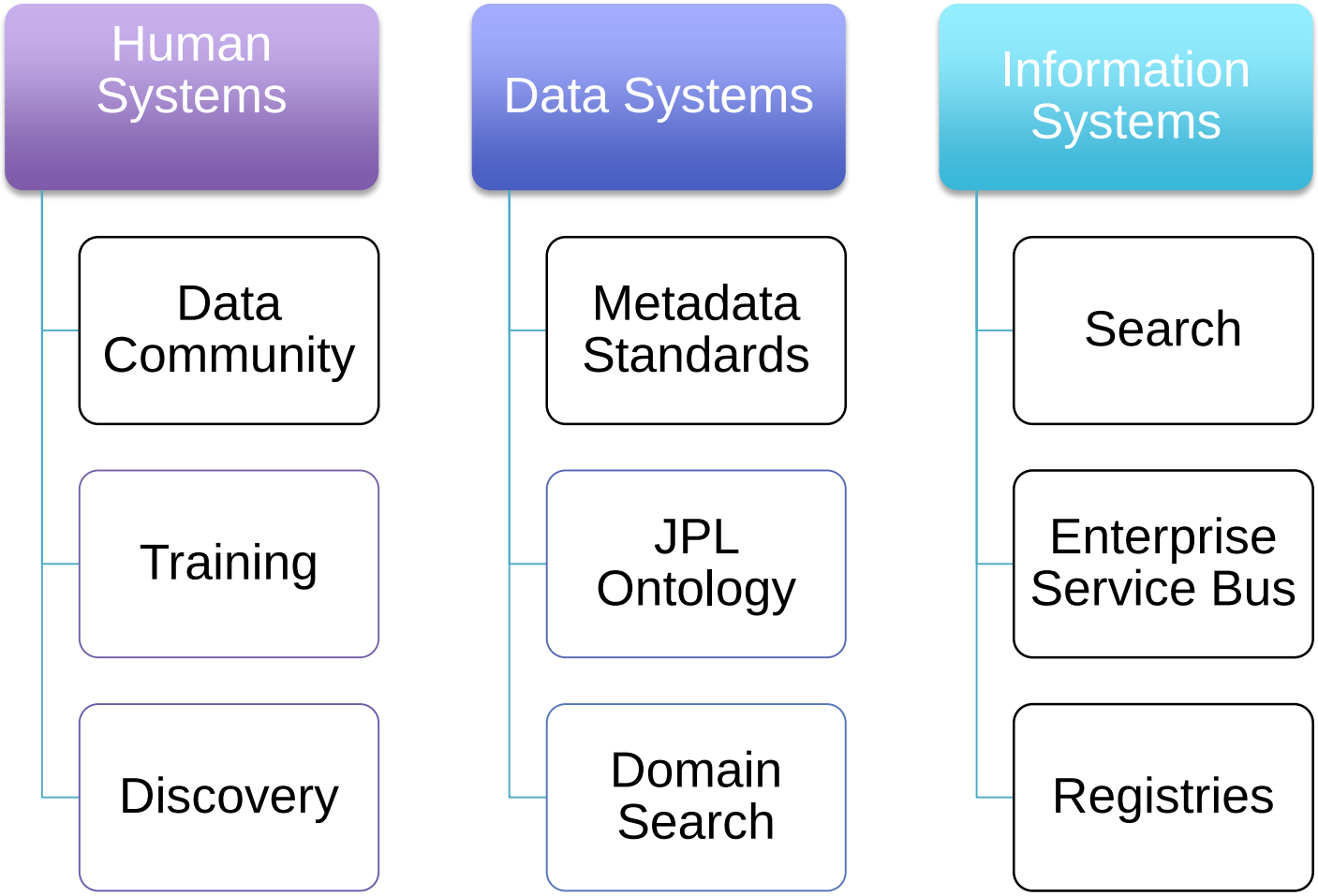
- Engineering anomalies
- Innovation investments
- Climate predictions

- Streamlining work flow while mitigating risk in engineering processes and flight projects
- Optimizing investments in new technology and measuring outcomes
- Understanding and sharing models and data for climate predictions

Data Ecosystem Framework



Digital Space Systems



Requirements for NEW Digital Space Systems

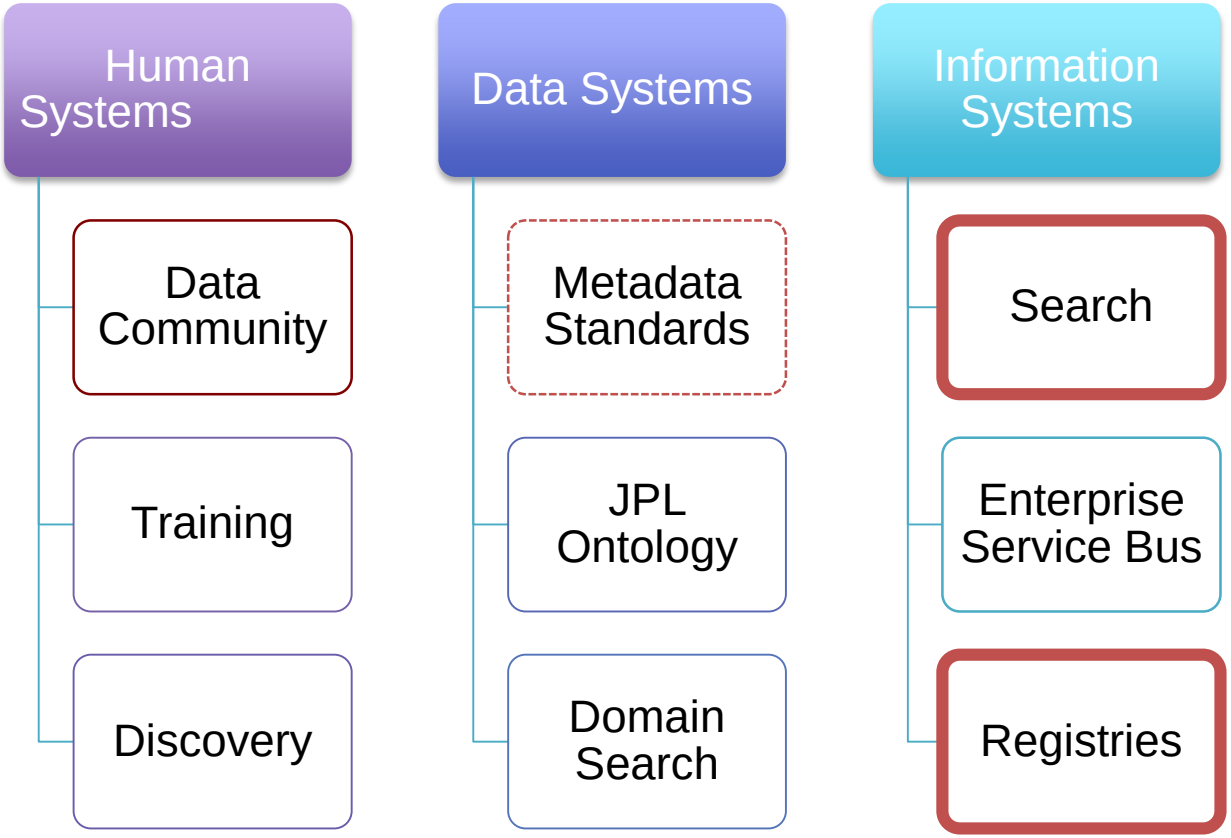
Human Systems
- Data Community
- Training
- Discovery

Data Systems
- Metadata Standards
- JPL Ontology
- Domain Search

Information Systems
- Search
- Enterprise Service Bus
- Registries

New systems need to:
- Subscribe to community updates
- Use JPL core metadata +
- Integrate with search
- Utilize the enterprise service bus
- Register the application and events

Requirements for LEGACY Digital Space Systems

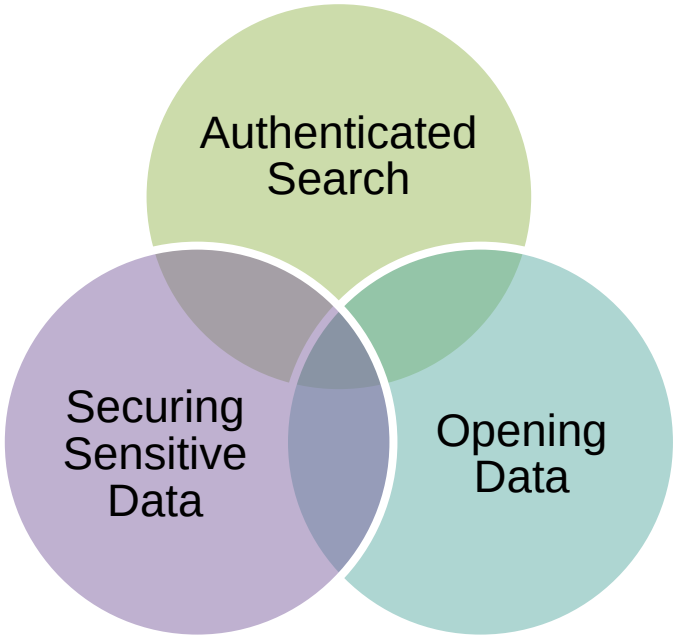


Legacy systems need to:

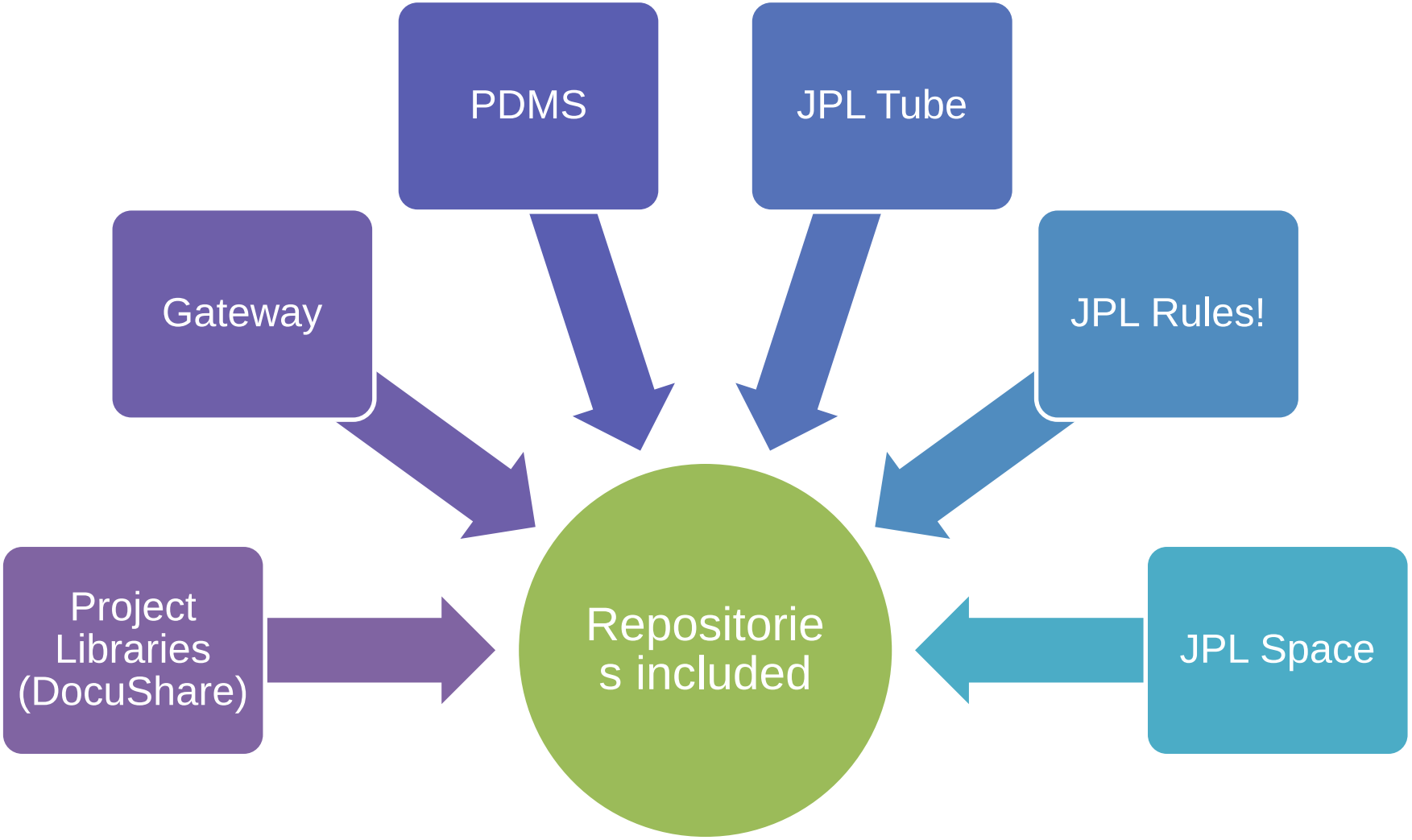
- Map to/use JPL core metadata
- Integrate with search
- Register the application

Open Access Initiative

- Provide easier access to non-sensitive data
  - Search across multiple repositories
  - Provide validated content from projects
  - Partner with many others
- Secure sensitive data
  - Mark and handle data
  - Use processes and technology to monitor and report
  - Create awareness
  - Partner with Spacecraft Asset Protection, cybersecurity, export control, and others

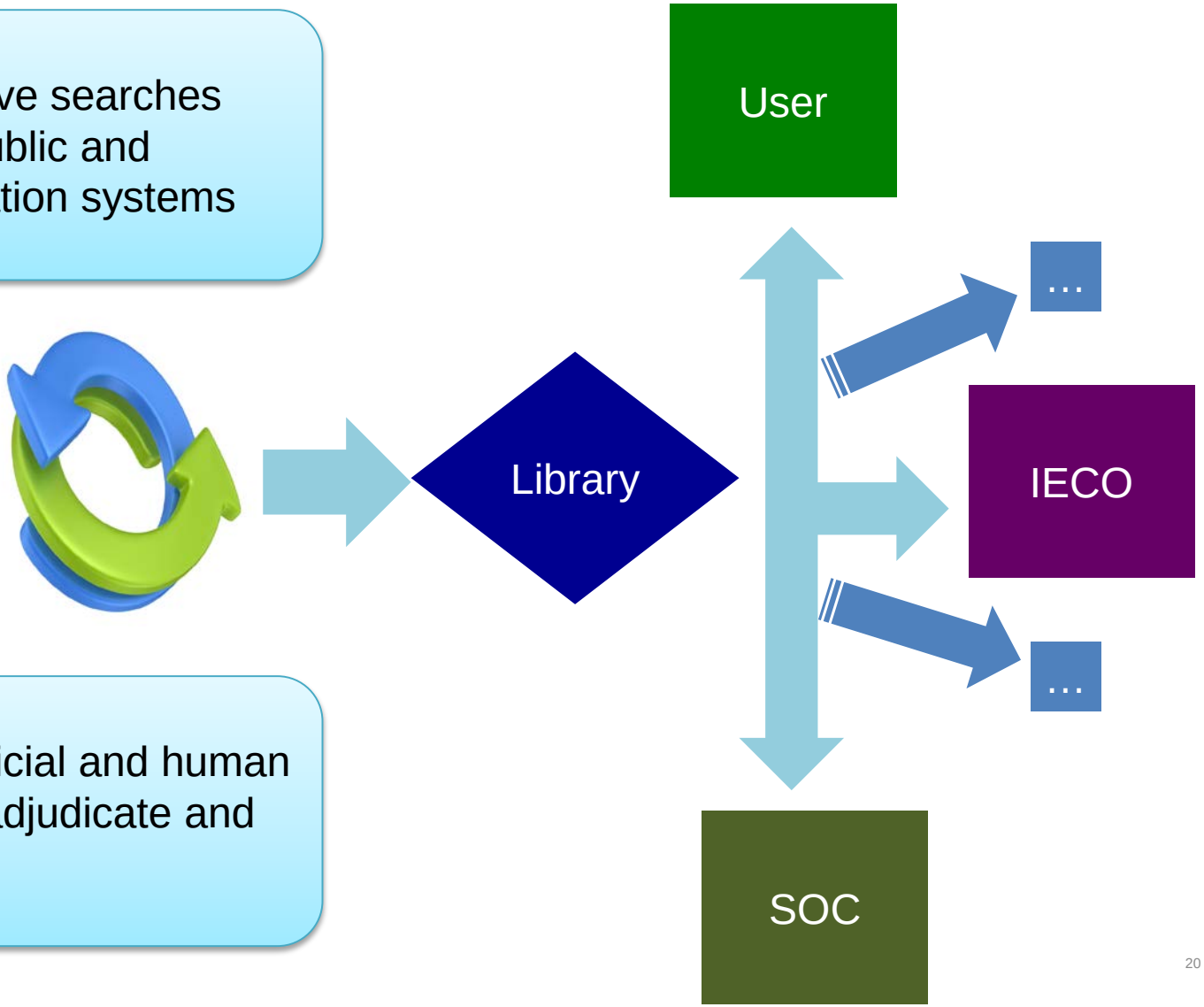


Builds on Authenticated Search



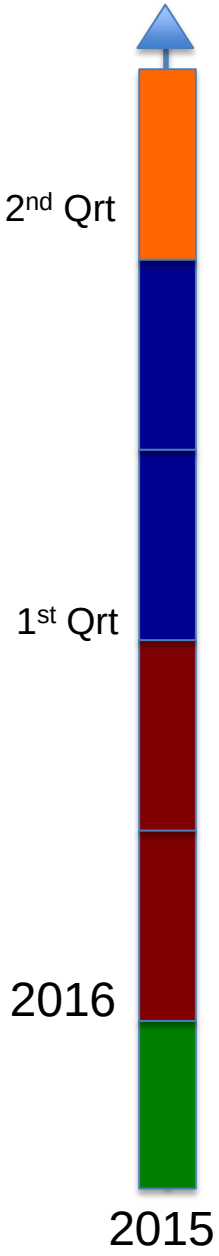
Detecting Data Out of Compliance

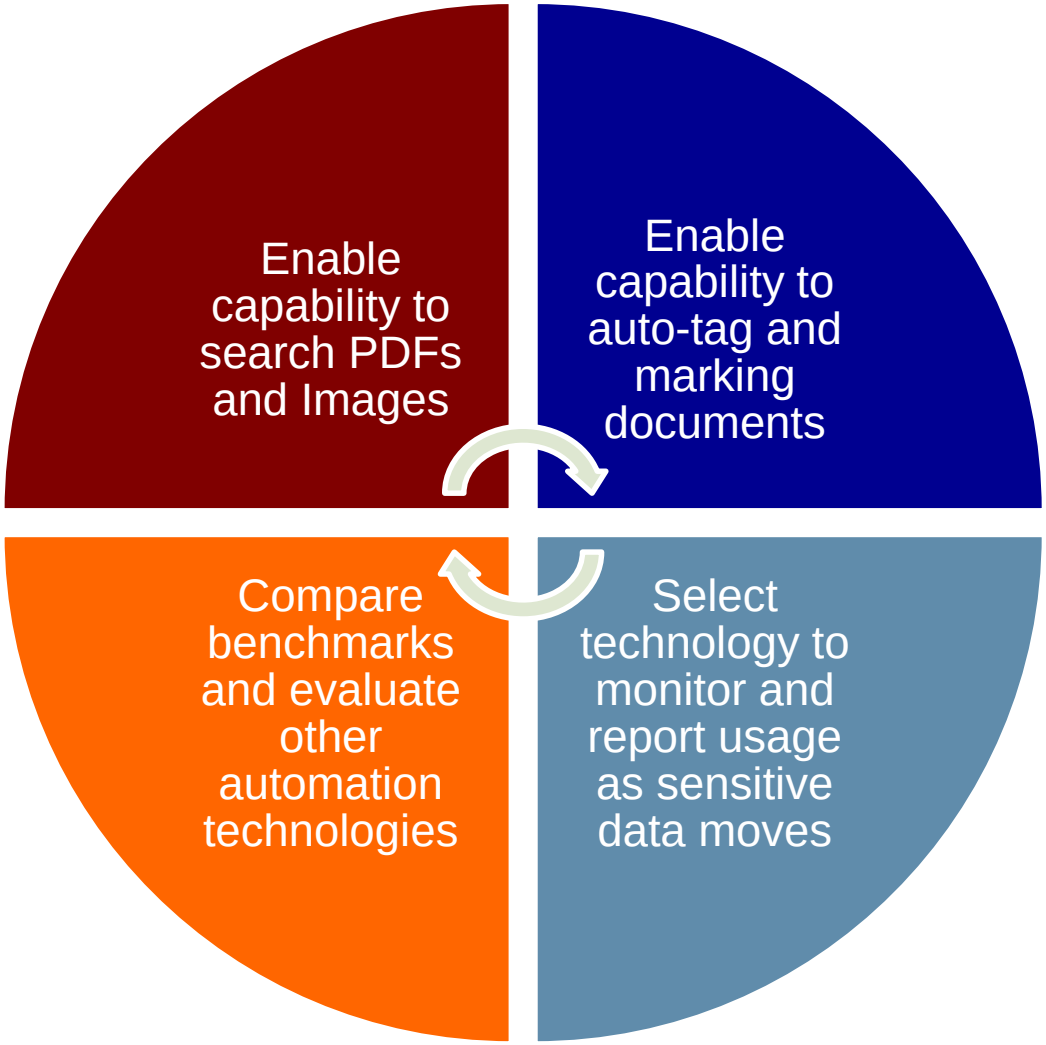
Performing active searches across JPL's public and internal information systems



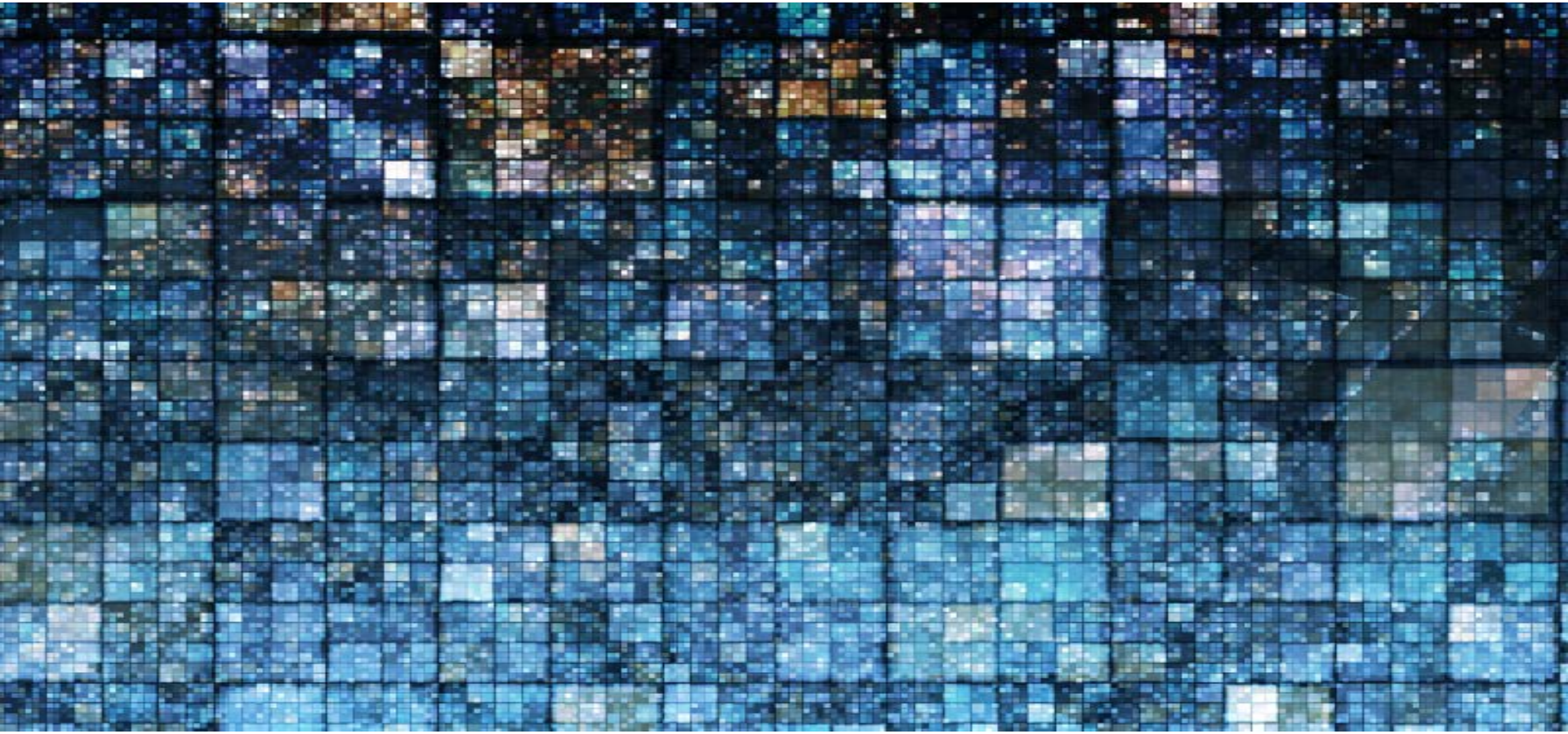
Combining artificial and human intelligence to adjudicate and dispose of data

Prototyping Technology

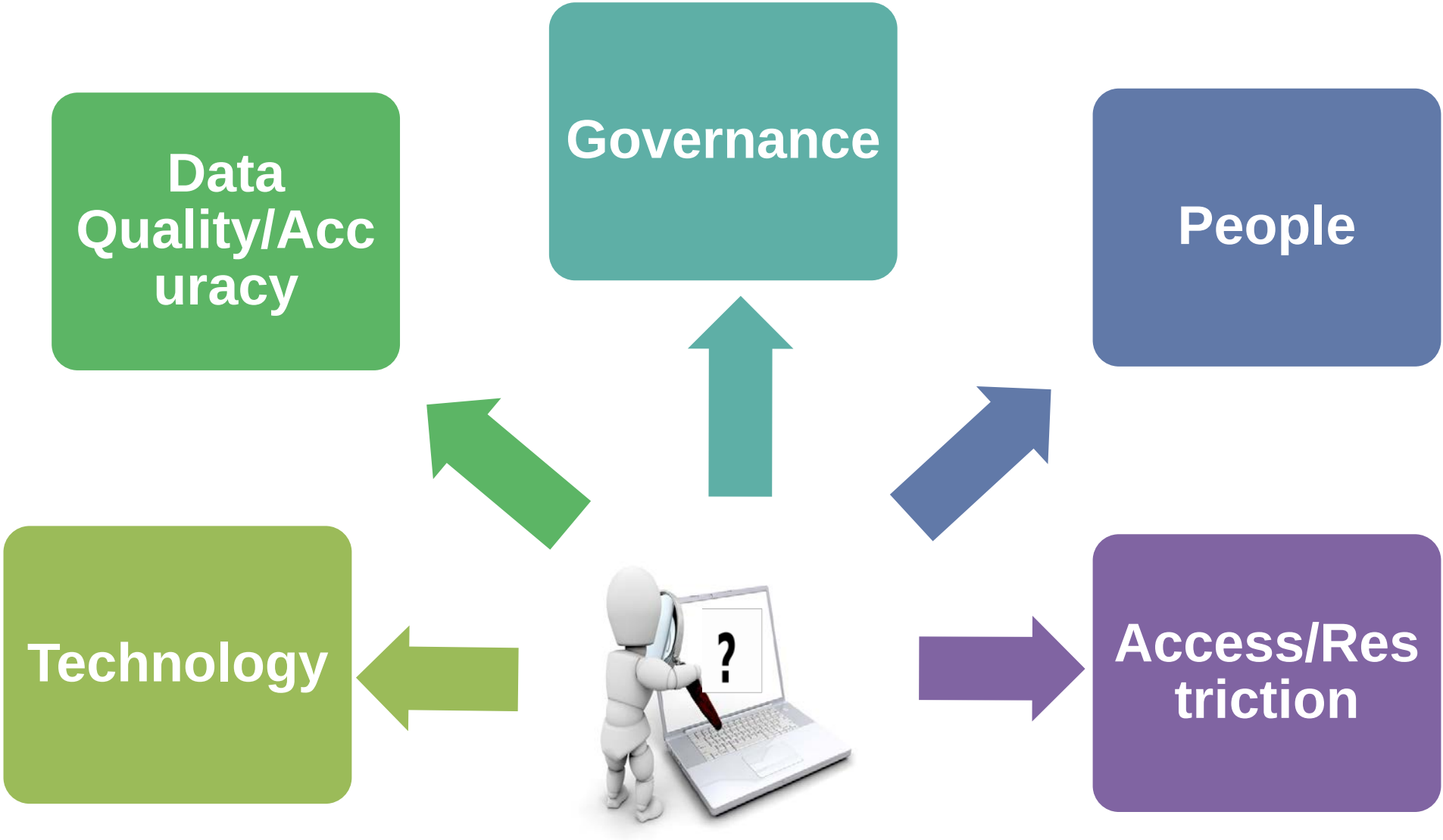




Innovation: Beyond Search



The Problems



The Goal: Make Valuable Data Discoverable
Keep Sensitive Data Secure

Less manual work

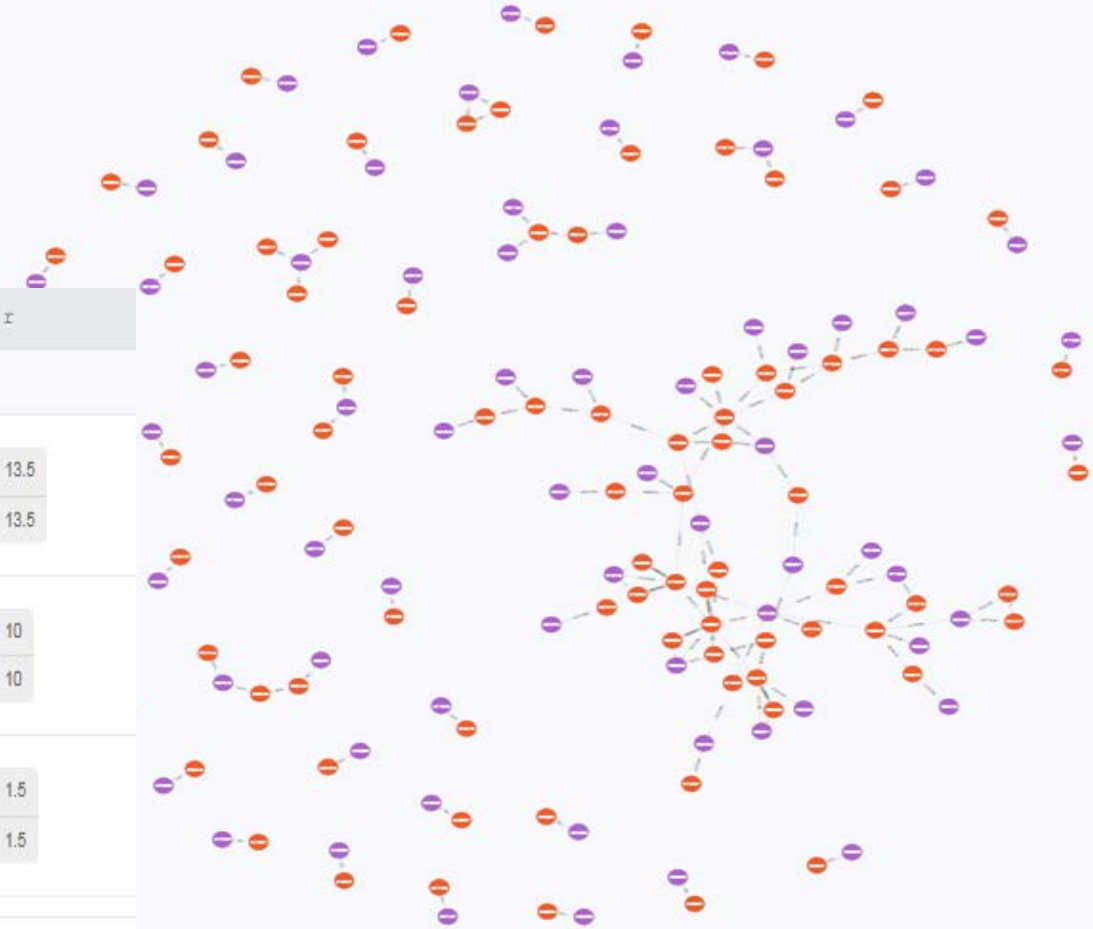
- Automated practice of tuning the search results that are most relevant for the search terms

Adaptive Learning

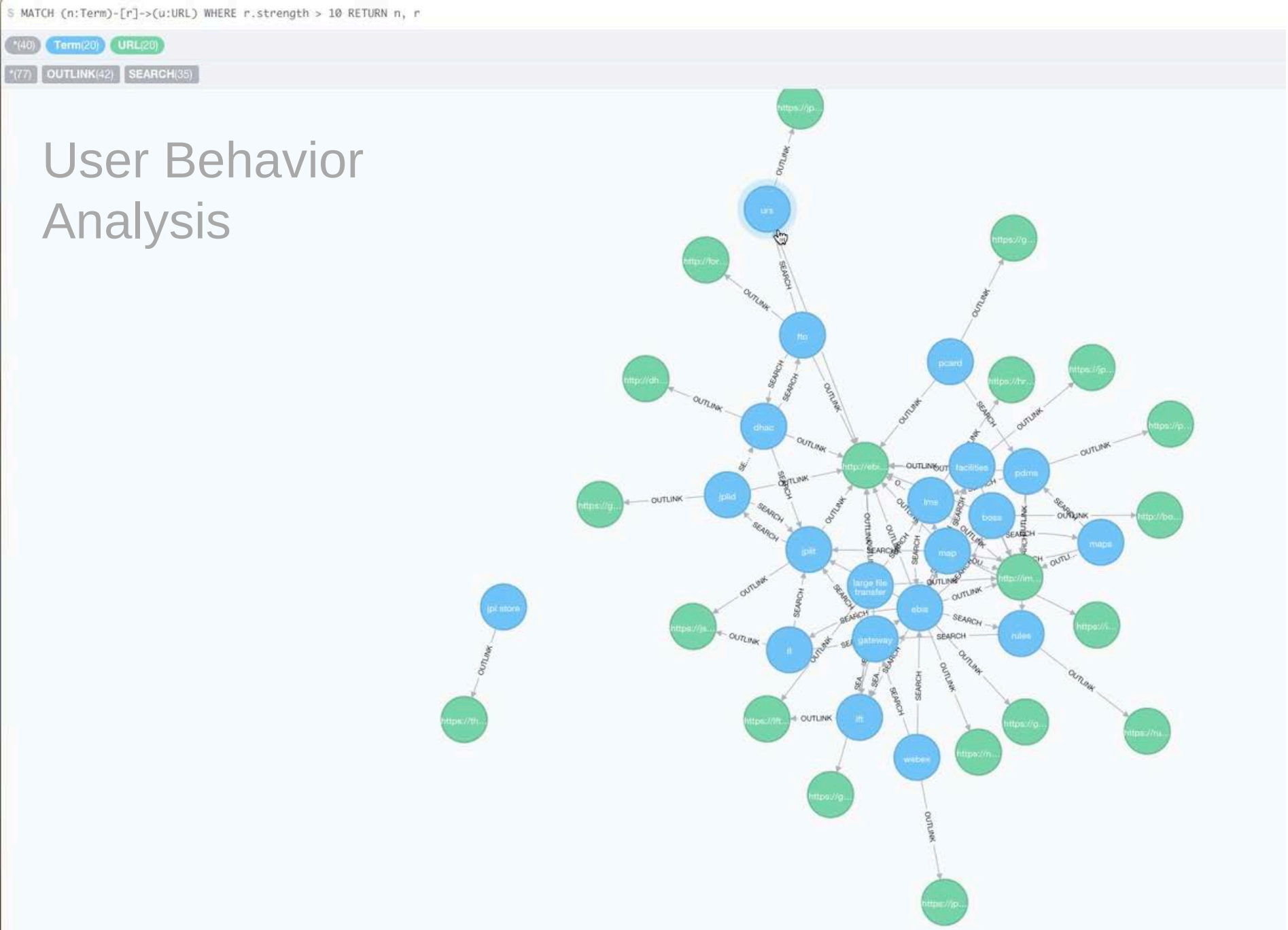
CYPHER `MATCH (n:Term)-[r]->(u:URL) WHERE r.strength > 1 RETURN n, r`

n	r
term ebis	strength 13.5 weight 13.5
term webex	strength 10 weight 10
term vpn	strength 1.5 weight 1.5

✔ Returned 92 rows in 147 ms



User Behavior Analysis



Cyber as a Competitive Advantage

JPL’s successful incorporation of cybersecurity into our processes, we will remain the leaders in protecting our customers data

In these days of a breach a minute, a strong information security program is a competitive differentiator

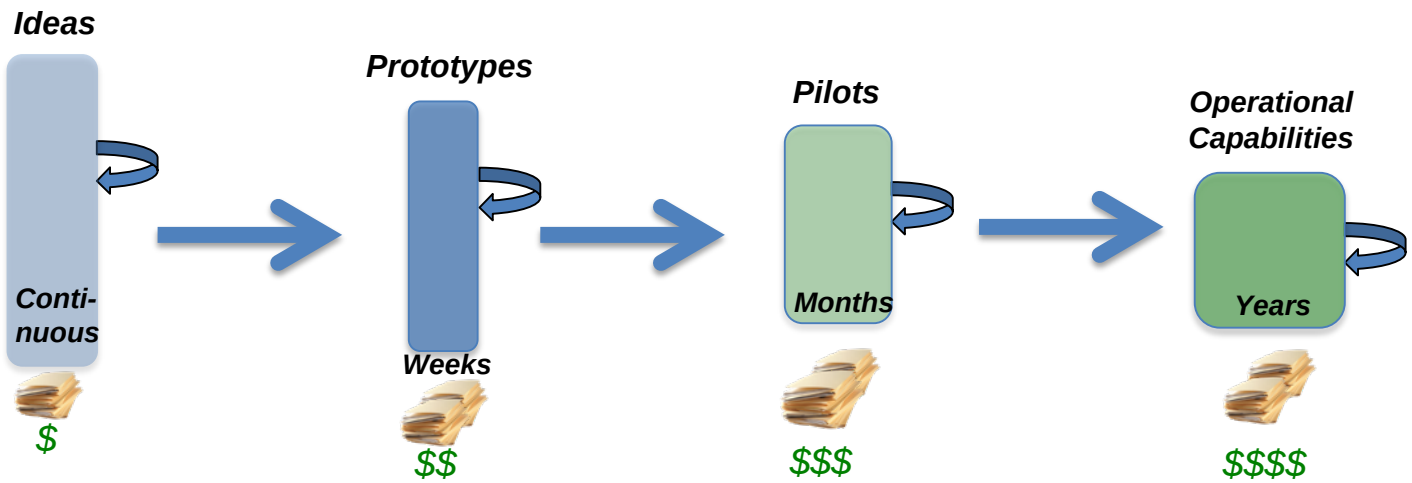
JPL’s balance of the needs of the customer and cyber risk will give us a competitive advantage

New IT Infused at JPL

WHAT

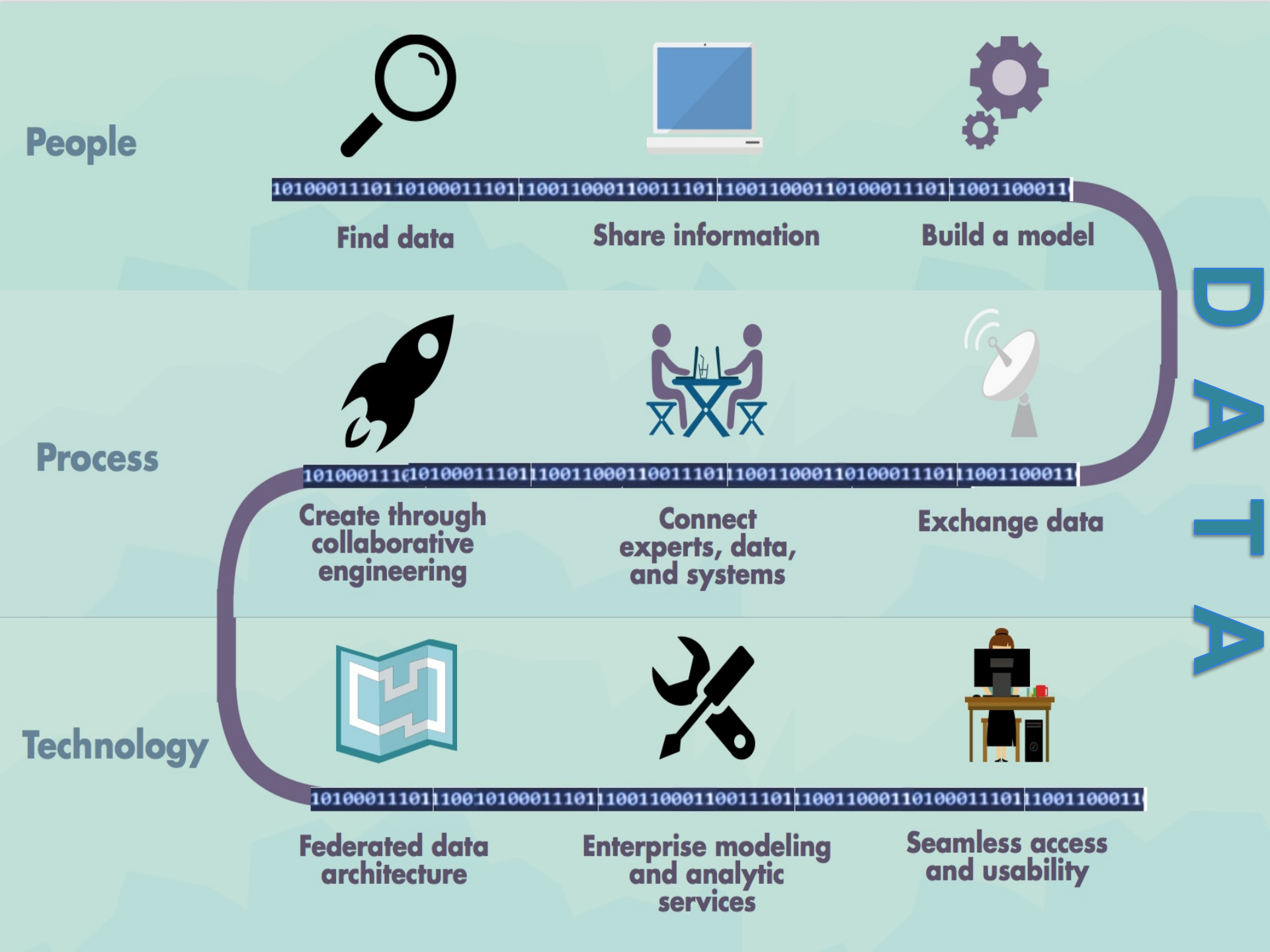
2009	2010	2011	2012	2013	2014	2015
						DEA
				Analytics	SSO	Workgroup 3D Printing
Sharepoint	HD Video Conf.	iPad	Desktop 3D Printing	Wireless Conf Rooms	Open Source	Auto-mation
iPhone		Android		Google Glass	Pebble Smartwatch	MS Halolens
Cloud Computing	Data Center B600		Secure Cloud	Data Center	Hybrid Cloud	Docker

HOW



Engage, Empower, and Enable Employees

- Engage and enable our employees
- Infuse technology through rapid prototyping
- Benefit from the Internet of Things
- Benefit from *intelligent data*


People
Find data
Share information
Build a model
Process
Create through collaborative engineering
Connect experts, data, and systems
Exchange data
Technology
Federated data architecture
Enterprise modeling and analytic services
Seamless access and usability
DATA

Jet Propulsion Laboratory
California Institute of Technology