





Comitê Nacional de Produção e Transmissão de Energia Elétrica O Futuro da
Engenharia de Projetos
na Área de Proteção,
Automação e Controle
de Sistemas Elétricos

Iony Patriota de Siqueira iony@cigre.org.br iony@tecnix.com.br www.tecnix.com.br



Schedule

State of the Art

Grid Requirements

Future Developments



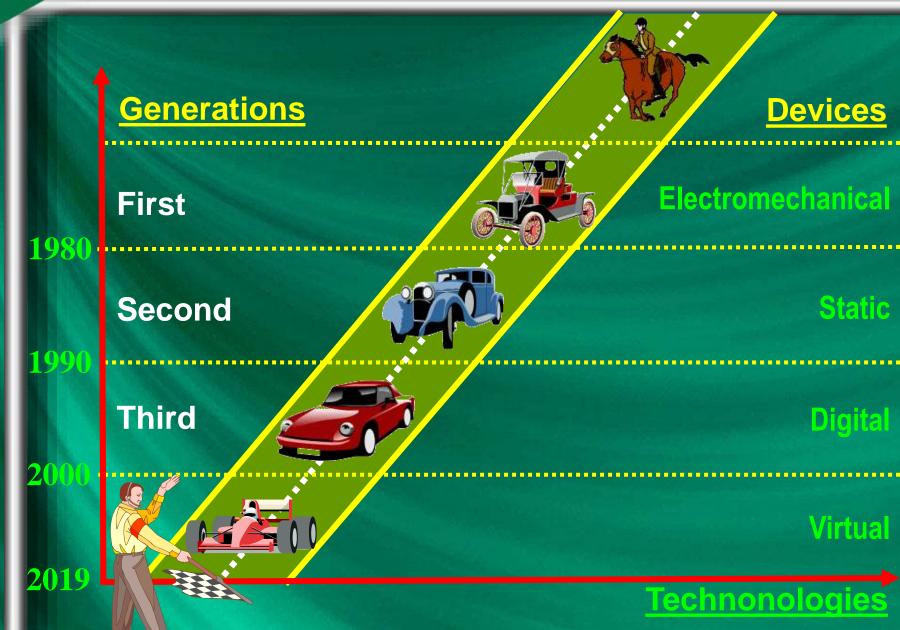


State of the Art



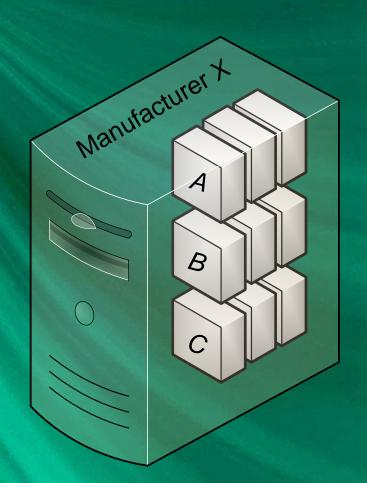


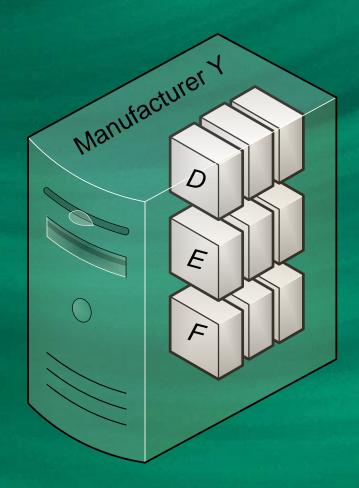
Automation Historical Evolution





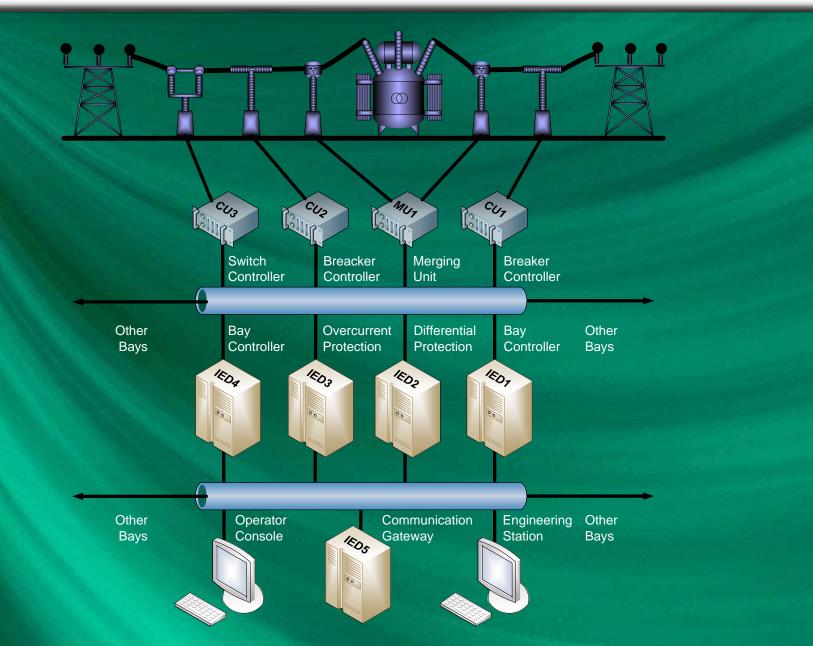
IEC 61850 Software Modularity





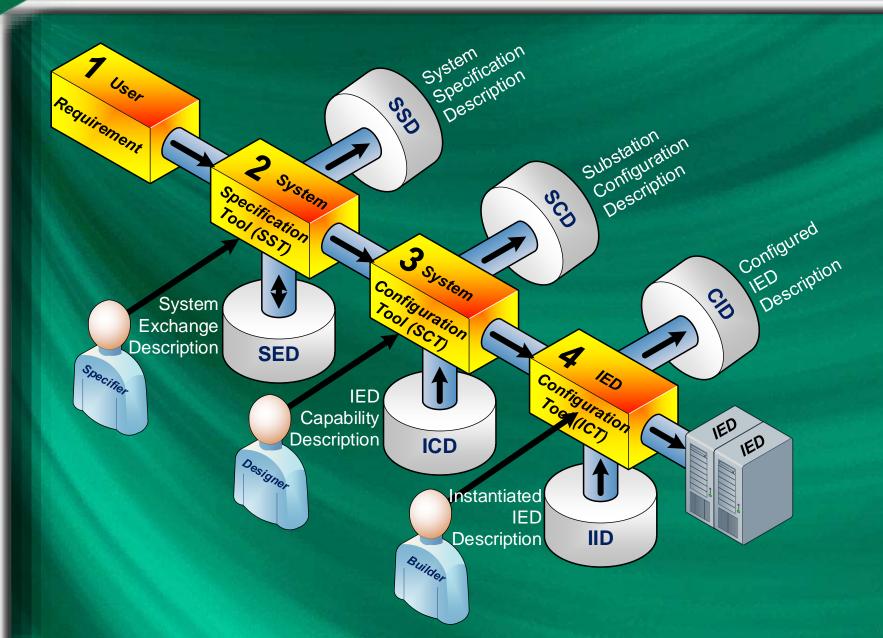


Substation State-of-the-Art



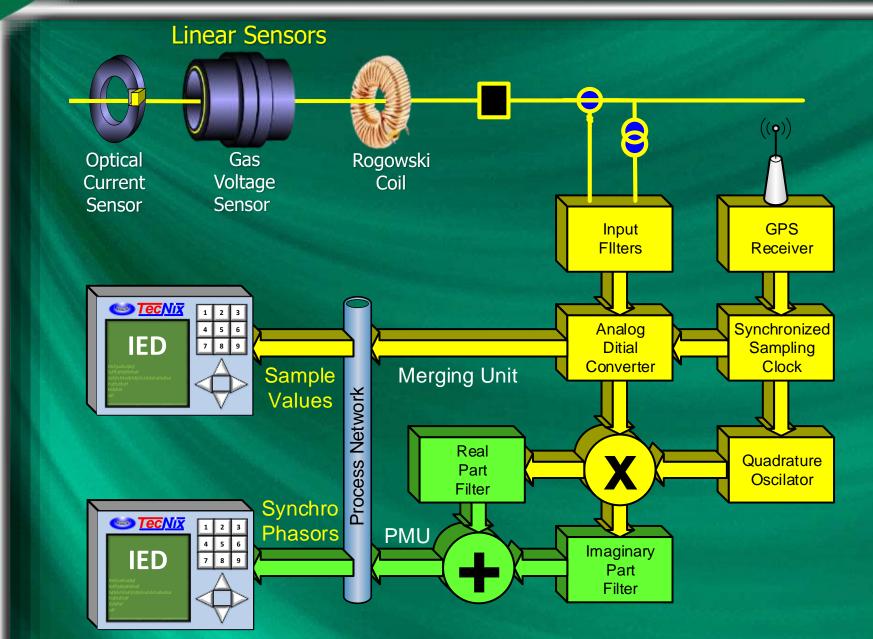


IEC 61850 Engineering Cycle



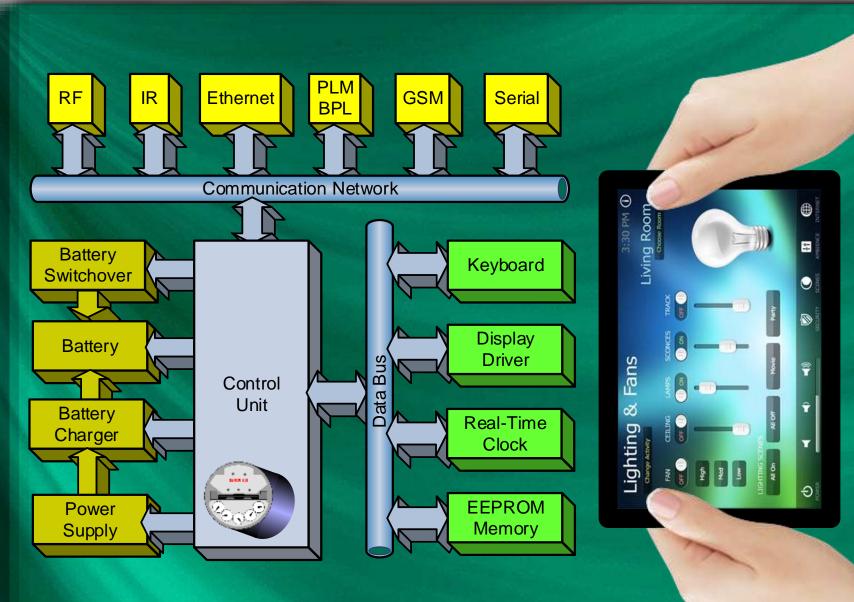


cigre Advanced Sensors and Phasor Measurement





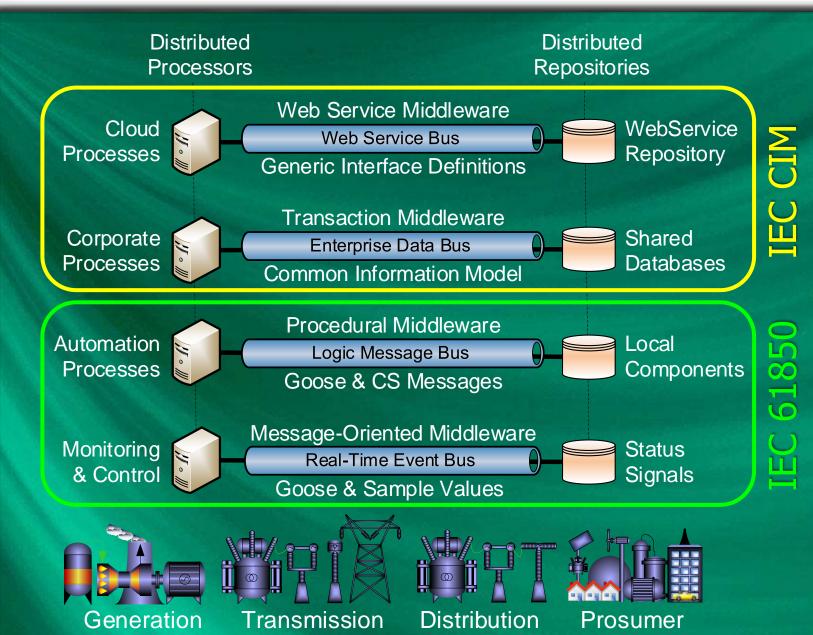
Advanced Metering Infrastructure (AMI)







Telecommunication State-of-the-Art





Common Information Model (CIM)



Business Functions External to Distribution Management

NO

Network Operation

AM

Records & Asset Management

OP

Operation Planning & Optimization

MC

Maintenance Construction

EMS

Energy Management & Trading

RET

Retail

Supply Chain & Logistics

SC

IEC 61968/61970 Compliant Middeware Services

NE

Network Extension Planning

CS

Customer Support

MR

Meter Reading & Control

ACT

Customer Account Management

FIN

Financial

PRM

Premises

HR

Human Resources

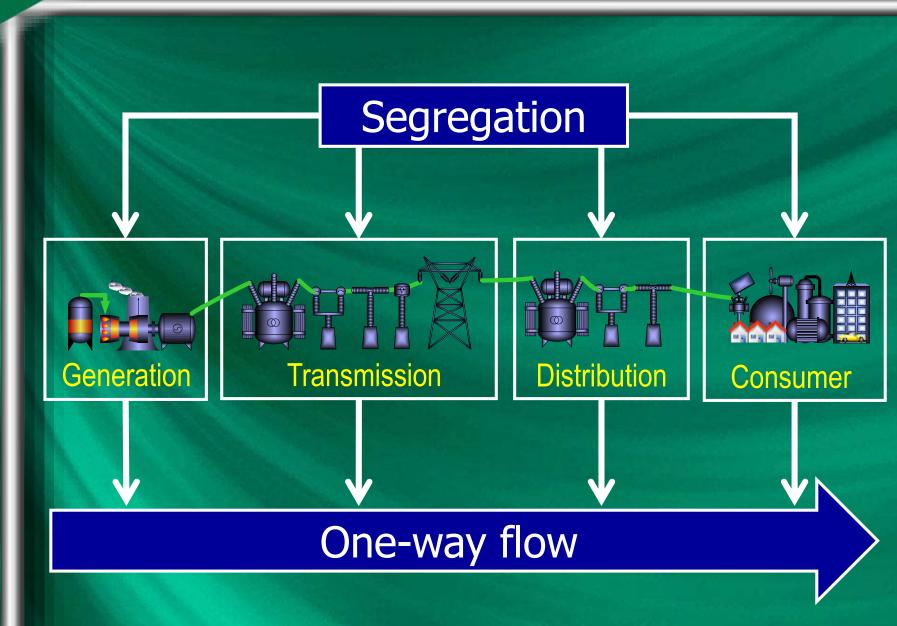
Electric Distribution Network Planning, Construction Maintenance and Operations

Generation and Transmission Management, Enterprise Resource Planning, Supply Chain and General Corporate Services



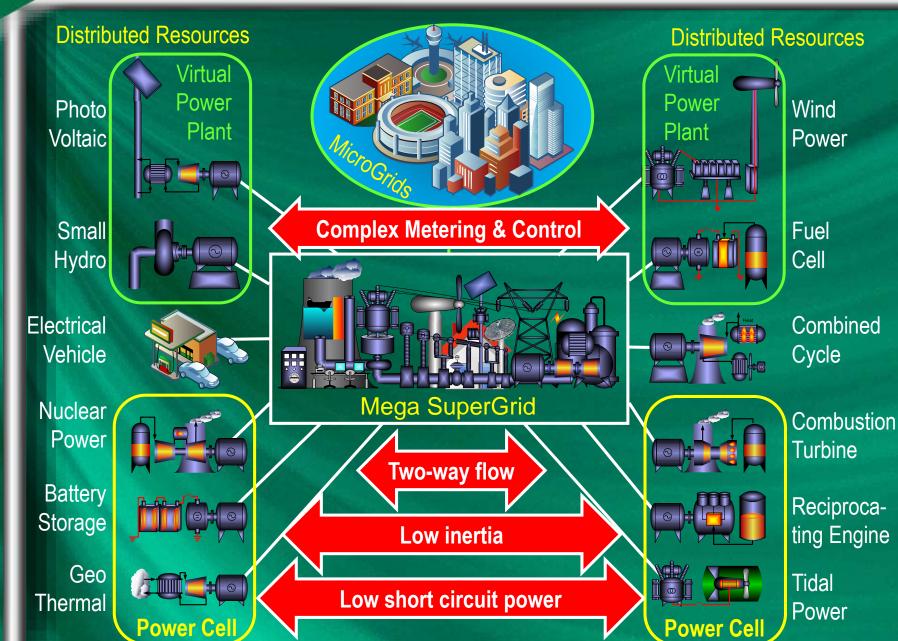


Current Structure of Electrical Grids



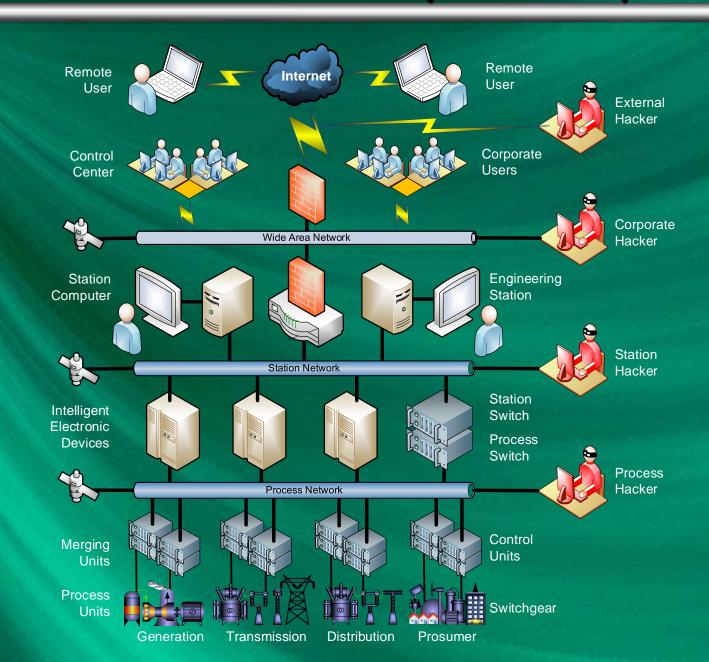


Future Network



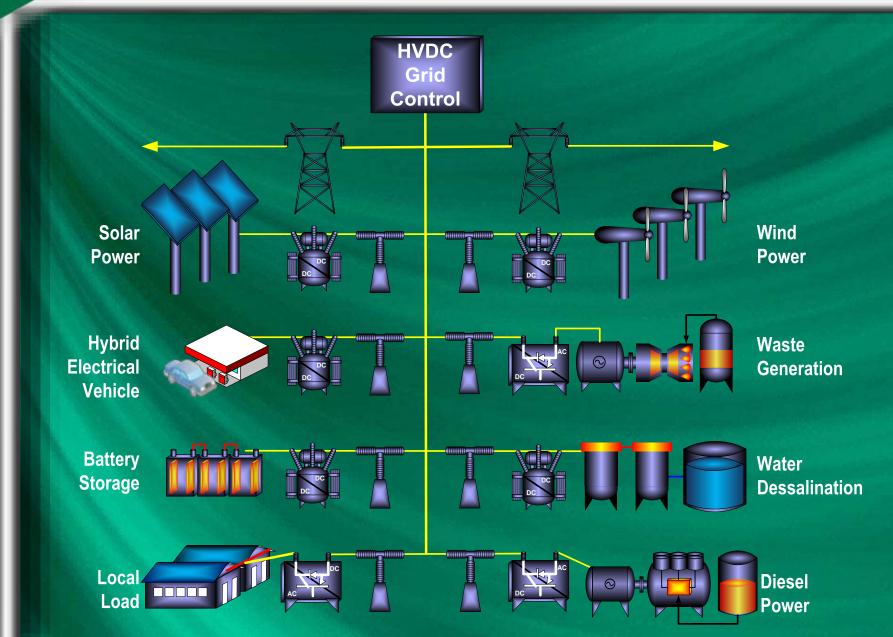


Cybersecurity Threats





Multi-Terminal HVDC Grid



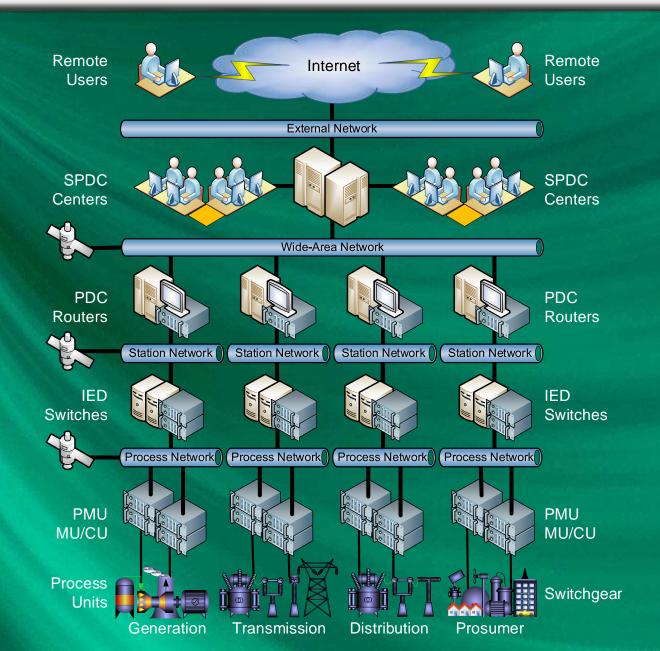




Future Developments

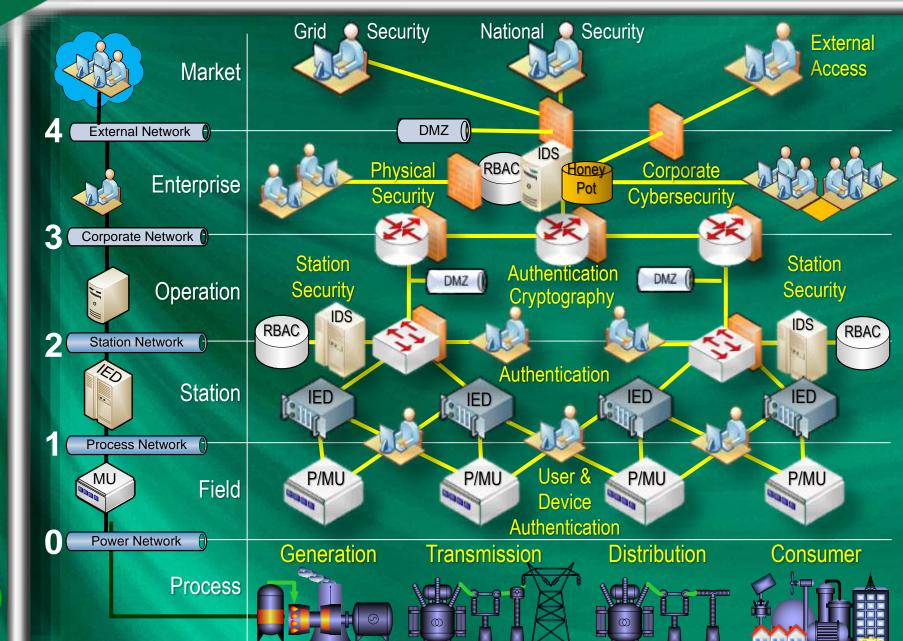


Wide-Area Protection & Control



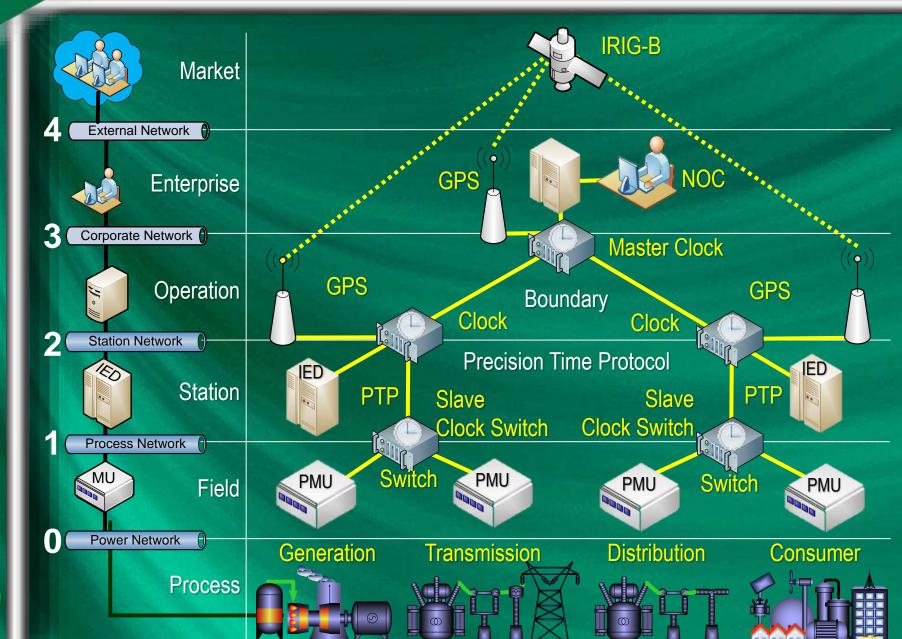


Wide-Area Cybersecurity



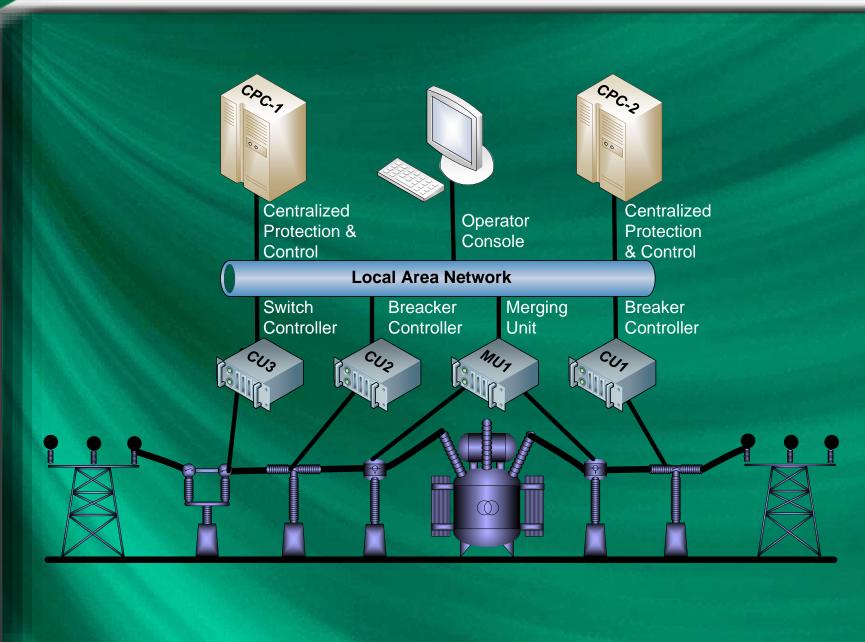


Wide-Area Synchronism



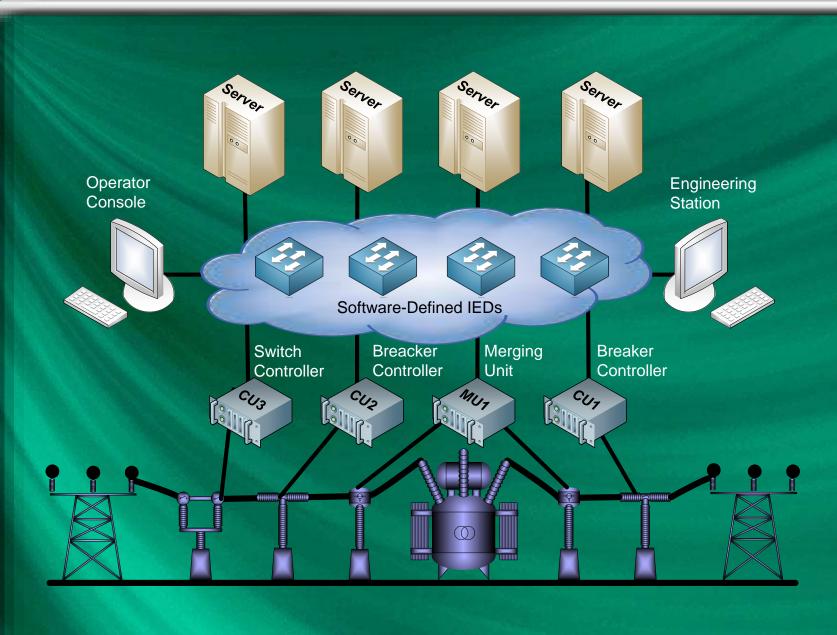


Centralized Protection & Control



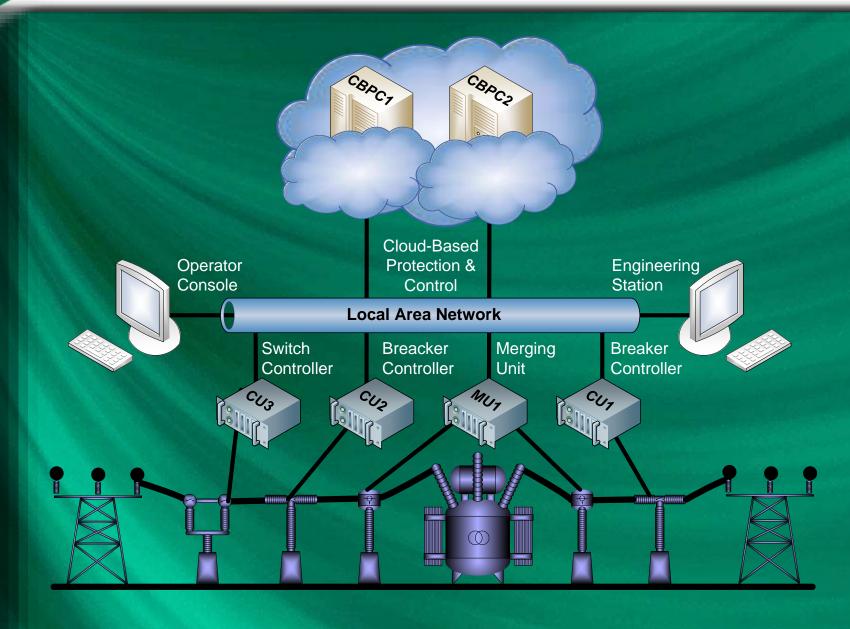


Software-Defined Protection & Automation



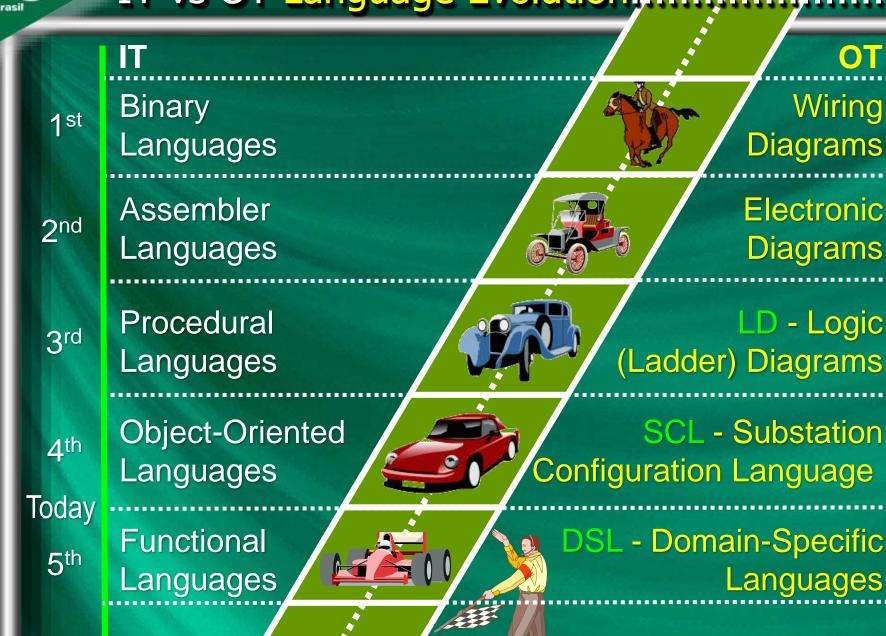


Cloud-Based Protection & Automation



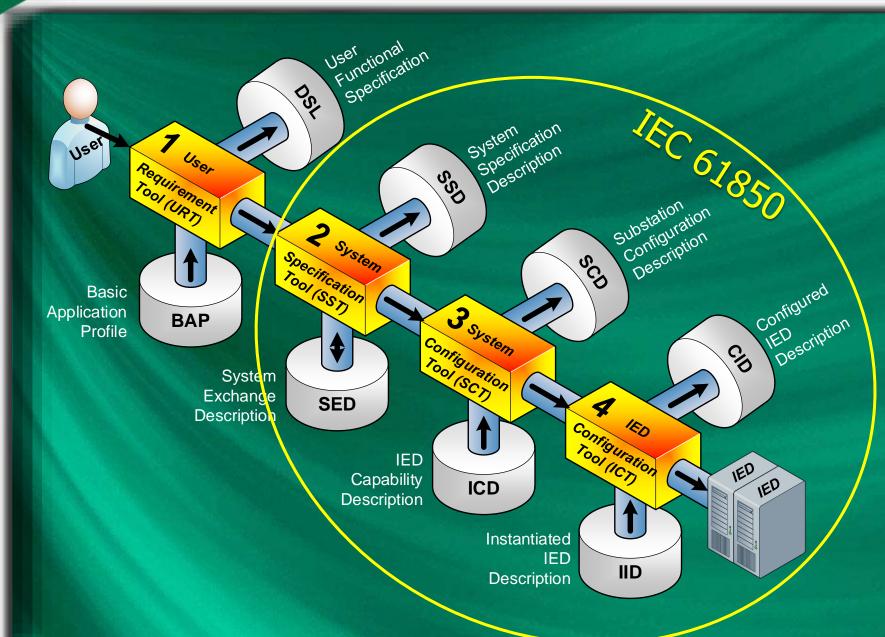


IT vs OT Language Evolution.



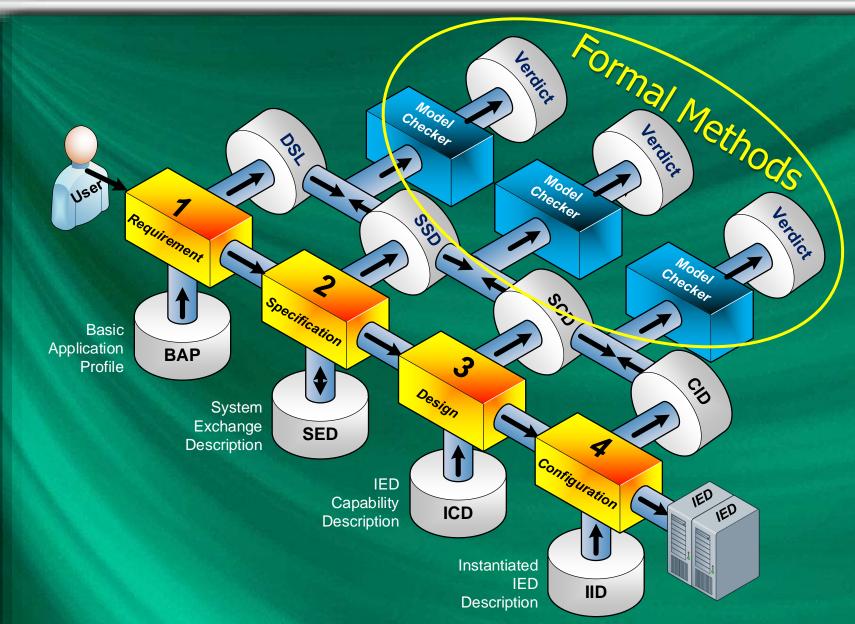


Advanced User-Requirement Tool



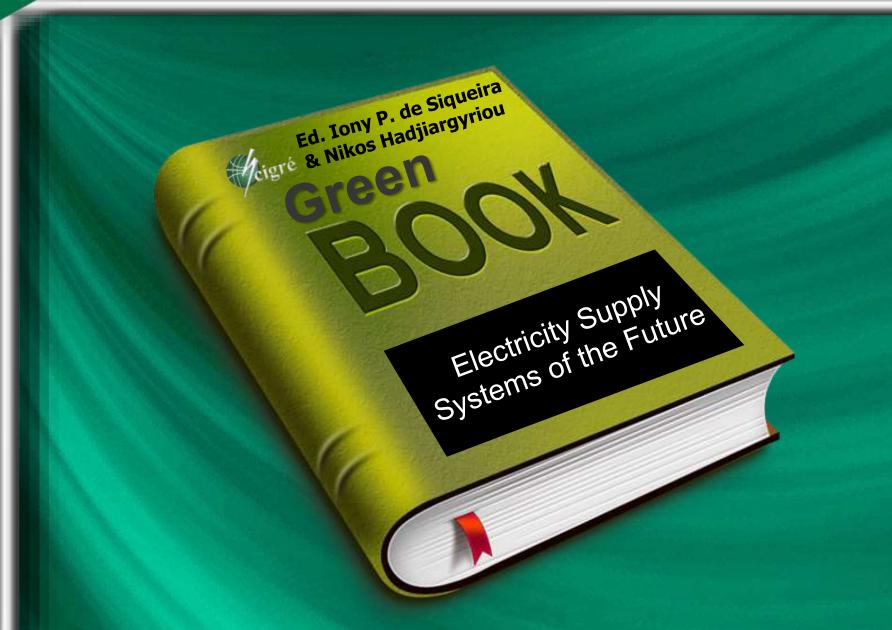


Application of Formal Methods





CIGRE Green Book Series









Comitê Nacional de Produção e Transmissão de Energia Elétrica **Obrigado!**

Iony Patriota de Siqueira iony@cigre.org.br iony@tecnix.com.br www.tecnix.com.br

