

# Rubin Observatory

Vera C. Rubin Observatory  
Data Management

## Vera C. Rubin Observatory Network Verification Document

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LDM-732

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## Abstract

The Vera C Rubin Observatory Network Verification Document (VNVD) and associated JIRA V&V Project define the flow-down of specifications from higher level documents to the LSST Observatory Network (as defined in LSE-78 LSST Observatory Network), and the methods and resources that will be used to verify that the networks have met the specifications satisfactory for accepting the Summit Network into DM Subsystem Integration Test (DMSSIT) and LSST System Integration Test (SIT)

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## Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Scope . . . . .	1
1.2	Specification Flow-down . . . . .	1
1.3	LSST Verification and Validation JIRA Project (LVV) . . . . .	2
1.4	Verification and Validation Schedule and Resources . . . . .	2
1.5	Applicable Documents . . . . .	3
<b>2</b>	<b>DM Network Verification Elements</b>	<b>4</b>
2.1	[LVV-71] DMS-REQ-0168-V-01: Summit Facility Data Communications . . . . .	4
2.2	[LVV-73] DMS-REQ-0171-V-01: Summit to Base Network . . . . .	6
2.3	[LVV-74] DMS-REQ-0172-V-01: Summit to Base Network Availability . . . . .	8
2.4	[LVV-75] DMS-REQ-0173-V-01: Summit to Base Network Reliability . . . . .	9
2.5	[LVV-76] DMS-REQ-0174-V-01: Summit to Base Network Secondary Link . . . . .	10
2.6	[LVV-77] DMS-REQ-0175-V-01: Summit to Base Network Ownership and Operation . . . . .	11
2.7	[LVV-81] DMS-REQ-0180-V-01: Base to Archive Network . . . . .	12
2.8	[LVV-82] DMS-REQ-0181-V-01: Base to Archive Network Availability . . . . .	13
2.9	[LVV-83] DMS-REQ-0182-V-01: Base to Archive Network Reliability . . . . .	14
2.10	[LVV-84] DMS-REQ-0183-V-01: Base to Archive Network Secondary Link . . . . .	15
2.11	[LVV-88] DMS-REQ-0188-V-01: Archive to Data Access Center Network . . . . .	16
2.12	[LVV-89] DMS-REQ-0189-V-01: Archive to Data Access Center Network Availability . . . . .	17
2.13	[LVV-90] DMS-REQ-0190-V-01: Archive to Data Access Center Network Reliability . . . . .	18
2.14	[LVV-91] DMS-REQ-0191-V-01: Archive to Data Access Center Network Secondary Link . . . . .	19
2.15	[LVV-183] DMS-REQ-0352-V-01: Base Wireless LAN (WiFi) . . . . .	20
2.16	[LVV-18491] DMS-REQ-0352-V-02: Base Voice Over IP (VOIP) . . . . .	21
<b>A</b>	<b>Traceability</b>	<b>22</b>

<b>B References</b>	<b>23</b>
<b>C Acronyms</b>	<b>24</b>

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# Vera C. Rubin Observatory Network Verification Document

## 1 Introduction

### 1.1 Scope

This plan governs only tests of the network infrastructure, not the applications and services that use the network. To be specific, this plan governs tests of the network only up to ISO OSI Layer [https://en.wikipedia.org/wiki/OSI\\_model](https://en.wikipedia.org/wiki/OSI_model).

As such, all of the tests governed by this plan and defined in the LSST Verification and Validation JIRA Project (LVV) are defined as Lower Level (LL) in the System Engineering test hierarchy. LL corresponds to Data Management Subsystem Integration. Where appropriate, additional comments regarding Same Level (SL) which corresponds to LSST System Integration, and Higher Level (HL) which corresponds to LSST Commissioning, are called out in the Verification Elements.

Note that significant testing of the networks occurs prior to subsystem and system integration, i.e. prior to verification, as documented in document-14789 LSST LHN End-to-End Plan and associated test documentation (see Collection-3758).

Finally, note that one significant network, the Summit Network, is not a DM deliverable and as such is not contained within this plan. As Telescope and Site deliverable, the Summit Network is covered by the Telescope and Site V&V plans.

### 1.2 Specification Flow-down

#### 1.2.1 Data Management Subsystem Requirements Flow-down

The Data Management Subsystem Requirements (LSE-61, aka DMSR) drive the LSST Observatory Network Design for all segments except the Summit Network (see above). The DMSR sections that directly drive the VNVD are listed here for convenience. These DMSR sections contain traceable network requirements as documented in the LSST V&V JIRA Project (LVV) Verification Elements:

- 1.2.1 Nightly Data Accessible Within 24 hrs
- 2.6.3 Transient Alert Distribution
- 2.6.8 Solar System Objects Available within 24 hours
- 2.8.1 Timely Publication of Level 2 Data Releases
- 4.4 Summit to Base
- 4.6 Base to Archive
- 4.8 Archive to Data Access Center

## 1.2.2 Observatory System Specifications Flow-down

Note that the Observatory System Specifications (LSE-30, aka OSS) also include general requirements on security, disaster recovery, physical environment (including seismic activity), and shipping which are flowed down to the subsystems, and while they apply to all subsystems, including the networks, they will be tested and verified in the Telescope and Data Management Subsystem Integration Tests and in the LSST Commissioning Phase, as part of the LSST System Integration Test. Those requirements are excluded from this specification and the associated verification matrix, as they will be addressed in the applicable plans.

## 1.3 LSST Verification and Validation JIRA Project (LVV)

The LSST Verification and Validation JIRA Project lists the specifications within or derived from, and traceable to, the DMSR specifications, in Verification Elements that also specify the methods to be used to verify, the responsible parties, and additional notes regarding verification, per the LSE-160 LSST Verification and Validation Process. The Verification Elements then have one or more Test Cases associated with them that describe the implementation of the verification activities in terms of specific tests to be executed. Those Test Cases are then scheduled via Test Plans and Campaigns, and executed with results reported in Test Cycles/

## 1.4 Verification and Validation Schedule and Resources

The schedule and resources required for network verification are defined in the LSST Project Management Control System (PMCS). They are covered by the final integration test activities

in the WBS elements 02C.08.03 Long-Haul Networks. In each Verification Element, a cross-reference to the ID of the appropriate predecessor PMCS activities is provided in the pre-conditions field.

## 1.5 Applicable Documents

- LSE-61 LSST DM Subsystem Requirements
- LSE-78 LSST Observatory Network Design
- LSE-160 Verification and Validation Process

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## 2 DM Network Verification Elements

The following is the list of verification elements defined in the context of the Network component of the DM subsystem.

### 2.1 [LVV-71] DMS-REQ-0168-V-01: Summit Facility Data Communications

Jira Link	Assignee	Status	Priority	Test Cases
LVV-71	Gregory Dubois-Felsmann	Not Covered	1a	LVV-T1097

#### Verification Element Description:

Verify that:

- Summit - Base Network has been properly implemented in Summit and Base facilities
- Summit - Base Network is properly integrated with Summit Control Network and DAQ/-Camera Data Backbone

Verify that OCS/DMCS triggers read-out from DAQ and queries EFD. verify that data from EFD and camera are accepted and transferred to the Summit DWDM. Requirement does not include data transfer to base (LVV-73) or from base to archive center (LVV-81, LVV-82, LVV-83).

Upstream Requirements				
Requirement ID	DMS-REQ-0168			
Requirement Description	<b>Specification:</b> The DMS shall provide data communications infrastructure to accept science data and associated metadata read-outs, and the collection of ancillary and engineering data, for transfer to the base facility.			
Requirement Priority	1a			
Upper Level Requirement	OSS-REQ-0002	The Summit Facility		

#### 2.1.1 Test Cases Summary

LVV-T1097	Verify Summit Facility Network Implementation			
Owner	Status	Version	Critical Event	Verification Type

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Jeff Kantor	Draft	1	false	Test
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**Objective:**

Verify that data acquired by a AuxTel DAQ can be transferred to Summit DWDM and loaded in the EFD without problems.

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## 2.2 [LVV-73] DMS-REQ-0171-V-01: Summit to Base Network

Jira Link	Assignee	Status	Priority	Test Cases
LVV-73	Robert Gruendl	Not Covered	1a	LVV-T1168 LVV-T1612

### Verification Element Description:

This requirement must be tested in sequence and collect performance metrics (both DAQ and Control sides unless noted):

1. ISO OSI Layer 1 Physical (fibers with test data from OTDR, AURA does test)
2. ISO OSI Layer 2 Data Link (DWDM equipment, line cards, with test data from multi-channel/lightwave/channel analyzer, Installer does test, AURA certify)
3. ISO Layer 3 minimal (DWDM with 2 x 10 Gbps ethernet port client cards with test data from 4 windows test boxes, 2 on each side, Installer does test, AURA certify, can repeat as part of #4 with DAQ)
4. ISO Layer 3 full (22 x 10 Gbps ethernet ports on DAQ side with test data from DAQ test stand, AURA, Camera DAQ team do test). Transfer data between summit and base over uninterrupted 1 day period. Demonstrate transfer of data at or exceeding rates specified in LDM-142.

### Upstream Requirements

Requirement ID	DMS-REQ-0171		
Requirement Description	<b>Specification:</b> The DMS shall provide communications infrastructure between the Summit Facility and the Base Facility sufficient to carry scientific data and associated metadata for each image in no more than time <b>summToBaseMaxTransferTime</b> .		
Requirement Parameters	<b>summToBaseMaxTransferTime = 2[second]</b> Maximum time interval to transfer a full Crosstalk Corrected Exposure and all related metadata from the Summit Facility to the Base facility.		
Requirement Priority	1a		
Upper Level Requirement	OSS-REQ-0003	The Base Facility	
	OSS-REQ-0127	Level 1 Data Product Availability	

### 2.2.1 Test Cases Summary

LVV-T1168	Verify Summit - Base Network Integration			
<b>Owner</b>	<b>Status</b>	<b>Version</b>	<b>Critical Event</b>	<b>Verification Type</b>
Jeff Kantor	Approved	1	false	Inspection

**Objective:**

Verify the integration of the summit to base network by demonstrating a sustained and uninterrupted transfer of data between summit and base over 1 day period at or exceeding rates specified in LDM-142. Done in 3 phases in collaboration with equipment/installation vendors (see test procedure).

LVV-T1612	Verify Summit - Base Network Integration (System Level)			
<b>Owner</b>	<b>Status</b>	<b>Version</b>	<b>Critical Event</b>	<b>Verification Type</b>
Jeff Kantor	Draft	1	false	Inspection

**Objective:**

Verify ISO Layer 3 full (22 x 10 Gbps ethernet ports on DAQ side with test data from DAQ test stand, AURA, Camera DAQ team do test). Demonstrate transfer of data at or exceeding rates specified in LDM-142.

## 2.3 [LVV-74] DMS-REQ-0172-V-01: Summit to Base Network Availability

Jira Link	Assignee	Status	Priority	Test Cases
LVV-74	Robert Gruendl	Not Covered	1a	LVV-T185

### Verification Element Description:

This requirement needs the network link to be active for a calculated amount of time (at least 1 week) without failure. Will require extrapolating from test and historical data as failures are rare. Monthly operating statistics will be acquired during commissioning. Demonstrate transfer of data at or exceeding rates specified in LDM-142, verify achieved average and peak throughput and latency.

Upstream Requirements			
Requirement ID	DMS-REQ-0172		
Requirement Description	<b>Specification:</b> The Summit to Base communications shall be highly available, with Mean Time Between Failures (MTBF) > <b>summToBaseNetMTBF</b> .		
Requirement Parameters	<b>summToBaseNetMTBF = 90[day]</b> Mean time between failures, measured over a 1-yr period.		
Requirement Priority	1b		
Upper Level Requirement	OSS-REQ-0373	Unscheduled Downtime Subsystem Allocations	
	DMS-REQ-0161	Optimization of Cost, Reliability and Availability in Order	

### 2.3.1 Test Cases Summary

LVV-T185	Verify implementation of Summit to Base Network Availability			
Owner	Status	Version	Critical Event	Verification Type
Jeff Kantor	Draft	1	false	Inspection

#### Objective:

Verify the availability of Summit to Base Network by demonstrating that the mean time between failures is less than summToBaseNetMTBF (90 days) over 1 year.

## 2.4 [LVV-75] DMS-REQ-0173-V-01: Summit to Base Network Reliability

Jira Link	Assignee	Status	Priority	Test Cases
LVV-75	Robert Gruendl	Not Covered	1a	LVV-T186

### Verification Element Description:

Disconnect, reconnect and recover transfer of data between summit and base. After disconnecting fiber at an intermediate location between summit and base, demonstrate reconnection and recovery to transfer of data at or exceeding rates specified in LDM-142 within MTTR specification. A Network operator will provide MTTR data on links during commissioning and operations.

Upstream Requirements			
Requirement ID	DMS-REQ-0173		
Requirement Description	De-	<b>Specification:</b> The Summit to Base communications shall be highly reliable, with Mean Time to Repair (MTTR) < <b>summToBaseNetMTTR</b> .	
Requirement Parameters	Pa-	<b>summToBaseNetMTTR = 24[hour]</b> Mean time to repair, measured over a 1-yr period.	
Requirement Priority	Prior-	1b	
Upper Level Requirement	Re-	OSS-REQ-0373 DMS-REQ-0161	Unscheduled Downtime Subsystem Allocations Optimization of Cost, Reliability and Availability in Order

### 2.4.1 Test Cases Summary

LVV-T186	Verify implementation of Summit to Base Network Reliability			
Owner	Status	Version	Critical Event	Verification Type
Jeff Kantor	Draft	1	false	Demonstration

#### Objective:

Verify the reliability of the summit to base network by demonstrating reconnection and recovery to transfer of data at or exceeding rates specified in LDM-142 following a cut in network connection, within MTTR specification. The network operator will provide MTTR data on links during commissioning and operations.

## 2.5 [LVV-76] DMS-REQ-0174-V-01: Summit to Base Network Secondary Link

Jira Link	Assignee	Status	Priority	Test Cases
LVV-76	Robert Gruendl	Not Covered	1a	LVV-T187

### Verification Element Description:

This requirement is verified by demonstrating use of a secondary transfer method (redundant fiber network, microwave link, or transportable medium) between Summit and Base capable of transferring 1 night of raw data ( $n\text{CalibExpDay} + n\text{RawExpNightMax} = 450 + 2800 = 3250$  exposures) within `summToBaseNet2TransMax` (72 hours).

Upstream Requirements				
Requirement ID	DMS-REQ-0174			
Requirement Description	De-	<b>Specification:</b> The Summit to Base communications shall provide at least one secondary link or transport mechanism for minimal operations support in the event of extended outage. This link may include redundant fiber optics, microwaves, or transportable media. It shall be capable of transferring one night's worth of raw data in <b>summToBaseNet2TransMax</b> or less.		
Requirement Parameters	Pa-	<b>summToBaseNet2TransMax = 72[hour]</b> Maximum time to transfer one night of data via the network secondary link.		
Requirement Priority	Prior-	1b		
Upper Level Requirement	Level Re-	DMS-REQ-0173	Summit to Base Network Reliability	
		OSS-REQ-0049	Degraded Operational States	
		DMS-REQ-0172	Summit to Base Network Availability	

### 2.5.1 Test Cases Summary

LVV-T187	Verify implementation of Summit to Base Network Secondary Link			
Owner	Status	Version	Critical Event	Verification Type
Jeff Kantor	Draft	1	false	Test

#### Objective:

Verify automated fail-over from primary to secondary equipment in Rubin Observatory DWDM on simulated failure of primary. Verify bandwidth sufficiency on secondary. Verify automated recovery to primary equipment on simulated restoration of primary. Repeat for failure of Rubin Observatory fiber and fail-over to AURA fiber and DWDM. Demonstrate use of secondary in "catch-up" mode.

## 2.6 [LVV-77] DMS-REQ-0175-V-01: Summit to Base Network Ownership and Operation

Jira Link	Assignee	Status	Priority	Test Cases
LVV-77	Robert Gruendl	Not Covered	1a	LVV-T188

### Verification Element Description:

This requirement is verified by inspecting construction and operations contracts and Infeasible Rights to Use (IRUs).

Upstream Requirements				
Requirement ID	DMS-REQ-0175			
Requirement Description	<b>Specification:</b> The Summit to Base communications link shall be owned and operated by LSST and/or the operations entity to ensure responsiveness of support.			
Requirement Priority	1b			
Upper Level Requirement	DMS-REQ-0173	Summit to Base Network Reliability		
	OSS-REQ-0036	Local Autonomous Administration of System Sites		
	DMS-REQ-0172	Summit to Base Network Availability		

### 2.6.1 Test Cases Summary

LVV-T188	Verify implementation of Summit to Base Network Ownership and Operation			
Owner	Status	Version	Critical Event	Verification Type
Jeff Kantor	Draft	1	false	Inspection

### Objective:

Verify Summit to Base Network Ownership and Operation by LSST and/or the operations entity by inspection of construction and operations contracts and Infeasible Rights.



## 2.7 [LVV-81] DMS-REQ-0180-V-01: Base to Archive Network

Jira Link	Assignee	Status	Priority	Test Cases
LVV-81	Robert Gruendl	Not Covered	1a	LVV-T193

### Verification Element Description:

This requirement is verified by transferring simulated or pre-cursor image data and meta-data between base and archive over an uninterrupted 1 day period. Analyze the network performance and show that data can be transferred by DAQ within the required time.

Upstream Requirements				
Requirement ID	DMS-REQ-0180			
Requirement Description	De-	<b>Specification:</b> The DMS shall provide communications infrastructure between the Base Facility and the Archive Center sufficient to carry scientific data and associated metadata for each image in no more than time <b>baseToArchiveMaxTransferTime</b> .		
Requirement Parameters	Pa-	<b>baseToArchiveMaxTransferTime = 5[second]</b> Maximum time interval to transfer a full Crosstalk Corrected Exposure and all related metadata from the Base Facility to the Archive Center.		
Requirement Priority	Prior-	1b		
Upper Level Requirement	Re-	OSS-REQ-0053	Base-Archive Connectivity Loss	
		OSS-REQ-0055	Base Updating from Archive	
		DMS-REQ-0162	Pipeline Throughput	

### 2.7.1 Test Cases Summary

LVV-T193	Verify implementation of Base to Archive Network			
Owner	Status	Version	Critical Event	Verification Type
Jeff Kantor	Draft	1	false	Test

#### Objective:

Verify that the data acquired by a DAQ can be transferred within the required time, i.e. verify that link is capable of transferring image for prompt processing in  $\text{baseToArchiveMaxTransferTime} = 5[\text{second}]$ , i.e. at or exceeding rates specified in LDM-142.

## 2.8 [LVV-82] DMS-REQ-0181-V-01: Base to Archive Network Availability

Jira Link	Assignee	Status	Priority	Test Cases
LVV-82	Robert Gruendl	Not Covered	1a	LVV-T194

### Verification Element Description:

This requirement is verified by transferring data between base and archive over uninterrupted 1 week period, modeling to extrapolate to an annual failure rate, and verifying that is within the requirement.

Upstream Requirements				
Requirement ID	DMS-REQ-0181			
Requirement Description	De-	<b>Specification:</b> The Base to Archive communications shall be highly available, with MTBF > <b>baseToArchNetMTBF</b> .		
Requirement Parameters	Pa-	<b>baseToArchNetMTBF = 180[day]</b> Mean time between failures, measured over a 1-yr period.		
Requirement Priority	Prior-	1b		
Upper Level Requirement	Level Re-	OSS-REQ-0053	Base-Archive Connectivity Loss	
		DMS-REQ-0162	Pipeline Throughput	
		DMS-REQ-0161	Optimization of Cost, Reliability and Availability in Order	

### 2.8.1 Test Cases Summary

LVV-T194	Verify implementation of Base to Archive Network Availability			
Owner	Status	Version	Critical Event	Verification Type
Jeff Kantor	Draft	1	false	Test

### Objective:

Verify the availability of the Base to Archive Network communications by demonstrating that it meets or exceeds a mean time between failures, measured over a 1-yr period of MTBF > baseToArchNetMTBF (180[day])

## 2.9 [LVV-83] DMS-REQ-0182-V-01: Base to Archive Network Reliability

Jira Link	Assignee	Status	Priority	Test Cases
LVV-83	Robert Gruendl	Not Covered	1a	LVV-T195

### Verification Element Description:

Disconnect, reconnect and recover transfer of data between summit and base, after disconnecting fiber at an intermediate location between base and archive

Upstream Requirements				
Requirement ID	DMS-REQ-0182			
Requirement Description	De-	<b>Specification:</b> The Base to Archive communications shall be highly reliable, with MTTR < <b>baseToArchNetMTTR</b> .		
Requirement Parameters	Pa-	<b>baseToArchNetMTTR = 48[hour]</b> Mean time to repair, measured over a 1-yr period.		
Requirement Priority	Prior-	1b		
Upper Level Requirement	Re-	OSS-REQ-0053	Base-Archive Connectivity Loss	
		DMS-REQ-0161	Optimization of Cost, Reliability and Availability in Order	

### 2.9.1 Test Cases Summary

LVV-T195	Verify implementation of Base to Archive Network Reliability			
Owner	Status	Version	Critical Event	Verification Type
Jeff Kantor	Draft	1	false	Test

#### Objective:

Verify Base to Archive Network Reliability by demonstrating that the network can recover from outages within baseToArchNetMTTR = 48[hour].

## 2.10 [LVV-84] DMS-REQ-0183-V-01: Base to Archive Network Secondary Link

Jira Link	Assignee	Status	Priority	Test Cases
LVV-84	Robert Gruendl	Not Covered	1a	LVV-T196

### Verification Element Description:

This requirement is verified by disconnecting the primary link, failing over to the secondary link, reconnecting primary link, and failing back to primary link, while verifying data is transferred within required times.

Upstream Requirements				
Requirement ID	DMS-REQ-0183			
Requirement Description	De-	<b>Specification:</b> The Base to Archive communications shall provide a secondary link or transport mechanism (e.g. protected circuit) for operations support and “catch up” in the event of extended outage which is capable of transferring data at least the same rate as the required minimum capacity of the primary link.		
Requirement Priority	Prior-	1b		
Upper Level Requirement	Re-	DMS-REQ-0181	Base to Archive Network Availability	
		DMS-REQ-0182	Base to Archive Network Reliability	
		OSS-REQ-0049	Degraded Operational States	

### 2.10.1 Test Cases Summary

LVV-T196	Verify implementation of Base to Archive Network Secondary Link			
Owner	Status	Version	Critical Event	Verification Type
Jeff Kantor	Draft	1	false	Test

### Objective:

Verify Base to Archive Network Secondary Link failover and capacity, and subsequent recovery primary. Demonstrate the use of the secondary path in “catch-up” mode.

## 2.11 [LVV-88] DMS-REQ-0188-V-01: Archive to Data Access Center Network

Jira Link	Assignee	Status	Priority	Test Cases
LVV-88	Robert Gruendl	Not Covered	1a	LVV-T200

### Verification Element Description:

This requirement is verified by transferring data between archive and both DACs over uninterrupted 1 day period, analyzing the network performance, and verifying that data can be transferred within the required time.

Upstream Requirements			
Requirement ID	DMS-REQ-0188		
Requirement Description	De-	<b>Specification:</b> The DMS shall provide communications infrastructure between the Archive Center and Data Access Centers sufficient to carry scientific data and associated metadata in support of community and EPO access. Aggregate bandwidth for data transfers from the Archive Center to Data Centers shall be at least <b>archToDacBandwidth</b> .	
Requirement Parameters	Pa-	<b>archToDacBandwidth = 10000[megabit per second]</b> Aggregate bandwidth capacity for data transfers between the Archive and Data Access Centers.	
Requirement Priority	Prior-	1b	
Upper Level Requirement	Re-	OSS-REQ-0004	The Archive Facility

### 2.11.1 Test Cases Summary

LVV-T200	Verify implementation of Archive to Data Access Center Network			
Owner	Status	Version	Critical Event	Verification Type
Jeff Kantor	Draft	1	false	Test

#### Objective:

Verify archiving of data to Data Access Center Network at or exceeding rates specified in LDM-142, i.e at archToDacBandwidth = 10000[megabit per second].

## 2.12 [LVV-89] DMS-REQ-0189-V-01: Archive to Data Access Center Network Availability

Jira Link	Assignee	Status	Priority	Test Cases
LVV-89	Robert Gruendl	Not Covered	1a	LVV-T201

### Verification Element Description:

This requirement needs the network link to be active for a calculated amount of time (at least 1 week) without failure. This will require modeling as failures are rare, so an annual MTBF will be estimated from test results.

Upstream Requirements				
Requirement ID	DMS-REQ-0189			
Requirement Description	De-	<b>Specification:</b> The Archive to Data Access Center communications shall be highly available, with MTBF > <b>archToDacNetMTBF</b> .		
Requirement Parameters	Pa-	<b>archToDacNetMTBF = 180[day]</b> Mean Time Between Failures for data service between Archive and DACs, averaged over a one-year period.		
Requirement Priority	Prior-	1b		
Upper Level Requirement	Re-	DMS-REQ-0161	Optimization of Cost, Reliability and Availability in Order	

### 2.12.1 Test Cases Summary

LVV-T201	Verify implementation of Archive to Data Access Center Network Availability			
Owner	Status	Version	Critical Event	Verification Type
Jeff Kantor	Draft	1	false	Test

#### Objective:

Verify availability of archiving to Data Access Center Network using test and historical data of or exceeding archToDacNetMTBF=180[day].

## 2.13 [LVV-90] DMS-REQ-0190-V-01: Archive to Data Access Center Network Reliability

Jira Link	Assignee	Status	Priority	Test Cases
LVV-90	Robert Gruendl	Not Covered	1a	LVV-T202

### Verification Element Description:

This requirement is verified by reconnecting and recovering transfer of data between archive and DACs, after disconnecting fiber at an intermediate location between archive and DACs.

Upstream Requirements				
Requirement ID	DMS-REQ-0190			
Requirement Description	De-	<b>Specification:</b> The Archive to Data Access Center communications shall be highly reliable, with MTTR < <b>archToDacNetMTTR</b> .		
Requirement Parameters	Pa-	<b>archToDacNetMTTR = 48[hour]</b> Mean time to repair, measured over a 1-yr period.		
Requirement Priority	Prior-	1b		
Upper Level Requirement	Level Re-	DMS-REQ-0161	Optimization of Cost, Reliability and Availability in Order	

### 2.13.1 Test Cases Summary

LVV-T202	Verify implementation of Archive to Data Access Center Network Reliability			
Owner	Status	Version	Critical Event	Verification Type
Jeff Kantor	Draft	1	false	Test

### Objective:

Verify the reliability of Archive to Data Access Center Network by demonstrating successful failover and capacity to the secondary part and subsequent recovery to primary within or exceeding chToDacNetMTTR = 48[hour].

## 2.14 [LVV-91] DMS-REQ-0191-V-01: Archive to Data Access Center Network Secondary Link

Jira Link	Assignee	Status	Priority	Test Cases
LVV-91	Robert Gruendl	Not Covered	1a	LVV-T203

### Verification Element Description:

This requirement is verified by reconnecting and recovering transfer of data between archive and DACs, after disconnecting fiber at an intermediate location between archive and DACs.

Upstream Requirements				
Requirement ID	DMS-REQ-0191			
Requirement Description	De-	<b>Specification:</b> The Archive to Data Access Center communications shall provide secondary link or transport mechanism (e.g. protected circuit) for operations support and “catch up” in the event of extended outage.		
Requirement Priority	Prior-	1b		
Upper Level Requirement	Re-	DMS-REQ-0189	Archive to Data Access Center Network Availability	
		DMS-REQ-0190	Archive to Data Access Center Network Reliability	

### 2.14.1 Test Cases Summary

LVV-T203	Verify implementation of Archive to Data Access Center Network Secondary Link			
Owner	Status	Version	Critical Event	Verification Type
Kian-Tat Lim	Draft	1	false	Test

### Objective:

Verify the Archive to Data Access Center Network via Secondary Link by simulating a failure on the primary path and capacity on the secondary path.



## 2.15 [LVV-183] DMS-REQ-0352-V-01: Base Wireless LAN (WiFi)

Jira Link	Assignee	Status	Priority	Test Cases
LVV-183	Robert Gruendl	Not Covered	1a	LVV-T192

### Verification Element Description:

At Base Facility, connect to WiFi, test connection speed, i.e. send email, browse web, and retrieve files from the Internet.

Upstream Requirements				
Requirement ID	DMS-REQ-0352			
Requirement Description	De-	<b>Specification:</b> The Base LAN shall provide <b>minBaseWiFi</b> Wireless LAN (WiFi) and Wireless Access Points in the Base Facility to support connectivity of individual user's computers to the network backbones.		
Requirement Parameters	Pa-	<b>minBaseWifi = 1000[megabit per second]</b> Maximum allowable outage of active DM production.		
Requirement Priority	Prior-	2		
Upper Level Requirement	Level Re-	OSS-REQ-0003	The Base Facility	

### 2.15.1 Test Cases Summary

LVV-T192	Verify implementation of Base Wireless LAN (WiFi)			
Owner	Status	Version	Critical Event	Verification Type
Jeff Kantor	Draft	1	false	Test

### Objective:

Verify as-built wireless network at the Base Facility supports minBaseWiFi bandwidth (1000 Mbs).

## 2.16 [LVV-18491] DMS-REQ-0352-V-02: Base Voice Over IP (VOIP)

Jira Link	Assignee	Status	Priority	Test Cases
LVV-18491	Robert Gruendl	Not Covered	2	LVV-T181

### Verification Element Description:

Verify (a) planned and (b) as-built VOIP at the Base Facility is operational and performs as expected (i.e. sufficient number of extensions allocated properly, no frequent drop-outs, no frequent jaggies on video, etc.). Test voice calls and videoconferencing.

Upstream Requirements				
Requirement ID	DMS-REQ-0352			
Requirement Description	De-	<b>Specification:</b> The Base LAN shall provide <b>minBaseWiFi</b> Wireless LAN (WiFi) and Wireless Access Points in the Base Facility to support connectivity of individual user's computers to the network backbones.		
Requirement Parameters	Pa-	<b>minBaseWifi = 1000[megabit per second]</b> Maximum allowable outage of active DM production.		
Requirement Priority	Prior-	2		
Upper Level Requirement	Level Re-	OSS-REQ-0003	The Base Facility	

### 2.16.1 Test Cases Summary

LVV-T181	Verify Base Voice Over IP (VOIP)			
Owner	Status	Version	Critical Event	Verification Type
Jeff Kantor	Draft	1	false	Test

### Objective:

Verify as-built VOIP at the Base Facility is operational and performs as expected (i.e. sufficient number of extensions allocated properly, no frequent drop-outs, no frequent jaggies on video, etc.) on both voice calls and videoconferencing.

## A Traceability

Requirements	Verification Elements	Test Cases
DMS-REQ-0168	LWV-71	LWV-T1097
DMS-REQ-0171	LWV-73	LWV-T1168 LWV-T1612
DMS-REQ-0172	LWV-74	LWV-T185
DMS-REQ-0173	LWV-75	LWV-T186
DMS-REQ-0174	LWV-76	LWV-T187
DMS-REQ-0175	LWV-77	LWV-T188
DMS-REQ-0180	LWV-81	LWV-T193
DMS-REQ-0181	LWV-82	LWV-T194
DMS-REQ-0182	LWV-83	LWV-T195
DMS-REQ-0183	LWV-84	LWV-T196
DMS-REQ-0188	LWV-88	LWV-T200
DMS-REQ-0189	LWV-89	LWV-T201
DMS-REQ-0190	LWV-90	LWV-T202
DMS-REQ-0191	LWV-91	LWV-T203
DMS-REQ-0352	LWV-183	LWV-T192
	LWV-18491	LWV-T181

## B References

- [1] **[LSE-61]**, Dubois-Felsmann, G., Jenness, T., 2018, *LSST Data Management Subsystem Requirements*, LSE-61, URL <https://ls.st/LSE-61>
- [2] **[LDM-142]**, Kantor, J., 2017, *Network Sizing Model*, LDM-142, URL <https://ls.st/LDM-142>
- [3] **[LSE-78]**, Lambert, R., Kantor, J., Huffer, M., et al., 2017, *LSST Observatory Network Design*, LSE-78, URL <https://ls.st/LSE-78>
- [4] **[LSE-160]**, Selvy, B., 2013, *Verification and Validation Process*, LSE-160, URL <https://ls.st/LSE-160>

## C Acronyms

Acronym	Description
BDC	Base Data Center
BERT	Bit Error Rate Tester
CCB	Change Control Board
CCS	Camera Control System
CISS	Computer Infrastructure Services South (part of the former NOAO Cerro Tololo Inter-american Observatory (CTIO), now merged into NSF'S OIR Lab Central Operating Services)
CTIO	Cerro Tololo Inter-American Observatory
DAC	Data Access Center
DAQ	Data Acquisition System
DM	Data Management
DMCS	Data Management Control System
DMS	Data Management Subsystem
DMS-REQ	Data Management top level requirements (LSE-61)
DMSR	DM System Requirements; LSE-61
DMSSIT	DM Subsystem Integration Test
DMTR	DM Test (Plan and) Report
DTN	Data Transfer Node
DWDM	Dense Wave Division Multiplex
Db	Decibel
EFD	Engineering and Facility Database
EPO	Education and Public Outreach
FIU	Florida International University
HL	Higher Level
IP	Internet Protocol
IRU	indefinable right to use
ISO	International Standards Organization
IT	Information Technology
LAN	Local Area Network
LATISS	LSST Atmospheric Transmission Imager and Slitless Spectrograph
LDF	LSST Data Facility

LDM	LSST Data Management (Document Handle)
LHN	Long-Haul Networks
LL	Lower Level
LS	La Serena
LSE	LSST Systems Engineering (Document Handle)
LSST	Legacy Survey of Space and Time (formerly Large Synoptic Survey Telescope)
LVV	LSST Verification and Validation (Jira project)
MTBF	Mean Time Between Failures
MTTR	Mean Time to Repair
NA	Not Available
NCSA	National Center for Supercomputing Applications
NET	Network Engineering Team
OCS	Observatory Control System
OSI	Open System Interconnect
OSS	Observatory System Specifications; LSE-30
OTDR	Optical Time Domain Reflectometer
PMCS	Project Management Controls System
REUNA	Red Universitaria Nacional
RFC	Request For Comment
SC	Science Collaboration
SCL	Santiago, Chile
SIT	LSST System Integration Test
SL	Same Level
SLAC	SLAC National Accelerator Lab
TCS	Telescope Control System
US	United States
VNVD	Vera C Rubin Observatory Network Verification Document
VOIP	Voice Over Internet Protocol
WBS	Work Breakdown Structure