



Report on the CCSDS DAI Working Group *Draft* Architecture Concept

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CCSDS DAI WG

Google Digital Vellum Project

(and a few other affiliations)

- ✦ Started in 1982 developing data interoperability standards for space programs.
- ✦ Organized by space agencies, inclusive of other agencies, industry and academia
- ✦ About 22 working groups, one of which is the DAI WG
- ✦ *Data Archive Interoperability WG* (other names in past)
 - ◆ Focused on **Digital Preservation** Archives
 - ◆ Developed the Open Archive Info System (OAIS) Ref Model
 - ◆ Because of broad worldwide adoption of OAIS, became very inclusive of non-space participants (libraries, archives)
 - ◆ CCSDS and DAI standards are procedurally adopted by and published by ISO (CCSDS = ISO TC20 / SC13)
 - ◆ Also developed Trusted Repository certification process.
 - ◆ Closely related to PTAB who conducts certification for ISO

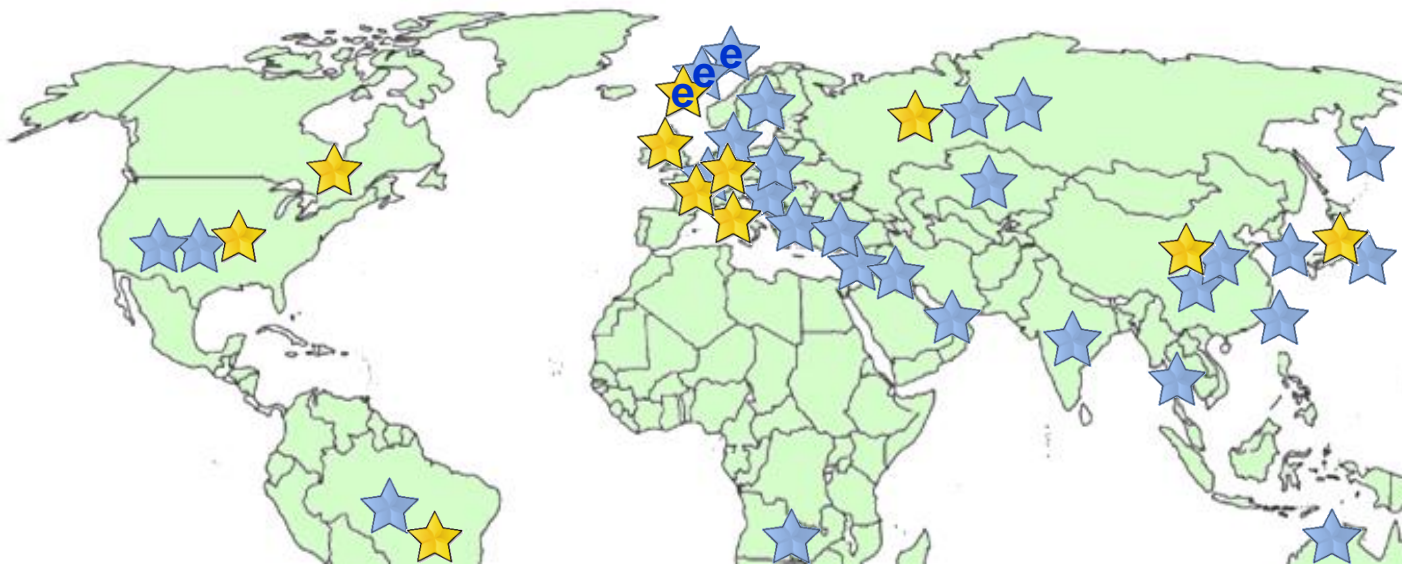
CCSDS Overview - Participation

★ CCSDS – An Agency-Led International Committee

- ◆ Currently 11 Member agencies
- ◆ Currently 31 Observer Agencies
- ◆ Agencies represent 29 nations (and 3 European orgs)
- ◆ Currently 118 Commercial Associates
- ◆ ~160-180 attendees at Spring/Fall meetings

★ Also functions as an ISO Subcommittee

- ◆ TC20/SC13 - Space Data & Info Transfer Systems
- ◆ Represents 20 nations



- ★ **OBSERVER AGENCIES**
ASA/Austria
BFSP0/Belgium
CAS/China
CAST/China
CLTC/China
CSIRO/Australia
DCTA/Brazil
DNSC/Denmark
ETRI/Korea
EUMETSAT/Europe
EUTELSAT/Europe
GISTDA/Thailand
HNSC/Greece
DLR/Germany
IKI/Russia
ISRO/India
KARI/Korea
KFKI/Hungary
MOC/Israel
MBRSC/UAE
NCST/USA
NICT/Japan
NOAA/USA
NSARK/Kazakhstan
NSPO/Taiwan
SANSO/South Africa
SSC/Sweden
SSO/Switzerland
SUPARCO/Pakistan
TsNIIMash/Russia
TUBITAK/Turkey
USGS/USA
- ★ **MEMBER AGENCIES**
ASI/Italy
CNES/France
CNSA/China
CSA/Canada
ESA/Europe
FSA/Russia
INPE/Brazil
JAXA/Japan
NASA/USA
UKSA/UK

CCSDS Overview

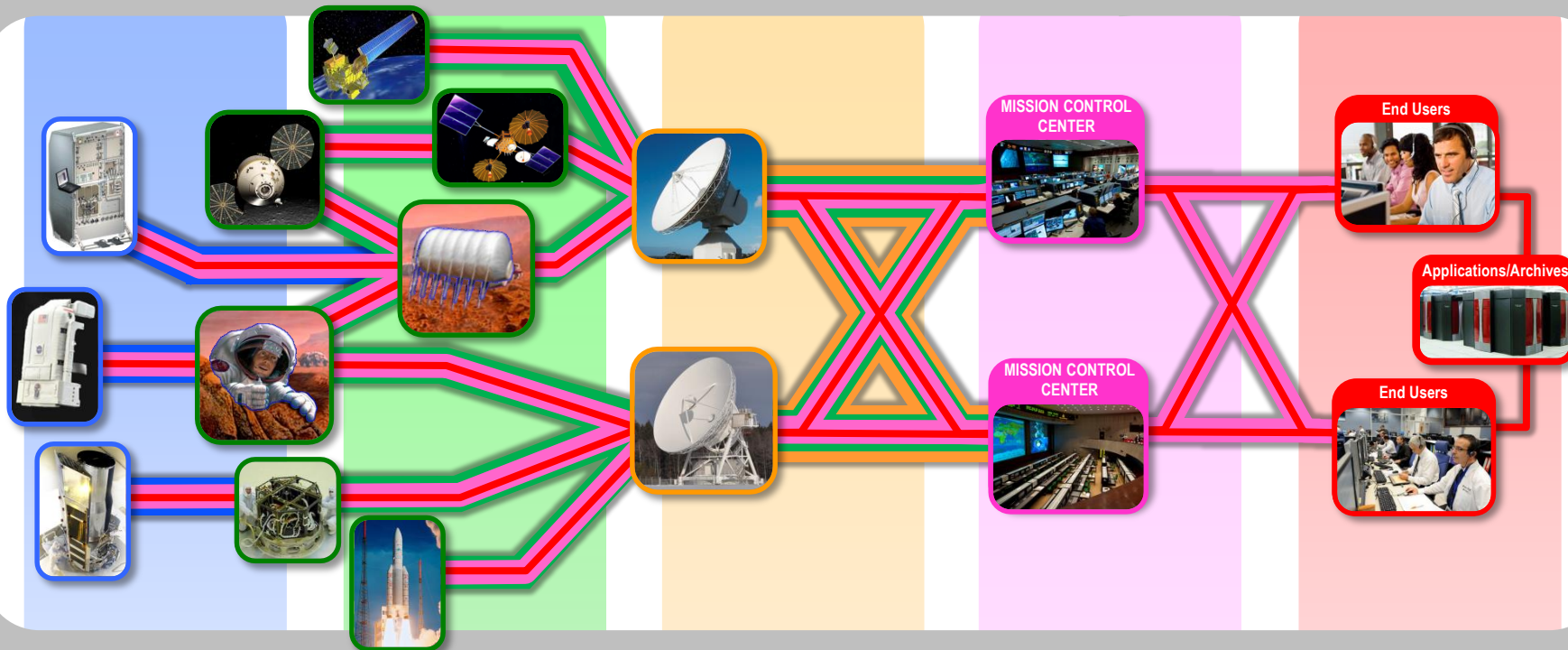
End-to-End Architecture

Six Technical Areas, Twenty-Three Teams

- ◆ Working Group (producing standards)
- ◆ Birds-Of-a-Feather stage (pre-approval)
- ◆ Special Interest Group (integration forum)

Systems Engineering

- ◆ Security
- ◆ Delta-DOR
- ◆ System Architecture



Spacecraft Onboard Interface Services

- ◆ Onboard Wireless WG
- ◆ Application Supt Services (incl. Plug-n-Play)
- ◆ Subnetwork Services WG

Space Link Services

- ◆ RF & Modulation
- ◆ Space Link Coding & Sync.
- ◆ Multi/Hyper Data Compress.
- ◆ Space Link Protocols
- ◆ Space Data Link Security
- ◆ Optical Coding and Mod

Cross Support Services

- ◆ CS Service Management
- ◆ CS Transfer Services

Space Internetworking Services

- ◆ Motion Imagery & Apps
- ◆ Delay Tolerant Networking
- ◆ Voice
- ◆ CFDP Revisions

Mission Ops & Info Mgt Services

- ◆ Data Archive Interop.
- ◆ Navigation
- ◆ Spacecraft Monitor & Control
- ◆ Telerobotics
- ◆ Mission Planning & Scheduling

Background on this new work / Why I'm here

- ✦ CCSDS DAI WG had the OAIS process complete, but did not yet have **system** interoperability standards.
- ✦ Google's Vint Cerf approached us and advocated stronger focus on technical interoperability for preservation archives.
- ✦ High-level notional architectural concepts were developed by DAI and they were recently OK'd by CCSDS mgt as a basis for future work plans.

- ✦ Purpose of this discussion with the RDA:
 - ◆ Peer review/feedback on the concept
 - ◆ Invitation to participate
 - ◆ Explain how this will help researchers

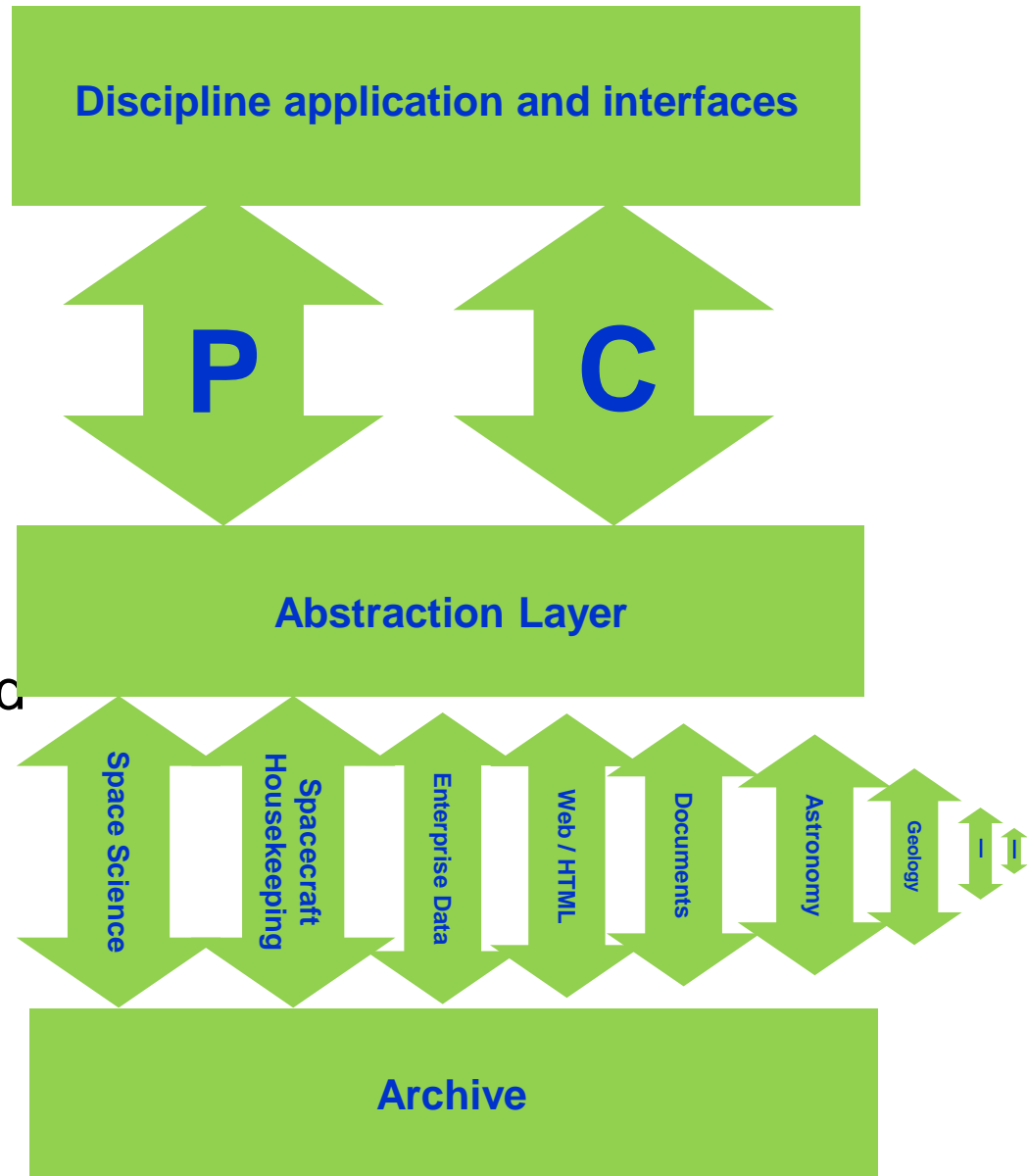
New Architecture Concept

- ✦ The CCSDS Data Archive Interoperability (DAI) WG has developed an architecture concept for archives that mirrors (somewhat) the CCSDS SM&C* architecture.
- ✦ This is notional/draft, and not absolutely locked in as a plan.
- ✦ DAI intends to coordinate with external groups to
 - (1) critique and improve the overall architecture concept, and;
 - (2) Help provide some components specific to external communities outside the realm of CCSDS Space Agencies
- ✦ “Core” portions of the architecture will support all disciplines.
- ✦ “Protocols/plugin/APIs” will be adapted to specific disciplines (“Designated Communities” in OAIS terminology)

*Spacecraft Monitor and Control WG, another CCSDS working group developing a Service Oriented Architecture (SOA) approach

Basic Concept – Layered Architecture

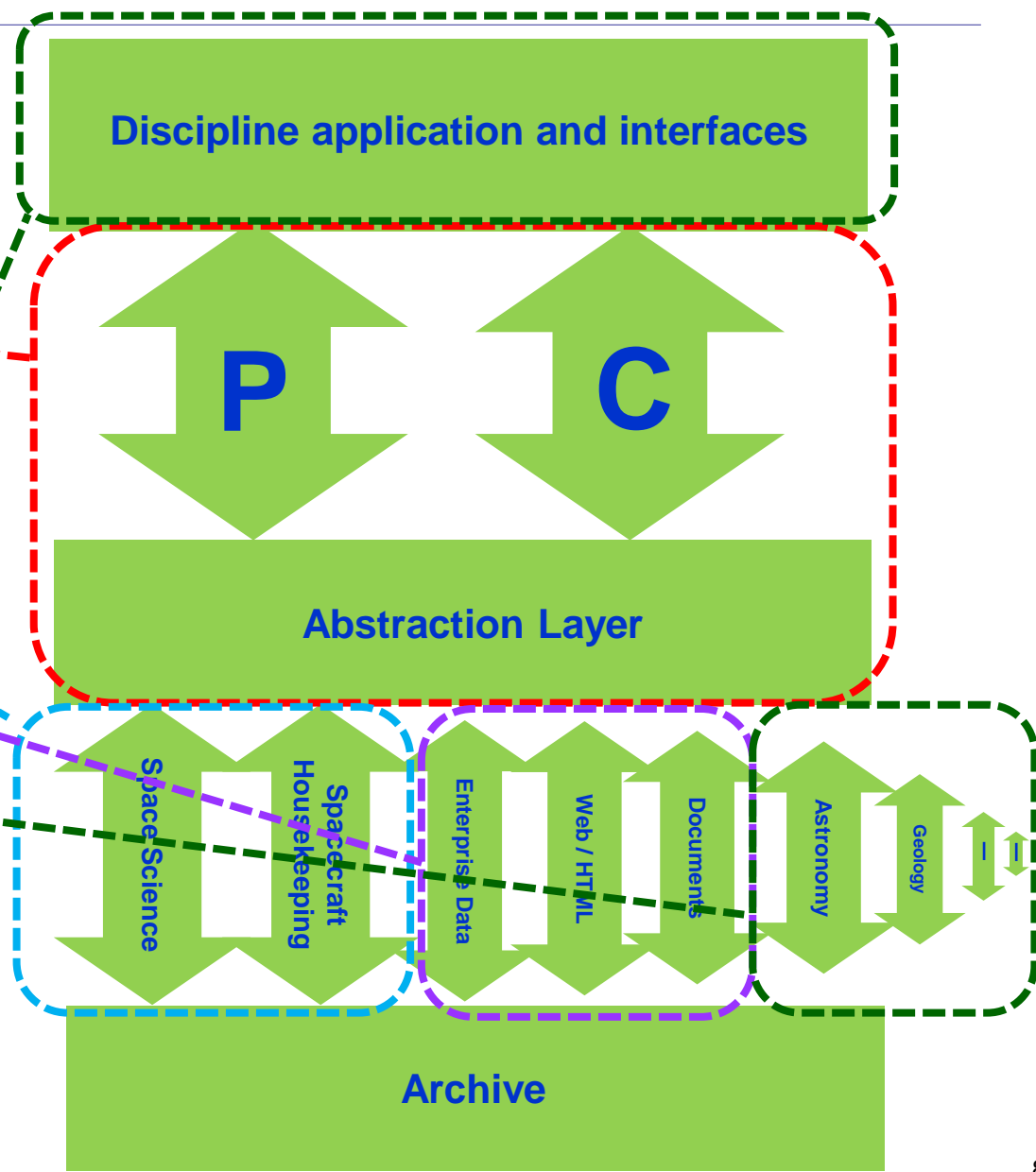
- ✦ User Interfaces
 - ◆ Producer, Consumer
- ✦ Abstraction Layer*
 - ◆ Modularizes
 - ◆ Interoperability
- ✦ Archive Interfaces
 - ◆ “Plug-ins” for specific applications
 - ◆ For specific designated communities
 - ◆ For specific data formats



* Wikipedia: An **abstraction layer** or **abstraction level** is a way of hiding the implementation details of a particular set of functionality, allowing the separation of concerns to facilitate interoperability and platform independence.

Basic Concept – Applicability and Development

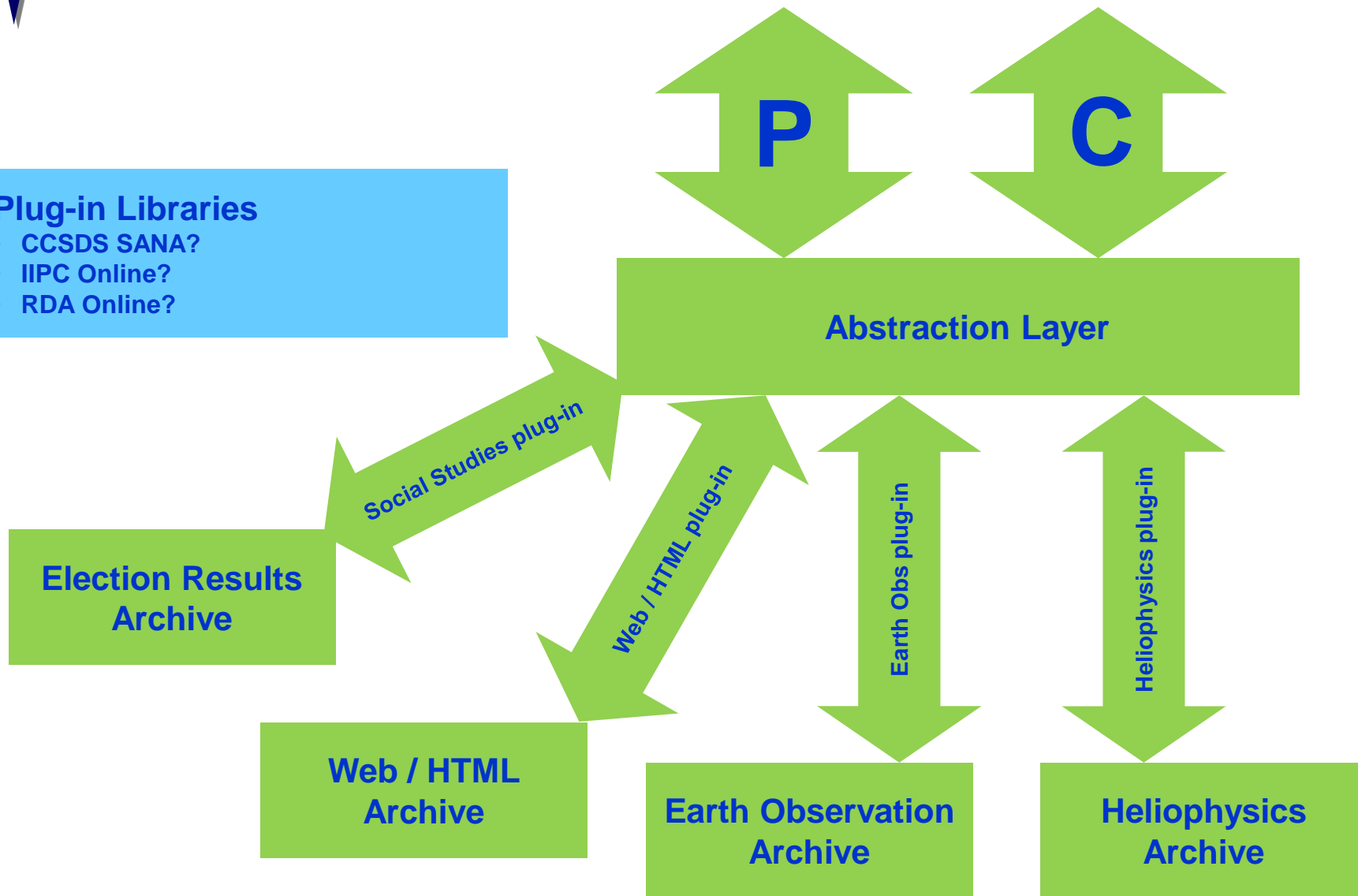
- ✦ Proposed framework for all archives
 - ◆ Developed in CCSDS/ISO
- ✦ Unique capabilities for spaceflight
 - ◆ Developed in CCSDS
- ✦ Common data types
 - ◆ Developed elsewhere
- ✦ Discipline-unique capabilities
 - ◆ Developed by and within each discipline
 - ◆ Hopefully shared via online forums/resources



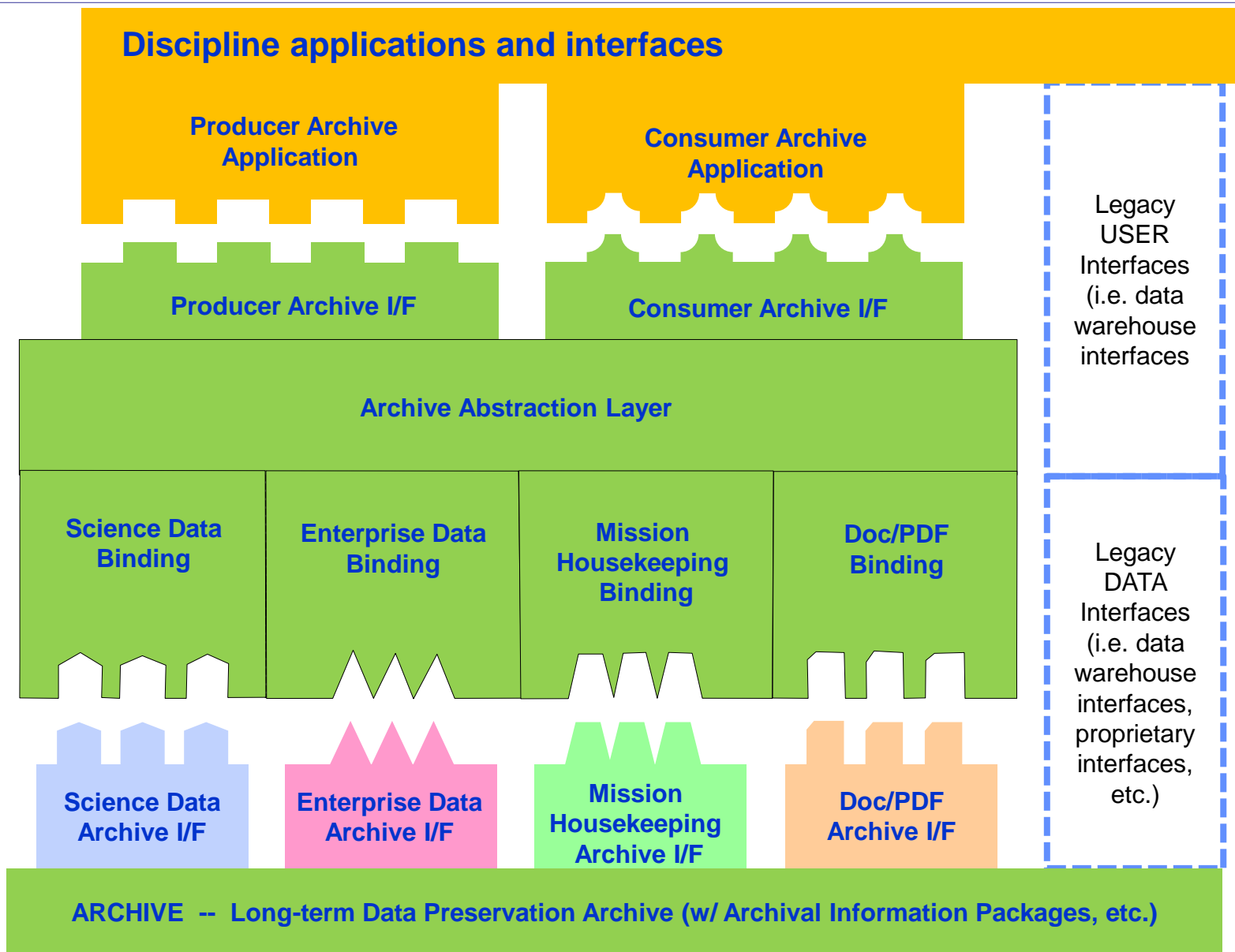
Basic Concept – Cross Discipline Capabilities



- Plug-in Libraries**
- CCSDS SANA?
 - IIPC Online?
 - RDA Online?

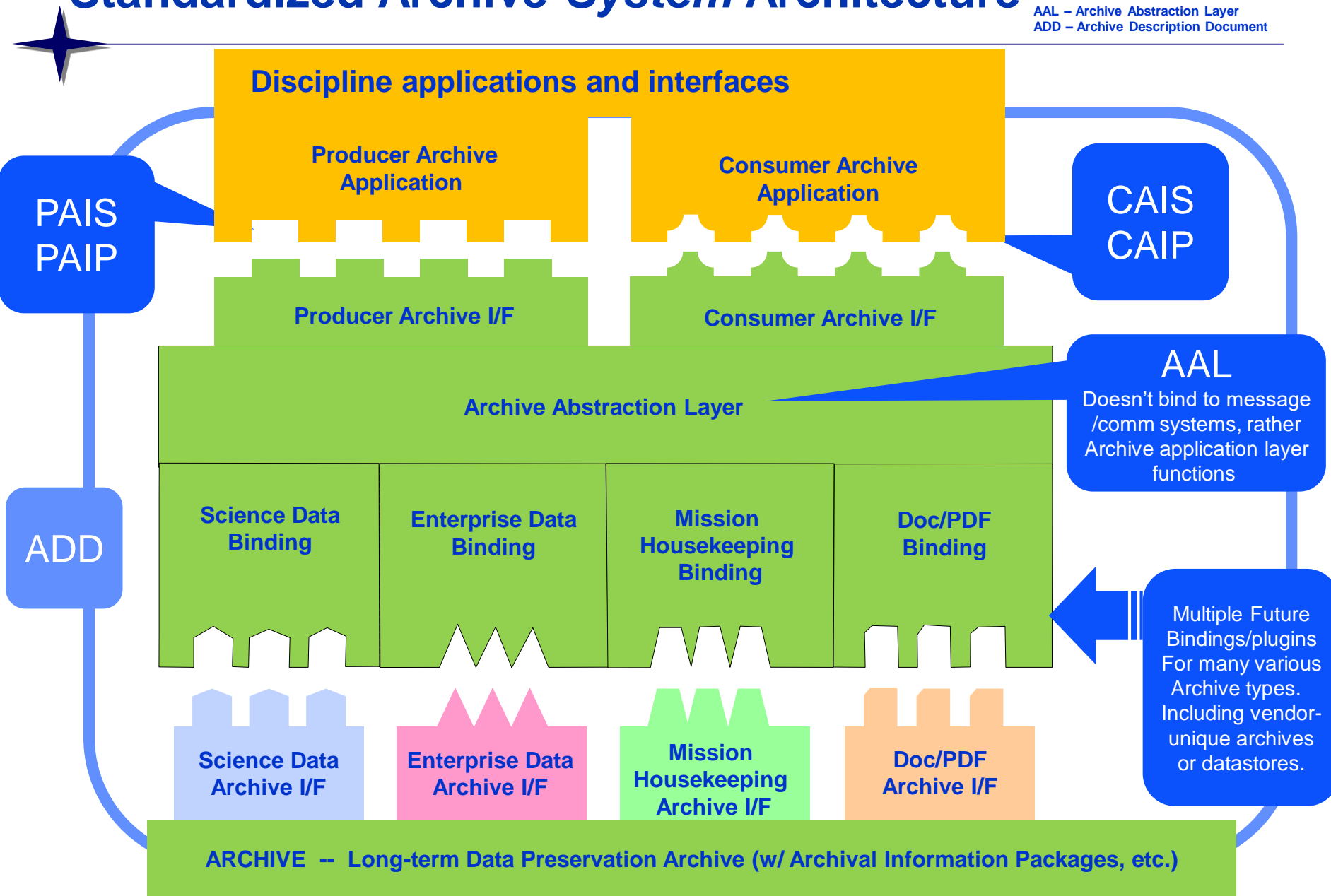


Standardized Archive System Architecture



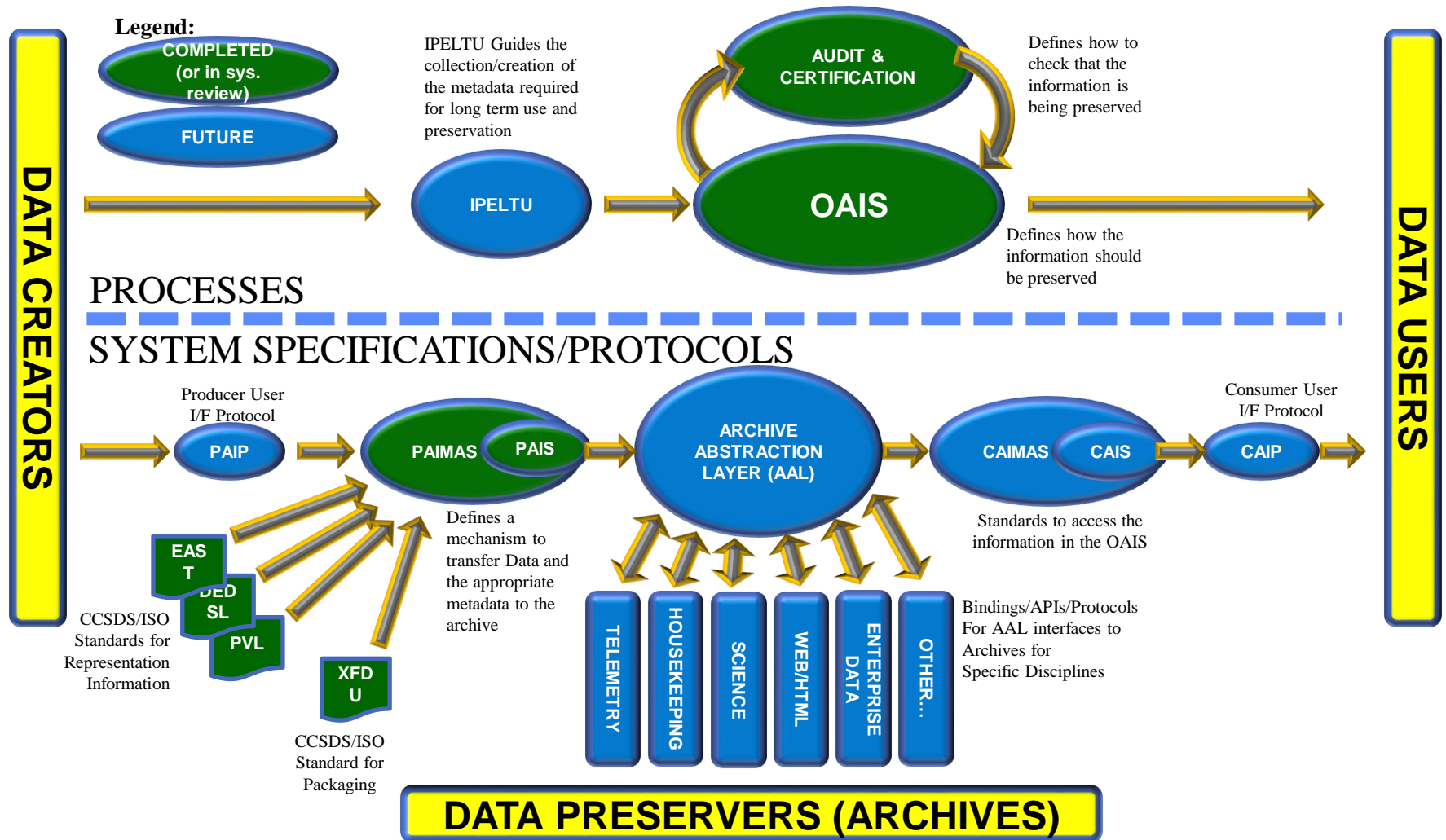
Standardized Archive System Architecture

PAIS – Producer Archive Interface Specification
PAIP – Producer Archive Interface Protocol
CAIS – Consumer Archive Interface Spec
CAIP – Consumer Archive Interface Protocol
AAL – Archive Abstraction Layer
ADD – Archive Description Document



Overview of OAIS standards

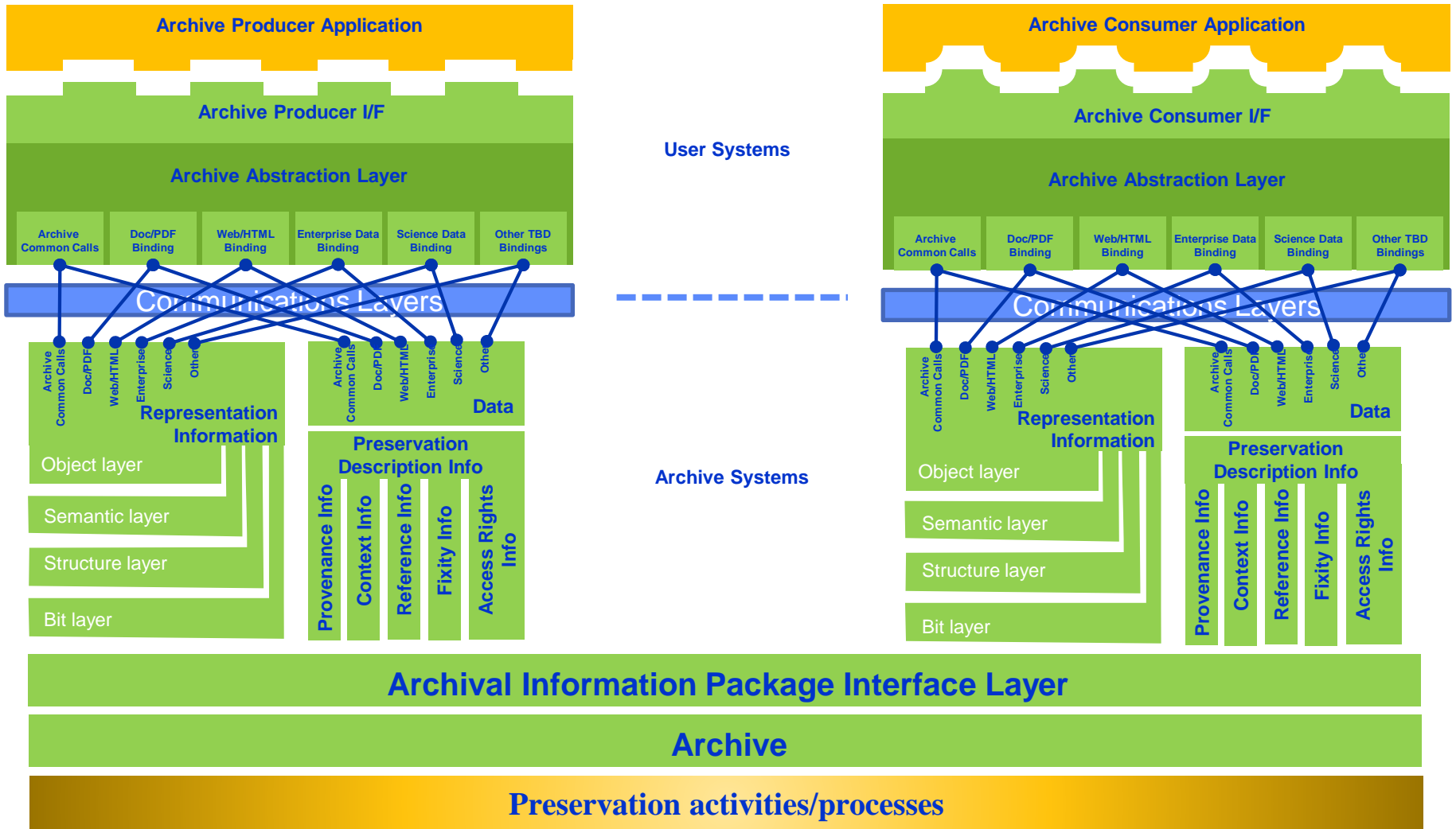
- OAIS – Open Archival Information System
- IPELTU – Information Preservation to Enable Long Term Use
- PAIS – Producer Archive Interface Specification
- PAIP – Producer Archive Interface Protocol
- PAIMAS – Producer Archive Interface Methodology Abstract Standard
- CAIS – Consumer Archive Interface Spec
- CAIP – Consumer Archive Interface Protocol
- CAIMAS – Consumer Archive Interface Methodology Abstract Standard
- EAST – Enhanced Ada SubseT (Data Descripton Language)
- DEDSL – Data Entity Dictionary Specification Language
- XFDU – XML Formatted Data Unit
- PVL – Parameter Value Language



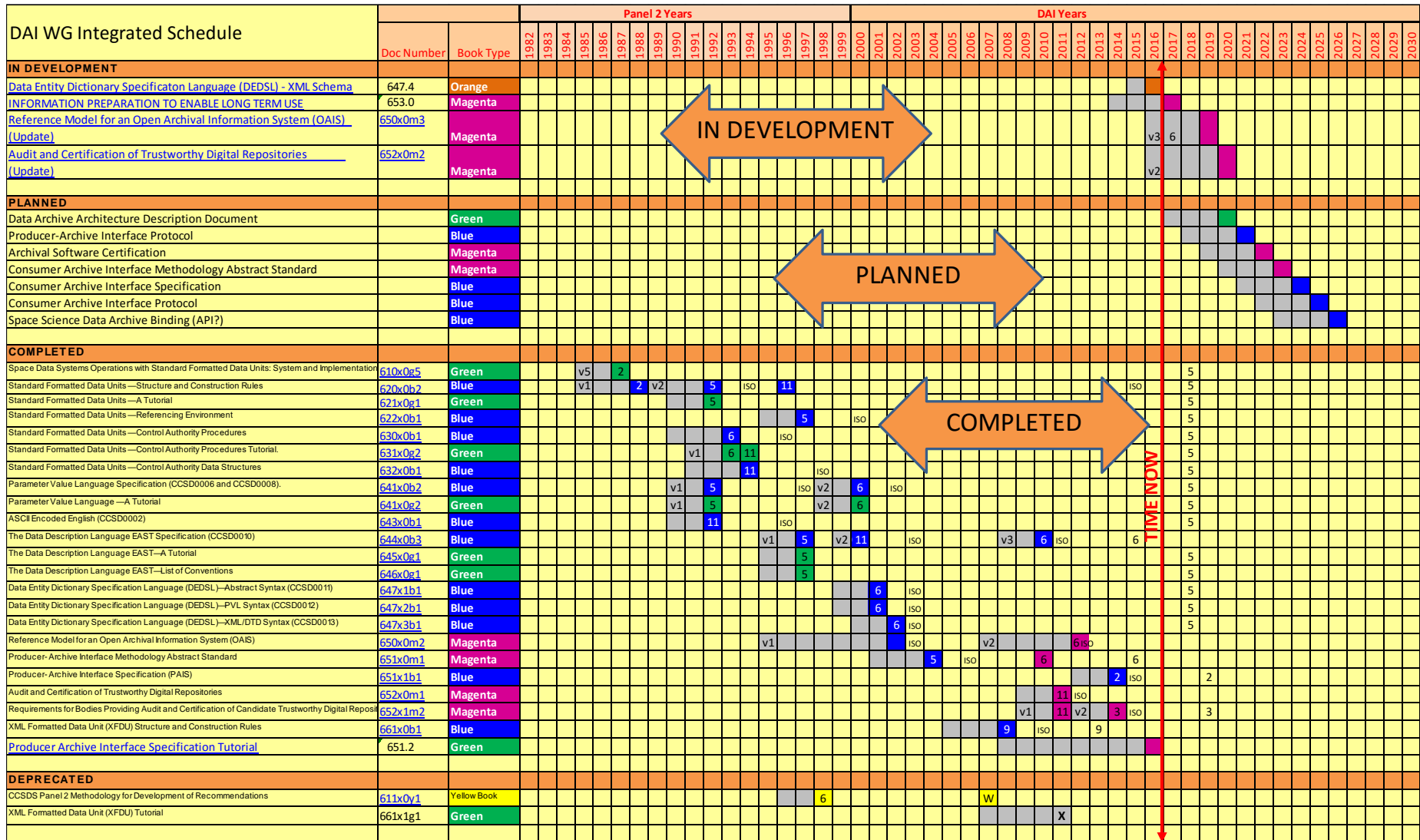
More Detailed Draft Concept - Standardized Archive System Architecture



Protocol view



Overall DAI WG schedule

Data Archive Architecture Description Document (ADD) Schedule



Schedule Milestones	Estimated Completion Date	Comments
Project Approved	7/1/2017	
Project Start Date	7/15/2017	
Internal WG Review		
First Draft Circulated to WG	2/4/2018	
First Draft Comments Due	4/6/2018	for 2018 CCSDS Spring meeting
Second draft circulated to WG	6/20/2018	
Second Draft Comments Due	8/20/2018	
Final WB Submitted to AD for Further Processing	10/20/2018	complete at 2018 CCSDS Fall meeting
External Milestones		
Secretariat Document Processing	3/15/2019	
First Agency Review	10/29/2019	Concurrent with ISO DIS review (5 month)
RID Resolution	5/16/2020	Complete at 2020 CCSDS Spring meeting
Secretariat Document Processing 2	8/18/2020	
Final Agency Review	3/19/2021	Concurrent with ISO FDIS review (3 month)
RID Resolution	5/19/2021	Complete at 2021 CCSDS Spring meeting
CMC Approval	9/25/2021	
Total Time to Complete (in months)	50	



Questions, Comments?



Backup material

Initial architecture concept expressed in UML

★ “Eye chart” for offline review, as an indicator of DAI architecture methodology

