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Management Requirements for Packet-based Timing Distribution
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Abstract

This Internet draft investigates the management aspects associated with packet-based distribution of time and frequency using protocols such as PTP (Precision Time Protocol, [1]). It explores some of the issues that need to be solved in connection with the management of synchronization distribution.

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1. Introduction

Synchronization for many telecoms applications (e.g. wireless basestations, circuit emulation services) is a mission-critical service, in the sense that if the synchronization service goes out of tolerance, the enabled service may fail, impacting revenue. When the synchronization is delivered by a packet-based mechanism (e.g. by use of PTP defined in [1]), continuous in-service monitoring is required to verify the quality and traceability of the synchronization.

The purpose of this draft is to examine some of the requirements of synchronization management and to propose options for how these issues may be tackled. It has been developed out of the informal "Problem Statement for Management of Synchronization Networks" presented at IETF 77.

1.1. Elements of synchronization management

Elements in effective management and monitoring for packet-based synchronization distribution include:

- Fault monitoring and reporting
- Performance and status monitoring of the synchronization equipment
- Performance and status monitoring of the packet network related to timing distribution

Analysis of the performance data for trends in key synchronization performance indicators may allow "early warning" of possible issues (e.g. congestion) that may affect synchronization. Continuous, in-service monitoring enables the operator to be informed of events or trends likely to affect the synchronization network and enable corrective action to be taken.

1.2. Use of a single synchronization management domain

Whilst distributed across the network, and possibly embedded into disparate network elements, synchronization forms a distinct infrastructural function within the network. This means it needs to be planned and managed as an entity, and not as collection of separate components.

The aggregation of synchronization information and processing of it as an integrated whole can provide powerful insights into the overall performance of the synchronization service, and indicate if more general corrective action is required. For example, degradation in the key performance indicators of several synchronization network elements may be an early warning sign of increased network loading.

Use of specific synchronization node manager can enhance such holistic management of the synchronization function. It also simplifies the integration of the synchronization management into an operator's OSS (Operations and Support System), by providing a single point of integration with visibility of the whole network, including the synchronization service, and allowing correlation of information from multiple network information.

2. Issues to be resolved

Some of the issues that need to be resolved in the creation of a coherent approach to synchronization management include:

- What information must be maintained by synchronization functions?
- What performance data related to synchronization are to be collected?
- What alarms must be generated by synchronization functions?
- How is the management information to be collected?
- How can network elements containing synchronization functions be discovered?

These issues are discussed in the following sections.

2.1. What information must be maintained by synchronization functions?

A standard set of "synchronization information" should be defined, such that all synchronization functions are able to report the same types of information. This should include node information related to timing and synchronization, protocol-specific information (e.g. for PTP-based functions, the standard data sets) and timing performance data, enabling a synchronization network manager to assess the health of a synchronization node.

The standard set of information should be defined in terms of a MIB (Management Information Base) for each type of synchronization function (e.g. packet master or slave clock, or "on-path" timing support elements).

2.2. What performance data related to the timing flow are to be collected?

A standard set of information relating to the quality and performance of the timing packet flow will enable a synchronization network manager to assess the health of a individual timing path and of the synchronization network as a whole.

The standard set of information could be defined in terms of a IPFIX Information Model using IPFIX protocol for collecting the information from various nodes.

2.3. What alarms must be generated by synchronization functions?

Similarly, a standard set of alarms for synchronization functions should be defined. These should include conventional alarm criteria such as input signal failure, as well as more specific packet-based synchronization criteria, such as the PTSF conditions defined in the ITU-T's Telecom Profile [2].

2.4. How is the management data to be collected?

Another consideration is how the data are to be collected. This may be dependent on the equipment in which the synchronization functions are embedded, the type of information, and the operator's own management strategy. Some potential options include:

- through a management channel in the synchronization flow (e.g. PTP management messages), to a synchronization network manager
- through a management channel distinct from the synchronization flow (e.g. SNMP or IPFIX protocols)
- through the element management system of a network element containing a synchronization function, and then northbound into the OSS
- through the element management system of a network element containing a synchronization function, and then northbound into a synchronization network manager

2.5. Identification of network elements containing synchronization functions

One of the main issues is to identify network elements containing synchronization functions. A synchronization network management system can only manage devices that it knows exist, and in a large network, it may be difficult to discover which network elements contain synchronization functions.

This identification process is not strictly speaking a management function, but it is relevant and necessary to enable on-going synchronization management. Some options for identification of synchronization functions include:

- synchronization function identifies itself to a pre-configured synchronization management node on startup
- synchronization masters or servers maintain a list of their currently serviced slaves/clients, and make the list available for the synchronization network manager to query.

3. Security Considerations

Security aspects of the above options will need to be considered in more detail.

4. IANA Considerations

No IANA actions are required as a result of the publication of this document.

5. Acknowledgements

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This document was prepared using 2-Word-v2.0.template.dot.

6. Informative References

[1] IEEE, "Standard for A Precision Clock Synchronization Protocol for Networked Measurement and Control Systems", IEEE1588-2008.

[2] "ITU-T PTP Profile for Frequency distribution without timing support from the network ", Draft Recommendation G.8265.1 (work in progress), TD-PLEN-0255-R1, June 2010

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