2010 and Beyond, a new Odyssey for the “Grid”

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Overall Presentation Summary

- General comments
- How communications have been evolving
- Connectivity challenges
- Smart Grid
- Example of Hydro Quebec evolution
- The Challenge
- Conclusion

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A General Statement

Why talk about an Odyssey instead of using the Term “Smart Grid”?

Simply stated, we are embarking on changing the way we have worked for decades, we will be using technologies and new approaches to plan the next evolution towards an integrated and rapidly evolving Grid. What we plan/decide today will be with us for at least the next 20 years and hopefully longer.

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A General Comment

In this discussion we will not focus on costs in regards to Smart Grid projects, since this seems to have become a very passionate discussion out of the realms of our focus on technological changes and challenges which are facing us

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A Few Statements on "SMART GRID"

EPRI

> « Enhancing existing assets through automation »

CEATI (Canadian Electricity Association)

> « Increase understanding of the distribution system to improve decision making »

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Defining the Odyssey

To understand our new challenges, we have to understand were we came from and where do we want to evolve to in moving towards the future!

The next few slides will show graphically how we have evolved…..

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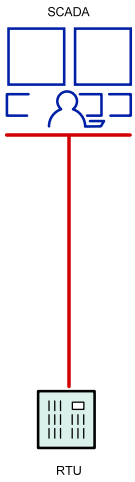
At the beginning - IED Integration



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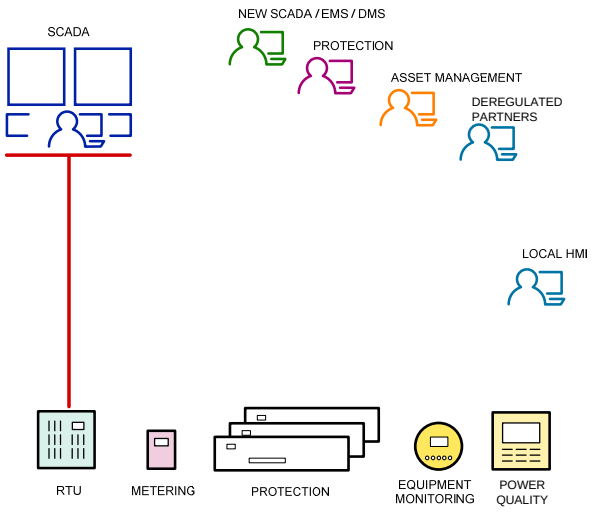
Then New IEDs and users…



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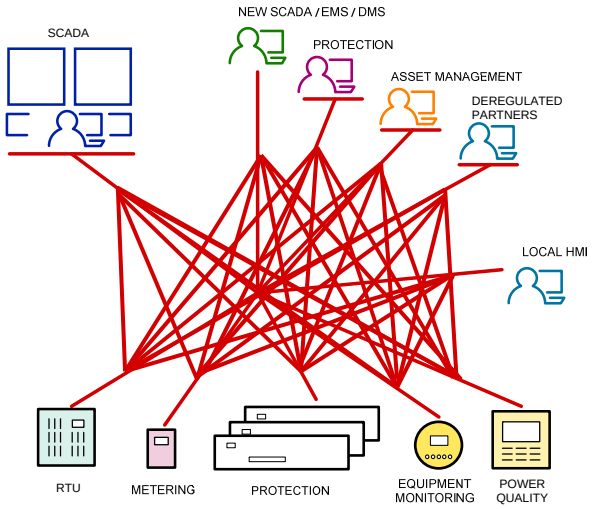
…lead to Limitations



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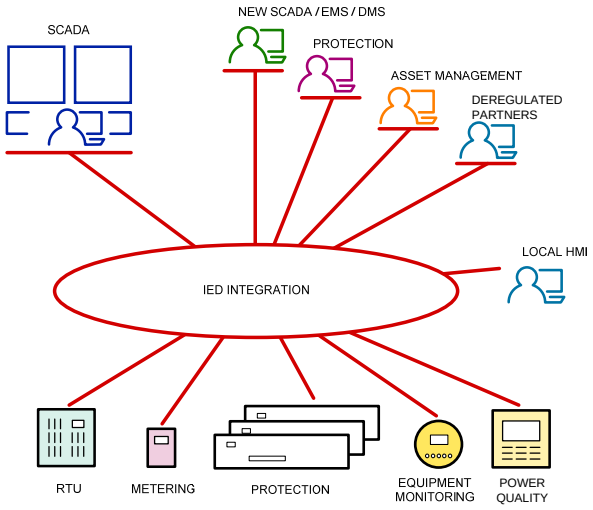
Integrating the Information for many Systems



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Equipment connectivity challenges

The “grid” currently contains a large number of IEDs and legacy equipment

- From many vendors
- That use different protocols
- Different types of connections - RS-232, RS-485 and LAN, Wireless, Power Line Carrier, etc…
- With many data types and data formats
- With little or no security
- Without spontaneous event(s) reporting
- Lacking connectivity to multiple clients

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An Example of connectivity challenges

This example is from a Hydro-Quebec ongoing Distribution Project

- Currently have 50,000 IEDs connected to a new central system;
- Communication is via numerous different technologies depending on the location of the devices geographically;
- Local protocols are currently very varied depending on IEDs;
- Data communications to central system is via DNP3;
- All IED information goes through data concentrators either at the pole-top(s) or at a local substation.

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From Dumb to Smart

Smart Grid = Existing "Dumb Grid"

+ More Equipment
- Generation
- Storage
- Regulators
- Capacitor Banks
- Breakers, Reclosers
- Switches
- CT, PT, Sensors
- Protection
- PMUs
- PDCs
- Meters & D/R
- Communications
- Etc…

+ Smart Applications
- SCADA
- EMS/DMS/OMS
- Dashboards
- Data Historians
- ----------
- Monitoring
- FISR
- IVVC
- DG/Load Mgmt
- Etc…

+ More Information
- Network Topology
- Equipment Info
- Network Data
- Customer Data
- Operational Settings
- Weather Data
- Historical Data
- Etc…

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The challenges of our new Odyssey

- Overwhelming?
  - Will it happen?
  - Will it work?
  - When?
  - Will it be manageable?
  - Is reliable migration possible?
  - How does it tie in with operations (SCADA, DMS, OMS, …)
  - Where does one start?
  - How far does one go?
  - Can solutions be scalable (Pilot vs Full deployment)?

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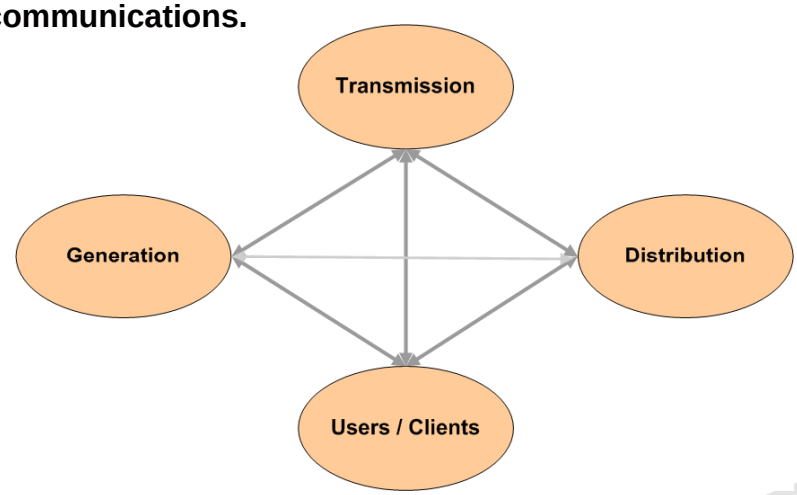
Smart Grid a simplistic view

Going to the next step and tying many different systems together by expanding our inter-systems communications.



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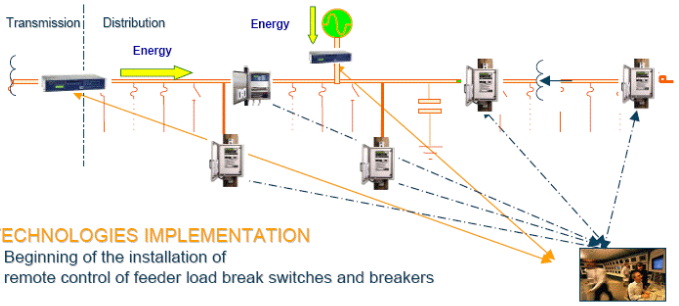
How a Utility is moving forward

The next few slides will show how a utility is moving forward to a Smart Grid context and its overall roadmap until 2015 and beyond.

Distribution Network 2006 - 2007



TECHNOLOGIES IMPLEMENTATION
- Beginning of the installation of remote control of feeder load break switches and breakers

INTERNAL DEVELOPMENT
- Voltage control
- Fault location

STUDIES
- Telecommunication architecture
- Network information acquisition and management
- Distribution capacitors optimisation

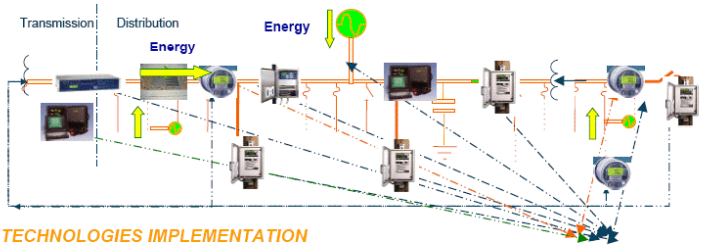
Operation Center SCADA

Existing remote control

New remote control

Hydro Québec Distribution

Distribution Network 2007 - 2010



TECHNOLOGIES IMPLEMENTATION
- *Addition of sensors for voltage control and fault location*
- *Gathering of information from remote control cabinet*
- *Addition of DER LV net metering*
- *Power Quality qualification*
- *Intelligent underground equipment*

Distribution Automation Program undergoing

INTERNAL DEVELOPMENT
- Telecommunication architecture
- Intelligent maintenance system

STUDIES
- Automatic network reconfiguration
- Data structure

SCADA, Maintenance, Planning…

Hydro Québec Distribution

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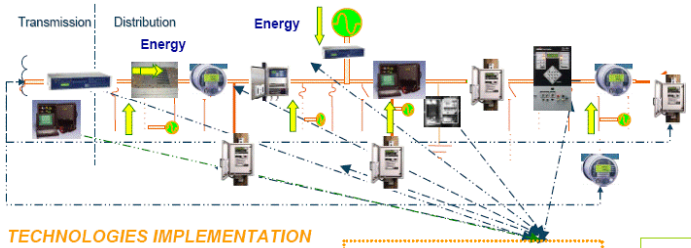
Distribution Network 2010 - 2015



TECHNOLOGIES IMPLEMENTATION

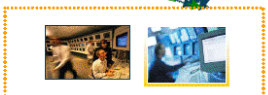
- *More DER on the distribution grid*
- *Automatic reconfiguration*
- *Voltage regulator control*
- *Capacitors control*

INTERNAL DEVELOPMENT

- Telecommunication architecture
- Intelligent system of predictive maintenance

STUDIES

- Automatic reconfiguration with DER (micro islanding)
- Demand side management



Distribution Automation Program completed

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Hydro Québec Distribution

12 Distribution Strategic Planning May 2006

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By 2015 Hydro-Quebec is seeing a broader use of 61850 for communication between devices.

Will this solve the overall challenge in meeting a Smart Grid?

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Would this help?

Some have been saying that creating a Service-Oriented Architecture would provide a means of meeting the general Smart Grid objective (ease of interoperability).

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The Challenge

The ultimate goal would be to make our work easier from the following perspectives (at least):

- Engineering
- Operations
- Maintenance

This could be accomplished by having the systems capable of identifying their surrounding equipment and adjusting themselves to communicate automatically or with very little configuration requirements with its new environment.

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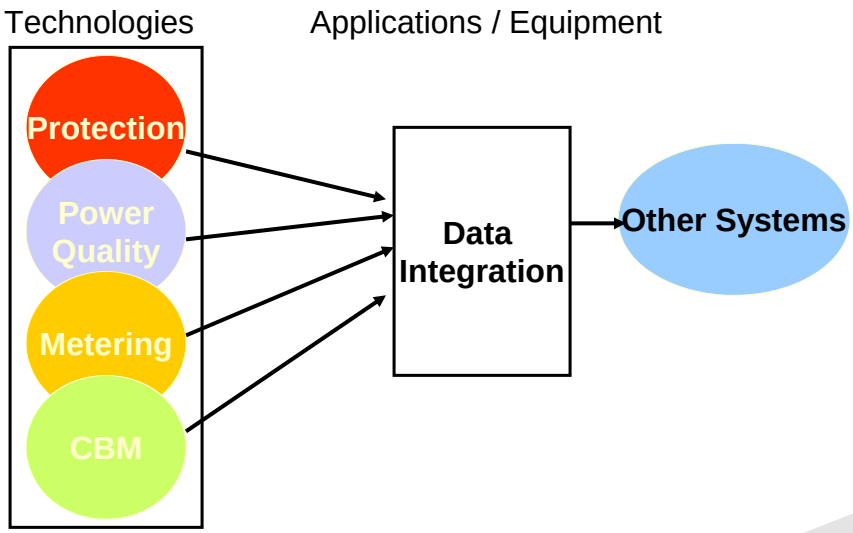
An Interim solution



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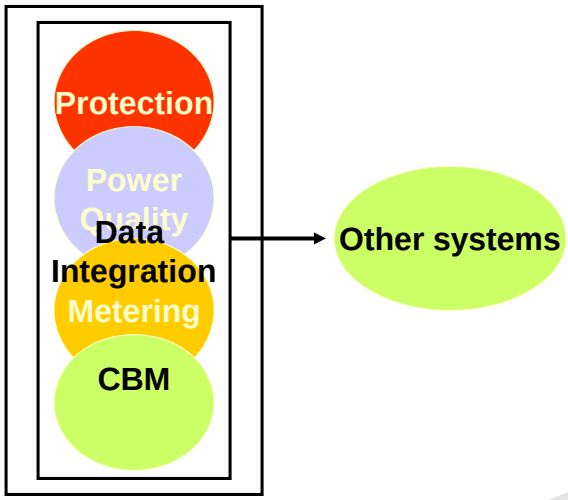
Have the data integrated in the equipment – Ideal Solution



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Conclusion

Distribution Automation and dynamic protection are the first steps in the evolution of an intelligent distribution & transmission network, which is inherent to the overall Smart Grid general concept.

Working groups must evolve integrated standards for Distribution Automation and dynamic protection concepts. This will help the industry on its road to an intelligent grid and will help-us all meet our long-term goal of having reliable systems that will meet utilities requirements over a long time period.

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Thank you!

Any Questions?

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References

Hydro-Quebec – Distribution system Automation Roadmap 2005-2020, report # 30012-05-044-R January 2006

Georges Simard & Denis Chartrand

Hydro-Quebec – Distribution Automation Vision and Roadmap May 2006

Georges Simard