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OSI Connectionless Transport Services on top of UDP
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Status of this Memo

This document describes a protocol for running OSI Connectionless service on UDP. This RFC specifies an IAB standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "IAB Official Protocol Standards" for the standardization state and status of this protocol. Distribution of this memo is unlimited.

1. Introduction and Philosophy

The Internet community has a well-developed, mature set of layered transport and network protocols, which are quite successful in offering both connection-oriented (TCP) and connectionless (UDP) transport services over connectionless network services (IP) to end-users. Many popular network applications have been built directly on top of the TCP and UDP over the past decade. These have helped the Internet services and protocols to become widely-spread de facto standards. In the past few years, the ISO and CCITT have defined a well-architected set of upper layer standards which include connection-oriented and connectionless session, presentation, and application layer services and protocols. These OSI upper layer standards offer valuable services to application developers (e.g., dialogue control, transfer syntax, peer authentication, directory services, etc.) which are not currently offered by the TCP/IP standards.

As indicated in RFC 1006, it is desirable to offer the OSI upper layer services directly in the Internet without disrupting existing facilities. This permits a more graceful convergence and transition strategy from IP-based networks to OSI-based networks in the future. Using the approach of RFC 1006, this memo specifies how to offer OSI connectionless transport service using the User Datagram Protocol (UDP) [RFC768] of the TCP/IP suite.

We will define a Transport Service Access Point (TSAP) which appears to be identical to the services and interfaces defined in ISO 8072 and its Addendum 1, but we will in fact implement the ISO T-UNIT-DATA protocol on top of UDP. By this means, OSI TPDU's can be delivered across the Internet network, and OSI connectionless upper layers can operate fully without knowledge of the fact that they are running on top of UDP/IP. In essence, the OSI T-UNIT-DATA service will use UDP as its connectionless network service provider.

2. Motivation

The primary motivation for the standard described in this memo is to facilitate the process of gaining experience with OSI connectionless upper layers protocols, i.e., S-UNIT-DATA [ISO9548], P-UNIT-DATA [ISO9576] and A-UNIT-DATA [ISO10035], and connectionless transport protocol T-UNIT-DATA [ISO8602].

Though many OSI standard applications such as X.400 and FTAM are connection-oriented, it is recognized in the OSI reference model [ISO7498/AD1] as well as in practice that the connectionless-mode operations are appropriate for certain distributed application classes and environments. The following connectionless application classes were identified by ISO SC21/WG6 [ISOSC21/WG6 N184]:

- Request-Response Applications
- Broadcast/Multicast
- Inward Data Collection
- Migratory/Unreliable Processes

Among them, the "request/response" client-server application class is the most prominent one, which is gaining popularity and importance. It is observed that the connection setup and tear-down protocol exchanges and complex connection-oriented protocol machines become unnecessary overheads for a simple request/response exchange between a client application and a server application, especially in reliable communications environments such as LAN and ISDN. The OSI connectionless upper layers are thought to be highly effective and efficient, both in time and space, for the distributed application classes mentioned above.

The stability, maturity and wide availability of UDP/IP are ideal for providing solid connectionless transport services independent of actual implementations.

3. The Model

The [ISO 8072/AD1] standard describes the OSI connectionless transport services definition. The [ISO 8602] standard describes the OSI connectionless transport protocols. A defining characteristic of transport connectionless-mode transmission is the independent nature of each invocation of the connectionless transport service.

The OSI transport service definition describes the services offered by the TS-provider and the interfaces used to access those services. It also describes the services required. This memo focuses on how UDP [RFC 768] can be used to offer the required services and provide the interfaces.

The following is the model:

```
        +-----------+                               +-----------+
        |  TS-user  |                               |  TS-user  |
        +-----------+                               +-----------+
              |                                           |
              |CLTS interface                             |
              |[ISO 8072/AD1]                             |
              |                                           |
     _________________________________________________________________
    |         |                                           |           |
    |         |                                           |           |
    |   +-----------+            UD TPDU            +-----------+     |
    |   |  TS-peer  |   <----------------------->   |  TS-peer  |     |
    |   +-----------+                               +-----------+     |
    |         |                                           |           |
    |         |                                           |           |
    |         |                                           |           |
    |         |UDP interface [RFC 768]                    |           |
    |         |                                           |           |
    |   +-----------+          UDP datagram         +-----------+     |
    |   |    UDP    |   <----------------------->   |    UDP    |     |
    |   +-----------+     (UD TPDU encapsulated)    +-----------+     |
    |         |                                           |           |
    |         |                                           |           |
    |         |                                           |           |
    |         |                                           |           |
    |                                                                 |
    |                                                                 |
    |                           TS-provider                           |
    |_________________________________________________________________|
```

The following abbreviations are used:

CLTS   Connectionless Transport

TS — Transport Services (implies connectionless transport service in this memo)

TSAP — Transport Service Access Point

TS-peer — a process which implements the mapping of CLTS protocols onto the UDP interface as described by this memo

TS-user — a process using the services of a TS-provider

TS-provider — the abstraction of the totality of those entities which provide the overall service between the two TS-users

UD TPDU — Unit Data TPDU (Transport Protocol Data Unit)

Each TS-user gains access to the TS-provider at a TSAP. The two TS-users can communicate with each other using a connectionless transport provided that there is pre-arranged knowledge about each other (e.g., protocol version, formats, options, ... etc.), since there is no negotiation before data transfer. In the above diagram one TS-user passes a message to the TS-provider, and the peer TS-user receives the message from the TS-provider. The interactions between TS-user and TS-provider are described by connectionless TS primitives.

All aspects of [ISO 8072/AD1] are supported in this memo with one exception: QOS (Quality of Service) parameter, which is left for future study.

The OSI standards do not specify the format of a TSAP selector. Neither does this memo. However, implementors should consult the GOSIP 1.0 specification [GOSIP88/FIPS146] for an interpretation of this parameter, wherein the TSAP selector consists of two octets and a value of (binary) 1 identifies the service interface between OSI transport layer and session layer.

4. The Primitives

This RFC assumes that UDP [RFC768] offers the following service primitives:

send datagram - datagram is sent to the IP address/destination port

read datagram - datagram is read from UDP

Data can only be read from a receive port after the port has been created. This is a local matter.

This memo reserves the use of UDP port 102 for the use of applications which realize the CLTS over UDP. However as with RFC 1006, other port values may be used by prior agreement (e.g., through use of the OSI Directory).

This RFC describes how to use these services to emulate the following connectionless-mode network service primitives, which are required by [ISO8602]:

N-UNIT-DATA.REQUEST - A NS-user requests unit data to be sent

N-UNIT-DATA.INDICATION - A NS-user is notified that unit data can be read from the NSAP

The mapping between the UDP service primitives and the service primitives expected by the connectionless transport peer entity are quite straightforward:

connectionless network service	UDP
N-UNIT-DATA.REQUEST	send datagram
N-UNIT-DATA.INDICATION	read datagram

The parameter mapping is:

connectionless network service	UDP
Source address	source IP address from calling TS-address
Destination address	destination IP address from called TS-address
Quality of service	(ignored)
NS-user data	UD TPDU constructed from T-UNIT-DATA

When the T-UNIT-DATA.REQUEST primitive is issued, the TS-peer constructs a UD TPDU and sends it as a single datagram to the desired IP address using UDP.

When UDP indicates that a datagram has been received, a UD TPDU is read from UDP, and a T-UNIT-DATA.INDICATION primitive is generated.

5. Packet Format

The following is the UD TPDU structure which is encapsulated in UDP data field:

```
1       2         3                m m+1          n
+---------------------------------------------------+
|  LI  |  UD      |  Variable Part  |  User Data   |
|      | 01000000 |                 |              |
+---------------------------------------------------+
```

LI (octet 1) - the length of the header including parameters, but excluding the LI and user data, with a maximum value of 254

UD (octet 2) - the type of TPDU

Variable Part (octets 3 to m) - the source and destination TSAP id's

```
      Parameter code:   source TSAP       11000001
                        destination TSAP  11000010
      Parameter length: the length of the parameter, not including
                        the parameter code or length fields, with a
                        maximum value of 254
      Parameter value:  source or destination T-selector
```

The optional checksum parameter is not required in the variable part since the UDP checksum field in the UDP header already performs the checking.

User Data (octets m+1 to n) - all the data of the TSDU.

The maximum NS-user data allowed in the OSI connectionless network service is 64,512 octets. This limit is further constrained by the lesser maximum datagram size supported by the two communicating UDP peers, which should be known by a priori agreement.

6. Conclusion

There is a general trend towards support of the OSI protocol suite in the Internet. This direction is being fostered by the Internet Activities Board (IAB) and its Internet Engineering Task Force, and by the Federal Networking Council. By offering an OSI connectionless transport service on top of the Internet, this RFC will allow future applications to use the OSI connectionless upper-layer services, which are required to be conformant to the OSI upper layer architecture. Currently, T-UNIT-DATA, S-UNIT-DATA, P-UNIT-DATA, and A-UNIT-DATA have reached International Standard (IS). As applications based on OSI connectionless services become widely available and OSI lower-layer service is widely implemented in the Internet, the underlying UDP/IP services can be simply replaced with the OSI lower layers.

7. Acknowledgements

Marshall T. Rose of PSI, Inc., provided many valuable comments and corrections.

8. References

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[ISO8072] ISO, "International Standard 8072 - Information Processing Systems - OSI: Transport Service Definition", June 1984.

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[ISO9548] ISO, "International Standard 9548 - Information Processing Systems - OSI: Connectionless Session Protocol Specification", April 1989.

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[RFC791] Postel, J., "Internet Protocol", RFC 791, USC/Information Sciences Institute, September 1981.

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Security Considerations

Security issues are not discussed in this memo.

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