

Implementation and impacts of DM scope options.

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1 Introduction

DM has been asked how we can save 10% of its remaining cost (\approx \$7M). The official scope options which one might invoke are listed in LPM-72, but we have also identified some further possibilities which are described in this document. This note also discusses the practical aspects of invoking these options.

We have identified three viable cost saving options in 2018, of which two are not in the currently baselined version of LPM-72:

- Eliminate portal aspect of science platform (DM-10; refer to Section 2).
- Reduce quality of data facility services provided to the construction project (DM15; refer to Section 3).
- Move staff from institutions to AURA posts (DM16; refer to Section 4).

In addition there are other tasks which may be delayed, thus keeping them available as options which may be invoked later. These are:

- Delay base center operation in Chile (keeps DM13 available, and saves money on operational costs).
- Delay development of the mini broker.
- Return some budget from DAX.

All of this will be rolled up in one or more LCRs in the not too distant future.

2 DM10: Science Platform Portal

A detailed run through specific requirements for the portal is given in Appendix C. Many of the front end requirements are currently met and others may be questioned, however invoking this option introduces some risk that science may be lost. We should be clear that effectively removing one of our development groups is disruptive to the DM project, especially after a review which approved the new budget and schedule which we have been following well.

Concretely we would reduce the effort expenditure on the Portal and Firefly from IPAC to about 0.2 FTE over a period of four to five months. We would continue the IPAC support for DM Architecture and the Science Platform Scientist.

If we follow DM10 to the letter, we would eliminate the Portal and this would mean a reduction in support of the broad science community, especially novice and casual users. Hence we would rather keep the portal in its current incarnation, pause development, and then restart closer to the initial need date for a portal (DR1). At this point, we would take the opportunity to evaluate the then-available technology for the Portal.

The LSST EPO subsystem also needs a portal (Section 2.1) and has already decided that Firefly is not a suitable technology. A consideration of possible alternatives is already underway. Within the AURA family, STScI and NOAO have portals. We have concerns about their capabilities and usability and believe that the current version of the LSST Portal is more advanced and suited to science goals of LSST, but perhaps those could be addressed with appropriate directives from AURA and synergy with LSST.

The existing system is adequate for the analysis of commissioning data. We would therefore target the availability of DR1 for the launch of an updated portal. The other area of potential concern is the front end for the alert subscription in the mini broker. This should be a thin veneer on the mini broker API and is also not needed until start of operations.

Given the above we would reserve \$1M for the later development of an updated portal for DR1. We would not go to zero immediately to allow IPAC to adjust accordingly. Plus we would keep some level of effort — say, 0.2 FTE — for bug fixes on the existing portal. An LCR will provide detailed costings, but initial estimates are that this will save at least \$2M. We believe the final impact on science is minimal.

2.1 EPO Skyviewer

The EPO equivalent of the DM Portal is called the Skyviewer. All EPO requirements including Skyviewer, are listed in LSE-89 which will be updated in the coming months. A few relevant requirements, particularly for Skyviewer, are listed below as well as more descriptive text based on the results of our market research, conducted during 2017 and early 2018.

The current EPO Skyviewer Design is on confluence <https://confluence.lsstcorp.org/x/kYGuBQ>.

The Skyviewer is intended for a general, non-specialist audience. Providing context for the data displayed through the Skyviewer enables meaningful and engaging user experiences and is part of the mission of EPO. The Skyviewer will display color images of the LSST sky and allow users to pan and zoom, and access additional information for individual objects. The Skyviewer will allow for guided or freeform exploration and will connect users to other features of the website that encourage deeper engagement, like citizen science projects, articles, or interactive notebooks (either html or Jupyter).

2.1.1 Requirements on Skyviewer

- EPO-REQ-0191: The Skyviewer image tiles shall be in color.
- EPO-REQ-0192: The Skyviewer will be mobile-friendly.
This is an important distinction between the DM Portal and the EPO Skyviewer. DM users will be happy with this but of course it may limit some functionality on the full screen version.
- EPO-REQ-0193-197 are about navigation - pan and zoom with keyboard, touchpad, mouse
- EPO-REQ-0197-198 Can select single object. Selection of single object presents *Object Page* with more info (EPO-REQ-0199) such as:
 - an object ID (EPO-REQ-0200),
 - coordinates (EPO-REQ-0131),
 - small image cutout (EPO-REQ-0201),
 - an animated sequence of images if they exist (EPO-REQ-0159),
 - alert stream data, if they exist (EPO-REQ-0202),
 - light curve data, if they exist (EPO-REQ-0203),

- link to other VO info (EPO-REQ-0204, EPO-REQ-0205)
- definitions for unfamiliar terms
- EPO-REQ-0156: EPO will present to users a list of curated objects to explore.
 - Listicles like “10 Beautiful Galaxies” or “Near Earth Objects” appeal to a non-scientist audience and provide context around the common “what now?” question.
 - EPO audiences are interested in search capabilities but will not know coordinates or specifics for queries. Instead, they will want a familiar “google-like” search bar to find the “faintest star seen” or “most distant galaxy”, for example.
 - Automatically highlighting interesting objects that are in the view of the user at any given time by circling them, displaying thumbnail images of these objects in a side panel, and providing further information (i.e. object pages with light curves, comparisons to similar objects). This type of UI design is more similar to World Wide Telescope than other existing options EPO has so far investigated (more on this below).
 - many of these features may require back end work similar to DMS-PRTL-REQ-0009 to 38, Async Queries, Spatial, Id etc.

All of these are compatible with the DM requirements, relevant DM requirements are in Appendix C.

2.1.2 Requirements related to Alerts

- EPO-REQ-0157: Graphic overlay of the Alert Stream will be presented
- EPO-REQ-0158: Filtering options will allow users to select different alert data criteria to adjust their graphic overlay

This functionality was not required in DM - we do have requirements for alert filter selection not covered in EPO.

2.1.3 Other considerations

Embedding the Skyviewer inside other web pages such as articles or as a supplement to press releases is a nice-to-have feature not currently described in the requirements.

There are currently no EPO requirements related to transferring between the Skyviewer and notebooks, or even selecting more than a single object (ie. nothing similar to DMS-LSP-REQ-0010: Transfer between portal and notebook.)

2.1.4 Existing Technologies

EPO has investigated existing technologies that could power the Skyviewer, including Aladdin lite, World Wide Telescope (WWT), and Google Sky. While WWT aligns most closely with the user interface design, no commitment has been made and EPO intends to revisit the topic when development is scheduled to begin in FY20 (this timing will be reflected in the upcoming EPO baseline update, planned to be in place by Feb 2019). We believe DM should be involved in this process to see how much we can work together to a single portal even if that is deployed in multiple locations with different data sets. .

3 DM15: Reduce institutional overheads

If we could identify perhaps ten individuals who would move to AURA posts, thus eliminating institutional overheads, we could save potentially \$100k per individual or \$1M per year. It will take months to put this in place of course so we would not get three years of savings. The institutes may complain but we expect this to be minimal. This is a scientifically and functionally painless way to trim the budget, but may cause some disruption for the individuals concerned in the short term.

Potential saving of \$2M or more to end of construction.

4 DM16: Reduce LDF service level

NCSA has been asked to do an impact analysis of a reduction in budget by 20%. This can only be achieved by reducing the staffing level from 20 FTE to 16. This may result in a lower service level for DM development but it probably has no impact on science, except in the realm of reliability. We are awaiting the analysis from NCSA.

Adopting a “cloud computing” based approach may yield further savings. We are currently

prototyping cloud-based deployments of DM systems in conjunction with Google. Assessing the actual cost of this relative to physical hardware at NCSA is difficult; see DMTN-072 for a rough comparison.

A 20% reduction in NCSA costs for the remaining four years of construction is worth about \$3.5M.

A References

- [1] **[LDM-554]**, Dubois-Felsmann, G., Ciardi, D., Mueller, F., Economou, F., 2018, *Science Platform Requirements*, LDM-554, URL <https://ls.st/LDM-554>
- [2] **[DMTR-52]**, Dubois-Felsmann, G.P., 2018, *LDM-503-01 (WISE Data Loaded in PDAC) Test Report*, DMTR-52, URL <https://ls.st/DMTR-52>
- [3] **[LSE-89]**, Emmons, B., Bauer, A., 2018, *Education and Public Outreach Requirements*, LSE-89, URL <https://ls.st/LSE-89>
- [4] **[LPM-72]**, Krabbendam, V., 2015, *Scope Options*, LPM-72, URL <https://ls.st/LPM-72>
- [5] **[DMTN-072]**, O'Mullane, W., Swinbank, J., 2018, *Cloud technical assesment*, DMTN-072, URL <https://dmtn-072.lsst.io>,
LSST Data Management Technical Note

B Acronyms

The following is a complete list of acronyms used in this document.

Acronym	Description
AP	Alerts Production
API	Application Programming Interface
AURA	Association of Universities for Research in Astronomy
DAX	Data access services

DM	Data Management
DMS	Data Management Sub-system
DMTN	DM Technical Note
EPO	Education and Public Outreach
FTE	Full-Time Equivalent
ID	Identifier
IPAC	No longer an acronym
LCR	LSST Change Request
LDF	LSST Data Facility
LDM	Light Data Management
LPM	LSST Project Management (Document Handle)
LSE	LSST Systems Engineering (Document Handle)
LSP	Low System Priority
LSST	Large Synoptic Survey Telescope
NCSA	National Center for Supercomputing Applications
NOAO	National Optical Astronomy Observatories (USA)
SUI	Science User Interface
UI	User Interface
VO	Virtual Observatory
WWT	World Wide Telescope

C Overview of requirements affected by DM-10

LDM-554 enumerates the Science Platform requirements. The labels used here are from that document and are the requirements affected by the scope option. DMTR-52 is a test report on the Science Platform.

Note: The commissioning needs for SUI/Firefly are mostly satisfied in the current version of Firefly. Remaining essential functionality will be addressed in the rampdown period.

- DMS-LSP-REQ-0008, DMS-PRTL-REQ-0004 Semantic linkage - logical links between data shown in portal
 - Have an implementation this but it is going to have to evolve with the data model.

- More work for science users if we do not expend further effort on it
- DMS-LSP-REQ-0010 Transfer between portal and notebook
 - We have a current implementation of this - it could be improved but is sufficient for commissioning needs.
- User Storage - implication of UI for DMS-LSP-REQ-0011 to 18
 - some of this is done.
 - the actual storage implementation is in DAX. This is the interface for the user.
- Portal aspect
 - DMS-PRTL-REQ-0001 Browser access - we have an implementation
 - DMS-PRTL-REQ-0002 Discovery - we have an implementation
 - DMS-PRTL-REQ-0005,6 Calibration and Coadd and Single Epoch access - we have an implementation
 - DMS-PRTL-REQ-0007 access to other VO services - On the list of things to do in ramp down
- Query support
 - DMS-PRTL-REQ-0009 to 38, Async Queries, Spatial, Id etc.
 - * Mainly backend work (i.e. will be addressed by effort in 02C.06) but need some need for supporting interfaces; some of these are available
 - * Other possibilities than bespoke development exist
 - * EPO will have to do many of these as well
 - DMS-PRTL-REQ-0040 to 46 - visualize based in images meta data
 - * We have an implementation - there are also other tools
- Alert and tabular data
 - DMS-PRTL-REQ-0048 to 54 - showing alerts and tabular data
 - * Mostly done
 - * Other tools exist to address these requirements (e.g. Topcat)
 - DMS-PRTL-REQ-0055 to 74 - Graphing, scatter plots, histograms, uncertainties etc..
 - * Arguably we should *not* provide this in the Portal: notebooks and other tools are more appropriate for this.

- * We should look more critically at requirements like this.
- DMS-PRTL-REQ-0075 to 77 - image overlay and color adjustment
 - * This is possible in firefly now
 - * Need in Portal questionable; most scientists will use their own tools.
 - * There are other tools that do this like Visiomatic.
- All Sky DMS-PRTL-REQ-0078 to 88
 - * The bigger job is to make the HiPS maps in processing which is not part of the portal.
 - * There are also other tools (Aladin Lite) which can zoom using HiPS - may not be as nicely integrated
- Exploration and Analysis DMS-PRTL-REQ-0089 to 108
 - Many nice to have things like table filtering, selection from plots, linked plots
 - Again questionable whether we *need* this in the Portal and there are other tools.
 - Not needed for commissioning activities.
- Control and Management DMS-PRTL-REQ-0115 to 118 (some of this is implemented)
 - Preferences, API, quotas...
- Alert support DMS-PRTL-REQ-0119 to 21,27
 - This is not done - mainly since the alert mini broker is not done
 - In the worst case, the simple interface delivered with the mini broker is used and not well integrated.
 - AP could see that as a slight upscope
- Documentation DMS-PRTL-REQ-0122 to 24
 - We have a documentation system www.lsst.io
 - This may not perhaps be as tightly integrated as may be liked.
 - This may be seen as a small upscope for SQuaRE