AURA-NMS WP2: Communications to Facilitate AURA-NMS Network Control

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I. INTRODUCTION

Communications are and will be, to an even greater extent, a necessary and important tool for the operation of the electric power network, as well as for administrative purposes. The communication infrastructure provides communication channels for supervisory control and data acquisition (SCADA), automatic generation control and scheduling, and for the distributed power generation operational functions. The implementation of an AURA-NMS system will require more advanced communication and IT systems than current provision for distributed power generation and enhanced operational functions.

The primary goal of AURA-NMS WP2 is to investigate the architecture of communication system to facilitate the AURA-NMS network control scheme. This work package effectively brings together two very complex networks: on the one hand is the electric power network with enhanced functionalities and, on the other hand, is the communication network with its own dynamics and reliability properties.

II. RESEARCH OBJECTIVES & RECENT PROGRESS

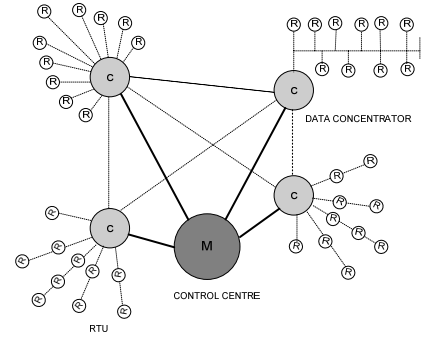
The objective for the WP2 research work are:

- Determine the effect of communication behaviour (e.g. latency, latency variability, and reliability) on power network control systems.
- Assess the deployment of a distributed communication and analysis network on a power system with non-uniformly distributed sensors.
- Investigate the behaviour of the communication system under abnormalities, e.g. congestion, outages or link failures, and power network events that cause loss of communication.
- Explore suitable communication & IT infrastructure (technology, equipments, protocol/standards) to facilitate AURA-NMS.

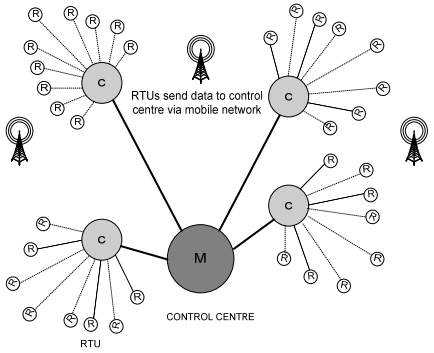
Recent work in WP2 focused on the key task of modeling the current communication provision and explores how this model interacts with network control functions. This includes:

- Obtaining communication provision information from EDF Energy and Scottish Power for performance assessment.
- Modeling and evaluating the performance of the current communication provision.
- Characterizing likely traffic patterns for normal and abnormal working conditions, etc.

III. CURRENT COMMS PROVISION



MODEL I: Scottish Power Network

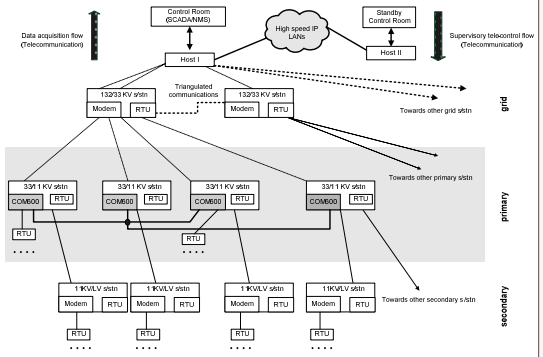


MODEL II: EDF Energy Network

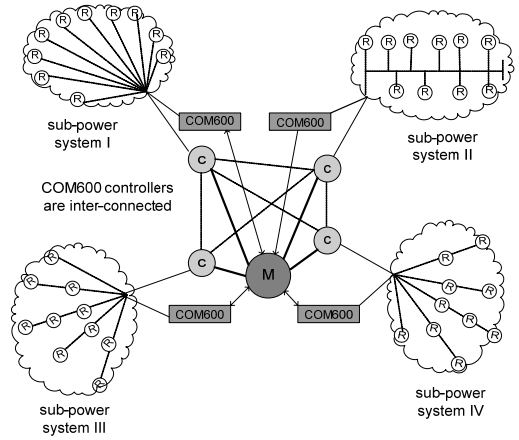
The current SCADA throughout the UK is a mixture of 2nd (1970s) or 3rd (1980s) generation systems. In current centralised SCADA system, all outstation RTUs in the power system sites send its most current status and information through the communication network to the control centre. In the control centre, these transmitted data will be scanned and analyzed by the system control software program to pick out any mismatch occurred at the corresponding outstation. The main control node will issue control messages to the RTUs connected in the network.

Each outstation RTU is modelled as a communication node which collects measurement report from sensors and deliver commands to control relays. All these nodes are connected together via heterogeneous communication links (e.g. leased digital fibres, private pilot cables, PSTN phone lines, radio, mobile cellular networks) with relatively low bandwidth (a few kb/s to 2Mb/s). At higher voltage sites (e.g.132/33KV), data concentrators are often adopted to collect information from downstream RTUs and the communication channels are more secure and robust with better reliability (e.g. triangulation, duplicated routes).

IV. VISION OF AURA-NMS COMMS ARCHITECTURE (SP CASE)



AURA-NMS Power and Communication System



AURA-NMS Communication System Model

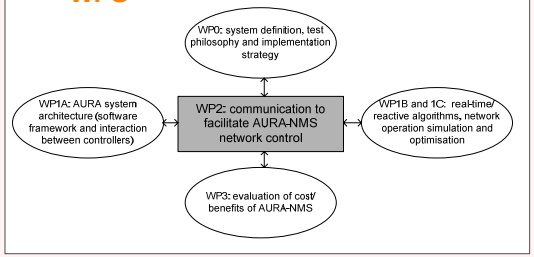
In the proposed autonomous regional active network management system, the AURA-NMS controllers based on COM600s are integrated in the substations of the power network. Under the AURA-NMS concept, all the data collected from the power network sites (both analogue and digital measurements) will be transmitted to the COM600s which have enhanced data processing and control functionalities. Only a small portion of data will be transmitted to the control centre for further processing.

All the COM600 controllers are inter-connected together and each COM600 shares a portion of data to other COM600s to perform the coordination control functions, etc. Also, each COM600 reports a portion of data to the control centre. This distributed communication architecture can be more efficient to facilitate the autonomous and regional active control of the power network.

In addition, there are some other issues relevant to the AURA-NMS communication infrastructure:

- Using the object-oriented common information model (CIM) for representing network data.
- Using the IEC 61850 as an interface between AURA controller and protection, control and monitoring devices in the substation.
- Using multi-agent system (MAS) technology for coordination among AURA-NMS controllers.

V. INTERACTION WITH OTHER WPS



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