CSI2343 Object-Oriented Analysis and Design

Assignment 1

Background:

The growth of cities and the ongoing modernisation of society results in an almost exponential increase in demand on the electricity grid. A challenge for most power companies is to support the fluctuating demand on the grid which varies throughout the year based on seasons.

Demand Management attempts to modify the consumers' behaviour through:

- Use of financial incentives and penalties
- Energy efficiency education
- Programs to modify the demand for energy.

It typically encourages the user to consume less energy at peak load times, or rather shift the usage to an off-peak time.

Why does the ACME Power Company need to manage demand?

- The top 15% of network load appears for less than 2% of time per year.
- This load appears over a few weeks of the year – summer peak.
- ACME spends $100m per year installing new network capacity to supply the peak load.

- ACME is a public company and is obliged to consider non-network solutions as an alternative to building new lines and substations.

The company wants to develop prototypes to explore the issues in two stages:

1. Home Area Network (HAN) connectivity – data collection, basic billing.
2. Device control – regulating demand

As part of an innovation programme for a small city, the ACME Power Company has assembled a project team has been assembled to develop a smart-grid prototype. They have engaged the ECU School of Computer and Security Science to design and develop the software components.

The product team developed a hardware and network prototype as depicted in the following diagram:

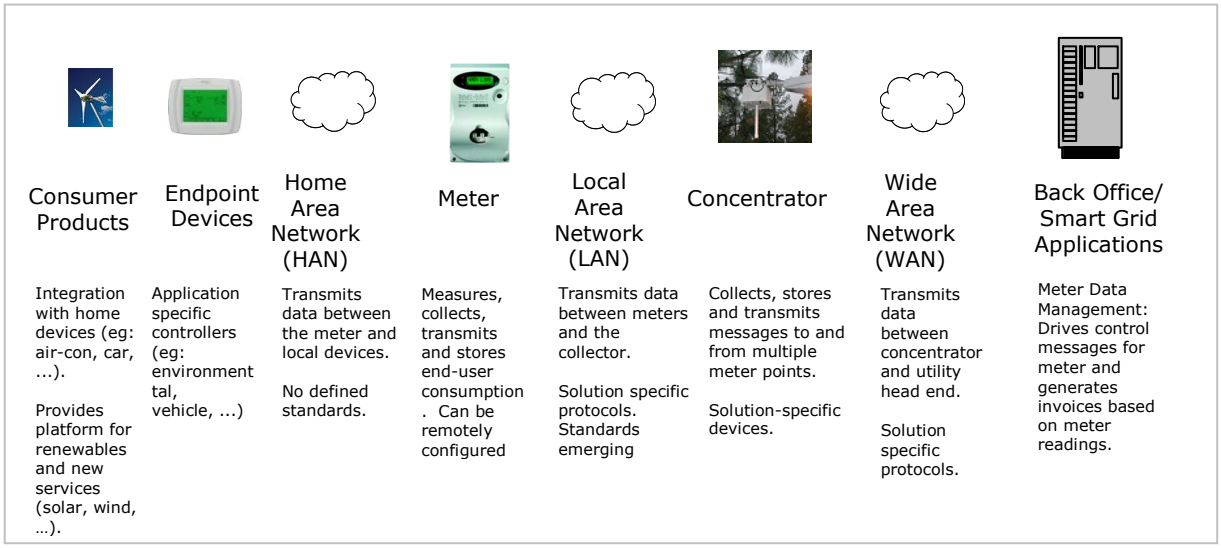

Figure 1 - SmartGrid

Assignment 1: (Group Project)

This assignment focuses on the 1st stage – connectivity, data collection, & billing.

You must design software for the smart-grid in support of the following requirements:

- The system will employ open-standards where possible.
- The system will be designed and built for maximum reliability and maintainability.
- Software, data, and configuration parameters will be stored on a removable memory card, which will not exceed 4GB in size.
- The meter and server will use a common operating system/environment, preferably with no licence cost, with optional support being available.

- The system will support standard IP-based connectivity and middleware where possible to allow for future modifications and enhancements.
- Information/status will be displayed on the meter's LCD and LED panel.
- To initialise, the meter will boot from the network and retrieve/install software delivered from the server.
- The environment will utilise FTP as a means of uploading usage data and downloading tariff information.
- The meter will perform self checks upon power-up and periodically.
- The meter will interrogate the LAN upon start-up and periodically, and respond to queries from devices on the LAN (new or existing).
- Two "smart" devices shall be used in the prototype:
    - A reverse-cycle air-conditioner (heating + cooling), with thermostat.
    - An electric vehicle will be allowed to connect to the LAN and support storage of electricity, and supply back to the grid.
- The meter will log all power consumed by each device connected on the LAN, and estimate costs for its usage based on the changing tariff throughout the day.
- An operator will be able to change the tariff for any 15 minute period at any time throughout the year. Consideration must be given to minimising downloads from the server to the meter.
- Based on a schedule, the server will automatically download a meter's usage data and prepare invoices for billing.

Assessment

Due: As specified on the Assessments web page on the Blackboard.

Assessment value: Assignment 1 is worth a maximum of 15% of your total marks for this unit. Marks may be scaled in accordance with School/ University policies.

Submission: Work should be submitted, according to SCSS electronic submission requirements. Note that assignment extension requests must comply with SCSS/university standards with which you should familiarise yourself.

Task:

You are to produce a UML model using Visio as the UML environment to describe the system above. The client will be available through the unit discussion forum to discuss their needs.

The model should include:

- Complete, documented, use case models, including use case realisations with associated underlying sequence diagrams,
- analysis class diagrams,
- requirements specifications (preferably contained within the use case model),
- other items you may judge necessary.

State clearly any assumptions or clarifications that you may make.