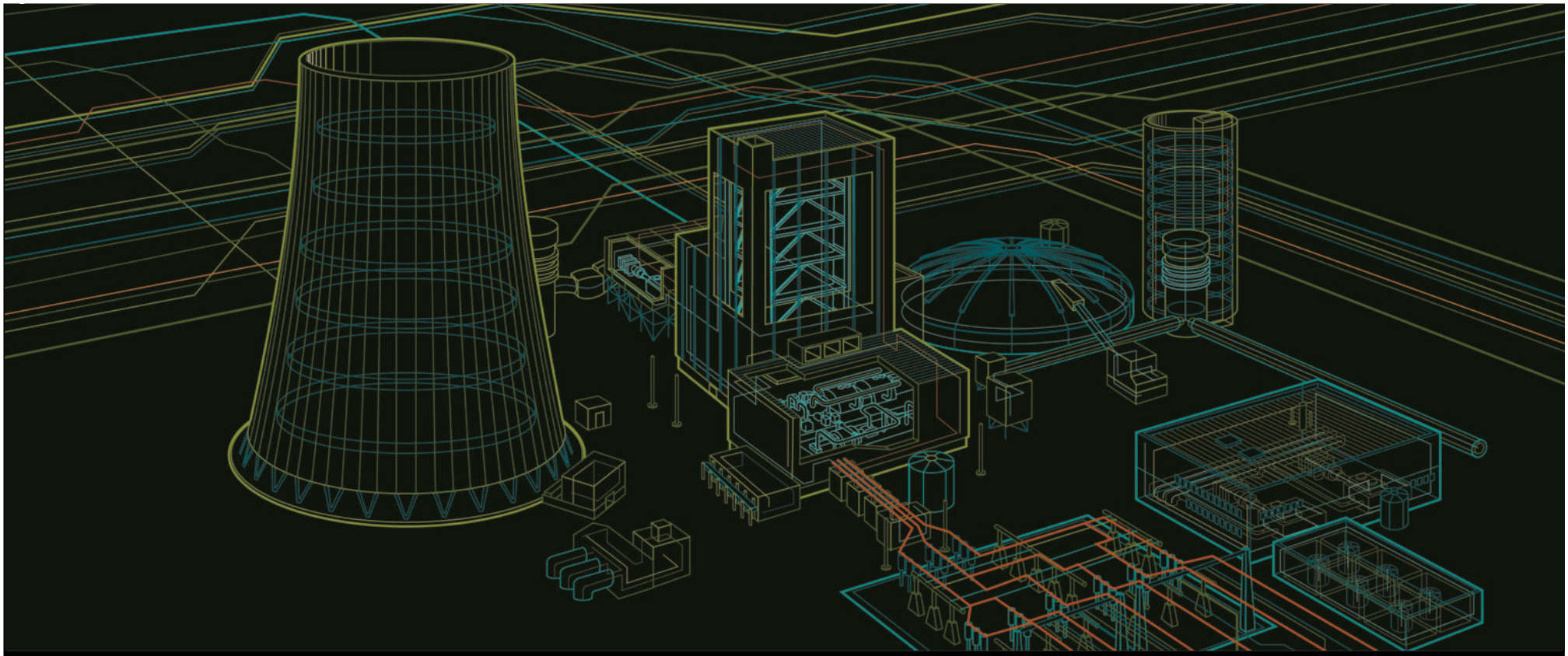


G. Brandt- ABB

Retrofitting existing plants with new communication standards for control and protection – are there benefits beyond the technical features?

A global leader in power and automation technologies
Leading market positions in main businesses

- 145,000 employees in about 100 countries
- $38 billion in revenue (2011)
- Formed in 1988 merger of Swiss and Swedish engineering companies
- Predecessors founded in 1883 and 1891
- Publicly owned company with head office in Switzerland

How ABB is organized
Five global divisions

Power Products

$10.9 billion
36,000 employees

Power Systems

$8.1 billion
20,000 employees

Discrete Automation and Motion

$8.8 billion
29,000 employees

Low Voltage Products

$7.7 billion
31,000 employees

Process Automation

$8.3 billion
28,000 employees

(2011 revenues, consolidated; including Thomas & Betts revenue for LP division)

- ABB's portfolio covers:
  - Electricals, automation, controls and instrumentation for power generation and industrial processes
  - Power transmission
  - Distribution solutions
  - Low-voltage products
  - Motors and drives
  - Intelligent building systems
  - Robots and robot systems
  - Services to improve customers productivity and reliability

Power and automation are all around us
You will find ABB technology…


orbiting the earth and working beneath it,


crossing oceans and on the sea bed,


in the fields that grow our crops and packing the food we eat,


on the trains we ride and in the facilities that process our water,


in the plants that generate our power and in our homes, offices and factories

Life Cycle Definition

- **Active ➡ active development and marketing**
  - Product will (further) developed according to market requirements
  - Active sales for new plants and service
- **Classic ➡ product maintenance**
  - Development as part of error and fault correction
  - No active sales anymore
- **Limited ➡ predominantly service and support**
  - Support via service organization (retroft, renovation)
  - Spare parts repair possible
- **Obsolete ➡ plant / site specific support**
  - Support via service organization with case-by-case agreement

Life Cycle
Evolution

Evolution through migration of systems

Plants specific upgrade to latest products under consideration of

- Existing system / installation
- Existing engineering data and structures

System migration and transition with little risk, based on experiences with stepwise implementation

Gained advantage

Good investment protection

Life cycle extension of plant

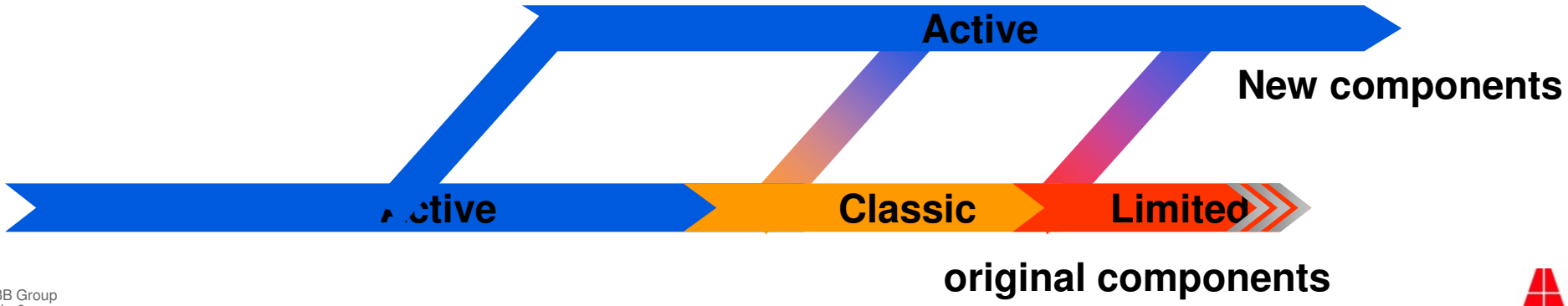
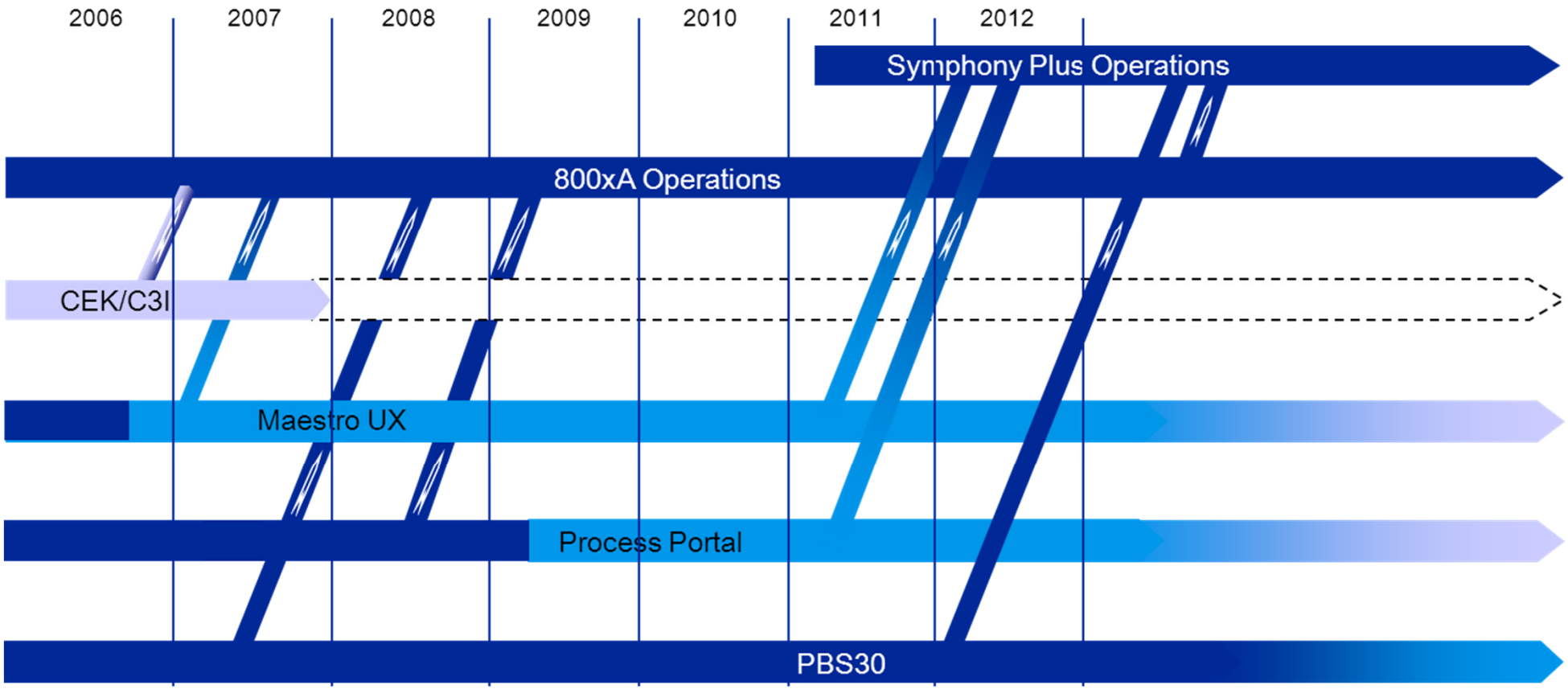


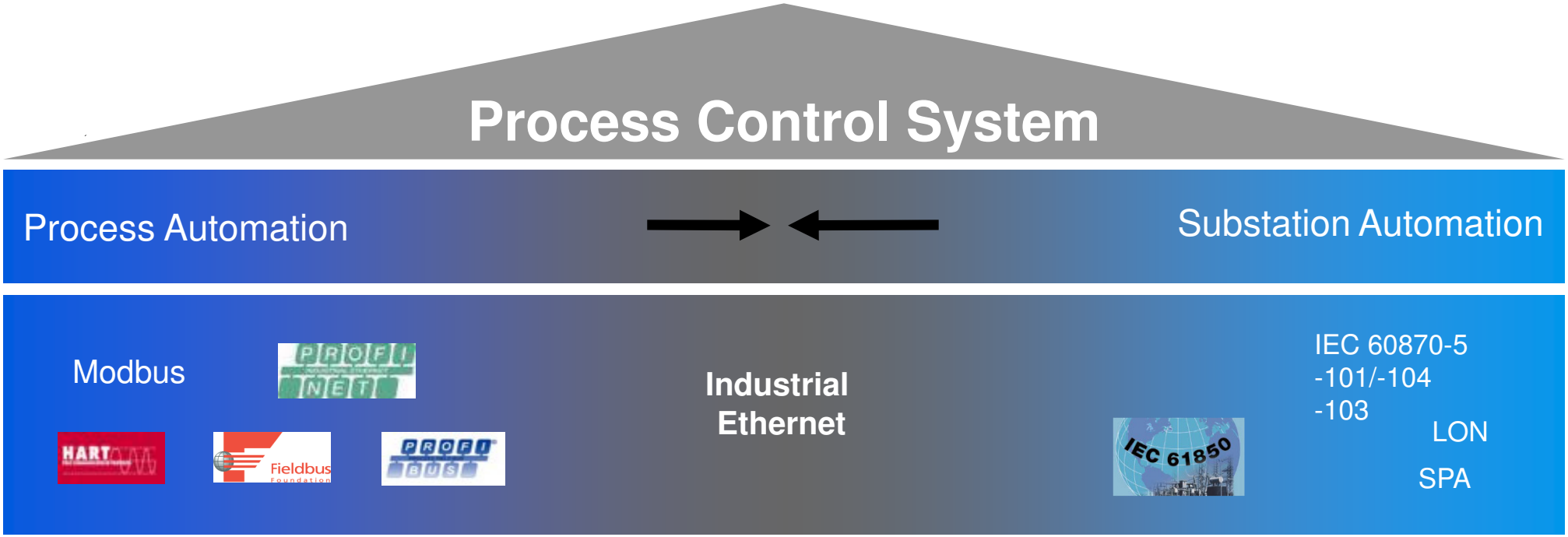
ABB Life Cycle
Evolution through Migration, e.g. HSI systems



New communication standards
Motivation of application

- Enable existing plants to comply with new and future operational and maintenance requirements
  - Lifetime extension
  - Operator effectiveness
  - Operational regime changes
    - Load and fuel flexibility
  - Plant asset management concept, fleet-wide
  - Advanced maintenance concepts
  - Security
  - Corporate / enterprise information management
    - Integration
- Significant plant modifications
  - Repowering, environmental, BoP-modification, co-firing
    - requiring major process / electrical changes

Communication standards
Trend in process and substation automation



Sensors + Consumers Low Voltage (LV)	Electrical system Low Voltage (LV)	Consumers Medium Voltage (MV)	Electr. system Medium Voltage (MV)	Unit protection
- Actuators - Unidirectional drive - Frequency converter - Intelligent Drives - Solenoid valves	- Protection - Control	- Unidirectional drive - Frequency converter	- Protection - Control - SUE	- Generator protection - Synchronization

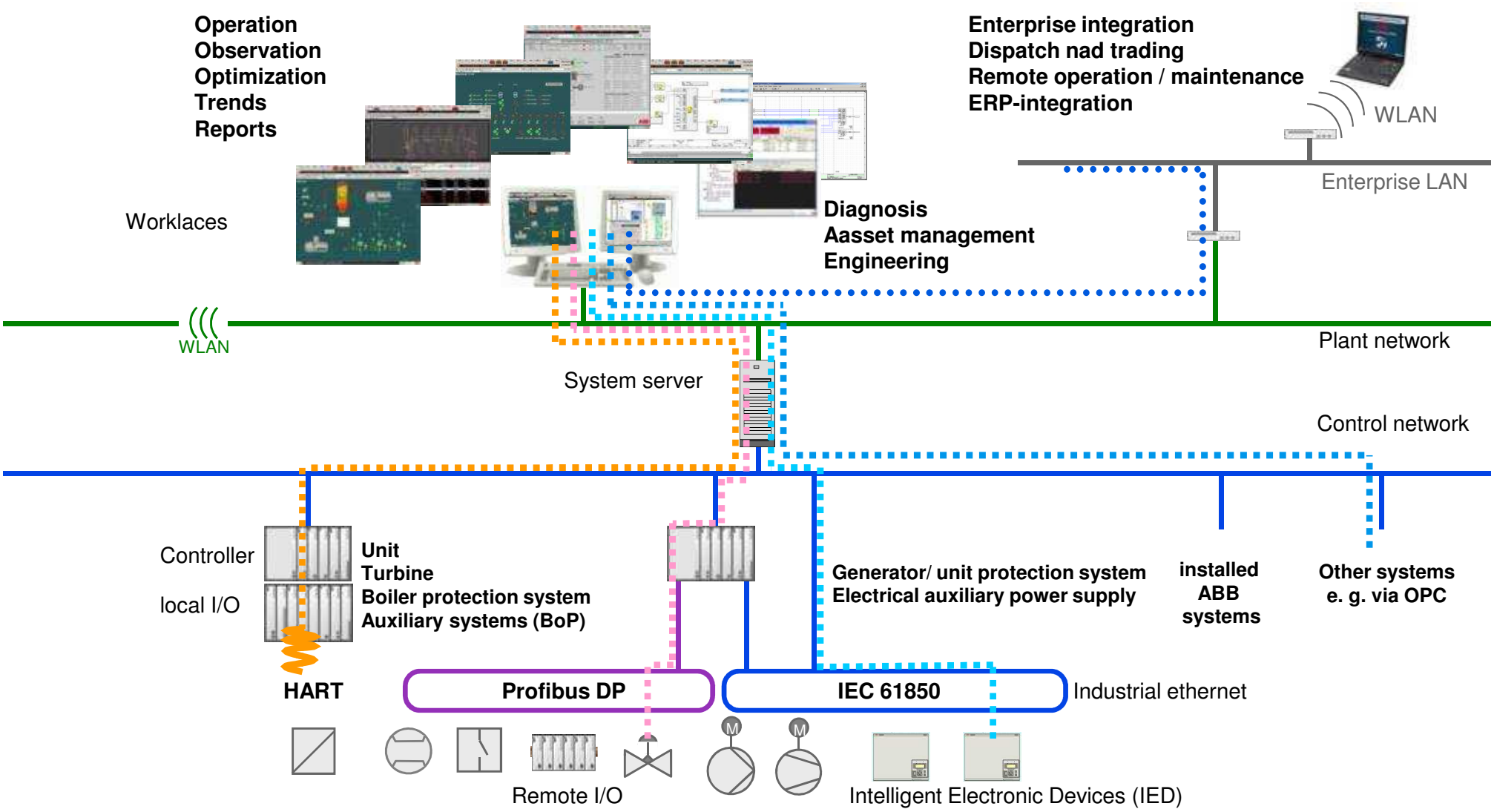
Constraints

- Maintaining existing infrastructure
  - Devices
  - Cables, trays, power supplies
  - I/O-level of DCS
  - Functions of controller, engineering tool, HIS, PIMS
  - Electrical control and protection
- Spare part stock
- Training investments
- Outage / downtime duration
- Diversity of standards – what to select
- ROI uncertainty
- Complex planning and engineering across various disciplines
  - process, electrical, DCS, security

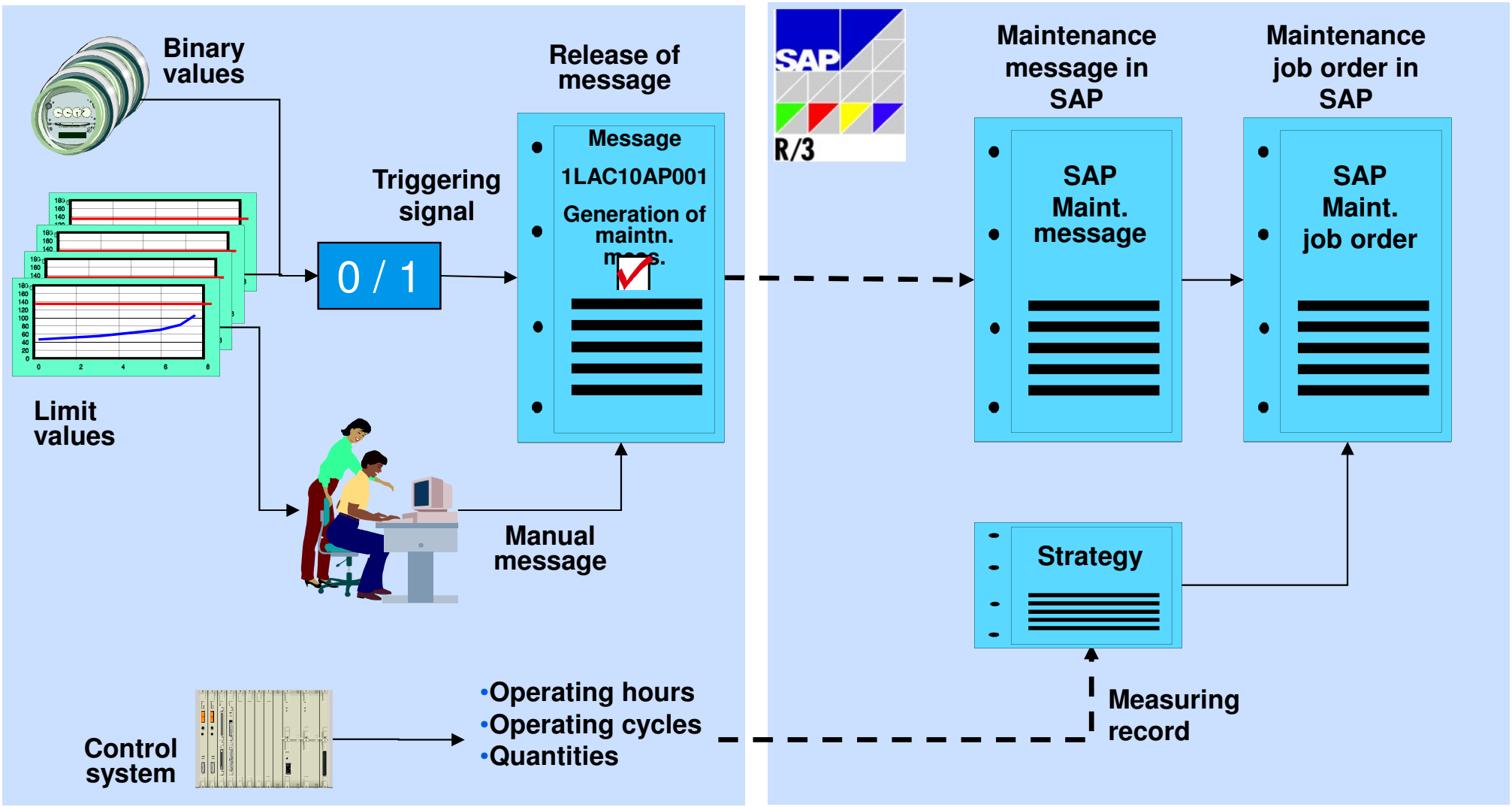
Operation and maintenance relevant information
Analysis

- **Analysis**
  - Continuous monitoring and analysis of the current operating condition (e. g. maintenance consumption) of components for predictive maintenance
  - Report of failures
- Diagnosis of failures
  - Root cause analysis of failure cause
  - Documentation of the failure
  - Proposals to improve the operation
  - Basis for maintenance planning and scheduling

Integrated communication paths



CMMS integration



Control system requirements

- Application of new communication standards needs support from existing DCS avoiding „rip and replace“ strategy
  - lifecycle management supports plant lifetime goals
  - I/O-level support for new standards
  - horizontal and vertical integration
  - controller-controller communication with new components
  - device integration for new standards
    - engineering, diagnostic, HSI, IMS
  - information integration with enterprise and trade systems

Summary

- The benefit of new communication standards requires several prerequisites:
  - suitable remaining plant lifetime
  - requirements to integrate the plant into future operational and maintenance concepts
  - integrated lifecycle management concept for electrical and I&C technologies
  - horizontal and vertical information management concept, including:
    - ERP
    - CMMS, predictive maintenance
    - operational integration (scheduling, trading, …)
    - security concept
  - Plant asset management concept with comprehensive analysis and diagnosis functions
  - Control system support for appropriate lifecycle management and support of future requirements

Life Cycle Management as example of association work

Multiple stakeholders from utility, industry, manufacture

Multiple, competing standards

Manufacturers no longer in business with unresolved support

Issues with unavailable spares and software upgrades

Information exchange on available alternatives

Availability of repair capabilities available

Others …

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