

Technical Note Concerning Space Data System Standards

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| Service Components In service Profiles |

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CONTENTS

Section Page

[DOCUMENT CONTROL i](#_Toc394930326)

[CONTENTS ii](#_Toc394930327)

[1 Introduction 1-1](#_Toc394930328)

[1.1 Purpose OF THIS REPORT 1-1](#_Toc394930329)

[1.2 Background 1-1](#_Toc394930330)

[1.3 Scope 1-1](#_Toc394930331)

[1.4 Document Organization 1-1](#_Toc394930332)

[1.5 Definitions 1-1](#_Toc394930333)

[1.6 References 1-1](#_Toc394930334)

[2 Types of Configuration Profiles and Service Agreements 2-1](#_Toc394930335)

[2.1 SLS Configuration Category 2-2](#_Toc394930336)

[2.1.1 Forward Data Delivery Services 2-2](#_Toc394930337)

[2.1.2 Return Data Delivery Services 2-3](#_Toc394930338)

[2.1.3 RadioMetric Services 2-4](#_Toc394930339)

[2.1.4 Service Management Functions 2-4](#_Toc394930340)

[2.2 Retrieval Configuration Category 2-5](#_Toc394930341)

[2.2.1 Return Data Delivery Services 2-5](#_Toc394930342)

[2.2.2 RadioMetric Services 2-5](#_Toc394930343)

[2.3 Forward Offline Configuration Category 2-6](#_Toc394930344)

[2.3.1 Forward Data Delivery Services 2-6](#_Toc394930345)

[3 Service Mappings to Abstract Service Components And Service Components for the SLS Configuration 3-1](#_Toc394930346)

[3.1 Forward Data Delivery Services 3-9](#_Toc394930348)

[3.1.1 Forward CLTU Service 3-9](#_Toc394930349)

[3.1.2 Forward Space packet Service 3-11](#_Toc394930350)

[3.1.3 Forward Frame Service 3-14](#_Toc394930351)

[3.1.4 Forward FILE Service 3-17](#_Toc394930352)

[3.2 Return Data Delivery Services 3-20](#_Toc394930353)

[3.2.1 Return All Frames Service 3-20](#_Toc394930354)

[3.2.2 Return Channel Frames Service 3-22](#_Toc394930356)

[3.2.3 Return Operational Control Fields Service 3-24](#_Toc394930358)

[3.2.4 Return Unframed Telemetry Service 3-25](#_Toc394930359)

[3.2.5 Return FILE Service 3-27](#_Toc394930360)

[3.3 RadioMetric Services 3-30](#_Toc394930361)

[3.3.1 Validated Data RadioMetric Service 3-30](#_Toc394930362)

[3.3.2 Raw Data RadioMetric Service 3-34](#_Toc394930363)

[3.3.3 Delta-DOR RadioMetric Service 3-38](#_Toc394930364)

[3.3.4 Open Loop Recording Service 3-39](#_Toc394930365)

[4 Service Mappings to Abstract Service Components And Service Components for the Retrieval Configuration 4-1](#_Toc394930366)

[4.1 Return Data Delivery Services 4-3](#_Toc394930367)

[4.1.1 Return All Frames Service 4-3](#_Toc394930368)

[4.1.2 Return Channel Frames Service 4-4](#_Toc394930369)

[4.1.3 Return Unframed Telemetry Service 4-5](#_Toc394930370)

[4.1.4 Return File Service 4-6](#_Toc394930371)

[4.2 Radiometric Services 4-7](#_Toc394930372)

[4.2.1 Validated Data Radiometric Service 4-7](#_Toc394930373)

[4.2.2 Raw Data Radiometric Service 4-8](#_Toc394930374)

[4.2.3 Delta-DOR Radiometric Service 4-9](#_Toc394930375)

[4.2.4 Open Loop Recording Radiometric Service 4-10](#_Toc394930376)

[5 Service Mappings to Abstract Service Components And Service Components for the Forward Offline Configuration 5-1](#_Toc394930377)

[5.1 Forward Data Delivery Services 5-2](#_Toc394930378)

[5.1.1 Forward File Service 5-2](#_Toc394930379)

# Introduction

## Purpose OF THIS REPORT

TBS

## Background

TBS

## Scope

The scope of this technical note is limited to the functional resources that are associated with what are called *Earth Space Link Terminals* (ESLTs) in the SCCS Architecture (reference [13]). As its name implies, an ESLT provides an Earth-side termination of a space-ground link to a user platform (spacecraft, rover, etc.). A typical ESLT is a ground station, but in the case of a relay satellite system in which both the ground terminal and the relay satellite belong to the same operational organization such that the operation of the links between the ground terminal and the relay satellite are not exposed to the user mission (such as the NASA Space Network), the ESLT represents the functionality of both the ground terminal *and* the relay satellite.

## Document Organization

TBS

## Definitions

TBS.

## References

The following documents are referenced in this Report. At the time of publication, the editions indicated were valid. All documents are subject to revision, and users of this Report are encouraged to investigate the possibility of applying the most recent editions of the documents indicated below. The CCSDS Secretariat maintains a register of currently valid CCSDS documents.

NOTE - Not all of the references listed below are used in this Technical Note. The unused reference will be removed in the future.

[1] *Cross Support Reference Model—Part 1: Space Link Extension Services*. Recommendation for Space Data System Standards, CCSDS 910.4-B-2. Blue Book. Issue 2. Washington, D.C.: CCSDS, October 2005.

[2] *Space Link Extension—Return All Frames Service Specification*. Recommendation for Space Data System Standards, CCSDS 911.1-B-3. Blue Book. Issue 3. Washington, D.C.: CCSDS, January 2010.

[3] *Space Link Extension—Return Channel Frames Service Specification*. Recommendation for Space Data System Standards, CCSDS 911.2-B-2. Blue Book. Issue 2. Washington, D.C.: CCSDS, January 2010.

[4] *Cross Support Transfer Service - Specification Framework*, Draft Recommended Standard, CCSDS 921.1-R-2-draft. March 2014.

[5] *TC Synchronization and Channel Coding*. Recommendation for Space Data System Standards, CCSDS 231.0-B-2. Blue Book. Issue 2. Washington, D.C.: CCSDS, September 2010.

[6] *TM Synchronization and Channel Coding*. Recommendation for Space Data System Standards, CCSDS 131.0-B-2. Blue Book. Issue 2. Washington, D.C.: CCSDS, August 2011.

[7] *Return Unframed Telemetry Cross Support Transfer Service*. Recommended Standard. CCSDS 922.?. (future)

[8] *Tracking Data Cross Support Transfer Service*. Draft Recommended Standard. CCSDS 922.2-W-0.6. March 2013.

[9] *IOAG Service Catalog #1*. Issue 1, Revision 4. Interagency Operations Advisory Group. June 2013.

[10] *Monitored Data Cross Support Transfer Service*. Draft Recommended Standard. CCSDS 922.1-W-0.12. February 2013.

[11] Doat, Yves, “Operational Scenario Implementation”, CSTSWG technical note. 20 May 2012.

[12] *Extensible Space Communication Cross Support Service Management Concept*. Draft Informational Report. CCSDS-902.0. Green Book. [in publication].

[13] *Space Communications Cross Support Architecture Description Document*. Report Concerning Space Data System Standards, CCSDS 901.0-G-1. Green Book. Issue 1. Washington, D.C.: CCSDS, November 2013.

[14] *Space Communication Cross Support - Service Management – Service Specification*. Recommendation for Space Data System Standards, CCSDS 910.11-B-1. Blue Book. Issue 1. Washington, D.C.: CCSDS, September 2009.

[15] *Space Communication Cross Support Service Management – Service Agreement and Configuration Profile Data Formats*. Future Recommended Standard.

[16] *IOAG Service Catalog #2*. IOAG.T.SC2.2011.V1.1. Issue 1, Revision 1. Interagency Operations Advisory Group. June 2013.

[17] *TC Space Data Link Protocol*. Recommendation for Space Data System Standards, CCSDS 232.0-B-2. Blue Book. Issue 2. Washington, D.C.: CCSDS, September 2010.

[18] *AOS Space Data Link Protocol*. Recommendation for Space Data System Standards, CCSDS 732.0-B-2. Blue Book. Issue 2. Washington, D.C.: CCSDS, July 2006.

[19] *TM Space Data Link Protocol*. Recommendation for Space Data System Standards, CCSDS 132.0-B-1. Blue Book. Issue 1. Washington, D.C.: CCSDS, September 2003.

[20] *Space Packet Protocol*. Recommendation for Space Data System Standards, CCSDS 133.0-B-1. Blue Book. Issue 1. Washington, D.C.: CCSDS, September 2003.

[21]*Communications Operation Procedure-1*. Recommendation for Space Data System Standards, CCSDS 232.1-B-1. Blue Book. Issue 1. Washington, D.C.: CCSDS, September 2003.

[22] *Encapsulation Service*. Recommendation for Space Data System Standards, CCSDS 133.1-B-2. Blue Book. Issue 2. Washington, D.C.: CCSDS, October 2009 (Cor. 1 September 2012).

[23] *Radio Frequency and Modulation Systems—Part 1: Earth Stations and Spacecraft*. Recommendation for Space Data System Standards, CCSDS 401.0-B-21. Blue Book. Issue 21. Washington, D.C.: CCSDS, July 2011.

[24] *Pseudo-Noise (PN) Ranging Systems*. Recommendation for Space Data System Standards, CCSDS 414.1-B-1. Blue Book. Issue 1. Washington, D.C.: CCSDS, March 2009.

[25] *Data Transmission and PN Ranging for 2 GHz CDMA Link via Data Relay Satellite*. Recommendation for Space Data System Standards, CCSDS 415.1-B-1. Blue Book. Issue 1. Washington, D.C.: CCSDS, September 2011.

[26] *CCSDS File Delivery Protocol (CFDP)*. Recommendation for Space Data System Standards, CCSDS 727.0-B-4. Blue Book. Issue 4. Washington, D.C.: CCSDS, January 2007.

[27] *Space Link Extension—Forward CLTU Service Specification*. Recommendation for Space Data System Standards, CCSDS 912.1-B-3. Blue Book. Issue 3. Washington, D.C.: CCSDS, July 2010.

[28] *Space Link Extension—Forward Space Packet Service Specification* Recommendation for Space Data System Standards, CCSDS 912.3-B-2. Blue Book. Issue 2. Washington, D.C.: CCSDS, July 2010.

[29] *Space Link Extension—Return Operational Control Fields Service Specification*. Recommendation for Space Data System Standards, CCSDS 911.5-B-2. Blue Book. Issue 2. Washington, D.C.: CCSDS, January 2010.

[30] *Rationale, Scenarios, and Requirements for DTN in Space*. Report Concerning Space Data System Standards, CCSDS 734.0-G-1. Green Book. Issue 1. Washington, D.C.: CCSDS, August 2010.

[31] *IP Over CCSDS Space Links*. Recommendation for Space Data System Standards, CCSDS 702.1-B-1. Blue Book. Issue 1. Washington, D.C.: CCSDS, September 2012.

[32] *Tracking Data Message*. Recommendation for Space Data System Standards, CCSDS 503.0-B-1. Blue Book. November 2007.

[33] *Delta-DOR Raw Data Exchange Format*. Recommendation for Space Data System Standards, CCSDS 506.1-B-1. Blue Book. Issue 1. Washington, D.C.: CCSDS, June 2013.

# Types of Configuration Profiles and Service Agreements

The Extensible SCCS Concept Green Book (reference [12]) identifies six types of configurations of functions that are used provide IOAG Service Catalog #1 SCCS services in ESLTs:

1. The SLS configuration, in which the ESLT transfers data to or from one or more Space User Nodes of a CSSS across one or more space links during an SLS;
2. The SLS data delivery configuration, in which the ESLT provides forward and/or return data transfer services during an executing SLS so that one or more Earth User Nodes communicate with the Space User Node(s) with end-to-end connectivity in “real time”;
3. The SLS radiometric configuration, in which the ESLT extracts radiometric measurements from space links of an active SLS and delivers those measurements to the destination Earth User Node in “real time”;
4. The retrieval data delivery configuration, in which the ESLT delivers data that was received from a Space User Node to an Earth User Node, but not necessarily during the execution of the SLS by which the data was received;
5. The retrieval radiometric configuration, in which the ESLT delivers radiometric measurements to the Earth User Node, but not necessarily during the execution of the SLS during which the radiometric measurements were extracted; and
6. The forward offline data delivery configuration, in which the ESLT receives and stores data from an Earth User Node destined for a Space User Node, before the execution of the SLS by which the data is transmitted to the Space User Node.

However, for the purposes of scheduling services and creating Service Packages, these six types combine into three categories[[1]](#footnote-1) of configurations:

1. The SLS configuration category, which comprises the functions of the ESLT that:
2. transfer data to or from one or more Space User Nodes of a CSSS across one or more space links during an SLS;
3. provide forward and/or return data transfer services during an executing SLS so that one or more Earth User Nodes communicate with the Space User Node(s) with end-to-end connectivity in “real time”; and
4. extract radiometric measurements from space links of an active SLS and deliver those measurements to the destination Earth User Node in “real time”.
5. The retrieval configuration category, which comprises the functions or the ESLT that:
6. deliver data that was received from a Space User Node to an Earth User Node, but not necessarily during the execution of the SLS by which the data was received; and
7. deliver radiometric measurements to the Earth User Node, but not necessarily during the execution of the SLS during which the radiometric measurements were extracted;
8. The forward offline data delivery configuration, in which the ESLT receives and stores data from an Earth User Node destined for a Space User Node, before the execution of the SLS by which the data is transmitted to the Space User Node.

These configuration categories have are reflected in both Service Agreements and Configuration Profiles. How they are so reflected is described in section XXX.

The following subsections map the IOAG Service Catalog #1 services into the respective configuration categories. Section 3 shows the mapping of each of the IOAG Service Catalog #1 services supported in the SLS configuration to the Service Components that support it. Section 4 shows the mapping of each of the IOAG Service Catalog #1 services supported in the Retrieval configuration to the Service Components that support it. Section 5 shows the mapping of the IOAG Service Catalog #1 service that is supported in the Forward Offline configuration to the Service Components that support it.

## SLS Configuration Category

All IOAG Service Catalog #1 services are supported to some degree in the SLS configuration category. Some of the services are supported completely in the SLE configuration, some are supported only partially, and for yet others the degree of support differs by the data delivery mode of the service. The following subsections explain the degree of support on a service-by-service basis. The descriptions are organized according the organization of the IOAG Service Catalog #1: Forward Data Delivery Services, Return Data Delivery Services, Radiometric Services, and Service Management Functions.

### Forward Data Delivery Services

Forward CLTU service. The SLS configuration includes all functions needed for the production and provision of the Forward CLTU service.

Forward Space Packet service. The SLS configuration includes all functions needed for the production and provision of the Forward Space Packet service.

NOTE - The Forward Space Packet service is limited to the case where Space Packets are transferred across the interface between User CSSS and Provider CSSS. The Forward File service (see below) may transfer files that *contain* Space Packets, but that is a different service.

Forward Frames (Forward Synchronous Encoded Frame)[[2]](#footnote-2) service. The SLS configuration includes all functions needed for the production and provision of the Forward Frames service.

Forward File service. The SLS configuration includes some of the functions needed for the production and provision of the Forward File service. The functions that are included involve the retrieval of the file to be transmitted from the forward file data store and the transmission of that file (or the contents contained therein, as defined by the configuration of the Forward File service and/or the metadata contained in the file (TBD)) across the forward space link.

### Return Data Delivery Services

Return All Frames (RAF) service. The SLS configuration includes all functions needed for the production and provision of RAF service instances that operate in online delivery mode (either timely or complete).

The SLS configuration includes some of the functions needed for the production and provision of RAF service instances that operate in the offline delivery mode. The functions that are included are the reception, frame synchronization, and decoding of frames received on the return space link and the storage of those frames for subsequent retrieval.

Return Channel Frames (RCF) service. The SLS configuration includes all functions needed for the production and provision of RCF service instances that operate in online delivery mode (either timely or complete).

The SLS configuration includes some of the functions needed for the production and provision of RCF service instances that operate in the offline delivery mode. The functions that are included are the reception, frame synchronization, and decoding of frames received on the return space link and the storage of those frames for subsequent retrieval.

Return Operational Control Field (ROCF) service. The SLS configuration includes all functions needed for the production and provision of ROCF service instances that operate in online delivery mode (either timely or complete).

NOTE - Although the ROCF is formally specified as having an offline delivery mode, using ROCF in offline mode is meaningless.

Return Unframed Telemetry (RUFT) service. The SLS configuration includes all functions needed for the production and provision of RUFT service instances that operate in real time delivery mode.

The SLS configuration includes some of the functions needed for the production and provision of RUFT service instances that operate in the complete delivery mode. The functions that are included are the reception of data received on the return space link, the segmentation of that data, and the storage of those segments for subsequent retrieval.

Return File service. The SLS configuration includes some of the functions needed for the production and provision of the Return File service. The functions that are included are the reception, frame synchronization, and decoding of frames received on the return space link, extraction of the files from those frames (or creation of files from packets in those frames), and the storage of those files for subsequent retrieval.

### RadioMetric Services

Validated Data Radiometric service. The SLS configuration includes some of the functions needed for the production and provision of Validated Data Radiometric service. The functions that are included are the reception of the return link signal, extraction of the raw radiometric data measurements and storage of those measurements.

NOTE - IOAG Service Catalog #1 defines the Validated Data Radiometric service as “relying on” an otherwise-undefined “CSTS Offline Radiometric Service [CORS]” over “CSTS Transfer File Service” (now known as the Generic File Transfer Service). However, according to Wolfgang Hell, the content and format of the captured radiometric data are unique to every Provider CSSS, and the validation process itself is manual and unique to every Provider CSSS.

Raw Data Radiometric service. The SLS configuration includes all functions needed for the production and provision of Tracking Data CSTS instances that operate in real time delivery mode.

The SLS configuration includes some of the functions needed for the production and provision of Raw Data Radiometric service instances operating in the complete delivery mode. The functions that are included are the reception of the return link signal, extraction of the radiometric measurements and conversion into parameters conformant with the Tracking Data Message (reference [32]), and storage of those formatted measurements.

Delta-DOR service. The SLS configuration includes some of the functions needed for the production and provision of the Delta-DOR service. The functions that are included are the reception of the return link signal, extraction of the Delta DOR measurements, conversion of the Delta-DOR measurements into parameters conformant with the Delta-DOR Raw Data Exchange Format (reference [33]), and storage of those raw-formatted measurements.

Open Loop Recording service. The SLS configuration includes some of the functions needed for the production and provision of the Open Loop Recording service. The functions that are included are the reception of the return link signal, digitial conversion of the Open Loop Recording signals into parameters conformant with the Delta-DOR Raw Data Exchange Format (reference [33]), and storage of those raw-formatted measurements.

NOTE - IOAG Service Catalog #1 defines the Delta-DOR service as processing and delivering both raw Delta-DOR and Open Loop Recording data. In this Technical Note the two are treated as separate services because the two have different operational purposes and behavior. Open Loop Recording data is converted to Delta-DOR Raw Data Exchange format prior to storage.

### Service Management Functions

Engineering Monitoring Data Delivery. The SLS configuration includes all functions needed for the production and provision of Monitored Data CSTS instances.

## Retrieval Configuration Category

Some IOAG Service Catalog #1 services in the Return Data Delivery and Radiometric services are supported in the Retrieval configuration category, as described in the following subsections.

### Return Data Delivery Services

RAF service. The Retrieval configuration includes some of the functions needed for the production and provision of RAF service instances that operate in offline delivery mode. The functions that are included are the retrieval of frames from the data store and the transfer of those frames via an RAF service instance operating in the offline delivery mode.

RCF service. The Retrieval configuration includes some of the functions needed for the production and provision of RCF service instances that operate in offline delivery mode. The functions that are included are the retrieval of frames from the data store and the transfer of those frames via an RCF service instance operating in the offline delivery mode.

RUFT service. The Retrieval configuration includes some of the functions needed for the production and provision of RUFT service instances that operate in complete delivery mode. The functions that are included are the retrieval of telemetry segments from the data store and the transfer of those telemetry segments via an RUFT service instance operating in the complete delivery mode.

Return File service. The Retrieval configuration includes some of the functions needed for the production and provision of Return File service instances. The functions that are included are the retrieval of files conforming to the Return File service file format from the data store and the transfer of those files via the CCSDS Generic File Transfer Service.

### RadioMetric Services

Validated Data Radiometric service. The Retrieval configuration includes some of the functions needed for the production and provision of Validated Data Radiometric service. The functions that are included are the retrieval of files of validated radiometric data formatted in conformance with the Tracking Data Message format (reference ???) and the transfer of those files via the CCSDS Generic File Transfer Service.

NOTES

1. The validation of raw radiometric data involves a Provider CSSS-specific manual process. In this Tech Note, this process is assumed to also include the creation of the TDM (or TDMs) containing the validated data, and the placing of the files containing those TDMs into the data store such that they can be subsequently retrieved.
2. IOAG Service Catalog #1 includes validated Delta-DOR in the category of validated radiometric data. The process of validating the Delta-DOR data and converting into the TDM representation of validated D-DOR information is also assumed to be part of the Provider CSSS-specific process of validating radiometric data.

Raw Data Radiometric service. The Retrieval configuration includes some of the functions needed for the production and provision of Raw Data Radiometric service instances operating in the complete delivery mode. The functions that are included are the retrieval of the specified TDM Segments from the data store and the transfer of those TDM segments via the Tracking Data CSTS operating in complete delivery mode.

Delta-DOR service. The SLS configuration includes some of the functions needed for the production and provision of the Delta-DOR service. The functions that are included are the retrieval of files of raw Delta-DOR data formatted in conformance with the Delta-DOR Raw Data Exchange Format (reference [33]) and the transfer of those files via the CCSDS Generic File Transfer Service.

Open Loop Recording service. The SLS configuration includes some of the functions needed for the production and provision of Open Loop Recording service. The functions that are included are the retrieval of files of Open Loop Recording data formatted in conformance with the Delta-DOR Raw Data Exchange Format (reference [33]) and the transfer of those files via the CCSDS Generic File Service.

## Forward Offline Configuration Category

One IOAG Service Catalog #1 Forward Data Delivery service is supported in the Forward Offline configuration category, as described in the following subsection.

### Forward Data Delivery Services

Forward File service. The Forward Offline configuration includes some of the functions needed for the production and provision of Forward File service instances. The functions that are included are the transfer of files formatted in accordance with the Forward File service format using the CCSDS Generic File Transfer Service, and the storage of those files for subsequent transmission on a forward space link during an active SLS.

NOTE- The Forward File service has not yet been defined. It is not known whether support for the Forward File service will require Forward Offline Service Packages to be created and/or scheduled. If such Service Packages are required, they could be constructed as described herein.

# Service Mappings to Abstract Service Components And Service Components for the SLS Configuration

Section 2.1 identifies the IOAG services for which the production and provision functions are fully or partially supported in SLS configurations. This section maps those production and provision functions to the Abstract Service Components (ASCs) and the current Service Components that contain the Functional Resources that represent those functions.

Figure 3‑1 illustrates the ASCs that are used in the SLS configuration. Each ASC icon is represented by a solid-lined, rounded-corner rectangle. Within each ASC icon, the current SC for that ASC are illustrated as dashed-line, rounded-corner rectangles. Connectivity between two ASCs is illustrated by a solid arrow connecting the two ASCs. Dashed lines are used in an ASC icon to represent connections that are not with that ASC but that bypass (i.e. go behind) it.

NOTE 1 - The figure also includes the Space Internetworking ASC and the Service Control SC specialization of the Service Management Functions ASC, neither of which is used by any Service Catalog #1 service. This ASC and SC are included in the figure to represent future extensibility of the ASC model to accommodate Space Internetworking services and the addition of a new specialization to support the anticipated future Service Control CSTS.

Figure 3‑2 illustrates the connectivity among the SCs that are used in the SLS configuration. This figure represents the template of SCs from which individual SLS Service Agreements and SLS Configuration Profiles are derived.

NOTE 2 - The term “SLS Service Agreement” is used to refer to the section of a Service Agreement that deals with the description of capabilities to be provided during SLSes. Similarly, the term “SLS Configuration Profiles” is used to describe the types of Configuration Profiles that are used in SLS Service Packages.

Table 3‑1 summarizes the ASCs that are used by the SLS configuration of each of the IOAG Service Catalog #1 services, and the conditions (if any) for that usage. “M” designates that the ASC is mandatory in all cases. “Cx” identifies the condition under which the ASC is used. Absence of any entry designates that the ASC plays no role in the production or provision of the service under any circumstances.

The following subsections map each of the IOAG Service Catalog #1 services to the SCs that participate in the production and/or provision of that service in the SLS configuration. For each service, the following information each ASC that is associated with that service is identified, whether the ASC is mandatory or optional for that service, if optional, the conditions under which the ASC is included.



Figure 3‑1: **Abstract Service Components Used in SLS Configurations**

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Figure 3‑2: **Connectivity of Service Components in SLS Configurations**

Table 3‑1: Abstract Service Components Used in the SLS Configurations of the IOAG Services





For each ASC used by a service, the following are identified:

1. Whether the service will be able to use other future SC specializations of ASC or is limited to the existing specialization(s);
2. The existing SC(s) that are to be used for the service. An existing specialization is one that is based on one or more published CCSDS Recommended Standards (or other standards) that are expected to be used for the service. Any constraints with respect to specific specializations are noted. If multiple specializations are identified, only one specialization can be used in any given Configuration Profile;
3. For each specialization, the Accessor port(s), if any, used in the configuration of that service, and whether the port is an essential port (see below) of the parent ASC or defined for the SC; and
4. For each SC specialization, the Service Access Point (SAP) port(s), if any, used in the configuration of that service, and whether the port is an essential port of the parent ASC or defined for the SC.

The SAP/Accessor ports are used to identify the relationships between instances of different SC types. These port pairs are necessary to eliminate the ambiguity when multiple instances of the same SC exist within a Service Package, or when a type of SC has different types of relationships with other types of SCs. Each port pair is named for the principal data type that is exchanged between the SC types, but the relationship is not necessarily limited to that data exchange.

The SC that possesses the SAP port is the SC that provides its “service” to other SCs[[3]](#footnote-3). An SC with an Accessor port of a particular type is one that requires that service from an SC. The SAP port normally belongs to the SC “nearer to” the space link, and the Accessor port normally belongs to the SC of the pair that is “farther away.”

Some of the ASCs have *essential* Accessor and SAP port types. An essential port is one that is fundamental to the nature of the ASC and is necessary for it to connect to the ASC upon which it depends and to the ASCs that depend on it. Every SC must implement the essential ports of its parent ASC. Table 3‑2 identifies the ASCs with essential ports and names those essential ports.

Table 3‑2: Essential SAP and Accessor Ports of Abstract Service Components Used in SLS Configurations

| **Abstract Service Component** | **Essential Accessor Port** | **Essential SAP Port(s)** |
| --- | --- | --- |
| Aperture | The Aperture ASC has no Accessor Ports because it terminates the configuration on the space link side. | Forward Modulated Waveform,  Return Modulated Waveform |
| Forward Physical Channel Transmission | Forward Modulated Waveform | Forward Channel Symbols  Transmit Frequency  Ranging Signal Timing |
| Forward Sync and Channel Encoding | Forward Channel Symbols | Forward All Transfer Frames |
| Forward Space Link Protocol Transmission | Forward All Transfer Frames | Forward Packett |
| Return Physical Channel Reception | Return Modulated Waveform | Return Channel Symbols  Receive Frequency  Range and Doppler |
| Return Sync and Channel Decoding | Return Channel Symbols | Return All Transfer Frames |
| Return Space Link Protocol Reception | Return All Transfer Frames | Return Packet |
| SLS Data Delivery Production | The SLS Data Delivery Production ASC has no essential Accessor ports. All Accessor ports are specific to the SC specializations. | The SLS Data Delivery Production ASC has no essential SAP ports. All SAP ports are specific to the SC specializations. |
| SLS Radiometric Data Production | Transmit Frequency  Range and Doppler | The SLS Radiometric Data Production ASC has no essential SAP ports. All SAP ports are specific to the SC specializations. |
| Offline Data Storage | The Offline Data Storage ASC has no essential Accessor ports. All Accessor ports are specific to the SCspecializations | The Offline Data Storage ASC has no essential SAP Ports. All SAP ports are specific to the SC specializations.  Note that for SLS configurations no SAP ports are active for any offline Data Storage SCs because transfer between data storage and the Mission is performed as part of an offline configuration by definition. |
| Data Transfer Services- | The Data Transfer Services ASC has no essential Accessor ports. All Accessor ports are specific to the specializations. | The Data Transfer Services ASC has no SAP Ports because it terminates the configuration on the ground side. |

Some of the services have *modes* and/or *options* that determine which ASCs, SCs, and/or ports are involved in a particular configuration of the service. The modes of a service represent different variants of the service. The values of a *mode* are mutually exclusive at any given time. For example, the Forward Frame service has three Service Data Unit modes: Telecommand (TC) Frame mode, Advanced Orbiting System (AOS) AOS Frame mode, and AOS Channel Access Data Unit (CADU) mode. An instance of the Forward Frame service can be configured in only one of these modes at any given time. Services can even have multiple mode types, where any one configuration must have values specified for each of the mode types. As an abstract example, a service might have one of its mode types being the type of Service Data Unit carried, and another being the kind of space link protocol to use.

*Options* are additional capabilities that can be configured as part of the provision or production of the service. Options can exist for the service as a whole or they can be tied to specific modes of the service.

Each of the service descriptions includes the following:

1. The name of each of the ASCs that are used to configure that service in an SLS configuration. If the ASC is optional or dependent on the mode of the service, those dependencies are also identified;
2. A class diagram of the known or planned SC that will be used to configure that service;
3. If the service has modes, a table that identifies the modes of the service. If the service has only one mode type, the syntax “M*n*” is used, where *n* is an integer value that represents one possible mode value for that mode. If the service has multiple mode types, each mod type is designated using the syntax “M*Xn*”, where *X* is an alphabetic character identifying the mode type and where *n* is an integer value that represents one possible mode value for that mode type. The Mode table lists the mode identifiers, the mode names (qualified by mode type if multiple mode type if multiple mode types are available in the service), and a brief description of the mode value;
4. If the service has options, a table that identifies the options for the service. The syntax “O*n*” is used, where *n* is an integer value that represents the individual option, The Option table lists the option identifiers, the option names, and a brief description of the option. If the option is predicated on specific modes, that conditional dependency is identified as a predicate of the option; and
5. A table that specifies:
6. The name of each ASC that is used to configure that service in an SLS configuration. If the use of that ASC for that service is dependent on particular modes or options, the name is prefixed by those modes or options sing the following syntax: a logical OR selection among mode or options is represented by commas between the identifiers of those modes or options, and a logical AND is represented by “&” between the identifiers . Thus “M1, M2” means that the ASC is used if either mode 1 or mode 2 is configured, and “M3 & O2” means that the ASC is used only if both mode 3 and option 2 are configured.. Any mode or option designation also applies to all SC specializations, Accessor ports, and SAP ports of that ASC.
7. Whether new SC specializations can be substituted for the known SCs (Yes) or not (No) in the future.
8. Identification of the SC specializations of the ASC that are known or planned. There may be multiple known or planned SCs, the use of which is dependent on the mode and/or options of the service. If so, the identification of each SC is prefixed with the mode and/or option identifiers using the syntax described above;

NOTE - If multiple SCs are known or planned, the selection of the SC is tied to a mode type.

1. Identification of the Service Access Ports that are used by the ASC in the SLS configuration of the service. If the use of the SAP port is conditional on one or more modes or options in addition to any conditions on use of that entire ASC, that conditional dependency prefixes the name of the SAP port using the syntax described above; and
2. Identification of the Accessor Ports that are used by the ASC. If the use of the Accessor port is conditional on one or more modes or options in addition to any conditions on use of that entire ASC, that conditional dependency prefixes the name of the SAP port using the syntax described above.
3. If notes are needed for clarification, they are designated by integers enclosed in parentheses that index the notes, which immediately follow the table.

## Forward Data Delivery Services

### Forward CLTU Service

The Forward CLTU service is configured using the following ASCs:

1. Aperture;
2. Forward Physical Channel Transmission,
3. Forward Sync and Channel Encoding;
4. Data Transfer Services;
5. Return Physical Channel Reception (optional);
6. Return Sync and Channel Decoding (optional); and
7. Return Space Link Protocol Reception (optional).

Figure 3-3 illustrates the ASCs and SCs used in the SLS configuration of the Forward CLTU service.



**Figure 3‑3: SCs Used in Forward CLTU SLS Configuration**

The Forward CLTU service does not support different operating modes.

Table 3‑3: Service Options for Forward CLTU SLS Configuration

|  |  |  |  |
| --- | --- | --- | --- |
| **Option** | **Name** | **Description** | **Predicate** |
| O1 | With Forward Link Status | Transfer of CLTUs is gated based on forward link status information that is reported in the CLCWs of transfer frames received on the return link. |  |

Table 3‑4: ASC Characteristics in Forward CLTU SLS Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Aperture | Yes | RF Aperture | Forward Modulated Waveform (essential)  O1: Return Modulated Waveform (essential). | none |
| Forward Physical Channel Transmission | Yes | CCSDS 401 Forward Physical Channel Reception. | Forward Physical Channel Symbols (essential). | Forward Modulated Waveform (essential)  O1: CLCW (specialization). |
| Forward Sync and Channel Encoding | Yes (1) | TC Sync and Channel Encoding | CLTU (specialization) | Forward Physical Channel Symbols (essential) |
| Data Transfer Services | No | Forward CLTU | n/a | CLTU (specialization). |
| O1: Return Physical Channel Reception | Yes | CCSDS 401 Return Physical Channel Reception. | Return Physical Channel Symbols (essential). | Return Modulated Waveform (essential). |
| O1: Return Sync and Channel Decoding | Yes | Return TM Synchronization and Channel Decoding | Return All Transfer Frames (essential). | Return Physical Channel Symbols (essential). |
| O1: Return Space Link Protocol Reception | Yes (2) | Return TM/AOS Space Link Protocol. | CLCW (specialization) | Return All Transfer Frames (essential). |

NOTES -

1 Due to the TC-specific nature of the Forward CLTU service, it is nominally tied to the TC Sync and Channel Encoding specialization. However, the SLE Forward CLTU service specification has an escape clause that allows it to be used to transfer any block of octets, so theoretically it could be used for a non TC CLTU forward service (such as a pseudo-serial command stream service).

1 Any future SC specialization of the Return Space Link Protocol Reception ASC must provide a CLCW SAP if it is to be used to support Forward CLTU service that is gated by forward link status information.

### Forward Space packet Service

The Forward Space Packet service is configured using the following ASCs:

1. Aperture;
2. Forward Physical Channel Transmission,
3. Forward Sync and Channel Encoding;
4. Forward Space Link Protocol;
5. Data Transfer Services;
6. Return Physical Channel Reception (optional);
7. Return Sync and Channel Decoding (optional);
8. Return Sync and Channel Decoding (optional); and
9. Return Space Link Protocol Reception (optional).

Figure 3‑4 illustrates the ASCs and SCs used in the SLS configuration of the Forward Space Packet service.



**Figure 3‑4: SCs Used in Forward Space Packet SLS Configuration**

The Forward Space Packet service does not support different service modes. The service options are listed in Table 3‑5.

Table 3‑5: Service Options for Forward Space Packet SLS Configuration

|  |  |  |  |
| --- | --- | --- | --- |
| **Option** | **Name** | **Description** | **Predicate** |
| O1 | With Forward Link Status | Transfer of CLTUs is gated based on forward link status information that is reported in the CLCWs of transfer frames received on the return link. |  |
| O2 | COP-1 | COP-1 is used for reliable transmission of the Space Packets. |  |

Table 3‑6: ASC Characteristics in Forward Space Packet SLS Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Aperture | Yes | RF Aperture | Forward Modulated Waveform (essential)  O1, O2: Return Modulated Waveform (essential). | none |
| Forward Physical Channel Transmission | Yes | CCSDS 401 Forward Physical Channel Reception. | Forward Physical Channel Symbols (essential). | Forward Modulated Waveform (essential)  O1: CLCW (specialization). |
| Forward Sync and Channel Encoding | Yes (1) | TC Sync and Channel Encoding | CLTU (specialization) | Forward Physical Channel Symbols (essential) |
| Forward Space Link Protocol Transmission | Yes | TC Space Link Protocol (1) | Forward Space Packet (specialization) | CLTU (essential)  O2: CLCW (specialization). |
| Data Transfer Services | No | Forward Space Packet | n/a | Forward Space Packet (specialization). |
| O1, O2: Return Physical Channel Reception | Yes | CCSDS 401 Return Physical Channel Reception. | Return Physical Channel Symbols (essential). | Return Modulated Waveform (essential). |
| O1, O2: Return Sync and Channel Decoding | Yes | Return TM Synchronization and Channel Decoding | Return All Transfer Frames (essential). | Return Physical Channel Symbols (essential). |
| O1, O2: Return Space Link Protocol Reception | Yes (2) | Return TM/AOS Space Link Protocol. | CLCW (specialization) | Return All Transfer Frames (essential). |

NOTES

1 -As currently defined, the SLE Forward Space Packet service operates only over TC space link protocols and TC sync and channel coding. However, the Cross Support Reference Model (reference [1]) also allows Forward Space Packet service to operate over AOS forward links, and other sync and coding schemes may arise in the future.

1 Any future SC specialization of the Return Space Link Protocol Reception ASC must provide a CLCW SAP if it is to be used to support Forward Space Packet service that operates over COP-1 and/or is gated by forward link status information.

### Forward Frame Service

The Forward Frame service is configured using the following ASCs:

1. Aperture;
2. Forward Physical Channel Transmission,
3. Forward Sync and Channel Encoding;
4. Forward Space Link Protocol;
5. Data Transfer Services;
6. Return Physical Channel Reception (optional);
7. Return Sync and Channel Decoding (optional);

Figure 3‑5 illustrates the ASCs and SCs used in the SLS configuration of the Forward Frame service.



**Figure 3‑5: SCs Used in Forward Frame SLS Configuration**

Table 3‑7: Service Modes for Forward Frame SLS Configuration

|  |  |  |
| --- | --- | --- |
| **Mode** | **Name** | **Description** |
| M1 | TC Frame Mode | Transfer of frames in TC Frame mode |
| M2 | AOS Frame Mode | Transfer of frames in AOS Frame mode |
| M3 | AOS CADU Mode | Transfer of frames embedded in CADUs in AOS CADU mode |

Table 3‑8: Service Options for Forward Frame SLS Configuration

|  |  |  |  |
| --- | --- | --- | --- |
| **Option** | **Name** | **Description** | **Predicate** |
| O1 | With Forward Link Status | Transfer of frames in TC Frame mode, where transmission of the CLTUs containing those TC frames is gated based on forward link status information that is reported in the CLCWs of transfer frames received on the return link. | M1 |

Table 3‑9: ASC Characteristics in Forward Frame SLS Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Aperture | Yes | RF Aperture | Forward Modulated Waveform (essential)  O1: Return Modulated Waveform (essential). | n/a |
| Forward Physical Channel Transmission | Yes | CCSDS 401 Forward Physical Channel Reception. | Forward Physical Channel Symbols (essential). | Forward Modulated Waveform (essential).  O1: CLCW (specialization). |
| Forward Sync and Channel Encoding | Yes | M1: TC Sync and Channel Encoding  M2, M3: AOS Sync and Channel Encoding | M1, M2: Forward All Transfer Frames (essential)  M3 - Forward AOS CADU (specialization) | Forward Physical Channel Symbols (essential). |
| M1, M2: Forward Space Link Protocol Transmission | Yes | M1: TC Space Link Protocol  M2: Forward AOS Space Link Protocol | M1: TC VC Frames (specialization)  M2: Forward AOS VC Frames (specialization) | Forward All Transfer Frames (essential). |
| Data Transfer Services | No | Forward Frame | n/a | M1: TC VC Frames (specialization).  M2: Forward AOS VC Frames (specialization).  M3: Forward AOS CADU (specialization). |
| O1: Return Physical Channel Reception | Yes | CCSDS 401 Return Physical Channel Reception. | Return Physical Channel Symbols (essential port). | Return Modulated Waveform (essential). |
| O1: Return Sync and Channel Decoding | Yes | Return TM Synchronization and Channel Decoding | Return All Transfer Frames (essential). | Return Physical Channel Symbols (essential). |
| O1: Return Space Link Protocol Reception | Yes | Return TM/AOS Space Link Protocol. | CLCW (specialization) | Return All Transfer Frames (essential). |

### Forward FILE Service

NOTE - The Forward File service has not yet been specified. The description in this subsection describes one possible configuration of SCs. The actual Forward File service configuration may or may not resemble this strawman description. **The following description is still very much a work in progress, with numerous issues that still need to be worked out.**

The Forward File service is configured using the following ASCs:

1. Aperture;
2. Forward Physical Channel Transmission,
3. Forward Sync and Channel Encoding;
4. Forward Space Link Protocol;
5. SLS Data Delivery Production;
6. Offline Data Storage;
7. Return Physical Channel Reception (optional);
8. Return Sync and Channel Decoding (optional);
9. Return Sync and Channel Decoding (optional); and
10. Return Space Link Protocol Reception (optional).

Figure 3‑6 illustrates the ASCs and SCs used in the SLS configuration of the Forward File service.



**Figure 3‑6: SCs Used in Forward File SLS Configuration**

Table 3‑10: Service Modes for Forward File SLS Configuration

| **Mode** | **Name** | **Description** |
| --- | --- | --- |
| MA1 | Space Link Protocol: TC Mode | Use of TC Space Link Protocol for forward transfer |
| MA2 | Space Link Protocol: AOS Mode | Use of AOS Forward Space Link Protocol for forward transfer |

Table 3‑11: Service Options for Forward File SLS Configuration

|  |  |  |  |
| --- | --- | --- | --- |
| **Option** | **Name** | **Description** | **Predicate** |
| O1 | Reliable CFDP | Files are transmitted via CFDP operating in reliable mode |  |
| O2 | With Forward Link Status | Transfer of CLTUs is gated based on forward link status information that is reported in the CLCWs of transfer frames received on the return link. | MA1 |
| O3 | COP-1 | COP-1 is used for reliable transmission of the Space Packets. | MA1 |

NOTE - If the file transfer is performed using reliable CFDP (option O1), COP-1 (option O3) will not be used.

Table 3‑12: ASC Characteristics in Forward File SLS Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Aperture | Yes | RF Aperture | Forward Modulated Waveform (essential)  O1, O2, O3: Return Modulated Waveform (essential). | n/a |
| Forward Physical Channel Transmission | Yes | CCSDS 401 Forward Physical Channel Transmission | Forward Physical Channel Symbols (essential). | Forward Modulated Waveform (essential).  O2: CLCW (specialization). |
| Forward Sync and Channel Encoding | Yes | MA1: TC Sync and Channel Encoding  MA2: AOS Sync and Channel Encoding | Forward All Transfer Frames (essential) | Forward Physical Channel Symbols (essential). |
| Forward Space Link Protocol Transmission | Yes | MA1: TC Space Link Protocol  MA2: Forward AOS Space Link Protocol | Forward Packet (essential) | Forward All Transfer Frames (essential).  O3: CLCW (specialization). |
| SLS Data Delivery Production | No | Forward File Data Delivery Production | Forward Space Data File (specialization | Forward Packet (essential)  O1: Return Packet (essential). |
| Offline Data Storage | No | Forward File Data Store | n/a | Forward Space Data File (specialization) |
| O1, O2, O3: Return Physical Channel Reception | Yes | CCSDS 401 Return Physical Channel Reception. | Return Physical Channel Symbols (essential port). | Return Modulated Waveform (essential). |
| O1, O2, O3: Return Sync and Channel Decoding | Yes | Return TM Synchronization and Channel Decoding | Return All Transfer Frames (essential). | Return Physical Channel Symbols (essential). |
| O1, O2, O3: Return Space Link Protocol Reception | Yes | Return TM/AOS Space Link Protocol. | Return Packet (essential).  O2, O3: CLCW (specialization) | Return All Transfer Frames (essential). |

## Return Data Delivery Services

### Return All Frames Service

The Return All Frames service is configured using the following ASCs:

1. Aperture;
2. Return Physical Channel Reception;
3. Return Sync and Channel Decoding;
4. Return Space Link Protocol Reception;
5. SLS Data Delivery Production;
6. Offline Data Storage; and
7. Data Transfer Services.

Figure 3‑7 illustrates the ASCs and SCs used in the SLS configuration of the Return All Frames service.



**Figure 3‑7: SCs Used in Return All Frames SLS Configuration**

Table 3‑13: Service Options for Return All Frames SLS Configuration

|  |  |  |  |
| --- | --- | --- | --- |
| **Option** | **Name** | **Description** | **Predicate** |
| O1 | Online | The service includes RAF service instances in online delivery mode |  |
| O2 | Storage | Transfer frames are to be stored for subsequent retrieval |  |

NOTE - At least one of O1 and O2 must be included.

Table 3‑14: ASC Characteristics in Return All Frames SLS Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Aperture | Yes | RF Aperture | Return Modulated Waveform (essential) | n/a |
| Return Physical Channel Reception | Yes | CCSDS 401 Return Physical Channel Reception. | Return Physical Channel Symbols (essential). | Return Modulated Waveform (essential). |
| Return Sync and Channel Decoding | Yes | Return TM Synchronization and Channel Decoding | Return All Transfer Frames (essential). | Return Physical Channel Symbols (essential). |
| Return Space Link Protocol Reception | Yes | Return TM/AOS Space Link Protocol. | Return All Annotated Transfer Frames (specialization). | Return All Transfer Frames (essential). |
| O2: SLS Data Delivery Production | No | Transfer Frame Data Sink | Return Selected Transfer Frames (specialization) | Return All Annotated Transfer Frames (specialization). |
| O2: Offline Data Storage | No | Offline Frame Buffer | n/a | Return Selected Transfer Frames (specialization) |
| O1: Data Transfer Services | No | SLE Return All Frames | n/a | Return All Annotated Transfer Frames (specialization). |

### Return Channel Frames Service

The Return Channel Frames service is configured using the following ASCs:

1. Aperture;
2. Return Physical Channel Reception;
3. Return Sync and Channel Decoding;
4. Return Space Link Protocol Reception;
5. SLS Data Delivery Production;
6. Offline Data Storage; and
7. Data Transfer Services.

Figure 3‑8 illustrates the ASCs and SCs used in the SLS configuration of the Return Channel Frames service.



**Figure 3‑8: SCs Used in Return Channel Frames SLS Configuration**

Table 3‑15: Service Options for Return Channel Frames SLS Configuration

|  |  |  |  |
| --- | --- | --- | --- |
| **Option** | **Name** | **Description** | **Predicate** |
| O1 | Online | The service includes RCF service instances in online delivery mode |  |
| O2 | Storage | Transfer frames are to be stored for subsequent retrieval |  |

NOTE - At least one of O1 and O2 must be included.

Table 3‑16: ASC Characteristics in Return Channel Frames SLS Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Aperture | Yes | RF Aperture | Return Modulated Waveform (essential) | n/a |
| Return Physical Channel Reception | Yes | CCSDS 401 Return Physical Channel Reception. | Return Physical Channel Symbols (essential). | Return Modulated Waveform (essential). |
| Return Sync and Channel Decoding | Yes | Return TM Synchronization and Channel Decoding | Return All Transfer Frames (essential). | Return Physical Channel Symbols (essential). |
| Return Space Link Protocol Reception | Yes | Return TM/AOS Space Link Protocol. | Return All Annotated Transfer Frames (specialization). | Return All Transfer Frames (essential). |
| O2: SLS Data Delivery Production | No | Transfer Frame Data Sink | Return Selected Transfer Frames (specialization) | Return All Annotated Transfer Frames (specialization). |
| O2: Offline Data Storage | No | Offline Frame Buffer | n/a | Return Selected Transfer Frames (specialization) |
| O1: Data Transfer Services | No | SLE Return Channel Frames | n/a | Return All Annotated Transfer Frames (specialization). |

### Return Operational Control Fields Service

The ROCF service is configured using the following ASCs:

1. Aperture;
2. Return Physical Channel Reception;
3. Return Sync and Channel Decoding;
4. Return Space Link Protocol Reception; and
5. Data Transfer Services.

Figure 3‑9 illustrates the ASCs and SCs used in the SLS configuration of the ROCF service.



**Figure 3‑9: SCs Used in ROCF SLS Configuration**

The ROCF service has no choice of service modes and no options.

Table 3‑17: ASC Characteristics in ROCF SLS Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Aperture | Yes | RF Aperture | Return Modulated Waveform (essential) | n/a |
| Return Physical Channel Reception | Yes | CCSDS 401 Return Physical Channel Reception. | Return Physical Channel Symbols (essential). | Return Modulated Waveform (essential). |
| Return Sync and Channel Decoding | Yes | Return TM Synchronization and Channel Decoding | Return All Transfer Frames (essential). | Return Physical Channel Symbols (essential). |
| Return Space Link Protocol Reception | Yes | Return TM/AOS Space Link Protocol. | Return All Annotated Transfer Frames (specialization). | Return All Transfer Frames (essential). |
| Data Transfer Services | No | SLE ROCF | n/a | Return All Annotated Transfer Frames (specialization). |

### Return Unframed Telemetry Service

The RUFT service is configured using the following ASCs:

1. Aperture;
2. Return Physical Channel Reception;
3. Return Sync and Channel Decoding; and
4. Data Transfer Services.

Figure 3‑10 illustrates the ASCs and ASCs used in the SLS configuration of the ROCF service.



**Figure 3‑10: SCs Used in RUFT SLS Configuration**

The RUFT service in the SLS configuration has two options, Real-time and Storage. The Real-Time option affects the ASCs and SAP ports used, but the Storage option has effects that are only internal to the SLS Data Delivery Production ASC. Therefore, the following table lists only the Real-time option.

Table 3‑18: Service Options for RUFT SLS Configuration

|  |  |  |  |
| --- | --- | --- | --- |
| **Option** | **Name** | **Description** | **Predicate** |
| O1 | Real-Time | The configuration includes RUFT service instances in online delivery mode |  |
| O2: | Offline | The configuration includes storage of TM segments for subsequent delivery via a retrieval configuration |  |

Table 3‑19: ASC Characteristics in RUFT SLS Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Aperture | Yes | RF Aperture | Return Modulated Waveform (essential) | n/a |
| Return Physical Channel Reception | Yes | CCSDS 401 Return Physical Channel Reception. | Return Physical Channel Symbols (essential). | Return Modulated Waveform (essential). |
| Return Sync and Channel Decoding | No | Telemetry Segmenter | Return All Transfer Frames (essential) (1) | Return Physical Channel Symbols (essential). |
| O2: SLS Data Delivery Production | No | TM Segment Sink (1) | Return All Transfer Frames (specialization) (1) | Return All Transfer Frames (specialization) (1) |
| O2: Offline Data Storage | No | TM Segment Recording Buffer | Return All Transfer Frames (specialization) (1) | Return All Transfer Frames (specialization) (1) |
| O1: Data Transfer Services | No | Return Unframed Telemetry | n/a | Return All Transfer Frames (specialization) (1) |

NOTE 1 - For the purposes of the RUFT service and its associated SCs, the telemetry segments are treated as Transfer Frames. Therefore the Telemetry Segmenter, TM Segment Sink, TM Segment Recording Buffer, and Return Unframed Telemetry SCs use the Return All Transfer Frames ports.

### Return FILE Service

NOTE 1 - The Return File service has not yet been specified. The description in this subsection describes one possible configuration of SCs. The actual Return File service configuration may or may not resemble this strawman description. **The following description is still very much a work in progress, with numerous issues that still need to be worked out.**

NOTE 2 - In this strawman conception, it is assumed that the Return File service can acknowledge receipt of files from space only through CFDP operating in reliable mode, and that in doing so COP-1 is not used.

The Return File service is configured using the following ASCs:

1. Aperture;
2. Return Physical Channel Reception;
3. Return Sync and Channel Decoding;
4. Return Sync and Channel Decoding; and
5. Return Space Link Protocol Reception;
6. SLS Data Delivery Production;
7. Offline Data Storage;
8. Forward Physical Channel Transmission (optional),
9. Forward Sync and Channel Encoding (optional); and
10. Forward Space Link Protocol (optional).

Figure 3‑6 illustrates the ASCs and SCs used in the SLS configuration of the Return File service.



**Figure 3‑11: SCs Used in Return File SLS Configuration**



Table 3‑20: Service Options for Return File SLS Configuration

|  |  |  |  |
| --- | --- | --- | --- |
| **Option** | **Name** | **Description** | **Predicate** |
| O1 | Reliable CFDP | Files are transmitted via CFDP operating in reliable mode, |  |
| O1.1 | AOS Mode | Files are transmitted via CFDP operating in reliable mode, with the acknowledgements over an AOS forward channel | O1 |
| O1.2 | TC Mode | Files are transmitted via CFDP operating in reliable mode, with the acknowledgements over a TC forward channel | O1 |
| O1.2A | With Forward Link Status | Transfer of CLTUs is gated based on forward link status information that is reported in the CLCWs of transfer frames received on the return link. | O1.2 |
| O1.2B | COP-1 | COP-1 is used for reliable transmission on the forward link. | O1.2 |

NOTE - If O1 is selected, precisely one of O1.1 and O1.2 must be selected.

NOTE - Either of O1.2A and O1.2B may independently be selected in combination with O1.2.

Table 3‑21: ASC Characteristics in Return File SLS Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Aperture | Yes | RF Aperture | Return Modulated Waveform (essential).  O1: Forward Modulated Waveform (essential) | none |
| Return Physical Channel Reception | Yes | CCSDS 401 Return Physical Channel Reception. | Return Physical Channel Symbols (essential port). | Return Modulated Waveform (essential). |
| Return Sync and Channel Decoding | Yes | Return TM Synchronization and Channel Decoding | Return All Transfer Frames (essential). | Return Physical Channel Symbols (essential). |
| Return Space Link Protocol Reception | Yes | Return TM/AOS Space Link Protocol. | Return Packet (essential).  O1.2A, O1.2B: CLCW (specialization) | Return All Transfer Frames (essential). |
| SLS Data Delivery Production | No | Return File Data Delivery Production | Return Space Data File (specialization) | Return Packet (essential).  O1: Forward Packet (essential) |
| Offline Data Storage | No | Return File Data Store | n/a | Return Space Data File (specialization) |
| O1: Forward Physical Channel Transmission | Yes | CCSDS 401 Forward Physical Channel Transmission | Forward Physical Channel Symbols (essential). | Forward Modulated Waveform (essential). |
| O1: Forward Sync and Channel Encoding | Yes | O1.1: AOS Sync and Channel Encoding  O1.2: TC Sync and Channel Encoding | Forward All Transfer Frames (essential) | Forward Physical Channel Symbols (essential).  O1.2A: CLCW (specialization). |
| O1: Forward Space Link Protocol Transmission | Yes | O1.1: Forward AOS Space Link Protocol  O1.2: TC Space Link Protocol | ~~M1:~~ Forward ~~Space~~ Packet (essential)  ~~M2: Forward Encapsulation Packet (essential)~~ | Forward All Transfer Frames (essential).  O1.2B: CLCW (specialization). |

## RadioMetric Services

### Validated Data RadioMetric Service

The Validated Data Radiometric service is configured using the following ASCs:

1. Aperture;
2. Forward Physical Channel Transmission (optional);
3. Return Physical Channel Reception;
4. SLS Radiometric Data Production; and
5. Offline Data Storage..

Figure 3‑12 illustrates the ASCs and SCs used in the SLS configuration of the Validated Data Radiometric service.



**Figure 3‑12: SCs Used in Validated Data Radiometric SLS Configuration**

Table 3‑22: Service Options for Validated Data Radiometric SLS Configuration

| **Option** | **Name** | **Description** | **Predicate** |
| --- | --- | --- | --- |
| O1 | Ranging |  |  |
| O2 | Pointing Angles |  |  |
| O3.1 | One-way Doppler |  |  |
| O3.2 | Two-way Doppler |  |  |

NOTE - At least one of O1, O2, and either O3.1 or O3.2 must be included.

Table 3‑23: ASC Characteristics in Validated Data Radiometric SLS Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Aperture | Yes | RF Aperture | Return Modulated Waveform (essential)  O1, O3.2: Forward Modulated Waveform (essential)  O2: Pointing Angles (specialization) | n/a |
| Return Physical Channel Reception | Yes | CCSDS 401 Return Physical Channel Reception. | Range and Doppler (essential)  Return Frequency (essential) | Return Modulated Waveform (essential)  O1, O3.2: Ranging Signal Timing (essential). |
| O1, O3.2: Forward Physical Channel Transmission | Yes | CCSDS 401 Forward Physical Channel Reception. | Transmit Frequency (essential).  Ranging Signal Timing (essential) | Forward Modulated Waveform (essential). |
| SLS Radiometric Data Production | No | Raw Radiometric Data Collection | Raw Radiometric Data (specialization) | Range and Doppler (essential).  Return Frequency (essential)  O2: Pointing Angles (specialization)  O1, O3.2: Transmit Frequency (essential). |
| Offline Data Storage | No | Raw Radiometric Data Store | n/a | Raw Radiometric Data (specialization) |

ALTERNATE APPROACH using different options and generic “Forward Radiometric Data” and “Return Radiometric Data” ports.

Table 3‑24: ALTERNATE Service Options for Validated Data Radiometric SLS Configuration

| **Option** | **Name** | **Description** | **Predicate** |
| --- | --- | --- | --- |
| O1 | Forward Radiometric | Radiometric data to be collected includes data requiring the use of the forward physical channel, including (but not limited to) transmit frequency, range, and two-way Doppler. |  |
| O2 | Return Radiometric | Radiometric data to be collected includes data requiring the use of the return physical channel, including (but not limited to) receive frequency, range, and two-way Doppler. |  |
| O3 | Pointing Angles | Radiometric data to be collected includes aperture pointing angles. |  |

NOTE - At least one of O1, O2, or O3 must be included.

NOTE - A radiometric configuration may implement the Forward Radiometric option (O1) but not the Return Radiometric option (O2) in cases of 3-wat Doppler tracking, where the configuration is for the ESLT that generates the forward link. In such a configuration, the relevant forward link data (e.g., the transmit frequency) can be supplied to the ESLT that receives the return link (and generates the Doppler measurements) via the tracking data service, where the receiving ESLT is configured to be a user of the tracking data service. SUCH A RECEIVING ESLT CONFIGURATION IS NOT YET INCLUDED IN THIS MODEL!

Table 3‑25: ALTERNATE ASC Characteristics in Validated Data Radiometric SLS Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Aperture | Yes | RF Aperture | O2: Return Modulated Waveform (essential)  O1: Forward Modulated Waveform (essential)  O3: Pointing Angles (specialization) | n/a |
| O2: Return Physical Channel Reception | Yes | CCSDS 401 Return Physical Channel Reception. | Return Radiometric Data (essential) | Return Modulated Waveform (essential)  O1: Forward Radiometric Data (essential). |
| O1: Forward Physical Channel Transmission | Yes | CCSDS 401 Forward Physical Channel Reception. | Forward Radiometric Data (essential). | Forward Modulated Waveform (essential) |
| SLS Radiometric Data Production | No | Raw Radiometric Data Collection | Raw Radiometric Data (specialization) | O2: Return Radiometric Data (essential)  O3: Pointing Angles (specialization)  O1: Forward Radiometric Data (essential). |
| Offline Data Storage | No | Raw Radiometric Data Store | n/a | Raw Radiometric Data (specialization) |

### Raw Data RadioMetric Service

The Raw Data Radiometric service is configured using the following ASCs:

1. Aperture;
2. Forward Physical Channel Transmission;
3. Return Physical Channel Reception;
4. SLS Radiometric Production;
5. Offline Data Storage; and
6. Data Transfer Services.

Figure 3‑13 illustrates the ASCs and SCs used in the SLS configuration of the Raw Data Radiometric service.



**Figure 3‑13: SCs Used in Raw Data Radio**m**tric SLS Configuration**

Table 3‑26: Service Options for Raw Data Radiometric SLS Configuration

| **Option** | **Name** | **Description** | **Predicate** |
| --- | --- | --- | --- |
| O1 | Ranging |  |  |
| O2 | Pointing Angles |  |  |
| O3.1 | One-way Doppler |  |  |
| O3.2 | Two-way Doppler |  |  |
| O4 | Online | The service includes real-time instances of the Tracking Data CSTS |  |
| O5 | Storage | Tracking data is to be stored for subsequent retrieval |  |

NOTE - At least one of O1, O2, and either O3.1 or O3.2 must be included.

NOTE - At most one of O3.1 and O3.2 may be included.

NOTE - At least one of O4 and O5 must be included.

Table 3‑27: ASC Characteristics in Raw Data Radiometric SLS Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Aperture | Yes | RF Aperture | Return Modulated Waveform (essential)  O1, O3.2: Forward Modulated Waveform (essential)  O2: Pointing Angles (specialization) | n/a |
| Return Physical Channel Reception | Yes | CCSDS 401 Return Physical Channel Reception. | Range and Doppler (essential). | Return Modulated Waveform (essential). |
| O1, O3.2: Forward Physical Channel Transmission | Yes | CCSDS 401 Forward Physical Channel Reception. | Transmit Frequency (essential). | Forward Modulated Waveform (essential). |
| SLS Radiometric Data Production | No | Real-Time Radiometric Data | TDM Segments (specialization) | Range and Doppler (essential).  O2: Pointing Angles (specialization)  O1, O3.2: Transmit Frequency (essential). |
| O5: Offline Data Storage |  |  |  |  |
| O4: Data Transfer Services | No | Real-Time Radiometric Data | n/a | TDM Segments (specialization) |

Table 3‑28: ALTERNATE Service Options for Raw Data Radiometric SLS Configuration

| **Option** | **Name** | **Description** | **Predicate** |
| --- | --- | --- | --- |
| O1 | Forward Radiometric | Radiometric data to be collected includes data requiring the use of the forward physical channel, including (but not limited to) transmit frequency, range, and two-way Doppler. |  |
| O2 | Return Radiometric | Radiometric data to be collected includes data requiring the use of the return physical channel, including (but not limited to) receive frequency, range, and two-way Doppler. |  |
| O3 | Pointing Angles | Radiometric data to be collected includes aperture pointing angles. |  |
| O4 | Online | The service includes real-time instances of the Tracking Data CSTS |  |
| O5 | Storage | Tracking data is to be stored for subsequent retrieval |  |

NOTE - At least one of O1, O2, or O3 must be included.

NOTE - At least one of O4 and O5 must be included.

Table 3‑29: ASC Characteristics in Raw Data Radiometric SLS Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Aperture | Yes | RF Aperture | O2: Return Modulated Waveform (essential)  O1: Forward Modulated Waveform (essential)  O3: Pointing Angles (specialization) | n/a |
| O2: Return Physical Channel Reception | Yes | CCSDS 401 Return Physical Channel Reception. | Return Radiometric Data (essential). | Return Modulated Waveform (essential)  O1: Forward Radiometric Data (essential) |
| O1: Forward Physical Channel Transmission | Yes | CCSDS 401 Forward Physical Channel Reception. | Forward Radiometric Data (essential). | Forward Modulated Waveform (essential). |
| SLS Radiometric Data Production | No | Real-Time Radiometric Data | TDM Segments (specialization) | O2: Return Radiometric Data (essential)  O3: Pointing Angles (specialization)  O1: Forward Radiometric Data (essential). |
| O5: Offline Data Storage |  | TDM Recording Buffer | n/a | TDM Segments (specialization) |
| O4: Data Transfer Services | No | TD-CSTS | n/a | TDM Segments (specialization) |

### Delta-DOR RadioMetric Service

The Delta-DOR Radiometric service is configured using the following ASCs:

1. Aperture;
2. Return Physical Channel Reception;
3. SLS Radiometric Production; and
4. Offline Data Storage.

Figure 3‑14 illustrates the ASCs and SCs used in the SLS configuration of the Delta-DOR Radiometric service.



**Figure 3‑14: SCs Used in Delta-DOR Radiometric SLS Configuration**



Table 3‑30: ASC Characteristics in Delta-DOR Data Radiometric SLS Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Aperture | Yes | RF Aperture | Return Modulated Waveform (essential)  Forward Modulated Waveform (essential) | n/a |
| Return Physical Channel Reception | Yes | CCSDS 401 Return Physical Channel Reception. | DOR Tones (specialization) | Return Modulated Waveform (essential). |
| SLS Radiometric Data Production | No | Delta-DOR Data Collection | Raw-formatted D-DOR Data | DOR Tones (specialization). |
| Offline Data Storage | No | Delta-DOR Raw Data Store | n/a | Raw-formatted D-DOR Data |

### Open Loop Recording Service

The Open Loop Recording service is configured using the following ASCs:

1. Aperture;
2. Return Physical Channel Reception;
3. SLS Radiometric Production; and
4. Offline Data Storage.

Figure 3‑15 illustrates the ASCs and SCs used in the SLS configuration of the Open Loop Recording service.



**Figure 3‑15: SCs Used in Open Loop Recording SLS Configuration**



Table 3‑31: ASC Characteristics in Open Loop Recording SLS Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Aperture | Yes | RF Aperture | Return Modulated Waveform (essential)  Forward Modulated Waveform (essential) | n/a |
| Return Physical Channel Reception | Yes | CCSDS 401 Return Physical Channel Reception. | Analog Waveform (essential). | Return Modulated Waveform (essential). |
| SLS Radiometric Data Production | No | Open Loop Receiver/Formatter | Formatted Open Loop Data | Analog Waveform (specialization). |
| Offline Data Storage | No | Open Loop Data Store | n/a | Formatted Open Loop Data |

# Service Mappings to Abstract Service Components And Service Components for the Retrieval Configuration

Section 2.1 identifies the IOAG services for which the production and provision functions are fully or partially supported in Retrieval configurations. This section maps those production and provision functions to the ASCs and the current SCs that contain the Functional Resources that represent those functions.

Figure 4‑1 illustrates the ASCs that are used in the Retrieval configuration.

Figure 4‑2 illustrates the connectivity among the SCs that are used in the Retrieval configuration. This figure represents the template of SCs from which individual Retrieval Service Agreements and Retrieval Configuration Profiles are derived.

NOTE- The term “Retrieval Service Agreement” is used to refer to the section of a Service Agreement that deals with the description of capabilities to be provided during the execution of Retrieval Service Packages. Similarly, the term “Retrieval Configuration Profiles” is used to describe the types of Configuration Profiles that are used in Retrieval Service Packages.

Table 4‑1 summarizes the ASCs that are used by the Retrieval configuration of each of the appropriate IOAG Service Catalog #1 services.

The following subsections map each of the IOAG Service Catalog #1 services to the SCs that participate in the production and/or provision of that service in the Retrieval configuration. For each service, each ASC that is associated with that service and the existing SC(s) that apply are identified. Any constraints with respect to specific specializations are noted, and the specific service access points used in the configuration of that service are identified.



Figure 4‑1: **Abstract Service Components Used in Retrieval Configurations**

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Figure 4‑2: **Connectivity of Service Components in Retrieval Configurations**

Table 4‑1: Abstract Service Components Used in the Retrieval Configurations of the IOAG Services



## Return Data Delivery Services

### Return All Frames Service

In the Retrieval configuration, the Return All Frames service is configured using the following ASCs:

1. Offline Data Storage; and
2. Data Transfer Services.

Figure 4‑3 illustrates the ASCs and SCs used in the Retrieval configuration of the Return All Frames service.



**Figure 4‑3: SCs Used in Return All Frames Retrieval Configuration**

Table 4‑2: ASC Characteristics in Return All Frames Retrieval Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Offline Data Storage | No | Offline Frame Buffer | Return All Buffered Transfer Frames (specialization) | n/a |
| Data Transfer Services | No | SLE Return All Frames | n/a | Return All Buffered Transfer Frames (specialization) |

### Return Channel Frames Service

In the Retrieval configuration, the Return Channel Frames service is configured using the following ASCs:

1. Offline Data Storage; and
2. Data Transfer Services.

Figure 4‑4 illustrates the ASCs and SCs used in the Retrieval configuration of the Return Channel Frames service.



**Figure 4‑4: SCs Used in Return Channel Frames Retrieval Configuration**

Table 4‑3: ASC Characteristics in Return Channel Frames Retrieval Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Offline Data Storage | No | Offline Frame Buffer | Return All Buffered Transfer Frames (specialization) | n/a |
| Data Transfer Services | No | SLE Return Channel Frames | n/a | Return All Buffered Transfer Frames (specialization) |

### Return Unframed Telemetry Service

In the Retrieval configuration, the Return Unframed Telemetry service is configured using the following ASCs:

1. Offline Data Storage; and
2. Data Transfer Services.

Figure 4‑5 illustrates the ASCs and SCs used in the Retrieval configuration of the Return Unframed Telemetry service.



**Figure 4‑5: SCs Used in Return Unframed Telemetry Retrieval Configuration**

Table 4‑4: ASC Characteristics in Return Unframed Telemetry Retrieval Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Offline Data Storage | No | TM Segment Recording Buffer | Return Buffered Unframed Telemetry Segments (specialization) | n/a |
| Data Transfer Services | No | Return Unframed Telemetry | n/a | Return Buffered Unframed Telemetry Segments (specialization) |

### Return File Service

In the Retrieval configuration, the Return File service is configured using the following ASCs:

1. Offline Data Storage; and
2. Data Transfer Services.

Figure 4‑6 illustrates the ASCs and SCs used in the Retrieval configuration of the Return File service.



**Figure 4‑6: SCs Used in Return File Retrieval Configuration**

NOTE - There is some question as to whether the Data Delivery Transfer Services specialization should be the Cross Support File Transfer Service (aka Generic File Transfer Service) or a more service-specific specialization. The resolution of this question will depend on the detailed specification of the Return File service, which is still vague as of this date (June 2014).

Table 4‑5: ASC Characteristics in Return File Retrieval Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Offline Data Storage | No | Return File Data Store | Return File (specialization) (1) | n/a |
| Data Transfer Services | No | Cross Support File Transfer Service | n/a | Return File (specialization) (1) |

NOTE 1 - There is some question as to whether the interface between the Offline Data Delivery Production and Data Delivery Transfer Services specializations for the Return File Service is a pure file transfer or whether it contains some out-of-file, service-specific information. The resolution of this question will depend on the detailed specification of the Return File service, which is still vague as of this date (June 2014).

## Radiometric Services

### Validated Data Radiometric Service

In the Retrieval configuration, the Validated Data Radiometric service is configured using the following ASCs:

1. Offline Data Storage; and
2. Data Transfer Services.

Figure 4‑7 illustrates the ASCs and SCs used in the Retrieval configuration of the Validated Data Radietric service.



**Figure 4‑7: SCs Used in Validated Data Radiometric Retrieval Configuration**

NOTE - There is some question as to whether the Data Delivery Transfer Services specialization should be the Cross Support File Transfer Service (aka Generic File Transfer Service) or a more service-specific specialization. The resolution of this question will depend on the detailed specification of the Validated Data Radiometric service, which is still vague as of this date (June 2014).

Table 4‑6: ASC Characteristics in Validated Data Radiometric Retrieval Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Offline Data Storage | No | Validated Radiometric Data Store | Return File (specialization) (1) | n/a |
| Data Transfer Services | No | Cross Support File Transfer Service | n/a | Return File (specialization) (1) |

NOTE 1 - There is some question as to whether the interface between the Retrieval Radiometric Data Production and Data Delivery Transfer Services specializations for the Validated Radiometric Data Store Service is a pure file transfer or whether it contains some out-of-file, service-specific information. The resolution of this question will depend on the detailed specification of the Validated Radiometric Data service, which is still vague as of this date (June 2014).

### Raw Data Radiometric Service

In the Retrieval configuration, the Raw Data Radiometric service is configured using the following ASCs:

1. Offline Data Storage; and
2. Data Transfer Services.

Figure 4‑8 illustrates the ASCs and SCs used in the Retrieval configuration of the Raw Data Radiometric service.



**Figure 4‑8: SCs Used in Raw Data Radiometric Retrieval Configuration**

Table 4‑7: ASC Characteristics in Raw Data Radiometric Retrieval Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Offline Data Storage | No | TDM Recording Buffer | Buffered TDM Segment (specialization) | n/a |
| Data Transfer Services | No | TD-CSTS | n/a | Buffered TDM Segment (specialization) |

### Delta-DOR Radiometric Service

In the Retrieval configuration, the Delta-DOR Radiometric service is configured using the following ASCs:

1. Offline Data Storage; and
2. Data Transfer Services.

Figure 4‑9 illustrates the ASCs and SCsservice.



**Figure 4‑9: SCs Used in Delta-DOR Radiometric Retrieval Configuration**

NOTE - There is some question as to whether the Data Delivery Transfer Services specialization should be the Cross Support File Transfer Service (aka Generic File Transfer Service) or a more service-specific specialization. The resolution of this question will depend on the detailed specification of the Delta-DOR Radiometric service, which is still vague as of this date (June 2014).

Table 4‑8: ASC Characteristics in Delta-DOR Data Radiometric Retrieval Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Offline Data Storage | No | Delta-DOR Raw Data Store | Return File (specialization) (1) | n/a |
| Data Transfer Services | No | Cross Support File Transfer Service | n/a | Return File (specialization) (1) |

NOTE 1 - There is some question as to whether the interface between the Retrieval Radioetric Data Production and Data Delivery Transfer Services specializations for the Delta-DOR Radiometric Service is a pure file transfer or whether it contains some out-of-file, service-specific information. The resolution of this question will depend on the detailed specification of the Delta-DOR Radietric service, which is still vague as of this date (June 2014).

### Open Loop Recording Radiometric Service

In the Retrieval configuration, the Open Loop Recording Radiometric service is configured using the following ASCs:

1. Offline Data Storage; and
2. Data Transfer Services.

Figure 4‑10 illustrates the ASCs and SCs used in the Retrieval configuration of the Open Loop Recording Radiometric service.



**Figure 4‑10: SCs Used in Open Loop Recording Radiometric Retrieval Configuration**

NOTE - There is some question as to whether the Data Delivery Transfer Services specialization should be the Cross Support File Transfer Service (aka Generic File Transfer Service) or a more service-specific specialization. The resolution of this question will depend on the detailed specification of the Open Loop Recording Radiometric service, which is still vague as of this date (June 2014).

Table 4‑9: ASC Characteristics in Open Loop Recording Radiometric Retrieval Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Offline Data Storage | No | Open Loop Data Store | Return File (specialization) (1) | n/a |
| Data Transfer Services | No | Cross Support File Transfer Service | n/a | Return File (specialization) (1) |

NOTE 1 - There is some question as to whether the interface between the Retrieval Radiometric Data Production and Data Delivery Transfer Services specializations for the Open Loop Recording Radiometric Service is a pure file transfer or whether it contains some out-of-file, service-specific information. The resolution of this question will depend on the detailed specification of the Open Loop Recording Radiometric service, which is still vague as of this date (June 2014).

# Service Mappings to Abstract Service Components And Service Components for the Forward Offline Configuration

Section 2.1 identifies the Forward File service as the IOAG services for which the production and provision functions are fully or partially supported in Forward Offline configurations. This section maps those production and provision functions to the abstract Functional Groups and the current Functional Group specializations that contain the Functional Resources that represent those functions.

NOTE 1- The Forward File service has not yet been defined. It is not known whether support for the Forward File service will require Forward Offline Service Packages to be created and/or scheduled. If such Service Packages are required, they could be constructed as described herein.

Figure 5‑1 illustrates the SCCS Functional Groups that are used in the Forward Offline configuration.

Figure 5‑2 illustrates the connectivity among the SCs that are used in the Forward Offline configuration. This figure represents the template of SCs from which individual Forward Offline Service Agreements and Forward Offline Configuration Profiles are derived.

NOTE 2 - The term “Forward Offline Service Agreement” is used to refer to the section of a Service Agreement that deals with the description of capabilities to be provided during the execution of Forward Offline Service Packages. Similarly, the term “Forward Offline Configuration Profiles” is used to describe the types of Configuration Profiles that are used in Forward Offline Service Packages.

Table 5‑1 summarizes the Functional Groups that are used by the Forward Offline configuration of each of the appropriate IOAG Service Catalog #1 services.

The following subsections map each of the IOAG Service Catalog #1 services to the SCs that participate in the production and/or provision of that service in the Forward Offline configuration. For each service, each ASC that is associated with that service and the existing SC(s) that apply are identified. Any constraints with respect to specific specializations are noted, and the specific service access points used in the configuration of that service are identified.



Figure 5‑1: **Abstract Service Components Used in Retrieval Configurations**

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Figure 5‑2: **Connectivity of Service Components in Forward Offline Configurations**

Table 5‑1: Abstract Service Components Used in the Forward Offline Configurations of the IOAG Services



## Forward Data Delivery Services

### Forward File Service

In the Forward Offline configuration, the Forward File service is configured using the following ASCs:

1. Offline Data Storage; and
2. Data Transfer Services.

Figure 5‑2 illustrates the ASCs and SCs used in the Forward Offline configuration of the Forward File service.

NOTE - There is some question as to whether the Data Delivery Transfer Services specialization should be the Cross Support File Transfer Service (aka Generic File Transfer Service) or a more service-specific specialization. The resolution of this question will depend on the detailed specification of the Forward File service, which is still vague as of this date (June 2014).

Table 5‑2: ASC Characteristics in Forward File Forward Offline Configuration

| **ASC** | **Future Replace­able** | **Known Specialization** | **SAP Port Used** | **Accessor Port Used** |
| --- | --- | --- | --- | --- |
| Offline Data Storage | No | Forward File Data Store | Forward File (specialization) (1) | n/a |
| Data Transfer Services | No | Cross Support File Transfer Service | n/a | Forward File (specialization) (1) |

NOTE 1 - There is some question as to whether the interface between the Offline Data Delivery Production and Data Delivery Transfer Services specializations for the Forward File Service is a pure file transfer or whether it contains some out-of-file, service-specific information. The resolution of this question will depend on the detailed specification of the Forward File service, which is still vague as of this date (June 2014).

1. Acronyms and Abbreviations
2. Reference Bookmarks (to be deleted)

[1] nRef\_910x4\_CSRM

[2] nRef\_911x1RAF

[3] nRef\_911x2\_RCF

[4] nRef\_921x1CstsSFW

[5] nRef231x0\_TcSync

[6] nRef\_131x0\_TmSync

[7] nRef\_922\_RUFT

[8] nRef\_922x2\_TD\_CSTS

[9] nRef\_IOAG1

[10] nRef\_922x1\_MD\_CSTS

[11] nRef\_DoatTN

[12] nRef\_902x0\_ESCCS\_SM

[13] nRef\_901x0\_SCCS\_ADD

[14] nRef\_910x11\_SCCS\_SM

[15] nRef\_902x\_SCCS\_SM\_SA\_CP

[16] nRef\_IOAG\_SC2

[17] nRef\_232x0\_TC\_SDLP

[18] nRef\_732x0\_AOS\_SDLP

[19] nRef\_132x0\_TM\_SDLP

[20] nRef\_133x0\_SPP

[21] nRef\_232x1\_COP\_1

[22] nRef\_133x1\_Encap

[23] nRef\_401\_RF\_Mod

[24] nRef\_414x1\_PN\_ranging

[25] nRef\_415x1\_CDMA

[26] nRef\_727x0\_CFDP

[27] nRef\_912x1\_CLTU

[28] nRef\_912x3\_FSP

[29] nRef\_911x5\_ROCF

[30] nRef\_734x0\_DTN

[31] nRef\_702x1\_IP\_Over\_CCSDS

[32] nRef\_503x0\_TDM

[33] nRef\_506x1\_D\_DOR\_Raw

1. The initial six “types” are preserved in this Tech Note for continuity with the Extensible SCCS-SM Concept Green Book and to provide a finer-grained decomposition to which we can fall back if the “three categories” model proves to be unsatisfactory. However, if the three categories model proves to be the best, we can get rid of the six types designation in the Concept Green Book at some point in the future. [↑](#footnote-ref-1)
2. IOAG Service Catalog #1 call for the Forward Synchronous Encoded Frame (FSEF) service, which would subsequently be superseded by the IOAG Service Catalog #2 Forward Frames (FF) services. Rather than creating both the FSEF and FF services, CCSDS is developing only the all-inclusive FF service. [↑](#footnote-ref-2)
3. The term “service” in the context of SAP and Accessor ports is not to be confused with the use of the term in the larger Space Communication Cross Support sense. In the SAP/Accessor port context it is roughly equivalent to the notion of service between layers of the ISO OSI protocol stack. This is the inspiration for using *SAP* to designate the port at which the service is provided. [↑](#footnote-ref-3)