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Intersystem Link Protocol

Revision: 0

Revision History

Revision		Date
Rev. 0	Initial Publication	January 2000

Note

This specification is an extract of TIA TR45.2 IS-728.

INTERSYSTEM LINK PROTOCOL (ISLP)

Foreword

This foreword is not part of PN-3660

PN-3660 specifies an Intersystem Link Protocol (ISLP) for circuit-mode data services. These data services include Asynchronous Data (ADS) and Group-3 Fax as specified in *TIA/EIA/IS-99* and *TIA/EIA/IS-135*. The ISLP adapts between air-interface data rates and higher-speed intersystem rates. The ISLP may be used between a serving system and an anchor system, possibly through one or more tandem systems (see *ANSI/TIA/EIA-41.1* for details on "serving system", "anchor system", and "tandem system").

The ISLP does not provide any error-checking or error-correcting services. Any intervening tandem system is only a physical-layer relay that transparently passes ISLP data without modification or significant delay.

PN-3660 was developed by TR45.2, the TIA Intersystem Operations Subcommittee.

TIA welcomes suggestions for improvement of this standard. Please send suggestions to the following address:

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Revision History

Version	Comments
0	March 1997.

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1. Purpose and Scope

This document specifies an Intersystem Link Protocol (ISLP) for circuit-mode data services. These data services include Asynchronous Data (ADS) and Group-3 Fax as specified in IS-99 [2] and IS-135 [4]. The ISLP adapts between air-interface data rates and higher-speed intersystem rates. The ISLP may be used between a serving system and an anchor system, possibly through one or more tandem systems.

This document comprises the following sections:

- § 2 provides an overview.
- § 3 specifies ISLP structure and processes.
- § 4 specifies ISLP enabling and disabling procedures.
- § 5 specifies terminology.
- § 6 lists references.

2. Terminology

ADS	Asynchronous Data Service
BS	Base Station
IMSCCID	Inter MSC Circuit Identification
ISDN	Integrated Services Digital Network
ISLP	Intersystem Link Protocol
IWF	Interworking Function
MAP	Mobile Application Part
MS	Mobile Station
MSC	Mobile Switching Center
PDU	Protocol Data Unit
PPP	Point-to-Point Protocol
PSTN	Public Switched Telephone Network
RLP	Radio Link Protocol
SDU	Service Data Unit
TCP/IP	Transport Control Protocol / Internet Protocol

3. References

The following standards contain provisions that constitute provisions of this standard. At the time of publication, the editions indicated were valid. Standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate applying the most recent editions. ANSI and TIA maintain registers of their currently valid standards.

1. TIA/EIA *Data Services*, Telecommunications Industries Association, 1997.

2. TIA/EIA/IS-99. *Data Services Option Standard for Wideband Spread Spectrum Digital Cellular System.,*Telecommunications Industry Association, 1995.

3. TIA/EIA/IS-130. *800 MHz Cellular Systems – TDMA Radio Interface – Radio Link Protocol 1,* Telecommunications Industry Association, 1995.

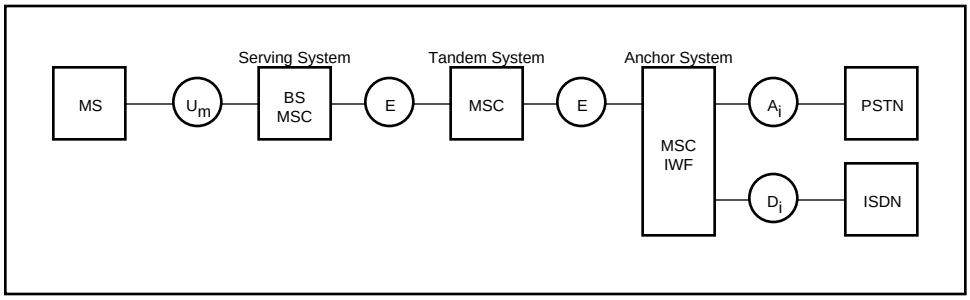
4. TIA/EIA/IS-135. *800 MHz Cellular Systems – TDMA Services – Async Data and Fax,* Telecommunications Industry Association, 1995.

5. ANSI/TIA/EIA-41. *Cellular Radiotelecommunication Intersystem Operationss,* Telecommunications Industry Association, 1997.

4. Overview

Figure 4–1 presents a simplified network reference model. This simplified model is based on the detailed network reference model in *ANSI/TIA/EIA-41.1* [5], with addition of the IWF at the anchor system. Figure 4–2 presents a communications profile showing the ISLP and its relationship to other layers.

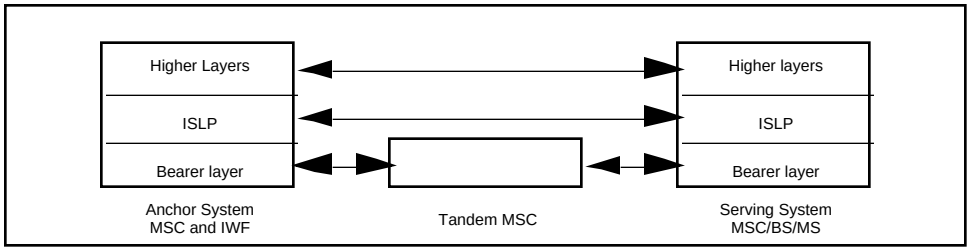
Figure 4–1 Simplified Network Reference Model



BS	Base Station
ISDN	Integrated Services Digital Network
IWF	Interworking Function
MS	Mobile Station (may include a Mobile Termination)
MSC	Mobile Switching Center
PSTN	Public Switched Telephone Network
A_i	MSC-to-PSTN interface
D_i	MSC-to-ISDN interface
E	MSC-to-MSC interface
U_m	BS-to-MS interface, also known as the air-interface

Circuit-mode data services transport data, via the Um and E interfaces, between the MS in the serving system and the IWF in the anchor system. Circuit-mode data services also transport data, via the Ai interface or the Di interface, between the IWF and a data terminal in the PSTN or ISDN.

Figure 4–2 ISLP Communications Profile



The ISLP transports circuit-mode data from the serving system, possibly via one or more tandem systems, to the anchor system where the interworking function (IWF) resides. At the anchor system, the IWF provides interoperability between the protocols used over the serving system's air interface and protocols used by PSTN-based or ISDN-based data terminals (e.g., V-series modems). The IWF is placed at the anchor system, rather than the serving system, to prevent data loss and PSTN or ISDN disconnects during intersystem handoffs or service changes.

The ISLP does not provide any error-checking or error-correcting services. Any intervening tandem system is only a physical-layer relay that transparently passes ISLP data without modification or significant delay.

The ISLP provides the following services to the higher layers:

- Rate adaptation between air-interface data rates and higher-speed intersystem data rates.

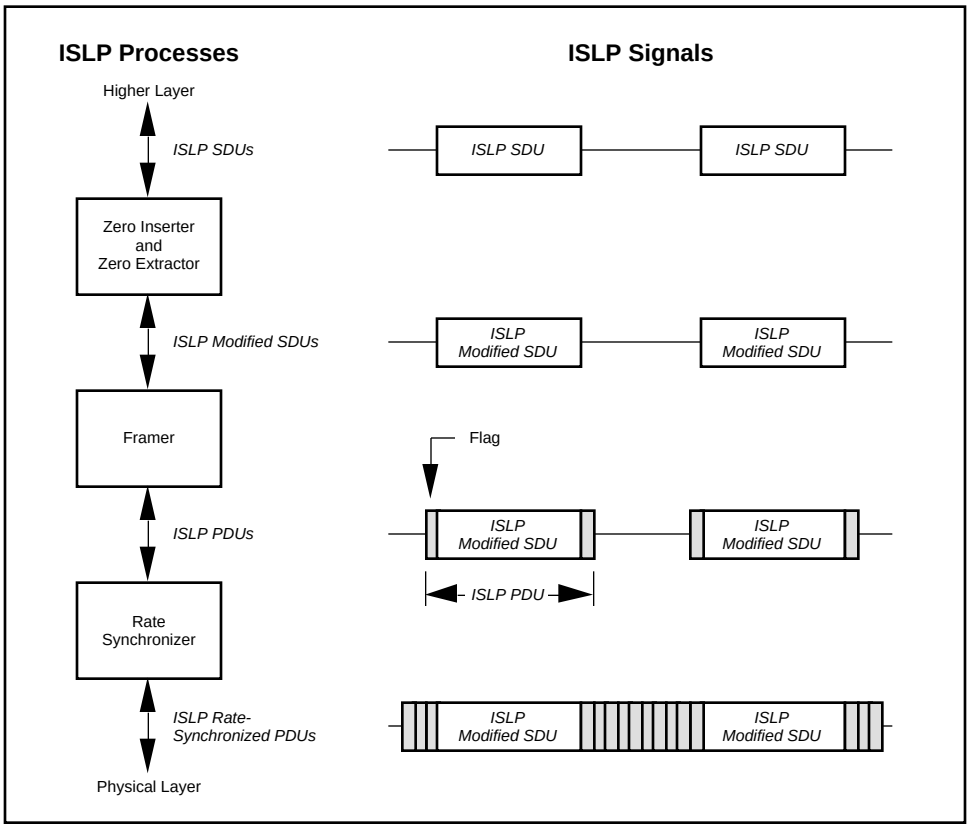
The ISLP requires the following services from the bearer layer:

- A 56 kbit/s clear channel.

5. ISLP Structure

The ISLP comprises the processes and signals shown in Figure 5–1. The model in Figure 5–1 is not meant to unnecessarily constrain implementations — any ISLP implementation that, as a whole, behaves the same as the ISLP specified in this standard, by definition, complies with this standard.

Figure 5–1 ISLP Processes and Signals



5.1 ISLP Service Data Units (SDUs)

The ISLP shall receive *ISLP SDUs* from the higher-level protocol (e.g., RLP1 [3] or TCP/IP/PPP). The ISLP shall also deliver *ISLP SDUs* to the higher-level protocol. The format and length of the *ISLP SDUs* shall be determined by the higher-layer protocol. The ISLP shall transmit *ISLP SDU* bits in the order in which they are received.

For ISLP implementations that carry RLP1 traffic, a one-to-one relationship shall be maintained between an RLP1 frame and an *ISLP SDU*. *IS-130* specifies an RLP1 frame size of 27 octets.

For ISLP implementations that support CDMA data services, the SDU relays octets that are received from higher-level protocols. The maximum number of octets carried in an *ISLP SDU* shall be 1508 octets.

5.2 Zero Inserter and Zero Extractor

ISLP SDU bit sequences that contain more than five consecutive 1s shall be modified since these sequences could be misinterpreted as flags. *ISLP Modified SDU*s may be of any length, but shall not contain any sequence of more than 5 consecutive 1s.

At the transmitting end, the zero inserter shall insert a 0 immediately following every sequence of five consecutive 1s (regardless of character boundaries). It shall output the resulting *ISLP Modified SDU* to the framer.

At the receiving end (following flag removal), the zero extractor shall remove a 0 immediately following a string of five consecutive 1s. It shall pass the resulting *ISLP SDU* to the higher-level protocol.

Zero-bit insertion is transparent to the end user and any intermediate tandem system.

5.3 Framer

*ISLP PDU*s are delimited by flag sequences (see 5.4).

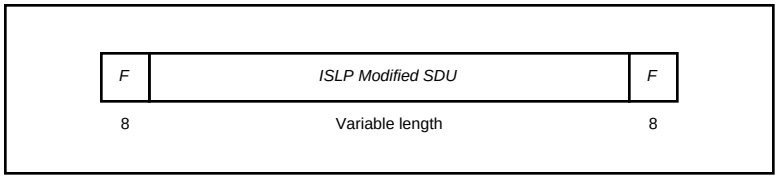
At the transmitting end, the framer shall insert flags at the beginning and end of every *ISLP Modified SDU*. It shall pass the resulting *ISLP PDUs* to the rate synchronizer.

At the receiving end, the framer shall remove the flags at the beginning and end of every *ISLP PDU*. It shall pass the resulting *ISLP Modified SDUs* to the zero extractor.

5.4 ISLP Protocol Data Units (PDU)

ISLP PDUs, also known as *ISLP Frames,* shall have the structure shown below:

Figure 5-2 ISLP Protocol Data Units (PDU)



- *F,* the flag sequence, serves as a frame delimiter and as interframe fill. It shall be the 8-bit pattern 01111110 (0x7E).
- *ISLP Modified SDUs* may be of any length.

5.5 Rate Synchronizer

Repeating flags shall be used as interframe fill to adapt the air-interface data rate to the intersystem-facility data rate.

At the transmitting end, the Rate Synchronizer shall perform the following functions, as needed:

- The Rate Synchronizer may delete flags between two adjacent *ISLP PDUs*, as long as at least one remains.
- The Rate Synchronizer shall synchronize the ISLP output data rate to the physical-layer transmission rate by continually inserting flags between *ISLP PDUs.* No flags shall be inserted within an *ISLP PDU*. Two consecutive flags shall not share a single interior 0 bit.

The Rate Synchronizer shall output *ISLP Rate-Synchronized PDUs* to the physical layer at the physical-layer transmission rate.

At the receiving end, the Rate Synchronizer shall perform the following functions, as needed:

- The Rate Synchronizer shall add one flag between any adjacent *ISLP Modified SDUs* separated by a single flag.
- The Rate Synchronizer shall delete interframe flags, i.e., those flags in excess of beginning flag and ending flag for each *ISLP PDU.*The rate synchronizer shall output *ISLP PDUs* to the Framer.

6. Enabling and Disabling Procedures

The ISLP may be enabled or disabled on an intersystem trunk. When the ISLP is enabled by an MSC at one end of a trunk, the MSC may begin sending ISLP Rate-Synchronized PDUs as described in 5.5.

The ISLP may be enabled under any of the following contexts:

- Intersystem handoff.
- In-call service change to a circuit-mode data service.

The ISLP may be disabled under the following contexts:

- Call release.
- Intersystem handoff (e.g. handoffback or handofftothird).
- In-call service change to a service that does not require the ISLP (e.g., voice).

The following sections describe in greater detail the signaling sequences and procedures for the ISLP.

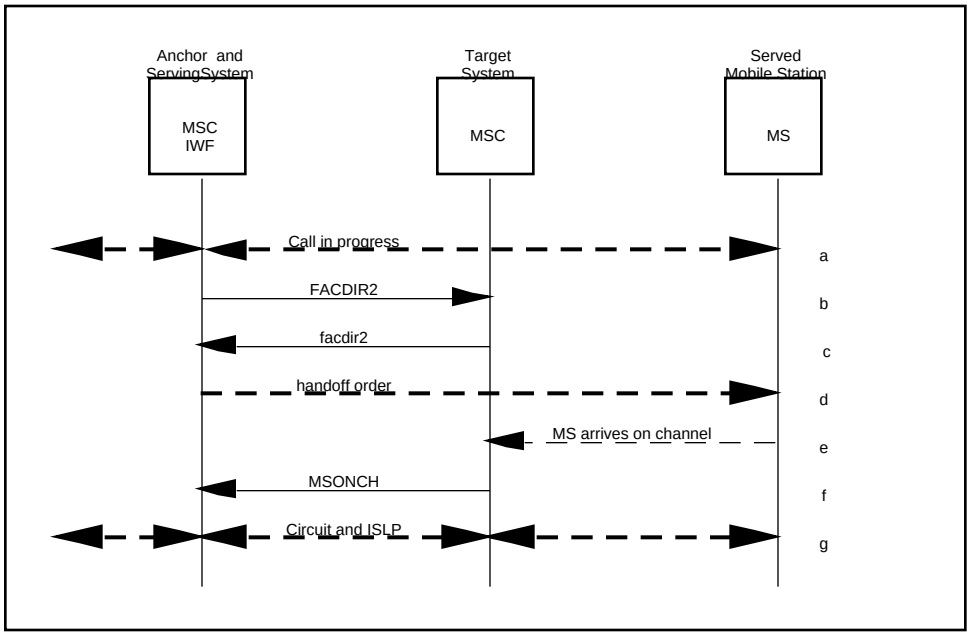
6.1 Enabling ISLP at Intersystem Handoff

ANSI/TIA/EIA-41.2 specifies the following MAP operations and invoke sequences for intersystem handoff, and intersystem call setup:

- FacilitiesDirective2 (FACDIR2)
- HandoffBack2 (HANDBACK2)
- HandoffToThird2 (HANDTHIRD2)
- InterSystemSetUp (ISSETUP)

Figure 6–1 illustrates, for a simple handoff forward, when the ISLP should be enabled during the specified intersystem handoff sequences. HandoffToThird2 only indirectly enables or disables the ISLP. The HandoffToThird2 results in FacilitiesDirective2 which enables the ISLP as shown in Figure 6-1.

Figure 6–1 Simple Handoff Forward



a. A circuit-mode data call is in progress.

b. The Serving System seizes a circuit and initiates a handoff by sending an FACDIR2 to the target system. The FACDIR2 identifies the call as a circuit-mode data call, references the IMSCCID, and indicates support for the ISLP in the ISLPInfo parameter (see chapter 5 of *Data Services* for a description of the parameter ISLPInfo). The Serving MSC may begin to enable ISLP.

c. The Target System receives the FACDIR2, verifies that it can support the specified circuit-mode data service and the ISLP, and sends a return result to the

Serving System confirming seizure of the circuit referenced by the IMSCCID. The Target System may enable the ISLP.

d. Upon receipt of the successful return result, the Serving System sends a handoff order to the mobile. The handoff order uses channel data returned by the Target System.

e. The target System determines that the mobile station has completed the handoff and sends the MSONCH to the Serving System. If not previously performed, the Target System enables ISLP.

f. Upon receipt of MSONCH, and if not performed previously, the Serving System enables ISLP.

g. The InterMSCID trunk is connected and the ISLP is enabled. The handoff is now completed.

6.2 Enabling ISLP at Service Change

Data Services specifies the following MAP Operations and invoke sequences for in-call service change which may result in enabling the ISLP:

- ChangeService (CHGSERV)
- ChangeFacilities (CHGFAC)

6.3 Disabling ISLP

The ISLP may be disabled when the FacilitiesRelease INVOKE (see *ANSI/TIA/EIA-41.5*) is either sent or received (e.g., call released, intersystem handoff, in-call service change).