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SD Provide Streaming Data

Summary

Provide Streaming Data is a service that provides data to the Common Operational Picture system (COPS) over an open communication channel. The channel can be opened or closed either by the COPS or by the data provider depending on whether it is the COPS or the data provider who wants to initiate or terminate the reporting of data. “Channel” in this context may be one of several communication options, e.g. a system where communication is set up over a fixed- or wireless network or a system where the communication is session based and the communication functionality is hidden within the session concept. The type of data might be tracks, plots or bearings produced by sensor systems.

The target groups and intended usage for this Service Description document include:

1. LedsystT design and TPOC implementation teams.
2. LedsystT VoV teams.
3. LedsystT system design teams for use in feedback activities for system design and design rule harvesting.

This design is valid for the system-proof-of-concept design and evaluation activities.

Sammanfattning

Provide Streaming Data är en tjänst som utnyttjar en öppen kommunikationskanal för att förse COP-systemet med kontinuerligt strömmande data. Kanalen kan öppnas och stängas antingen av COP-systemet eller av datakällan beroende på vem av dem som önskar initiera eller terminera dataströmmen. ”Kanalen” i denna mening kan vara av flera typer, t.ex. ett system där kommunikation etableras över ett fixt- eller trådlöst nätverk eller ett system som är sessionsbaserat där kommunikationen är gömd inuti sessionskonceptet. Typen av data kan vara målföljen, plottar eller bäringar producerade av sensorsystem. Inga krav på datafrekvens över kanalen förekommer.

Mottagare/användare av detta dokument är:

1. LedsystT design och TPOC implementations team.
2. LedsystT VoV team
3. LedsystT system design teams för användning vid återkopplingsaktiviteter vid system design och vid skördande av design regler.

Denna design är giltig för system-proof-of-concept samt VoV-aktiviteter..

Regarding this document

Table of contents

1 General

1.1 Background

In order to be able to create and maintain Common Operational Pictures it shall be possible to report situation information, for example sensor data, ID/POS-data and tactical intelligence information, to the Common Operational Picture System (COPS). The service Provide Streaming Data allows technical sensors and platforms to report real time data to the COPS.

Sensor data are received in a continuous stream, and hence there is a need to be able to receive and process the data without the need to open and close the communication channels each time new data is received. Data received in this manner is here called **Streaming Data**. This distinguishes Streaming Data from so called **Reports** where the communication channel is closed after the data is received. Examples of streaming data are tracks, plots or bearings from radars or SIGINT/COMINT-sensors. Examples of reports are oral or written text messages from soldiers dispatching observations or intelligence information from the battlefield. Also video captures and images from the battlefield, are considered to be reports. For this reason there is an analogous service Provide Report [1] which allows users to input text messages including tactical intelligence information to the COPS.

Sensors that do provide continuous target data, at least including bearing, should enter Provide Streaming Data. Certain acoustic sensors and hydrophone arrays belong to this class. Sensors that provide spurious reports, often via manual processing, should enter Provide Reports. This might include magnetic or seismic sensors, motion detectors and wiretraps. And other sensors that do provide continuous data but cannot be used for updating tracks, such as thermometers or NBC sensors, should not be handled by COPS at all.

It is important to notice that Streaming Data as it is described here in terms of real time sensor data should not be confused with streaming video. Even if streaming video can be considered to be streaming digital data the target information contained can not immediately without any preprocessing or analysis be included in an operational picture produced by the COPS. For this reason we do not include streaming video in the Provide Streaming Data service. Services that delivers sensor data or measurements which are not immediately intended to be included in an operational picture produced by the COPS are not included in COP-system. Such services should be found in the NCES system *Sensor Systems*. For an introduction to the COPS functionality, please see ref[14]

1.1.1 Overview of the COPS

Fig. 1 gives a schematic overview of the services included in the COPS. The services *Provide Streaming Data* and *Provide Report [1]* supply the COPS with situation information from various sources such as technical sensors and HUMINT. Processes for automatic correlation and fusion will process the streaming data when it is entered into the COPS. These automatic processes are supported by operators using the service *Support COP[3]* in order to correct errors and/or to resolve ambiguities in these processes. The service *Support COP* is also used to manually update situation

information about detected objects and to manually create new objects based on reports delivered by the service *Provide Report*.

The *Process Intelligence Service* [2] is a service that performs gathering and processing of intelligence information. The information involved in this process is intelligence reports from available repositories and background information from other available sources. The result is stored in a processed information repository within the COPS and some results might also be used to update information about detected targets via the service *Support COP*.

Finally, the functionality of the service *Access COP Information* [4] is to access information stored

in COPS regarding the battle space including positions, identities and status information about our own, enemy and third parts i.e. neutral forces.

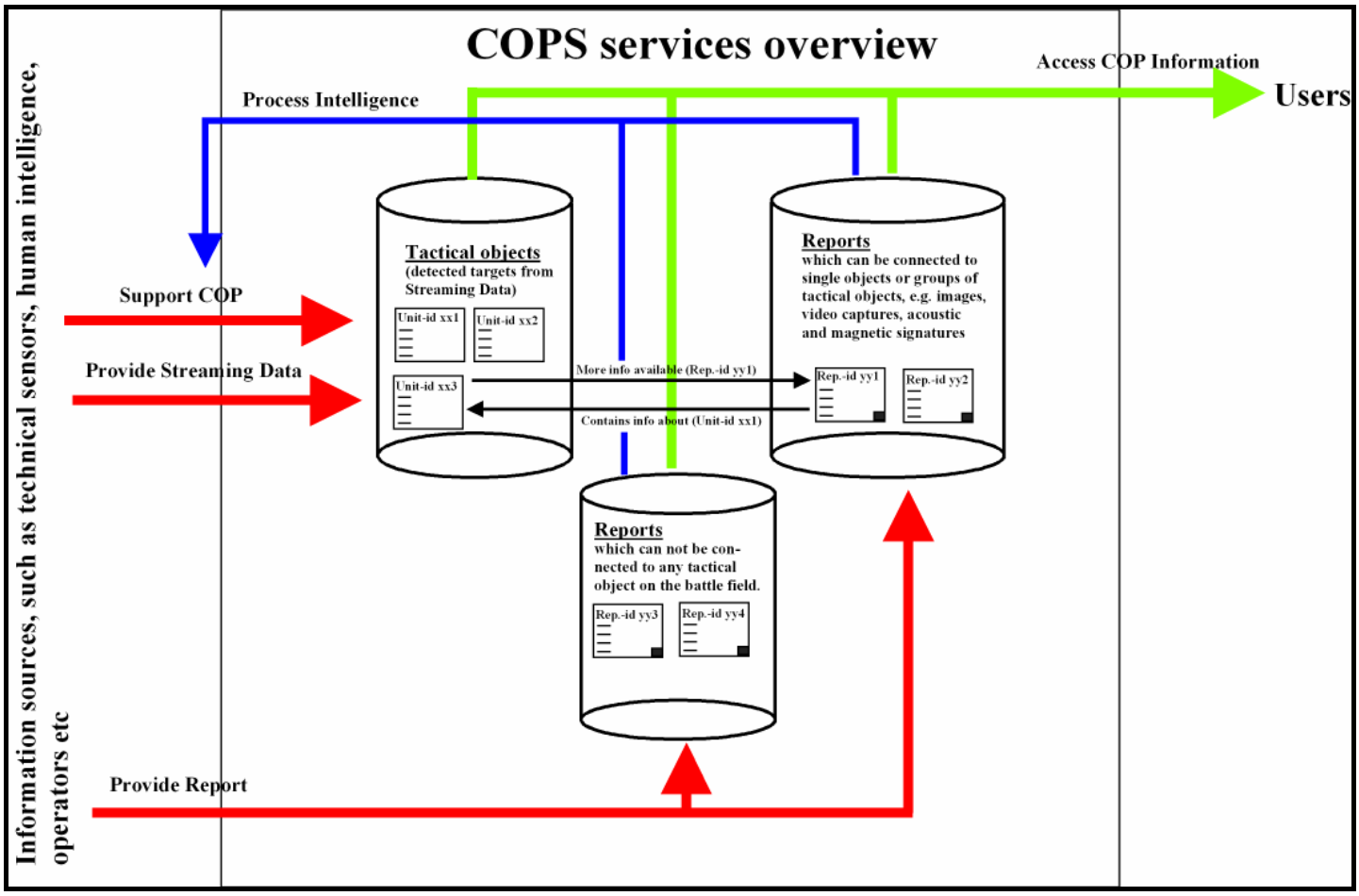

Fig. 1 Schematic overview of COPS services and their relations

1.2 Scope

The current version of this document covers the Provide Streaming Data functionality needed for Sys POC. It is intended that parts of this is to be implemented for the associated TPOC experiments.

1.3 References

[1]	SD Provide Report	LT1K P06-0036
[2]	SD Process Intelligence	LT1K P06-0037
[3]	SD Support COP	LT1K P06-0038
[4]	SD Access COP Information	LT1K P06-0039
[5]		
[6]	System Requirements for FMLS 2010 Technical System, SysPOC	LT1K P06-0027
[7]	High-Level Requirements for FMLS 2010 Technical System	LTIK P06-0026
[8]	System Requirement Specification, System Proof-of-Concept	LT1K P05-0483 rev 0.9
[9]	System Requirements for FMLS 2010 Technical System, SysPOC, Classified	LTIK P06-0028
[10]	Integrated Dictionary for FMLS 2010 Technical System	
[11]	COPS Information Model 0.1	LT1K P06-0091
[12]	C2IEDM data model Edition 6.15d,	C2IEDM – Main-UK-DMWG-Edition 6.15d 2005-09-30, http://www.mip-site.org
[13]	COPS Internal Requirements	LT1K P06-0382
[14]	COPS Overview	LT1K P06-0143

2 Specification

2.1 Context

The functionality of the service Provide Streaming Data is to allow reporting of streaming data, either tracks, plots or bearings for both objects detected by sensors and self-reporting objects, blue force tracking (BFT), to the COPS. The service provides methods for the COPS to set up subscriptions on the data produced by sensors and BFT-systems and for reporting the data back to the COPS.

The primary sources for this information are sensor systems, such as radars, SIGINT/COMINT-sensors, electro optical-sensors (EO) etc, and cooperating ID/POS report systems, so called BFT-systems, situated on the platforms within the current organization.

2.2 Overview diagram

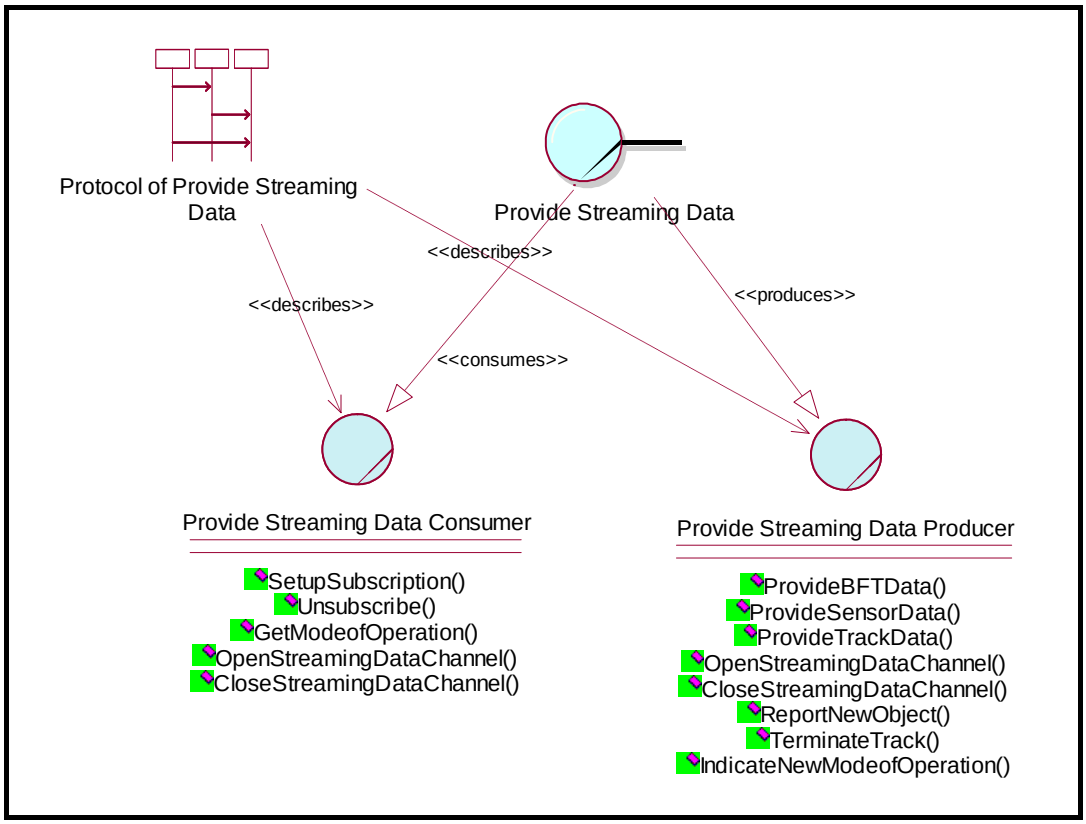

Figure 2. Static Service dependency

2.3 External requirements

This service complies with the requirements specified in ref. [6], ref. [7], ref.[8] and ref. [9]. The specific terminology for the requirements is explained in ref [10].

2.4 Use case model

The use case Provide Streaming Data describes how technical sensors and platforms to report streaming data to the system. Examples of streaming data are tracks, plots or bearings from radars, SIGINT/COMINT-sensors and BFT-data from ID/POS-systems on our own platforms. The communication between the consuming sensor and COPS is normally initiated by the sensor but under special circumstances also COPS can open the channel. The same is true for the closing the communication. After the communication channel between the sensor and COPS have been opened the process involved in this service is schematically described by the black box diagram below.

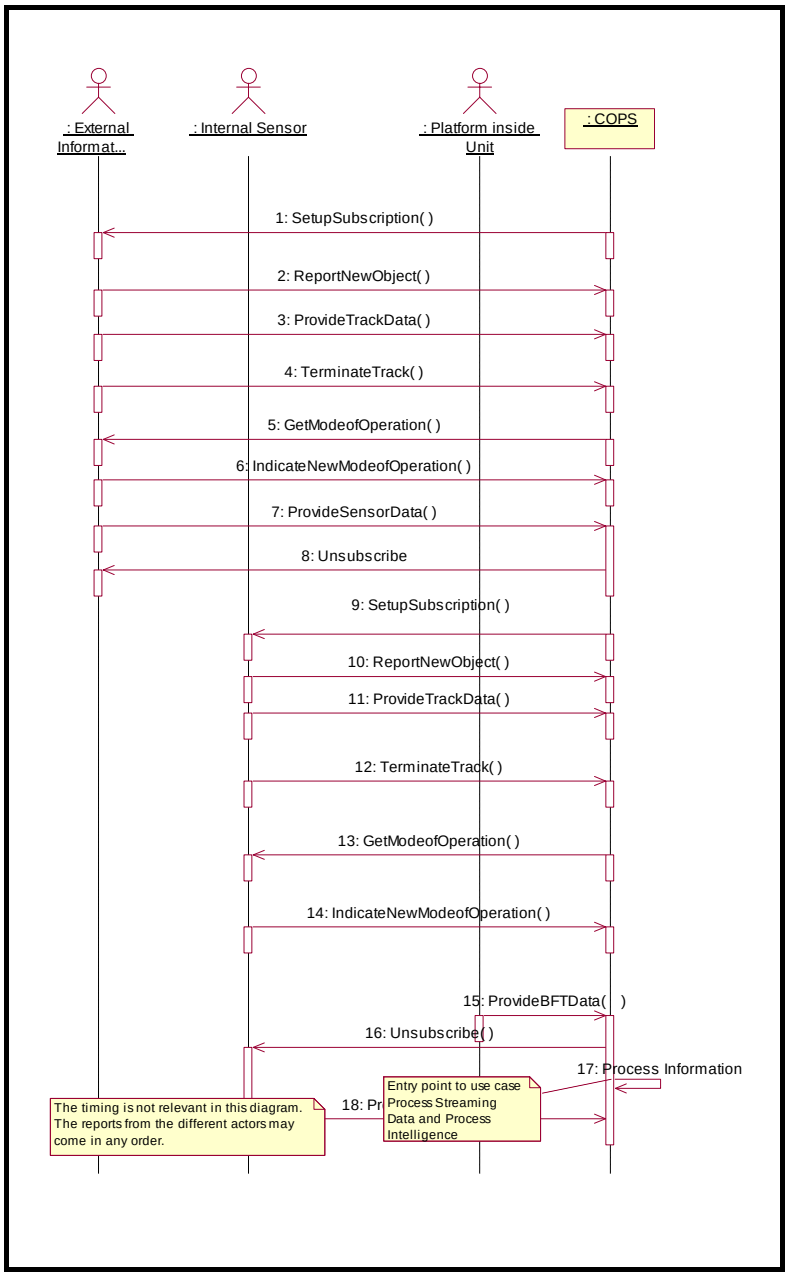

Figure 3: Black Box View: Provide Streaming Data

Figure 3 above illustrates the black box view of the Provide Streaming Data service.

Actors in the use case model:

External Information Provider: The unit may at times be connected to other systems within own organisation or with allied systems (interoperability) without being able to control the sensor or information source. These systems usually provide the unit with information and they are

represented by this actor. Examples of external information providers are major technical sensors, HUMINT-organisations, public radio transmission systems etc. not controlled by the unit.

Internal Sensor: This actor represents sensors that are internal to the unit and under the control of operators within the unit.

Platform Inside Unit: This actor represents a platform/vehicle belonging to the unit. It reports its own position and status.

Use case model

The process involved in this service can be described as following:

1. The actors *External Information Provider*, *Internal Sensor* and *Platform Inside Unit* all represents sources within the organisation that can provide the COPS with streaming situation information. These are considered to be consumers of the service Provide Streaming Data. These actors represent radars, SIGINT/COMINT sensors, electro optical sensors and ID/POS-systems, which can provide the COPS with real time situation information.

2. The streaming data that is supplied from these actors are either track-data, raw sensor data such as plots or bearings or BFT data. These types of data are provided through the operations *Provide Track data, Provide Sensor Data* and *Provide BFT Data* in fig. 2.

3. After the actor/consumer has been initialised to the COPS and a Streaming Data Channel has been opened the general black box flow (see fig. 2), can be described as follows

   i. The COPS sets up a subscription of data with the consumer that defines which type of data that the consumer should provide to the COPS, which update interval that should be used. BFT-data should be provided to the COPS without any prior subscription procedure. (However, from a system management point of view it should also be possible to stop/pause the BFT reports). It is important to note here that it is the COPS that sets up the subscription of data from the consumer (i.e. provider of data), and NOT the users of COPS. The individual users subscribe to situation information from the COPS through the service *Access COP information [4]* and the COPS will then setup the subscription of data from the sensors in accordance. In this way there will be no direct contact between the users and the providing sensors.

   ii. The consumer starts providing data to the COPS in accordance to the subscription using the operations *Provide Track Data, Provide Sensor Data* and *Provide BFT Data*. If prompted the consumer should also be able to supply information about which mode of operation it is currently employing in order to produce the data it reports. Furthermore, if the consuming sensor changes mode of operation it should indicate this to the COPS.

   iii. The consumer should continue to provide streaming data to the COPS until it is prompted to stop through the *Unsubscribe*-operation.

2.5 Internal Requirements

This service type fulfils the internal requirements from [13].

2.6 Service/Interface Provide Streaming Data

2.6.1 Generic Protocol

2.6.1.1 Information model and protocol

The ambition is that information entered into the COPS should be structured in a manner enabling it to be compatible with the C2IEDM/JC3IEDM information model used in the Multilateral Interoperability Program (MIP), as described in ref. [12]. The reason for this is to ensure that the services using the COPS will fulfil future requirements on Interoperability between Swedish forces and international coalition partners. The situation information entered into the COPS is therefore structured and grouped to as large extent as possible in accordance to the C2IEDM/JC3IEDM scheme. The information model for the COPS is given in ref. [11]. When C2IEDM/JC3IEDM has not been sufficient the COPS information model has been extended with additional attributes. These additions are clearly indicated in ref. [11].

To describe various aspects of the situation within the battle space the number of different information attributes needed is very large. So even if the COPS information model only contains a limited subset of the C2IEDM/JC3IEDM the COPS information model is still quite extensive. In order to make the information model useable the attributes have been collected into groups of information, which are used for outlining the protocols/interfaces for the operations in the COPS services. These groups or aggregates of information attributes are described in detail in the COPS Information model document, [11]. Instead of using all the individual attributes when specifying the interface for an operation in this document these groups are used as a short notation. A typical operation within the service Provide Streaming Data will therefore be described in the following way

OperationA()

- A description of OperationA, (which usually provide the COPS with certain situation information).

- A description of which types of information the information model should contain for this operation.

- A description of the interface

IN: *Parameters: A,B,C,*
Infomodel groups: OBJECT_ITEM_REF, INFO_ABOUT_OBJECT, REPORTING_DATA

OUT:

FAULTS: *LOG_ERROR, NO_CONNECTION...*

where the names OBJECT_ITEM_REF, INFO_ABOUT_OBJECT and REPORTING_DATA refers to groups of information attributes detailed in the COPS Information model ref. [11].

2.6.1.2 Operations

Producer Interface

OpenStreamingDataChannel()
This operation sets up an open communication channel between the COPS and the consumer (for example a sensor system) that is used for reporting real time sensor data. This normally amounts to looking up the Provide Streaming Data service in the service directory and starting a session. But it could also involve opening a data link, e.g. over the telephone network, although this is not handled further in the design. The channel remains open until either the COPS or the sensor closes it using the operation Close Streaming Data Channel.. The operation uses the NERE service ComBroker in this task.

Interface:
IN: TBD
OUT: TBD
FAULTS: LOG_ERROR, NO_CONNECTION

CloseStreamingDataChannel()
This operation closes an already open communication channel (see previous operation) between the COPS and the consumer that is used for reporting streaming data to the COPS. This operation can be performed both by the COPS and the consumer depending on which one that wants/needs to stop the reporting of data.

Interface:
IN: TBD
OUT: TBD
FAULTS: LOG_ERROR

ReportNewObject()
This operation initiates a new object (track, blue force object etc) to the COPS. Initiation to the COPS means creating an object (an OBJECT-ITEM using MIP-terminology) within the COPS-database. The info model for the object should contain

- Track number,
- Callsign
- Link to type information,
- Name information

Metadata:

- Reporting unit
- Source type code
- Type of data
- Time of report:
- Estimation of reliability
- Estimation of credibility
- Security classification for track data stream
- Type of information (Metadata that makes the information searchable.)

Interface:
IN: Info model groups: OBJECT_ITEM_INFO, REPORTING_DATA
OUT:
FAULTS: LOG_ERROR, NO_CONNECTION

ProvideTrackData()
This operation represents the reporting of local track data from the assigned sensors. This data will include information about both own and other forces. Subsequently a correlation of track to targets will be performed that determine the affiliation of the targets.

Information model:
Target Track information contains the following information

- Local Track number
- Track position
- Heading
- Track Identity
- Timestamp
- Target Velocity
- Track Type
- Affiliation
- Quantity (estimated number of targets in a track if, for example, poor resolution)
- Quality
- Velocity standard deviation
- Position standard deviation
- Position Covariances

Jammer Track information contains the following information

- Local Track number
- Direction
- Track Identity
- Category
- Track Type
- Direction standard deviation
- Timestamp
- Direction Velocity
- Class
- Affiliation
- Quality
- Direction Velocity standard deviation
- Direction Covariances

Metadata:
- Reporting unit
- Type of data
- Estimation of reliability
- Source type code
- Time of report:
- Estimation of credibility
- Security classification for track data stream
- Type of information (Metadata that makes the information searchable.)
- Message ID

Interface:
IN: Info model groups: ITEM_REFERENCE, ORG_LOCATION_position_speed
REPORTING_DATA(Mess.Id 1), ORG_STATUS_part1, REPORTING_DATA(Mess.Id 2).

It is important to note that the inclusion of both ORG_LOCATION_position_speed and ORG_STATUS_part1 is viewed in MIP as two separate reports and hence REPORTING_DATA must be repeated for each report.

OUT:
FAULTS: LOG_ERROR, NO_CONNECTION.

TerminateTrack()
This operation signals to COPS that a local track from the consuming sensor has been terminated, and should therefore be terminated in COPS as well.

Interface:
IN: ITEM_REFERENCE (i.e. local track number)
OUT: ACKNOWLEDGEMENT

ProvideBFTData()
This operation represents the reporting of information from Blue Force units/actors reporting about themselves. The messages contain dynamic information about the reporting organisation /unit /platform. BFT-data should be provided to the COPS without any prior subscription procedure.

Information model:

- Unit Identity
- Organisation Affiliation
- Unit Position
- Unit Velocity
- Heading
- Status parameters
- Security Classifications
- Time of report
- Time span of validity
- Quality Estimation

Metadata:

- Reporting unit
- Source type code
- Type of data
- Time of report:
- Estimation of reliability
- Estimation of credibility
- Security classification for BFT-data stream
- Type of information (Metadata that makes the information searchable.)
- Aggregated Unit Traceability: List of subunits from which the Aggregated Unit is created.
- Message ID

If the reporting unit is an organisation, (e.g. mech. company), containing several subunits the information above might be repeated for every subunit.

Interface:
IN: Info model groups: ITEM_REFERENCE, ORG_LOCATION_position_speed
REPORTING_DATA(Mess.Id 1), ORG_STATUS, REPORTING_DATA(Mess.Id 2).

It is important to note that the inclusion of both ORG_LOCATION_position_speed and ORG_STATUS is viewed in MIP as two separate reports and hence REPORTING_DATA must be repeated for each report.

OUT:
FAULTS: LOG_ERROR, NO_CONNECTION

ProvideSensorData()
This operation represents the reporting of sensor data from the assigned sensors. This data will include information about both own and other forces in terms of a plot data stream. No mapping to C2IEDM/JC3IEDM is expected to be needed for this type of information.

Information model:

- Position (R, theta, Phi)
- Time of measurement
- Measured SNR/JNR....
- Sensor mode (PRF ....)
- Lobe information
- SIGINT data (Freq, PW, PRF, Ampl, MOP, classifications,...)
- ECM data
- Variances in platform position and velocity.
- Doppler frequency
- Variances in measured entities
- Target extension (range, bearing)
- Clutter information (sea state ...)
- Threshold information (CFAR)
- Platform position and velocity vector

Metadata:

- Reporting unit
- Type of plot
- Estimation of reliability
- Source type code
- Time of report
- Estimation of credibility
- Security classification for plot data stream
- Type of information (Metadata that makes the information searchable.)
- Message ID

Interface:
IN: Info model groups: SENSOR_DATA_Plot_data, SENSOR_DATA_Jammer_data, SENSOR_DATA_ESM_data, SENSOR_DATA_ECM_data, SENSOR_DATA_ECM_data
OUT:
FAULTS: LOG_ERROR, NO_CONNECTION

IndicateNewModeofOperation()
When the sensor switches between different modes of operation it should indicate this to COPS since the processing of reported sensor data might be mode-dependent. This operation accomplishes this.

IN: Parameters: SensorMode, SubscriptionID
OUT:
FAULTS: NO_MATCHING_SUBSCRIPTION, LOG_ERROR, NO_CONNECTION

Consumer Interface

OpenStreamingDataChannel()
This is similar corresponding operation in the producer interface above, except that it is COPS that looks up a sensor service in the service directory.

CloseStreamingDataChannel()
See the corresponding operation in the producer interface above.

SetupSubscription()
The COPS sets up a subscription of data with the consumer that defines which type of data that the consumer should provide to the COPS, which update interval that should be used. BFT-data should be provided to the COPS without any prior subscription procedure. The selected update interval should be derived from the subscriptions on the data made to COPS by the end-users using the Access COP Information service, ref. [4].

Interface:
IN: Parameters: IncludeTrackData, IncludeSensorData, AreaOf Interest, UpdateInterval, Parameters for Qualityof Service (Bandwidth, Latency, ...)
OUT: ACKNOWLEDGEMENT, SubscriptionId
FAULTS: MATCHING_SUBSCRIPTION_EXISTS, NO_DATA_WITHIN_AREA_OF_INTEREST, UPDATE_INTERVAL_ERROR, LOG_ERROR, NO_CONNECTION,

Unsubscribe()
This operation represents the cancellation of an existing subscription of data from a sensor.

Interface:
IN: Parameters: SubscriptionID
OUT: ACKNOWLEDGEMENT
FAULTS: NO_MATCHING_SUBSCRIPTION, LOG_ERROR, NO_CONNECTION

GetModeofOperation()
This operation represents the request for information about the sensors present mode of operation.

Interface:
IN: Parameters: SubscriptionID
OUT: Parameters: SensorMode, SensorParameters (such as PRF, frequency, RPM, AreaOfCoverage, ... for a radar) PresentlyPrioritizedUser, ResourceOwner
FAULTS: NO_MATCHING_SUBSCRIPTION, LOG_ERROR, NO_CONNECTION

2.6.1.3 Protocol behaviour

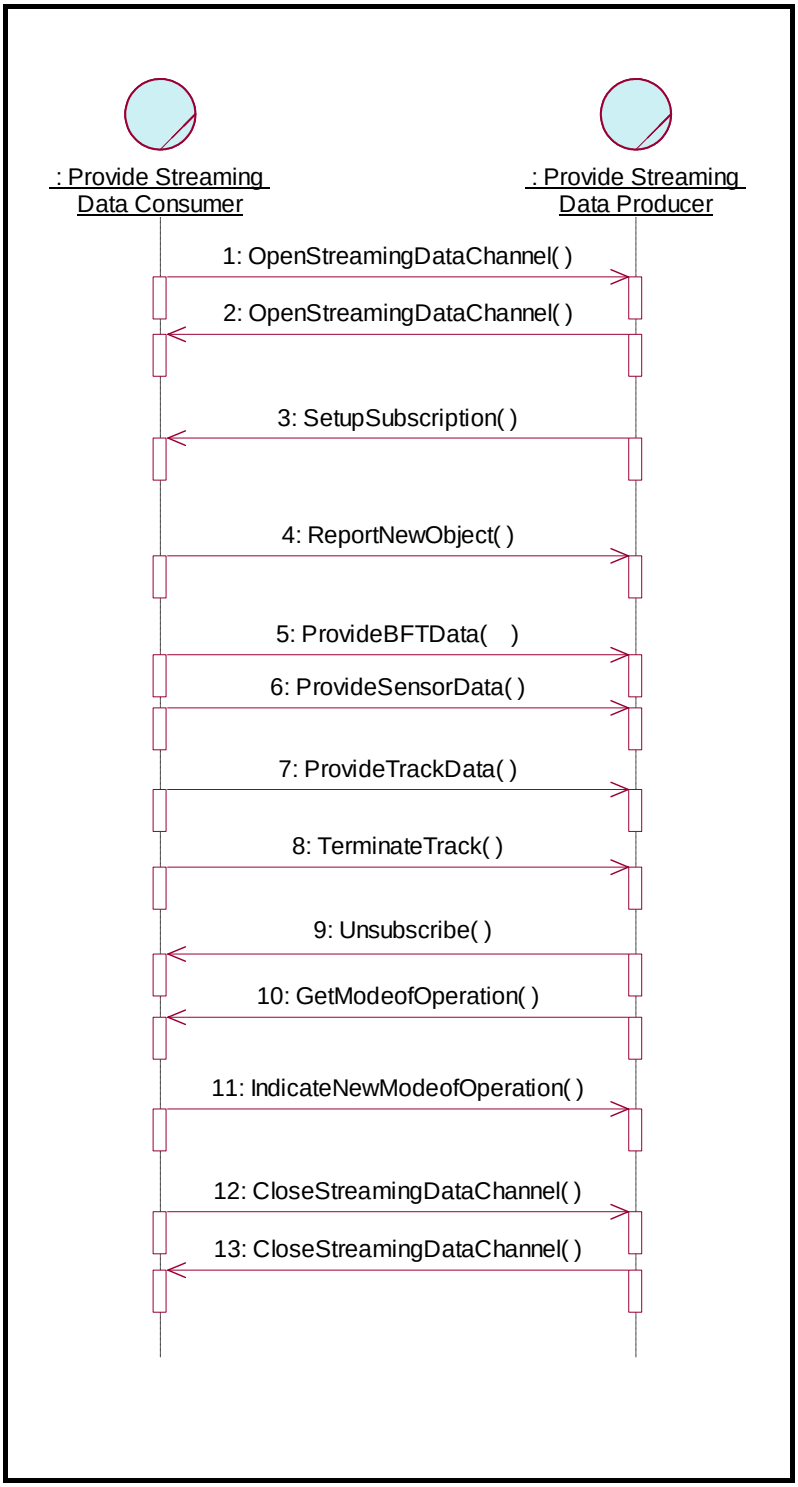

Figure 4: The service protocol for Provide Streaming Data service

2.6.2 Properties

2.6.3 Interface implementations

2.6.3.1 Provide Streaming Data implementation

Since much of the data in this service is streaming real time data, parts of the service interface is probably not suitable for implementation using WSDL/SOAP.

3 Revision history

Date	Issue	Description	Signature
2006-09-27	1.0	Approved for publication.	STSTR