

## Leaflet:

# Time server / Time server infrastructure for intelligent measuring systems

This leaflet is intended as an aid to the interpretation of the requirements for time servers for intelligent measuring systems, as formulated in the PTB-A 50.8, Chapter 8 [1]. The individual requirements are explained below. In addition, aspects that should be included in the documentation of the time server are provided to enable a smooth and quick software examination. All terms used here are taken from the Technical Guideline BSI TR-03109 [2] and the PTB-A 50.8 [1].

The testing of the services of time servers is based on the following PTB statement.

## 1 Official classification of time servers by PTB<sup>1</sup>

*"Time servers are important for the use of Smart Meter Gateways (SMGW) in intelligent measuring systems (reliable time synchronization, trustworthy time source). These must meet certain requirements of the Measures and Verification, as well as the Measuring Point Operation Act (Messstellenbetriebsgesetz - MsbG).*

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<sup>1</sup> From the German version: „Offizielle Einstufung von Zeitservern durch die PTB“

*"Zeitserver sind wichtig für die Verwendung von Smart Meter Gateways (SMGW) in intelligenten Messsystemen (sichere Zeitsynchronisation; vertrauenswürdige Zeitquelle), die gewisse Anforderungen des Mess- und Eichrechts sowie des Messstellenbetriebsgesetzes (MsbG) erfüllen müssen.*

*Anforderungen an Zeitserver werden zur Zeit am besten durch die PTB-Anforderung (PTB-A) 50.8, Kapitel 8, abgebildet.*

*Die Gewährleistung des MsbG-konformen SMGW-Admin-Betriebes ist gesetzliche Aufgabe des BSI [Bundesamt für Sicherheit in der Informationstechnik; Anm. d. Verf.]. Nach Aussagen des BSI besteht die Möglichkeit, im Rahmen seiner einschlägigen Tätigkeiten beim Admin auch den Betrieb eines Zeitservers im Sinne der PTB-A 50.8, Kapitel 8, sicherzustellen. Eine künftige Aufgabenteilung zwischen BSI, PTB und Eichbehörden betreffend des Zeitservers soll im Ausschuss "Gateway-Standardisierung" nach § 27 MsbG geklärt werden.*

*Bis zu einer endgültigen Klärung und Festlegung der Anforderungen an Zeitserver, einschließlich der Gewährleistung einer korrekten Zeitführung der Gateways durch Zeitserver beim Admin, durch den neu zu gründenden Ausschuss bietet die PTB als Interimslösung folgende freiwillige Dienstleistung für interessierte Hersteller an:*

*Prüfung des vorgestellten Zeitservers nach PTB-A 50.8, Kapitel 8 "Komponente externer Zeitserver", und Ausstellung eines "Berichts" über die durchgeführten Prüfungen und das Ergebnis, ohne Bezug auf das MessEG [Mess- und Eichgesetz; Anm. d. Verf.] oder das EinZeitG [Einheiten und Zeitgesetz; Anm. d. Verf.]. Somit handelt es sich bei dieser Prüfung um keine Konformitätsbewertung des Zeitservers im Sinne des MessEG.*

*Die PTB-Berichte für Zeitserver können während der Übergangszeit sowohl durch die Verwendungsüberwachungsbehörden nach MessEG, als auch von den nach MsbG tätigen Stellen als Nachweise verwendet werden, dass die geltenden Rechtsvorschriften eingehalten werden.*

*In der Übergangszeit wird die PTB in Baumusterprüfbescheinigungen für SMGWs auch Hinweise an die Messgeräteverwender auf ihre Pflichten nach § 31 MessEG aufnehmen, insbesondere die Pflicht, für den richtigen Stand und Gang der SMGW-internen Uhr zu sorgen, d.h. auf geeignete Weise sicherzustellen, dass der SMGW-Admin mit Hilfe eines PTB-A 50.8-geprüften Zeitservers die Uhr im SMGW korrekt stellt."*

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*Requirements for time servers are currently best illustrated by the PTB requirements (PTB-A) 50.8, Chapter 8.*

*The guarantee of the MsbG-compliant SMGW-Admin-operation is the statutory task of the BSI [Federal Office for Information Security, Bundesamt für Sicherheit in der Informationstechnik; note from the author]. According to the BSI, it is also possible to ensure the operation of a time server in the sense of PTB-A 50.8, Chapter 8, in the framework of BSI's relevant activities. A future division of tasks between BSI, PTB and the verification authorities, regarding the time servers, is to be clarified in the committee "Gateway-standardization", according to MsbG § 27.*

*As an interim solution, the PTB offers the following voluntary service for interested manufacturers to a final clarification and definition of the requirements for time servers, including the guarantee of correct time management of the SMGW-Admin-operation:*

*The testing of the presented time server, according to PTB-A 50.8, Chapter 8 'Component of external time servers', issuing of a 'report' on the conducted tests and the results, without reference to the MessEG [Measures and Verification Act, Mess- und Eichgesetz; note from the author] or the EinZeitG [Units and Time Act, Einheiten- und Zeitgesetz; note from the author]. Thus, this testing is not a conformity assessment of the time server, in the sense of the MessEG.*

*The PTB reports for time servers can be used during the transitional period, both by the usage surveillance authorities, according to MessEG, as well as by the active bodies, according to the MsbG, as evidence that the applicable legal regulations are respected.*

*In the transitional period, the PTB will also include instructions to the measuring instrument users in their type examination certificates for the SMGWs to fulfill their obligations pursuant to MessEG § 31, in particular the obligation to ensure the correct status and movement of the SMGW internal clock, i.e. to make sure that the SMGW-Admin sets correctly the clock in the SMGW, by means of the PTB-A 50.8-audited time server."*

**[Dr. Roman Schwartz, Vice-President of PTB, November 14<sup>th</sup>, 2016]**  
(Translated by Dr.-Ing. Marko Esche, February 2<sup>nd</sup>, 2020)

## 2 Synchronization with PTB time servers

The time servers of the Smart Meter Gateway Administrator (GW-Admin) must use at least one time server provided by the PTB for authenticated time synchronization. For this purpose, a symmetric authentication method must be used, according to RFC5905 [3]. [PTB-A 50.8/8.1/a,b]

In Germany, the legal time is presented and disseminated by the PTB, according to the Units and Time Act (EinZeitG) §6 [4]. Since the current time plays a decisive role in event-based tariffs, this must be traceable to the legal time. For this, the time server of the GW-Admins, from which the SMGW receives in turn the current time, synchronizes itself with the time servers of the PTB. For this purpose, two separate time servers are available for GW-Admins: ntpsmgw1.ptb.de and ntpsmgw2.ptb.de. So far, the PTB time servers have provided a symmetric authentication of the transmitted data, using a pre-shared key, according to the Network Time Protocol (NTP) specification RFC5905. Therefore, this is currently the only way for authenticated time synchronization. Further information can be found in the leaflet "Allgemeine Bedingungen zur Teilnahme an der >>Authentifizierten Zeitsynchronisation<<" by PTB Section Q.42 [5] .

In the documentation, it must be specified with how many and with which time servers of PTB the time server of the GW-Admin is synchronized. In addition, the NTP-standard used must be named and the authentication method used must be briefly described.

### 3 Secure use of the pre-shared key

The key to the symmetric authentication that the GW-Admin receives from the PTB must be securely entered into the GW-Admin's time server (GW-Admin Server), as well as protected against spying. [PTB-A 50.8/8.1/b]

As described in the previous section, a symmetric pre-shared key is used for authentication. If a third party obtains a symmetric key, a false identity can be faked and thus the time synchronization can be manipulated. For this reason, a symmetrical key has increased protection needs.

The documentation shall contain a description of how the key can be securely entered into the time server, as well as the measures taken to protect it against unauthorized retrieval or modifications.

### 4 Time deviation

The time servers of the GW-Admin may not deviate from the time servers of the PTB by more than 1% (90 ms) of the required maximum permissible error for the SMGW. If this limit is exceeded, this must be documented in a system log. If the deviation is more than 10% (900 ms) of the maximum permissible error for the SMGW, this must be recorded in a verification log and measures must be taken, according to the implemented redundancy concept, in order to ensure compliance with the maximum permissible error for the SMGW. [PTB-A 50.8/8.1/c]

The redundancy concept is addressed in the next section. Requirements for the verification log are detailed in PTB-A 50.8, Section 4.4. A protection of the verification log by organizational measures of the GW-Admins is possible, if the GW-Admin is certified according to BSI TR-03109-6.

The documentation must indicate how a transgression of the maximum permissible error are detected and which reactions of the time server occur for these deviations. A description of the measures taken to protect the verification log against unintentional or intentional changes is required. If this protection is implemented by means of organizational measures, it must be pointed out that the GW-Admin requires a corresponding certification, according to BSI TR-03109-6. Configuration options (such as notification in case of time deviation, etc.) must be described.

### 5 Redundancy of the time server

A suitable redundancy concept must be implemented by the GW-Admin to ensure the availability of the time synchronization service for the SMGW. [PTB-A 50.8/8.1/d]

A suitable redundancy concept is to be implemented, in order to enable the SMGW to have access to the legal time, even in the event of a failure of the time server. Various possibilities are available for this, such as several time server instances, a sufficient hardware reserve or an uninterrupted power supply for the time server. If there are several time server instances, one instance can be changed to another, for example if the deviation from legal time of one instance is too large.

The documentation must include a description of the technical measures implemented on the time server to ensure the availability of the time synchronization service.

### 6 Synchronization of the SMGW

The communication of the GW-Admin's time server with the SMGW is done via a modified NTP, secured with TLS (Transport Layer Security). Two possible methods (ntp-over-http and ntp-over-TLS) are described in BSI TR-03109-1, in Sections 3.2.6.3.3.1 and 3.2.6.3.3.2, respectively. [PTB-A 50.8/8.1/e]

The documentation must describe the methods implemented to synchronize the SMGW. When more than one method is used, the selection criteria must be described, according to which the respective method used is chosen.

## 7 Use of UTC

Internally, the GW-Admin's time server uses Coordinated Universal Time (UTC). [PTB-A 50.8/8.1/f]

The PTB time servers use UTC as the time base, so the time server of the GW-Admins must also use UTC as the time base. If the SMGW expects its time packages based on Central European Time (CET) / Central European Summer Time (CEST), the transferred values must be adjusted.

The documentation must describe the internal time representation in the time server and indicate how the time is processed for transmission to the SMGW.

## 8 Configuration of the operating systems

The operating system of the GW-Admin server must be protected against unauthorized interventions and modifications, according to PTB-A 50.8, Section 9. [PTB-A 50.8/8.1/g]

The requirements of the Measures and Verification Act (Mess- und Eichgesetz - MessEG) [6] regarding the integrity and authenticity of the measured value (here the time) as well as the legally relevant software lead to certain conditions that must be met when using a general purpose operating system. These can be found in the "Leaflet: Configuration of general purpose operating systems for measuring devices" of PTB Working Group 8.51 [7], which shows how the software can be secured against unauthorized access and modifications.

Therefore, the documentation must address the points from [7]. According to PTB-A 50.8, Section 9 Annex A1, proof of the fulfillment of the requirements for the protection of the operating system can also be covered by a corresponding certification, according to BSI TR-03109-6 of the GW-Admin. If this variant is selected, a corresponding entry must be made in the documentation. In this case, the non-tested points are listed in the test report of the PTB and the indication that the time server of the GW-Admin fulfills the requirements is included, only after the corresponding certification by the BSI.

## 9 References

- [1] PTB-Anforderungen - Smart Meter Gateway, PTB-A 50.8 , Physikalisch-Technische Bundesanstalt, December 2014
- [2] Technische Richtlinie BSI TR-03109, Bundesamt für Sicherheit in der Informationstechnik, November 11, 2015
- [3] D. Mills, U. Delaware, J. Martin, J. Burbank, W. Kasch, RFC 5905 - Network Time Protocol Version 4: Protocol and Algorithm Specification, June 2010, [URL: https://tools.ietf.org/html/rfc5905](https://tools.ietf.org/html/rfc5905) (last accessed on May 4, 2020)
- [4] Gesetz über die Einheiten im Messwesen und die Zeitbestimmung (Einheits- und Zeitgesetz - EinheitsG), Bundesgesetzblatt, Jahrgang 2016 Teil 1 Nr. 35, February 1985, last modified on July 18, 2016
- [5] Merkblatt: Allgemeine Bedingungen zur Teilnahme an der "Authentifizierten Zeitsynchronisation", Physikalisch-Technische Bundesanstalt, Referat Q.42 "Zeitverteilung mit IP", January 08, 2019
- [6] Gesetz über das Inverkehrbringen und die Bereitstellung von Messgeräten auf dem Markt, ihre Verwendung und Eichung sowie über Fertigpackungen (Mess- und Eichgesetz – MessEG), Bundesgesetzblatt, Volume 2013 Part 1 No. 43, July 2013, last modified on April 11, 2016
- [7] Leaflet: Configuration of general purpose operating systems for measuring devices, Physikalisch-Technische Bundesanstalt, Working group 8.51 "Metrological Software", in the current version