Author:	Juhana Räsänen
Document:	SSCOP
Date:	3/6/1998
Version:	0.1

# SSCOP

The sscop module implements the ITU-T Recommendation Q.2110 [1] (B-ISDN ATM Adaptation Layer - Service Specific Connection Oriented Protocol (SSCOP)). SSCOP is a sub-layer of SAAL (Signalling ATM Adaptation Layer) that is responsible for assured data delivery between signalling AAL connection endpoints.

## 1 Introduction

SSCOP (Service Specific Connection Oriented Protocol) is a link layer protocol that offers the signalling protocols a reliable transport of data over an AAL5 link to the neighbouring system. Its functionality is defined in [1].

SSCOP uses CPCS adapter to access AAL5 service offered by the ATM Network Interface Card, and the service interface of SSCOP is implemented in AAIF module, that contains OVOPS++ messenger classes for AA primitives. Usually the applications (eg signalling protocols) don't use SSCOP directly, but through a suitable SSCF (Service Specific Coordination Function). Currently there are SSCFs defined for UNI and NNI signalling protocols.

## 2 Architecture

The sscop module implements a protocol conduit that can be used in user to network interface and network to network interface signaling stack as shown in Figure 1 and Table 1.



Figure 1. The upper and lower interfaces and modules used with sscop module.

Upper protocol:	usscfProtocol or nsscfProtocol
Upper module:	ussef or nssef
Upper interface:	aaif
Module:	sscop
Lower interface:	cpcsif
Lower module:	cpcs
Lower protocol:	cpcsATMAdapter or cpcsUDPAdapter
Uses:	switch (toveManager) (not currently supported, should be used)
Used by:	saal (saalConnection)

Table 1. The upper and lower interfaces and modules used with sscop module.

#### 3 Implementation details

The implementation of this co-ordination function is a straightforward conduit implementation without any modifications. To demonstrate this, Figure 3 has a small part of SSCOP SDL diagram. Q.2110 Recommendation defines 10 states for the protocol state machine and the inputs driving the state machine (as well as the primitives sent by SSCOP) are represented in Figure 2.



Figure 2. SSCOP inputs

The main inputs for SSCOP are the primitives from the SSCOP user and data indications from AAL5 CPCS layer. Other sources of events are the primitives from layer management entity (MAA-\* primitives), timeouts from SSCOP timers and internal events generated by SSCOP itself (these events are generated e.g. when data is accepted for transfer, but it is first buffered inside SSCOP and the actual transfer takes place later). Also the PDU inputs can be viewed as internal events, since on an arrival of a CPCS-UNITDATA.indication the contents of the AAL5 data indication are decoded into a SSCOP PDU, which is then accepted as a new event into the message queue of SSCOP. This is indicated with the dotted line in Figure 2.





The code snippet below contains the corresponding input methods from SSCOP state machine code. One can see that one SDL block translates into approximately one line of code, so reading code with the SDL diagram is quite easy.

```
void sscopIdle :: aaESTABLISHreqAct(
    aaESTABLISHreq *messenger_,
    pfProtocol *protocol_) const
{
    sscopProtocol *sscop = (sscopProtocol *) protocol_;
    clearTransmitter(sscop);
    sscop->_clearBuffers = messenger_->getBufferRelease();
    sscop->_VT_CC = 1;
sscop->_VT_SQ++;
    initializeVR_MR(sscop);
    sscop->sendBGNpdu(messenger_->getSSCOP_UU());
    sscop->_timerCC.start();
    changeState(protocol_,
                 sscopOutgoingConnectionPending::instance());
    return;
}
void sscopIdle :: sscopBGNpduAct(
    sscopBGN_PDU *messenger_
    sscopProtocol *protocol_) const
```

## 4 Features implemented

Most of the features of SSCOP are implemented.

Global statement of conformance

Global statement: The implementation specified in this PICS meets all the mandatory requirements of the referenced standards:

Yes/No

NOTE – Answering "No" to this question indicates non-conformance to this Recommendation. Non-supported mandatory capabilities are to be listed in the PICS below, with an explanation for the abnormal status of the implementation. The supplier will have fully complied with the requirements for a statement of conformance by completing the statement contained in this subclause. However, the supplier may find it helpful to continue to complete the detailed tabulations in the subclauses which follow.

### 1.1 B.5 SSCOP – Q.2110

1.1.1 B.5.1 Protocol Capabilities (PC) – SSCOP

See Table B.1.

ITEM #	Protocol Feature	Status	Reference	Support
PC1	Does IUT support Keep Alive function?	М	5.0 e)	Yes
PC2	Does IUT support the Local Data Retrieve function? (Optional in Q.2130)	M / (O)	5.0 f)	Yes
PC3	Does the IUT support SSCOP initiated error recovery due to protocol error?	М	5.0 i)	Yes
PC4	Does the IUT recognize all of the Messages regardless of state?	М	Table 2	Yes
	BGN	М		Yes
	BGAK	М		Yes
	BGREJ (Optional in Q.2130)	M / (O)		Yes
	END	М		Yes
	ENDAK	М		Yes
	ER	М		Yes
	ERAK	М		Yes
	POLL	М		Yes
	STAT	М		Yes
	USTAT	М		Yes
	RS (Optional in Q.2140)	M / (O)		Yes
	RSAK (Optional in Q.2140)	M / (O)		Yes
	SD	М		Yes
	UD (Optional in Q.2140)	M / (O)		Yes
	MD (Optional in Q.2130 and Q.2140)	M / (O)		Yes
PC5.1	In the absence of protocol error, does the IUT support assured data transfer with sequence integrity?	М	5.0 a) h); 7.1 j)	Yes
PC5.2	Does IUT support the sending of the Unassured Data PDU? (Optional in Q.2140)	M / (O)	5.0 h); 7.1 n)	Yes
PC5.3	Does IUT support the sending of the Management Data PDU? (Optional in Q.2130 and Q.2140)	M / (O)	7.1 о)	Yes
PC6	Does IUT support user invoked re-synchronization procedures? (Optional in Q.2140)	M / (O)	5.0 g)	Yes
PC7	Does IUT support the establishment procedures for an SSCOP connection?	М	5.0 g)	Yes
PC8	Does IUT support release procedures for an SSCOP connection?	М	5.0 g)	Yes
PC9	Does IUT support polling after retransmission? (Mandatory in Q.2140)	O / (M)	SDL	Yes
PC10	Does IUT support the segmenting of STAT PDUs?	М	7.2.5	Yes
PC11	Can the IUT initiate SSCOP connection?	М	5.0 g)	Yes
PC12	Can the IUT reject (BGREJ) the establishment of an SSCOP connection from its peer? (Not available in Q.2130)	M / (N/A)	SDL	Yes
PC13	Does IUT support error reporting to layer management?	М	5.0 d)	Yes

## SSCOP PDUs - Protocol Data Units (PD)

ITEM #	Protocol Feature	Status	Reference	Support
Order of Octet Transmission				
PD1	Ascending numerical order	М	7.2.1	Yes
Field Mapping Convention				
PD2	Lowest bit number = Lowest order value	М	7.2.1	Yes
PD3	Are PDU formats 32 bit aligned?	М	7.2	Yes
PD4	Are all reserved bits coded as zeros?	М	7.2.3	Yes

# SSCOP System Parameters (SP)

ITEM #	Protocol Feature	Status	Reference	Support
SP1	Maximum number of transmissions of a BGN, END, ER, or RS PDU (MaxCC)	М	7.7 a)	Yes / Value:
SP2	Maximum number of SD PDUs before transmission of a POLL PDU (MaxPD)	М	7.7 b)	Yes / Value:
SP3	Maximum number of List Elements in a STAT (MaxSTAT)?	М	7.7 c)	Yes / Value:
SP4	Maximum PDU size	М	7.2.4	Yes / Value:
SP5	Timer_POLL	М	7.6 a)	Yes / Value:
SP6	Timer_KEEP-ALIVE	М	7.6 b)	Yes / Value:
SP7	Timer_NO-RESPONSE	М	7.6 c)	Yes / Value:
SP8	Timer_IDLE	М	7.6 c)	Yes / Value:
SP9	Timer_CC	М	7.6 d)	Yes / Value:
SP10	If PC16 is supported, what is the maximum size of the SSCOP-UU?	М	6.1.2 b); 7.2.4	Yes / Value:
SP11	Does the IUT support a SSCOP-UU length of at least four octets? (Mandatory in Q.2140)	O / (M)	6.1.2 b); 7.2.4; clause 11/Q.2140	Yes / Value:

# 5 Known bugs and flaws

Know bugs:

• The handling of SSCOP PDU sequence numbers is not currently correct. Sequence numbers are integers (modulo 2<sup>2</sup>24), but the present code can't handle the situation where sequence numbers wrap over 2<sup>2</sup>24, so if an SSCOP instance runs over a long time, it will eventually encounter this bug.

Features not yet implemented:

- Handling of MAA-UNITDATA.requests, MD PDUs and MD PDU Queued Up events.
- Buffering of SD PDU Queued Up events in states 7, 8 and 9.

## 6 Future development

The ITU-T implementation guides should be checked and needed modifications implemented. Final code modifications should be performed. The final code inspection should be performed.

## 8 References

[1] ITU-T Recommendation Q.2110, *B-ISDN ATM Adaptation Layer - Service Specific Connection Oriented Protocol (SSCOP)*, July 1994