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# NYISO – Selected Topics

Dejan Sobajic

*New York Independent System Operator*

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# NYISO – Selected Topics

**Dejan J Sobajic**

*New York Independent System Operator  
Technical Advisor*

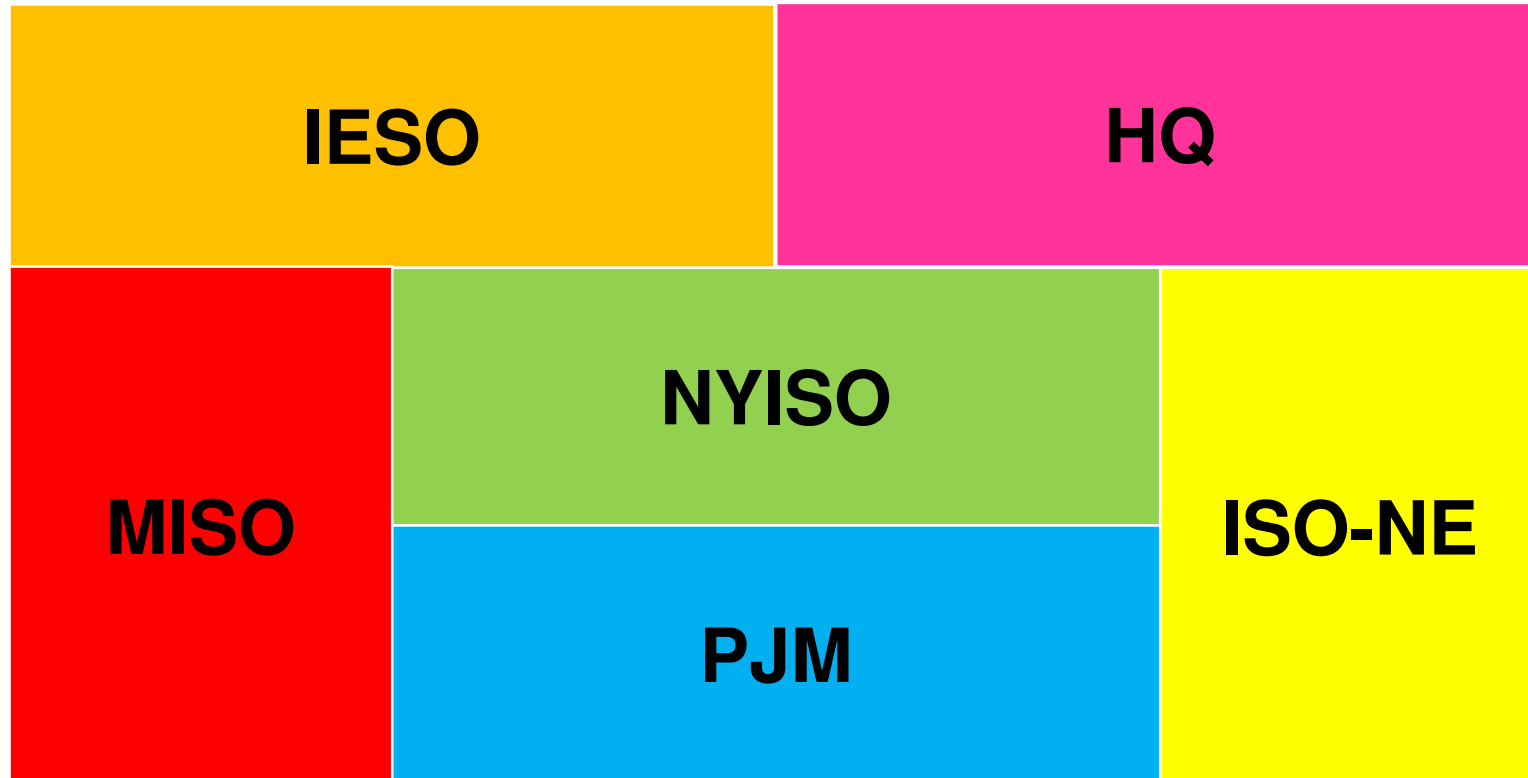
# Outline

- ◆ **Wide area (broader) regional markets**
- ◆ **Wide area transmission planning**
- ◆ **Wide area monitoring of real-time system behavior**
- ◆ **Operator's Situational Awareness**

# Markets

- ◆ Improved efficiency of electricity exchange in the region
  - *Option 1 – Market Solutions (market modeling, interchange optimization,....)*
  - *Option 2 – Physical solutions (coordinated PARs, ATC/AFCs,...)*
  - *Option 3 - ISO Virtualization*
  
- ◆ Real time pricing - demand response opportunities
  
- ◆ Integration of renewables
  - *Volatility and uncertainty of renewable resources*
  - *Regulatory and market incentives in support of renewables*
  - *Maintaining market competitiveness*
  
- ◆ Market power assessments under uncertainty

# ISO virtualization



Necessary Condition: Single System Model  
Issue: Process Convergence

# Transmission Planning

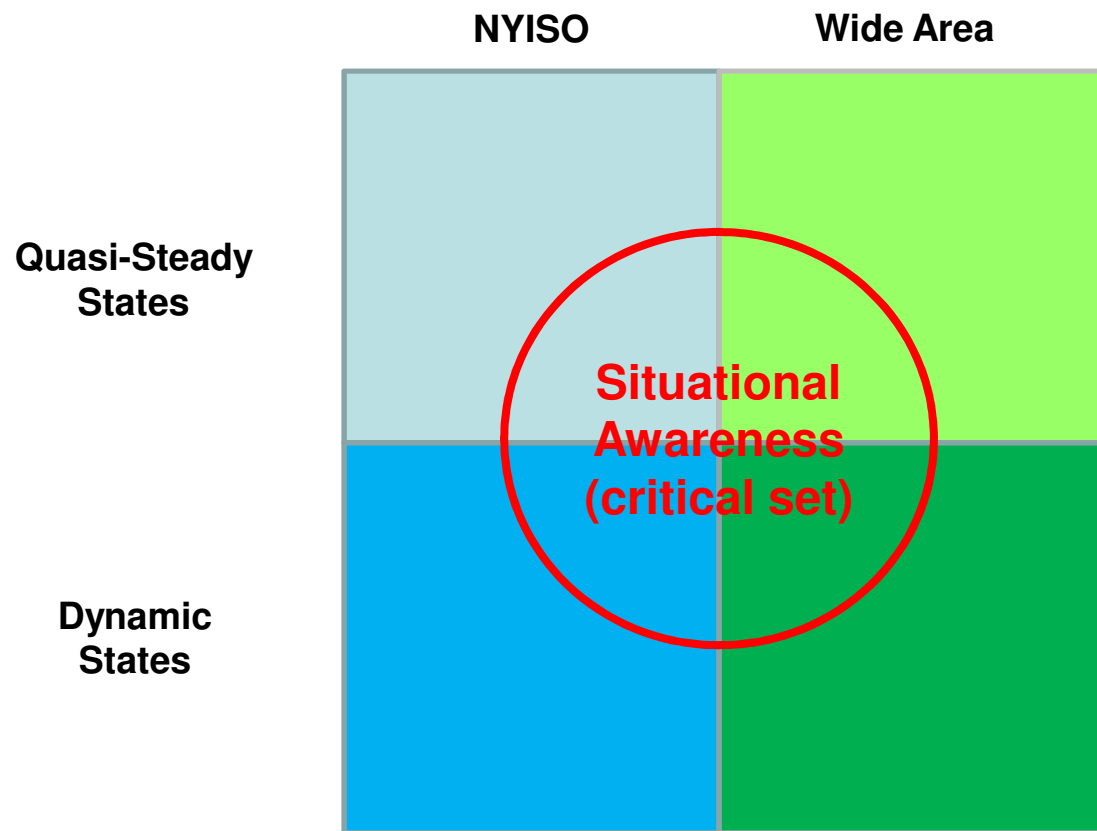
- ◆ Wide area analysis tools
  - ◆ *Use of dynamic phasors*
- ◆ Calibration of Dynamic NYCA System Models (DOE ARRA)
  - *Prerequisite for analysis and synthesis of wide area real time system controls*
- ◆ Long-term adequacy of market-driven bulk power systems
  - *Impact of real time operations strategies on adequacy planning criteria*
  - *Dynamic system modeling and analysis based on the first principles and real time system measurements.*
  - *Coexistence of load forecasting and demand response*
- ◆ Techno-economic congestion assessment studies
  - *Risk-based reliability assessment with/without real time controls*
- ◆ Analysis and design of real-time enabled relay coordination infrastructure

# System Operations

- ◆ Large scale system monitoring (multi ISO; 110kV)
  - *real time system characterization*
    - measurement-based & model-based (what-ifs)
  
- ◆ Wide area security assessment
  - *WA state estimation & contingency analysis*
  - *WA voltage stability assessment*
  - *Areas of responsibility & observability*
  - *Coordinated emergency procedures*
  
- ◆ Human factors
  - *situational awareness – individual awareness, shared awareness*

# Situational Awareness

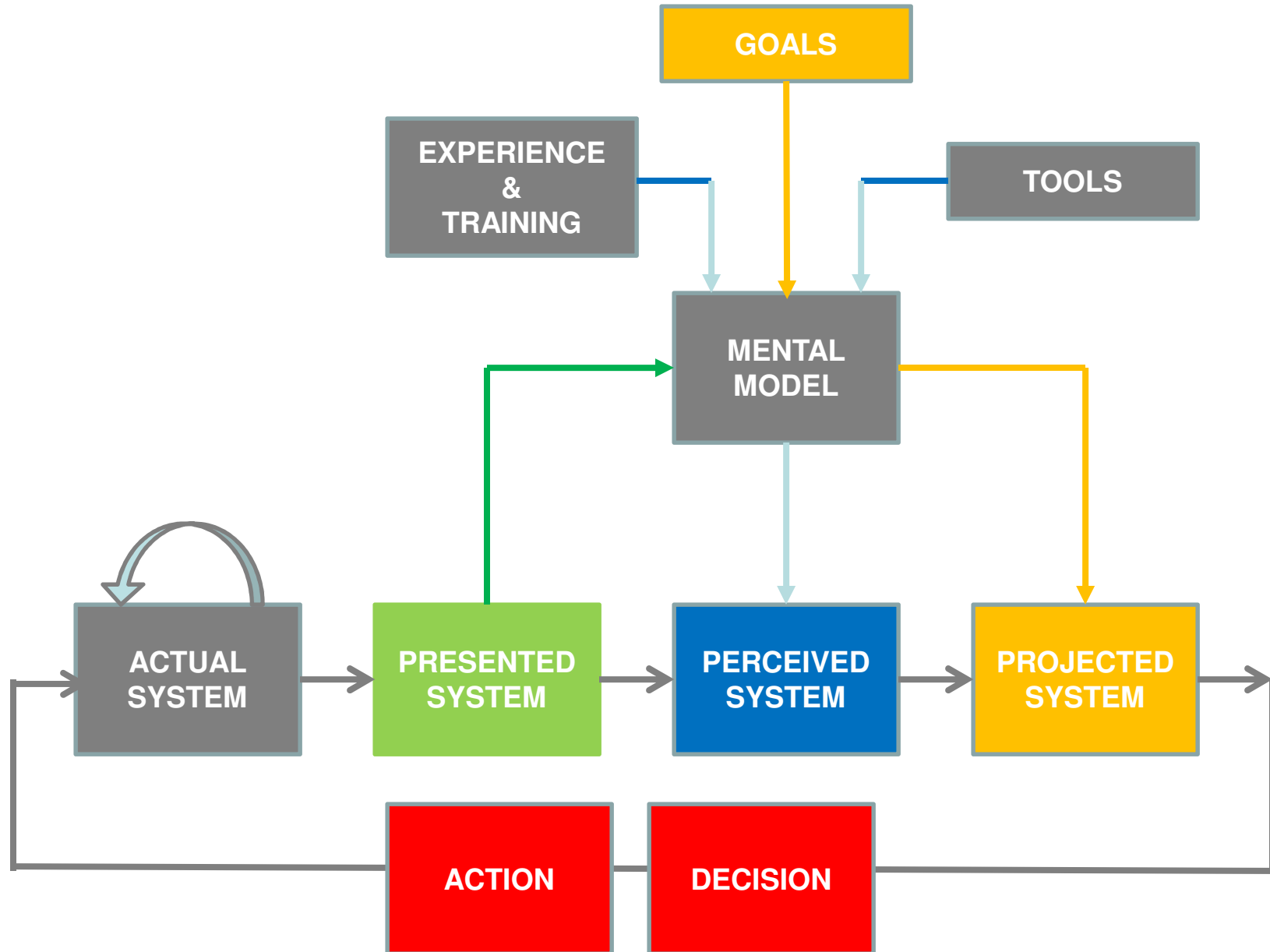
- ◆ Characterizing system behavior in real time - not later





# Operator's Situational Awareness

Characterizing system behavior in real time - not later



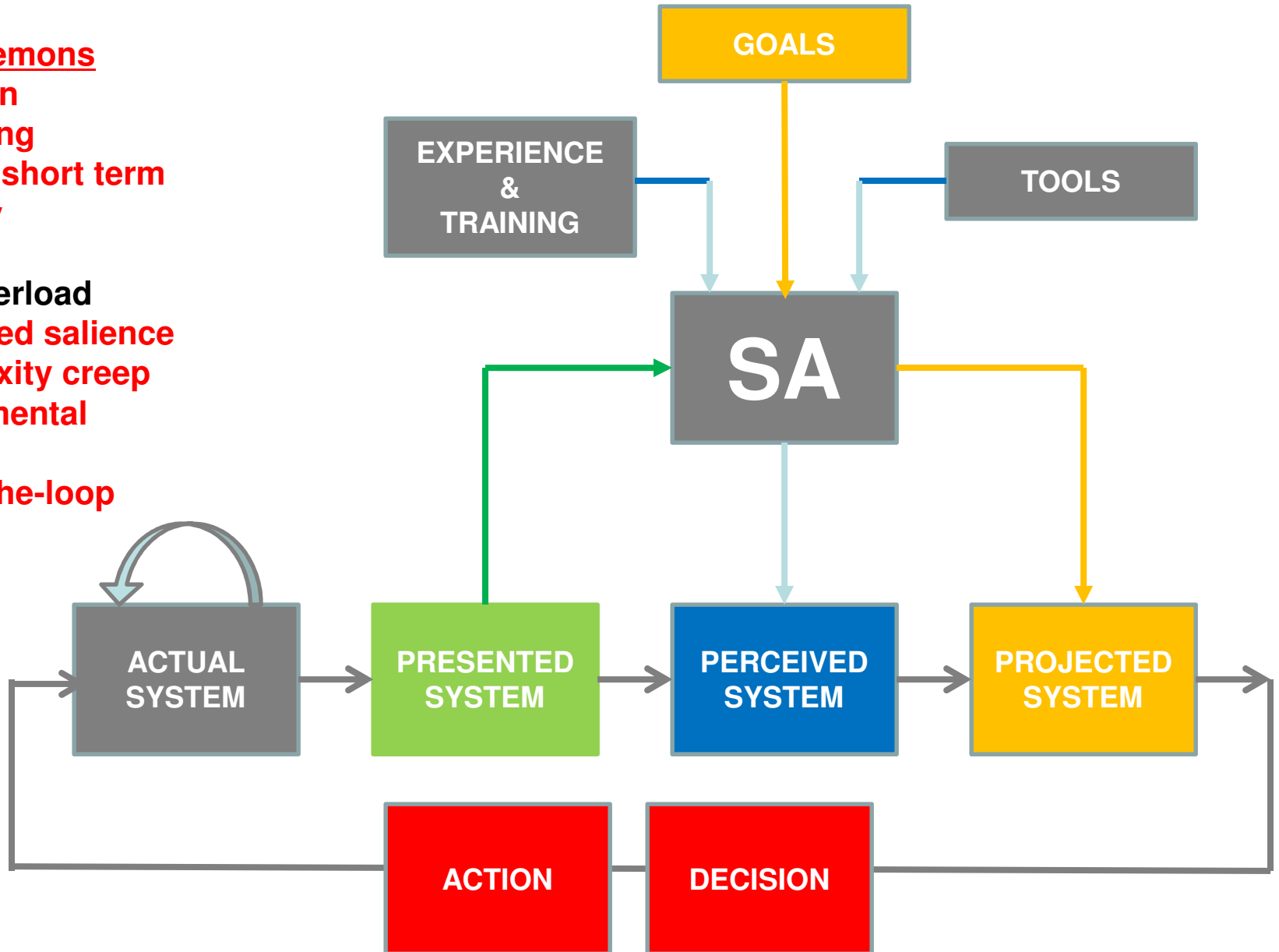
# Operator's Situational Awareness



Characterizing system behavior in real time - not later

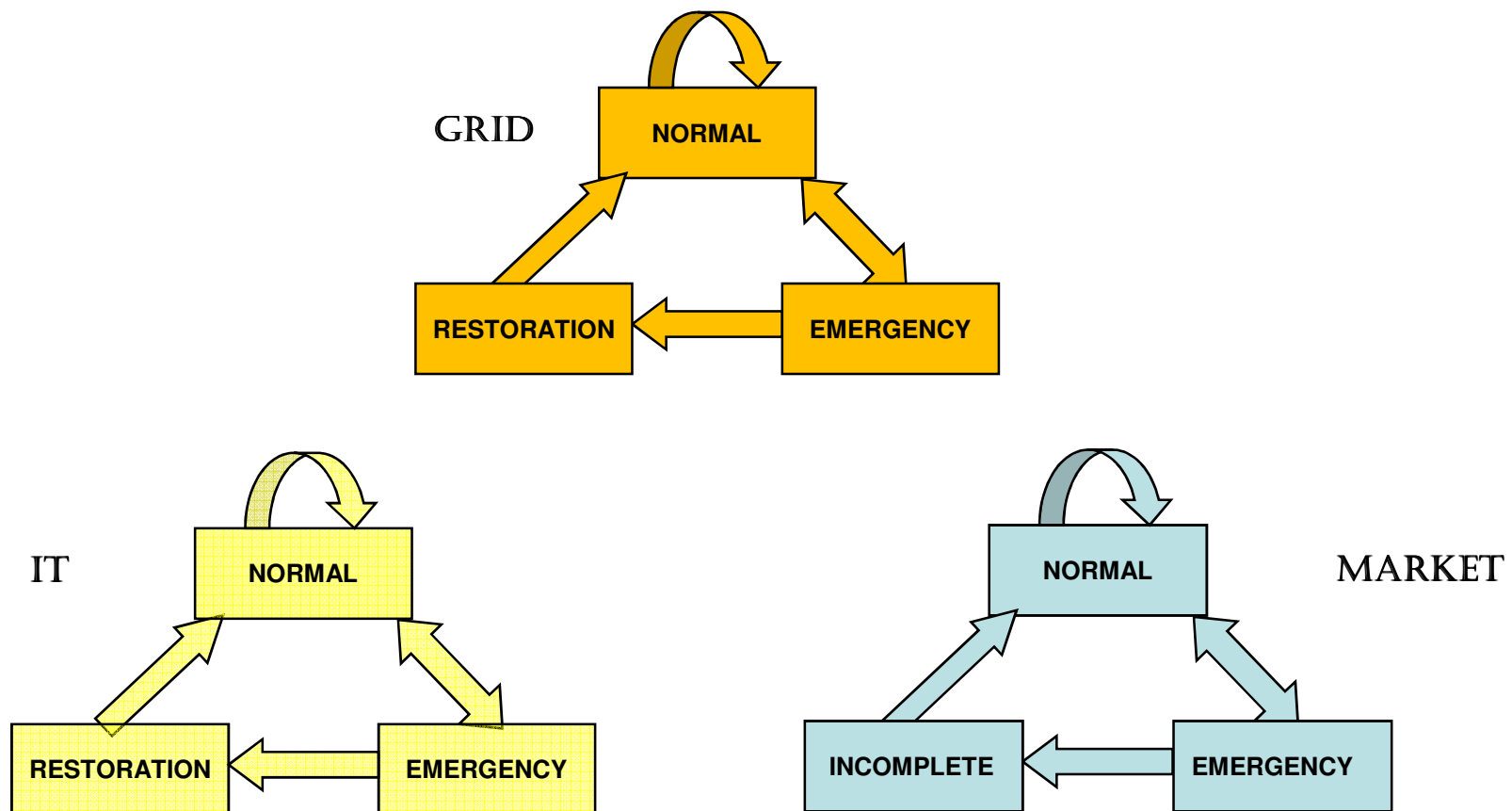
## SA Demons

- Attention narrowing
- Limited short term memory
- Fatigue
- Data overload
- Misplaced salience
- Complexity creep
- Errant mental models
- Out-of-the-loop

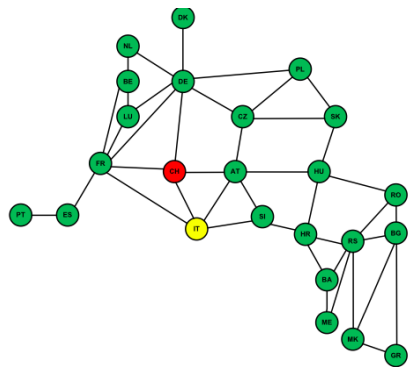


# States of Situational Awareness

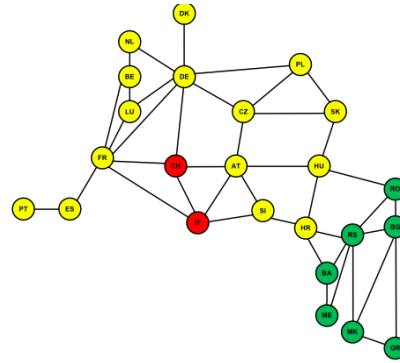
- ◆ (Grid, Market, IT) = (N, N, N); (E, N, N); .....



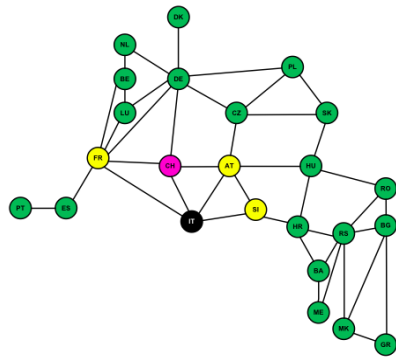
# Evolution of Italian Blackout (2003)



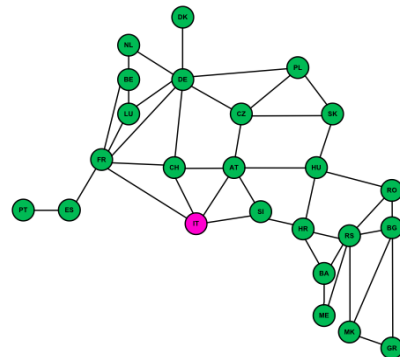
a) 3:01am



b) 3:25am



c) 3:28am



d) 8:00am

**Green: normal**  
**Yellow: alert**  
**Red: emergency**  
**Magenta: restoration**  
**Black: blackout**  
**Grey: no information available**

# Thank You

The New York Independent System Operator (NYISO) is a not-for-profit corporation that began operations in 1999. The NYISO operates New York's bulk electricity grid, administers the state's wholesale electricity markets, and conducts comprehensive planning for the state's bulk electricity system.



[www.nyiso.com](http://www.nyiso.com)