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The evolution of EMS architecture in CSG

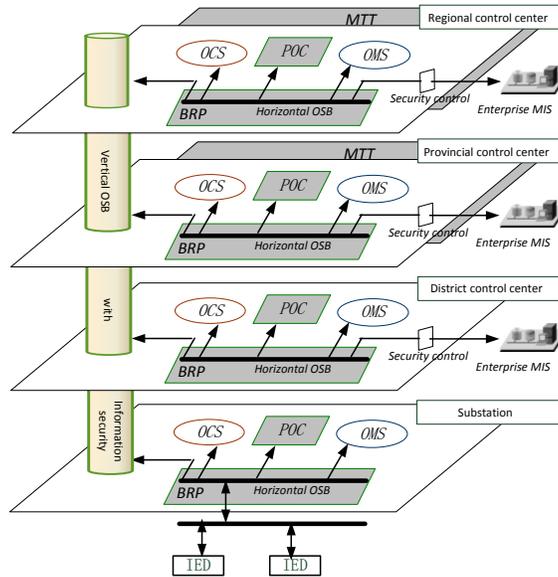
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Abstract

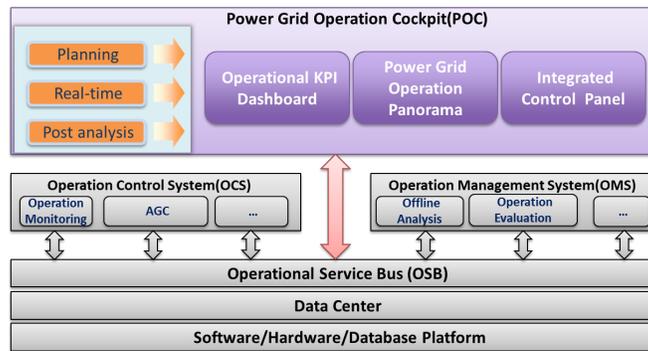
The presentation consists of three parts.

Firstly, there will be a brief introduction of the background. In this part, everybody can get a basic idea of the grid of CSG (China Southern Power Grid), in addition to the challenges we were facing in 2010. Although a large number of advanced applications have been developed and operated, the framework of EMS still follows the initial design, which is a tightly-coupled platform, i.e. independent systems are developed in each control center or substation of CSG for handling one or more emerging situations. Due to lack of coordination, it is difficult to share data or integrate functions around these isolated systems and, furthermore, without the support of adequate data, it is not easy to aware the grid situation quickly and to establish sound responses.

After that, the second part will give a detailed description of a brand new system architecture of OS2 (Operation Smart System), which was proposed to have an integrated architecture, an open platform, a flexible and standardized method for data sharing, and numerous intelligent functionalities. It is Service Oriented Architecture (SOA) based and loosely-coupled. OS2 of CSG is comprised of subsystems at all levels of control centers and substations. Each subsystem is divided into Basic Resource Platform (BRP), Operation Control System (OCS), Operation Management System (OMS), Power system Operation Cockpit (POC) for control centers or Substation Operation Cockpit (SOC) for critical substations and Mirror system for Testing & Training (MTT) only for high-level control centers. The overall architecture of OS2 is shown as follows.



POC is designed as the topmost functional module of OS2 and provides “one-stop” functionality for KPI monitoring, decision-making and control.



Based on a basic principle of “standardized development for new-built systems and upgrading for existing systems”, the new architecture has been applied in the design and development of the new-built systems for all control centers and substations in CSG.

It’s considered as the first revolution of EMS architecture and aims to provide a loosely-coupled architecture which supports data sharing and “plug and play”.

At the last part, we’d like to present the emerging issues that may lead to the second revolution i.e. a new architecture of EMS will be proposed for the future operation of power grid. One of the key issues is the integration of large-scale Renewable Energy Sources, and another one is the influence of the new economical pattern to the power companies, including power industry deregulation and digital economy in China. As a result of that, the control units will be much more distributed and flexible, and the number of units will expand quickly. New technologies, such as Cloud Computing, Edge Computing, Big Data and AI, will be adopted in the design of the next generation of EMS. A new architecture, called Cloud-Edge Coordination based Energy Ecosystem Platform, will be proposed.