WP1

Semantic System Description

by Olaf Owe (UiO)

UiO team

- **Olaf Owe** (PMA group leader, leader Conserns)
- **Christian Johansen** (50% IoTSec), senior researcher (UNIK + UIO)

Postdocs/researchers hired at UiO

- **Ming-Chang Lee "Leo"** (hired 6 month until 1.7.16, then at Simula)
- **Toktam Ramezani** (hired from 1.8.16)

PhD students hired at UiO

- **Elahe Fazel** (hired from 1.1.17)

Other members from PMA and ConSeRNS are associated.

Major Achievements

- T.1.1 Semantic description of infrastructure, attack detection, system view
  - Semantic Modeling of Smart Homes and Smart Grids: *Formal, executable* modeling
    - i. (Full) *Maude* model. Purpose: adaptability, abstraction mechanisms, intrusion detect.
      - Owe: Maude prototype of smart grids/homes + analysis of undesired attacks
    - ii. ABS modeling. Purpose: Compare different cloud solutions at an abstract level
      - Lee&Owe: Smart home modelling + ABS prototype
      - "Semantic Modeling of Smart Homes in the ABS Real-time modeling language". IFI res. report 457
    - iii. Language-based security: Secrecy policies in "SeCreol". Enforcement of secrecy.
      - Ramezani&Owe: NWPT'16 + paper in progress
      - A Secrecy-Preserving Language for Programming of Object-Oriented and Distributed Systems NWPT
  - Static detection of attacks and system weaknesses.
    - i. McDowell&Owe: Flooding detection NWPT'15 + invited journal paper (in review)
    - ii. Ramezani&Owe: Information flow analysis, attack detection and information leakage

Major Achievements

- **T.1.2 Measurable security, privacy and dependability, metrics**
  - **Work by UNIK** led by Seraj Fayyad and Josef Noll
    - i. The multi-metrics methodology from IoTSec is included as one of the technological building blocks in the SCOTT project (ECSEL JU), involving 56 partners from 12 countries.
    - ii. Multi-Metrics Framework for measurable security (concept established)
  - **Publications:**
    - i. Principles of Multi-Metrics approach in Journal paper [1]
    - ii. Critical dependencies of components addressed through novel method [2]

Research collaborations
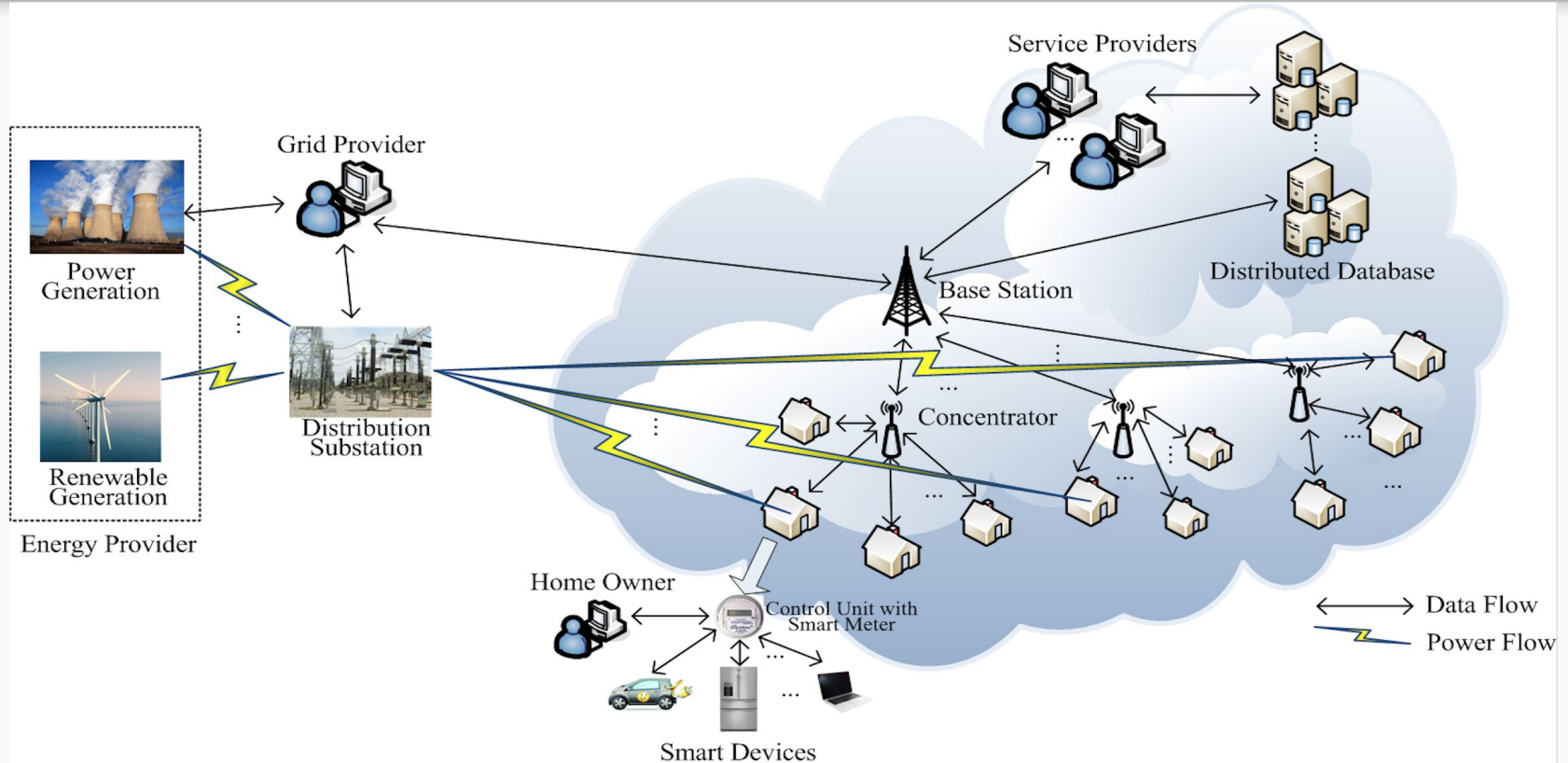
- **Project Applications based on IoTSec :**
    - Cooperation with the energy group at UiO (Vitenberg/Eliassen). CPS Lab.
    - Safety of IoT systems (by PMA)
        - Cooperation with Chalmers U., Liverpool U., and ITU Copenhagen among others.
        - Coordinated by IoTSec members (Owe), with international collaborators from UK, DK, SE.
- **Cooperations:**
    - **Papers** with coauthors from U. of Darmstadt, U. Braunschweig, ITU. Copenhagen, Chalmers U., U. Torino, and SIRIUS centre at UiO
    - **Guest lectures** from Chalmers, Copenhagen, Bristol, INRIA-Paris industry
    - Cooperations with groups: ConSeRNS (IFI strategic initiative), Shukun Tokas
    - And with other Norwegian Institutions: HiØ via Dang Ha The Hien and Roland Olsson

Ongoing work

- Defining a framework for modeling and analysis of secrecy and privacy in distributed Object Oriented systems, suitable for IoTSec (and smart grids/homes).
  - Based on the Creol language, adding features for secrecy

  - Developing static and dynamic detection of attacks

  - Planned implementation in the K framework (G.Rosu group at UIUC)

  - Persons: Ramezani, Fazel, Tokas, Johansen, Owe, Noll, Fayyad, et al. + MSc students (ca. 5)
- Continue cooperation with Chalmers U., U. Copenhagen, U. Bristol, industry

Challenges

Research challenges:

- **Language-based security** frameworks for IoT systems
  - Formal semantics
  - Adaptivity
  - Security analysis, formal and tool-oriented methods
- **Cloud solutions** for storage of user data & **privacy** issues
  - Openness and access for 3rd party companies
  - Subscription, information Filters and encryption
- **Virtual machines** and Operating system level security issues
  - IoT applications

Industry challenge: make use of modeling and analysis tool on prototypes

Suggestions to funding agencies

- Modeling of IoT and smart infrastructures
  - Executable modeling and tool-based analysis
    - Useful at an early phase
    - Gives better foundation for services
    - Existing frameworks can be improved (and specialized to IoT and privacy)
    - Use of embedded models in IoT systems -- better flexibility
- Topics related to smart infrastructures.
  - International standardized of security-related case studies
    - **Common Weakness Enumeration and National Institute of Standards Technolog**ies
  - Further investigations on:
    - Vulnerabilities
    - Weaknesses
    - Attacts

List of Publications related to WP1

[1] J. Noll, I. Garitano, S. Fayyad, E. Åsberg, H. Abie, "Measurable Security, Privacy and Dependability in Smart Grids", Journal of Cyber Security, 3_4, (2015)

[2] S.Fayyad and J.Noll. "Components Interconnection Consideration In Multi-Metrics Approach", CENTRIC 2015