



SKA1 SDP CONFIGURATION ITEM DATA LIST

Document Number..... SKA-TEL-SDP-0000048
 Document Type..... LIS
 Revision..... 04
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 Date..... 2019-03-29
 Document Classification..... Unrestricted
 Status..... Released

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DOCUMENT HISTORY

Revision	Date Of Issue	Engineering Change Number	Comments
02C	2018-05-20	ECP-160012 ECP-170031 ECP-SDP-180001	Prepared for SDP Pre-CDR
03	2018-10-31	ECP-SDP-180002	Prepared for M21, SDP CDR
04	2019-03-15	ECP-SDP-190001	Prepared for M22 SDP Closeout

DOCUMENT SOFTWARE

	Package	Version	Filename
Word processor	Google Docs		SKA System Sizing
Images	eBentley		
Google docs Add-ons	Cross Reference Table of contents List of figures		Used for figure & table numbering and references. Used for heading numbering. Used to generate list of figures and tables

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LIST OF ABBREVIATIONS

SKA	Square Kilometre Array
SKAO	SKA Project Office

1 Introduction

1.1 Key Definitions

A **Configuration Item** (CI) is an aggregate of hardware, software or firmware that is a deliverable entity to which certain technical function has been allocated and that requires management visibility and control of its inherent characteristics or its interfaces with other items.

1.2 Purpose of the document

This document lists the configuration data for the Square Kilometre Array (SKA) Phase 1 Science Data Processor (SDP) Configuration Items. This data lists includes all documents that define the SKA SDP system. The data are derived from the information contained in the SKA Configuration Management system, located at <https://ska-aw.bentley.com/SKAProd/>.

1.3 Scope of the document

This document covers the hierarchy of SDP systems for the SKA-MID and SKA-LOW telescopes, and the SDP software common to both telescopes. These systems have the following item numbers:

Science Data Processor MID:	304-000000
Science Data Processor LOW:	104-000000
SDP Software:	701-000000

The design and system engineering documents pertaining to the SDP systems are also listed.

2 References

2.1 Applicable documents

The following documents are applicable to the extent stated herein. In the event of conflict between the contents of the applicable documents and this document, **the applicable documents** shall take precedence.

- [AD1] SKA-TEL-SKO-0000120 SKA1 Configuration Management Plan, Rev 01
- [AD2] 104-000000 [01] Science Data Processor (SDP) LOW Parts List, Rev 03
- [AD3] 304-000000 [01] Science Data Processing (SDP) MID Parts List, Rev 03

2.2 Reference documents

The following documents are referenced in this document. In the event of conflict between the contents of the referenced documents and this document, **this document** shall take precedence.

None

3 SDP Physical Items

This list comprises the Physical Items that make up the SDP, consisting of hardware deployed on-site in data centres in South Africa and Perth, and common software deployable at both data centre sites [AD02, AD03].

Code	Name	State	Status	ResponsibilitiesOrganization	Glossary
104-00000	Science Data Processor (SDP) LOW	Current	Not Approved	SKA Office (SKAO)	<p>The Science Data Processor LOW is a product that encompasses all of the hardware and software for the data processing needed to process the data generated by the CSP-Low product, for both visibilities and time-domain data, together with a short- to medium-term archive for observation processing, and long term archival of data products. It also interfaces with Telescope Manager LOW for the observation specific and telescope state information, and with the outside world for the data delivery of archived products. In addition, it interfaces with Low Frequency Aperture Array (LFAA) LOW for receiving transient data, and delivering updated versions of the Global Sky Model to LFAA. It does not contain tools which are required at Observatory level, which are included as part of SDP Observatory (604-000000).</p> <p>The amount of data processing needed for imaging the data from the SKA1-Low telescope means that an HPC-like computing infrastructure is needed as an integral part of the telescope. The SDP provides such infrastructure, and also the means to store the large amounts of data to be generated, preserve them, and make them available for consumption by external users.</p>

104-00001	SDP Compute Hardware LOW	Current	Not Approved	Science Data Processor (SDP)	This product encompasses all the hardware required for the ingest and scientific data processing of the visibilities and time-domain data coming from the CSP Low, and the ingest of transient data coming from LFAA. This system interfaces with the Signal and Data Transport (SADT) LOW for the networking interfaces, with the Science Processing Facility for the physical/mechanical hosting interfaces, with the Preservation Hardware LOW for long term data preservation and retrieval. It also interfaces with the outside world the delivery of archived products. No software is included in this product, except for relevant vendor firmware (BIOS, EFI/UEFI, lights-out management, etc.)
104-00002	SDP Preservation Hardware LOW	Current	Not Approved	Science Data Processor (SDP)	This product encompasses all the hardware required for the long-term preservation of all scientific data generated by the operation of the SKA1 Low telescope in a hierarchy of storage devices. It interfaces with the Science Processing Facility LOW for the physical hosting interfaces, and with the SDP Compute Hardware LOW for long term data preservation and retrieval. No SKA-specific software is included in this product. It does include relevant vendor firmware (maintenance and monitoring tools, lights-out management, etc.) and vendor or COTS software for the management of the storage hierarchy/tiered storage.
104-00003	Compute Rack LOW	Current	Not Approved	Science Data Processor (SDP)	A Compute Rack is the basic replicable unit in the SKA SDP. It is a self-contained, independent collection of servers and infrastructure needed to keep the compute rack running. The compute rack is expected to be a monolithic procurable unit. The Compute Rack includes the following: Management switches, servers,

					high throughput ethernet switches, low latency switches, cabling and rack infrastructure.
104-00004	Interconnect System LOW	Current	Not Approved	Science Data Processor (SDP)	The Interconnect System includes: Low latency network core switches, management network core switches, high throughput ethernet core switches, edge security equipment and interconnect system rack equipment.
104-00005	Inter-rack Infrastructure LOW	Current	Not Approved	Science Data Processor (SDP)	This is the hardware that crosses a single rack. It includes: Hot aisle/cold aisle equipment (roofs, doors), high capacity power equipment (cables, etc), liquid cooling equipment (hoses, etc) and cross-rack cable management (trays, etc).
104-00006	Hierarchical Storage Management LOW	Current	Not Approved	Science Data Processor (SDP)	The Hierarchical Storage Management will provide an interface to Cold Buffer and manage the intermediate and long term storage of the Preservation Hardware which could consist of MAID and Tape.
104-00007	Intermediate Storage LOW	Current	Not Approved	Science Data Processor (SDP)	This is the performant tier of the hierarchical storage stack in the SDP preservation hardware.
104-00008	Long Term Storage LOW	Current	Not Approved	Science Data Processor (SDP)	This is the capacity tier of the hierarchical storage stack in the SDP preservation hardware. This is intended to be low-cost, high-capacity storage that can cheaply and efficiently store SDP products for the lifetime of the telescope.

304-00000	Science Data Processor (SDP) MID	Current	Not Approved	Science Data Processor (SDP)	<p>The Science Data Processor MID is a product that encompasses all of the hardware and software for the processing needed to process the data generated by the CSP-Mid product, for both visibilities and time-domain data, together with a short- to medium-term archive for observation processing, and long term archival of data products. It also interfaces with Telescope Manager MID for the observation specific and telescope state information, and with the outside world for the data delivery of archived products. It does not contain tools which are required at Observatory level, which are included as part of SDP Observatory (604-000000).</p> <p>The amount of data processing needed for imaging the data from the SKA1-Mid telescope means that an HPC-like computing infrastructure is needed as an integral part of the telescope. The SDP provides such infrastructure, and also the means to store the large amounts of data to be generated, preserve them, and make them available for consumption by external users.</p>
304-00000	Science Data Processor (SDP) MID	Current	Not Approved	SKA Office (SKAO)	<p>The Science Data Processor MID is a product that encompasses all of the hardware and software for the processing needed to process the data generated by the CSP-Mid product, for both visibilities and time-domain data, together with a short- to medium-term archive for observation processing, and long term archival of data products. It also interfaces with Telescope Manager MID for the observation specific and telescope state information, and with the outside world for the data delivery of archived products. It does not contain tools which are required at</p>

					<p>Observatory level, which are included as part of SDP Observatory (604-000000).</p> <p>The amount of data processing needed for imaging the data from the SKA1-Mid telescope means that an HPC-like computing infrastructure is needed as an integral part of the telescope. The SDP provides such infrastructure, and also the means to store the large amounts of data to be generated, preserve them, and make them available for consumption by external users.</p>
304-00001	SDP Compute Hardware MID	Current	Not Approved	Science Data Processor (SDP)	<p>This product encompasses all the hardware required for the ingest and scientific data processing of the visibilities and time-domain data (including transients) coming from the CSP Mid. This system interfaces with the Signal and Data Transport (SADT) MID for the networking interfaces, with the Science Processing Facility MID for the physical/mechanical hosting interfaces, with the SDP Preservation Hardware MID for long term data preservation and retrieval. It also interfaces with the outside world the delivery of archived products. No software is included in this product, except for relevant vendor firmware (BIOS, EFI/UEFI, etc.)</p>
304-00002	SDP Preservation Hardware MID	Current	Not Approved	Science Data Processor (SDP)	<p>This product encompasses all the hardware required for the long-term preservation of all scientific data generated by the operation of the SKA1 Low telescope in a hierarchy of storage devices. It interfaces with the Science Processing Facility LOW for the physical hosting interfaces, with the SDP Compute Hardware LOW for long term data preservation and retrieval. No SKA-specific software is included in this product. It does include relevant vendor firmware (maintenance and monitoring tools, lights-out management, etc.) and vendor or COTS</p>

					software for the management of the storage hierarchy/tiered storage.
304-00003	Compute Rack MID	Current	Not Approved	Science Data Processor (SDP)	A Compute Rack is the basic replicable unit in the SKA SDP. It is a self-contained, independent collection of servers and infrastructure needed to keep the compute rack running. The compute rack is expected to be a monolithic procurable unit. The Compute Rack includes the following: Management switches, servers, high throughput ethernet switches, low latency switches, cabling and rack infrastructure.
304-00004	Interconnect System MID	Current	Not Approved	Science Data Processor (SDP)	The Interconnect System includes: Low latency network core switches, management network core switches, high throughput ethernet core switches, edge security equipment and interconnect system rack equipment.
304-00005	Inter-rack Infrastructure MID	Current	Not Approved	Science Data Processor (SDP)	This is the hardware that crosses a single rack. It includes: Hot aisle/cold aisle equipment (roofs, doors), high capacity power equipment (cables, etc), liquid cooling equipment (hoses, etc) and cross-rack cable management (trays, etc).
304-00006	Hierarchical Storage Management MID	Current	Not Approved	Science Data Processor (SDP)	The Hierarchical Storage Management will provide an interface to Cold Buffer and manage the intermediate and long term storage of the Preservation Hardware which could consist of MAID and Tape.
304-00007	Intermediate Storage MID	Current	Not Approved	Science Data Processor (SDP)	This is the performant tier of the hierarchical storage stack in the SDP preservation hardware.
304-00008	Long Term Storage MID	Current	Not Approved	Science Data Processor (SDP)	This is the capacity tier of the hierarchical storage stack in the SDP preservation hardware. This is intended to be low-cost, high-capacity storage that can cheaply and efficiently store SDP products for the lifetime of the telescope.

701-0 0000 0	SDP Software	Curre nt	Not Approv ed	Science Data Processor (SDP)	This product encompasses all the software running on either the Science Data Processor (SDP) LOW or Science Data Processor (SDP) MID products; it is common to both of them. SDP Software interfaces with Telescope Manager (TM) MID/LOW for monitoring, control, and observation setup purposes, with CSP MID/LOW for the data ingest from visibility and time-domain products (including transient data in SKA1 MID). In addition, in the SKA1 LOW it interfaces with LFAA for the ingest of transient data and the update of the Global Sky Model. It also interfaces with the outside world for the delivery of archived products. No hardware whatsoever is included in this product.
701-0 0000 1	SDP Execution Control	Curre nt	Not Approv ed	Science Data Processor (SDP)	Groups all modules related to the control and monitoring of the SDP. This especially handles top-level resource allocation and process (services / execution framework) orchestration.
701-0 0000 2	SDP Services	Curre nt	Not Approv ed	Science Data Processor (SDP)	Groups modules that provide domain-specific SDP services to support processing. As this is a data-driven architecture, this especially concerns maintaining data items around the execution of Science Pipeline Workflows: Buffer Management maintains the primary data exchange of the SDP architecture. Model Databases, Delivery as well as Long Term Storage manage long-term data stores serving and/or getting updated by processing.
701-0 0000 3	Science Pipeline Workflows	Curre nt	Not Approv ed	Science Data Processor (SDP)	Data-driven pipelines configured by Processing Blocks, describing the required work in terms of a graph of workflow stages. Workflows support top-level parallelism of Execution Engines, therefore the workflow will correspond to

					a directed acyclic graph of workflow steps, with edges representing synchronisation points due to (typically data) dependencies.
701-00004	SDP Platform Services	Current	Not Approved	Science Data Processor (SDP)	Groups modules that provide a non-domain-specific cloud-like computing platform environment. As such it should allow deployed software components to as agnostic as possible both of the concrete hardware set-up as well as the other software instances running on the cluster. It should especially provide high-level facilities to track available resources and deploy new software instances on them. It is expected that the Platform will be implemented mostly using off-the-shelf modules plus (possibly substantial) configuration and scripting.
701-00005	Execution Frameworks	Current	Not Approved	Science Data Processor (SDP)	Used for execution of Science Pipeline Workflows stages. The SDP will support multiple independently developed and maintained Execution Frameworks, even within the same workflow. Execution Frameworks will be used by Execution Engine Code from Science Pipeline Workflows to instantiate Execution Engines.
701-00006	Processing Functions	Current	Not Approved	Science Data Processor (SDP)	Libraries implementing core SDP-specific data processing. The main radio-astronomy and interferometry components are implemented as Processing Components. Just-in-time handling of incoming data from CSP and LFAA is handled by Receive libraries.
701-00007	SDP Data Models	Current	Not Approved	Science Data Processor (SDP)	Groups the definitions and implementations of data representations, data formats, and appropriate utility code for SDP data. It includes support for versioning and conversion between data formats and versions. It is composed of Buffer Data Models (formats for e.g. visibility, pulsar candidates, pulsar timing, and transient

					data in the Buffer) and Memory Data Models (in-memory data representations for processing components and queues).
701-00008	SDP System Interfaces	Current	Not Approved	Science Data Processor (SDP)	Common interfaces in use by all SDP modules. Implementations are going to be managed by Platform Services. As changes to these modules might impact the entire system, this should be restricted to well-established standard interfaces.
701-00009	Quality Assessment	Current	Not Approved	Science Data Processor (SDP)	Workflows will emit information allowing early assessment of the quality of scientific data products. The general mechanism for this is to gather it from Processing Components, emit it using Data Queues, possibly aggregate it to make the metrics more useful to users, then push it out using the TANGO Control Interface in Execution Control. This type of data path will be shared by many workflows, therefore the Quality Assessment module provides templates to simplify this task.
701-00010	Workflow Libraries	Current	Not Approved	Science Data Processor (SDP)	Provides an interface to manage the interaction between Science Pipeline Workflows and the rest of the architecture. This especially covers a way for the workflow to instantiate the Execution Framework for a Science Pipeline Workflow using provisioned resources - such as compute and storage, but also services such as data queues. It should allow workflow code to monitor and influence processing, mediated via the Configuration Database or Data Queues.
701-00011	Platform Interfaces	Current	Not Approved	Science Data Processor (SDP)	Interface used by the Platform to access hardware and SDP-external platform resources. For example this could be an existing container infrastructure for SKA regional centre deployments.

701-00012	Operations interface	Current	Not Approved	Science Data Processor (SDP)	Provides (user) interfaces for operators to the internal functionality of the platform, including internal monitoring and control as well as infrastructure and inventory management. In implementing a cloud-like environment, this interface will be used for initial start-up of the SDP, but otherwise have minimal direct interaction with the Operational System.
701-00013	Platform Software	Current	Not Approved	Science Data Processor (SDP)	Off-the-shelf software deployed by Configuration & Coordination to help it provide the required services to the rest of the architecture. While this software will not be used directly by components external to the platform, the complexity of operating a cloud-like environment at scale will require a significant internal infrastructure. Platform software might especially include low-level storage and compute provisioning, software deployment facilities as well as internal logging and health tracking.
701-00014	SDP Dependencies	Current	Not Approved	Science Data Processor (SDP)	These dependencies will be deployed and configured by the Platform, but serve to provide visible infrastructure to the rest of the system. It will be configured to enable interaction with both the Operational System and Platform Services as required. E.g. Configuration Database which will be used for storing both Operational System and Platform configuration parameters. Also Data Queues will be used throughout the architecture as a mechanism to stream data in real-time between different components. It is also expected that further "standard" infrastructure modules such as databases will be provided.

701-00015	Configuration & Orchestration	Current	Not Approved	Science Data Processor (SDP)	This is the Platform interface to the rest of the SDP. It provides the capability to monitor and use platform resources to provide processing and storage components. It includes keeping track of platform resource states, as it has to provide a consistent view of platform load and capacity in the presence of internal and external restrictions (e.g. low-power mode). It also supports checking the state of deployed components, retrieving generated log and keeping track of generated sw and hw metrics. It is also responsible for providing the means for communication with deployed sw.
701-00016	Master Controller	Current	Not Approved	Science Data Processor (SDP)	Tracks status of the SDP, especially all services including Processing Control. Handles top-level control, such as shutting down individual services or the entirety of SDP.
701-00017	Monitoring	Current	Not Approved	Science Data Processor (SDP)	Collects information about global operational status and service health using information provided by Platform Services and SDP Services. This especially concerns following logging and other system health information and aggregating information relevant to telescope management. This will include information about SDP load and capacity metrics that will feed into high-level observation planning. This module specifically implements SDP-specific filtering and aggregation for the purpose of the control interfaces.
701-00018	Processing Controller	Current	Not Approved	Science Data Processor (SDP)	Manages Processing Block execution according to resource availability. Starts and coordinates Processing Block Controllers to execute Science Pipeline Workflows according to control commands. The main function implemented by Processing Control is scheduling buffer and compute

					resources for Batch Processing Blocks.
701-00019	TANGO Control	Current	Not Approved	Science Data Processor (SDP)	Implements TANGO devices to allow control and monitoring of the SDP. This means implementation of TANGO device servers offering information about the current state of the SDP system, which might include Quality Assessment and Telescope State information obtained internally from Data Queues. Furthermore it communicates commands and attribute updates (where allowed by the TANGO control interface) back to the rest of the system. This interface will be used by the Telescope Manager sub-system in order to control SDP and coordinate it with the rest of the telescope. This module is meant to entirely encapsulate the control interface in such a way that it can easily be replaced to eliminate the TANGO dependency for control, e.g. in case of SRC deployments.
701-00020	Delivery	Current	Not Approved	Science Data Processor (SDP)	Delivers Data Products to the observatory or SKA Regional Centres. Maintains the Science Data Product Catalogue using data from Scheduling Blocks and the Science Data Model produced by Model Databases. The implemented services are Data Product discovery (both to Observatory and SRCs), locally providing IVOA access to Data Products, and providing data transfer interfaces to SKA Regional Centres.
701-00021	Buffer Management	Current	Not Approved	Science Data Processor (SDP)	Arranges storage of input data for workflow execution as well as Data Products. Manages lifecycle of storage instances across Buffer and Long Term Storage. Implements Data Island Interface for applications to access storage.

701-000022	Model Databases	Current	Not Approved	Science Data Processor (SDP)	Produces the Science Data Model using the Global Sky Model database as well as Telescope State and Configuration data obtained using TANGO from other SKA sub-systems. Handles queries and updates to the Sky Model database.
701-000023	Long Term Storage	Current	Not Approved	Science Data Processor (SDP)	Provides long-term storage for Data Products. This is the software interface to an off-the-shelf storage appliance.
701-000024	Processing Components	Current	Not Approved	Science Data Processor (SDP)	Library of domain-dependent radio astronomy and interferometry algorithm implementations consuming and producing data according to Memory Data Models.
701-000025	Receive	Current	Not Approved	Science Data Processor (SDP)	Handles incoming data from CSP and LFAA (for transient buffer data). The received data will be both written into the Buffer for Batch processing as well as handed over directly to Real-time Processing Pipelines (such as fast imaging or real-time calibration). This data hand-over will require deploying Receive using the same workflow and likely the same execution framework as real-time processing.
701-000026	Execution Framework Implementation	Current	Not Approved	Science Data Processor (SDP)	This is the core functionality of an Execution Framework: Handles fine-grained scheduling of assigned compute resources, organises data movement and invokes Processing Component execution through Processing Wrappers
701-000027	Processing Wrappers	Current	Not Approved	Science Data Processor (SDP)	Wraps Processing Components, Receive and SDP service interfaces for Science Pipeline Workflows and the Execution Framework Implementation. Should allow the Execution Framework Implementation to instantiate and execute processing graphs in a distributed way without introducing strong coupling to

					the actual Processing Component implementations.
701-00028	Buffer Data Models	Current	Not Approved	Science Data Processor (SDP)	Definitions of data representations of data inputs and products in the buffer as well as utility code for reading, writing and interpreting it. This may include intermediate Data Products not visible outside pipelines. Note that this especially includes the in-buffer representation for the Science Data Model, which this module should provide an interface for that is similar to database queries in terms of flexibility and scalability.
701-00029	Memory Data Models	Current	Not Approved	Science Data Processor (SDP)	Data representations used by Processing Components and Data Queues. Meant to be used as a high-speed way to interface processing components and pipelines with each other. Might also include utility code as appropriate.

Table 1: SDP Physical Items. Generated by REP-00048 from eB on 2018-10-31.

4. ICDs with SDP

Code	Name	Revision
100-000000-002	SKA1 LOW SDP to CSP Interface Control Document	06
100-000000-025	SKA1 LOW SADT to SDP Interface Control Document	05
100-000000-029	SKA1 LOW SDP to TM Interface Control Document	04
100-000000-033	SKA1 LOW SDP to LFAA Interface Control Document (ICD)	01
300-000000-002	SKA1 MID SDP to CSP Interface Control Document	06
300-000000-025	SKA1 MID SADT to SDP Interface Control Document	05
300-000000-029	SKA1 MID SDP to TM Interface Control Document	04
SKA-TEL-SKO-0000484	SKA1 SDP to INFRA-AUS and SKA SA Interface Control Document	02

Table 2: ICDs between the SDP and other SKA elements. List of ICD revisions to use in the SDP Design Baseline. Rows highlighted in green indicate that the correct revision of the ICD is available in eB.

5. SDP Design and System Engineering Documents

Code	Name	Revision	IsLatestRevision	ApprovalStatus	ChangeControlled	IsLatestApprovedRevision
SKA-TEL-SDP-0000013	SDP Architecture	7	Y	Approved	Y	Y
SKA-TEL-SDP-0000033	SDP L2 Requirements Specification and Compliance Statement	4	Y	Approved	Y	Y
SKA-TEL-SDP-0000038	SKA1 SDP System Sizing	4	Y	Approved	N	Y
SKA-TEL-SDP-0000043	SKA1 SDP Costing Model	5	Y	Approved	N	Y
SKA-TEL-SDP-0000046	SKA1 SDP Costing Basis of Estimate	5	Y	Approved	N	Y
SKA-TEL-SDP-0000047	SKA1 SDP Construction and Verification Plan	5	Y	Approved	N	Y
SKA-TEL-SDP-0000048	SKA1 SDP Configuration Item Data List	4	Y	Not Approved	N	N ¹
SKA-TEL-SDP-0000050	SKA1 SDP Integrated Logistic Support (ILS) Plan	4	Y	Approved	N	Y
SKA-TEL-SDP-0000052	SDP High-Level Risk Register	9	Y	Approved	N	Y
SKA-TEL-SDP-0000056	SKA1 SDP Glossary	4	Y	Approved	N	Y
SKA-TEL-SDP-0000078	SDP Load List	1	Y	Approved	N	Y
SKA-TEL-SDP-0000081	SKA1 SDP Operations Plan	3	Y	Approved	N	Y
SKA-TEL-SDP-0000115	SKA1 SDP RAMs analysis	2	Y	Approved	N	Y

Table 3: Design and System Engineering Documents that are required to build the SDP. Generated by REP-00049 from eB on 2019-03-26.

¹ The CI list is not currently approved, as this report had to be run to write this document, which hence could not be approved.