



Vera C. Rubin Observatory
Rubin Observatory Operations

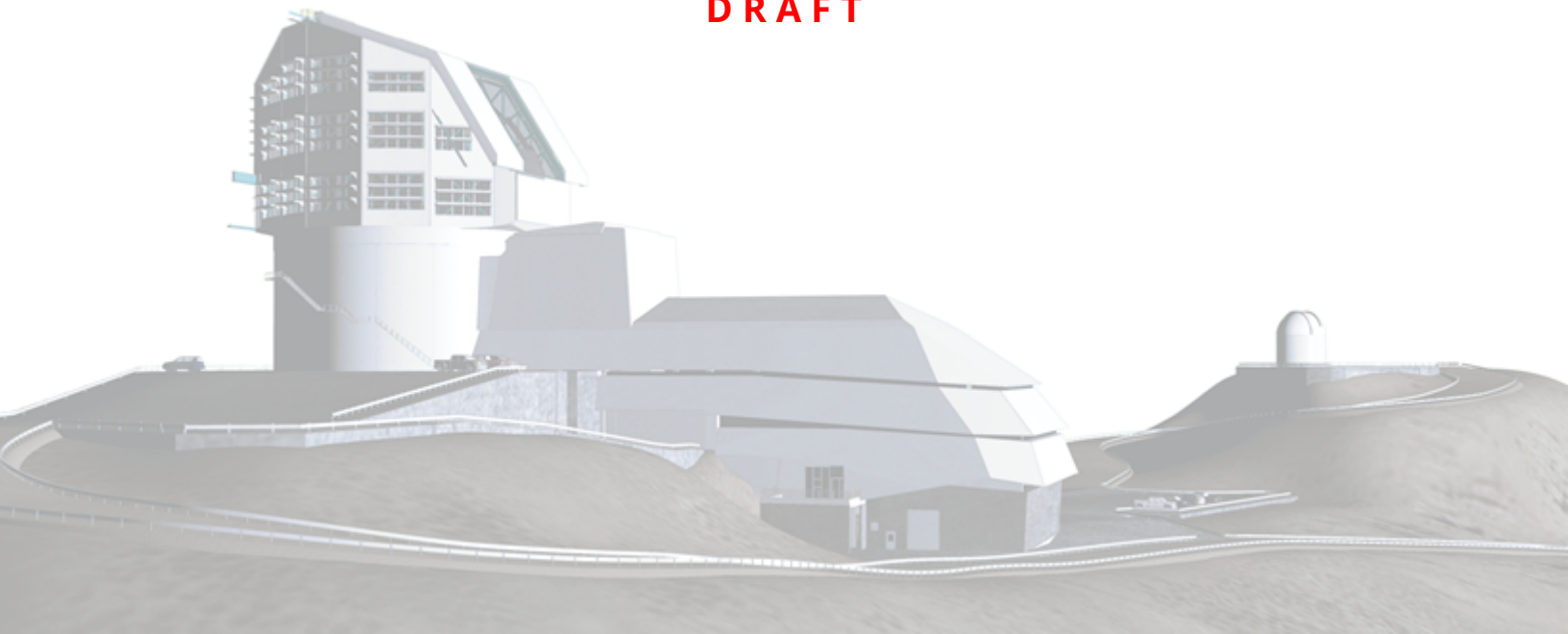
Management and Execution plan for Data Management Operations.

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RTN-046

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DRAFT



Abstract

This is the management plan for operations of Data Management - this includes software products and data products.

Draft

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Management and Execution plan for Data Management Operations.

1 Introduction

1.1 Purpose

This document defines the mission, goals and objectives, organization and responsibilities of Vera C. Rubin Observatory Data Management Operations.

1.2 Mission Statement

Maintain, improve and operate a suite of Vera C. Rubin data management services to produce and serve to the community high-quality data products from the Legacy Survey of Space and Time.

1.3 Goals and Objectives

These are similar to our construction goals outlined in LDM-294. Rubin Data Management Operations will:

- Produce the data products as outlined in LSE-61
- Maintain and improve data production mechanisms.
- Maintain and improve data access mechanisms.
- Maintain and improve data abstraction mechanisms.
- Assess current and operations-era technologies for use in providing engineered solutions for Vera C. Rubin Observatory .
- Maintain appropriate cybersecurity measures throughout Vera C. Rubin Observatory and especially on external facing services.
- Document the operational procedures associated with using and maintaining DM capabilities.
- Evaluate, select, recruit, hire/contract and direct permanent staff, contract, and in-kind resources in Rubin and from partner organizations participating in DM initiatives.

The goals in selecting and, where necessary, developing Rubin software solutions are:

- We prefer to acquire and configure existing, off-the-shelf, solutions. Where no satisfactory off-the-shelf solutions are available, we develop the software and hardware systems necessary to meet our objectives. This extends into maintenance where we will continue to probe choices and may replace custom systems with off-the-shelf solutions where appropriate.
- The software architecture is actively managed at the subsystem level. A well engineered and cleanly designed codebase is less buggy, more maintainable, and makes developers who work on it more productive. We continue to follow and maintain the developer guide¹.
- Other than when prohibited by licensing, security, or other similar considerations, all newly developed source code, and in particular that pertaining to scientific algorithms, is public. Our primary goals in publicizing the code are to simplify reproducibility of LSST data products and to provide insight into algorithms used. Achieving these goals requires that the software must be properly documented.
- Background decision material on choices made will be documented in technical notes with "DMTN", "RTN" or similar series handles. (see `lsst.io`)

2 Architecture

The construction era DM architecture is defined in LDM-148.

As stated in the introduction our operational goals now include production of the data products. In broad terms we may think of two prongs in data management: Data Production and Data Serving. This is depicted in Figure 3.

We also now have three operational data facilities for data release production and a Cloud Facility on Google for the science users. This is all depicted in Figure 1.

Details about the build up the data facilities is given in RTN-021.

3 Functionality based teams and organisation

While Figure 2 Shows the reporting structure Figure 3 puts this more in a operations concept. We consider the main functions to be Data Production and Data Serving,

¹`developer.lsst.io`

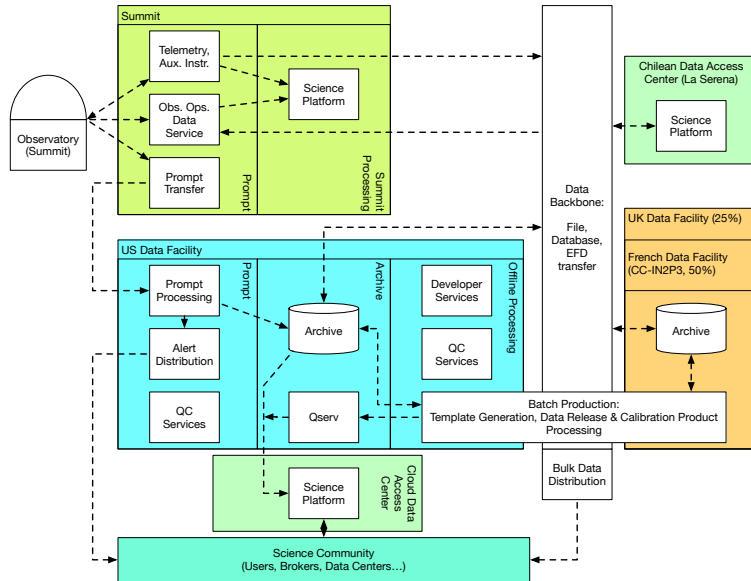


FIGURE 1: Simplified operations architecture for Data Management.

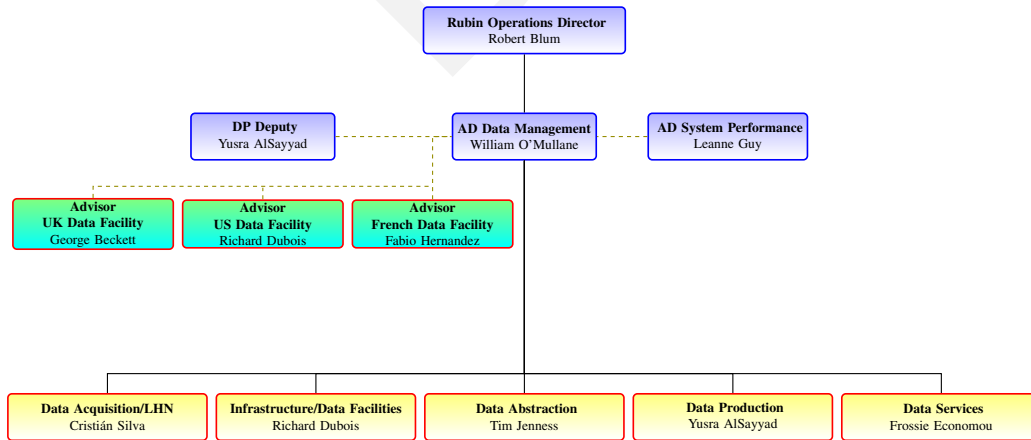


FIGURE 2: Reporting lines in Data Management Operations.

these are supported by the data abstraction team and the data facilities.

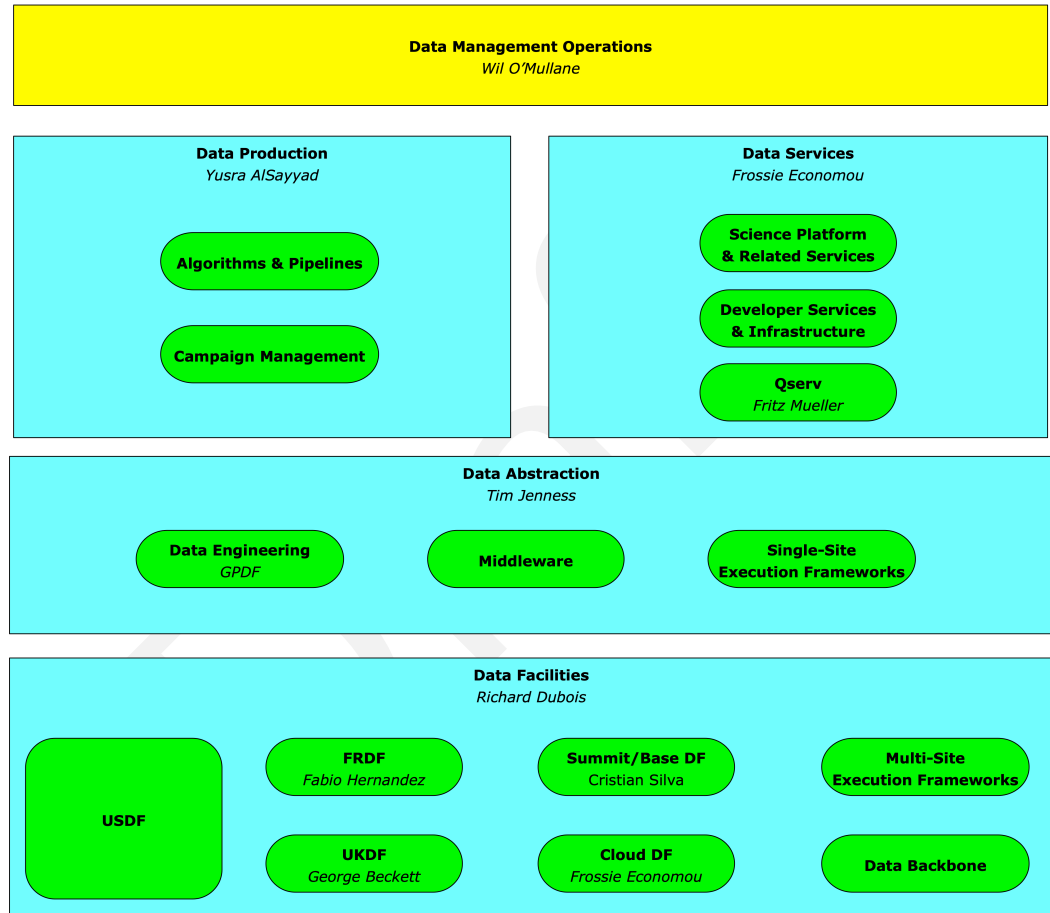


FIGURE 3: Functions in operations of Rubin Data Management.

3.1 Data services

All services associated with data serving are in this group. As depicted in Figure 3 this includes:

- The Science Platform
- Developer Services Infrastructure
- Qserv advanced Database
- The Engineering Facilities Database

A more complete list of items under may be found in the section 7

3.2 Data Acquisition and Long Haul Networks

After the camera team close the shutter and they read out an image and put header on it. From this point on Data Management take that image process, store and transmit it to the USA..

The hardware and software infrastructure for doing this and for running all telescope control software is part of the Summit facility. The Chile DevOps team delivers and maintains the base and summit facilities (see subsection 4.5).

The team provides networking and machines plus a kubernetes layer ready for deployment of services from data management as well as telescope and site software.

On the summit there are also some bare metal machines which are setup usually with puppet.

This team also controls the more classic IT support for desktops and laptop connections etc.

3.3 Making Data

All services associated with data making are in this group. As depicted in Figure 3 this includes:

- The Science Pipelines code
- Execution of science pipelines to produce data products
 - Alert production
 - Data Release Production

A more complete list of items under may be found in the section 7

3.4 Data Abstraction

Underpinning Data Making and Data Serving is out abstraction of data and services. This includes middleware such as butler and batch production systems etc. But also Prompt Processing execution and Data engineering. It is crucial for our system portability to maintain the abstraction layer.

A comprehensive list is given in section 7.

Some of these require a little more discussion here.

3.4.1 Data Engineering

- Support the metadata translation infrastructure (astro_metadata_translator) and monitor correctness of FITS headers.
- Advise on file formats and file metadata for all systems writing files that are to be archived.
- Support the Felis system for specifying schemas.
- Define the data models for everything in the consolidated database. (“global data model” schema?)
- Write and support code that populates the consolidated database (for example, code that analyzes the EFD and creates the “exposure” and “visit” tables).
- Gregory Dubois-Felsmann is product owner (“Data Scientist”)
- Staffing: tiny in construction. 0.5 FTE in ops + fractional GPDF.

3.4.2 Middleware Assumptions

As can be seen in the product list there are a lot of elements to Middleware. A few assumptions are made.

- Assumes butler/Rucio integration is entirely handled by the infrastructure team.
- Assumes database administration is done by the infrastructure team.
- Staffing: 0.5 Andy S; 0.5 new NateP; NateL 0.25; Matthias 0.5; MichelleG 0.5; Kowalik 0.25; at least 0.25 PanDA ongoing person for ctrl_bps_panda.

4 Data facilities and access centers

Hardware underpins all of our operations. This is arranged in three data facilities in US, UK and France as outlined below. We also have two on project Data Access Centers to provide services to the scientific users.

The plan for building up the data facilities is in RTN-021. A more complete list of items under may be found in the section 7

4.1 USDF

The USDF will be the main archive of Rubin data. It performs the daily processing of data including alert generation. It performs 25% of th DRP processing. There is a full description in DMTN-189. User batch will run at the USDF [DMTN-223].

4.2 FrDF

The French Data facility will hold a copy of the Raw data. The FRDF will run 50% of the DRP processing.

4.3 UKDF

The FRDF will run 25% of the DRP processing.

4.4 US DAC

The USDAC is hosted on Google Cloud. Most image data remains at USDF but some catalogs and possibly coadds will be kept on Google. All User files spaces and the RSP will be on google [DMTN-209].

4.5 Chile facilities

There are facilities at the base and the summit in Chile.

4.5.1 Summit Facilities

We maintain a data center on the summit of cerro Pachon. A large part of this is a kubernetes cluster which runs the control system components (CSCs) and the science platform to allow the team access to the images coming of the cameras. There are many other machines for individual control - mostly within the data center though some are physically close to the devices they control. We are responsible for all fibre cabling and networking within the facility to allow interconnection of the equipment.

4.5.2 Base Facilities

Within the NOIRLab base data center we maintain a full DAQ and ancillary machines for testing the control system. This is detailed in .. ITTN-00 The base facility is also where our DWDM connects to the summit and to the LHN . Finally some virtual machines run here for services and backups of services in the US such as email.

4.5.3 Chile DAC

The Chilean Data Access Center will be built after operations commences. Some discussions are still pending on its exact shape see LDM-572. This will be hosted in the base data center.

5 Project Controls

DM operations tracks work and milestones in Jira following RTN-005.

Risk management follows the Operations risk management plan [RDO-71].

Security is covered in O'Mullane et al. (RTN-030).

Disaster recovery is covered in various documents:

- ITTN-058 covers Disaster Recovery for Infrastructure Support Devices
- ITTN-057 covers Disaster Recovery for Computing
- ITTN-056 covers Disaster Recovery for the Network

5.1 Work Breakdown Structure

Table Table 1 gives the WBS structure for DM in operations.

Table 1: WBS elements for Rubin Observatory Data Management Operations

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6 Roles and Responsibilities

Table 2: Management roles for Rubin Observatory Data Management Operations

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6.1 Data Serving Roles

Table 3: SQuARE roles for Rubin Observatory Data Management Operations

WBS	Role Title	Role Description
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3.10a	Technical Lead/Manager	Responsible for technical leadership and management of the Service Quality and Reliability Engineering Team. This includes running stand ups and looking after budgets and staff issues as well as making technical calls where decisions are needed. The technical lead is responsible overall for the architecture of the team's services and for ensuring it is fit for purpose for the observatory's evolving needs. They also represent the team's work both inside the organization and to the astronomical and computing technical community.
3.10b.1	Senior Full Stack and Documentation Engineer - NOIRLab	A Senior Full-Stack Engineer is a DevOps Engineer who is versed in architecture and implementation of both backend and frontend architectures. They are able to synthesize requirements, propose system architectures and independently implement services. They have advanced skills in DevOps engineering, including Continuous Deployment and Infrastructure As Code, and must also be able to improve the infrastructure and debug problems which can span hardware, network and operating system all the way to the end user delivered service. A Documentation Engineer is well versed in architecting effective ways to support documentation oriented workflows such as documentation continuous delivery systems and integration with communication platforms. They have advanced skills in service implementation and deployment, familiarity with documentation infrastructure libraries such as Sphinx, and best practices in software documentation, including code-level, package-level and user guides.
3.10b.2	Security Architect / Senior DevOps Engineer - NOIRLab	A Security Architect is a software engineer with advanced expertise in designing and building software services with particular regard to security concerns such as authentication & authorization, hardening, auditability, penetration testing and dependency management. A Senior Devops Engineer has advanced skills in DevOps engineering, including Software Engineering, Continuous Deployment and Infrastructure As Code, and must also be able to improve the infrastructure and debug problems which can span hardware, network and operating system all the way to the end user delivered service.

3.10c.1	Front End Engineer / Senior Front End Engineer - NOIRLab	Front-end engineers with strong javascript skills, web services architecture, user interface design and astronomical search and visualisation to focus on the Science Platform portal. At least one of these FTEs needs to be at IPAC at a senior engineer level to reflect our current technical investment in Firefly and coordinate effort appropriately in conjunction with other IPAC Firefly development. An appropriately skilled FTE may be found elsewhere or may be added to an IPAC subcontract if available
3.10c.2	Front End Engineer / Senior Front End Engineer - IPAC	Front-end engineers with strong javascript skills, web services architecture, user interface design and astronomical search and visualisation to focus on the Science Platform portal. At least one of these FTEs needs to be at IPAC at a senior engineer level to reflect our current technical investment in Firefly and coordinate effort appropriately in conjunction with other IPAC Firefly development. An appropriately skilled FTE may be found elsewhere or may be added to an IPAC subcontract if available
3.10d.1	Science Platform & Production Services Engineer	A Science Platform and Production Services Engineer is responsible for identifying and resolving issues with production services, including user-facing services such as the Science Platform as well as facility services (such as deployments of the Science Platform at the telescope summit). They are also responsible for evolving services on the basis of rapidly changing user demand, for example the JupyterLab-based component of the Science Platform. They have strong software engineering skills including coding, testing and service deployment and can perform technical work in an independent manner.

3.10d.2	Services Architect / Senior DevOps Engineer	<p>A Services Architect is a software engineer with advanced expertise in designing and building software services with particular regard to scalability, performance, deployment infrastructure and interface design. They are able to synthesize requirements, propose system architectures and independently implement services. A Senior Devops Engineer has advanced skills in DevOps engineering, including Software Engineering, Continuous Deployment and Infrastructure As Code, and must also be able to improve the infrastructure and debug problems which can span hardware, network and operating system all the way to the end user delivered service.</p>
3.10d.3	Intern	Intern
3.10e.1	Senior Scientific Programmer / Data Exploration Specialist	<p>A Senior Scientific Programmer has deep domain expertise and is adept in capturing and implementing data analysis solutions. Their scientific background allows them to anticipate user data exploration needs and other requirements and to effectively communicate them to other engineers on their team. A Data Exploration Specialist communicates data exploration needs to the engineers, documents and develops tools, demonstrates how to achieve scientific goals with the tools provided. This would explicitly include technical consultations to the Community Science Team and EPO scientists. Their scientific background allows them to translate the technical needs of the users of services (external and internal) into an engineering request, as well as functioning as liaison to other interrelated systems (in particular Middleware and Infrastructure) to which Science Platform services have a dependence.</p>

3.10e.2	Senior Devops Engineer / Data Engineer - NOIRLab	<p>A Senior Devops Engineer has advanced skills in DevOps engineering, including Software Engineering, Continuous Deployment and Infrastructure As Code, and must also be able to improve the infrastructure and debug problems which can span hardware, network and operating system all the way to the end user delivered service. A Data Engineer is a software engineer with the ability to model and abstract data flow and representation, as well as design and implement appropriate systems for the effective curation and visualisation of particular kinds of data (eg. time series). A Data Exploration Specialist communicates data exploration needs to the engineers, documents and develops tools, demonstrates how to achieve scientific goals with the tools provided. This would explicitly include technical consultations to the Community Science Team and EPO scientists. Their scientific background allows them to translate the technical needs of the users of services (external and internal) into an engineering request, as well as functioning as liaison to other interrelated systems (in particular Middleware and Infrastructure) to which Science Platform services have a dependence.</p>
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3.10e.3	Senior Devops Engineer / Data Engineer - SLAC	<p>A Senior Devops Engineer has advanced skills in DevOps engineering, including Software Engineering, Continuous Deployment and Infrastructure As Code, and must also be able to improve the infrastructure and debug problems which can span hardware, network and operating system all the way to the end user delivered service. A Data Engineer is a software engineer with the ability to model and abstract data flow and representation, as well as design and implement appropriate systems for the effective curation and visualisation of particular kinds of data (eg. time series). A Data Exploration Specialist communicates data exploration needs to the engineers, documents and develops tools, demonstrates how to achieve scientific goals with the tools provided. This would explicitly include technical consultations to the Community Science Team and EPO scientists. Their scientific background allows them to translate the technical needs of the users of services (external and internal) into an engineering request, as well as functioning as liaison to other interrelated systems (in particular Middleware and Infrastructure) to which Science Platform services have a dependence.</p>
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Table 4: Qserv roles for Rubin Observatory Data Management Operations

WBS	Role Title	Role Description
3.11a	Qserv Lead	Coordinates development efforts for Qserv (coordinating efforts with other teams, balancing priorities, facilitating descisions, detailed work assignments, reporting, etc.)
3.11b	Database Engineer (Qserv) - SLAC	Develops, maintains, and implements the science Databases e.g. QSERV database, data butler, Prompt Products Database. May also work on other middleware as needed.

3.11c	Dev/Ops Software Engineer - IN2P3	Develops, maintains, and implements DF software, including: QSERV database, data butler, DAX, Alert Filtering Service, orchestration software, workflow software, data backbone software, integration testing framework, authentication services, pipeline construction tools, operational fabric codes, logging, messaging, monitoring and health and status software, hosting environment for Rubin Observatory Data Space, Data Space batching services, and bulk export to other sites.
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6.2 Data Production Roles

Table 5: Data Production roles for Rubin Observatory Data Management Operations

WBS	Role Title	Role Description
3.6a	Pipeline Middleware Lead	Organizes the software maintenance effort and assigns work in a way that provides for continuity of maintenance for all Rubin Observatory maintained software. Is primarily responsible for further defining and enforcing software engineering rules related to maintenance, including maintenance of documentation, correct security practices, testing, and other aspects of delivery of a complete change set. Ensures that software tasks are consistent with authorized changes. Carries share of maintenance load. Participates in reviews.
3.6b.1	Pipeline Middleware Engineer - NOIRLab	Develops, maintains, and implements pipeline and workflow software, including: Data Butler, orchestration software, workflow/workload software, integration testing framework, pipeline construction tools, and pipeline infrastructure libraries.
3.6b.2	Pipeline Middleware Engineer - SLAC	Develops, maintains, and implements pipeline and workflow software, including: Data Butler, orchestration software, workflow/workload software, integration testing framework, pipeline construction tools, and pipeline infrastructure libraries.

Table 6: Algorithm and Pipeline roles for Rubin Observatory Data Management Operations

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Table 7: Campaign Management roles for Rubin Observatory Data Management Operations

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6.3 Data Abstraction Roles

Table 8: Data Engineering roles for Rubin Observatory Data Management Operations

WBS	Role Title	Role Description
3.7a	Data Scientist	Hold project history on data models etc and guide VO developments
3.7a	Data Scientist	Hold project history on data models etc and guide VO developments
3.7b.2	Data Engineer - SLAC	Develops, maintains, and implements pipeline and workflow software, including: Data Butler, orchestration software, workflow/workload software, integration testing framework, pipeline construction tools, and pipeline infrastructure libraries.
3.7b.2	Data Engineer - SLAC	Develops, maintains, and implements pipeline and workflow software, including: Data Butler, orchestration software, workflow/workload software, integration testing framework, pipeline construction tools, and pipeline infrastructure libraries.
3.7b.3	Data Engineer - NOIR-Lab	TBD

3.7c.1	Build Engineer	Maintain and improve the builds for the various Data Management Operations software products. This includes fixing the continuous integration builds and improving the packaging system (currently aiming for Conda but could potentially move to another system over ten years). With hundreds of packages this is not a trivial task. This role would also support the observatory software builds which could potentially remain different to the Data Management Operations builds.
3.7c.2	Build Engineer - AAL	Maintain and improve the builds for the various Data Management Operations software products. This includes fixing the continuous integration builds and improving the packaging system (currently aiming for Conda but could potentially move to another system over ten years). With hundreds of packages this is not a trivial task. This role would also support the observatory software builds which could potentially remain different to the Data Management Operations builds.

Table 9: Pipeline Middleware roles for Rubin Observatory
Data Management Operations

WBS	Role Title	Role Description
3.6a	Pipeline Middleware Lead	Organizes the software maintenance effort and assigns work in a way that provides for continuity of maintenance for all Rubin Observatory maintained software. Is primarily responsible for further defining and enforcing software engineering rules related to maintenance, including maintenance of documentation, correct security practices, testing, and other aspects of delivery of a complete change set. Ensures that software tasks are consistent with authorized changes. Carries share of maintenance load. Participates in reviews.
3.6b.1	Pipeline Middleware Engineer - NOIRLab	Develops, maintains, and implements pipeline and workflow software, including: Data Butler, orchestration software, workflow/workload software, integration testing framework, pipeline construction tools, and pipeline infrastructure libraries.

3.6b.2	Pipeline Engineer - SLAC	Middleware	Develops, maintains, and implements pipeline and workflow software, including: Data Butler, orchestration software, workflow/workload software, integration testing framework, pipeline construction tools, and pipeline infrastructure libraries.
3.6b.3	Pipeline Engineer - NOIR-Lab/NCSA	Middleware	Develops, maintains, and implements pipeline and workflow software, including: Data Butler, orchestration software, workflow/workload software, integration testing framework, pipeline construction tools, and pipeline infrastructure libraries.
3.6b.4	Pipeline Engineer - NOIR-Lab/Princeton	Middleware	Develops, maintains, and implements pipeline and workflow software, including: Data Butler, orchestration software, workflow/workload software, integration testing framework, pipeline construction tools, and pipeline infrastructure libraries.

6.4 Data Facility Roles

Table 10: Chile Summit and Base Facility roles for Rubin Observatory Data Management Operations

WBS	Role Title	Role Description
3.5a	Chilean DevOps Technical Lead/Manager	Responsible for technical leadership and management of the Chilean DevOps Support Team, including planning and overseeing the installation, operation and maintenance of all Chilean computing hardware. This includes all summit hardware, networks and cabling. The summit systems are run as infrastructure through service deployment; the Chilean devops team must maintain a deployment ready layer (foreman, puppet, kubernetes) for software teams to work with. This also includes maintaining the camera test stands in Chile and in Tucson in a similar as that for the summit. Interface with NOIRLab COS-IT to coordinate delivered IT services such as helpdesk and network support. Work with the I&S Team's DF/DACs Technical Coordinator to build the Chilean DAC into the Rubin DAC Network.

3.5b.1	Chilean DevOps Engineer	Responsible for the installation, operation and maintenance of all Chilean and test stand (Tucson) computing hardware. This includes guidance on technical decisions for technology both in terms of hardware and software. This may require negotiation/persuasion of COS/IT to support desired Rubin technology in the future and open mindedness to offered solutions from NOIR-lab. Training and inclusion of less experienced staff is an essential part of this role.
3.5b.2	Surge Chilean DevOps Engineer Cover	Responsible for the installation, operation and maintenance of all Chilean and test stand (Tucson) computing hardware. This includes guidance on technical decisions for technology both in terms of hardware and software. This may require negotiation/persuasion of COS/IT to support desired Rubin technology in the future and open mindedness to offered solutions from NOIR-lab. Training and inclusion of less experienced staff is an essential part of this role.
3.5c	DevOps Security Analyst	Responsible for the analysis of logs, threats and develop local policies to anticipate and protect against potential threats. The analyst should also be responsible to create and maintain protocols, processes, and procedures to guard against cyber threats, unauthorized access, and data breaches, all under the DevOps environment of Rubin observatory

Table 11: USDF roles for Rubin Observatory Data Management Operations

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Table 12: FRDF roles for Rubin Observatory Data Management Operations

WBS	Role Title	Role Description
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Table 13: UK roles for Rubin Observatory Data Management Operations

WBS	Role Title	Role Description
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6.5 DM support in Operations

DM is not responsible for critical systems and hence would work *normal hours* which nominally would be 09:00 to 17:00 Pacific. One may consider *normal hours* in operations may be different and the DM Chile DevOps team will work Chile hours and provide early nighttime support.

We do have DM people in various timezones which may give more coverage however the range of functionality is vast and not everyone can support all of it.

6.6 On-Call Support for Prompt Processing

DM is required to deliver 98% of detectable alerts within the required latency. Loss of a single night represents a sizable portion of this budget, so on-call support of Alert Production and Prompt Processing will necessary throughout operations.

LSR-REQ-0025

DM will use a multi-tier triage and on-call system to meet this requirement. Automated metrics systems will raise alarms when images are taken and alerts are not being sent. These will be initially handled by a triage worker on-shift; ideally this work can be split between the US West Coast and/or Europe to minimize shift work after midnight local time. We will develop a playbook to enable the triage to resolve some issues themselves, but it may be necessary for them to page other DM staff members in an on-call rotation to debug more serious problems. Experience suggests that in steady state operations most sustained problems will be due to failures of services, databases, and networks rather than the algorithmic pipeline components.

The Observing Specialists at the summit should also be involved: in particular, in case of a failure of the Long-Haul Networks, images may be taken at the summit but no alerts produced. We will implement a status display at the Summit that will indicate if alerts are not being sent for the images being recorded. In case of sustained outages the observers may backstop the automated alerts by contacting the triage and on-call staff through appropriate channels.

Members of the triage and on-call team will be drawn from throughout DM, and will include expertise from the Data Facility, Campaign Management, Data Abstraction,

and Algorithms & Pipelines. The current Campaign Management pilot for Alert Production will be responsible for maintaining and overseeing the on-call rotation.

Where possible we will use tooling to reduce the risk of downtime, for example by running an automated integration test prior to the start of observing to identify potential new failures due to changes in the deployed pipelines and services. Problems identified can then be fixed during regular working hours.

6.6.1 Out of hours - best effort

DM is committed to supporting the software we developed. Most DM software, apart from Prompt Processing, is not particularly time sensitive.

There are other products build by DM such as the EFD which are critical for which an arrangement needs to be made with TSSW since it is a summit system. There is a discussion of this and other summit items in RTN-069.

Several of us are available out of hours and look at problems when they arise however there is no guaranteed support out of hours.

If we do on call on best effort basis we should agree on some ground rules. Institutionally it may be difficult to formalize these . These might be:

- Should an individual get called out of hours they would not need to be in any meetings or workplace the following morning.
- Any hour worked out of hours may be taken as 1.5 hours leave at another point in time.
- If requested specific mobile phones for on call should be provided (may be hard given our distributed nature).

7 Products

Product	Manager	Owner	Notes
DM Ops	Wil O'Mullane		Data Management (Ops)
Data Abstraction	Tim Jenness		Data Abstraction
Build Engineering	Tim Jenness		Build Engineering
Data Eng	Gregory Dubois Felsmann		Data Engineering
Felis	TBD		Felis
Metadata	TBD		Metadata
Pipe Middleware	Tim Jenness		Pipeline Middleware
Sis Exec	TBD		Single-site Exec
OCPS	KT Lim ?		Observatory Controlled Processing System

Prompt f/ w	TBD		Prompt forwarder
s3daemon	TBD		s3 object transfer daemon
BPS	TBD		BPS
Butler	Tim Jenness	Y (Jim B)	Butler
Control Interface	TBD		Control Interface
ctrl_bps	TBD		ctrl_bps
ctrl_mpexec	TBD		ctrl_mpexec
user batch envelope	TBD		user batch envelope
Pipeline interfaces	TBD		Pipeline interfaces
pex_config	TBD		pex_config
pipe_base	TBD		pipe_base
EUPS	TBD		EUPS and EUPS.lsst.code
Data Acquisition LHN	Cristian Silva		Data Acquisition and Lonf Haul Networks
Chile DevOps	Cristian Silva		Chile DevOps
Data Facilities	Richard Dubois		Data Facilities
Data Curation	TBD		Data Curation
Data Backbone	TBD		Data Backbone
Backups	TBD		Backups
Bulk Download	TBD		Bulk Download
Consolidated DB	TBD		Consolidated DB
Butler repos	TBD		Butler repos
Rucio	TBD		Rucio
OODS	Steve Pietrowicz		Observstory Operations Data System
Infrastructures	TBD		Infrastructures
CDAC	Frossie Economou		Chile Data Access Center
FrDF	Fabio Hernandez		French Data Facility
SDF	Cristián Silva		Summit and Base Data Facility
UKDF	George Beckett		UK Data Facility
USDF	TBD		US Data Facility
trans embargo	TBD		Transfer Embargo
Multi-site & User Exec	TBD		Multi-site & User Exec
PanDA	TBD		PanDA
User Batch	TBD		User Batch
UWS	KT Iim		Universal Worker Service
Data Production	Yusra ALSayyad		Data Production
Campaign Management	?	Y (N/ A)	Campaign Management
Algorithms & Pipelines	Yusra ALSayyad	? (Jim Bosch)	Algorithms & Pipelines:In ops our construction POs (JimB+EricB) become our group leads, so PO prob not necessary.
Data Services	Frossie Economou		Data Services
Complex. DB	Fritz Mueller	Y (Colin)	Complex Database Support:Should this be complex Databases or somethign ? Qserv under
Big Databases	Fritz Mueller		Big Databases
PromptDV	TBD		Prompt Products DB
Qserv	Fritz Mueller		Qserv
User Databases	TBD		User Databases
SQuaRE	TBD		SQuaRE
Doc Services	TBD		Doc Services

Documentation standards	TBD		Documentation standards
LtD	TBD		LtD
Templating	TBD		Templating
Phalanx	TBD		Phalanx
Authorisation	TBD		Authorisation
Reliability Engineering	TBD		Reliability Engineering
Secrets	TBD		Secrets
Planned Obs.	Willam O'Mullane		Planned Observation Publication
RSP	TBD		Rubin Science Platform
APIs		Y (GPDF)	APIs:IVOA and non-VO Apis
data.lsst.cloud	TBD		data.lsst.cloud
Authentication			Authentication:and security engineering
Notebook		Y (KSK)	Notebook
Portal		Y (GPDF)	RSP Portal
Square One	TBD		Square One
User Support			User Support:clo service and helpdesk
Sasquatch	TBD		Sasquatch
EFD	TBD		EFD
Metrics	TBD		Metrics
Telemetry Gateway	TBD		Telemetry Gateway

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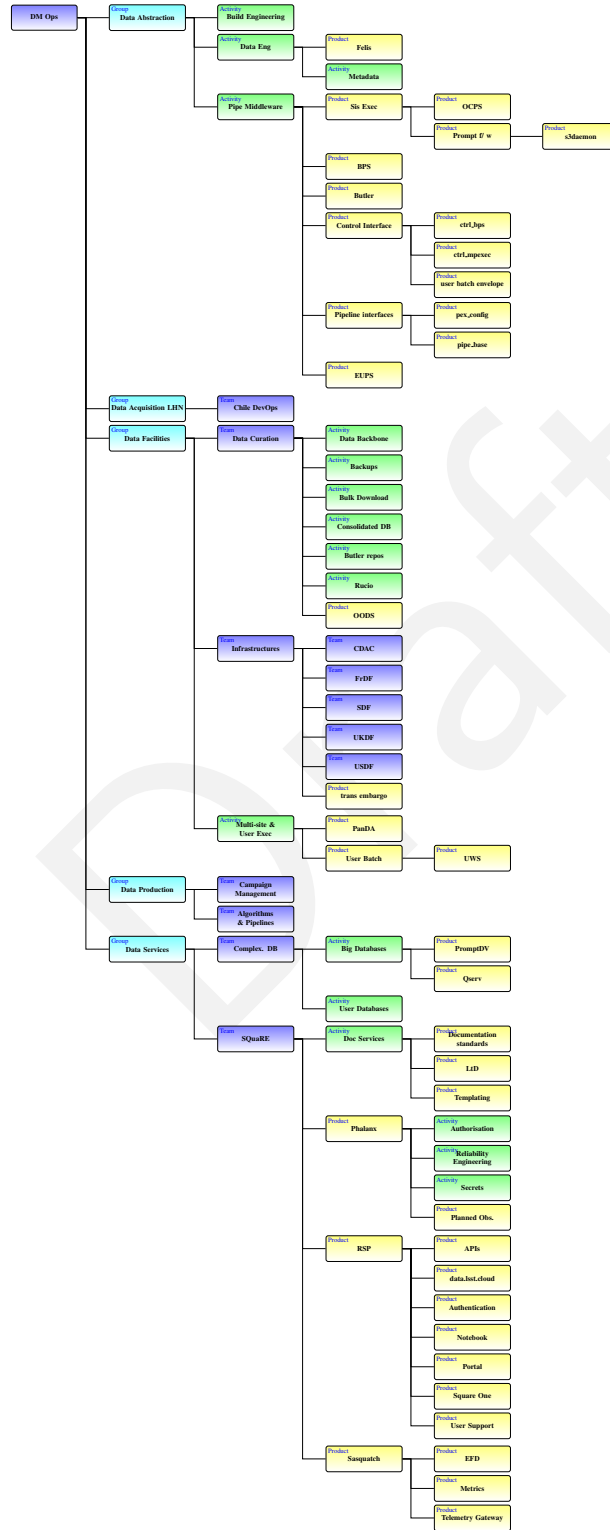
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B Acronyms

Acronym	Description
B	Byte (8 bit)
BPS	Batch Production Service
CDF	Cumulative Distribution Function
DAC	Data Access Center
DAQ	Data Acquisition System
DB	DataBase
DF	Data Facility
DM	Data Management
DMTN	DM Technical Note
DP	Data Production
DRP	Data Release Processing
DWDM	Dense Wave Division Multiplex
EFD	Engineering and Facility Database
EUPS	Extended Unix Product System
FITS	Flexible Image Transport System
FRDF	French Data Facility
FTE	Full-Time Equivalent
FrDF	French Data Facility
IT	Information Technology
ITTN	IT Technote
IVOA	International Virtual-Observatory Alliance
LDM	LSST Data Management (Document Handle)
LHN	long haul network
LSE	LSST Systems Engineering (Document Handle)
LSST	Legacy Survey of Space and Time (formerly Large Synoptic Survey Telescope)
NOIRLab	NSF's National Optical-Infrared Astronomy Research Laboratory; https://noirlab.edu
OCPS	OCS Controlled Pipeline System
OODS	Observatory Operations Data Service
OPS	Operations
PO	Program Operations

PanDA	Production ANd Distributed Analysis system
RSP	Rubin Science Platform
RTN	Rubin Technical Note
SQuaRE	Science Quality and Reliability Engineering
TBD	To Be Defined (Determined)
UK	United Kingdom
UKDF	United Kingdom Data Facility
US	United States
USA	United States of America
USDAC	United States Data Access Center
USDF	United States Data Facility
UWS	Universal Worker Service (IVOA standard)
VO	Virtual Observatory
VRO	(not to be used)Vera C. Rubin Observatory
WBS	Work Breakdown Structure
bps	bit(s) per second