

# The Use of the PI System in the Electric Energy Management System

Presented by **Jose Renato**

# Agenda

1. ONS Overview
2. Strategic View of the Brazilian Interconnected Power System
3. The use of PI within the ONS
4. Challenges
5. Wishlist

# ONS Overview

# ONS Operador Nacional do Sistema Elétrico



A private, non-profit organization which functions under the regulation and fiscalization of ANEEL.

## Human Resources and Offices

Number of employees: 721

586 with university degree

400 engineers

# Attributions and Macrofunctions

- ➔ Operations planning and programming and the centralized generation dispatch
- ➔ Control Center supervision and coordination
- ➔ Supervision and control of national and international interconnections
- ➔ Administration of transmission services, open access to the grid and ancillary services
- ➔ Proposition of reinforcements and expansion of the main T grid
- ➔ Definition of the main T grid operating rules

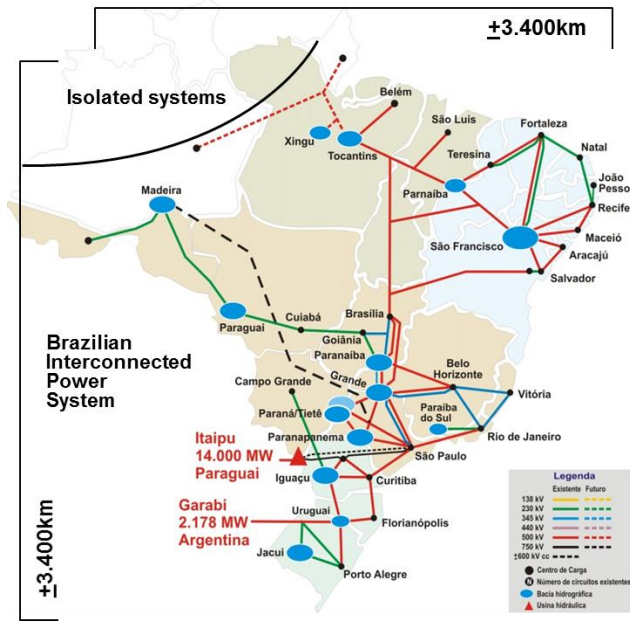
Macro functions

- **Transmission Administration**
- **Operations Planning and Programming**
- **Real Time Operation**

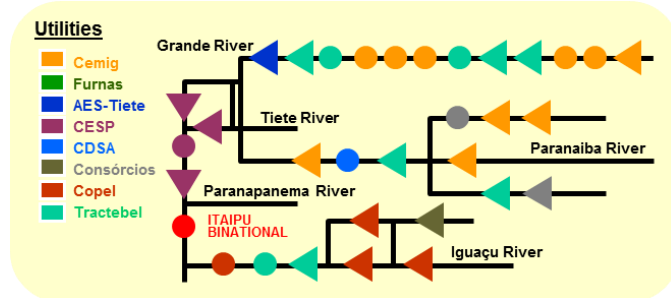
## Coding and legal basis

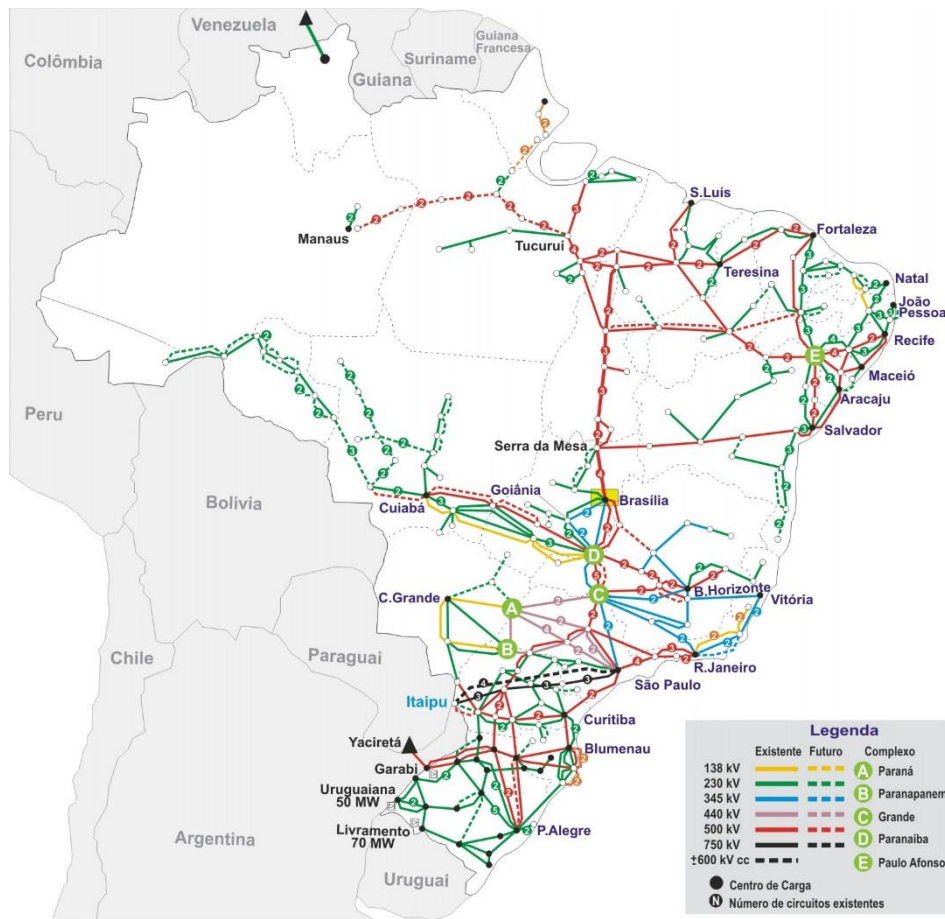
- Módulo 10 - Manual de Procedimentos da Operação - revisão 1.1.**
- 1. Conceituação e Regras da Operação - SM 10.1 a 10.17
  - 2. Cadastros de Informações Operacionais - SM 10.18
  - 3. Instruções de Operação - SM 10.21
    - 3.1. Controle da Transmissão
    - 3.2. Controle da Geração
    - 3.3. Operação em Contingência
    - 3.4. Recomposição da Rede
    - 3.5. Gerenciamento da Carga
    - 3.6. Operação de Reservatórios
    - 3.7. Operação de Instalações
      - 3.7.1. Interligação entre Regiões
      - 3.7.2. Sudeste
      - 3.7.3. Nordeste
      - 3.7.4. Norte
        - 3.7.4.1. Área 500/230 kV Pará
        - IO-OI.N.CJ - Procedimentos Sistemáticos para a Operação da SE Carajás
        - IO-OI.N.CN - Procedimentos Sistemáticos para a Operação da SE Castanhal
        - IO-OI.N.GM - Procedimentos Sistemáticos para a Operação da SE Guamá
        - IO-OI.N.KI - Procedimentos Sistemáticos para a Operação da SE Integradora
        - IO-OI.N.SR - Procedimentos Sistemáticos para a Operação da SE Santa Maria
        - IO-OI.N.UG - Procedimentos Sistemáticos para a Operação da SE Utinga
        - IO-OI.N.VC - Procedimentos Sistemáticos para a Operação da SE Vila do Conde
        - IO-OI.N.XD - Procedimentos Sistemáticos para a Operação da SE Xinguaná 2
      - 3.7.4.3. Área 230 kV Triângulo Oeste
      - 3.7.4.4. Área 230 kV Acre - Rorôndônia
      - 3.7.4.5. Área 500/230 kV Manaus - Macapá
    - 3.7.5. Sul
    - 3.7.6. Centro-Oeste
  - 3.8. Mensagens Operativas
  - 3.9. Execução do PGO
- 4. Rotinas Operacionais - SM 10.22
- 5. Ajustamentos Operativos - SM 10.20
- 6. Regulamentos Internacionais - SM 10.19
- 7. Referências Técnicas

# Strategic View of the Brazilian Interconnected Power System



- The BIPS covers most of the national territory.
- The BIPS supplies about 98% of the country's electricity consumption. (549 TWh in 2013)  
Peak Demand is 85.7 GW (in 05/02/14)
- Hydro generation is dominant: about 75% of the installed capacity.
- Thermal generation is complementary with diversity of fuels: nuclear, coal, natural gas, oil, diesel = about 18%.
- Small share (about 7%) of non-conventional renewable energies: wind and biomass.
- Main transmission grid with long distance lines ( $\geq 230$  kV).





- Multi-owned T system: 105 agents have assets at 230 kV and above.
- Main T Grid is operated and expanded aiming at safety of supply and energy optimization.
- Transmission links allow the interchange of large energy blocks between regions and basins, benefitting from diversity of hydrological behavior.
- The present challenge is the integration of existing and future power plants in the Amazonian region to the BIPS

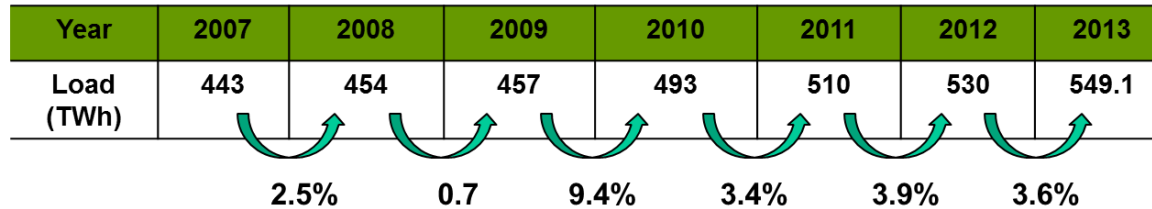
### Extension of transmission lines $\geq 230$ kV

Year	2002	2012	2014	2021
km	72.500	106.443	112.772	148.969 (*)



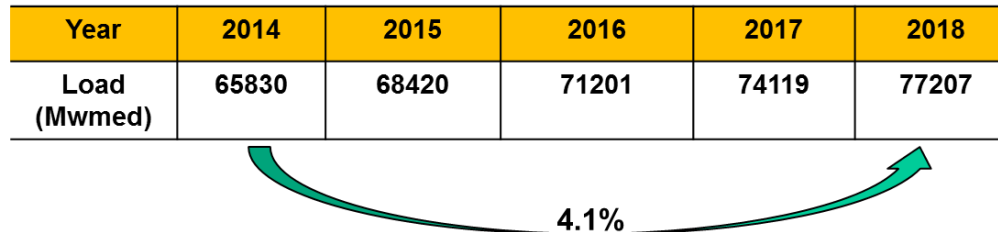
# Energy load

- Energy consumption in the BIPS has grown steadily in the recent past.



- Forecasts for 2013/2017:

EPE and ONS forecasts revised in December'13



# Installed Capacity Expansion – 2013 to 2018

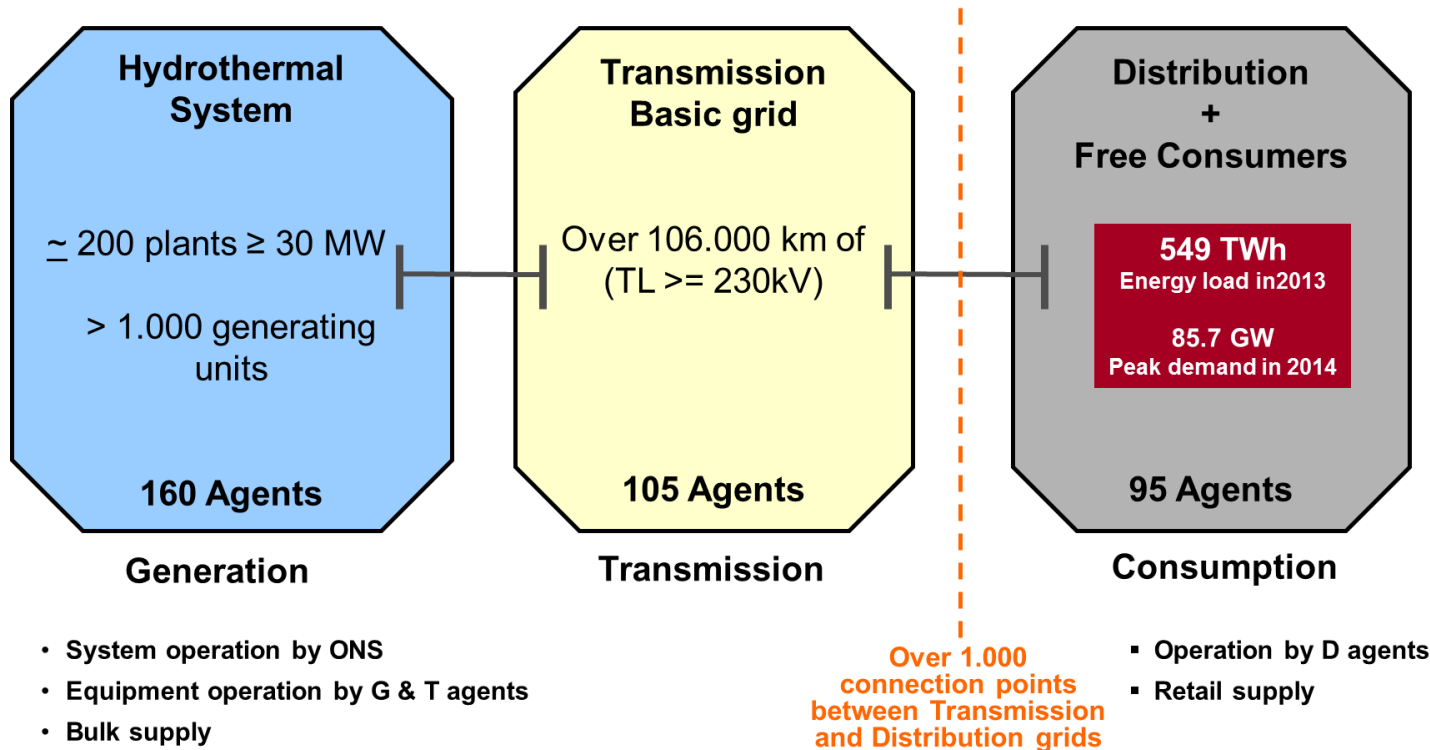
	31/12/2013		31/12/2018		2013-2018 Increase	
	MW	(%)	MW	(%)	MW	(%)
Hydro	91,114	75.1	111,369	71.7	20,255	22.2
Nuclear	1,990	1.6	3,395	2.2	1,405	70.6
Gas/LNG	11,400	9.4	13,365	8.6	1,965	17.3
Coal	3,210	2.6	3,210	2.1	-	0.0
Biomass	6,089	5.0	7,272	4.7	1,183	19.4
Other <sup>(1)</sup>	749	0.7	749	0.5	-	0.0
Oil	4,694	3.9	4,821	3.1	127	2.7
Wind	2,070	1.7	10,963	7.1	8,893	429.6
<b>TOTAL</b>	<b>121,316</b>	<b>100</b>	<b>155,144</b>	<b>100</b>	<b>33,828</b>	<b>27.9</b>

(1) Usinas Biomassa com CVU



- Hydroelectricity will continue to be dominant. Although, its share in the total installed capacity of the Brazilian system will decrease from 75.1% in Dec'13 to 71.7% in Dec'18.

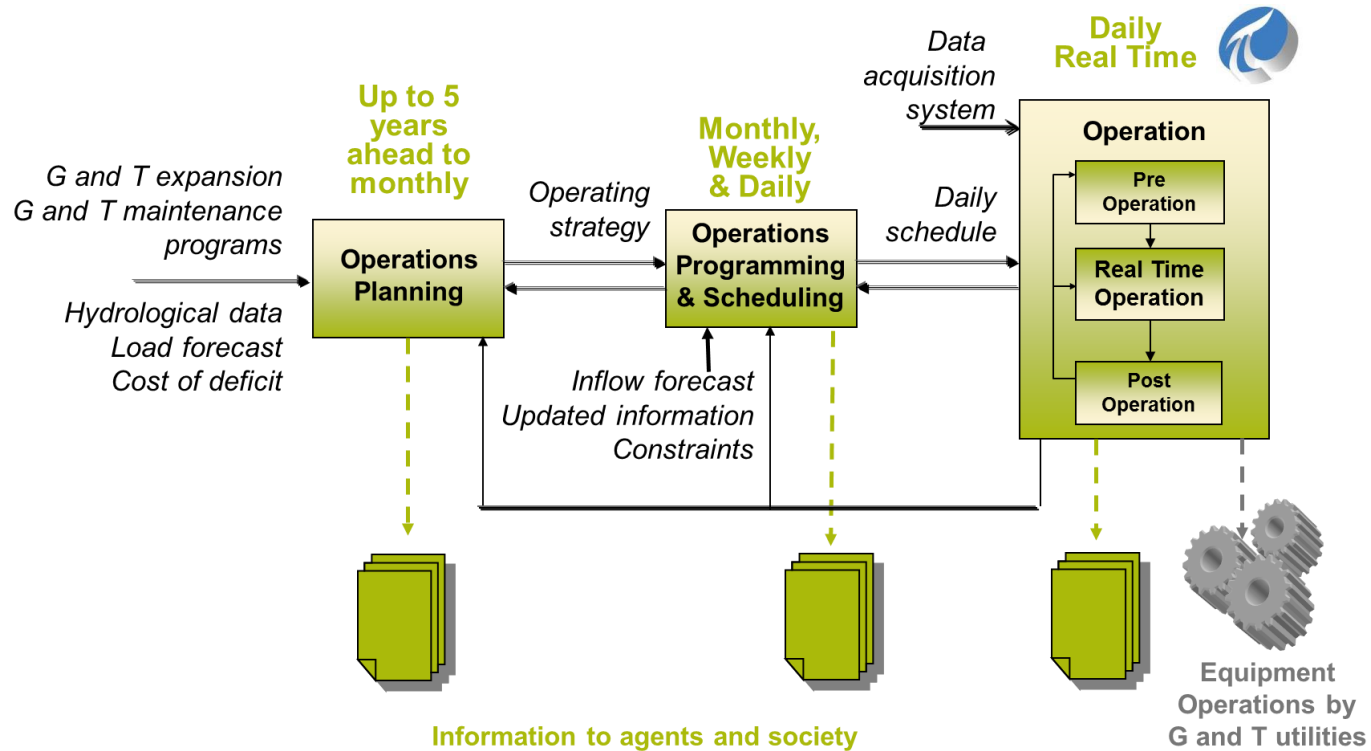
# Boundaries of ONS action



(\*) Total number of agents is 360. Some are vertically integrated companies.

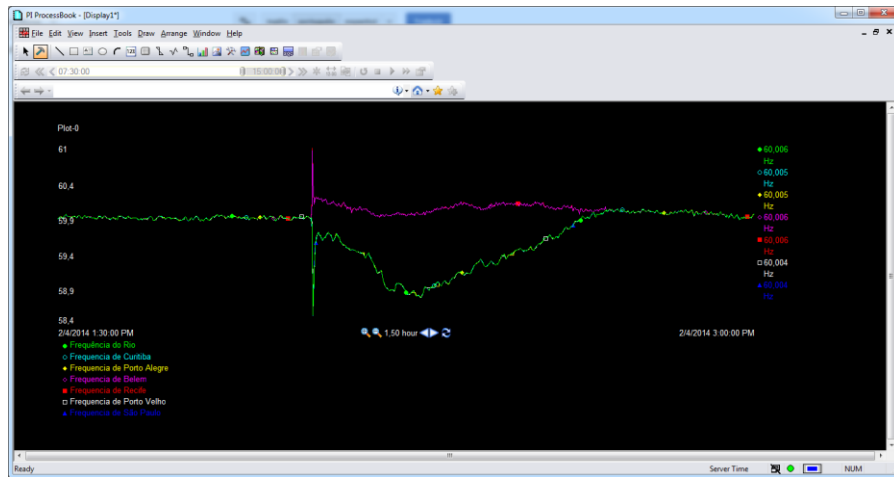
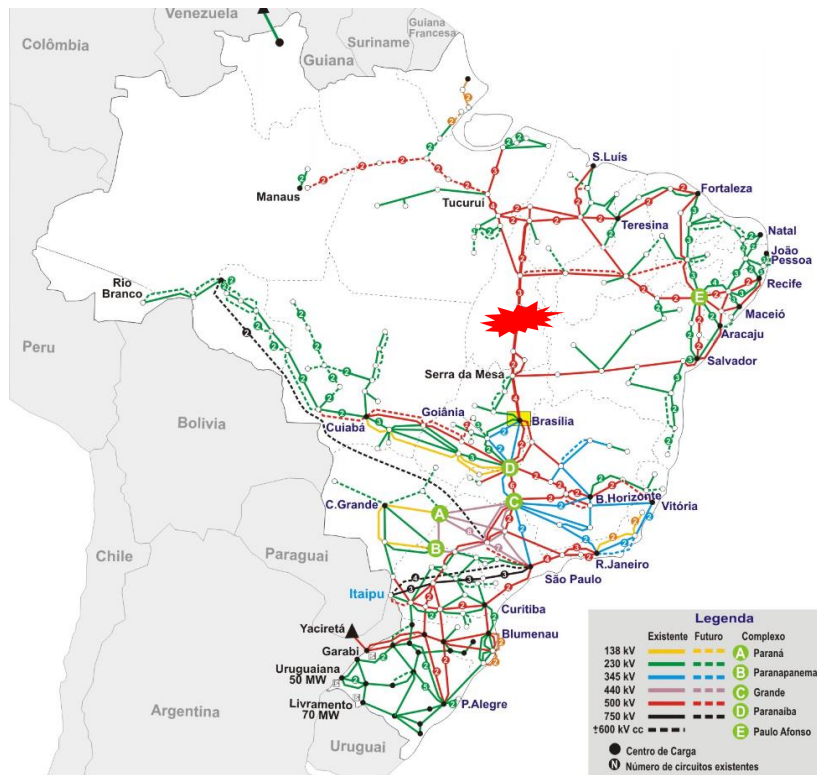
• Fiscalization by ANEEL

# Chain of Activities in System Operation



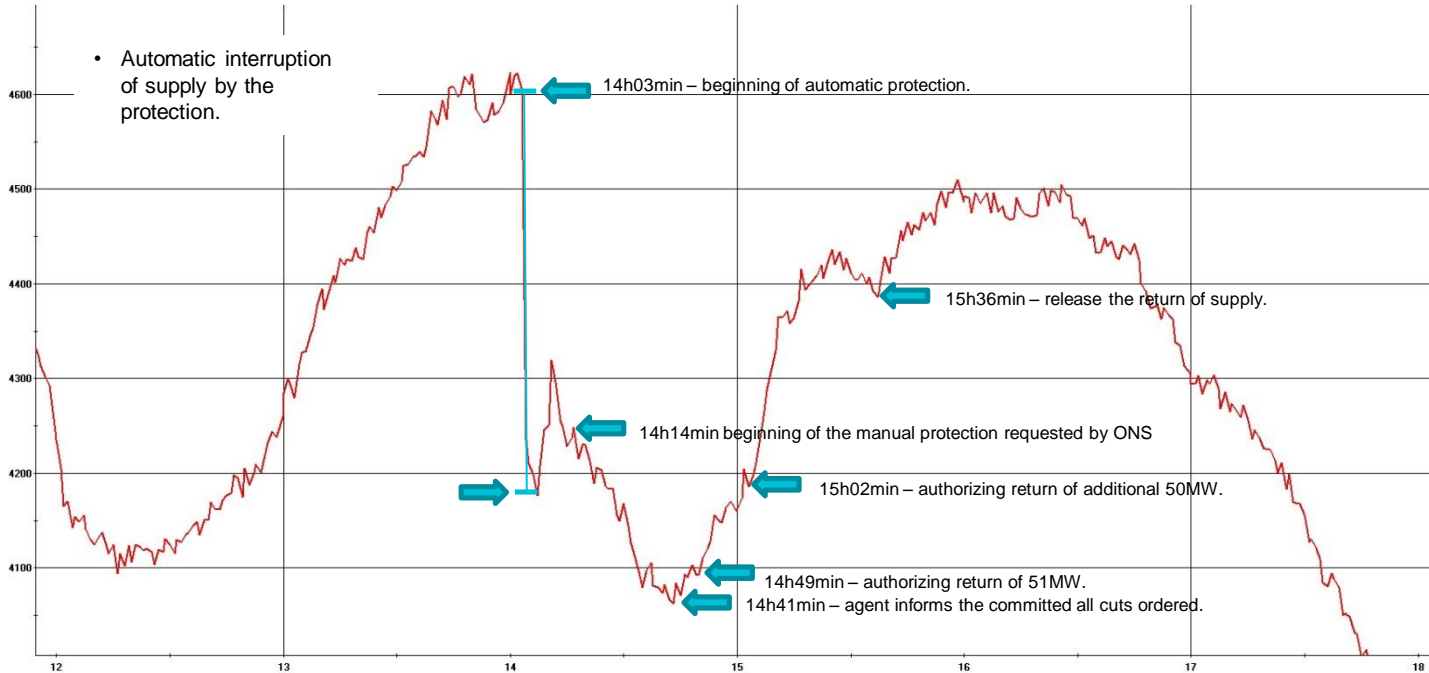
# The use of the PI System within the ONS

# Disturb on February 4 , 2014

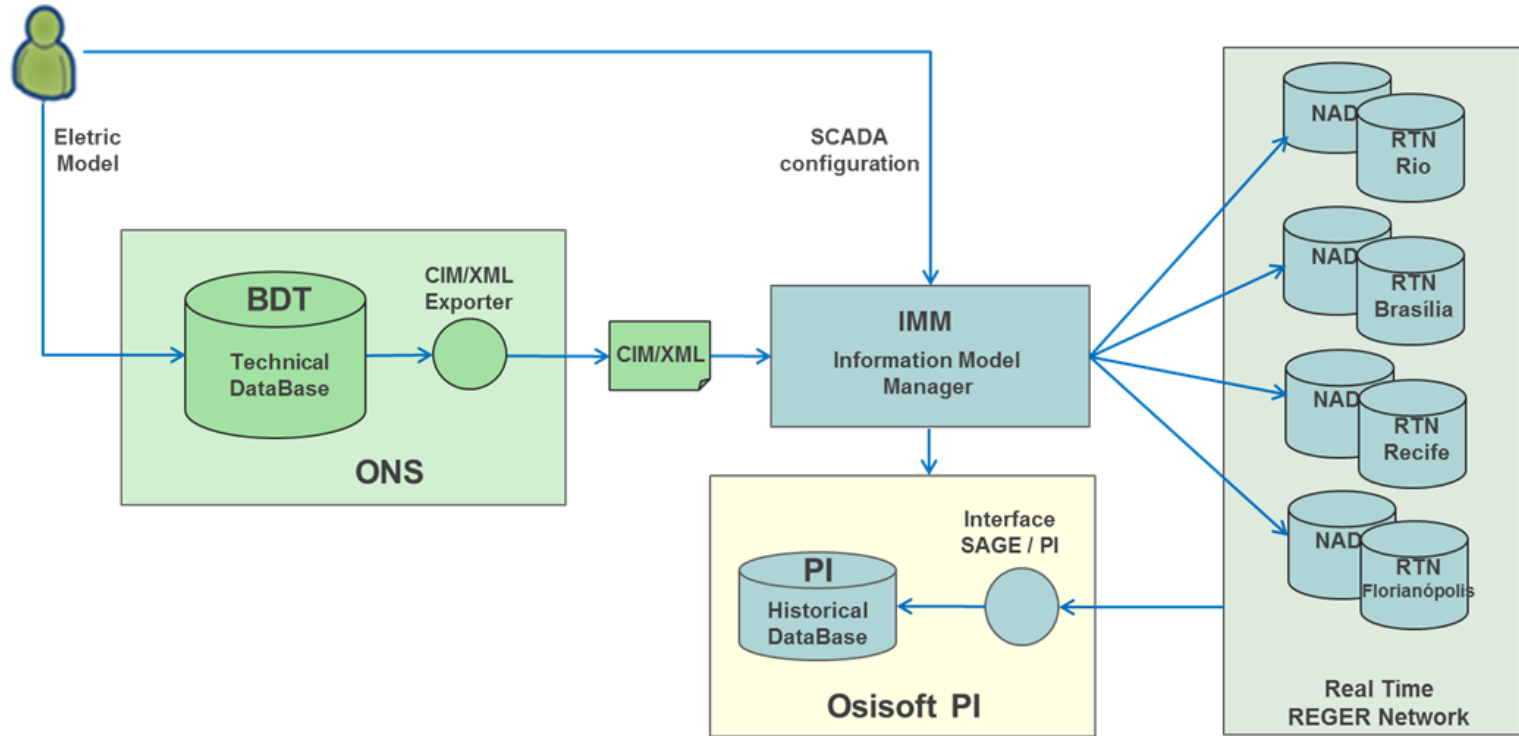


# Reflection of the disturbance in the South of the country

## State of Santa Catarina



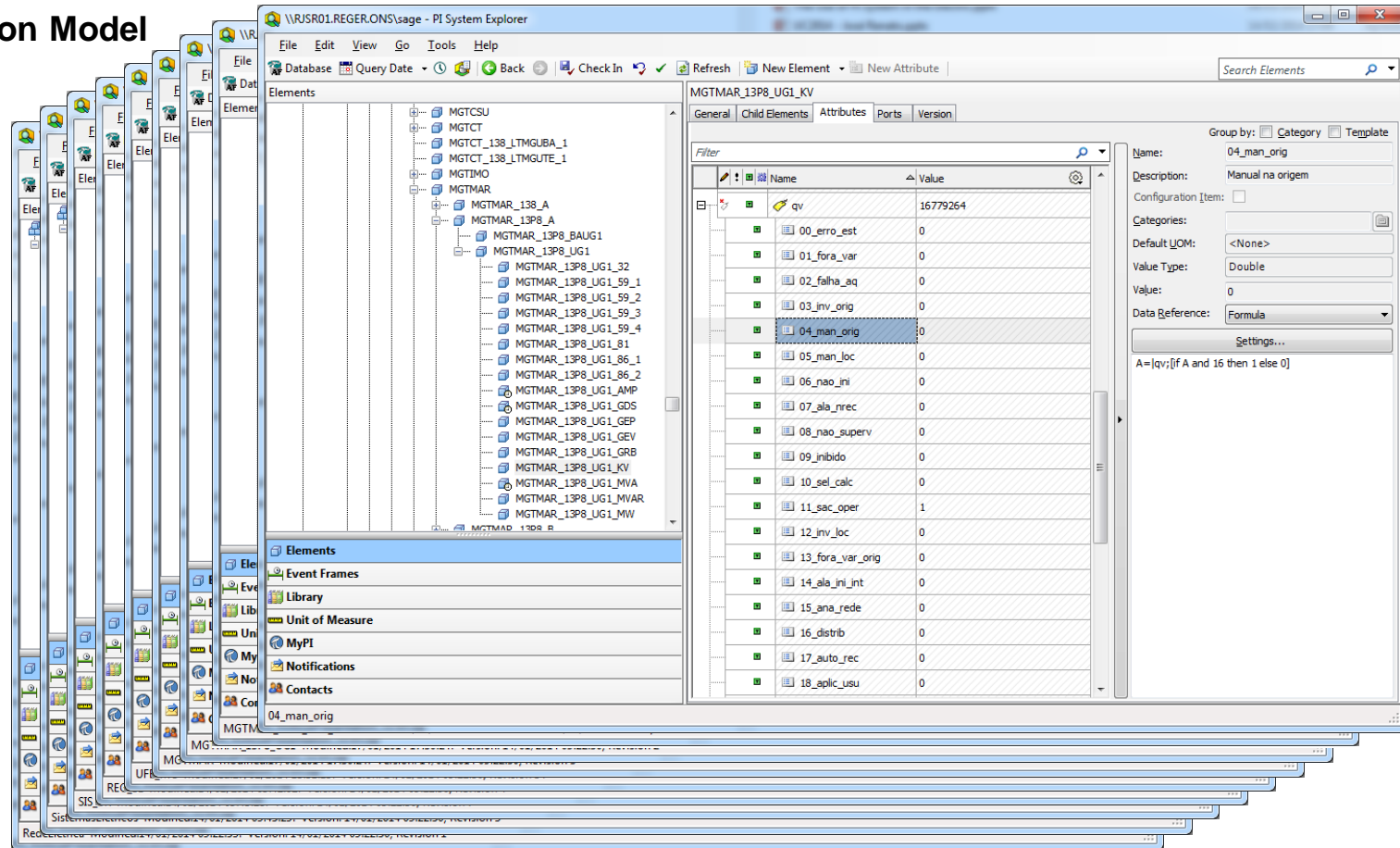
# ONS Database Architecture



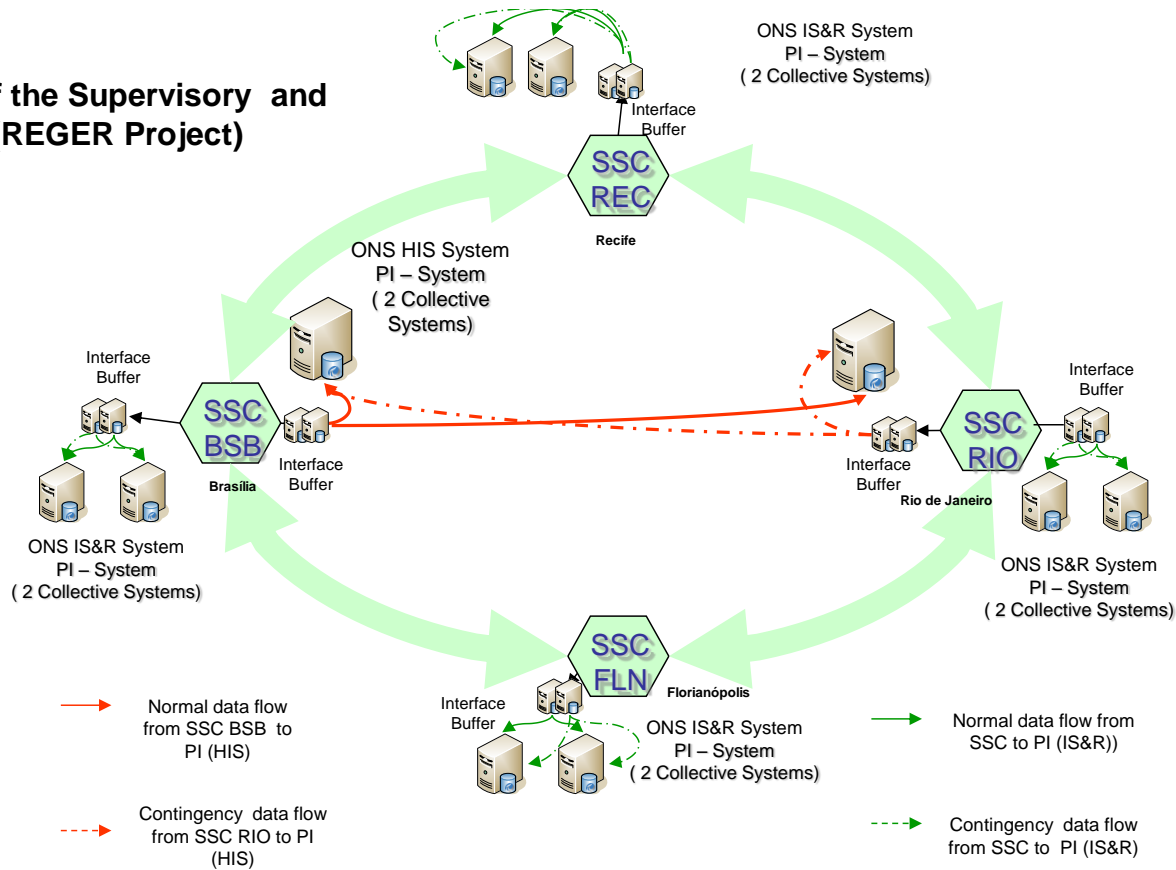


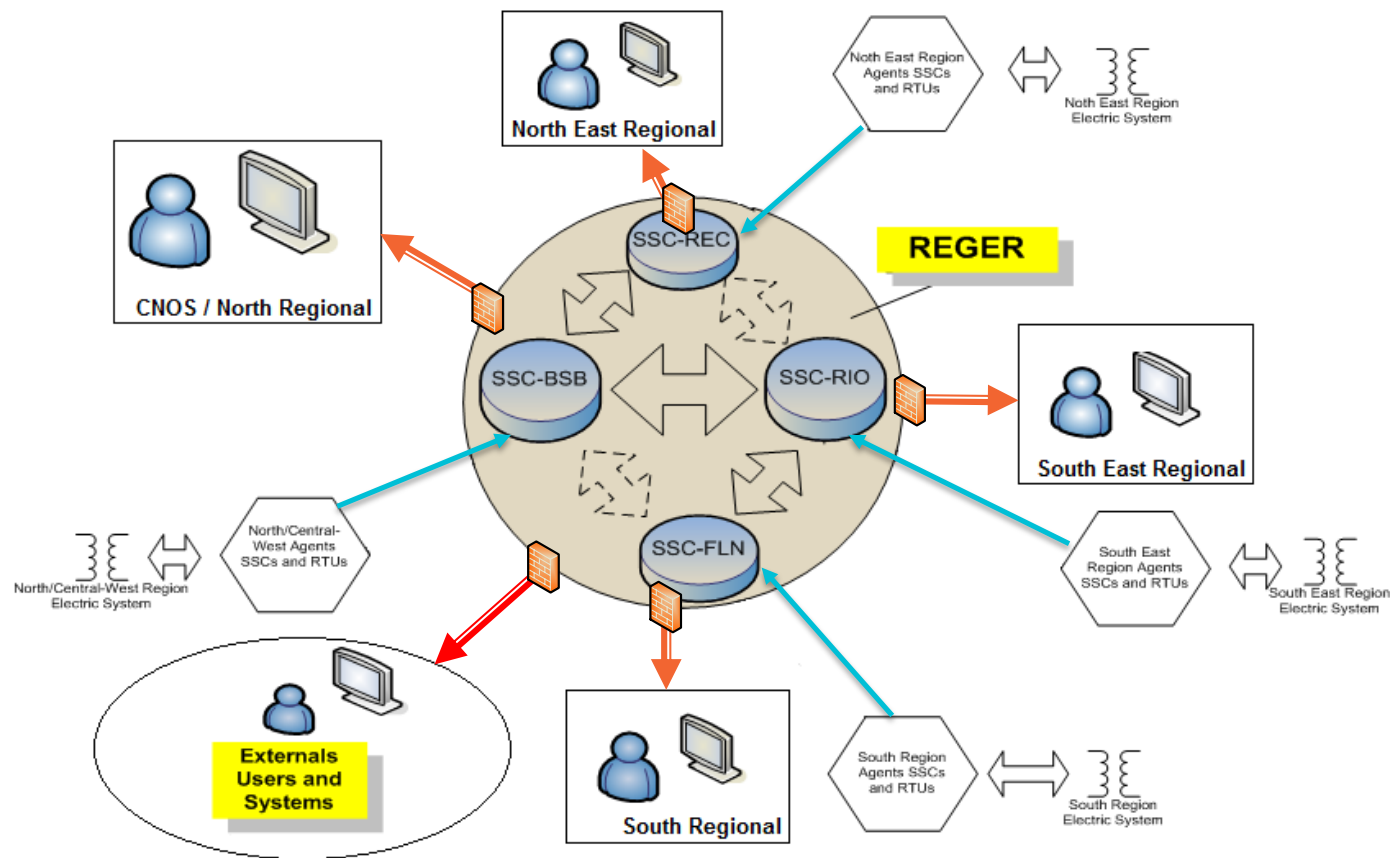
# AF Structure

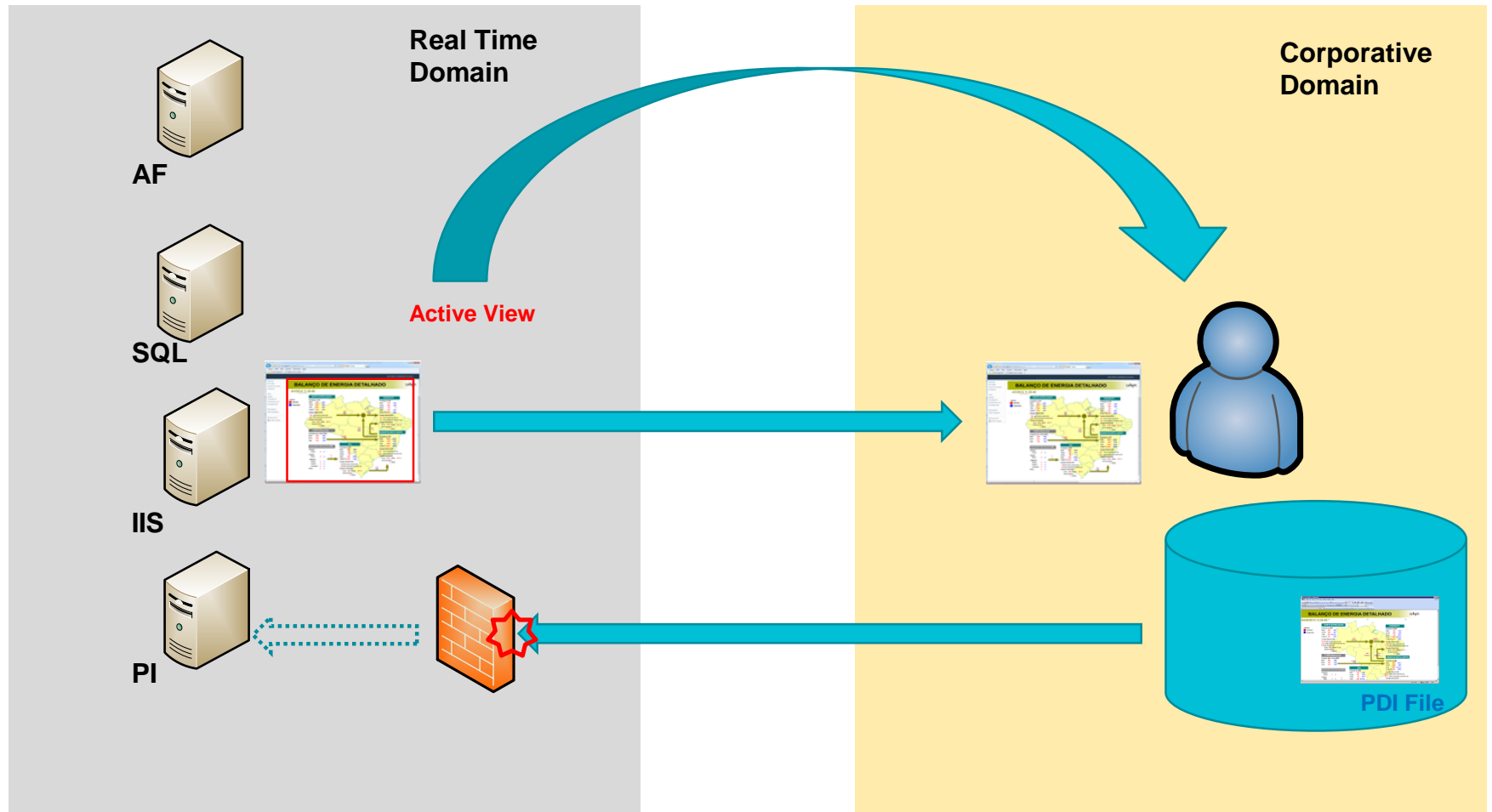
## Common Information Model



# Modernization of the Supervisory and Control System (REG Project)







# Challenges

- Develop the situation awareness tools
- Develop the web service to consume Notifications
- Improving the time to create new tags within PI on new version of Real Time database
- Implement the integration with google tools
- Develop the ONS application to iPad and Android
- Implement the ONS page on internet

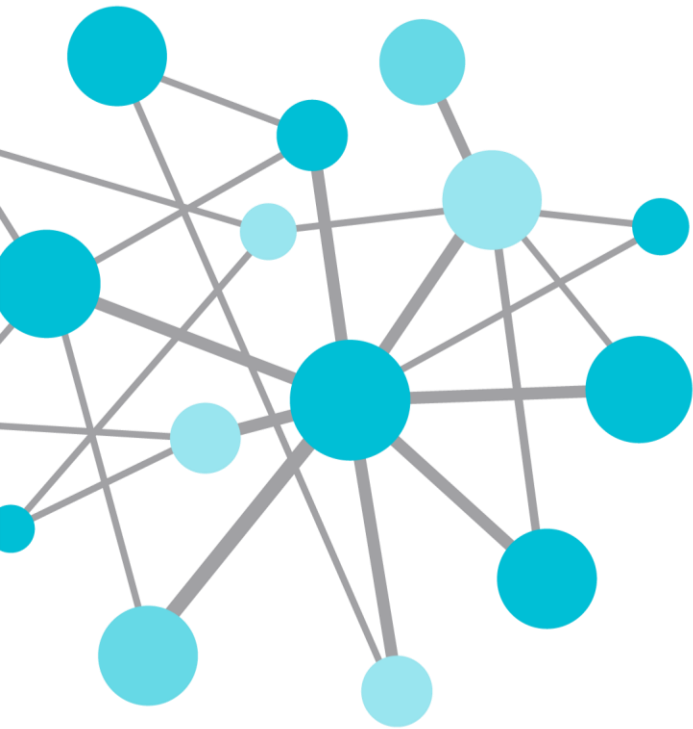
# Wishlist

- Acknowledge the blink multistate
- Coresight with ProcessBook Pages
- PI Notification Console
- PI Notification tree view with multiple levels
- Event Frame instances



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