Gridstream Solution

Landis+Gyr
manage energy better

14.0

Landis+Gyr AIM

Product Description

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1 Introduction to Landis+Gyr AIM

Landis+Gyr's smart metering solution simplifies the way energy companies collect and manage their metering data. The solution includes smart meters, versatile communication options, advanced software and comprehensive services. All this is also available for multi-energy solutions. Landis+Gyr AIM is an essential part of the Gridstream solution as an advanced metering management (AMM) software.

Landis+Gyr AIM is an automated smart metering system. It stores and prepares metering information for viewing, reporting or use in other applications. It includes functionalities for automated meter reading (AMR) as well as for meter data management (MDM). It offers a comprehensive range of value-adding applications for, for example, deployment and reporting. The system also enables network monitoring, thus forming the foundation for smart grids.

Based on openness and modularity, Landis+Gyr AIM is designed for the ever-changing energy market to help energy companies collect and manage their metering data efficiently, process it in a flexible manner and transfer information between various parties effortlessly. It offers a single source for metering data that can then be transferred to other systems. The architecture of Landis+Gyr AIM ensures an easy integration with other IT systems in the utility, enabling easy access to data in Landis+Gyr AIM.

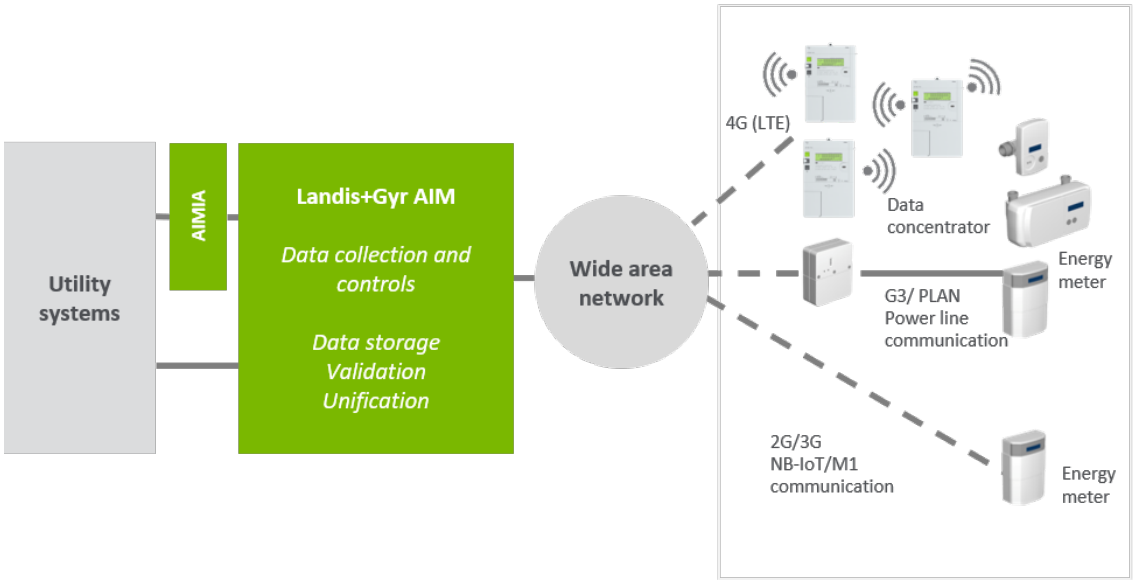

Figure 1: Comprehensive Gridstream solution

With Landis+Gyr AIM, you can streamline your internal metering-related processes and make them more effective. In addition, you can provide your customers with better service, and invoices based on real energy consumption. Landis+Gyr AIM smooth operation by supporting, for example, the following utility processes:

- Business processes: billing, balance settlement, customer service, contract management and new business development
- Network management: network monitoring, load management and network investment planning
- AMM operations: automated data collection and management, device asset management and troubleshooting

Further, Landis+Gyr AIM provides the utilities with efficient tools for smart meter mass roll-out deployment.

2 Benefits of Landis+Gyr AIM

Landis+Gyr AIM enables utilities to make smart metering infrastructure and data an integral part of their business processes. To this end, it provides utilities with easy an access to accurate and up-to-date metering data at all times. It offers comprehensive tools for meter management in a user-friendly manner as well as a single source for all metering data This enhances many of the utility processes from billing and balance settlement to investment planning and infrastructure monitoring. When Landis+Gyr AIM is integrated to utility's systems, the advanced features of Landis+Gyr AIM become available and can be used through the energy utility's own system.

The figure below shows how Landis+Gyr AIM supports utilities processes and helps you to fulfil your strategy and improve your own operations, efficiency and profitability.

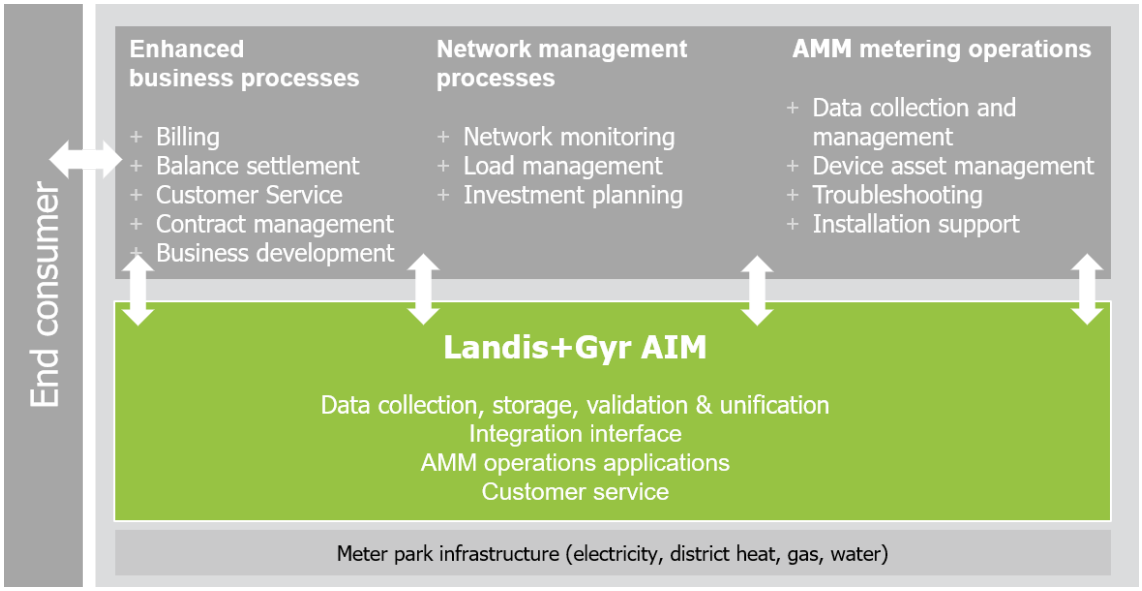

Figure 2: Landis+Gyr AIM supports utility processes

Landis+Gyr AIM is especially designed for efficient energy metering. Besides electricity, it is capable of reading and managing metering data from other energy sources, such as gas, heat and cold, and water. Data is transferred from devices into the system by using cost-efficient methods that utilize open standards and IP-based technology.

2.1 Benefits for business processes

2.1.1 Billing based on actual consumption

By providing accurate, near real-time meter reading information Landis+Gyr AIM enables billing based on actual consumption. This removes the need for billing based on estimated consumption, reduces the amount of billing errors and minimizes the need for clarification.

Also, as the level of automation increases, the operating cost per metering point decreases. As a result the overall process becomes faster, simpler and more cost-efficient. It is also possible to schedule automated meter readings for billing purposes and perform event-based or on-demand readings whenever necessary. Further, Landis+Gyr AIM enables efficient debt collection as it is easy to disconnect and reconnect power remotely.

2.1.2 Balance settlement

With Landis+Gyr AIM, up-to-date metering information is always available, ensuring that the required data for balance settlement reporting can be automatically calculated and distributed.

Landis+Gyr AIM allows processing profile data for various balance settlement purposes. Data delivery format can be specified according to customer needs. Automated data delivery and processing saves costs and reduces the need for further investments.

2.1.3 Improved customer service

By taking Landis+Gyr AIM and its efficient tools in use, the utilities can ensure that their customer service is able to provide customers with accurate, near real-time information on actual consumption values.

This not only enhances the customer service but also reduces the overall costs as issues can be closed instantly without further investigations. Also, in claim and troubleshooting situations actual consumption data is available either scheduled or on-demand. It is even possible to provide the customers with consumption and power quality reports. Thus, the overall service reliability will be improved, which increases customer satisfaction in the long run. Further, events, such as alarms triggered by smart meters, are available in short notice to improve the responsiveness of utility's processes.

2.1.4 Easy contract management

Landis+Gyr AIM allows instant contract changes and makes contract management easy and efficient.

In contract change situations and removals the meter can be read and power can be connected or disconnected remotely by the customer service personnel, for example when the customer moves or changes a supplier. Additionally, connection or disconnection can be scheduled. Significant savings can be achieved, as on-site visits are not needed. Data synchronization between Landis+Gyr AIM and customer information system can be secured via integration. Thus, Landis+Gyr AIM guarantees a smooth process to both the customer and the service personnel.

2.1.5 Business development opportunities

Landis+Gyr AIM enables new energy products and services for end-customers as well as new business opportunities for utilities. By supporting multiple energy forms – electricity, water, gas, heat and cold – it optimises the potential of an AMM system.

Landis+Gyr AIM eases up the implementation of new tariff structures and sales products. It is possible to include load control components in new electricity products offering customer opportunities to select the product according to their unique consumption requirements. For instance, the utility is able to offer an additional service for connecting power of, for example, holiday homes as power can be remotely disconnected and reconnected.

The multi-utility functionality of Landis+Gyr AIM opens also business-to-business markets. For example, an energy utility using Landis+Gyr AIM can offer reading services to a water utility.

2.2 Benefits for network management processes

2.2.1 Network monitoring

Landis+Gyr AIM enables the monitoring of low voltage network.

Access to accurate metering data offers utilities valuable knowledge on networks including information on power outages and recoveries, voltage drops and tampering. Further, power quality information (PQI) on voltage and supply, and time-stamped power outage information is readily available at all times. This way metering faults can be detected effortlessly and corrective actions can be focused on right areas. It makes the handling of complaints easier and forms the basis for network maintenance. As Landis+Gyr AIM helps to detect power outages

and failures rapidly, the risk of critical network failure can be minimized. Furthermore, the data can be provided further for other systems, such as distribution management systems (DMS).

2.2.2 Load Management

With Landis+Gyr AIM, it is possible to manage individual loads in residential sector through various relay controls that can be run as scheduled commands or as on-demand commands whenever needed.

It is even possible to manage loads dynamically to quickly adapt to market changes such as tariff changes. All this reduces energy consumption and capacity needs as well as and cuts costs during peak hours. The risk of network overload can be minimized and energy supply is secured. Further, utilities can offer end-consumers compensation for turning loads off.

2.2.3 Network investment planning

Planning any network investments becomes easier when actual metering data can be used in calculations.

With Landis+Gyr AIM, the utility can monitor and calculate loads on transformer areas, which allows it to identify the critical capacity areas as well as consumption trends. Forecasting energy demand becomes easier and it is possible to evaluate and plan future investment needs. Also, network failures can be avoided as necessary investments can be taken care of in time. The proactive maintenance improves network reliability significantly.

2.3 Benefits for AMM operations

2.3.1 Automated data collection and management

Landis+Gyr AIM ensures efficient and reliable meter readings.

Data is collected in an automated way including the retrieval of missing data. This increases cost-efficiency and minimizes the number of human errors. Further, Landis+Gyr AIM provides the utilities with information related to network and meter status. The system can also be configured flexibly to meet customer and user requirements. For example, task sequences can be automated and configured according to utility’s needs.

2.3.2 Device asset management and troubleshooting

When Landis+Gyr AIM is in use, device asset management becomes simple and easy.

Landis+Gyr AIM stores device information and allows remote meter configuration and firmware management. The need for on-site visits can be minimized. Additionally, meter related events can be accessed easily. This is also available for multi-energy devices connected to a smart meter. The utility has all necessary information conveniently available, thus allowing smooth and cost-efficient processes.

Landis+Gyr AIM includes comprehensive tools for monitoring the status of the AMM system. For example, you can monitor data deliveries and communication quality on a daily basis, which allows fast and efficient troubleshooting. Defects can be detected quickly down to a single meter. Rapid reaction to problems and critical failures reduces costs and ensures a high service level. Moreover, during field maintenance repairs can be tested instantly as devices can be accessed remotely.

2.4 Easy deployment

Landis+Gyr AIM enables an end-to-end deployment process that ensures a smooth flow of data from device manufacturing up to customer information system. It offers automated tools for smart metering roll-out and field device installations.

The utility is able to plan the roll-out project thoroughly and carry it out effectively. The risk of manual errors can be minimized and the roll-out progress can be monitored. All this makes it easier to manage the overall process and meet the required deadlines and budget. Also, Landis+Gyr AIM realizes the benefits of smart metering from the early phases of the project - an area at a time. Thus, there is no need to wait until the whole roll-out is completed to benefit from the advanced features of your new smart metering system.

2.5 Secure investment

2.5.1 Supporting utility processes

By streamlining operator processes Landis+Gyr AIM improves the total cost of ownership (TCO) of these processes. This is gained, for example, by responsive customer service, efficient missing data analysis, smooth meter changes and seamless support for integrating deployment process from ordering devices to automated meter reading. Well analysed and prepared data also decrease the need to invest into other IT systems. Further, intuitive user interfaces enable a user-friendly use of the AMM system.

2.5.2 Interoperability

Interoperability is the key to system flexibility, and the use of industry standards is the key to Gridstream interoperability. Landis+Gyr actively participates in standardization activities in Europe and utilises industry standards and protocols in research and development.

The architecture ensures a high level of openness and interoperability across multi-utility infrastructures and enables bi-directional communication with other manufacturers' hardware and software platforms. Thus, Landis+Gyr AIM also enables flexible integration to other systems.

System integration allows the utility to manage the entire chain of metering information through a single interface, which increases the security of the metering information chain. Information handling takes place without delays caused by transferring data manually. This brings efficiency and reliability to the operations, as unnecessary copying and re-typing of information can be avoided. In addition, the need to learn how to use multiple systems is reduced.

2.5.3 Scalability

Landis+Gyr AIM is an ideal metering data information system in most cases since it is possible to configure the system for a small or large utility or even to several utilities.

The horizontal scalability possibilities make Landis+Gyr AIM the optimal solution for large-scale advanced meter reading and control. Scalability also allows increasing the number of devices and supported communication options.

2.5.4 References

Landis+Gyr is one of the world's leading suppliers of smart metering solutions. Since 1984, it has delivered several hundreds of two-way communicating system solutions in different sizes.

There are currently more than 29 million data values processed per day in Landis+Gyr AIM systems in Europe. Landis+Gyr AIM has proven its reliability and scalability in smart metering operation during the past decades. It includes efficient user interfaces for daily operations and versatile communication options. With Landis+Gyr AIM your investment is secured.

2.5.5 Flexibility through variety of applications

Landis+Gyr AIM system offers companies that operate in the energy market an efficient and modular tool for gathering, processing and transferring metering data. The system is designed for network and sales companies as well as for service providers.

Consisting of different applications Landis+Gyr AIM provides unlimited possibilities for flexibility. The amount and quality of the needed data varies according to the customer segment. Various applications allow optimization of the system, which in turn enables gathering the required data from each customer segment as cost-efficiently as possible. It is possible for the utility to choose which applications they take in use; more applications can be introduced to the system later on, if needed.

2.5.6 Single vendor for data collection and management

All required data collection and management functionalities are available in Landis+Gyr AIM; that is they are available from one single vendor.

Thus, managing the overall AMM system and necessary integration becomes simpler and more cost-efficient. The utility only has one contact point and partner to negotiate the contract and project responsibilities. Also, for integration needs, the system provides just one interface. Management and integration efforts are reduced to an absolute minimum, increasing the predictability of deployment and eliminating the risk of unexpected issues and system incompatibilities.

3 Features of Landis+Gyr AIM

Landis+Gyr AIM is a versatile system that contains a variety of features for both automated meter reading (AMR) and metering data management (MDM).

The system contains several applications, which makes it possible to include only the desired features into the customer solution. Landis+Gyr AIM also serves as large-scale data storage. It ensures that you have the correct data in the right format and place at the right time. Data can be loaded from multiple data sources–even multiple head-end systems–and stored in the database in a unified format. Figure below gives an overall picture of the features of Landis+Gyr AIM.

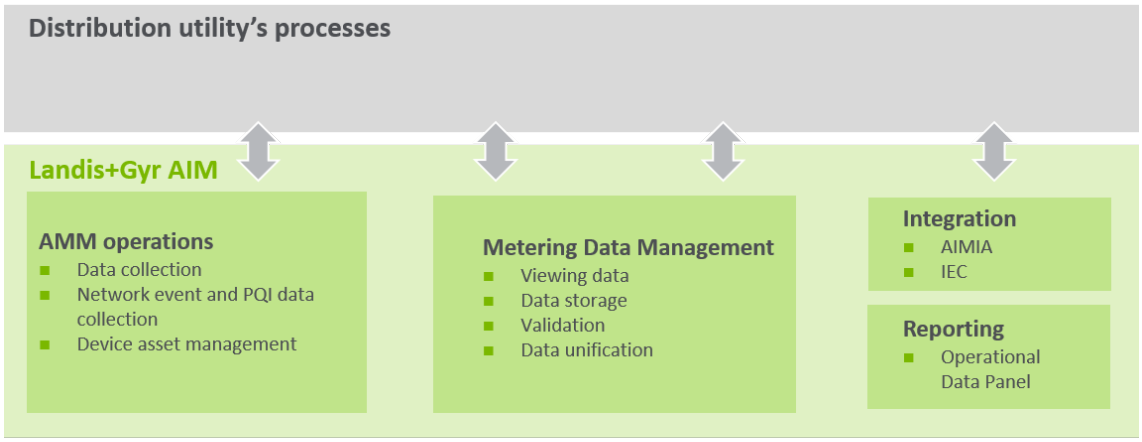

Figure 3: Features of Landis+Gyr AIM

3.1 Features supporting processes

3.1.1 Features supporting the billing process

Landis+Gyr AIM enables automated meter reading. It contains tools for reading metering data from the energy meters to the HES database based on specific events or on-demand requests, or according to predefined schedules. The system supports automatic data push from the meters but can also request data from the meters (pull). The push method is typically used whenever high capacity is required by the utility. The results are saved in the database from which they can be viewed, reported or transferred further to other systems.

Automatic readings can be scheduled to take place at a defined time, either once or repeatedly during a defined period of time. On-demand readings can be requested whenever the user needs up-to-date metering data. The system also detects the metering points that have not delivered data according to the scheduled task, and can automatically trigger re-reading process to achieve the data to the system. To ensure high reading performance Landis+Gyr AIM system can have one or more AMR engines, depending on the utility's needs and circumstances.

Additionally, Landis+Gyr AIM includes tools for managing time of use for defined loads. You are able to configure and update a new time of use schedule to the meters in order to schedule tariff changes and relay controls according to the customer's contract. Tariff calculation allows automatically processing tariff data for billing purposes. It brings flexibility for tariff planning and switching, thus enabling easy tariff management.

3.1.2 Features supporting balance settlement

The meter reading features of Landis+Gyr AIM ensure that data is automatically available for balance settlement reporting.

Further, Landis+Gyr AIM supports profile calculation and enables processing profile data automatically for various balance settlement purposes. Delivery format can be specified according to the needs. It is also possible to produce new profiles from existing ones.

3.1.3 Features supporting new business development

In Landis+Gyr AIM the utility can configure time of use, tariff calculation and tariff management flexibly. Thus, the implementation of new energy products and tariff structures is simple.

In addition, Landis+Gyr AIM allows several utilities to use the same system architecture. Thanks to this multi-utility functionality, one utility can offer, for example, reading services to another utility.

3.1.4 Features supporting customer service and contract management

Thanks to the meter reading feature of Landis+Gyr AIM, the customer service personnel have access to up-to-date data. Landis+Gyr AIM readings from a single meter immediately, for example during a service call, or at a scheduled time. It is also possible to cancel scheduled readings.

The disconnection/re-connect feature allows disconnecting or reconnecting the electricity supply of a customer. The customer service person can do this remotely while still talking to the customer on the phone. Or alternatively, reconnecting and disconnecting can be scheduled, for example when customer moves or changes supplier. Although the power is off, for example when an apartment or summer cottage is empty, the electricity meter is always available for reading and monitoring. A disconnector can be integrated into the meter or it can be an external device that is connected to and controlled by the meter and the Landis+Gyr AIM system.

3.1.5 Features supporting network monitoring and investment planning

Power quality information (PQI) is easily available in Landis+Gyr AIM. Landis+Gyr AIM can collect and display power quality data from the meters, including logs of, for example, over and under voltage or current as well as power outages. In case of ICG meters more advanced PQI parameters are in use, such as Total Harmonics Distortion.

Similarly, event and alarm management is one of the main features of Landis+Gyr AIM. Landis+Gyr AIM collects event data from the meters and ensures its availability to the user. For example, events logs for disconnector and relay control commands, power outages, errors in the meter and fraud attempts are created. Landis+Gyr AIM can also receive alarms triggered by specified events in the meter. These alarms can be further directed to other systems via integration interface. Typically alarms are sent in case of power outages, power quality problems (high voltage, low voltage or missing neutral), fraud attempts and critical failures in the meter. For some meter types it is even possible to remotely configure which events shall be logged by the meter and which events shall trigger an alarm.

As one example of network monitoring, Landis+Gyr AIM enables the utility to monitor transformer stations to identify losses. You can utilize the task flows in the Task Manager application and combine the features of different applications (see the below figure).

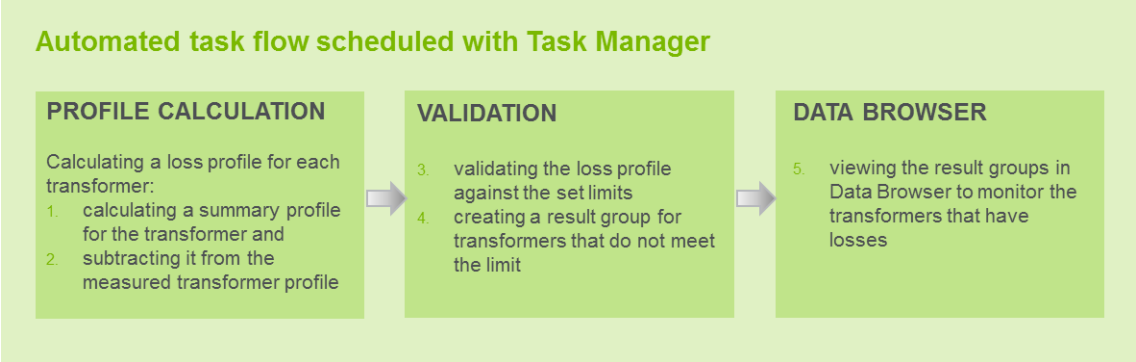

Figure 4: An automated task flow for monitoring transformer stations

3.1.6 Features supporting load management

The load management feature of Landis+Gyr AIM consists of various relay controls for defined loads.

Depending on the selected module and voltage system, a control job can be targeted to a single device, device group or all devices in a certain area. The system users can activate controls whenever necessary. Automatic controls can be scheduled to take place at a defined time, either once or repeatedly during a defined period of time. Dynamic and automated controls enable connecting and disconnecting energy supply remotely when necessary and switching different loads, such as streetlight control, on and off. Also, you can control the network load, tariffs and other services. The time of use feature also supports load management. Landis+Gyr AIM allows you to configure time of use schedules for tariff related relay controls and demand or current thresholds to the meters. If the demand or current thresholds are exceeded, the meter can disconnect the power supply for the defined time period.

3.1.7 Features supporting data collection and management

Meter reading in Landis+Gyr AIM enables remote data retrieval according to predefined schedules or on-demand, and offers a traceable data flow.

Task flow management in Landis+Gyr AIM allows performing data management tasks automatically according to a schedule determined by the user. Also, it is possible to combine data-refining tasks into seamless information flows. Tasks are defined and launched through the Task Manager application and they can be combined to a task flow in which the success of a previous task determines which task is run next. So, tasks are automatically activated depending on the result of the previous tasks in the flow. The task flows make it easier to manage exceptional situations. They can, for example, be configured to find missing values and re-read them automatically. The information flows allow utilities to automate their entire metering process. Figure below shows an example task flow for handling metering data.

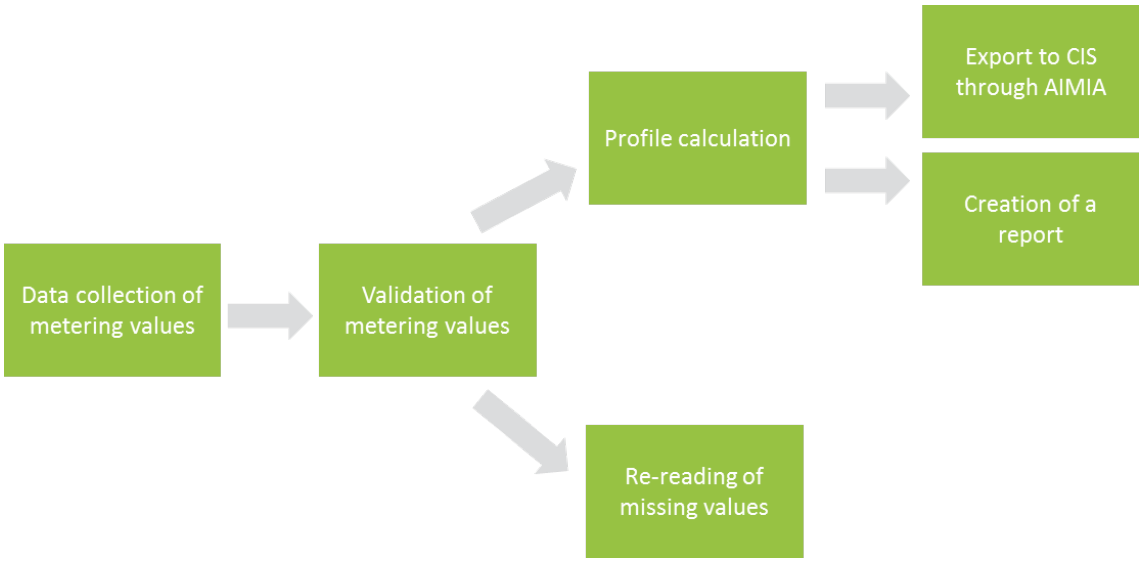

Figure 5: Example task flow for data management

When the metering data is saved to the database, validation is used to check and prove the quality and validity of the incoming metering information. The system can be configured to, for example, re-read the meters in case some values are missing. After validation the information can then be used for a variety of purposes, for example, for calculating tariffs or profiles. Validation can be automated by using pre-defined and scheduled validation tasks.

3.1.8 Features supporting device asset management and troubleshooting

Landis+Gyr AIM enables easy device management.

Landis+Gyr AIM includes tools for installing devices to metering points as well as replacing and removing them. It is possible to import device production and configuration data to the system and remotely configure device parameters and firmware versions. Landis+Gyr AIM provides you with device grouping tools for reading and control tasks. You can read device configuration information as well as disconnector or relay state information. Similarly, it is possible to manage multi-energy meters and devices connected to a smart meter. Landis+Gyr AIM also supports automated and manual time synchronisation between the system and the meters.

In addition, event and alarm management supports managing devices as events triggered by the meters are logged and available all the time. This also enables smooth and efficient troubleshooting. For example, errors in the meter and fraud attempts are detected rapidly as those are logged to various event logs and can be monitored constantly. Alarms triggered by specified events in the meter give instant information on problems and critical failures, which makes it possible for the utility to react rapidly. Further, Operational Data Panel reports provide detailed information on various events, thus allowing efficient troubleshooting.

3.2 Reporting

Landis+Gyr AIM contains a variety of reporting possibilities.

Task Manager application can be used for data exchange and reporting. Data can be exported through FTP/SFTP by creating specific tasks with Task Manager. Exporting can be automated by creating a schedule for the export task or adding the task to a task flow. Automated tasks minimize human errors and save time and money.

Data Browser, on the other hand, includes reports for events and PQI data.

Data File Tool is designed for generating report and data files, such as CSV files, from the profile and periodic metering data in the Landis+Gyr AIM database. These files are used for

transferring the data to other applications such as billing and CIS systems, report tools and so on.

Moreover, the optional application Operational Data Panel offers versatile possibilities for reporting. It includes ready reports but also offers possibilities to customize and develop reports based on customer needs.

3.3 Integration to other systems

The open architecture of Landis+Gyr AIM ensures that it can be integrated with the utility's other systems without the need for further system investments. Standardised interfaces and a platform for tailored integration enable system-level integration in a seamless manner. The system is always offered case-by-case and the integrations are carefully planned and adapted to meet your special needs.

Integrations are usually implemented with AIMIA integration application. AIMIA integration application is also a very convenient way to export and import metering data between Landis+Gyr AIM and other systems. AIMIA integration application supports messages in various formats via web service, message queueing or FTP/SFTP. Supported message formats include, for example, standards IEC 61968-9 (2nd edition) as well as custom XML and CSV formats. For more information on AIMIA, refer to separate document AIMIA Product Description (D000032355).

3.4 Applications

Landis+Gyr AIM includes versatile and effective tools for data collection and device management as well as data management tools, which enable processing raw metering data into unified but accurate information. It contains applications that are designed for further refining the collected data.

In addition to the applications that are part of the Landis+Gyr AIM package by default, there are several advanced, value-adding applications that can be purchased as optional extensions to the utility's overall system. The basic package completed with optional applications makes Landis+Gyr AIM a solution that can offer the best possible service for utilities of all types and sizes. The list of additional applications expands continually.

We are currently renewing the user interface of Landis+Gyr AIM. In the first phase the new user interface includes basic functionalities but will in the future replace some of the applications.

3.4.1 Standard applications

Standard applications are part of the Landis+Gyr AIM system delivery by default.

3.4.1.1 New AIM UI

Landis+Gyr AIM has a new user interface that allows you to view metering points and device information as well as metering data. You can also read data from devices and control disconnector and relays.

The new AIM follows user-centered design and is simple and intuitive to use. It utilises Angular web application framework and NgRx store and uses Rest API to connect to AIM MDM. We are constantly developing the new UI to include more functionalities.

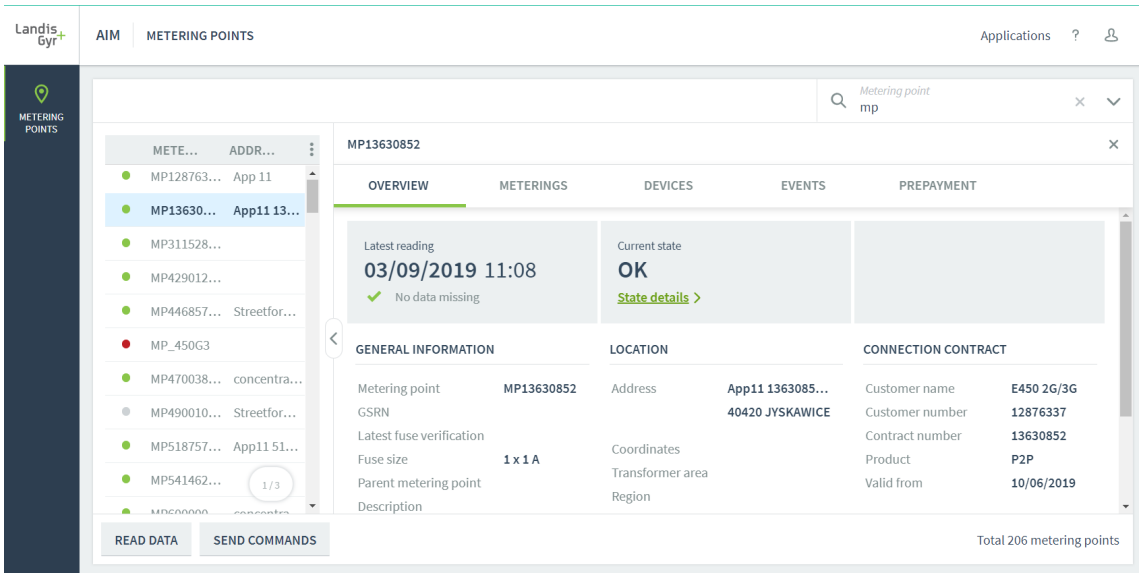

Figure 6: Metering point overview in the new AIM UI

3.4.1.2 Device Management for advanced meter management

The web-based AMR application Device Management offers an intuitive user interface for taking care of most of the daily tasks related to handling metering devices and their environments, and scheduling meter readings.Device Management can be used to load devices and their configurations to the system database, to monitor the process of loading tasks, connect devices to metering points, create groups and read consumption values from individual devices or device groups–either directly or as scheduled tasks.

Device Management contains tools for reading metering data from the energy meters to the AMR database based on specific events or on demand requests, or according to predefined schedules. The results are saved in the database from which they can be viewed, reported or transferred to other systems. Automatic readings can be scheduled to take place at a defined time, either once or repeatedly during a defined period of time. On-demand readings can be requested whenever the user needs up-to-date metering data.

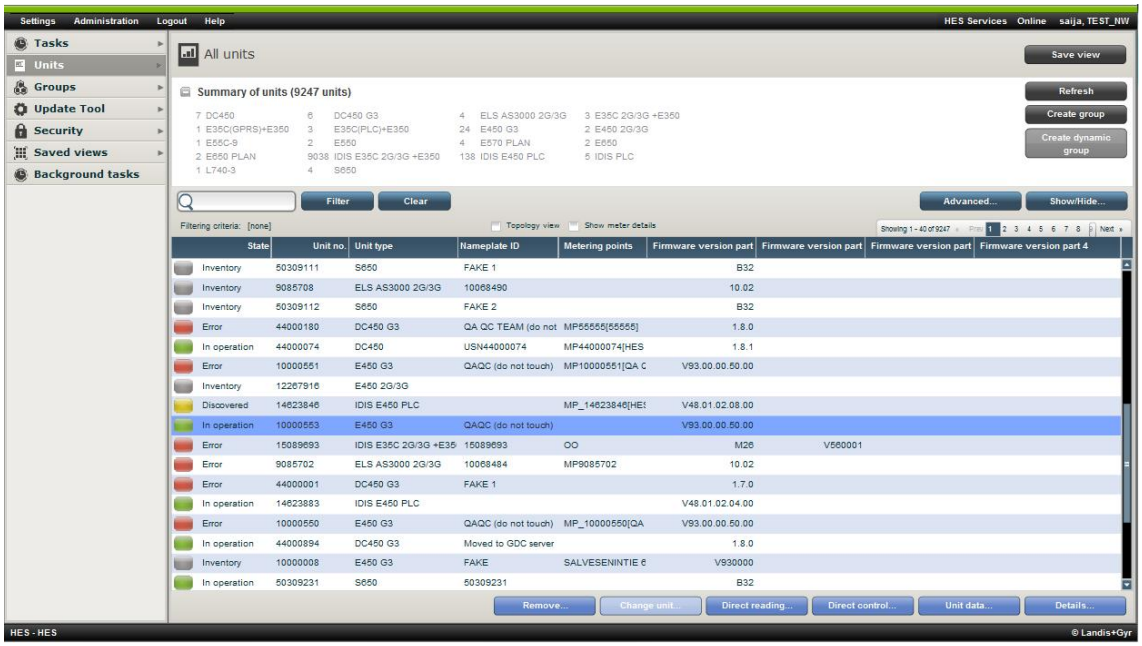

Figure 7: One of the main windows

In Device Management, it is also possible to configure data concentrators and set reading profiles, push schedules as well as push registers for the connected devices. Further, Device Management includes tools for updating device parameters remotely and for performing firmware upgrades remotely to certain meters.

Similarly, it is possible to control metering devices remotely through Device Management. Depending on the selected module and voltage system, a control job can be targeted to a single device, device group or all devices in a certain area. The users can activate controls whenever necessary. Automatic controls can be scheduled to take place at a defined time, either once or repeatedly during a defined period of time. For example, a control job can be used for disconnecting or reconnecting the electricity supply of a customer. It is also possible to control the network load, tariffs and other services. Note that remote device configuration options vary depending on the device type.

Landis+Gyr AIM also offers the possibility to remotely change the device's time, when necessary. The master-time setting tasks of Device Management are used for sending a time setting command to one or more terminal units. The master-time-setting command forcibly sets the device's time to conform to the system.

3.4.1.3 Administration

Administration offers a user with administrative rights a tool for creating and managing energy trade parties in Landis+Gyr AIM. It also enables, for example, updating the time zone and measured property information of a network company and browsing through measured properties.

3.4.1.4 Data Browser

Data Browser is an application for viewing and managing, for example, metering data, metering points and events.

Data Browser can be used for a quick access to the metering information saved in the database. It can also be used for editing and even deleting some of the metering information stored in the database.

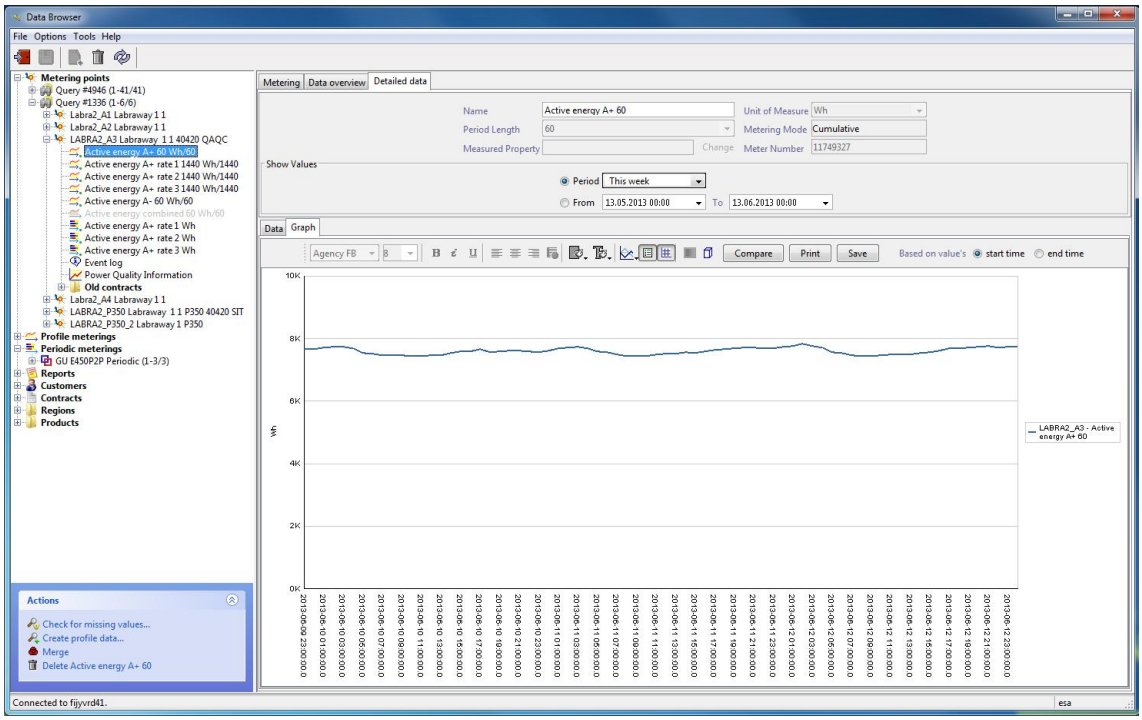

Figure 8: Viewing metering information in Data Browser

3.4.1.5 Data File Tool

Data File Tool is designed for generating report and data files, such as CSV files, from the profile and periodic metering data. These files are used for transferring the data to other applications such as billing and CIS systems, report tools and so on.

3.4.1.6 Validation

Validation is designed for validating imported metering data according to a set of validation rules. It allows you to check and validate the metering data's status information and the actual values. In addition, it enables the estimation of values.

3.4.1.7 Task Manager

Task Manager is a tool for scheduling and automatically executing various tasks according to predefined schedules defined by the users.

Task Manager is integrated into most of the data management applications as a common scheduler tool. For example, Validation usesTask Manager for scheduling its tasks. Task Manager can also be used for data exchange and reporting.

3.4.1.8 User Access Management

The User Access Management component provides an own UI for managing users, their permissions and possible LDAP/Active Directory integration.

You can easily configure user details and permissions as well as run reports of user permissions. It is also possible to configure various settings, for example, the password policy.

3.4.2 Optional applications

Optional applications are additional value-adding application that are sold separately and can be included in your system delivery.

3.4.2.1 AIMIA

AIMIA is an integration application especially designed to enable automated two-way data transfer between Landis+Gyr AIM and other systems. As an example, it is possible to automate the loading of basic information (such as customer information) from an external system, or delivering metering data to an external system, such as a CIS.

AIMIA handles data transfers according to predefined schedules and in the right format. Automated data transfer eliminates overlaps in system maintenance and reduces manual work, thus minimising errors typical for manual processing, such as typing errors.

For more information on AIMIA, refer to separate document AIMIA Product Description (D000032355).

3.4.2.2 Tariff Calculation

Tariff Calculation is a versatile tool for processing tariff data. It allows converting profile metering data into periodic metering data to be used as the basis for billing. Different periodic meterings can be generated from the same source profile meterings. This is useful when planning new products and estimating the revenue incomes the new products would generate with the current consumption.

3.4.2.3 Profile Calculation

Profile Calculation is a tool for automatically processing profile data for various balance settlement purposes. It also enables producing new profiles from existing ones. For example, profile data can be used for combining the hourly profiles from all the metering points of a supplier or transformer. The resulting profile can then be used, for example, in validation or when estimating the load. It is also possible to convert profile meterings for example from 15 minute profiles to hourly profiles. Profiles can also be further utilized in validation

3.4.2.4 Operational Data Panel

Operational Data Panel is a modern and interactive reporting solution. It helps to visualize data and offers reports for monitoring.

The solution includes a data warehouse (DW) and reports. The reports are based on Microsoft's Power BI solution. Basic reports are included in the solution and advanced reports are provided additionally. Contact your system deliverer for purchase information for the advanced reports.

Power BI Service with Pro license is recommended for using the reports but they can also be run on top of a desktop version. Note, however, that the desktop version has a very limited performance.

3.4.2.5 Audit UI

Audit UI is a tool for viewing audit information. It includes excellent search functionalities and provides an easy access to required information on user actions.

3.5 Communication

Landis+Gyr AIM supports various communication options and protocols. It provides ideal communication options for all customer segments and network areas. It includes fast and reliable solutions for both point-to-point (P2P) and point-to-multipoint (P2M) communication. The support for multiple communication media enables a reliable and cost-effective solution for both rural and densely populated areas.

Bi-directional communication between the meters and Landis+Gyr AIM enables remote meter reading, dynamic pricing and demand responses, as well as remote firmware updates.

Development is based on open platforms to ensure interoperability and communication with third-party systems.

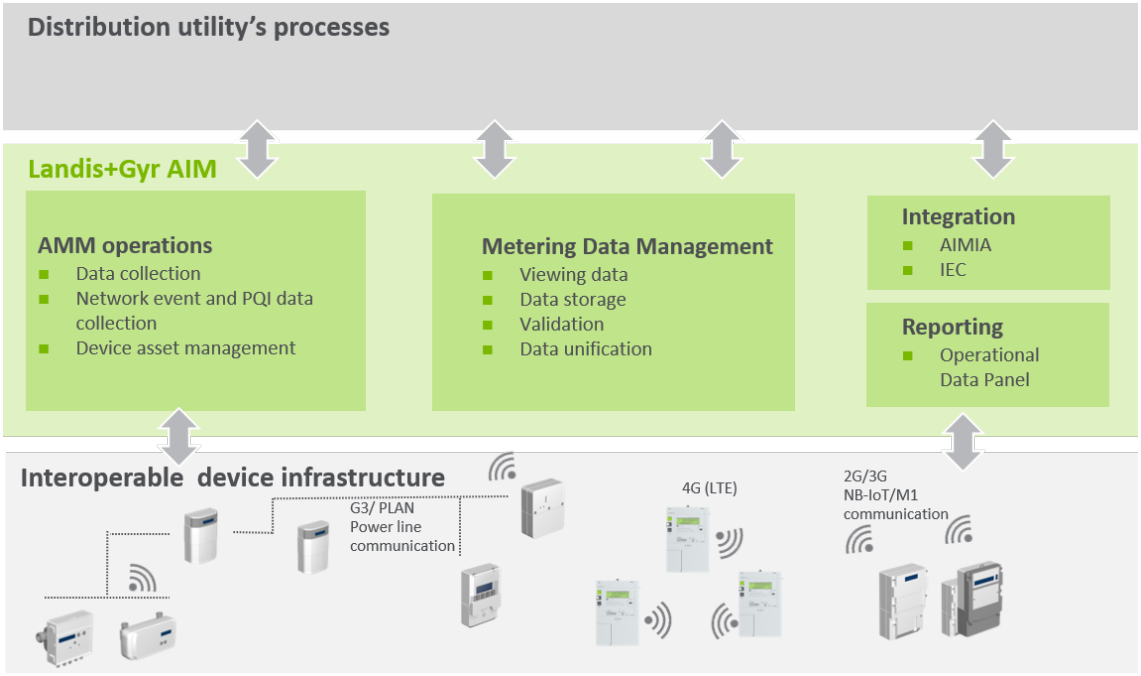

Figure 9: Landis+Gyr AIM communication platform

In addition to the traditional request-reply communication between the system and devices, certain metering devices can actively push their data to the system. This makes communication in a metering system more efficient, flexible, and reliable.

3.5.1 Supported communication media

Landis+Gyr AIM offers a wide range of communication options.

For example the following options can be used:

- Low voltage PLC network
- GPRS, 3G, NB-IoT/M1
- IP networks (LAN, WAN)

All combinations of the offered communication media are possible. The most commonly used options include PLC and GPRS/3G either separately or as a combination.

- PLC communication shows its strengths in large-scale transformer areas. It provides cost-efficiency due to lower investment and communication costs. When PLC is used with concentrators, it also offers operational efficiency because the concentrator can operate as a single communication interface for several metering devices.
- GPRS/3G communication is the optimal communication media in rural areas. It also enables additional functionality, such as SMS alarms, data push functionalities from the meter to Landis+Gyr AIM, and a variety of wake-up functionalities.
- NB-IoT/M1 communication provides robust data transfer and reliable operations with higher range and better building penetration. It also offers additional functionalities like active notifications and alarms based on events as well as last gasp for power outages.

3.5.2 Supported communication protocols

To ensure a smooth communication between different meter types Landis+Gyr AIM supports various protocols.

The following list shows the most commonly utilized protocols:

- DLMS (IEC 62056-61/62)
- PLAN (IEC 61334-5-1)
- M-BUS
- TCP/IP
- IEC1107
- IDIS (61334-5-1)

For example, communication through ABB SCA Ethernet adapter to ABB DELTA Plus meter and Kamstrup e-meter is done transparently using the M-Bus protocol.

3.5.2.1 DLMS protocol

Landis+Gyr AIM is able to communicate through standard protocols (for example DLMS/ COSEM) with meters and data concentrators from several manufacturers. DLMS COSEM, the Companion Specification for Energy Metering, specifies the behaviour of the meter from the point of view of the utility's business processes. The formal specification of the behaviour is based on object modelling techniques (interface classes and objects).

To achieve interoperability, the large variety of elements offered by the DLMS COSEM standard are tailored and described in detail in the IDIS companion specification. In other words, the detailed object model and the communication protocols used are described in specific detail for a smart metering application.

The DLMS COSEM specifications provide the following interoperability benefits:

- Allows various data collection systems to have access to metering data.
- Allows the exchange of data with single metering equipment at a metering site.
- It is possible to exchange data with metering equipment either remotely or locally.
- Depending on the resources of the metering equipment, local and remote data exchange may be performed without interfering with each other.
- It is possible to use various communication media both on local area networks (LAN) and wide area networks (WAN).
- Provides authentication mechanisms to control access to data.
- Provides cryptographic protection of the messages.

Based on the open meter standard and within the DLMS Cosem specification the Landis+Gyr's E450 PLC meter family supports the following use cases with full interoperability with other meter manufacturers:

- Meter registration
- Remote tariff programming
- Meter reading on-demand
- Meter reading for billing
- Meter disconnection and reconnection
- Meter clock synchronisation
- Quality of supply
- Load management by relay
- Firmware update

3.5.2.2 IDIS (61334-5-1) support

To secure the interoperability required to ensure a seamless flow of data Landis+Gyr AIM supports IDIS (61334-5-1). IDIS defines standardised communication between devices of

different manufacturers. Among the first in the world Landis + Gyr provides utilities with both smart meters and a head-end system compatible with IDIS.

IDIS support in Landis+Gyr AIM allows the use of Landis+Gyr meters and third-party meters in the same system. The system's IDIS support covers the typical smart metering use cases: billing energy data collection periodically or on-demand, relay and disconnector controls, load profile, data collection and event identifications.

3.5.3 High reading performance

Landis+Gyr AIM system can include one or more reading engines according to customer requirements. The capacity of each reading engine can be enhanced by push and pull method.

Landis+Gyr AIM supports automatic data push from the meters but can also request data from the meters (pull). The push method is typically used whenever high capacity is required by the utility.

When Landis+Gyr AIM receives readings, it makes sure that the data is complete and stores it to the metering system database. The system monitors readings automatically and re-reading is performed, if any data is missing. Only if necessary, for example if a special reading is needed, Landis+Gyr AIM system sends a request to the metering device. This means fewer and shorter connections and more efficient communication.

Installation and management of the metering system is easier with Landis+Gyr AIM. Devices can be pre-configured in production to contact the metering system after they have been installed. Landis+Gyr AIM then automatically recognises and registers them, and communication to the device is immediately available.

3.6 Security

For Landis+Gyr the confidentiality, integrity and availability of metering data are the top priorities when developing smart metering systems. Landis+Gyr AIM ensures a secure and reliable data transfer at all system levels.

Communication is secured by using various security methods, including data encryption according to IDIS standard, to prevent unauthorized contacts. Access to metering data is secured by utilising centralised user access management.

Landis+Gyr also holds the Information security ISO/IEC 27001:2013 certificate which covers among other things system software development, solution integration testing and support processes.

The corner stones of the Gridstream solution security are:

- Authentication
- Authorizations
- Encryption
- Logging

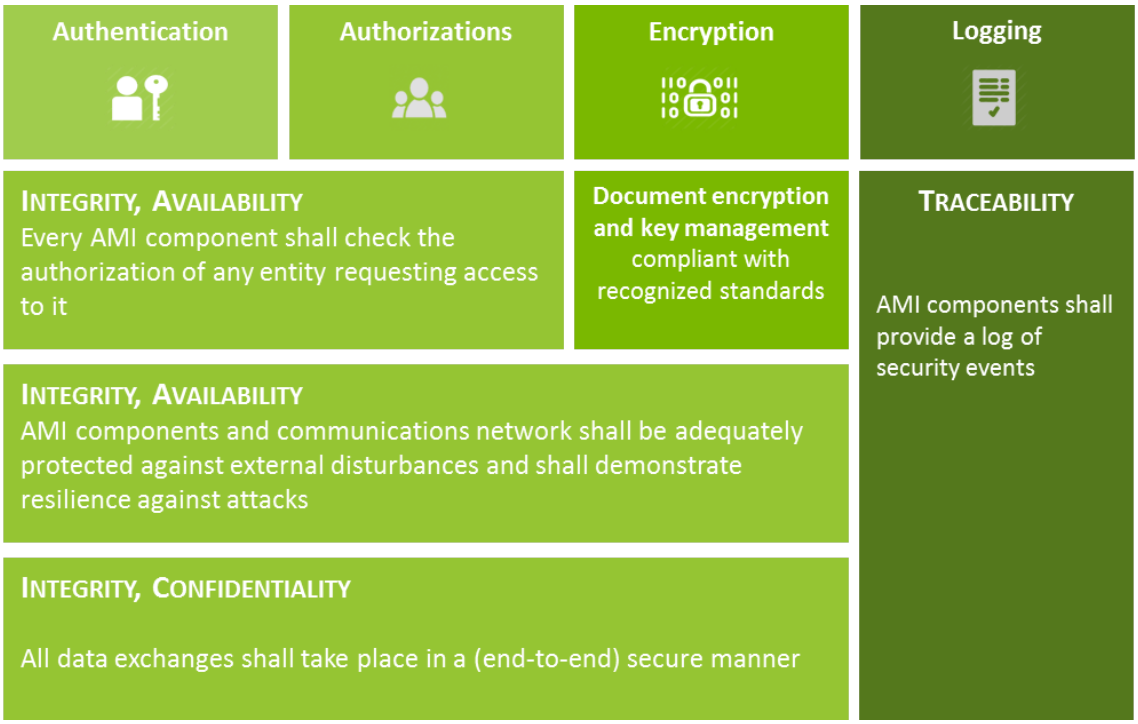

Figure 10: Corner stones of the Gridstream solution security

3.6.1 System security

Landis+Gyr AIM includes a User Access Management component that provides centralised user access management as well as single sign-on between all system applications.

System functions are only available for authorized users to protect the system from unauthorized access. Also, user rights are defined in detail to ensure that each user only has access to features essential for him. You can easily assign user rights to different types of users, such as admin users, customer service personnel and users responsible for metering. User rights are managed outside of the integrated applications.

In addition to centralised user management, auditing is a key security feature. The User Access Management component includes an audit trail functionality to answer to your auditing needs. User authentication and authorization – both successful and failed ones – are written to the audit trail with details. Also, the User Access Management administrative operations are audited. Passing an action context between applications is also supported to enable end-to-end auditing of cross-application business processes. When used, it enables binding the different audit messages to the originating user action.

The User Access Management component can also be integrated with different authentication providers such as Active Directory (AD) or Lightweight Directory Access Protocol (LDAP).

Further, the system includes possibilities to limit the number of operation within a defined time period. This is available for selected control operations.

To further improve the system security, Landis+Gyr recommends network segmentation.

3.6.2 Communication security

Landis+Gyr AIM offers security for all data communications.

It is possible to secure the communication

- between the data concentrator and the system (WAN security)
- between the data concentrator and IDIS meters under it (PLC security)

- between point to point devices and the system

Symmetric key cryptography, based on DLMS data transport security and data access security, is used for the PLC meter to data concentrator interface and for the point to point device to system interface. TLS is used for the data concentrator to system interface. A public key infrastructure is used to facilitate key generation and distribution for the secure solution. Security settings can be easily configured in Device Management application.

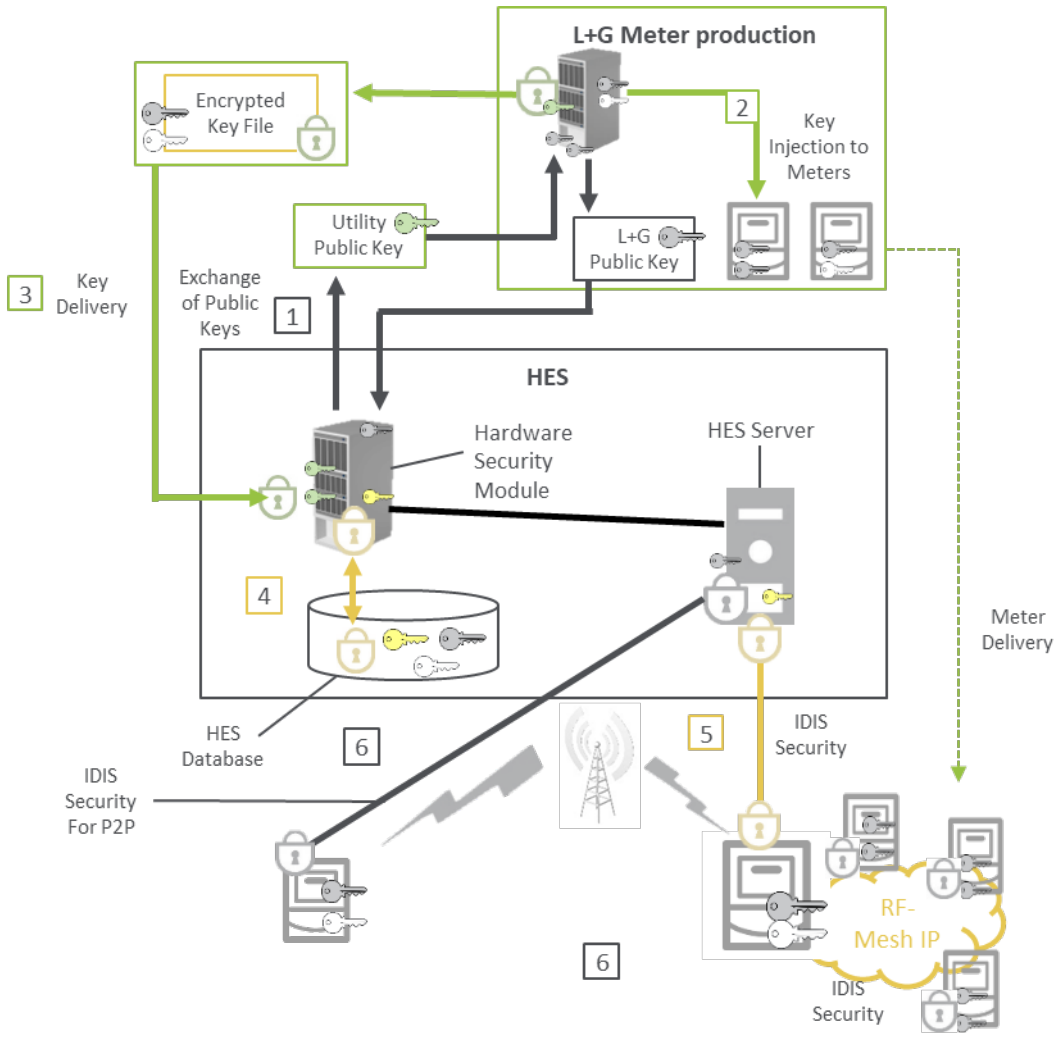

Figure 11: Communication security

4 Technology and hardware

Landis+Gyr AIM is a multi-tier solution that utilises the Oracle database and WebLogic application server. The system is mainly developed using Java technology. Existing user interfaces are implemented using Java Swing, Adobe Flex and AngularJS. User interface renewal is currently in progress with Angular. Landis+Gyr AIM system operates on Microsoft Windows® operating systems.

System hardware requirements are always checked case-by-case. The requirements vary according to the number of metering points and devices to be connected to the system. Furthermore, the way of using the system affects the hardware requirements. For example, if data is to be read quickly within a few hours, the hardware system requirements are more demanding than when the reading can be done during a longer period of time.

Landis+Gyr AIM also supports Oracle Real Application Cluster (RAC) and Oracle Fail Safe environments. The database is then clustered which guarantees high system availability.

Scalability of the Landis+Gyr AIM system enables connecting the system to as many AMR engines as necessary. This way Landis+Gyr AIM grows together with your business.

5 Easy set-up and management of Landis+Gyr AIM

Each system installation is always carefully customized to fit in the utility's existing environment in the best possible way. Before Landis+Gyr AIM can be taken into use, Landis+Gyr conducts a detailed and thorough analysis of your business processes and information system environment. Based on the analysis Landis+Gyr can offer you a reliable and cost-effective solution with the best possible products for your business.

5.1 Integration to existing systems and processes

Landis+Gyr AIM includes a possibility to integrate the system with other existing information management systems without the need for new system investments. Landis+Gyr AIM offers standardised interfaces as well as a platform for tailored integration.

Integration can be handled with the optional integration application AIMIA integration application. The architecture of the modular, two-way AIMIA application includes several integration components to support different integration technologies and fast adaptation to different integration needs. As an example, AIMIA includes an adapter for handling installation and event information in the Landis+Gyr AIM system, and downloading installation information from other systems to Landis+Gyr AIM. In fact, all related systems can be integrated together with Landis+Gyr AIM by building an information exchange on top of AIMIA.

AIMIA integration application supports messages in various formats via web service, message queueing or FTP/SFTP. Supported message formats include, for example, standards IEC 61968-9 (2nd edition) as well as custom XML and CSV formats. To be prepared for the challenges of the future, it enables replacing the file transfer media and technology when necessary. This way your system can keep up with developments as the demands of the required level of service, security and performance change.

In addition to AIMIA, the Landis+Gyr AIM system offers metering data in numerous different transfer-file formats, such as FOS and Asterix, to support the traditional data transfer interfaces.

5.2 Integration with IEC 61968-9 interface

Landis+Gyr AIM supports IEC messages that follow the open standard IEC 61968-9 13 edition 2.0 interface. The support includes both data import from and data export to an external system.

Data can be transferred from HES to MDM and further to an external system using IEC messages. Both readings and events can be included in the data flow. IEC messaging also enables delivering voltage and current measurements from HES to MDM.

5.3 Deployment service and support

For system deployment Landis+Gyr offers excellent services.

The first phase of system deployment is typically included in the implementation project. This ensures that trained and experienced professionals are in charge and make sure that the system will be up and running smoothly. After the initial system deployment and the during maintenance, Landis+Gyr support is always available for the customers. An active licence agreement guarantees the availability of Landis+Gyr support in any situation.

The Software Life Cycle Policy of Landis+Gyr AIM guarantees maximum asset utilization and protects your investment. It is our commitment to support software version for the announced period. The Software Life Cycle Policy defines three different life cycle support phases with related support services: active, extended and retired. The active phase lasts from 1 to 2 years after the released version. This is followed by an extended phase during which the software support timeline can last up to four years. The Software Life Cycle Policy provides full transparency of the current and future state of the software version life cycle. State changes

are communicated early in advance, and the extended phase allows the utility to schedule software updates or upgrades flexibly according to their business needs.

5.4 Services with Landis+Gyr AIM

Landis+Gyr offers a wide range of advanced metering services, including turnkey deliveries and meter reading services according to your requirements. Landis+Gyr AIM acts as a solid platform for SaaS (Software as a Service) and MaaS (Metering as a Service) solutions. As a service platform, it allows cost-efficient, scalable capacity to meet utility needs.

Landis+Gyr SaaS enables the utility customers to maintain their AMI solution easily and cost-efficiently. While the utility continues to run the daily operations, Landis+Gyr takes full responsibility on the AMI platform, including updates, maintenance as well security.

Landis+Gyr MaaS, on the other hand, frees the utility from the AMI routines allowing them to focus on processes increasing shareholder value and improving customer satisfaction. Landis+Gyr manages the daily operations, including the required readings, communications and field operations as well as platform maintenance and security. The utility receives the data in accordance with the agreed SLA, with known costs and minimized risks.

SaaS and MaaS solutions consists of several different service modules and can be customized based on customer requirements. For further information on the service offerings of Landis+Gyr, please consult Product Management.

6 Supported metering devices

Landis+Gyr AIM supports a wide range of residential meters, commercial and industrial meters, grid meters, terminal units and concentrators, repeaters, modems and routers. In addition, the system offers interoperability with third-party meters. System compatibility allows the devices to be controlled remotely through the Landis+Gyr AIM.

For a list of supported devices and supported features for the devices, refer to document D000038445 Supported Devices.

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