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Custom Transport Interface for the Integration of Trusted Network Connect in German Smart Metering Systems

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INTRODUCTION

Introduction

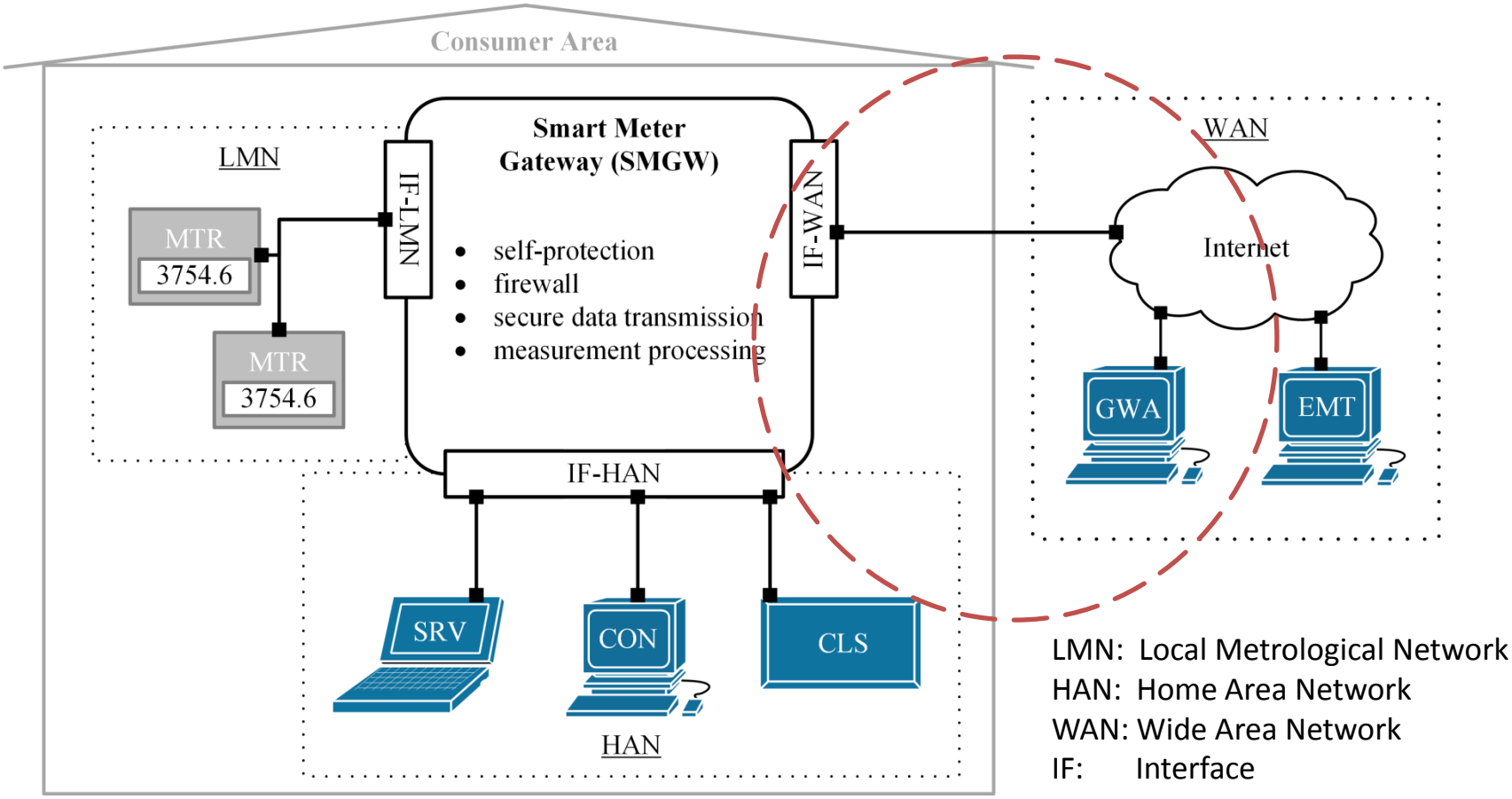
- Introduction of Smart Metering Systems by the German government
- Security architecture for Smart Metering Systems developed by the Federal Office for Information Security (BSI)
- Research project SPIDER
  - Analysis of the security architecture revealed that the integrity of a major component may be vulnerable
  - Trusted Network Connect (TNC) specified by the Trusted Computing Group (TCG) for integrity monitoring

Introduction

- Main tasks for this paper:
  - Evaluation of the existing specifications
    - BSI specifications for the Smart Metering System
    - TCG specifications for the Trusted Network Connect architecture
  - Development of solutions to overcome contradictions between the existing specifications
  - Evaluation of the developed solutions

SMART METERING SYSTEM

Smart Metering Systems



LMN: Local Metrological Network
HAN: Home Area Network
WAN: Wide Area Network
IF: Interface

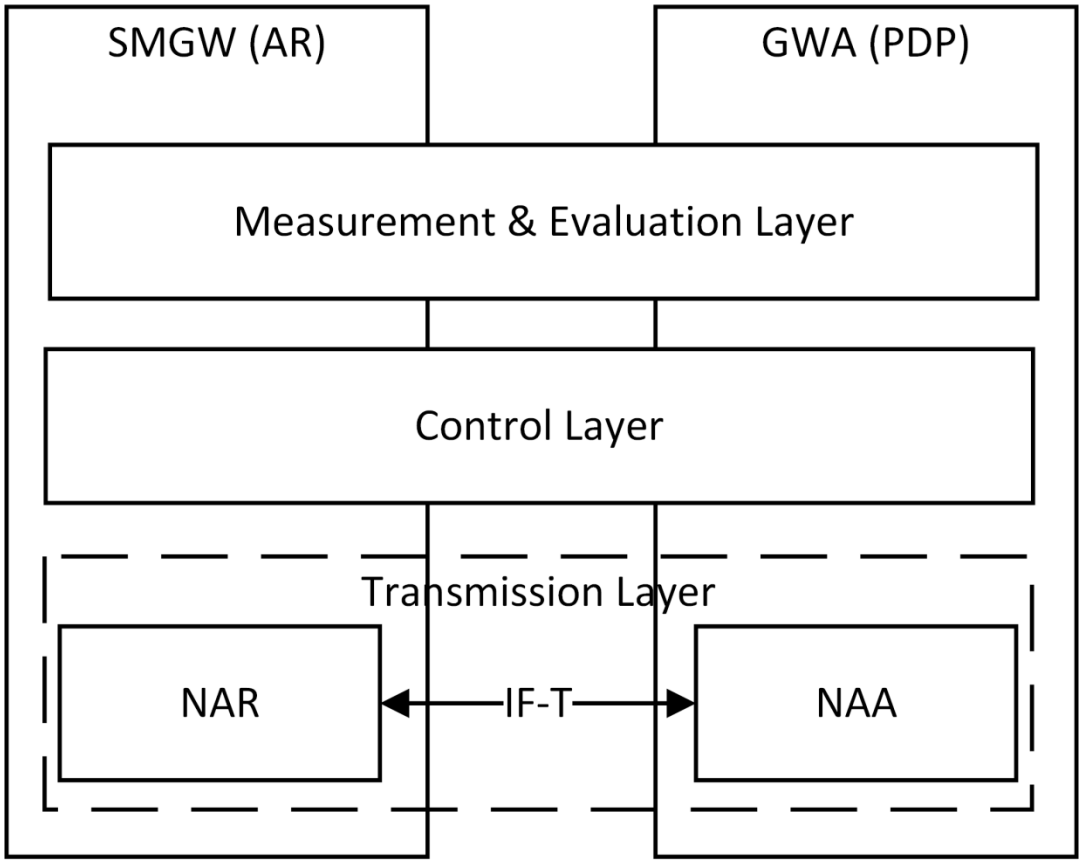
MTR: Smart Meter SRV: Service Technician CON: Consumer CLS: Controllable Local System
GWA: Gateway Administrator EMT: Authorized External Entity

INTEGRITY PROTECTION AND MONITORING

Integrity Protection and Monitoring: Concept

- Hardware protection
  - Visible permanent seal, housing state detection, tamper resistant grid
- Boottime protection
  - Secure Boot-Pattern
- Runtime protection
  - Remote Attestation using TNC
    - Continuously measurement of the systems integrity state
    - Assessment of the systems integrity by a remote instance using the measured system integrity state

Integrity Protection and Monitoring: TNC



DATA TRANSPORT

Data Transport: TCG IF-T

- Interface depends on physical connection and its lower layer protocols
- Separate specifications for different connection types
  - TCG Trusted Network Connect TNC IF-T: Protocol Bindings for Tunneled EAP Methods (IF-T-EAP)
    - Integrity state as part of an authentication to access a network (e. g. 802.1x)
  - TCG Trusted Network Connect TNC IF-T: Binding to TLS (IF-T-TLS)
    - Integrity state as part of a continuous system monitoring through an existing connection to a network

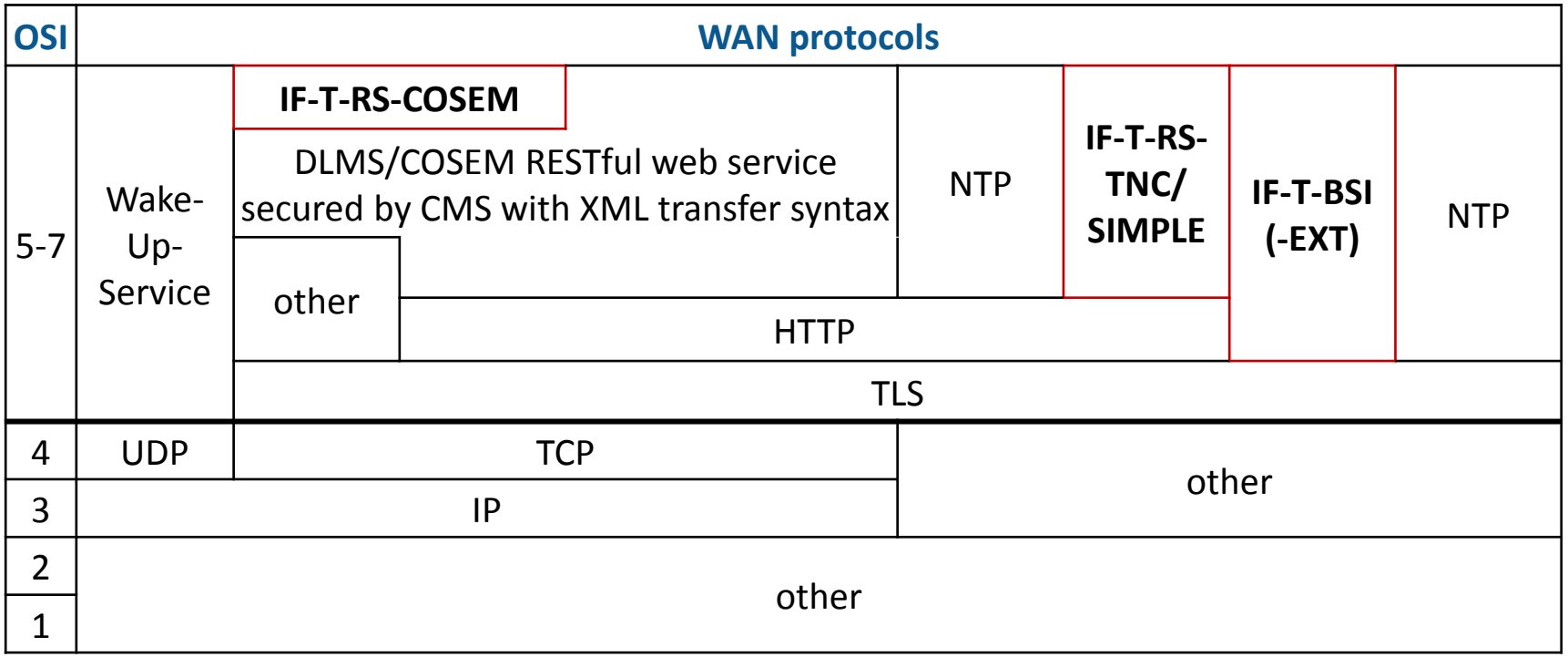
Data Transport: BSI IF-WAN

<table>
<tr><th>OSI</th><th colspan="5">WAN protocols</th></tr>
<tr><td rowspan="3">5-7</td><td rowspan="3">Wake-Up-Service</td><td colspan="2">DLMS/COSEM RESTful web service secured by CMS with XML transfer syntax</td><td>NTP</td><td>other</td><td rowspan="2">NTP</td></tr>
<tr><td rowspan="2">other</td><td colspan="2">HTTP</td></tr>
<tr><td colspan="4">TLS</td></tr>
<tr><td>4</td><td>UDP</td><td colspan="2">TCP</td><td colspan="2" rowspan="2">other</td></tr>
<tr><td>3</td><td colspan="3">IP</td></tr>
<tr><td>2</td><td colspan="5" rowspan="2">other</td></tr>
<tr><td>1</td></tr>
</table>

Data Transport: Differences IF-T and IF-WAN

- Most differences concern the use of TLS
- TCG specifications have a lot of recommendations for the use of TLS to make it flexible
- TCG recommendations regarding TLS are …
  - partially considered mandatory by the BSI
  - partially prohibited by the BSI
- At least one element specified by the TCG for TLS is fully contradicting:
  - Cipher suite TLS_RSA_WITH_AES_128_CBC_SHA

Data Transport: Custom IF-T



EVALUATION

Evaluation: Criteria

- Criteria based on ISO 25010 quality model:
  - Functionality
  - Complexity
  - Flexibility
  - Efficiency
  - Security
  - Standard orientation
- No approach was unsuitable at all

Evaluation: Approaches

- IF-T-BSI: Strong orientation on TCG specifications
- IF-T-BSI-EXT: Good efficiency and good functionality (best rating)
- IF-T-RS-COSEM: Very complex and BSI compliance not clear (worst rating)
- IF-T-RS-TNC: High flexibility and little to no standard orientation
- IF-T-RS-SIMPLE: Tradeoff between IF-T-BSI and IF-T-RS-TNC

Evaluation: Final Result

- DLMS/COSEM RESTful web service should be used to configure TNC at the SMGW
- IF-T-BSI should be used for the transmission of TNC data
  - Not the best rated approach but:
    - Strong orientation on TCG specifications
    - Less complex (TLS only)
    - Theoretically compatible to existing TNC implementations (low adoption barrier)
    - TCG specifications are more mature than the specifications of the BSI

CONCLUSION & PROSPECTS

Conclusion

- Demonstration of TNC for a Smart Metering System was implemented
  - Integration of an AR at an SMGW
  - Integration of a PDP at a GWA
  - Configuration of TNC at the SMGW can be done using the DLMS/COSEM RESTful web service
- Different approaches for the transmission of TNC-Data where introduced
  - The approach with the strongest orientation on the TCG specifications was chosen to lower the adoption barrier

Prospects

- The results of this paper have to be discussed further with the TCG
- Development of a Trusted Grid using TNC for other components in the Smart Grid
- Integration of further (TNC-)components for monitoring the Smart Metering System as well as the Smart Grid
- Open Source project for a Java based TNC library (jTNC): https://github.com/trusthsbremen/jtnc

Thank You

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Questions?