Security Considerations in Implementing Smart Grid

Anuranjan Misra, Raj Kumar Baghel, Raoashu

Abstract- Smart Grid facilitates efficient and reliable end-to-end intelligent two-way delivery system from source to sink as well as integration of renewable energy sources • Smart grid will be able to coordinate the needs and capabilities of distribution utilities, end users and electricity market stakeholders in such a way. It can optimize asset utilization, resource optimization, control and operation. Reduction in losses, performance improvement • It encompasses Integration of Power, Communication, intelligent devices, intelligent computing system for improved electrical infrastructure that serves consumers with reliability, quality & affordable price • Helps both Utility and consumers to participate in the management of electricity sector including efficient utilization of assets – bringing efficiency and sustainability .In This Paper we had discuss Communication Plane, Energy Plane, required Security features.

Keywords:- Smart, Grid, efficient, Power, electricity, Energy, Plane, Security, management, coordinate

I. INTRODUCTION

Smart Grid is a new electricity network, which highly integrates the advanced sensing, and measurement technologies, information and communication technologies (ICTs), analytical and decision-making technologies, automatic control technologies with energy and power technologies and infrastructure of electricity grids. Some important aspects of what 'smart' are as follows:

- ***Observability*:** It enables the status of electricity grid to be observed accurately and timely by using advanced sensing and measuring technologies;
- *Controllability*: It enables the effective control of the power system by observing the status of the electricity grid;
- ***Timely analysis and decision-making*:** It enables the improvement of intelligent decision-making process;
- ***Self-adapting and self-healing*:** It prevents power disturbance and breakdown via self-diagnosis and fault location.
- ***Renewable energy integration*:** It enables to integrate the renewable energy such as solar and wind, as well as the electricity from micro-grid and supports efficient and safe energy delivery services for electric vehicle, smart home and others.

II. Communication Plane

The communication (control & connectivity) plane includes communication network domain. The following describes essential capabilities for the communication plane.

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The protocols and functional requirements are described in the Requirement deliverable following this Overview deliverable.

- Capability of IP base transport
  - Support capability of IP base transport, such as IPv4 and/or IPv6.
- OAM function
  - Failure detection and alarm transfer;
  - Hierarchical operations for failure detection and alarm transfer;
  - Communication path trace;
  - Performance measurement.
- Protection and restoration
  - Support of one or more types according to target performance, e.g., service outage period, localization, useless traffic load;
  - Co-operations among types without contradiction.
- Traffic engineering and QoS control
  - Service Level Agreement (SLA) guidelines, traffic provisioning and traffic control.
- Connectivity and routing
  - Reach ability based IP capability;
  - Specific signaling protocol, e.g., SIP;
  - Static routing.
- Access control
  - Various types of access interfaces: wired access (e.g., Optical, xDSL, Coaxial, PLC), wireless access (e.g., Cellular, WiFi, ZigBee, Bluetooth, other sensor)
  - Poling, demand assignment, no prevention access, etc.
- Network security[1]
  - Authentication;
  - Encryption.
- Network management
  - Monitor/surveillance of networks to manage failure, topology, performance, etc;
  - Monitor/surveillance of communication component to manage component type, failure, etc;
  - Provisioning of operation parameter;
  - Remote testing;
  - Compression of information;
  - Northbound interface for communication from/to the higher network management entity.
- End networked device management

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  - Management of end devices in energy plane, such as electric vehicle, distributed generation, electric storage or appliances.
- Data management
  - Data aggregation, suppression and unification of interface to reduce traffic load of communication network.

III. Energy Plane

Energy plane includes grid domain, customer domain and smart metering. This plane consists of energy generation, storage, and consumption devices with communication interfaces. Information through these interfaces is transferred on communication network. The following describes essential capabilities for each domain of the energy plane.

III. 1. Grid domain (bulk generation, distribution and transmission)

The following describes essential capabilities for bulk generation, distribution and transmission in this domain:

- Monitor and control energy generation, transmission, and distribution;
- Store and integrate renewable energy.

III.2 Smart metering (AMI)

The following describes essential capabilities for AMI in this domain:

- Support meter reading and network interface for remote meter data reading from service provider domain;
- Provide the home area networking with direct access to consumer-specific usage data, i.e., instantaneous usage, interval usage, volts, amps, VAR, power factor, and others.

IV. Security

In addition to network security, the following security features are required:

- ***Confidentiality*:** The Smart Grid should preserve authorized restrictions on information access and disclosure during communications, including means for protecting personal privacy and proprietary information. A loss of confidentiality is the unauthorized disclosure of information;
- ***Data & User privacy*:** Data must be treated as personal and aggregation and removal of personal details may be required. The Smart Grid should preserve authorized restrictions on information access and disclosure during use & storage, including means for protecting personal privacy and proprietary information. A loss of Data & User privacy is the unauthorized disclosure of information during use & storage;
- ***Integrity*:** Smart Grid should prevent against improper information modification or destruction, and includes ensuring information non-repudiation and authenticity. A loss of integrity is the unauthorized modification or destruction of information;
- ***Availability*:** Smart Grid should ensure timely and reliable access to and use of information. A loss of availability is the disruption of access to or use of information or an information system;

V. Conclusion

The following issues need to be considered when considering the security features:

- Extensive data gathering and two-ways information flows may broader the potential for compromises of data confidentiality and breaches of customer privacy, and compromises of personal data and intrusion of customer privacy;
- The complexity of the grid could introduce vulnerabilities and increase exposure to potential attackers and unintentional errors;
- Increased number of entry points and paths are available for potential adversaries to exploit.

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