ADMS (Advanced Distribution Management System) in Smart Grid

柯佾寬 博士
Yi-Kuan Ke, Ph.D.

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Smart Grid Solution

Global substation & feeder automation portfolio for Utilities

- Network consulting
  - Network expertise
    - (extension, reinforcement, integration...)

- Substation Automation
  - PACIS®
    - Substation Control Systems

- Feeder Automation
  - RTU, bay controller, fault detector

- Protection IEDs
  - Protection relays
    - 61850

Real time software suite for global grid management

- Distribution Management
  - Load, Volt/VAR control
    - Outage management

- Geographic Info Systems (GIS)
  - Life cycle asset management

- Smart Metering
  - Meter data control
    - Rollout & operations

- Substation Automation
  - Remote Terminal Units (IEC-61850)

Reliability & Efficiency

- Advanced grid management
- Integration of renewables
- Optimized network operations
- Safety & Security
Advanced Distribution Management System is unification of DMS, OMS, SCADA

- Real-time distribution management solution
- Monitors, analyzes, and controls changes to the network
- Provides operations, planning and optimization analytics
- Operates in both real-time and study modes
- Performs network analysis and reporting
ADMS System

ADMS Function List
- VVC (closed loop) / IVVO
- VSSM
- FLISR
- Load Flow
- Network Model
- Topology Analyzer
- ...

GIS
DMS
OMS
SCADA

ADMS

Smart AMI

Feeder Auto.
Sub. SCADA
Power Plant SCADA
Solar Power
Offshore Wind FARM
EV Charging
Integrated SmartGrid Solution

ADMS – functionality with list of power applications
SCADA and RTU provide open, secure operational control for critical grid elements

GIS optimizes asset management, saving money and resources

DMS analyzes, optimizes and automates the grid

OMS improves system reliability and reduces the ‘real cost’ of Service

AMI enable utilities and customers to work together to save energy

Network Solutions - Smarter Grid

(OMS—Outage Management System: including trouble call, fault detection, fault location, isolation and supply restoration, crew management and outage reporting.)
## Basic DMS = Infrastructure + Standard Modules

<table>
<thead>
<tr>
<th>Standard SCADA</th>
<th>Standard DMS</th>
<th>Standard OMS</th>
<th>Standard EMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>● OASys RT full license</td>
<td>● Accurate Network Model</td>
<td>● Trouble Calls</td>
<td>● Transmission network model</td>
</tr>
<tr>
<td>● Remote control, data acquisition</td>
<td>● Accurate State Estimation</td>
<td>● Incident Management</td>
<td>● State Estimation</td>
</tr>
<tr>
<td>● Alarms, Events</td>
<td>● Power Flow</td>
<td>● Crew Management</td>
<td>● Power Flow</td>
</tr>
<tr>
<td>● Tags, Trends</td>
<td>● Performance Indices</td>
<td>● Reporting</td>
<td>● Contingency Analysis</td>
</tr>
<tr>
<td>● Summaries</td>
<td>● Fault Calculation</td>
<td></td>
<td>● Short-circuit Analysis</td>
</tr>
<tr>
<td>● RT History</td>
<td></td>
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</tbody>
</table>
Advanced Modules

DMS LV
- LV Network model
- State Est./Load Flow
- LV Power losses
- LV Reliability
- LV short circuits

Planning DMS
- MTLF/LTLF
- Network planning
- Network Automation
- Network Reinforcement
- Optimal Capacitor plc
- DG planning

Optimization/Analysis DMS
- Network Reconfiguration
- VVO
- Short Circuit Analysis
- Relay protection
- Contingency Analysis
- Breaker/Fuses Capacity

DMS RT operation
- Switching validation
- Incident Mngmt (Fault Location, Isolation)
- Under Load Switching
- Feeder/Area Restoration
- NTLF/STLF
- Load/Phase Balancing
- Emergency support (Load Shedding, Voltage Red.)

Generators EMS
- AGC/ED
- ITS/ITE
- NTLF/STLF
- Load Shedding
- Renew. Power Forecast

Work Order Management
- Maintenance Scheduling
- Planned Outages Mngmt
- Incident Management
- Reporting

Advanced EMS
- Optimal Power Flow
- Equipm.Outage Schedule
- STLF
- Bus Load Forecast

DMS DR/DG Automation
- FLISR
- VVC (closed loop)
- DSDR
- Load Management
- DG Monitoring
- DG Dispatch

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Advanced Modules

Standard SCADA

Standard DMS

Standard OMS

Standard EMS

ADMS Infrastructure
ADMS Power Applications

Network Operation
- Performance Indices
- Fault Management
- Supply Restoration
- Large Area Restoration
- Switching Order Mngm.
- Load Shedding
- Temporary Elements
- Thermal Monitoring
- Low Voltage Analysis
- DG Management
- Dispatcher Training Simulator

Operation Planning and Optimization
- Volt/VAR Control
- Voltage Reduction
- Network Reconfiguration
- Near Term Load Forecasting
- Short Term Load Forecast
- Load Management
- Demand Response Management

Network Analysis
- Energy Losses
- Reliability Analysis
- Operational Losses
- Fault Calculation
- Relay Protection
- Breakers/Fuses Capacity
- Contingency/Security Assessment
- Motor Start
- Harmonic Analysis
- Historian analysis/reports

Network Development Planning
- Load (long-term) forecasting
- Network Planning
- Network Automation
- Capacitor Placement
- Network Reinforcement

Mandatory (resident) DMS functions
- Network Model
- Topology Analyzer
- Load Flow
- State Estimation
Smart Generation to integrate Renewable safely and efficiently
Smard Grid to Integrate Solutions

Flexible Distribution
- HV/MV – MV/MV – MV/LV
- Consulting
- Switchgear
- Protection
- Metering
- Distribution Grid Automation
- Substation Automation
- Feeder Automation
- SCADA

Demand Response
- Consulting
- Aggregation

Residential energy management
- Circuit Protection
- EV charging spots

Power Management
- IT Management & Secure Power

Building Management & Security Management
- Process & Machine Management
- EcoStruxure integrated architectures
- Performance Contracting
- EV charging spots

Efficient Home

Efficient Enterprise

Smart Generation
- In-plant MV, LV, SCADA* & Automation
- Services & Retrofit

Renewable farms
- Renewable installations
- Renewable energy integration

* SCADA: Supervisory Control And Data Acquisition
Feeder Solutions

**MV Feeder Automation**
- Reduce Outage Time
- Reduce cost of curative actions
- Reduce Installation, operation & maintenance costs

**LV management integration**
- Monitor LV power supply quality
- Reduce technical losses of the transformer
- Monitor the load & control the peak load
- Reduce the transformer fault

**Smart Metering integration**
- Reduce tech. and non technical losses on LV network
- Ease LV network maintenance & evolution
- Reduce outage time on LV network
- Keep LV network stable with DG proliferation
A Self Healing Grid is a grid where, in case of a fault, the disturbed part of the grid automatic will be isolated and the healthy part stays energized or will be energized automatically. Customers can be affected by an outage time which is very short.

- It’s divided into three ranges,
  - Overhead loop with recloser
  - Under ground with switches
  - Under ground with CBs

- Main function
  - Connection with the SCADA
  - Switches, CBs, Reclosers
  - Controllers
  - Fault Detection & protection units
Different architecture for MV/LV solutions

FRTU “all in one box”
- Easy installation for existing network, with repetitive RMU and reclosers
- Pre-configuration, pre-tested to limit the engineering cost
- Easy retrofit of existing substations

Vs.
Distributed, modular embedded IEDs
- Easy installation with new switchgears
- Modular and plug and play architecture
- Local network: flexible to future Smart Grid evolution
- Intelligent circuit breakers and switchgear with smart sensors
- LV monitoring
- Substation monitoring

PLC connection

Smart meters
Substation Automation Offering

**HV/MV SS**
(1 Transfo + 6-16 MV feeders)

**HV/MV SS**
(1-2 Transfos + 6-16 MV feeders)

**HV/MV SS**
(>2 Transfos + >16 MV feeders)

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**Substation Automation Offering**

- **100 – 500+ IOs**
  - IEC61850 & legacy IEDs + local HMI with SCADA

- **500 – 5000+ IOs**
  - IEC61850 & legacy IEDs + local HMI

- **> 5000 IOs**
  - Multi-ring+ Redundancy + IEC61850 & legacy IEDs + local HMI
Network Model (NM):

Topology Analyzer (TA):

Load Flow (LF):

State Estimation (SE):

Performance Indices (PI):

FLISR (Fault Location, Isolation and Supply Restoration):

Element Isolation (EI):

Supply Restoration (SR):

Switching Order Management (SOM):

Temporary elements (TE):
Topology Analyzer (TA) :

*Topology Analyzer* (TA) provides an accurate insight into the actual topology of the distribution network (normal or disturbed). Topology Analyzer analytical application (TA) is a general tool for various topology analyses of the distribution network represented in form of graphs. Main functionalities are finding a certain element of the network, determining and marking supply paths of network elements.
Load Flow (LF) application is used for the calculation of steady states of radial and weakly meshed primary MV power grids (networks), as well as state of secondary LV power grids. The network state consists of: complex voltages, currents, flows of real and reactive power, voltage drops, losses, etc. Usually, among all state variables.
Performance Indices (PI)

*Performance Index.* (PI) is used for detection of violations, alarm states, reports of the overall performances of the network state (power injection, losses, consumption, voltage situation and deviations, overloads, etc.). The PI application is used to provide insight into network state and to offer objective assessment whether some changes that improve network operation or not are needed.
FLISR (Fault Location, Isolation and Supply Restoration) presents collection of tools used for detection, location, isolation of faults and restoration of supply for all de-energized customers. FLISR can be used in manual semi-automatic and automatic mode. Each of applications which can be used as part of FLISR is also available as a separate application.
Supply Restoration (SR) used for determining an optimal plan of switching actions for restoring supply on the de-energized part of distribution network.
Volt/VAR Optimization is one of the basic applications used for control in distribution network operation. As such, it allows management of voltages and reactive power flows in distribution network. VVO, as a part of ADMS, operates in centralized way on the whole considered sub-network (HV substation or network supplied from a HV/MV transformer), rather than on the local level as it is possible with local controllers.
Optimal Network Reconfiguration (NR)

Network Reconfiguration (NR) determines the optimal radial distribution network configuration (locations of normally open tie switches) regarding to optimization objective (minimal active power and energy losses; maximal reliability; best load balance or best voltages profiles). Reports about improvement of operation performances and reduction of losses are provided, as well as switching sequence for transfer from existing to optimal state (graphical and listing).
Thank You.

Raymond.ko@schneider-electric.com