ANSI E1.17 - 2015 (R2020) Architecture for Control Networks – EPI 20. Maximum Transmission Unit (MTU) Size for ACN on IPv4 Networks

E1.17 Profile for Interoperability

Part of ANSI E1.17 – 2015 (R2020), which was approved by the ANSI Board of Standards Review on 23 March 2020.
This part has no substantive changes from the 2010 edition.

TSP document ref. CP/2004-1036-R1-draft-439:454M

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Architecture for Control Networks – EPI 20. Maximum Transmission Unit (MTU) Size for ACN on IPv4 Networks

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Revision History	
Revision R1-draft-439:454M	2011-04-29
Revision R1pre1	2004-11-09

Abstract

This EPI discusses the issues of MTU size in ACN systems and specifies requirements for specific implementations.

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ACN EPIs

ANSI E1.17-2010 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. Introductory Discussion

The ACN Specifications mention Maximum Transmission Unit (MTU) Size in various places and specifically requires the implementer observe MTU restrictions. However, establishment of MTU size is not a trivial issue. On Internet Protocol (IP) networks, the consequences of overflowing MTU are not catastrophic since the IP layers can reassemble fragmented datagrams. However, this can lead to inefficiencies and in some cases unexpected behavior.

This EPI assumes understanding of the ACN Architecture and Root Layer Protocol. See [Arch] and [RLP-UDP].

1.1. Establishing MTU

MTU for a given route from one host to another – so called Path MTU – can be established statically based on exterior knowledge of the network segments involved, or dynamically by probing the network.

1.1.1. Static MTU

Static establishment of MTU is very inflexible and in generic equipment on the wider internet is almost unworkable. If no other information on MTU can be gleaned, a frequent strategy is to restrict packets to an arbitrary size (512 octets is common) on the assumption that no link in the path is likely to have an MTU less than this value.

Many ACN systems can be assumed to be running on homogeneous networks where all links have similar characteristics. In particular, Ethernet of one form or another will be the most common carrier. In this environment, static assumptions of MTU can be made with more confidence.

1.1.2. Dynamic MTU discovery

Dynamic establishment of MTU is possible either by a blunt approach of probing the path with datagrams of different sizes or by the Path MTU Discovery mechanism outlined in [PathMTU]. However, for various reasons routers and hosts may not support this mechanism and so dynamic determination of Path MTU can be demanding on the host and unreliable.

1.2. Consequences of Fragmentation

If a datagram is larger than the MTU for the path it is sent through it will normally be fragmented by the IP layer and the fragments will be reassembled at the receiving end by UDP [UDP]. This has various implications.

If a single fragment is lost or corrupted, the entire datagram must be retransmitted. This is inefficient and therefore undesirable, but not catastrophic.

Some lightweight TCP/IP stacks cannot handle fragmented packets at all – they will simply discard the incoming fragments and no amount of retransmission of the same datagram will get it through. This could give rise to unpredictable errors and even complete communications failure.

There are many other reasons why fragmentation should be avoided which are well discussed elsewhere.

2. An MTU Value for Homogeneous Ethernet and IPv4 Networks

2.1. Link Layer Encapsulation

The raw packet size on Ethernet or IEEE802.3 networks is 1514 octets maximum (excluding 8-octet preamble and 4-octet CRC). The size of the link layer header (hardware addresses etc.) depends on the encapsulation but is commonly 14 octets for Ethernet or 22 octets for IEEE802 encapsulation.

2.2. IP Layer

The standard IP layer header is 20 octets, but options may extend this up to a maximum of 60 octets. Options are not present in most routine packets so we can assume the minimum. However, if record route or other options are being used MTU will be reduced accordingly.

2.3. UDP

UDP adds an 8 octet header to all datagrams.

2.4. Conclusion

Provided no IP options are added and Ethernet encapsulation is in use, the ACN root layer will be able to transmit 1472 octets in a UDP datagram without fragmentation. Use of IP options and IEEE encapsulation could reduce this to as little as 1424 octets. However, this is unlikely in common practice except for experimental or test conditions.

3. MTU for ACN

Rather than force difficult MTU discovery support onto implementers, this EPI assumes that IPv4 networks are largely implemented on Ethernet or compatible technology. There is positive efficiency benefit to allowing as large a datagram as possible provided MTU is not exceded and so network implementations are predicated on the assumption of a fixed ACN packet size of 1472 octets.

3.1. Requirements

In order to conform to this EPI, implementations must observe the following requirements and recommendations:

3.1.1. Reception

Implementations shall support reception of Root Layer Protocol packets up to 1472 octets in size, they may support larger packets.

3.1.2. Transmission

The Transmission MTU value shall default to 1472 octets. It shall not be greater than this but may be reduced as specified below.

Implementations shall not pass Root Layer Protocol packets to UDP for transport which are larger than the MTU as determined below.

Implementations should support configuration of reduced MTU, either by manual configuration or automatically using Path MTU Discovery [PathMTU] or both.

If operation of a reduced MTU is available to the ACN implementation in a host either by manual configuration, by automated discovery or by other methods (e.g. in recognition of the use of IEEE802 encapsulation) then that implementation shall observe the reduced MTU and reduce its root layer packets to ensure that they do not excede that MTU.

Definitions

IPv4	Internet Protocol version 4.

References

Normative

[ACN] Entertainment Services and Technology Association, since 1 January 2011 PLASA NA [http://tsp.plasa.org]. ANSI E1.17-2010, *Entertainment Technology - Architecture for Control Networks*.

[Arch] Entertainment Services and Technology Association, since 1 January 2011 PLASA NA [http://tsp.plasa.org]. ANSI E1.17 - 2010,. *Entertainment Technology – Architecture for Control Networks*. “ACN” Architecture.

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

[RLP-UDP] Entertainment Services and Technology Association, since 1 January 2011 PLASA NA [http://tsp.plasa.org]. ANSI E1.17 - 2010, *Entertainment Technology - Architecture for Control Networks*. EPI 17. Root Layer Protocol Operation on UDP.

[PathMTU] Internet Engineering Task Force (IETF) [http://ietf.org/]. RFC 1191 [http://ietf.org/rfc/rfc1191.txt]. J. Mogul and S. Deering. *Path MTU Discovery*. 1990.