

# Distribution Grid Management

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# Topics

## ❑ Traditional Distribution System

- ❖ Physical Construct
- ❖ Management of Electrical Grid

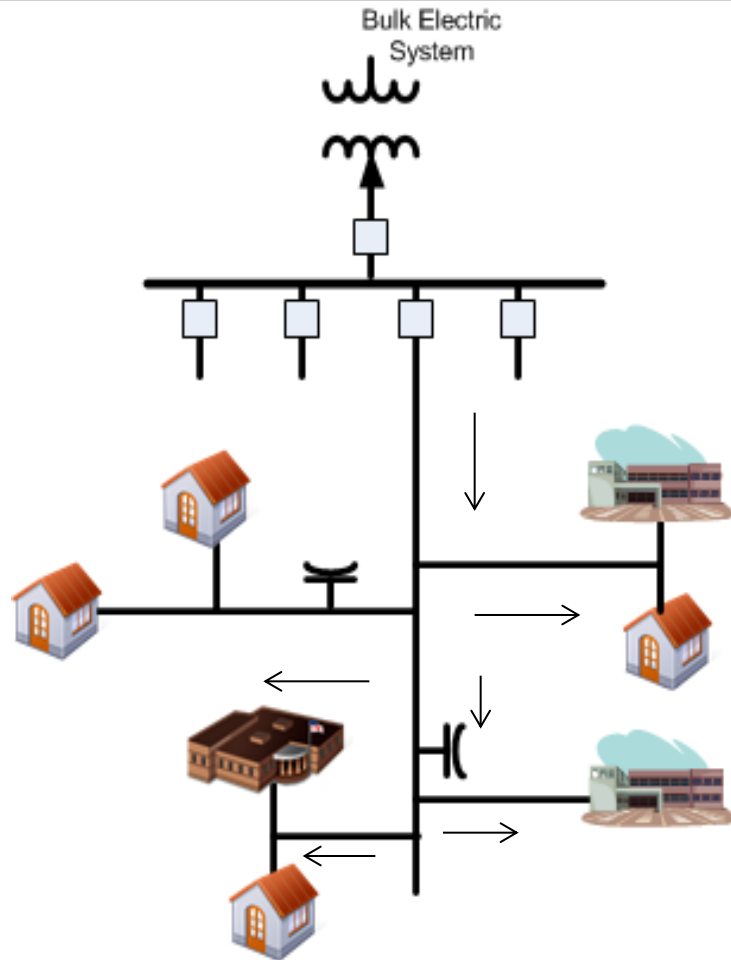
## ❑ Emerging Influences to the Distribution System

- ❖ Distributed Energy Resources
- ❖ Regulatory / Customer
- ❖ Corporate

## ❑ Managing the Distribution System in the future- Grid Management

- ❖ Intelligent Field Devices
- ❖ Advanced Distribution Management System (ADMS)
  - *IVVO*
  - *FLISR*
- ❖ Operational Resources

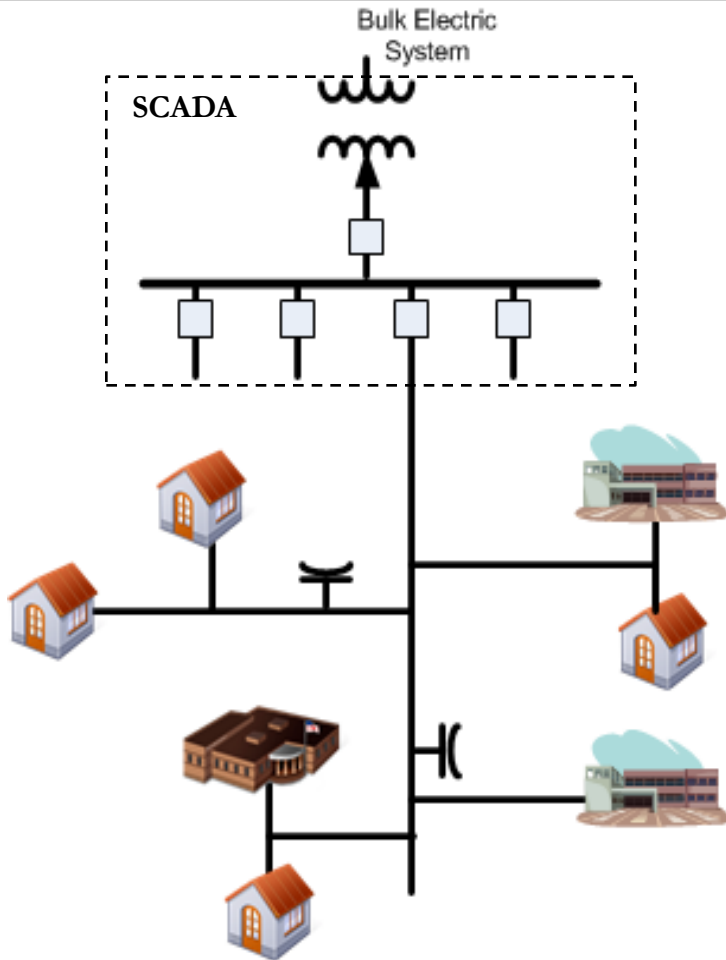
# Traditional Distribution System – Physical Construct



## Traditional Distribution System - Characteristics

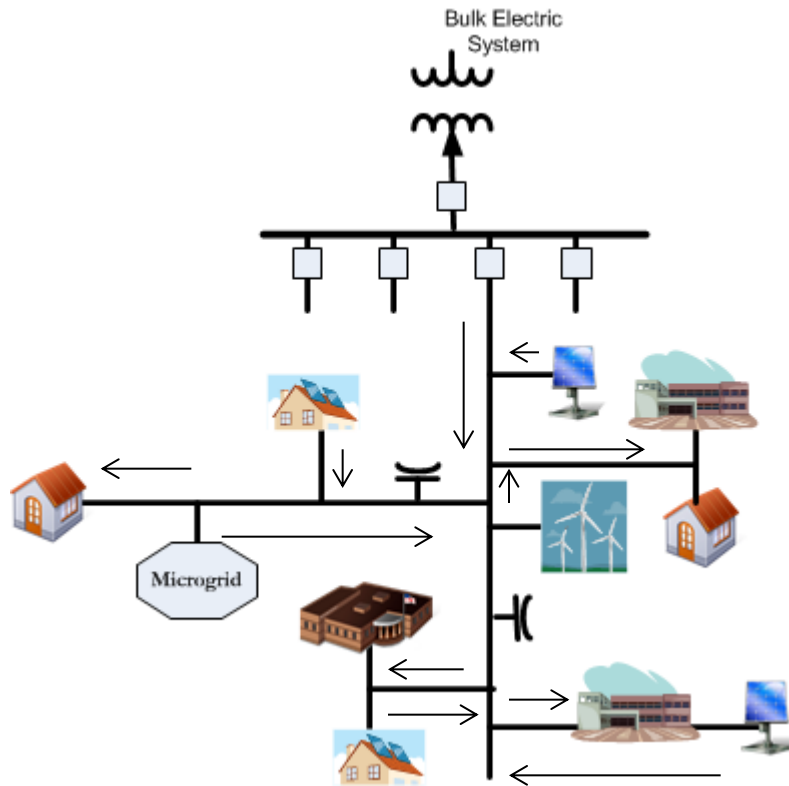
- ❑ One-direction power flow
- ❑ Typically radial feeders
- ❑ Stand-by generation at customer site

# Traditional Distribution System - Management



- SAIDI/CAIDI Reliability Targets
- Outages
  - ❖ SCADA for Feeder and Substation level events
  - ❖ Customer Call for tap level and below
- Large workforce to manually manage grid.

# Emerging Influences to Distribution System – Distributed Energy Resources (DER)



□ Solar

❖ *Rooftop*

❖ *Solar farms*

□ Wind Generation

□ Micro-Grids

Issues:

❖ *Voltage Regulation*

❖ *Bi-Directional power flow*

# Emerging Influences to Distribution System – Regulatory / Customer / Corporate

## □ Regulatory

- ❖ Accountable for MAIFI – Momentary Outages
- ❖ Customer Credits
- ❖ Environmental pressures

## □ Customer

- ❖ Power Quality
- ❖ Reliability

## □ Corporate

- ❖ Safety
- ❖ Revenue



# Managing the Distribution System – Grid Management

Solution to electrical influences:

## “Grid Management”

- ❖ Intelligent Field Devices
- ❖ Central Control of Grid functions
  - *Advanced Distribution Management System (ADMS)*
- ❖ Operational Resources managing the Grid

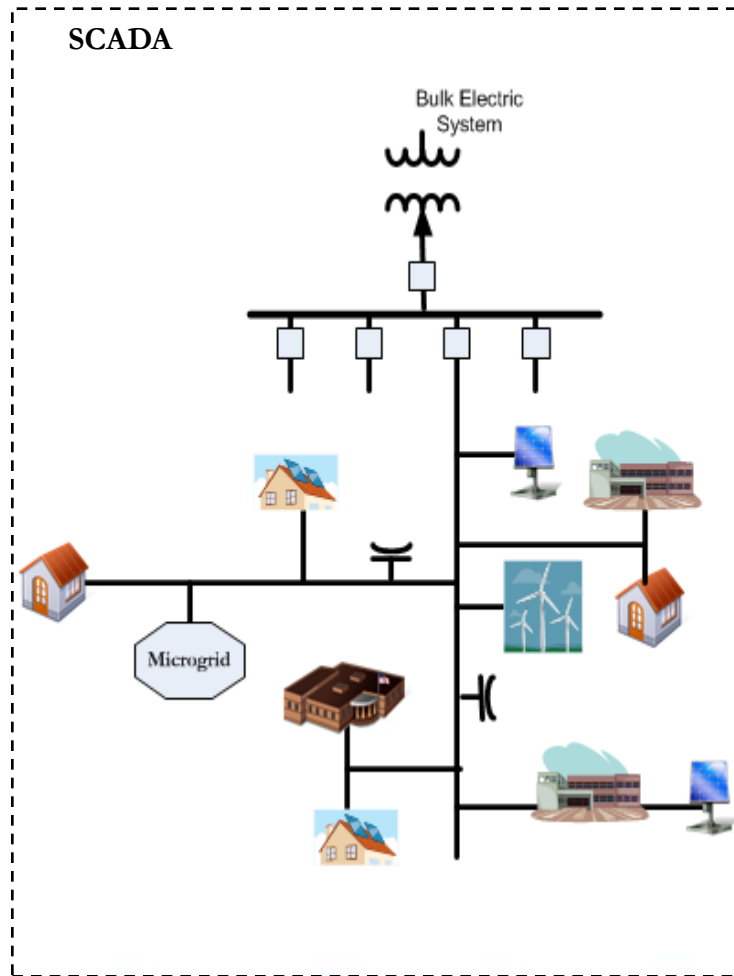
# Grid Management - Intelligent Field devices

## Examples of Intelligent Field Devices:

- ❑ Automated Field Switches
  - ❖ SCADA (Intelliteam) Switches
  - ❖ Intellirupter - recloser
- ❑ Remote Fault Indication / Power Flow Sensing devices
- ❑ Remote Control of:
  - ❖ Capacitor Banks
  - ❖ Field Regulators
  - ❖ LTC's
- ❑ AMI (Advanced Metering Infrastructure) Meters at customer sites



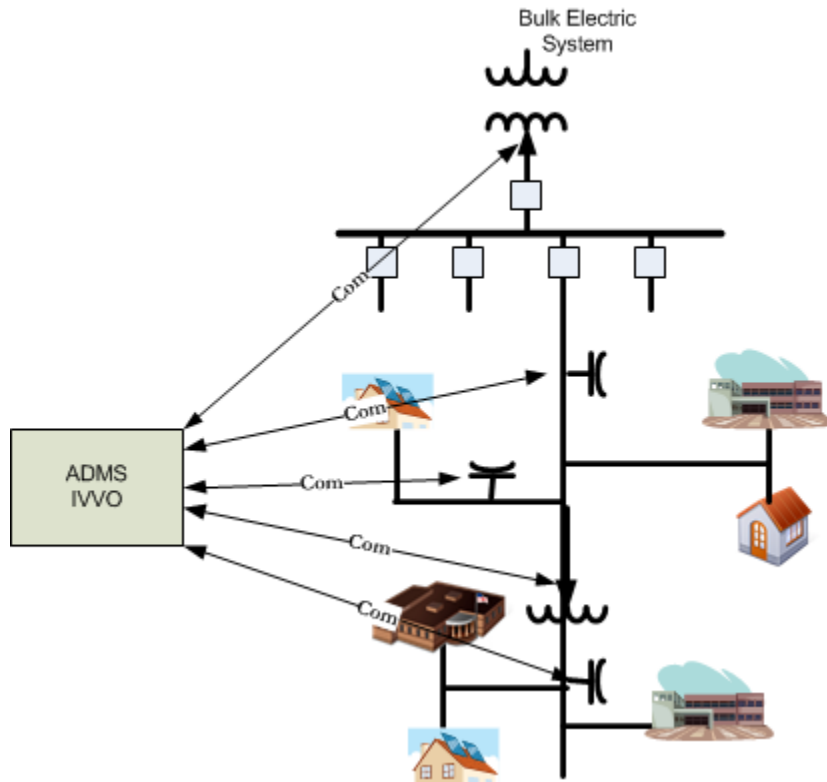
# Grid Management – Advanced Distribution Management System (ADMS)



## □ ADMS

- ❖ Distribution SCADA
- ❖ Distribution Network Impedance Model
- ❖ Distribution Network Topology processor
- ❖ Unbalanced Load Flow / Load Allocation
- ❖ State Estimation

# Grid Management – ADMS IVVO



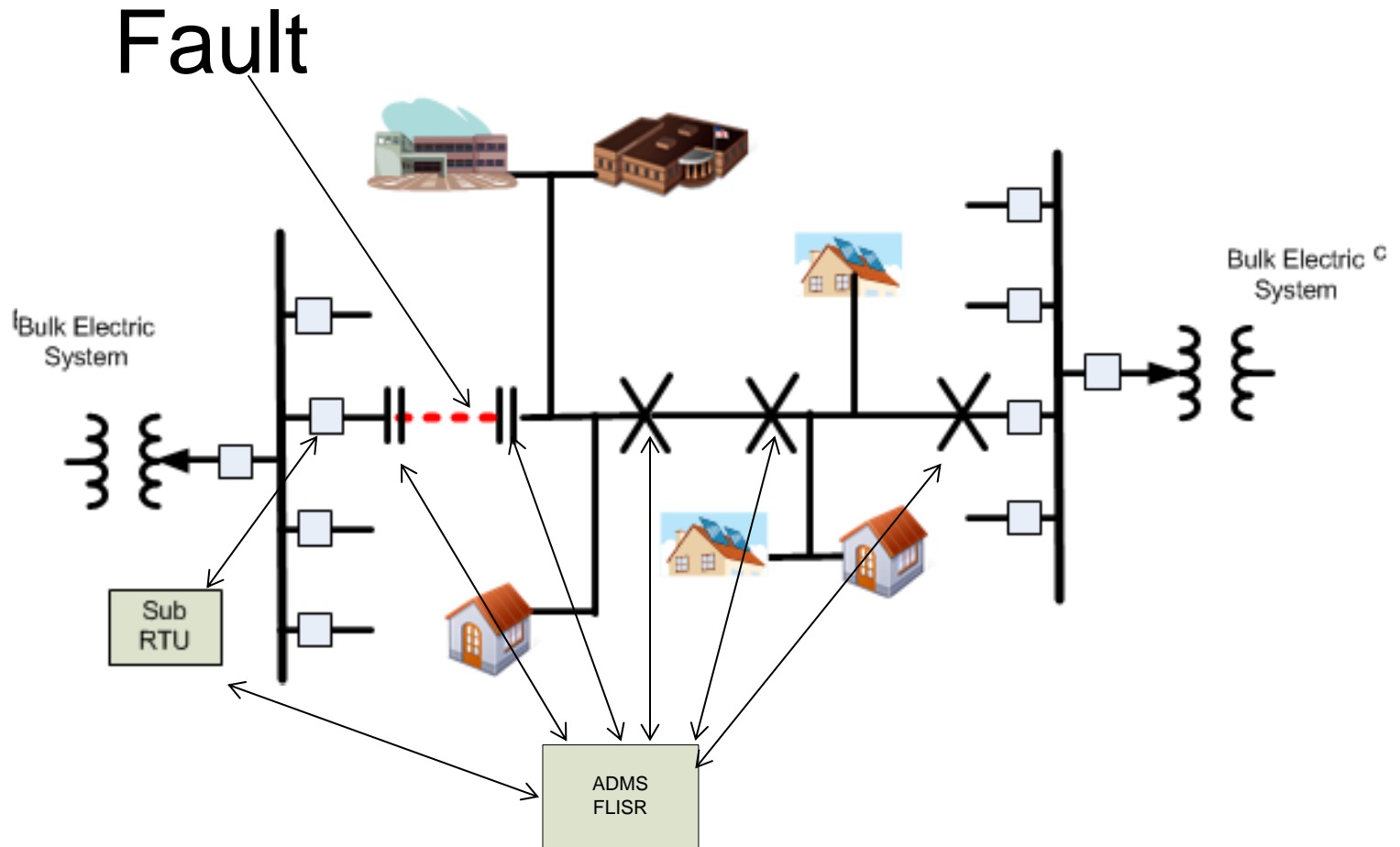
## □ ADMS – Integrated Volt/Var Optimization (IVVO)

- ❖ Manage voltage/var flow on feeder/substation bus
- ❖ Central control
  - *Transformer LTC's*
  - *Feeder Capacitors*
  - *Feeder Regulators*
- ❖ Operational Modes:
  - *Demand Reduction*
  - *Voltage / VAR Optimization*

# Grid Management – ADMS FLISR

- ❑ ADMS – Fault Location Isolation and Service Restoration
  - ❖ Model Based (Impedance model built from GIS)
  - ❖ Fault data sent/polled automatically from RTU/Relay
  - ❖ Fault location identified by applying fault magnitudes to dynamic impedance model
  - ❖ Identify/control devices for isolating fault
  - ❖ Identify/control devices to restore service to customers

# Grid Management – ADMS FLISR example



# Grid Management – Communications

## □ Communications

- ❖ Point to Point
- ❖ Mesh
- ❖ Fiber
- ❖ Increased criticality of communication availability
  - *IVVO*
  - *FLISR*

# Grid Management – Organizational Resources

## □ Grid Management Organization

- ❖ Engineering/Technician resources
  - *ADMS System availability*
  - *Field Device availability*
  - *Communications availability*
- ❖ Information Technology / Operations Technology Group
  - *ADMS System accurate and available*
  - *Distribution Network Model Accuracy*
- ❖ Real-Time use of the ADMS functions for Operations decisions.
  - *Control Center Personnel*
  - *Risk Assessment*
- ❖ **Training**

# Conclusion – Grid Management

## □ ADMS - Distributed Energy Resources

- *Power-flow analysis displayed on system model on a tap, feeder, or substation level.*
- *Distribution SCADA enables state estimation for improved power-flow accuracy.*
- *Leverage weather, model, and DER characteristics to predict/ understand system performance (bi-directional power flow and hidden load)*

## □ Reliability – Regulatory and Customer Expectation

- *Automated Fault Locating*
- *Automated FLISR – Central control and Field based*
- *Improved momentary outage identification*
- *Model based load flow analysis to identify system issues*

## □ Corporate

- *Reduce Losses / Leverage voltage for capacity*
- *Safety – Improved system awareness and decision-making*