ANSI E1.17-2015 (R2020), Architecture for Control Networks
EPI 18.
Operation of SDT on UDP Networks

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This part has no substantive changes from the 2010 edition.

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Foreword – ACN EPIs

E1.17 is the “Architecture for Control Networks” standard [ACN]. It specifies an architecture including a suite of protocols and languages that may be configured and combined with other standard protocols in a number of ways to form flexible networked control systems.

E1.17 Profiles for Interoperability (EPIs) are standards documents that specify how conforming implementations are to operate in a particular environment or situation in order to guarantee interoperability. They may specify a single technique, set of parameters or requirement for the various ACN components. They may also specify how other standards (including other EPIs) either defined within ACN or externally are to be used to ensure interoperability.

1 Introduction

This EPI specifies conditions required for the operation of SDT [SDT] on UDP networks operating on Internet Protocol version 4 or 6 (IPv4, IPv6) networks. It assumes homogeneous networks with latencies shorter than hundreds of milliseconds.

Further requirements for components operating on IPv6 networks may be specified elsewhere. Other network layers are not covered by this EPI.

2 UDP Support

With the special exception of high bandwidth components as noted below, all components shall support both unicast and multicast SDT channels.

2.1 IP version 4

Components using IPv4 shall advertise their subscription to multicast addresses using [IGMPv3] or failing that [IGMPv2] protocol (host part).

2.2 IP version 6

Components using IPv6 shall advertise their subscription to multicast addresses using Multicast Listener Discovery [MLD].

2.3 Special Consideration for High Bandwidth Components

SDT is designed to allow many short messages to different but related devices to share a single packet. This saves network bandwidth and resources in controllers and other components where there is often a large overhead for handling many small packets rather than fewer large ones.

However, this is not the only use of SDT. A session member that requires a very high message rate (for example a device representing a large number of rapidly switching elements such as an LED curtain) presents an obvious burden on other components within the same multicast channel, since these have to receive and process the same packets. It helps therefore to put such components in a channel (and therefore a session) on their own.

When placing high bandwidth components in isolated channels in this way it is also beneficial to ensure that the channel uses a unicast destination address because using a multicast address in this case greatly increases the risk that packets for that component may be received (and dropped) by other components within the system. (This is because switching infrastructure is more likely to pass

multicast packets to multiple hosts and those hosts are more likely to have to filter some or all multicast addresses in software).

For these reasons, a component that in order to function correctly expects to receive data at a rate greater than 10% of the theoretical bandwidth of its network connection may choose not to support membership of multicast channels. Such devices shall respond to Join requests with Join Reject with the reason code “only unicast supported”.

3 Address Specification

Refer to [SDT] section “Transport Layer Address”

When using SDT with [UDP] session addresses shall consist of both an IP address and a UDP port. (The option “SDT_ADDR_NULL” shall also be used as specified below to take the address and port from the UDP packet).

Table 1. IPv4 Address Specification

Octet	Description
0	Address type = SDT_ADDR_IPV4
1..2	UDP Port number in network byte order
3..6	IPv4 address in network byte order

Table 2. IPv6 Address Specification

Octet	Description
0	Address type = SDT_ADDR_IPV6
1..2	UDP Port number in network byte order
3..18	IPv6 address in network byte order

4 Choice of Channel Addresses and UDP Ports

Rules and guidance for choice of channel addresses are given in [SDT]. Further rules specific to UDP are given here.

4.1 Source Address

All channel source addresses shall be unicast. The SDT specification requires the owner to send the originating Join message from the address and port that they wish to use as the source address for the channel.

The owner should use an ephemeral port for the source address and may pick a port on any basis that suits their implementation. In most cases selection of address is dependent on the host’s routing table and often both source address and port can be selected by the TCP/IP stack with no specific intervention by the application.

IANA reserved ports shall not be used.

IANA registered ports should not be used.

4.2 Destination Address

Channel destination addresses may be unicast or multicast.

> **Note**
>
> The terms multicast and unicast refer specifically to the style of IPv4 addressing used and not to the number of members. It is possible to run a channel using a multicast address, but with only one member (this is a common condition when the channel membership is expected to change or expand). It is also possible, in theory, to operate a unicast channel with multiple members where there are multiple components at the same IP address.

4.2.1. Unicast Channels

When a channel is to use a unicast destination address, SDT specifies that the owner shall use the value ADDR_NULL in the destination address field of the Join message. This gives the member component control over which address and port it is to receive channel messages on. It also allows operation through NAT in some circumstances by only opening a single port through the NAT router (the ad hoc port).

The member should use an ephemeral port for this purpose and may pick a port on any basis that suits their implementation.

IANA reserved ports shall not be used.

IANA registered ports should not be used.

4.2.2. Multicast Channels

When a channel uses a multicast destination address, the owner shall select the destination address using the algorithm of [MallocIPv4] for IPv4 networks. For IPv6 networks the selection of multicast addresses is specified elsewhere.

Because the members have no control over the choice of destination port for multicast messages, and because management of large numbers of incoming ports can cause implementation problems, channel owners shall specify the single SDT registered port SDT_MULTICAST_PORT as the destination port for all multicast channels.

Despite the previous rule, channel members shall always use the port that is specified in the Join message as the destination port for multicast channels. This may not be SDT_MULTICAST_PORT for various reasons (e.g. NAT or special configurations) and using the specified port ensures the best chance of interoperability. (A channel member that cannot support any more incoming ports should use the join_refuse message with a reason code of Low Resources).

5 Symbolic Parameters

The following values shall be assigned to SDT symbolic parameters.

Table 3. SDT symbolic parameters

Symbol	Value
MAK_TIMEOUT_FACTOR	0.1
MAK_MAX_RETRIES	2 (3 tries total)
AD_HOC_TIMEOUT	200 ms
AD_HOC_RETRIES	2 (3 tries total)
RECIPROCAL_TIMEOUT_FACTOR	0.2
MIN_EXPIRY_TIME	2s
NAK_TIMEOUT_FACTOR	0.1
NAK_MAX_RETRIES	2 (3 tries total)
NAK_HOLDOFF_INTERVAL	2 ms
NAK_MAX_TIME	10 x NAK_HOLDOFF_INTERVAL
NAK_BLANKTIME	3 x NAK_HOLDOFF_INTERVAL
SDT_MULTICAST_PORT	5568 (IANA registered port “sdt”)

Annex A Definitions

IPv4 Internet Protocol version 4.

IPv6 Internet Protocol version 6.

Annex B Normative References

[ACN] Entertainment Services and Technology Association [http://tsp.esta.org]. E1.17. Entertainment Technology – Architecture for Control Networks. The edition current when this Standard is approved.

[SDT] Entertainment Services and Technology Association, [http://tsp.esta.org]. E1.17. Entertainment Technology – Architecture for Control Networks. Session Data Transport Protocol. The edition current when this Standard is approved.

[UDP] Internet Engineering Task Force (IETF) [http://ietf.org/]. RFC 768 [http://ietf.org/rfc/rfc0768.txt]. Postel. User Datagram Protocol. 1980.

[IGMPv2] Internet Engineering Task Force (IETF) [http://ietf.org/]. RFC 2236 [http://ietf.org/rfc/rfc2236.txt]. Fenner. Internet Group Management Protocol, Version 2. 1997.

[IGMPv3] Internet Engineering Task Force (IETF) [http://ietf.org/]. RFC 3376 [http://ietf.org/rfc/rfc3376.txt]. B. Cain, S. Deering, I. Kouvelas, B. Fenner, and A. Thyagarajan. Internet Group Management Protocol, Version 3. October 2002.

[MLD] Internet Engineering Task Force (IETF) [http://ietf.org/]. RFC 2710 [http://ietf.org/rfc/rfc2710.txt]. Deering, Fenner, and Haberman. Multicast Listener Discovery (MLD) for IPv6. 1999.

[MallocIPv4] Entertainment Services and Technology Association [http://tsp.esta.org]. TSP CP/2004-1026R2. Entertainment Technology - Architecture for Control Networks. EPI 15. E1.17 Allocation of Multicast Addresses on IPv4 Networks. 2006-10-19.