

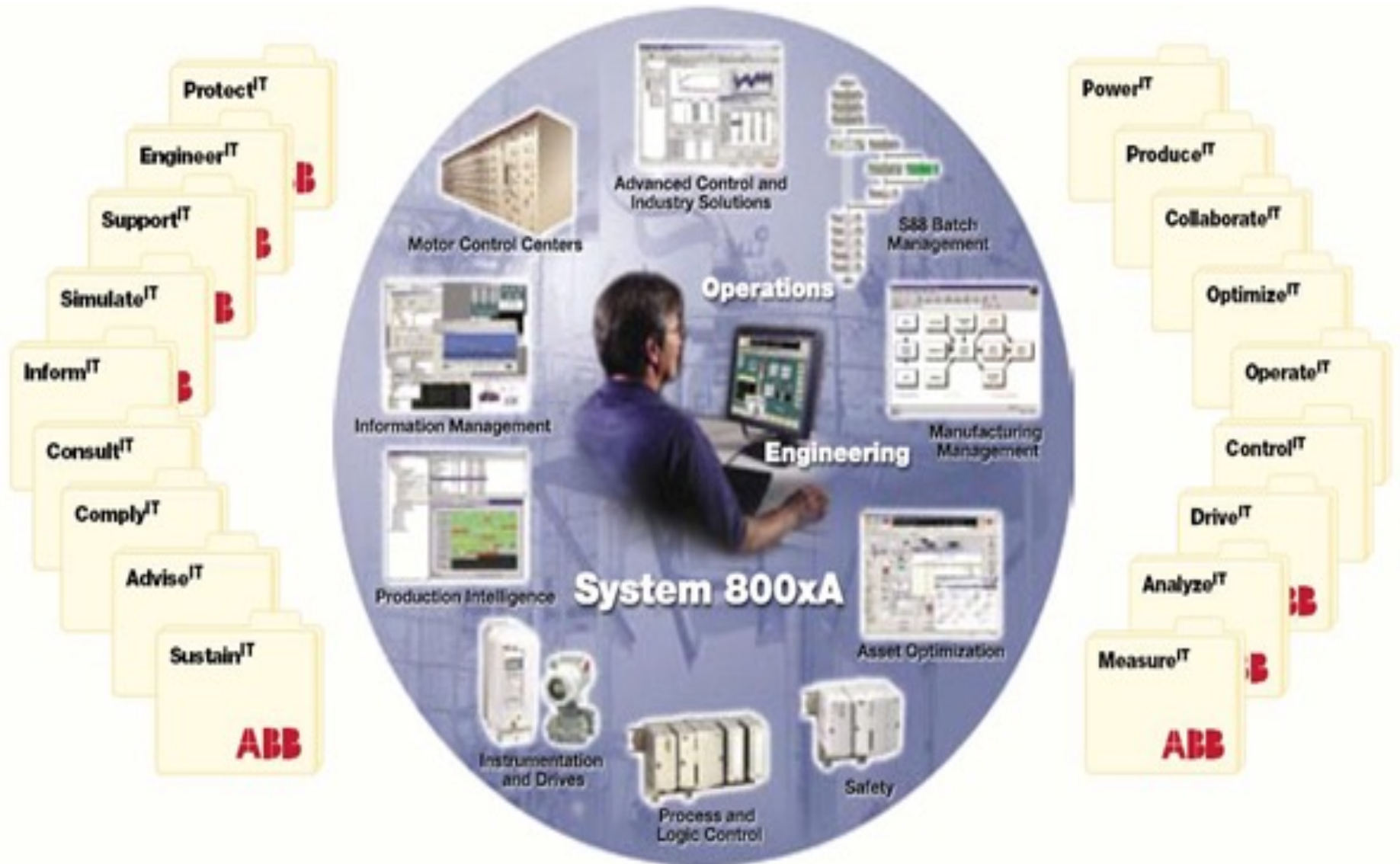


Aalto University
School of Chemical
Technology

CHEM-E7215 - Special Course in Process Systems Engineering

Jukka Kortela

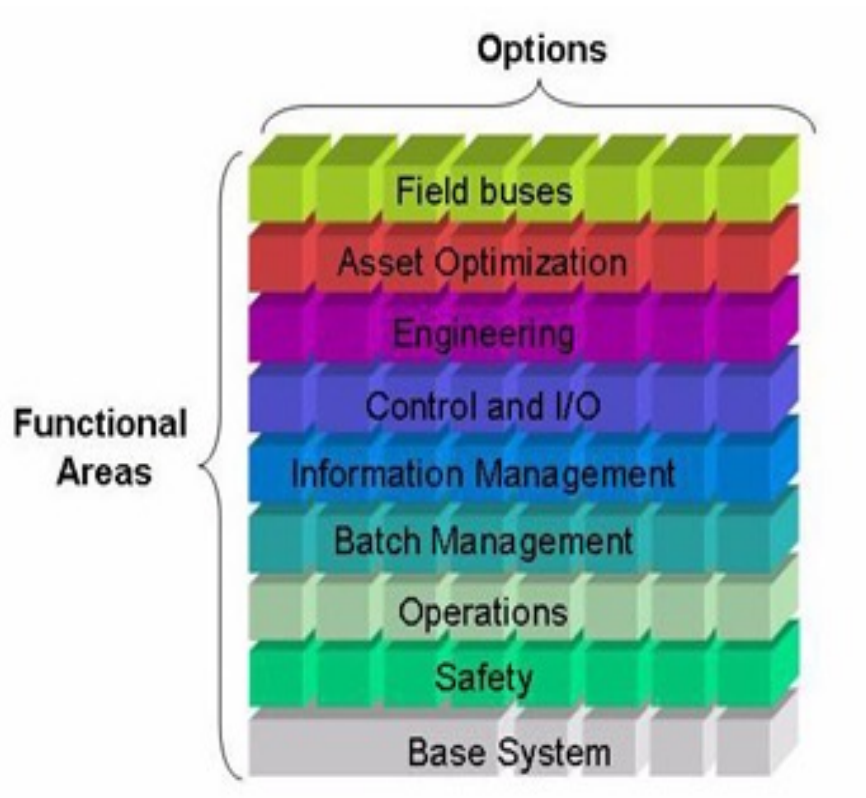
ABB 800xA Industrial^{IT} enabled



Learning outcomes

- Lecture 1: Structure of an automation system
- Student knows the structure of an automation system
- Introduction to ABB 800xA

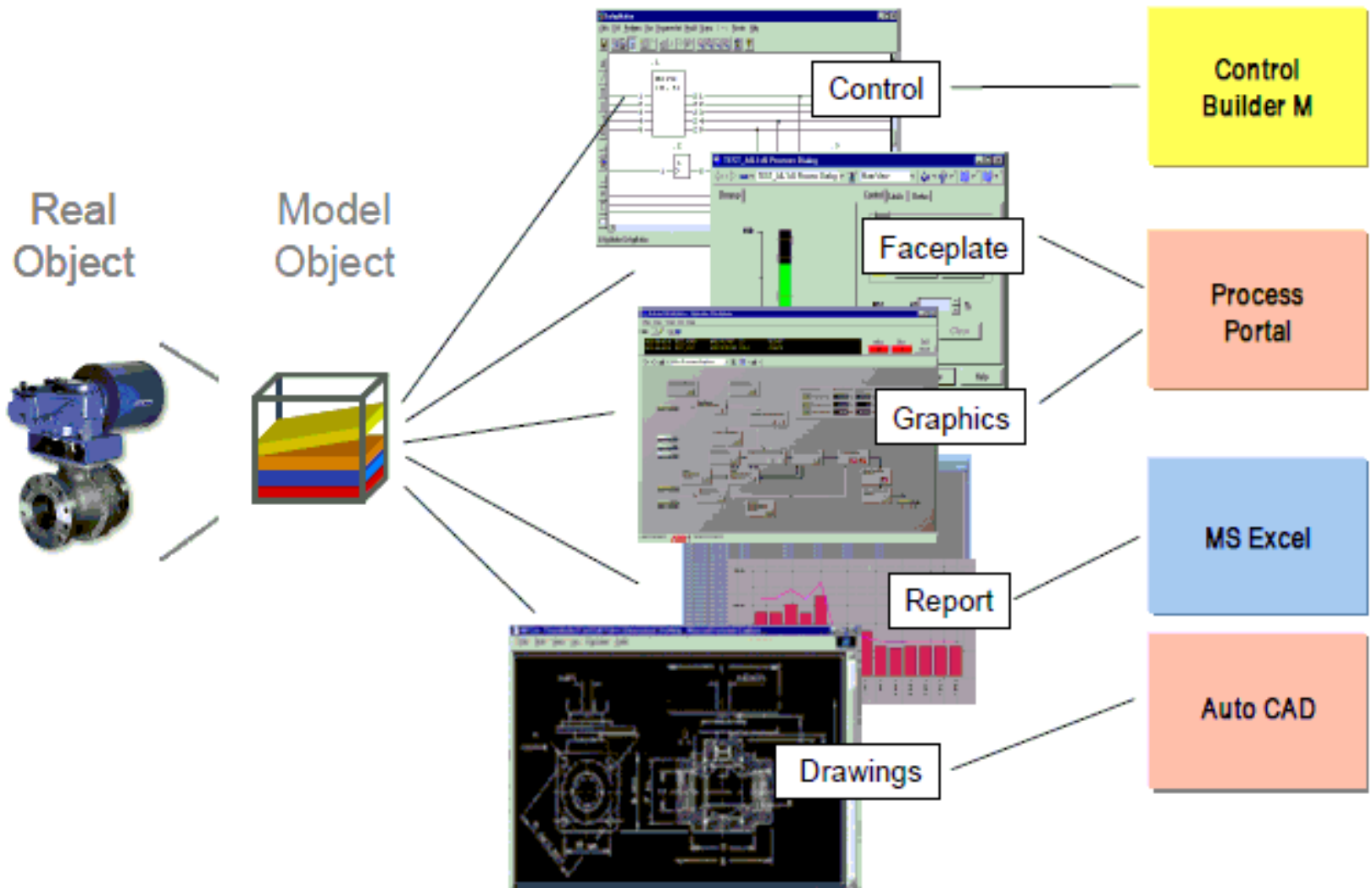
Options Grouped in Functional Areas



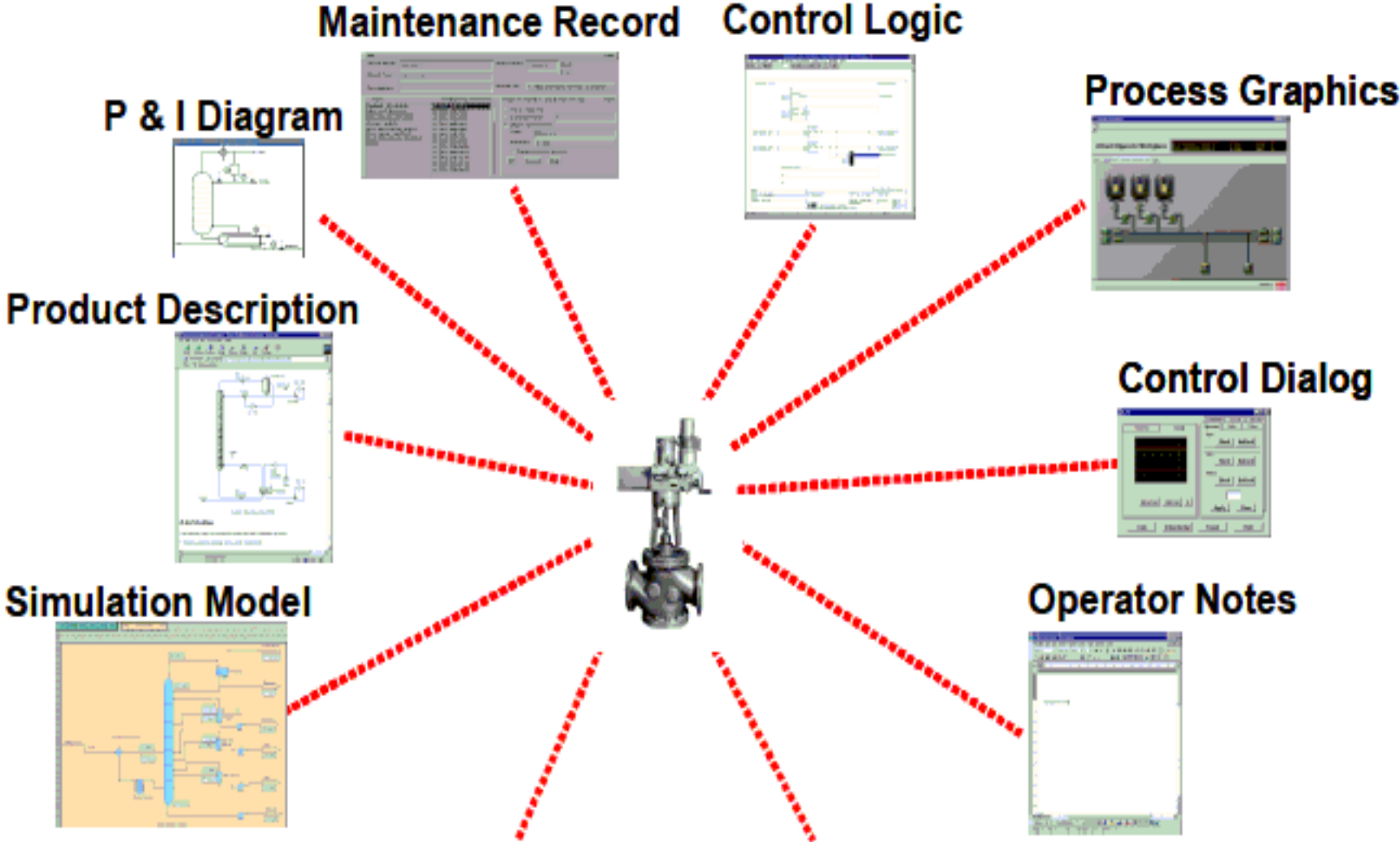
Standards



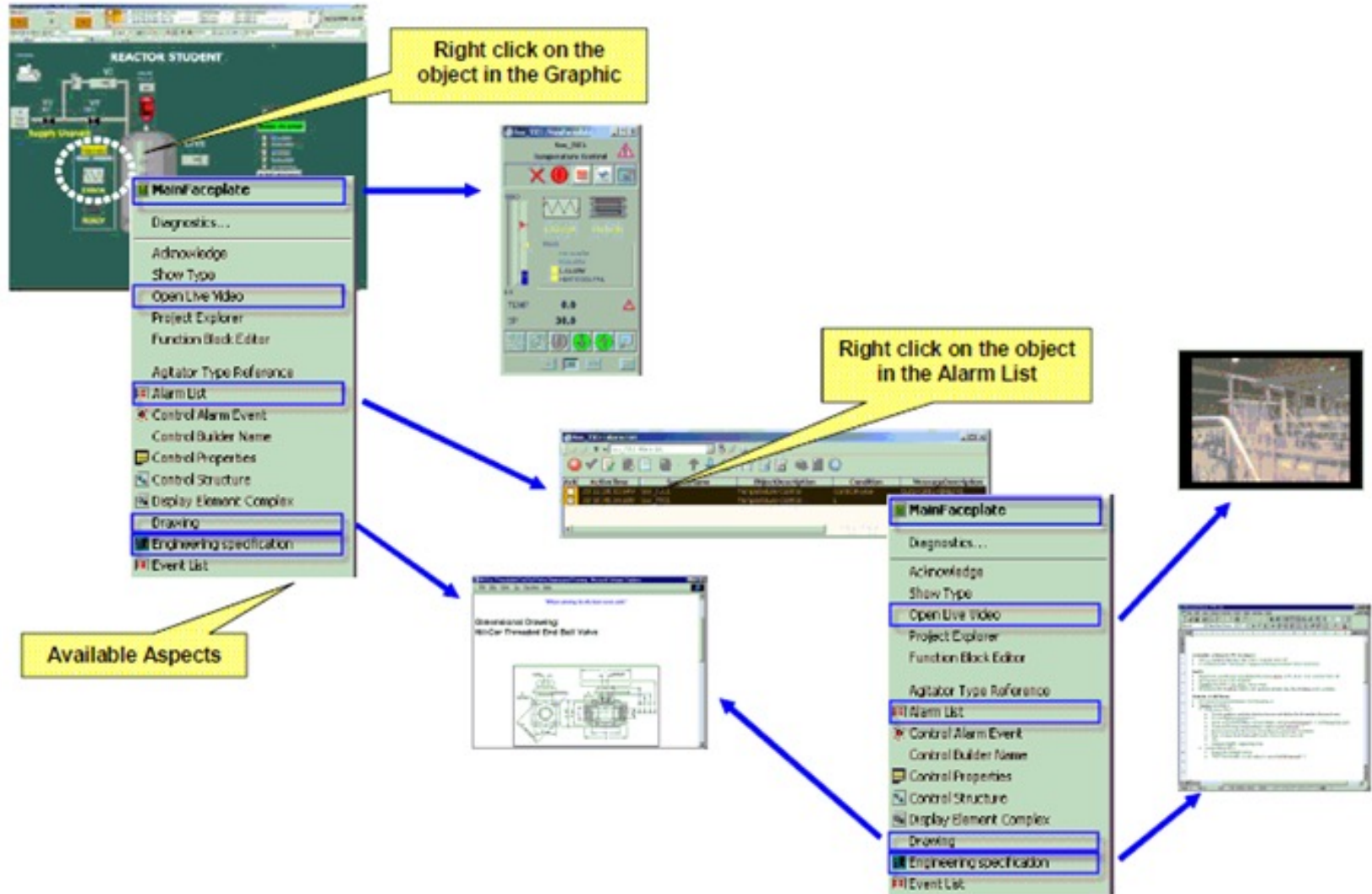
2 Aspects and Objects



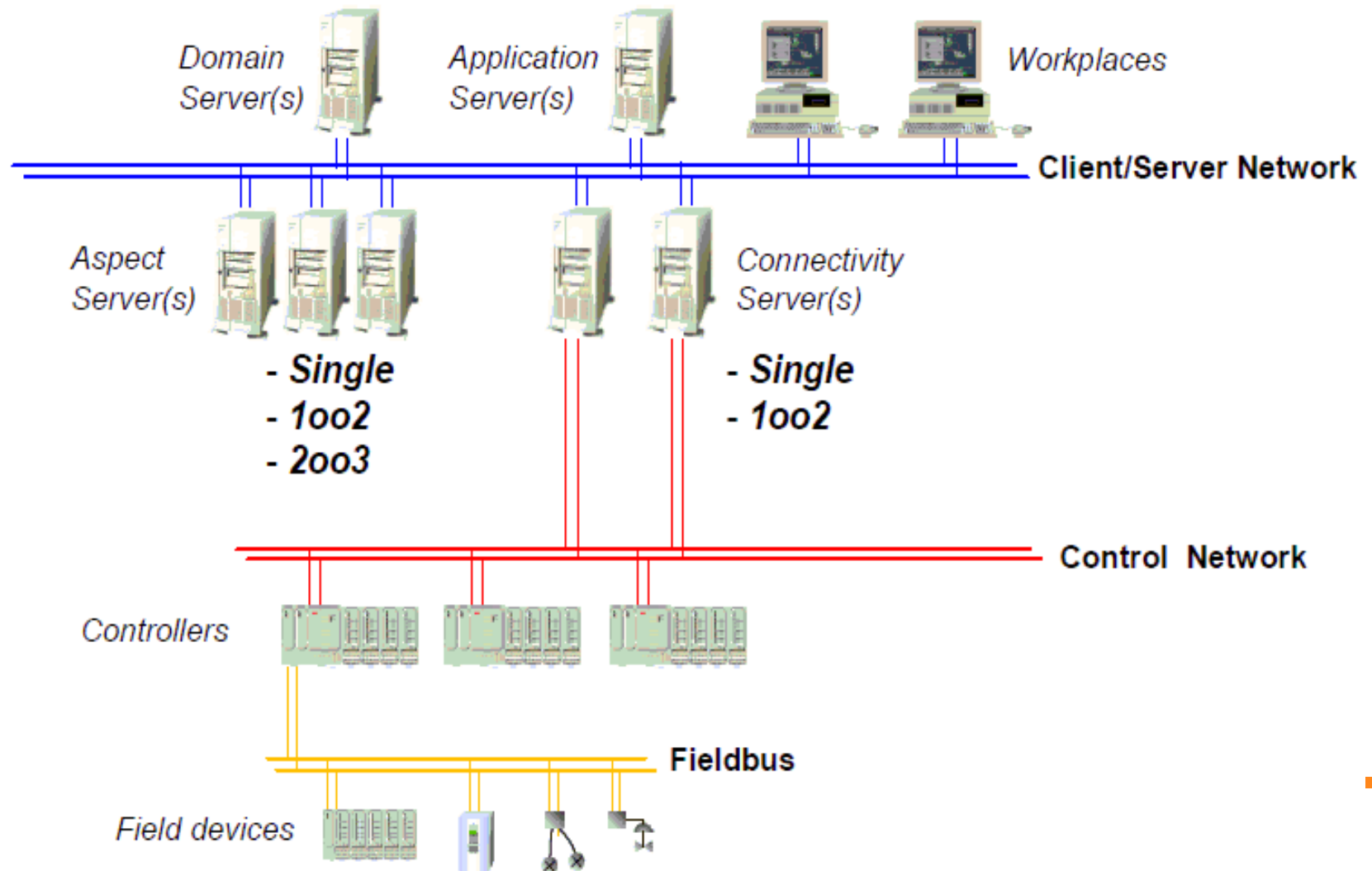
Example of a Control Valve



Intuitive Navigation



3 System Topology



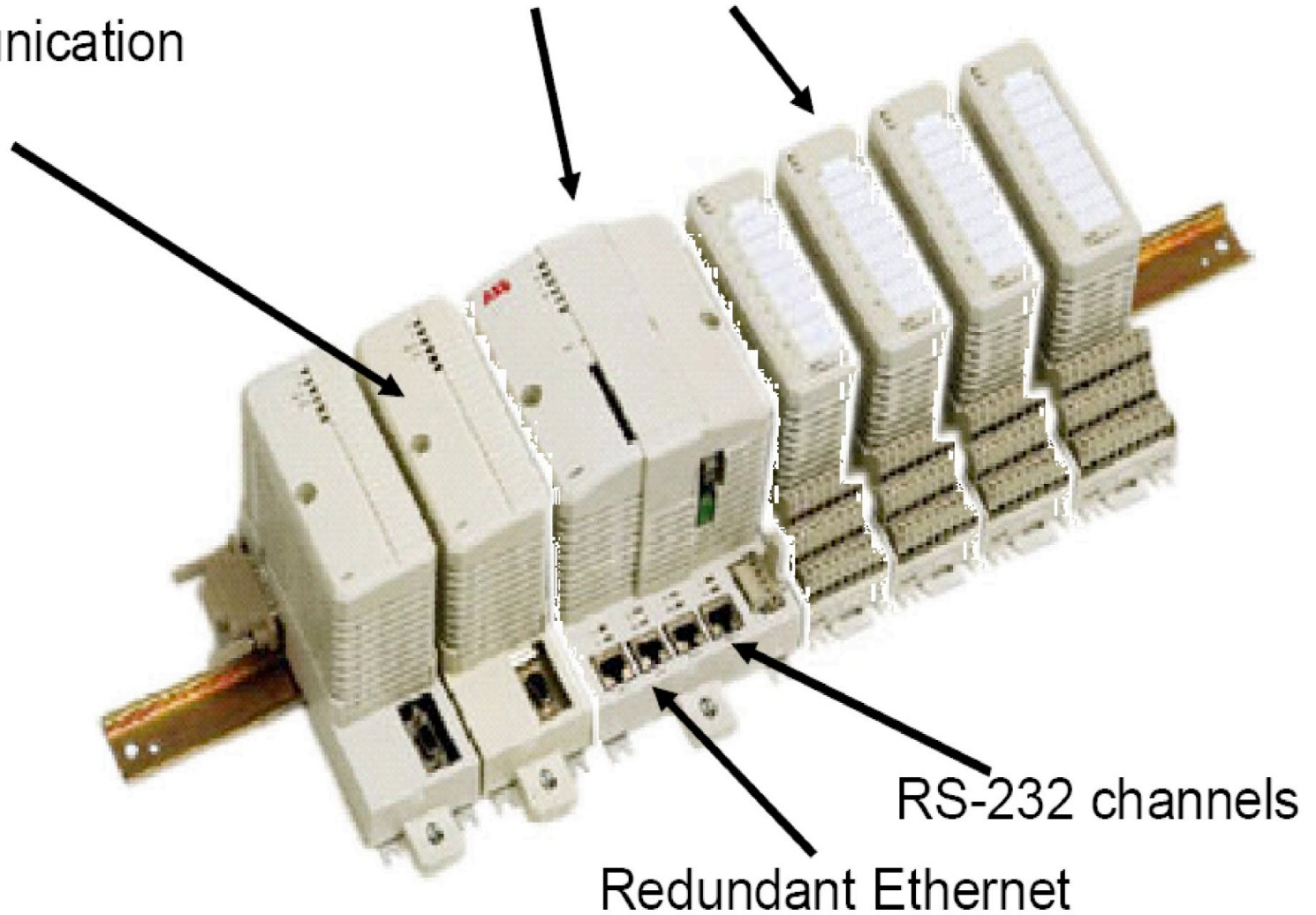
3 System Topology

1. Domain Server
2. Aspect Server
3. Connectivity Server
4. Application Server
5. Plant Network
6. Client/Server Network
7. Control Network
8. Controllers

Optional up to
12 Communication
modules

CPU

S800 I/O

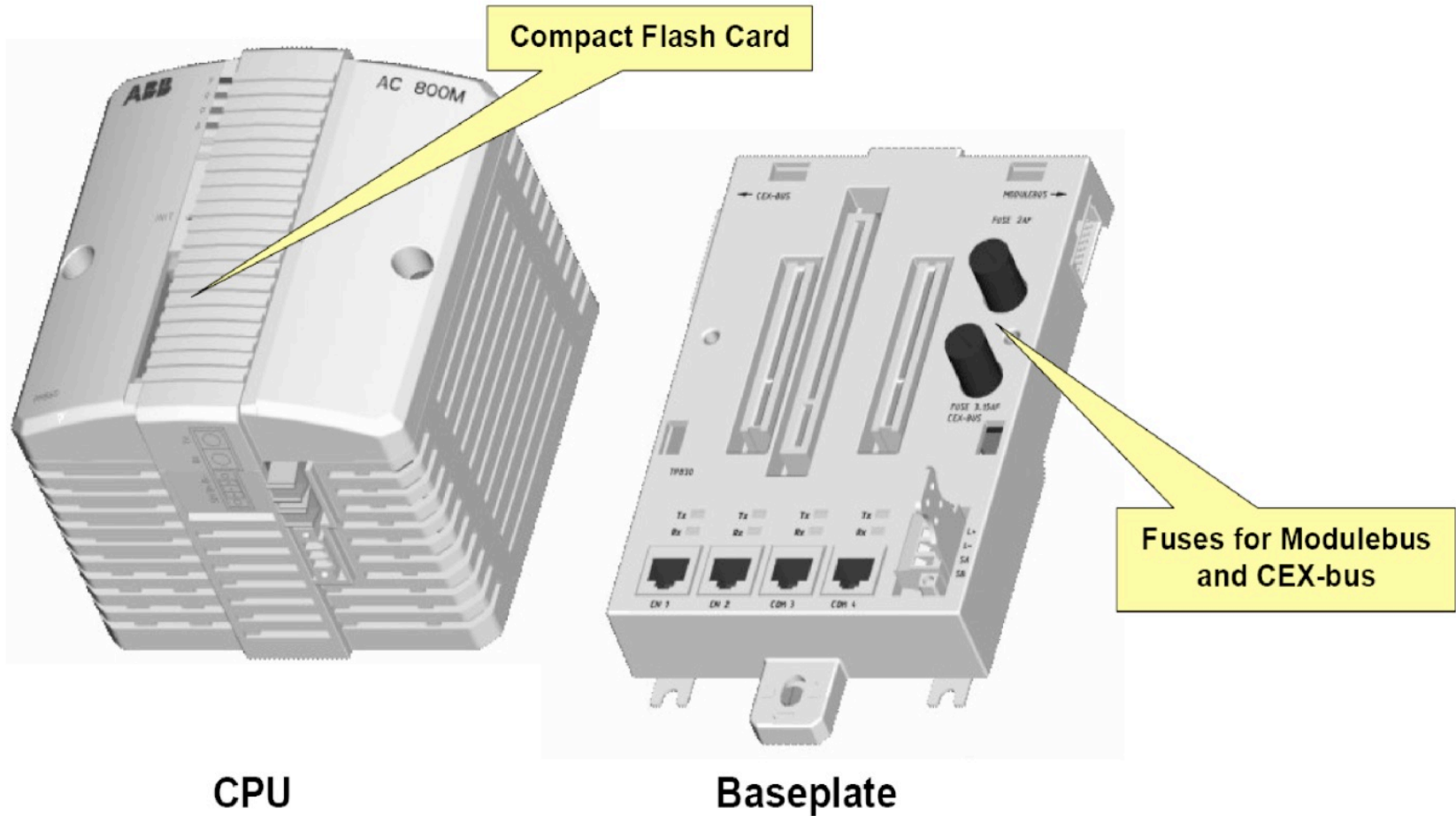


RS-232 channels

Redundant Ethernet

Various I/O systems can be connected to the AC 800M controller, either directly (S800 I/O) or via PROFIBUS or FOUNDATION Fieldbus.

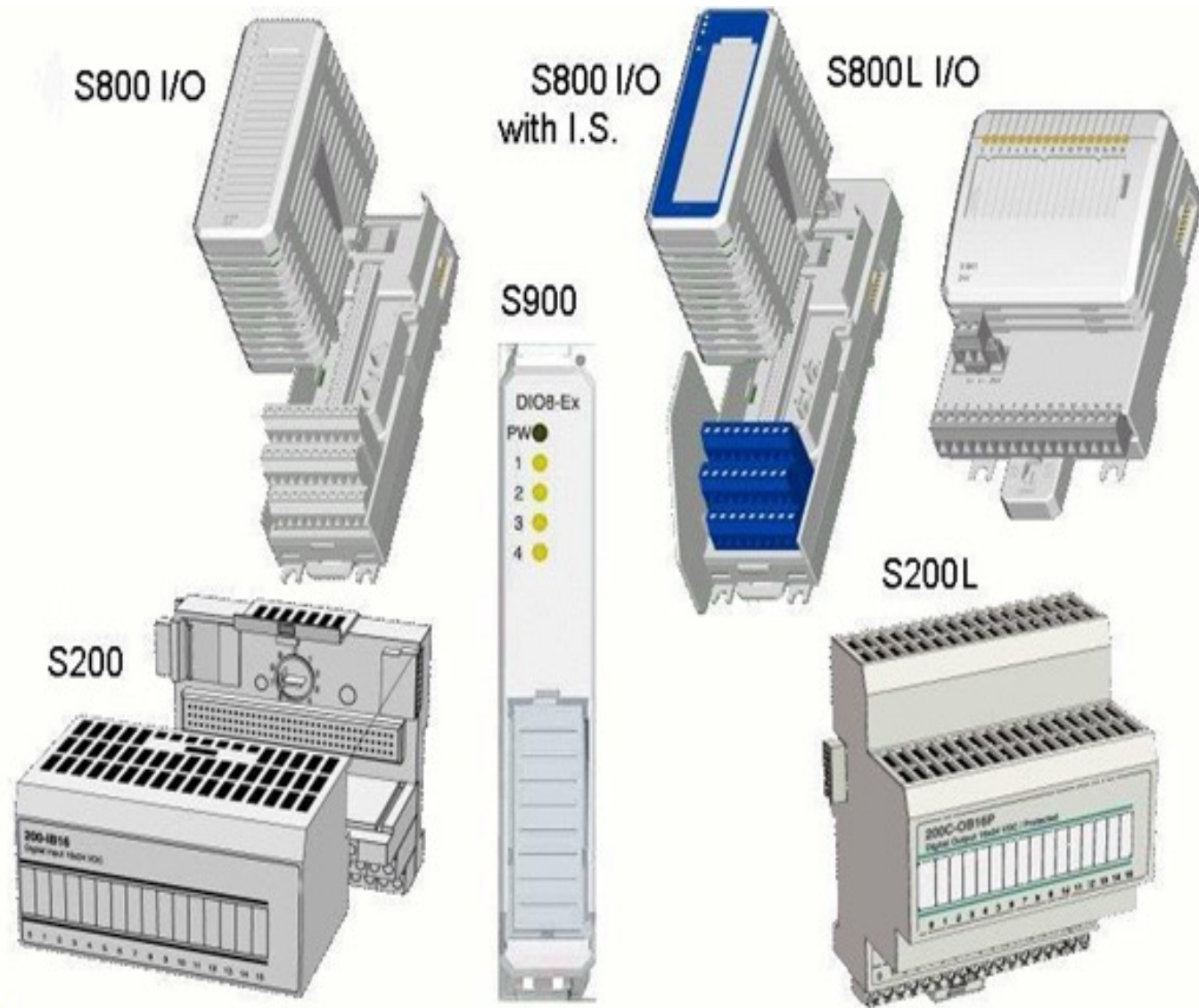
3.8.1 800xA PLC stations



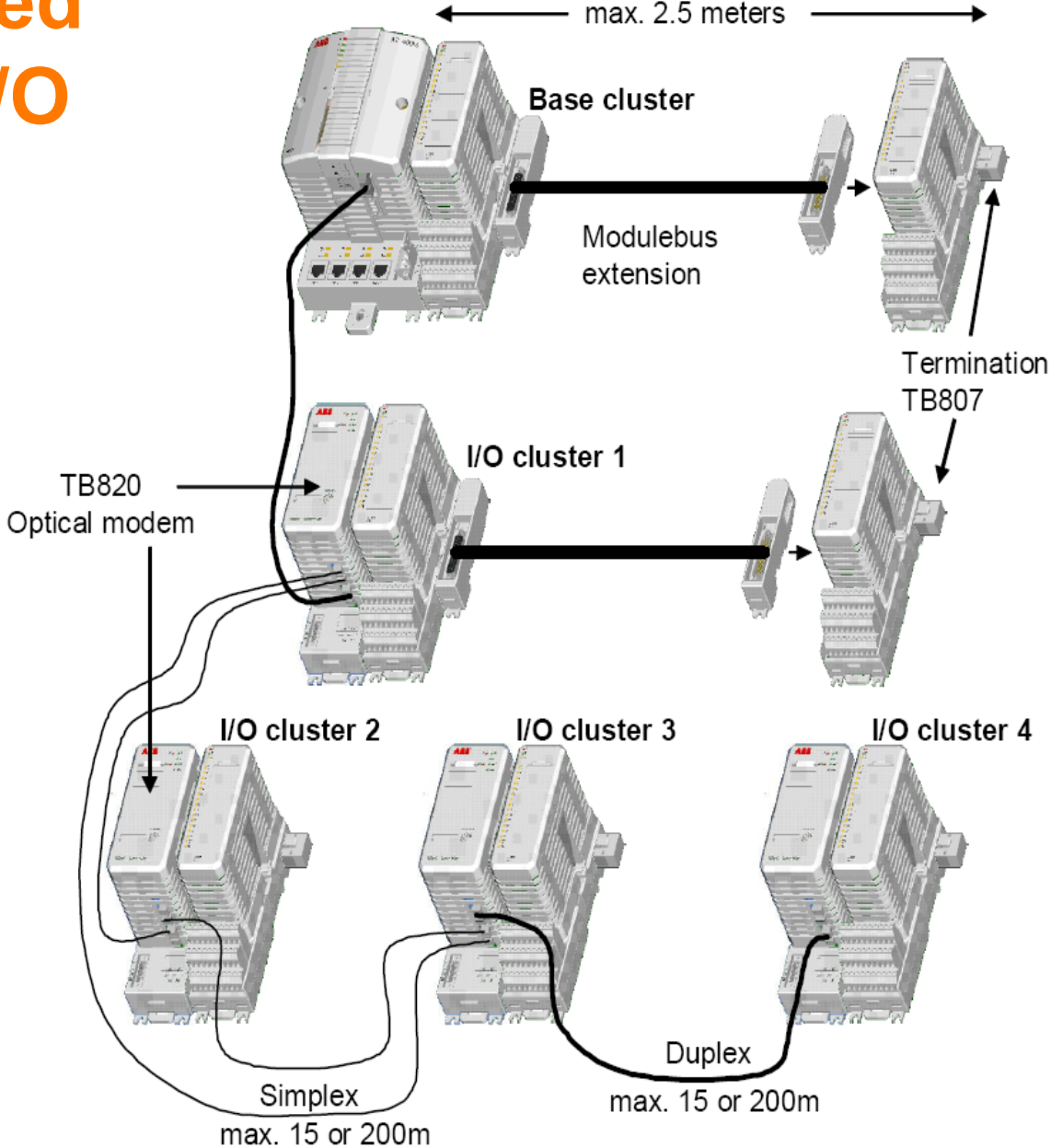
800xA – PLC options

Unit	Description	On-line replacement	Redundancy
PM851	24 MHz (48MHz for communication) / 8 Mbytes RAM 1 Ethernet port, 1 Serial port and 1 tool port. Application speed is half of PM860. Maximum one CEX bus module.	No	No
PM856	24 MHz (48MHz for communication) / 8 Mbytes RAM 2 Ethernet ports, 1 Serial port and 1 tool port. Application speed is half of PM860.	No	No
PM860	48 MHz / 8 Mbytes RAM 2 Ethernet ports, 1 Serial port and 1 tool port.	No	No
PM861	48 Mhz / 16 Mbytes RAM 2 Ethernet ports, 1 Serial port and 1 tool port. Singular or redundant.	Yes	Yes
PM861A	Same as PM861 but can use redundant communication unit CI854A, CI860 and BC810.	Yes	Yes
PM864	96 Mhz / 32 Mbytes RAM 2 Ethernet ports, 1 Serial port and 1 tool port. Singular or redundant. PM864 is 50% faster than PM861 in executing an application.	Yes	Yes
PM864A	Same as PM864 but can use redundant communication unit CI854A, CI860 and BC810.	Yes	Yes
PM865 (PA/HI)	96 Mhz / 32 Mbytes RAM 2 Ethernet ports, 1 Serial port and 1 tool port. PM865 can be used in an AC 800M High Integrity system.	Yes	Yes

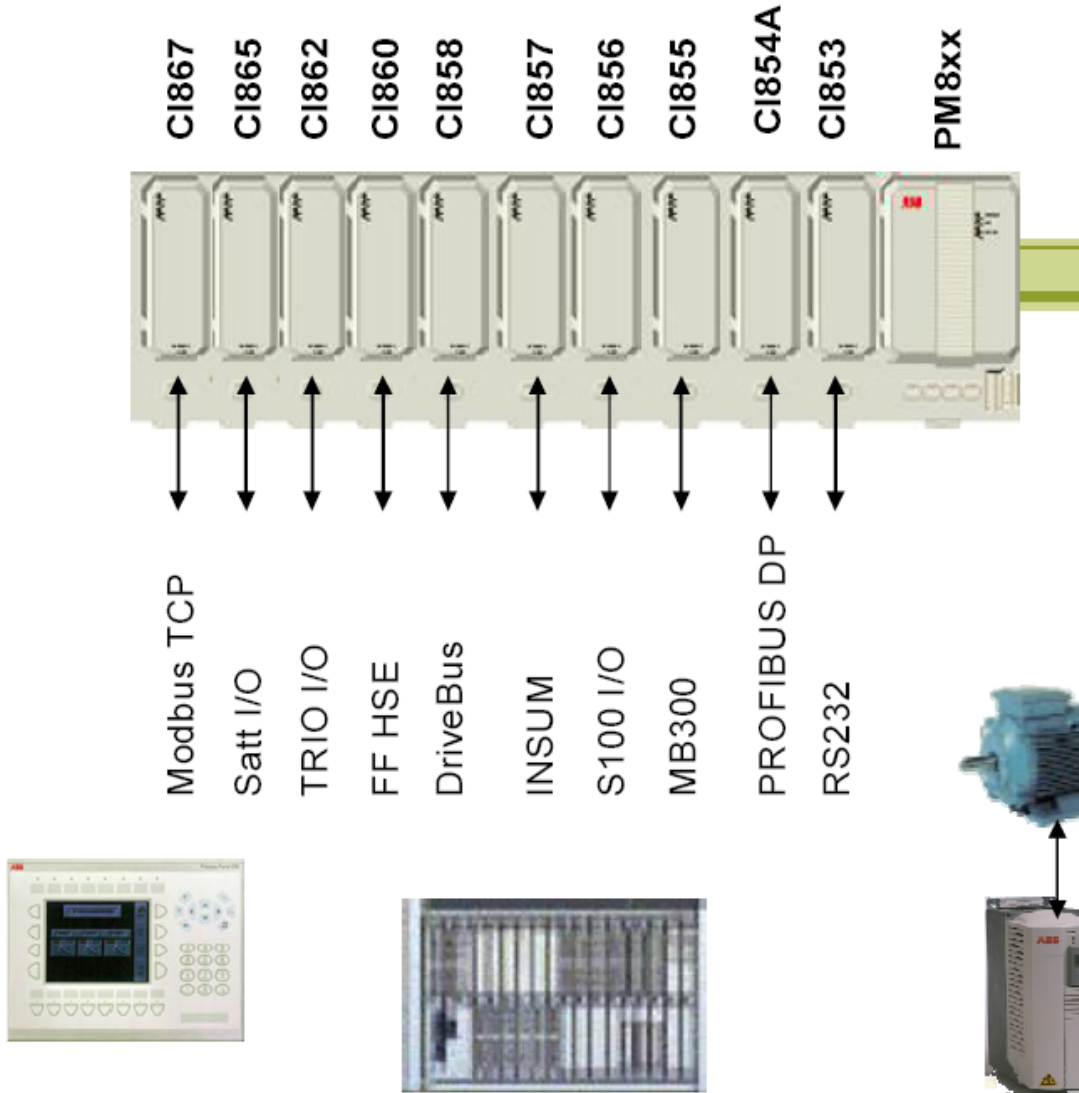
3.8.2 I/O stations



3.8.2.1 Centralized and distributed I/O stations

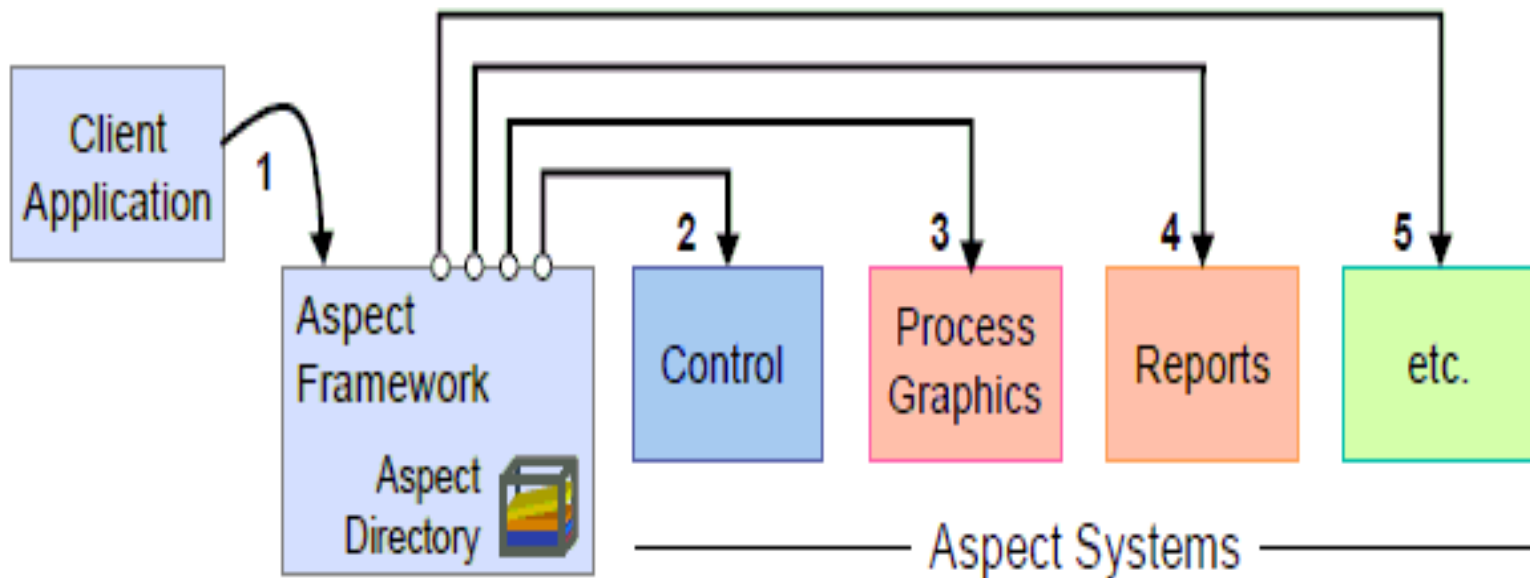


3.8.3 Communication ports

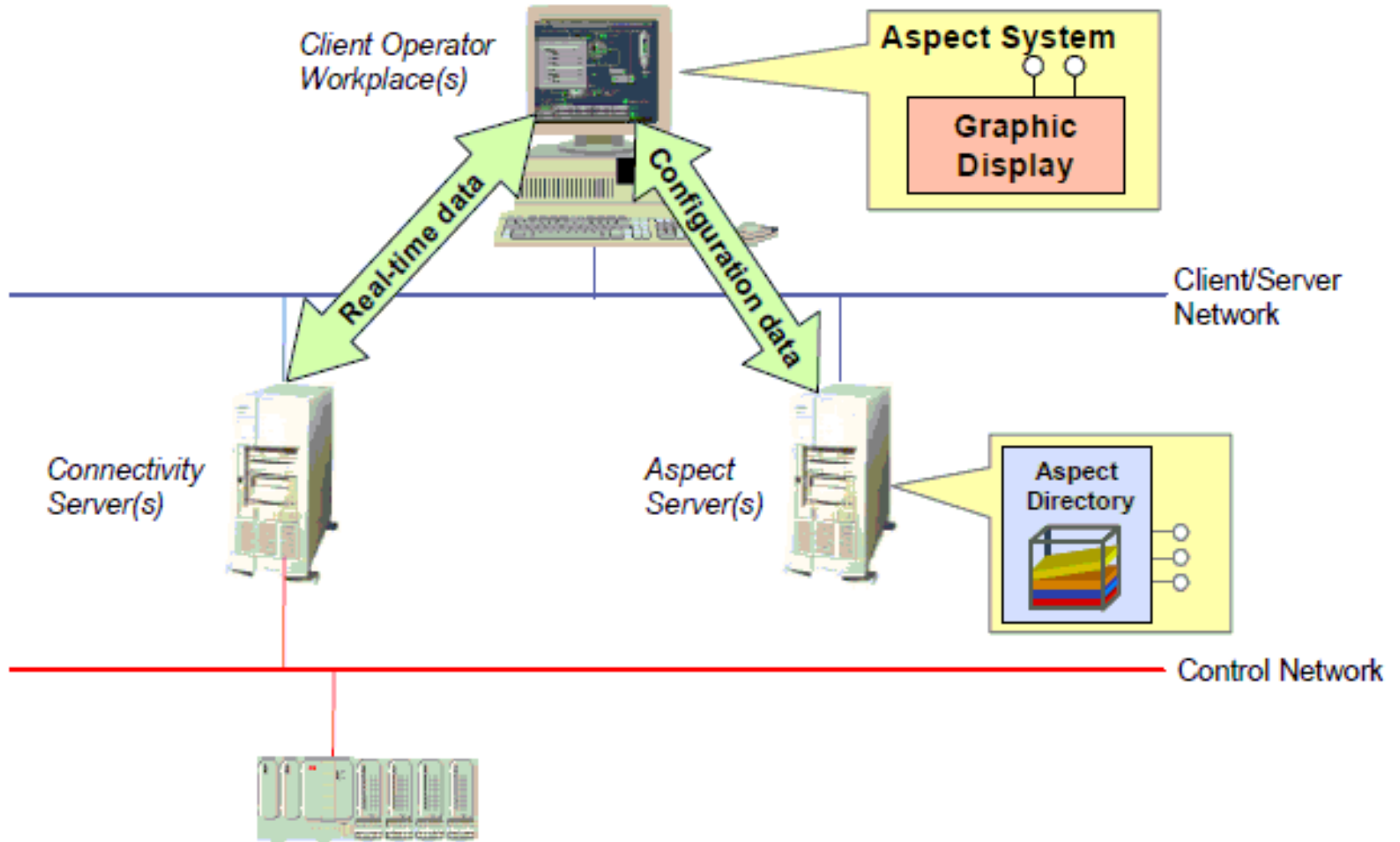


4 Client / Server Principle

Aspect Directory

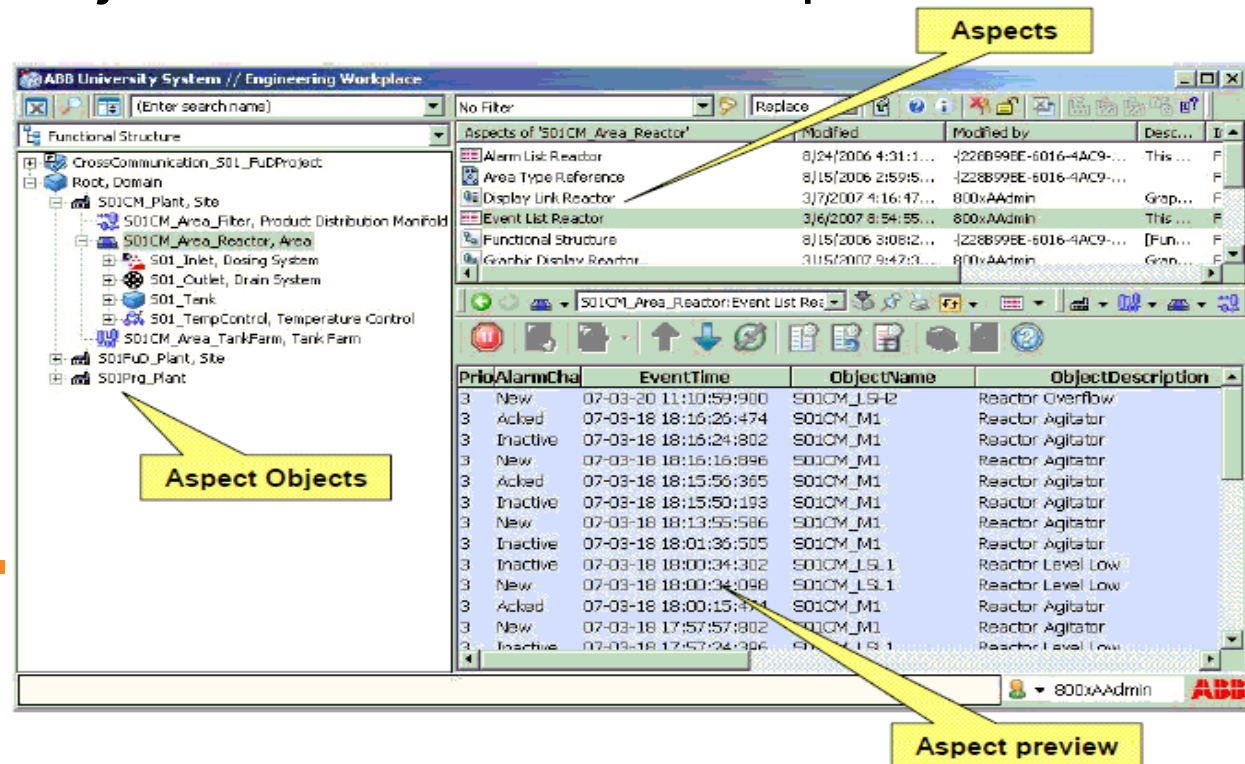


4.1.1 Example: Graphic Display



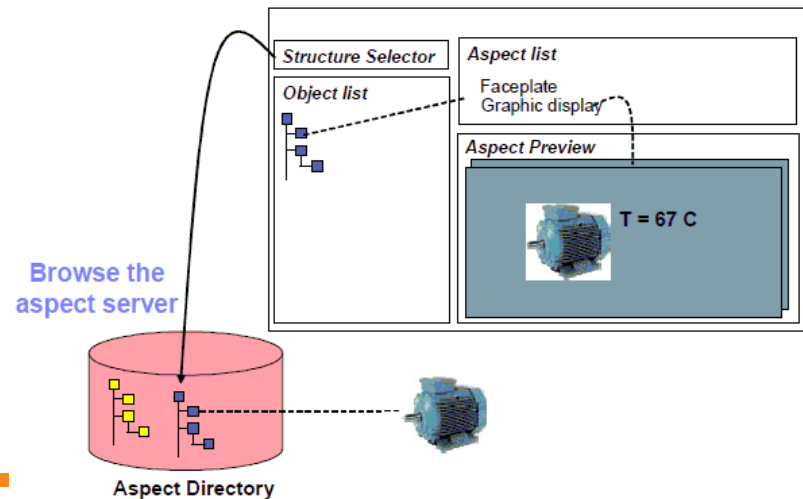
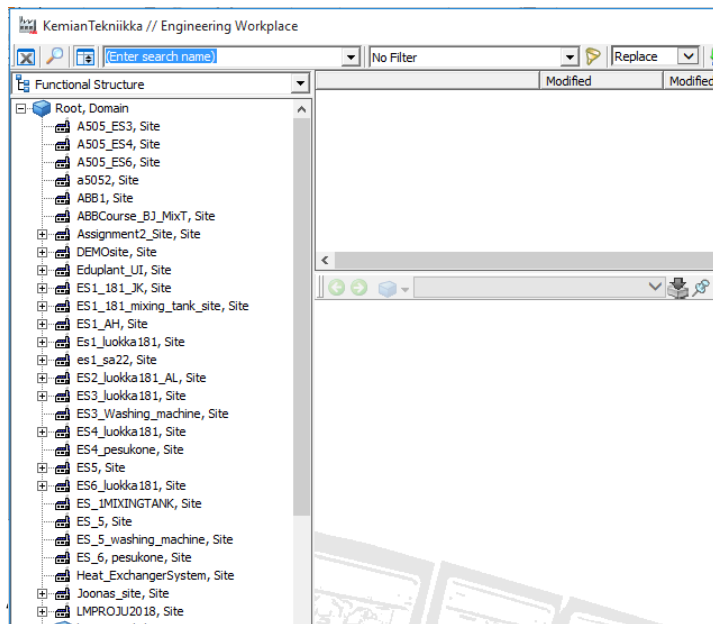
5 Engineering Workspace

- Engineering Workplace / Plant Explorer is the tool that is primarily used for System 800xA configuration. The Engineering Workplace is the workplace used for all project work done by application engineers. It is used to create and manage Aspect Objects and their related Aspects.



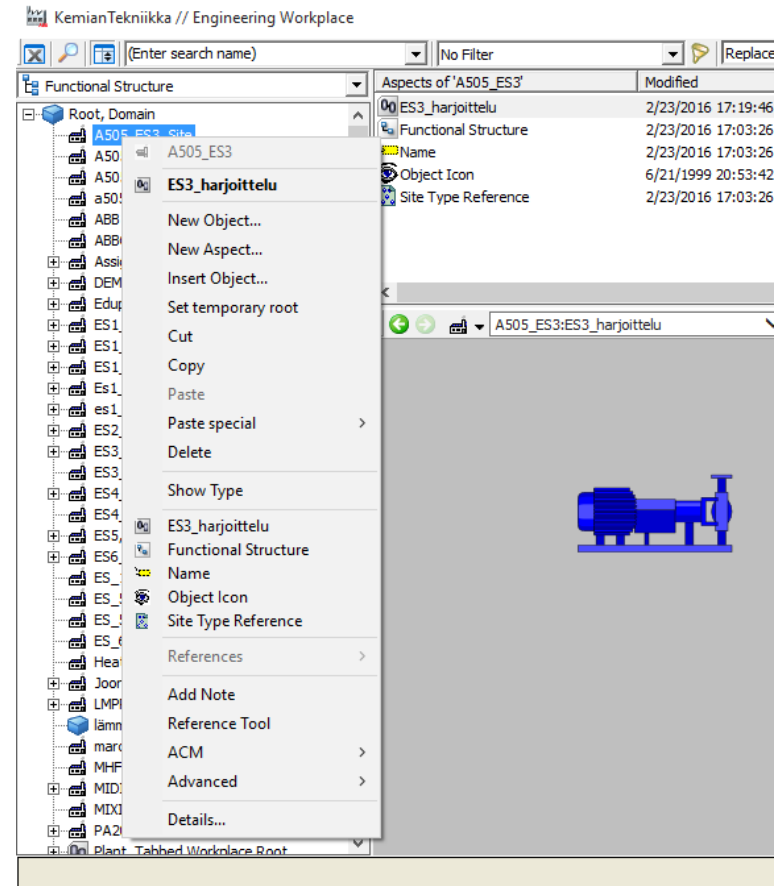
5.4 Browse the Aspect Directory

- Plant Explorer is used to browse and navigate in the Aspect Directory.
- When viewing a structure, objects are in the left-hand window (pane) and aspects of the selected object are in the right-hand window (pane).



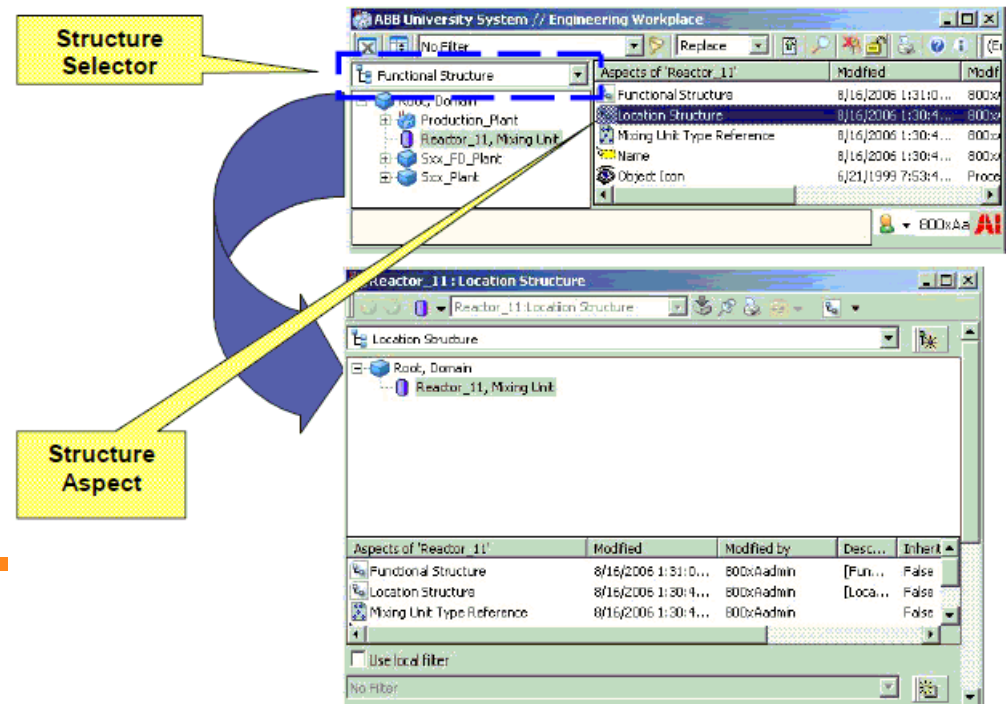
5.6 Context Menus

- By right-clicking on an object, the corresponding aspects will appear.
- Each object has certain aspects available, which can be different from one object to the other.



5.7 Navigate between Structures

- You can easily navigate from one structure to another, if the same object is used in several structures.
- Just click on the structure aspect and it will lead you to the place where the object is located in the other structure.



5.8 Structures used for Application Engineering

- These are the main application structures of the 800xA system. These structures are primary structures, because it is assumed that most Application Engineers will perform most of their work within these structures.
- **Functional Structure**
 - It is used to structure the plant into systems and subsystems according to the plant equipment.
- **Control Structure**
 - It is initialized without any objects. After the configuration is done, it contains the networks and nodes that are used to control the plant process.

5.8 Structures used for Application Engineering

- **Location Structure**
 - The Location Structure (optional) is supplied to help the user identify plant equipment based on the geography or location of the objects in the plant.
- **Library Structure**
 - It contains all object type libraries and its versions. The object types of these libraries are stored in Object Type Structure.
 - It contains the templates for such object types as the Alarm and Event List configuration, History Logs, and Trends.

5.8 Structures used for Application Engineering

- **Object Type Structure**

- Almost all aspect objects are instances of an Object Type. The intent is to make it possible to create and efficiently re-use standardized solutions to recurring problems.
- Rather than create a new and unique Aspect Object for every valve in your plant, it would be more efficient to create a few valve types.

5.9 Structures used for Administration

- **User Structure**
 - The User Structure holds the defined users and user groups allowed to work in the system.
- **Workplace Structure**
 - The Workplace structure is used to define and create the layout of the screens for user interface to the system.
 - This includes workplaces for operations, maintenance, management etc.
- **Service Structure**
 - The Service Structure holds the services, their groups and providers, and the relations between these defined in a system.

5.9 Structures used for Administration

- **Maintenance Structure**
 - The Maintenance Structure is used to define and work on Backups, System Configuration Versions, and Synchronizations
- **Additional Structure**
 - Admin Structure
 - Aspect System Structure
 - Node Administration Structure
 - Graphics Structure

Configuration?

800xA System

Control Builder M Project Explorer

Handles one
Control Project

Control Project
configuration

Download and
testing

AC 800M Controller

Plant Explorer / Engineering Workplace

Handles many
Control Projects

Control Project
administration

Faceplates and
Alarm Lists

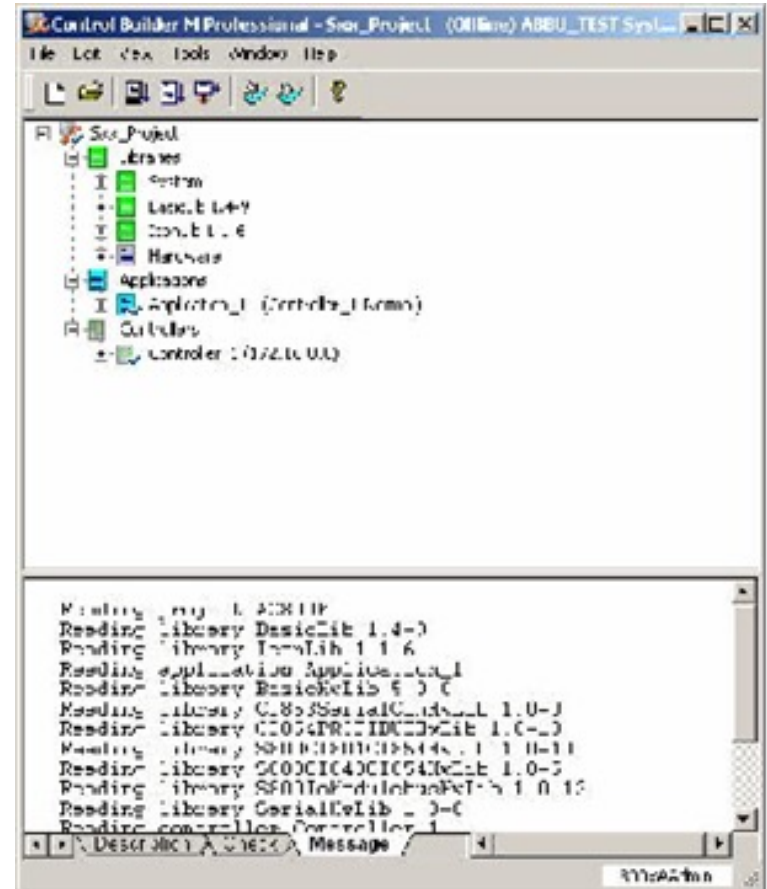
Operator Workplace

Synchronization

```
graph LR; subgraph "800xA System"; direction LR; subgraph "Control Builder M Project Explorer"; direction TB; C1[Handles one Control Project]; C2[Control Project configuration]; C3[Download and testing]; end; subgraph "Plant Explorer / Engineering Workplace"; direction TB; P1[Handles many Control Projects]; P2[Control Project administration]; P3[Faceplates and Alarm Lists]; end; C1 <--> P1; C2 <--> P2; C3 <--> P3; end; C3 --> AC[AC 800M Controller]; P3 --> OP[Operator Workplace];
```

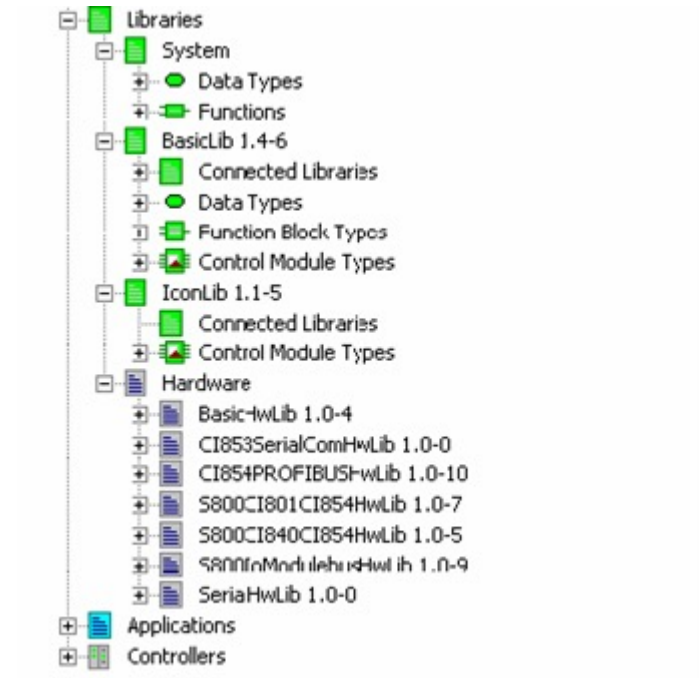
Project Explorer – Overview

- The Project Explorer is a tool you can use to create, modify and navigate in a project.
- You can select all objects such as data types; functions and function block types and display them in an editor.



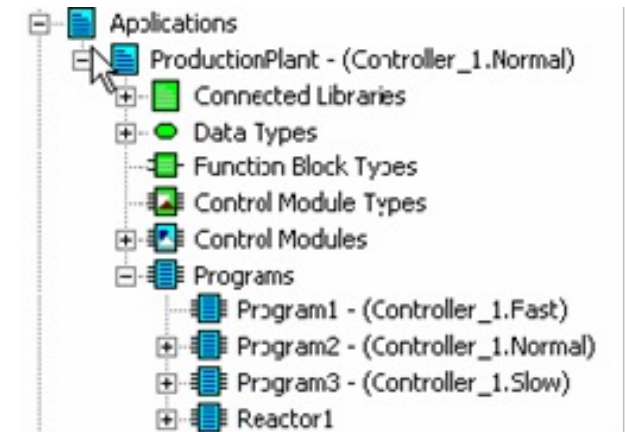
Libraries

- The Libraries folder contains all libraries used in a project. By inserting a library in to a project, its type will become available to connect to an application.
- There is also a Hardware folder available, containing several hardware libraries.



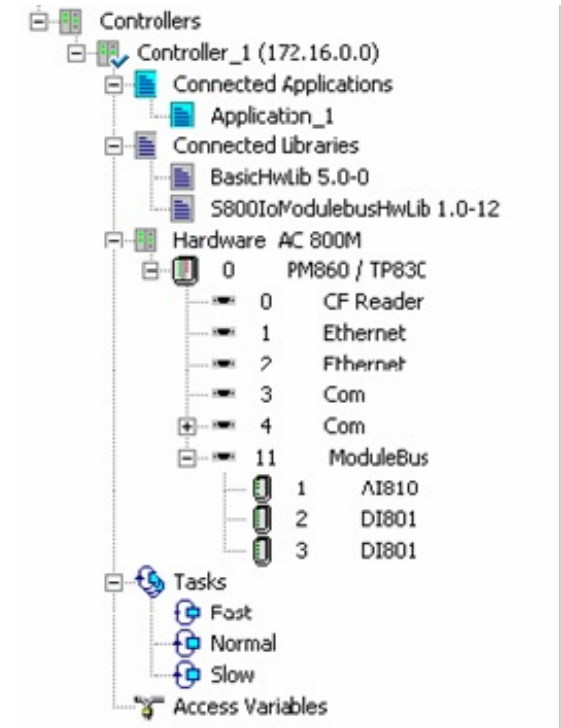
Applications

- A Control Project may contain one or more applications.
- In the application create the program(s) or control modules containing the program code to be compiled and downloaded for execution in the controller(s).



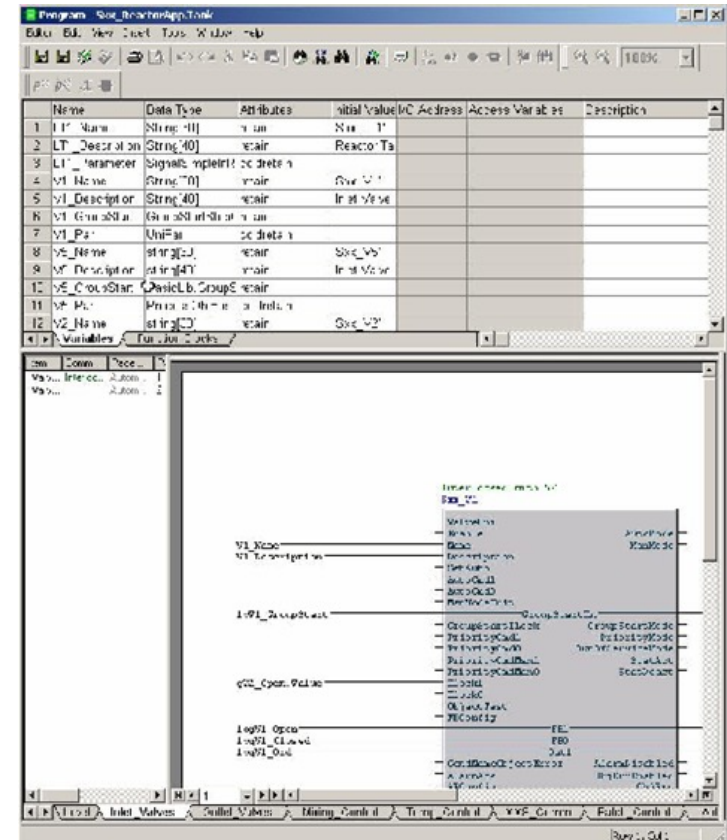
Controllers

- The hardware definition and the I/O connection are done in the Controllers folder.
- In the root of the Controllers folder of each project, several controllers can be created.
- The applications containing the code are not executed unless a “work scheduler” - a task - is connected and serves as an “engine” running the code in the controller.



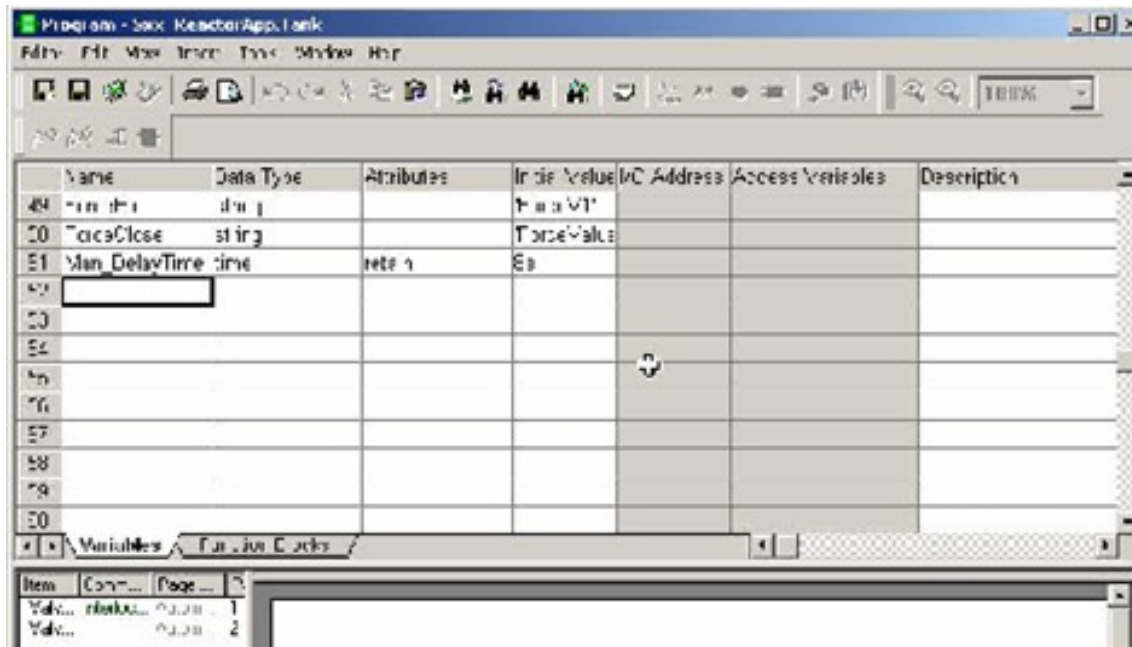
Program Organization Units (POU)

- The application contains the program code that is to be compiled and downloaded for execution in the controller.
- An application should be seen as a container more than as a programming object, since it does not contain any code of its own.



Declaration Pane

- Use the declaration pane to declare variables and function blocks.



Familiarization with the ABB automation system

Aalto University ABB 800xA Overall System Layout

