ANSI E1.17-2015 (R2020), Architecture for Control Networks
EPI 10.
Autogeneration of Multicast Address on IPv4 Networks

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This part has no substantive changes from the 2010 edition.

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Abstract

This EPI specifies a technique to be used by ACN implementations for autonomous generation of IPv4 Multicast addresses which achieves a reasonable spread of address allocation across components using the technique and results in low rates of address overlap which would give rise to processing inefficiency.

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Foreword – ACN EPIs

E1.17-200x is the “Architecture for Control Networks” standard [ACN]. It specifies an architecture – including a suite of protocols and languages which 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 which 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

1.1 General

The ACN architecture [ACN] and particularly SDT [SDT] relies on use of multicasting. SDT’s sessions may be very transient in nature and so need quick and easy allocation of multicast addresses.

MALLOC [MALLOC] describes different ways of allocating multicast addresses across IP systems. However, in smaller ACN systems centralized administration (e.g. via a MADCAP server [MADCAP]) may not be present and distributed configuration via static assignments is not feasible. Therefore a lightweight technique is sometimes required for automated allocation of multicast addresses.

The ACN architecture uses multicasting to provide low level (and in many cases hardware level) separation and filtering of different sessions and of traffic to and from different components. However, while this separation provides significant efficiency gains, it is not a requirement that traffic be fully separated for the protocols to work. Two independent uses of the same multicast group for different sessions or for different purposes may cause some loss of efficiency but will not cause failure of the protocols.

This interoperability profile documents a technique to be used in ACN systems for generating IPv4 multicast addresses in such a way that each component may independently acquire a reasonable number of multicast addresses for its own use with a good probability that the addresses will be different from any assigned by other components on the same network which use the same technique.

Logic operations

This document uses the symbols of the C programming language to denote logical operations:

`|`	bitwise inclusive or
`^`	bitwise exclusive or
`&`	bitwise and
`~`	bitwise inversion (ones complement)
`<<`	logical shift left
`>>`	logical shift right (all numbers are unsigned)

2 Autogeneration of IPv4 Multicast Addresses

Addresses assigned using this technique are divided into three parts, the scope, the host part and the dynamic part.

```
MAddress = ScopeAddress | HostPart | DynamicPart
```

The scope defines the high order bits, the host part defines the next 8 bits and the dynamic part defines the low order bits. The position of the boundary between the parts is specified as part of the scope which shall define a minimum of 10 bits and a maximum of 16 bits.

2.1 Scope

The scope is constant across all components which must interoperate in a network and defines the high order bits of the address. The scope shall define an administrative scope conforming to [AdminScope].

Scopes are defined by a combination of a Scope Address and a Scope Mask analogous to a network address and netmask in unicast addresses.

For example, the link-local scope has Scope Address = 224.0.0.0 and Scope Mask = 255.255.255.0. This is often written using the shorthand 224.0.0.0/24.

The scope should be configurable in each device. Where no explicit configuration of scope has been provided, the default scope of E1_17_AUTO_SCOPE_ADDRESS/E1_17_AUTO_SCOPE_MASK shall be used.

2.2 Host Part

The 8 bits of the host part shall be the same as the least significant 8 bits of the (unicast) IP address of the interface to be used. These bits are left shifted to concatenate with the active bits of the ScopeAddress.

```
HostPart   = (IPaddress & 0xff) << HostShift

HostShift  = 24 - ScopeBits

ScopeBits  = bitcount(ScopeMask)     //14 for E1_17_AUTO_SCOPE_MASK
```

This ensures that the component has a good probability of assigning unique addresses on small networks – on class C networks or smaller, there will be no other hosts using the same address range. Furthermore, any clashes of this part of the address are deterministic and predictable based on the IP addresses assigned across the network.

Where an interface has multiple addresses assigned, the address with the largest netmask (the smallest network size) should be chosen.

2.3 Dynamic Part

The dynamic part is initialized at startup from the time_low and node fields of the CID of the component which is autogenerating the address. The dynamic part is then incremented by one after each address that is allocated.

```
DynamicPart        = (InitialDynamicPart + DynamicSequence) & DynamicMask
InitialDynamicPart = CID.time_low ^ CID.node
DynamicSequence    = 0, 1, 2, 3 ...
DynamicMask        = (1 << HostShift) - 1 //0x3ff for E1_17_AUTO_SCOPE_MASK
```

3 Limitations and Restrictions

The mechanism defined here does not guarantee unique assignments and provides no mechanism for detecting other uses of the same addresses. It will give a good chance of addresses which do not conflict being assigned across small ACN networks and where conflicts occur, they should not cause disruption of ACN protocols. However, this mechanism is internal to ACN and cannot be guaranteed not to cause disruption to other protocols which use multicasting on the same network.

It may be possible to alleviate any disruption of other protocols by reconfiguration of address scoping but by the time a network reaches this complexity it is probably preferable to install more centralized multicast address allocation mechanisms.

4 Constants

Symbolic constants used in the text are defined to have the following values:

Table 1. Scope Constants

E1_17_AUTO_SCOPE_ADDRESS	239.192.0.0
E1_17_AUTO_SCOPE_MASK	255.252.0.0

Note

ACN default scope is the Organization Local scope of [AdminScope]. If this scope is in use within the network then it is possible that an alternative scope or subrange may have to be configured.

Annex A. Definitions

CID: Component Identifier. A UUID [UUID] identifying a particular component.

component: The process, program or application corresponding to a single ACN endpoint. All messages in ACN are sent and received by a component which is identified by a CID. See [Arch] for a more complete definition. See also CID.

IPv4: Internet Protocol version 4.

Annex B. Normative References

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

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

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

[MALLOC] Internet Engineering Task Force (IETF) [http://ietf.org/]. RFC 2908 [http://ietf.org/rfc/rfc2908.txt]. Thaler, Handley, and Estrin. The Internet Multicast Address Allocation Architecture. 2000.

[MADCAP] Internet Engineering Task Force (IETF) [http://ietf.org/]. RFC 2730 [http://ietf.org/rfc/rfc2730.txt]. S. Hanna, B. Patel, and M. Shah. Multicast Address Dynamic Client Allocation Protocol (MADCAP). 1999.

[AdminScope] Internet Engineering Task Force (IETF) [http://ietf.org/]. RFC 2365 [http://ietf.org/rfc/rfc2365.txt]. Mayer. Administratively Scoped IP Multicast. 1998.

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

[UUID] Internet Engineering Task Force (IETF) [http://ietf.org/]. RFC 4122 [http://ietf.org/rfc/rfc4122.txt]. P. Leach, M. Mealling, and R. Salz. A Universally Unique IDentifier (UUID) URN Namespace. July 2005.