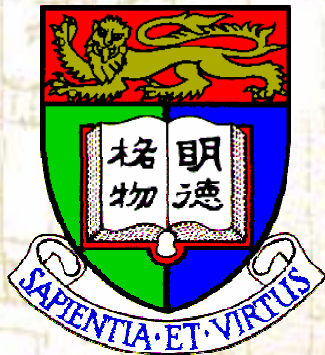


Transmission Conference
December 15, 2004, Pittsburgh

Transmission Operation: Time for Paradigm Shift?

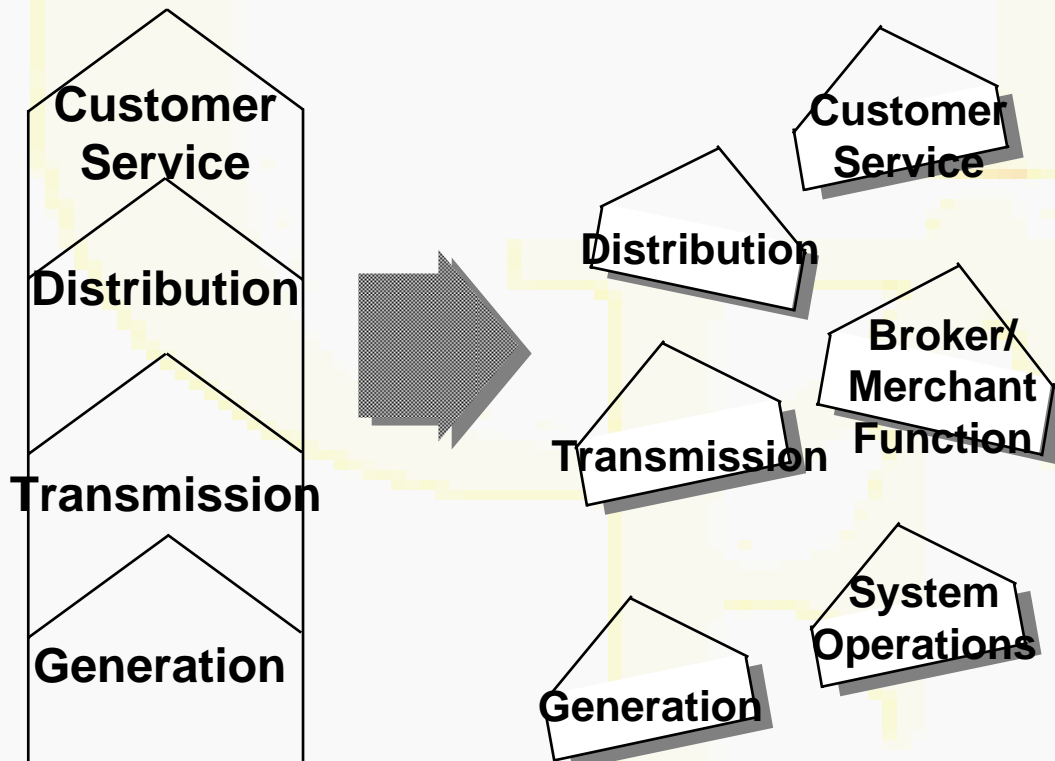


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Restructuring

Unbundling



- Generation competition
- Transmission open access
- Customer choice

Transmission Operation

- Traditional practice
- Congestion management
- ...
- ...

Is the traditional transmission operation evolved for the vertically integrated monopoly compatible to the restructured industry?

Old Paradigm

- Philosophy
 - » Preventive control
 - » (n-1) criterion
- Operational planning
 - » Setting limits
 - Physical
 - Stability,
- Real-time operation
 - » Security-constrained dispatch
 - » Contingency analysis and re-dispatch

Justification

- (n-1) criterion
 - » Obligation to serve
- Preventive control
 - » Reliability justification for capital investment
 - » Cost redistribution within a company
 - » Technology not possible for post-contingency control

An aerial night photograph of a city, showing a dense grid of lights and a prominent power plant tower with a glowing top. The text is overlaid on the image.

Prediction:

Blackout will happen again.

old approach

Can blackout be avoided?

Yes.

alternative approach

August 14, 2003 blackout happened.

Load Shedding

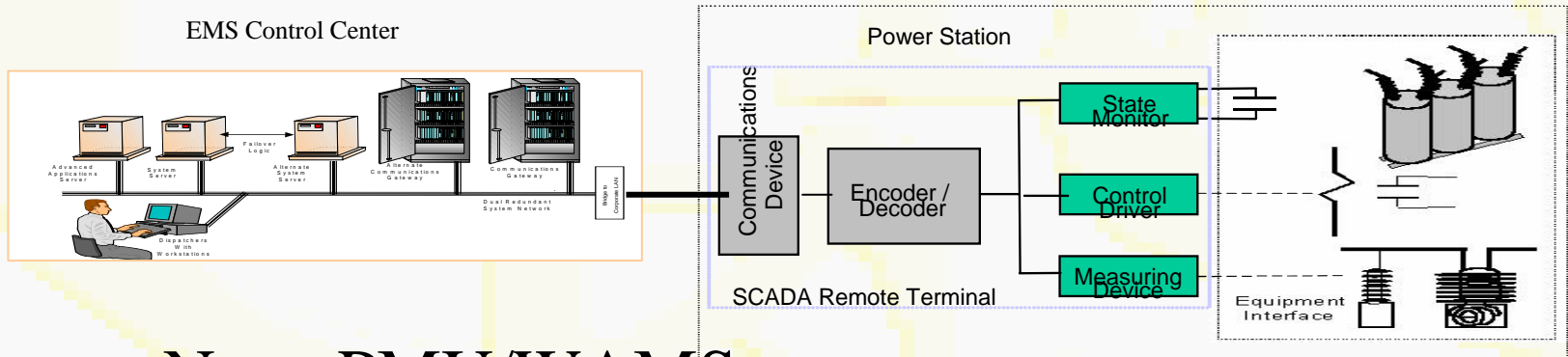
- Power balance
 - » Fundamental physical law
 - » Spatial and temporal
- Power imbalance causes
 - » Overload
 - » Instability
- Control strategy
 - » Remove imbalance
- Protective relays disconnect
 - » Generators
 - » Transmission lines
- Cascading outages result in blackout
- Load shedding is the most effective measure for blackout prevention

Alternative Approach

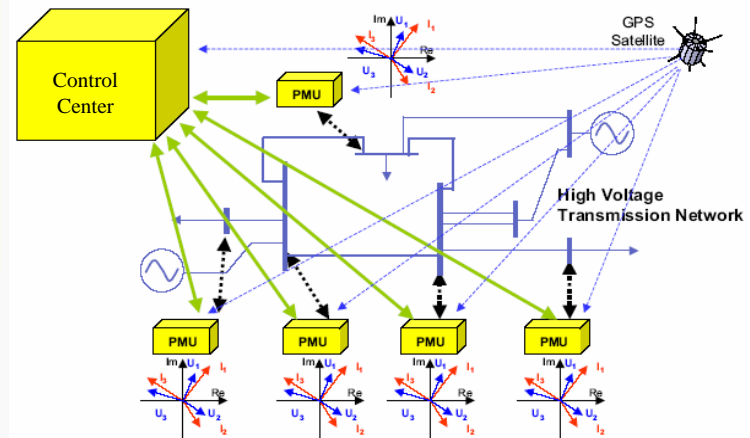
- Value of service (load demand)
- Preventive control = \$\$
 - » Supply-side measures
- Load shedding = \$\$
 - » Demand-side measures
- Value balance
 - » Stochastic
- Post-contingency control

Feasibility (1)

- Post-contingency control
 - » Control center: RTU/SCADA



- » New: PMU/WAMS



Feasibility (2)

- Load shedding
 - » Traditional: Under-frequency, under voltage
 - » New: Direct load control
- Value of service
 - » Interruptible load
 - » Priority service

Conclusion

- The philosophy underlining traditional transmission operation is rooted in an industry that is a vertically integrated monopoly.
- A fresh look at the transmission reliability practice seems warranted.
- We propose a new approach based on:
 - » Value of service
 - » Post-contingency control
- Post-contingency control is on the verge of being technically feasible. There were programs on the value of service.

Thank You



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