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EPI 25 Time Reference in ACN Systems Using SNTP and NTP

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This standard was originally published when the Entertainment Services and Technology Association was operating under the name of PLASA North America.
ESTA has reverted to its original name, and this document has been rebranded with the current corporate name and logo. No changes have been made to the contents of the standard.

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The Control Protocols Working Group, which authored this Standard, consists of a cross section of entertainment industry professionals representing a diversity of interests. ESTA is committed to developing consensus-based standards and recommended practices in an open setting.

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Interest category codes:
CP = Custom-market Producer
DE = Designer
DR = Dealer or Rental company
G = General interest
MP = Mass-market Producer
U = User

Table of Contents

ACN EPIs

ANSI E1.17-2006 is the “ESTA 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.

Foreword

This EPI specifies restrictions and guidelines for establishment of a common time reference across components within an ACN system using SNTP (Simple Network Time Protocol) and optionally NTP (Network Time Protocol). This EPI does not define a control synchronization model, but the network wide time reference it establishes can form the basis of a number of different models.

1 Introductory Discussion

Within the control of entertainment lighting and effects time synchronization is very important. In a typical system this can require that hundreds or thousands of individual and autonomous components are required to behave in a coordinated manner to achieve a desired effect, and the coordination needs to remain the same night after night.

The variation in synchronization must therefore be imperceptible or at least unobtrusive to an audience.

Historically, connection between a controller and a piece of controlled equipment has taken the form of a direct linkage by wire and in most cases a single controller has been the main or only source of commands. In this model, synchronization is down to the performance of the controller and to the well known characteristics of the wire connection. Delays within the system of tens of milliseconds can easily be compensated if they are nearly constant - and are anyway often imperceptible when the object of control is an incandescent lamp with a filament time constant which ranges into hundreds of milliseconds.

With control of an ever widening array of equipment controlled in entertainment technology and the inclusion of equipment with very short time constants such as LED based or video effects, much smaller time discrepancies become perceptible — especially when sound, lighting and other effects are combined.

Within an ACN system the linking factor for control of all these components is the network - they cannot be relied upon to have any other linkage. However, delays and variation within the network infrastructure can mean that there is much more variability - even where total delays are no greater - than with the historical model described above.

2 Definitions

accuracy: Refers to how well a clock's frequency and time compare to international standards. See [NTPv3].

component: An ACN communications endpoint. Defined in [Arch].

drift: The variation in skew over time (the second derivative of offset with time). See [NTPv3].

host: A single node on the network. The term is used in the sense commonly used in networking.

offset: The difference in time between two clocks. See [NTPv3].

precision: A measure of the error (or lack of it). See [NTPv3].

skew: The difference in frequency between two clocks (the first derivative of offset with time). See [NTPv3].

stability: Refers to how well a clock can maintain a constant frequency. See [NTPv3].

3 Synchronization Models

3.1 Synchronizing Control vs. Time Reference

There is a difference between synchronization of control and synchronization of time reference. Synchronization of control means that separate controlled devices which are intended to act in a time coordinated way, do so with acceptably small variation from instance to instance. Synchronization of time reference simply means that all components within the system, which operate with a concept of time, use and are synchronized to the same agreed time reference to within acceptable limits.