Planetary Data System

PDS 2010: A Vision for 2010 and Beyond

Project Plan

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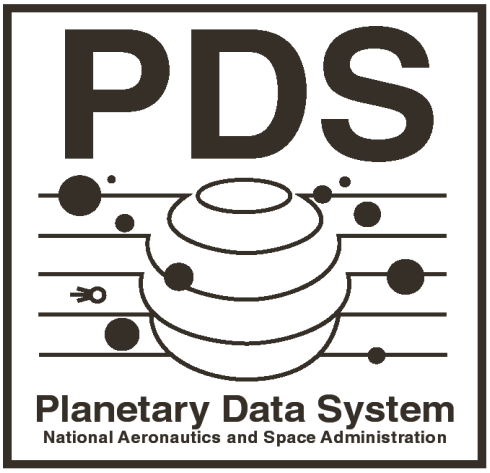

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EXECUTIVE SUMMARY

The past decade has witnessed major changes in both Solar System exploration and computing. Missions are smaller, shorter lived and are often international. The instruments they fly are more capable and complex, generating enormous amounts of data that are contained in a diverse set of increasing data formats. Similarly, changes in computing technologies are driving paradigm shifts for the way in which scientists and engineers interact with each other and the missions. The distributed nature of the Internet is enabling researchers world-wide to plan and execute missions which have been traditionally developed and flown by NASA at just a few institutions. The users of the acquired science data from these missions are also international, having been trained to use data based on standards defined by the Planetary Data System. At the same time, the next generation of scientists are also getting trained using modern Internet tools, expecting systems to be virtually connected, where they can locate, access and request that data be transformed and delivered online using formats and coordinate systems that are required by their local analysis environments.

The vision for PDS 2010 is that it "will provide the community with planetary science archiving standards that are consistent and simple to use. It will provide online services for using its data archives, allowing users to access and transform data quickly from across the federation of PDS nodes. Data providers will be given adaptable tools to design, prepare, and deliver data efficiently to PDS. PDS 2010 data and services will be managed and delivered from a highly reliable and scalable computing infrastructure that is designed to protect the integrity of the data and virtually link PDS nodes into an integrated data system."[1]

PDS 2010 represents a significant step forward for PDS. By rebuilding the system using modern computing infrastructure and tools, it will be *architected* for the internet age. It's data standards will also be significantly improved by both simplifying them and making sure they are explicitly defined and consistent. This is a critical step towards ensuring interoperability across PDS nodes and as well as promoting compatibility with international planetary science archives. Presently, PDS nodes offer a number of differing services and are not well integrated. While PDS does have some common services for finding and accessing data products across heterogeneous PDS repositories, much of the data system was built prior to the introduction of these services. The pathway forward is to define a consistent system architecture and ensure that PDS, as a system, is ultimately integrated with these services so the core functions for archive and distribution

[1] Accepted by PDS Management Council, April 4, 2008

are distributed, but virtually connected. Another problem that is planned to be resolved is an ad hoc storage infrastructure. PDS, having gone through various generations of storage technologies, has very different storage solutions across the nodes, which has resulted in data integrity concerns such as instances where data exists in only one place, data that may only be available offline, and data which has not been delivered to the PDS deep archive. In addition, PDS needs to improve the tracking of its data from end-to-end including delivery of data from data providers all the way to the deep archive. The technology to build PDS 2010 exists and it is critical that PDS leverage and implement a standards-based system to position it to support NASA's future solar system exploration goals.

PDS 2010 is planned using a multi-phased project approach. *Phase I* will focus on upgrade of PDS standards as well as definition of technical standards, implementing a robust data integrity infrastructure with its data holdings, and building the distributed service infrastructure in which the other functions will be built. *Phase II* will focus on migration of data to the PDS 2010 version of standards[2], construction of a new distributed catalog system for managing data sets and products, and exploration of new technologies for deploying portals that support search and distribution for data located across the PDS. It will also focus on integration of the distributed service infrastructure at the PDS nodes. In addition, it will extend its core tools for validation and design to support the new data standards while beginning the process of decommissioning old tools. Phase III will focus on building the portal, search and distribution infrastructure. It will also focus on laying a robust hardware system in place with monitoring to ensure that the online services offered by PDS achieve a high quality of service (QoS) level. It will also work to adopt solutions for high-speed transfer of data in order to support electronic packaging and data movement for products delivery to PDS and exchanged across the enterprise. Finally, Phase IV will focus on building discipline-specific extensions that are optimized for a particular node's community by introducing services that allow for transforming and delivering data in format and structure desired by their users.

PDS will manage the project by appointing an implementation manager who will be responsible for building design and project teams, overseeing development, integration and operations of PDS 2010. These teams will include personnel from both the Engineering Node and the discipline nodes to ensure that the system meets the needs of PDS. In addition, the implementation manager will be responsible for coordinating, tracking and reporting progress on PDS 2010 to the PDS Management Council, PDS Program Manager and Headquarters. The phasing of PDS 2010 is expected to be aligned with fiscal year boundaries.

[2] PDS 2010 is planning to reversion PDS data standards to v4.0

1 Introduction

The Planetary Data System (PDS) has its roots in the mid-eighties, having responded to a report assembled by Committee on Data Management, Archiving and Computing (CODMAC) from the National Academies that recommended that NASA develop a data system to "preserve" and provide "scientific expertise" in using the data. As PDS plans its support for missions from 2010 and beyond, it is clear that its needs to redefine itself to continue to support the expansion of PDS as a set of supporting data services for planetary science research. And, while this transformation to an online system has been occurring over the past decade, the future demands of both the users and the missions require that PDS be proactive in looking at how to harness the available computing technologies and standards so that they can be leveraged and used to support the increasing demands of both missions and users. What has become clear is that PDS has expanded far beyond the basic requirement to "preserve data" and is expanding on its charter to provide "scientific expertise". While protecting the integrity of the planetary science data as a national asset is a fundamental goal of PDS, it has shifted to become much more of an interactive data system, where users expect data and services to be available online, and on-demand 24x7, enabling world-wide access to a data system that provides them seamless access and use of data regardless of where or how it is being stored. Furthermore, PDS users are demanding that it supports greater cross-disciplinary research, fostering collaboration from different scientific disciplines that support scientific investigations that span missions, instruments and data sets.

On the mission-side, the increasing number, diversity and complexity of missions are placing new demands of PDS that require that it delivers new tools and services to missions that support the design, validation and submission of data to the PDS. This also requires that PDS increases its efficiency, introducing automation where possible, ensuring that PDS tools and services are adequate, and that they can continue to support increases in the number of missions and the size of their data.

As a system, PDS has a rich history of developing a world-class data system that is being replicated by international space agencies to support their own planetary science archiving needs. At the same time, PDS, as an archive "facility" for planetary science data, needs to ensure that it is making long-term investments that will keep it as a leader in delivering data system services for NASA and its international partners. PDS was developed prior to Internet-age, and while PDS has continued to evolve itself to become an online data system, much of its heritage is based on user scenarios which pre-date computing technologies that are now available. This has led to challenges in evolving the system since much of the architectural choices for the design of the system were made based on technologies from two decades ago. These challenges and limitations include system and process inefficiencies, difficultly for PDS as a collection of nodes to work as an integrated virtual system, data standards which have become "bloated" and often ambiguous, and storage services which have grown in an ad hoc manner. PDS now faces

a dilemma in determining how much to evolve the system vs. how much to reassert a new system architecture. Where possible, PDS needs to divest itself of aging software components that need to be re-implemented for PDS 2010.

PDS Standards serve as the basis by which its system is built. PDS Standards are the "de facto" standard for planetary science. This is an important leadership role for NASA. While PDS has spurred an international community that knows how to work with its data, there is a need to improve the standards to ensure that they can be both understood and consistently applied by PDS, its data providers, users and partners. In addition, the standards are critical for describing the data and the lineage that's been used to acquire it (methods, technologies, etc). As international partners build upon PDS standards, it's going to be critical to ensure that data acquired from partners can be used in conjunction with data sets from U.S. missions archived in the PDS. The alignment of PDS standards with the international community is therefore critical as PDS embarks on the next decade.

2 Goals for PDS 2010

It is clear that PDS needs to perform a major system renovation that will enable it to meet its future demands. The vision for PDS 2010 is that it "will provide the community with planetary science archiving standards that are consistent and simple to use. It will provide online services for using its data archives, allowing users to access and transform data quickly from across the federation of PDS nodes. Data providers will be given adaptable tools to design, prepare, and deliver data efficiently to PDS. PDS 2010 data and services will be managed and delivered from a highly reliable and scalable computing infrastructure that is designed to protect the integrity of the data and virtually link PDS nodes into an integrated data system."[3]

PDS is at a cross-roads. While investments in PDS3 can certainly continue to improve the service offerings of the system, it is the position of the PDS that it steps back and develops a multi-year, multi-phase implementation plan that allows it to rapidly expand its capabilities while at the same time improving the efficiency and usability of the system. Adoption of current computing technologies will help PDS transition itself to continue to become NASA's computing infrastructure for planetary science research. Employing a well thought-out architecture will allow PDS to evolve the system as both science and technology evolve. As a result, PDS has identified a set of system goals for PDS 2010 which include:

(i) *Explicit Data Standards:* PDS data standards need to be explicitly defined so that they can be consistently used and implemented by users. A small number of data formats are needed in order to simplify both the data provider and user-side of PDS. At present, PDS standards are described in a narrative standards reference rather than explicitly engineered which has lead to inconsistent implementations and use. In addition, there are a large and diverse set of data formats that has increased the complexity for generating and using PDS data products.

(ii) *Distributed Online Services:* A critical part of the PDS 2010 vision is that it will "provide online services for using its archives, allowing users to access and transform data quickly from across the federation of PDS nodes." Distributed services, often referred to as a service-oriented architecture in the IT community, are envisioned to allow PDS to "plug-in" the types of data management and transformation services necessary to support its diverse user community. At present, PDS has a set of services for accessing distributed catalogs and repositories, however, in PDS 2010, it is envisioned that PDS will be able to offer a broad set of services based on industry standards which will allow it to expand its online service offerings by adding new services over time.

[3] Accepted by PDS Management Council, April 4, 2008

(iii) *End-to-End Data Integrity: Data integrity* is a critical part of the vision for an online distributed system. The PDS Management Council, in its integrity policy for the archive, is concerned about three issues including protecting against file corruption, ensuring that data can be accessed over time, and ensuring that PDS does not lose any data. At present, PDS is currently working to divest itself of the dependency of physical media. Reliability issues in more recent optical media technologies such as DVD have shown to be fairly prevalent. In addition, PDS lacks a checksum standard for ensuring that data is not corrupted. With PDS 2010, PDS' archive integrity goal is to ensure that all data is tracked, transfer and stored error-free, and available at three highly reliable geographically distributed locations.

(iv) *Efficiency and Automation:* Improved *automation* of PDS is another part of the PDS 2010 vision. The implication of increasing diversity, product types and volumes is ensuring that PDS automates core, human-intensive functions to allow for scalability of PDS. It is critical that automation be understood from data delivery through to the NSSDC. One of the existing challenges of PDS is that it was designed as a human-intensive data system. A critical goal of PDS 2010 is to redesign PDS to improve the efficiency of operating the data system.

(v) *Increased Integration with Data Suppliers:* PDS has recognized that it is important to work with data suppliers as earlier as possible. Both PDS and missions benefit greatly by working together as earlier as possible. A goal of PDS 2010 will be to provide tools and recommendations to data providers to support the design of data products and archives as early as possible. While this trend has already begun and PDS has delivered tools to support design of data products, a goal of PDS 2010 will be to ensure that similar tools and support is available to PDS data suppliers.

(vi) *High-Speed Data Movement and Delivery: Data movement* is a critical part of providing an online system. With PDS 2010, PDS needs the ability to both develop standards for electronic data delivery as well as provide mechanisms for high-speed data movement. Historically, PDS has used physical media along with standards for packaging a volume construct as its de facto standard for data delivery and movement. This included deliveries of data to PDS, between nodes and to the NSSDC. Given that data is now being delivered online, a goal for PDS 2010 will be to define explicit standards for data delivery. In addition, due to increasing volumes of data, it needs to be able to also move data across the federation in a reasonable time.

(vii) *Flexible Search:* Providing the PDS user community with improved search tools both at the discipline nodes and centrally is another goal of PDS 2010. The goal is to have an architecture that allows PDS to build better search tools by leveraging the distributed service infrastructure whereby nodes can present virtual views of PDS holdings from across PDS through discipline-specific tools. At

present, search tools differ greatly across PDS and, with the exception of tools at Imaging and Geosciences, provide only local views of holdings.

(viii) *Highly Scalable Computing Infrastructure:* Another goal of PDS 2010 is to deploy a highly reliable and scalable standards-based computing infrastructure. In addition, as PDS 2010 offers online, distributed services, it needs to monitor the availability of these services and its data to ensure that it meets a minimum quality of service metric. It is also to identify a finite set of computing platforms and operating systems that will be fully supported.

3 PDS 2010 Projects

In order to realize PDS 2010, it needs to be conducted in phases. Each phase includes a set of projects that are defined by requirements, a schedule, and clear deliverables. The phases of PDS 2010 enable incremental delivery of system capabilities and are ordered based on both their priority and their dependencies . The phases of PDS 2010 are as follows:

- Study Phase
- Project Architecture Formulation Phase
- Development Phase I: Standards Definition, Data Integrity, Distributed Services Development
- Development Phase II: Catalog System, Distributed Service Integration
- Development Phase III: Portals, Distribution, Ingestion
- Development Phase IV: Node and Discipline-specific Service Development

PDS is following the mission lifecycle, performing early studies on the needs of PDS, followed by a definition of the system, and then development phases that include implementation of the key components of PDS 2010. Each phase and project is identified below:

STUDY PHASE

The study phase of the project identifies the vision for PDS 2010 including data, system and user services. It also includes identification of core drivers, problems, limitations and issues with the current implementation of PDS, and recommendations for proceeding to PDS 2010. The deliverables are white papers which include the findings for each of these areas.

ARCHITECTURE FORMULATION PHASE

The architecture formulation phase of the project will define the core system definition including both the data and software architectures. The data architecture includes the data model, data dictionary model, core formats, and grammar. The software architecture includes the decomposition of the system, core services to be built, and the system design including ingestion, distribution and search. The deliverables of the architecture formulation phase are primarily system engineering documentation that will be used to support the development of PDS 2010.

IMPLEMENTATION PHASE I

Phase I of PDS 2010 will focus on projects that will be used to create the foundation of PDS 2010, particularly standards and securing the data holdings of PDS. In addition, feasibility projects will be introduced earlier in the PDS 2010 development to provide evaluate design decisions early and help to provide initial capability quickly for PDS 2010. Feasibility projects will have a full deployment to PDS in the future, if successful.

Phase I projects are defined as follows:

i. PDS 2010 Data Standards Project: The data standards project will focus on releasing v4 of the PDS Standards Reference. This should include a core set of data formats and simplified, explicit data model that is used to document the standards. It will also include definition of the grammar for documenting PDS data as well as a structure for a new data dictionary. The primary deliverable for this project is PDS Standards Reference version 4.0.

ii. PDS 2010 Technical Standards Project: The technical standards project will focus on defining v1 of the PDS Technical Standards. These will include hardware and software standards. The primary deliverable will be a website which includes recommended technology standards for PDS.

iii. Data Integrity Project: The data integrity project will implement the PDS MC policy and the archive integrity requirements including data integrity, tracking and availability. It will address the "three" copy rule of data and ensure that data properly archived and can be accessed as needed. Some work on data integrity is expected to begin prior to Phase I since several pieces of data integrity are not dependent on PDS 2010 design decisions. These include ensuring that all data is delivered to the NSSDC and that each node has an operational backup of their data holdings. The Data Integrity project is expected to have multi-pronged implementation that includes processes, standards and tools that address data integrity, tracking and availability. Tracking will ultimately be integrated in Phase II with the catalog system re-design.

iv. Distributed Infrastructure and Services Project (Year 1): The Distributed Infrastructure and Services Project will evaluate technical solutions for

moving PDS to a fully distributed, "service-oriented" architecture. This will be used to support integrated search, distribution, data delivery, and data processing (transformation, subsetting, etc). The project will focus on evaluation and testing within a subset of PDS and then schedule full deployment as a project in a later phase of PDS 2010. Critical deliverables will include a specification for constructing services, construction of a core set of services as defined in the architecture phase, and a prototype with a couple of nodes.

v. Data Movement Feasibility Project: The Data Movement Feasibility Project will evaluate data movement technologies for PDS by selecting and implementing a data movement capability for a subset of PDS where high-speed data throughput is critical. The primary deliverables will be a prototype along with a white paper that captures a set of recommendations for proceeding to a full project in a later phase.

IMPLEMENTATION PHASE II

Phase II of PDS 2010 will focus on migration of the existing data and tool infrastructure to the PDS 2010 design and standards. This will include alignment of the technical infrastructure, cleanup of the data dictionary, migration of the repository to a PDS 2010 structure, construction of the PDS 2010 catalog system and migration from PDS3, and tools to support the submission of data to PDS.

Phase II projects are defined as follows:

i. Data Migration & Clean Up Project: The Data Migration and Clean Up project will migrate data repositories from PDS3 to PDS 2010 as needed. The purpose is to be forward-compatible with PDS 2010. The PDS MC will need to consider the policy associated with migrating data. The primary deliverable will be a schedule and plan for migration along with reports to the Management Council on the migration.

ii. PDS Catalog System: The PDS Catalog System project will implement a distributed catalog system for PDS, based on the PDS 2010 information model, and built on the PDS 2010 distributed services. The primary deliverables will be an overall design for the distributed catalog system, a specification for interfacing catalogs and an re-implementation of the central catalog based on the design and specification.

iii. Tool Migration Project to PDS 2010: Changes to the PDS 2010 standards will require changes to the existing tools and system. This project will focus on the migration of the PDS tools, particularly VTOOL, LTDTOOL and NASAView, to support PDS 2010. The primary deliverables will new versions of these tools for PDS 2010.

iv. Distributed Infrastructure and Services Project (Year 2): The Distributed Infrastructure and Services Project will work to integrate the services at the PDS nodes. The primary deliverables will be a schedule along with on-going reports to the Management Council on the integration status. It is anticipated that these services will be able to run along side existing services in order to accommodate the transition between PDS3 and PDS 2010.

v. Portals, Search and Distribution Feasibility Project: The Portals, Search and Distribution Feasibility Project will evaluate various approaches for better integrating PDS and allowing product level search and access to data. This will also include evaluation of product level vs record level access to data. The results of this feasibility project will be used to guide full deployment to PDS in a later phase. The primary deliverable will be a report with a given set of recommendations that can be reviewed and discussed with the Management Council.

IMPLEMENTATION PHASE III

Phase III will focus on implementing several of the feasibility projects for PDS 2010 which move PDS to a virtual system including integration of the distributed infrastructure and the web/portal infrastructure within PDS, high-speed data movement across the PDS enterprise, improved ingestion of data into PDS and upgrades of the operational infrastructure to support better quality of service and uptime for PDS.

Phase III projects are defined as follows:

i. Portal, Search and Distribution: The Portal, Search and Distribution project will focus on "re-architecting" PDS such that there is an integrated technical approach with respect to the user experience in navigating portals, searching for data, and requesting PDS data holdings. This needs to include the ability to support cross-node searching and access to data. Deliverables will include an upgrade central portal, along with a technical specification and set of recommendations for integrating node portals into PDS 2010.

ii. Data Movement and Delivery Project: The Data Movement and Delivery Project will focus on adoption and deployment of technologies and standards to support high-speed data movement across the PDS enterprise as well as to/from data producers and customers. It will focus on addressing movement of large-scale data products and will build on the feasibility project. The primary deliverables will include adoption of technology to support high-speed data transfer along with a specification for delivery of data to all the way to the deep archive (e.g., standard packaging and manifests).

iii. Ingestion and Data Producer Tool Suite Project: The Ingestion and Data Producer Tool Suite will focus on delivery of tools to data producers from missions and DAPs to support improved design and electronic submission of data to the PDS. The primary deliverable will be a set of tools.

iv. Technical Infrastructure/Operations Project: The Technical Infrastructure and Monitoring Project will focus on upgrading the technical infrastructure of PDS, based on the technical standards recommendations. It will also employ a monitoring capability for monitoring the quality of service for PDS operations. The primary deliverable will be definition and implementation of an operations plan for PDS 2010.

IMPLEMENTATION PHASE IV

Phase IV will focus on extended services once the service architecture is fully in place. These services include node and discipline-specific services and will be based on the service specification model. The schedule and deliverables for this project phase are expected to be defined after completion of development phases I and II.

4 PDS 2010 Transition Plan

The transition from PDS3 to PDS 2010 will be multi-phased. Due to PDS being an operational system, PDS needs to identify multiple cut-over opportunities to transition from PDS3 to PDS 2010. Ultimately, each project will include a transition plan that addresses the transitions necessary for completing the project (e.g., releasing a new catalog system).

First, PDS must understand the structure of the system and ensure there is a plan for each of the *components* in the system. Below is a decomposition of PDS as a system that was developed by the PDS 2010 Architecture Working Group. The decomposition enables PDS to perform a sanity check to ensure that a plan exists for each of the components. That plan is presented in a table following the decomposition.

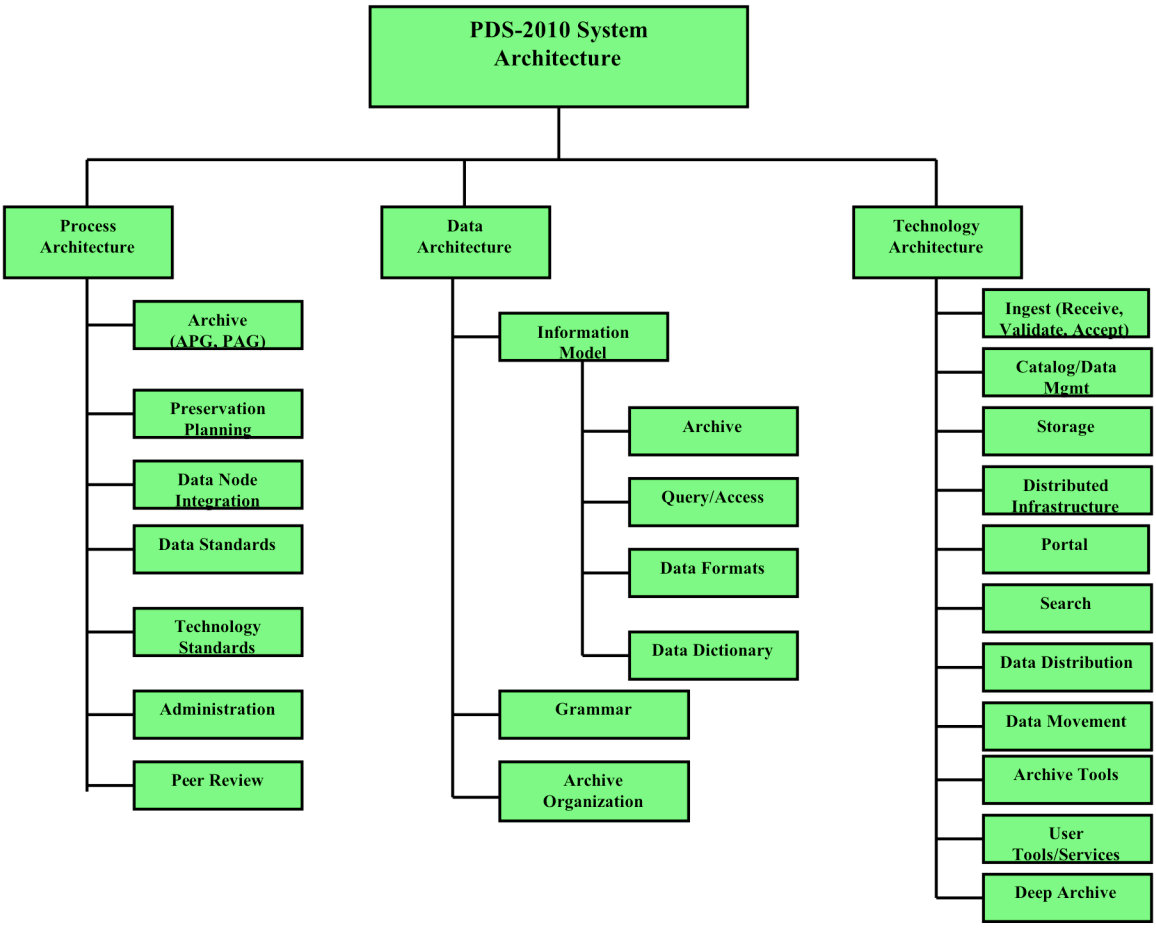

Figure 1: DRAFT PDS 2010 System Decomposition

Below is a mapping of the critical components of the matrix to the plan in PDS 2010 where they will be developed and/or adopted for PDS 2010. Note that some components listed above are not included in the table primarily because their change is minimal including peer review, archiving process and data nodes.

PDS 2010 Component	PDS 2010 Plan	PDS 2010 Project	Development Phase	Transition Phase
Data Architecture	Formalize and update the PDS Information Model as PDS 2010 based on the PDS3 data standards, issues and problems and recommendations of the PDS Information Model WG.	PDS 2010 Information Model Project	Architecture Formulation Phase	N/A
System Architecture	Formalize the system architecture of PDS identifying the decomposition of the system, the core design patterns (e.g., ingest, search, distribution, deep archive), initial standards and core services.	PDS 2010 System Architecture Project	Architecture Formulation Phase	N/A
Data Standards	Develop a new PDS standards reference based on the updated data architecture. Release final PDS3 standards reference.	Data Standards	Phase I	End of Phase I
Data Dictionary	Develop a new data dictionary structure and set attributes. Clean up of the existing keywords and values. The data dictionary structure will be created as part of the data standards effort, however, population of the data dictionary will occur during data migration.	Data Standards Data Migration	Phase I	End of Phase II
Technology Standards	Identify a core set of technology standards including platform, operating system and interface standards.	Technology Standards	Phase I	End of Phase I
Distributed Infrastructure	Develop, implement and deploy a distributed service architecture for PDS including the ability to search, access, download, and transform PDS data holdings. Replace PDS-D product, profile services with the new service architecture. Ensure the service architecture can support multiple standards-based service interfaces.	Distributed Infrastructure and Services	Phase I, Phase II	End of Phase II
Storage	Ensure that PDS data holdings are managed in both a primary and secondary storage with geographic separation.	Archive Integrity	Phase I	End of Phase I
Deep Archive	Deliver all PDS data holdings to	Archive Integrity	Phase I	End of Phase

Preservation Planning	the NSSDC and develop a QQC plan for the deep archive.			I
Catalog/Data Management	Develop the catalog infrastructure including a centralized data set catalog as well as distributed catalog at all PDS nodes. Support multiple design patterns for populating the distributed catalog system including mechanisms for distributed access and updates.	Distributed Catalog System	Phase II	End of Phase II
Ingest	Deliver tools to support preparation, delivery and ingest of data into PDS	Ingestion and Data Producer Tool Suite	Phase III	End of Phase II
Archive Tools	Migrate VTOOL and LTDTOOL to PDS 2010 data standards. Ensure the tools can continue to support PDS3 and PDS 2010.	Tool Migration to PDS 2010	Phase II	End of Phase II
Portal Search Data Distribution	Replace the current portal structure, search and distribution architecture so it is service based. Upgrade portal software so it is served by a content management system for publishing information on the PDS website. Decommission old PDS portals.	Portal, Search and Distribution	Phase III	End of Phase III
Data Movement	Deliver tools and a package structure for moving PDS data holdings.	Data Movement	Phase III	End of Phase III
Data Management (Repository)	Migrate PDS data to PDS 2010 structure	Data Migration	Phase III	End of Phase III
User Tools (Services)	Deploy new domain-specific services that are built using the PDS distributed service software and standards.	Node-specific Services	Phase IV	Phase IV +

Figure 3: PDS 2010 Component Transition Matrix

While there will be multiple transition periods for moving from PDS3 to PDS 2010, there is a key transition that will occur at the end of phase II (2010) which will drive the transition from PDS3 to PDS 2010. This includes:

a. Data Deliveries to PDS using PDS 2010: Agreements to deliver data to PDS using PDS 2010 standards will be put in place once the data standards and tools are available. Currently, it is estimated that these agreements can be put in place at the end of Phase II based on the schedule dependency for both of these items.

Note: PDS can only expect to receive data formatted for PDS 2010 for new missions that do not have a signed SIS with PDS. Therefore, PDS can not expect to receive PDS 2010 data until those new missions, which have agreed to deliver using PDS 2010 standards, start delivering (e.g., 2013). *PDS will receive both PDS3 and PDS 2010 data for many years to come.*

b. Catalog System: Cut over to a new catalog system for PDS, based on the PDS 2010 plan, can be scheduled to occur at the end of Phase II. The old system will be decommissioned and the new system will be brought online and will support both PDS3 and PDS 2010 data standards since PDS3 data deliveries will continue to occur for many years to come.

c. Tools: Cut over to new tools will occur at the end of phase II. These tools will be capable of supporting validation of PD3 and PDS 2010 tools as well as working with the PDS 2010 data standards and data dictionary.

d. Data Dictionary: PDS will begin publishing a new PDS 2010 structured data dictionary during Phase II.

Another major transition will occur in Phase III for portal, search and distribution. This will represent an upgrade to use the new services and catalog.

5 Schedule

The PDS 2010 schedule with each of the phases and core projects is identified below.

[[[SEE EXTERNAL SCHEDULE]]]

6 Management Plan

PDS 2010 will ultimately be implemented though a phased set of projects. While there are some critical tasks upfront to formulate the overall system architecture, each project will be run independently and, where appropriate, consist of:

- Implementation Plan (including schedule, deliverables, dependencies)
- Requirements
- Design
- Implementation
- Test Plan
- Operations Plan (including transition plan)

The project model is important to ensuring that design decisions are made at the appropriate level. The overall architecture is critical to understand how both the data and software can be brought together to formulate a system. However, each of the components of PDS 2010, as shown in the system decomposition in figure 1, will be implemented as part of a PDS 2010 project. In general, design decisions that only impact a local component will be deferred until the implementation project that includes that component. Global design decisions such as the types of the components, common system interfaces, etc will be made when defining the system architecture during the Architecture Formulation Phase.

In terms of staffing, PDS 2010 will consist of multiple teams that will be responsible for assessment, design, implementation, and operations. These teams are defined as follows:

Assessment Working Groups: Assessment working groups include the PDS 2010 user, data and architecture working groups as well as the PDS3 specification WG. They are responsible for providing assessments on both PDS3 as well as the needs for PDS 2010.

Design Teams: Design teams will include a team for defining the PDS 2010 data architecture and a team for defining the PDS 2010 system architecture. These teams may also participate in rapid prototyping in order to evaluate PDS 2010 proposals for the Management Council.

Project Teams: Project teams consist of members involved in development, integration and operations. It crosses nodes of the PDS. Nodes are critical to the integration aspects of the implementation. Project teams are expected to vary depending the needs and scope of the project. Project teams involved in operations will provide periodic presentations to the PDS Management Council on the health of PDS as a system.

In terms of reporting, the PDS 2010 project will report to the PDS Management Council both monthly at teleconferences and at face-to-face meetings. This will include status and schedule updates, issues, and any policy related items.

7 References

[1] PDS 2008 and Beyond Architecture Recommendations, December 2007
[2] PDS4 User Services Working Group Recommendations, December 2007
[3] PDS 2010 Management Council presentation, April 2008
[4] PDS Roadmap 2006 – 2015, February 2006