InFrame Synapse PCS

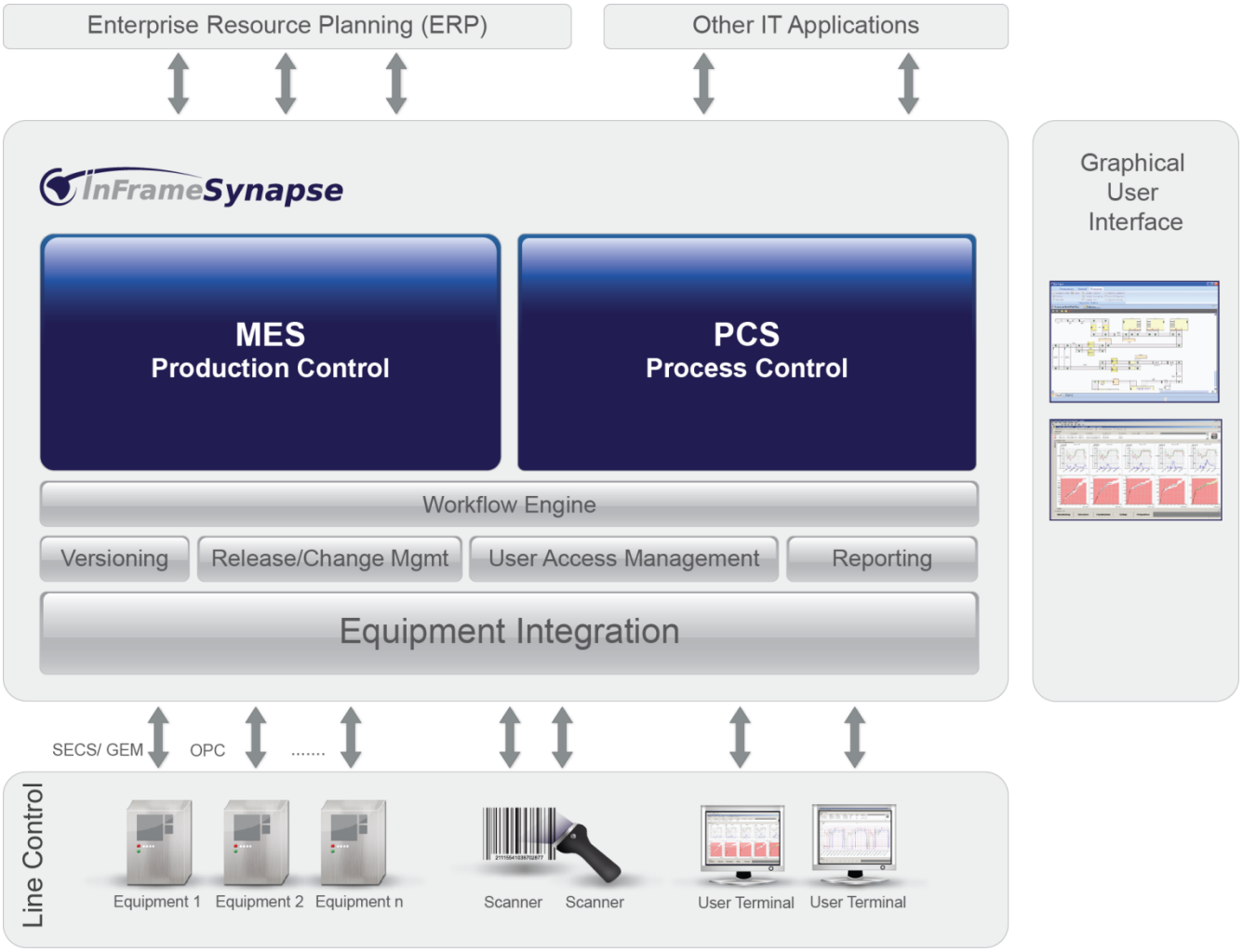
Process Monitoring and Control for
Automated Manufacturing Processes and Equipments

Agenda

1. Product Positioning
2. Why InFrame Synapse PCS?
3. InFrame Synapse PCS Packages
4. Supporting the Continous Improvement Process
5. Architecture
6. Integration with Existing MES

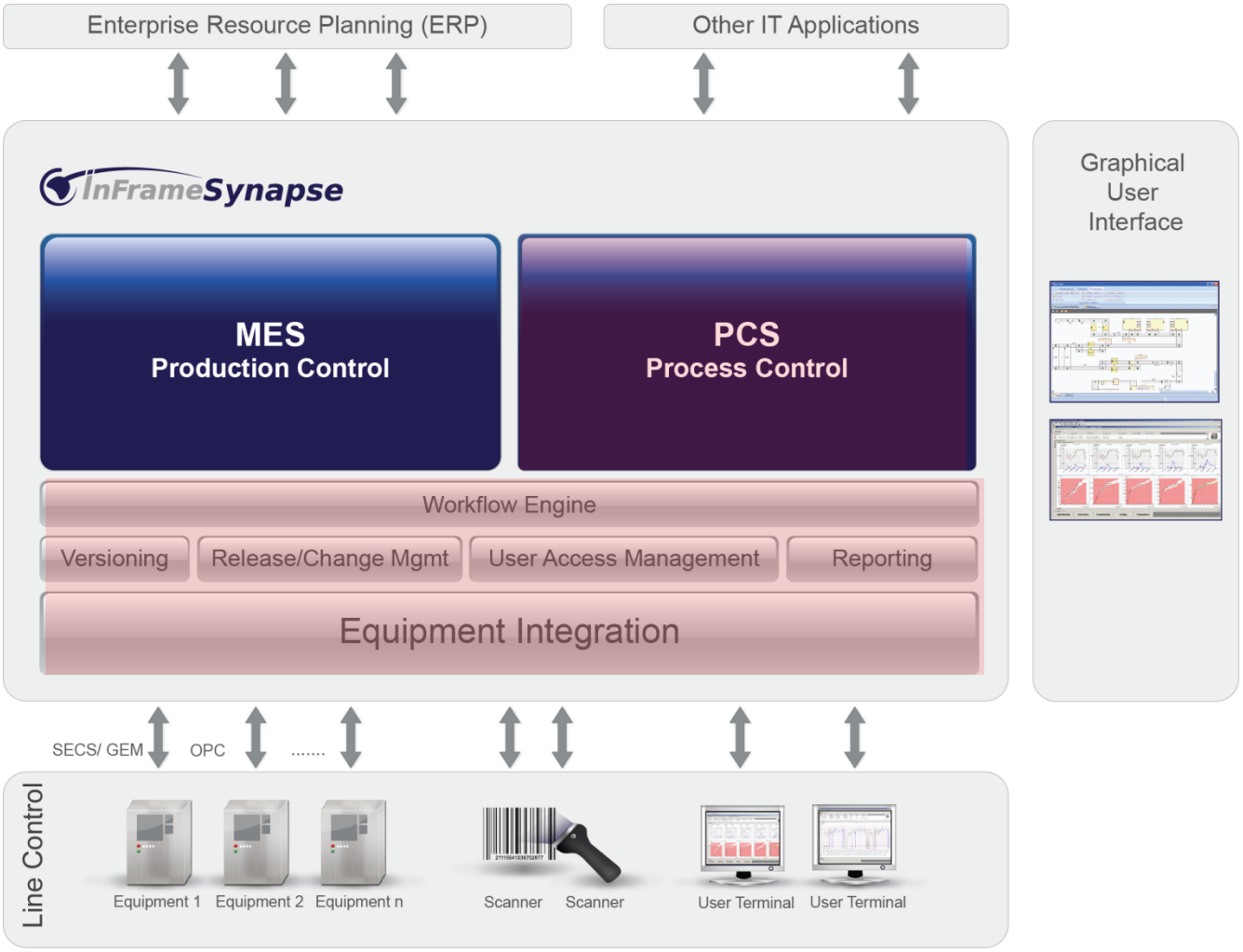
InFrame Synapse: Integrated MES and PCS Functionality

Integrated but independent functionality for Production Control and Process Control

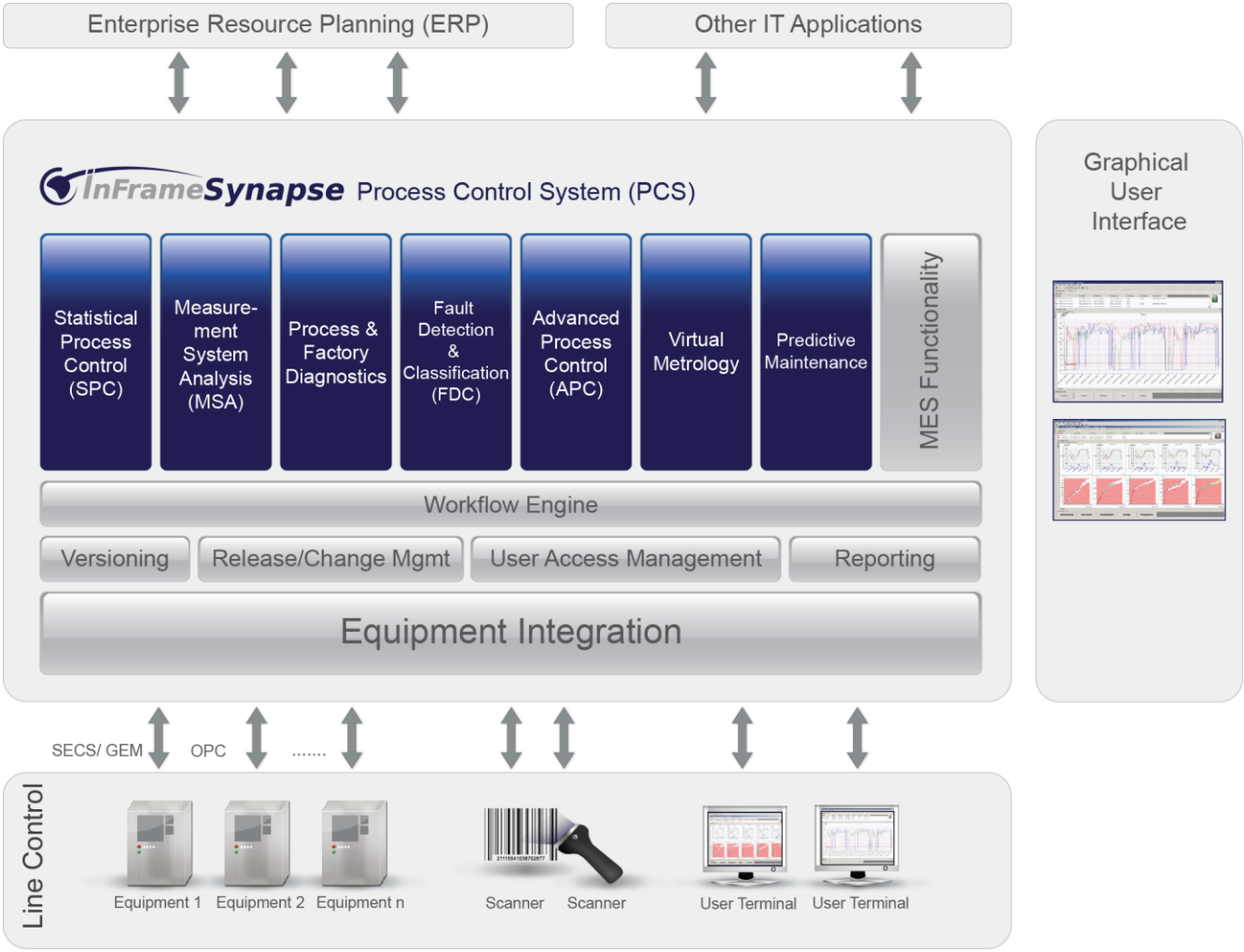


InFrame Synapse - Process Control System

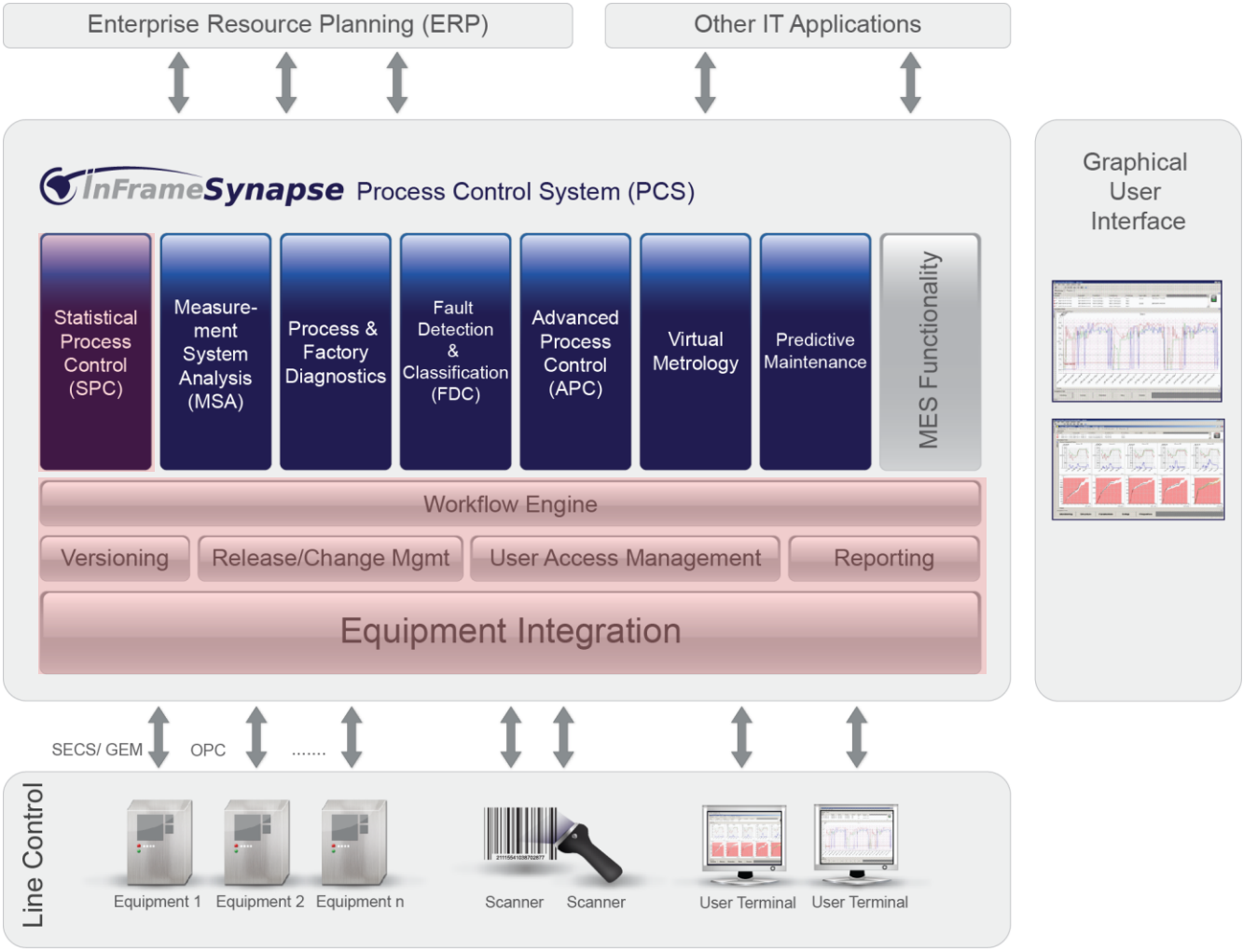
Monitoring and Control of Equipments and Processes Diagnostics of Historical Data



InFrame Synapse PCS – Scaleable Functionality on Scenarios



InFrame Synapse PCS – Statistical Process Control



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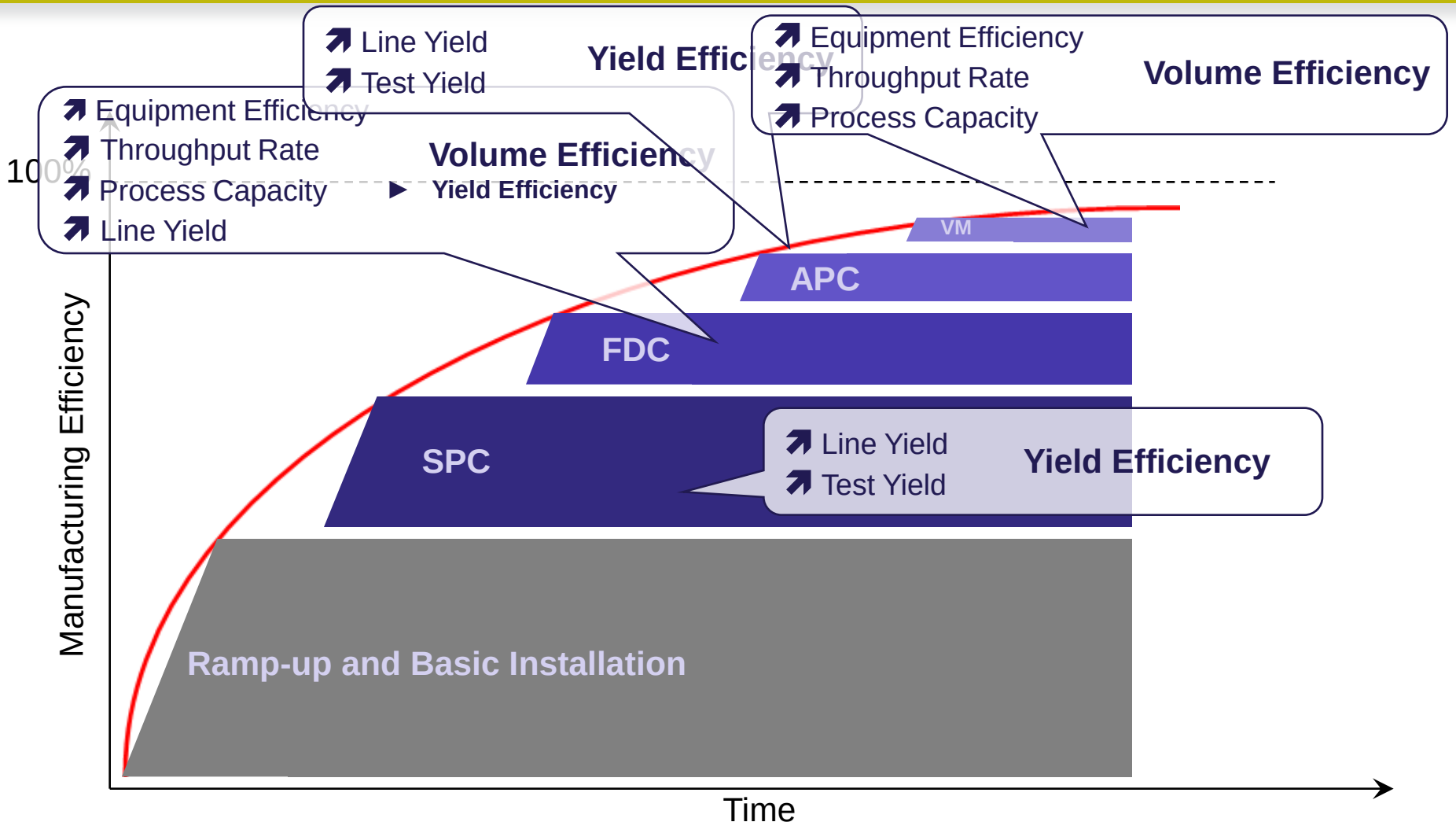
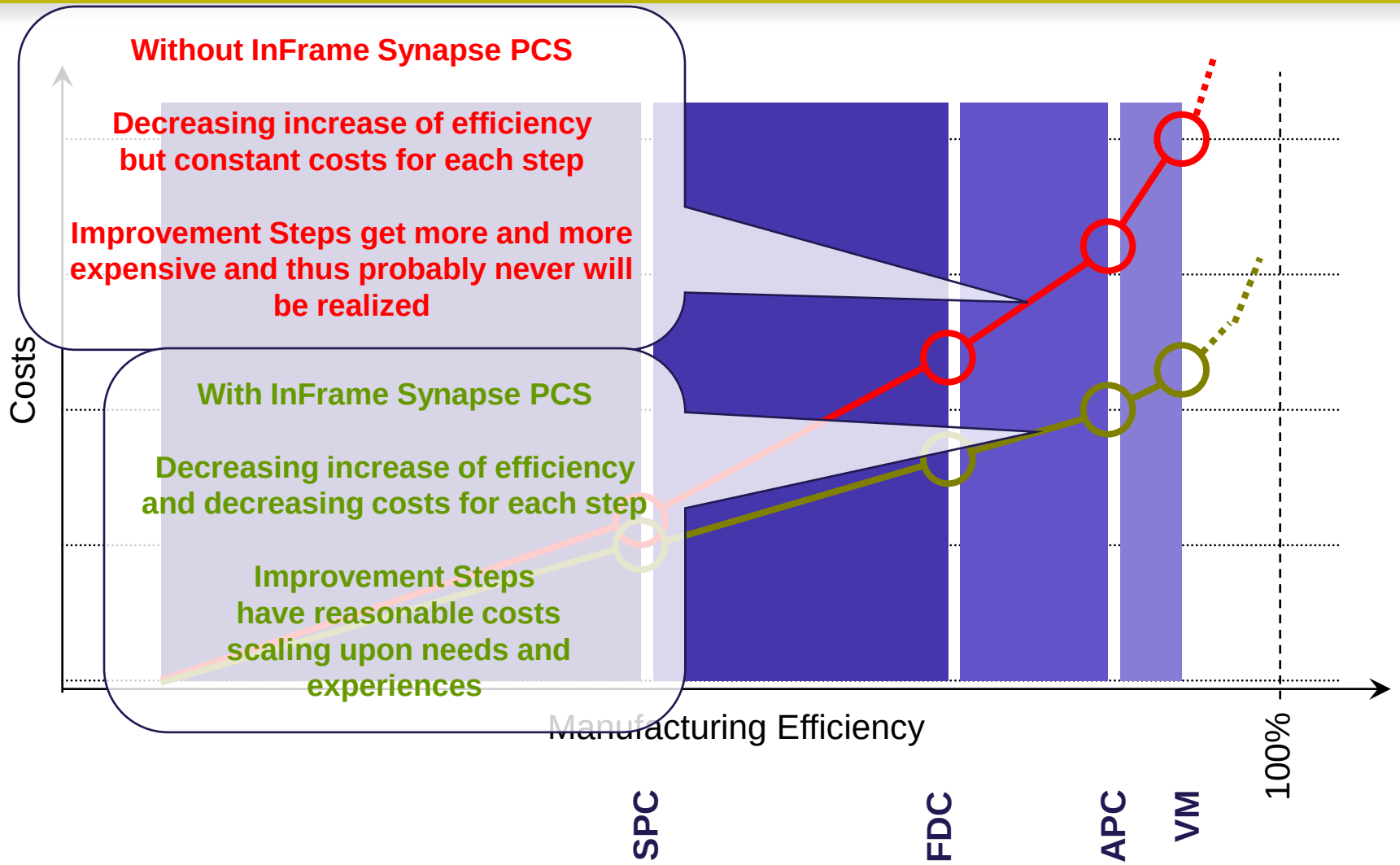
Techniques to increase Manufacturing Efficiency



Increasing Manufacturing Efficiency with InFrame Synapse PCS‘ scaleable functionality



InFrame Synapse PCS is growing with your needs and experiences

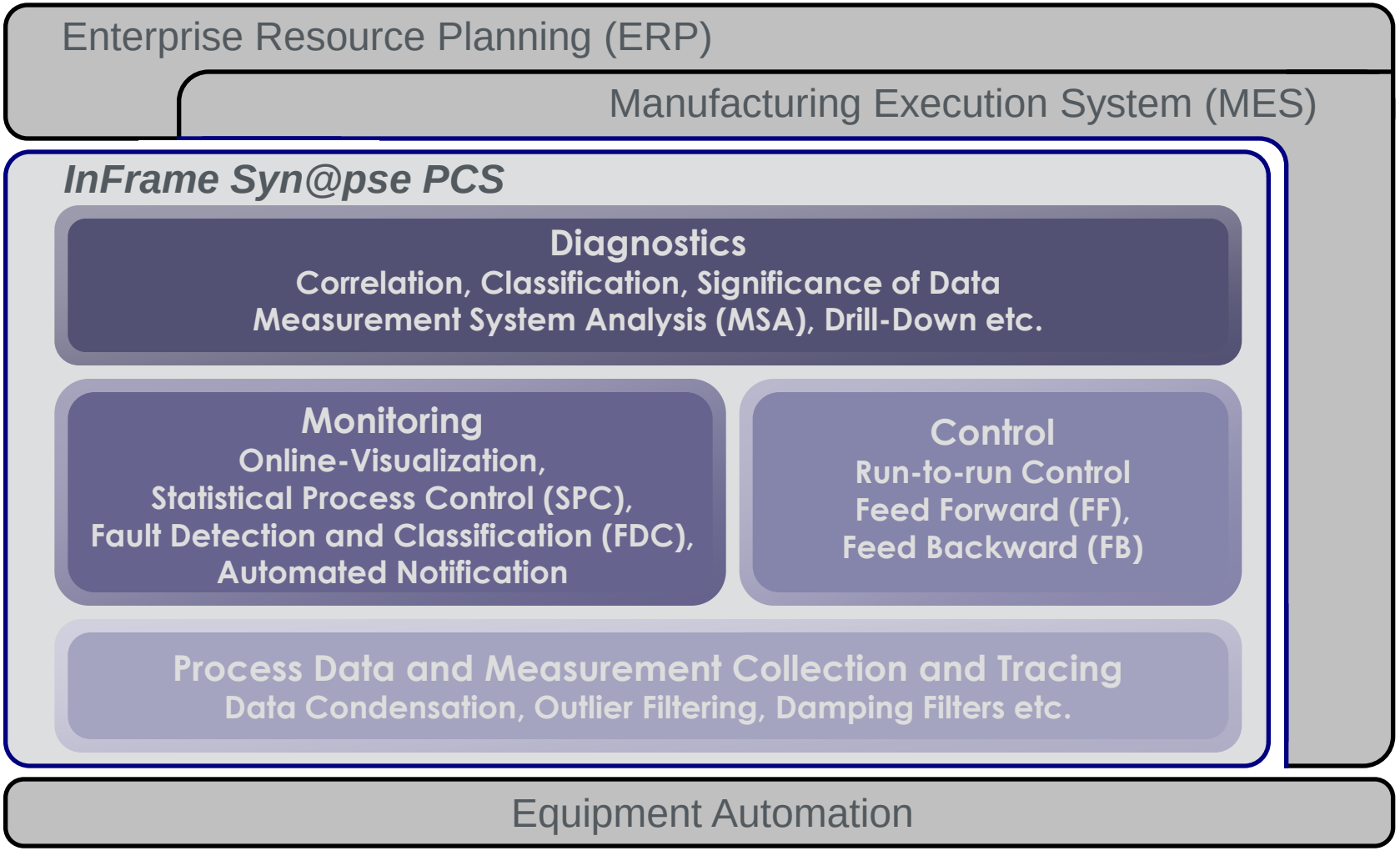
Enhancing the basic installation step by step

Avoiding future efforts and costs for

- Procurement
- System Integration
- Customizing
- Training
- Data Consistence

Increasing ROI with each future improvement step

The Positioning of InFrame Syn@pse PCS



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Statistical Process Control

Several Types of Control Charts

- X-MR Chart, XR Chart, XR-Median Chart, Xs Chart
- cChart, npChart, pChart, uChart

Functions for Definition of Control Charts

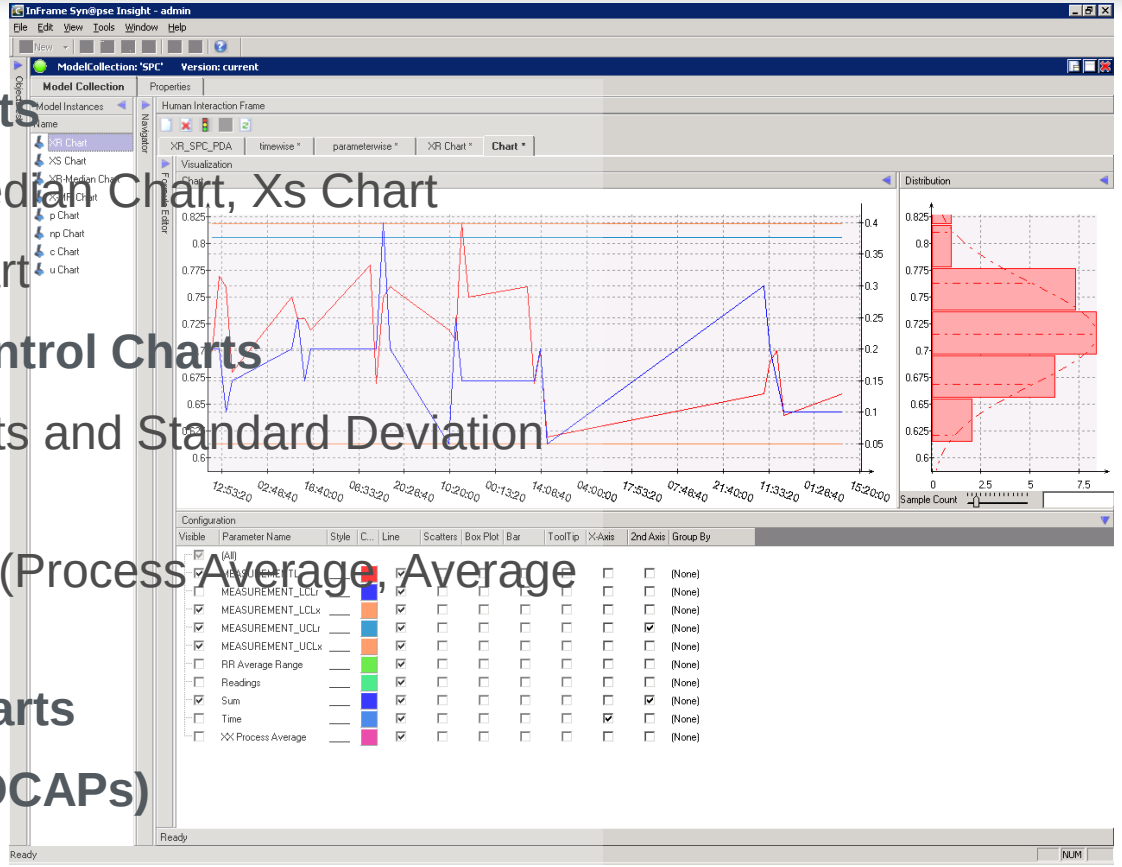
- Cp, Cpk, SPC Factors for Limits and Standard Deviation (A_2, d_2, D_3, D_4, A_3, c_4, B_3, B_4)
- Statistical Standard Functions (Process Average, Average Range, Median, etc.)

Online and Offline Control Charts

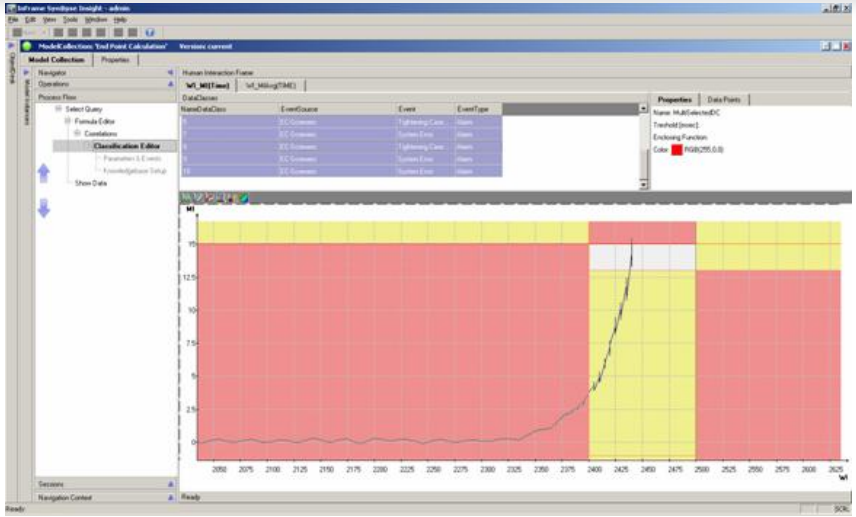
Out of Control Action Plans (OCAPs)

Reaction Rules

- Western Electric Rules
- Customizable Rules



Immediate Detection of Process Excursion Through Online Endpoint Monitoring and Process Tunnels

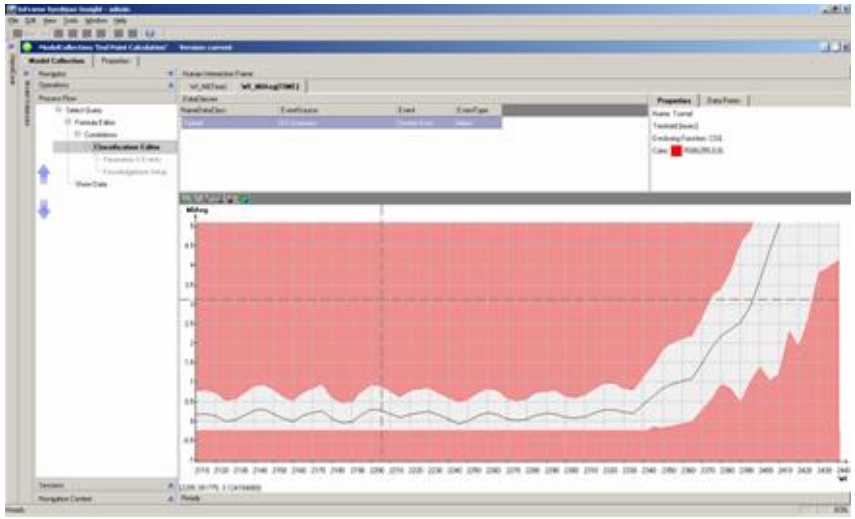


Customizable Endpoint Analysis

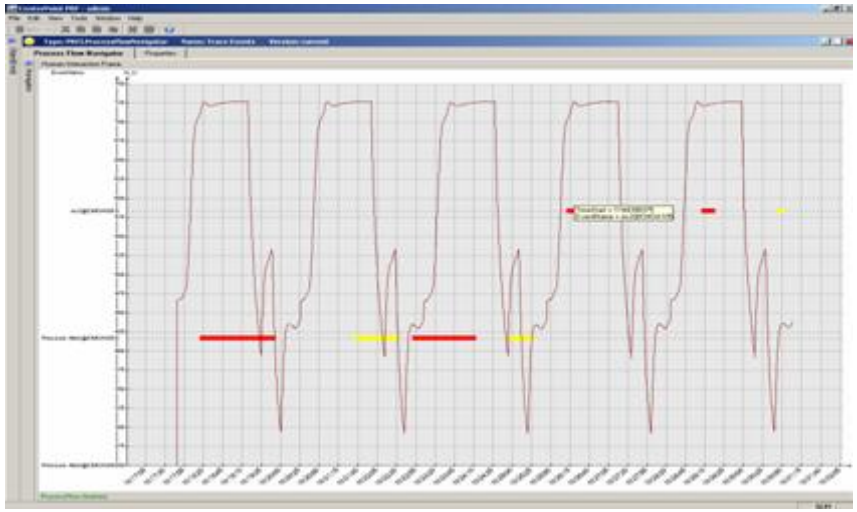
Automated Calculation of Process Tunnels

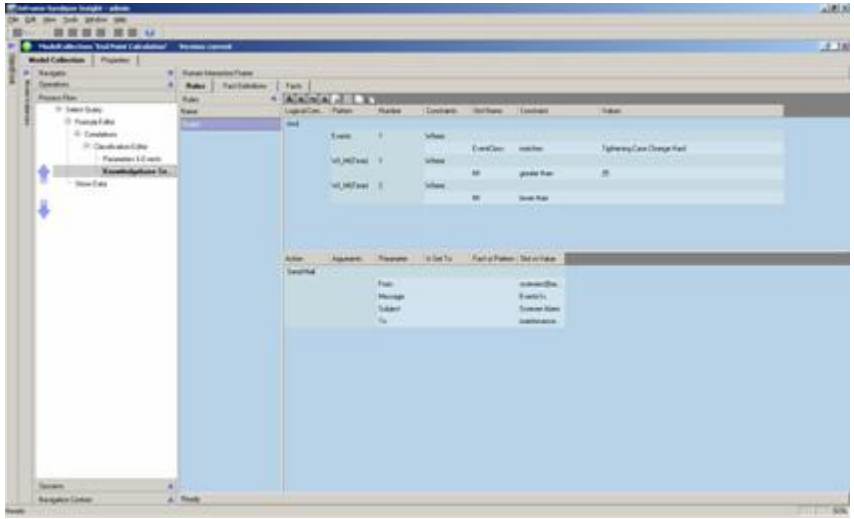
Online Monitoring of Endpoints and Process Tunnels

Automated Notification in Case of Excursions



Combined Online Parameter Monitoring and Event Monitoring





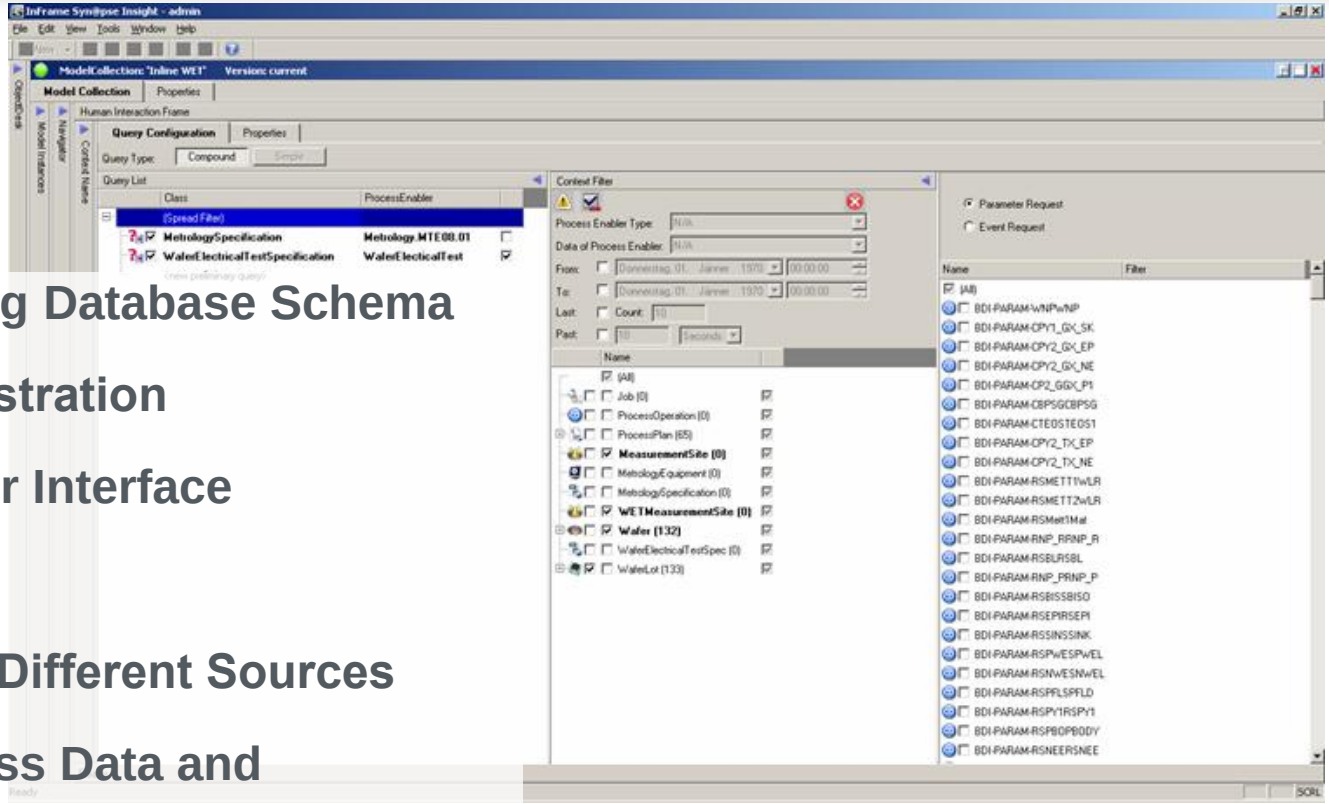
Combined Visualization of Events and Parameteric Data

Graphical Rule Editor

→ Combined Conditions on Parametric Data and Events

→ Customizable Automated Actions in Case of Rule Excursions

Factory-wide
Collecting and Filtering of Process Data and Events



Automatically Adapting Database Schema

→ No Schema Administration

Adaptive Filtering User Interface

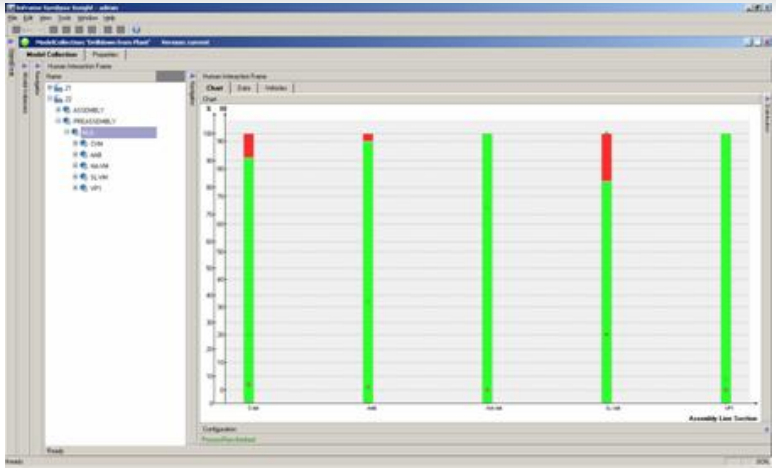
Compound Filters

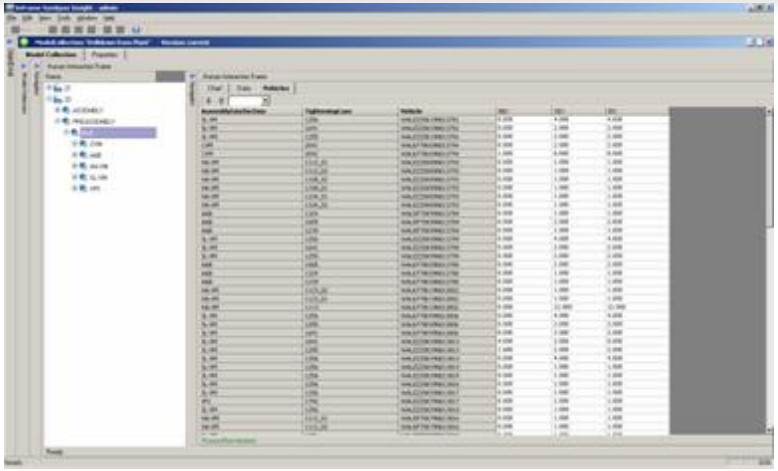
→ Combining Data of Different Sources

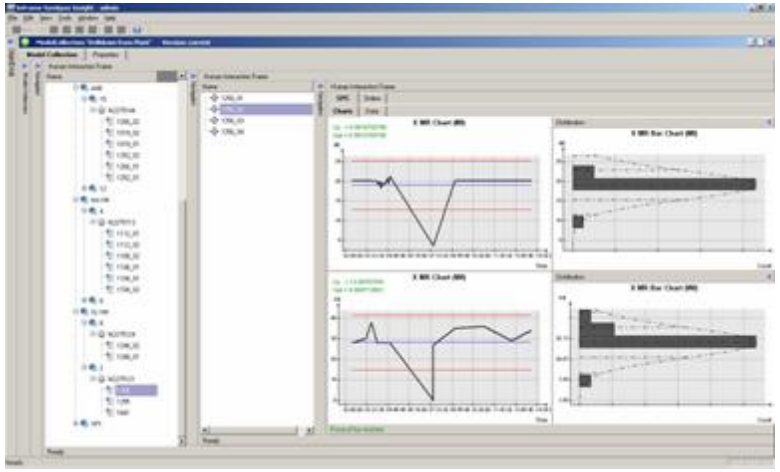
Management of Process Data and Process Events

→ Merged with Process Context Information

Drill-Down
From the Factory to the Single Equipment





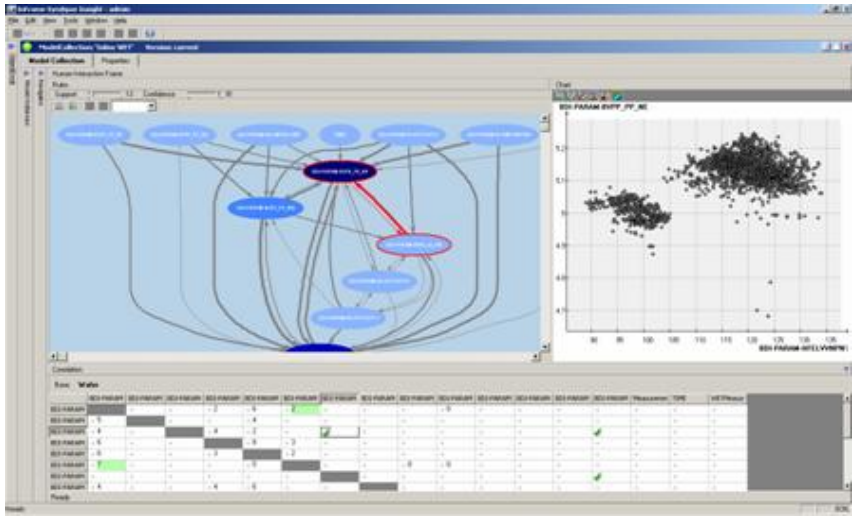


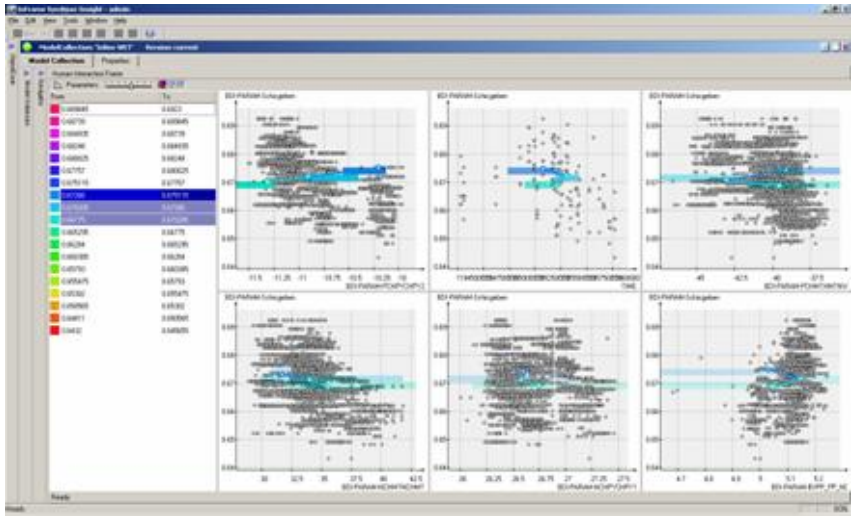
Customizable Drill-Down Paths

Any Combination of Visualization Elements

Coupling of Online- and Offline-Data

Correlation Analysis





Interactive Correlation Editor

Dependencies Graph

Exploration of Associations

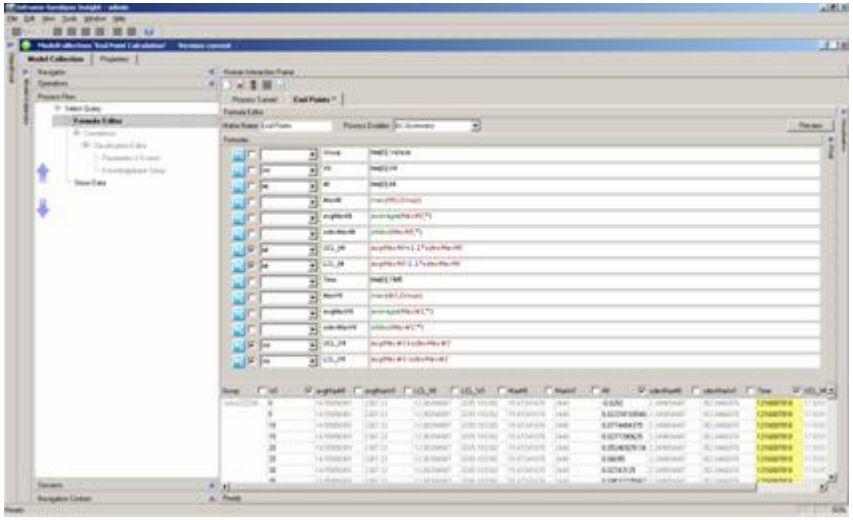
→ Between Process Data and Quality Measurements

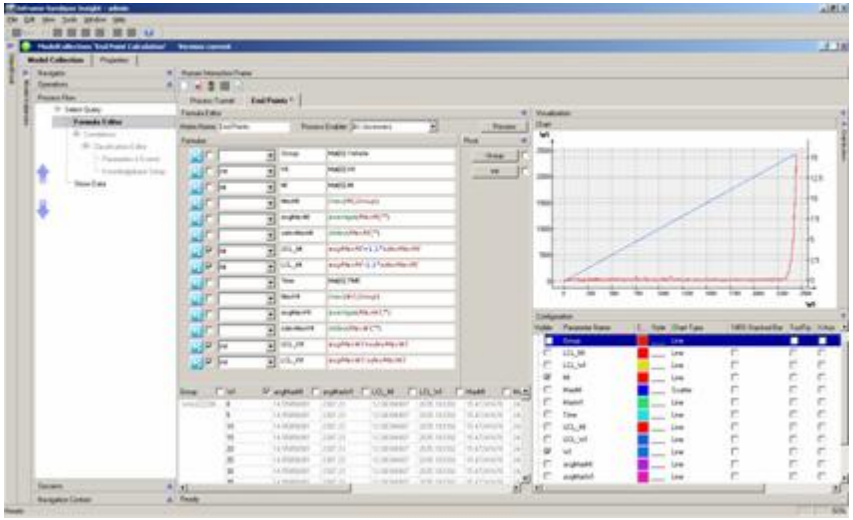
→ Between Processes

Prediction Models

Integration of Prediction Into Process Monitoring

Fast Adaption Due to Changing Requirements





Interactive Definition of Mathematical and Statistical Models

Off-the-Shelf Libraries with Mathematical and Statistical Models

Features for Process Monitoring and Control

→ EWMA, Outlier-Filter, Cp, Cpk, ...

Derived (Virtual) Parameters

Integration of Context-Specific Process Properties

Logical Process Model

Process Abstraction from Single Equipment to Whole Factory

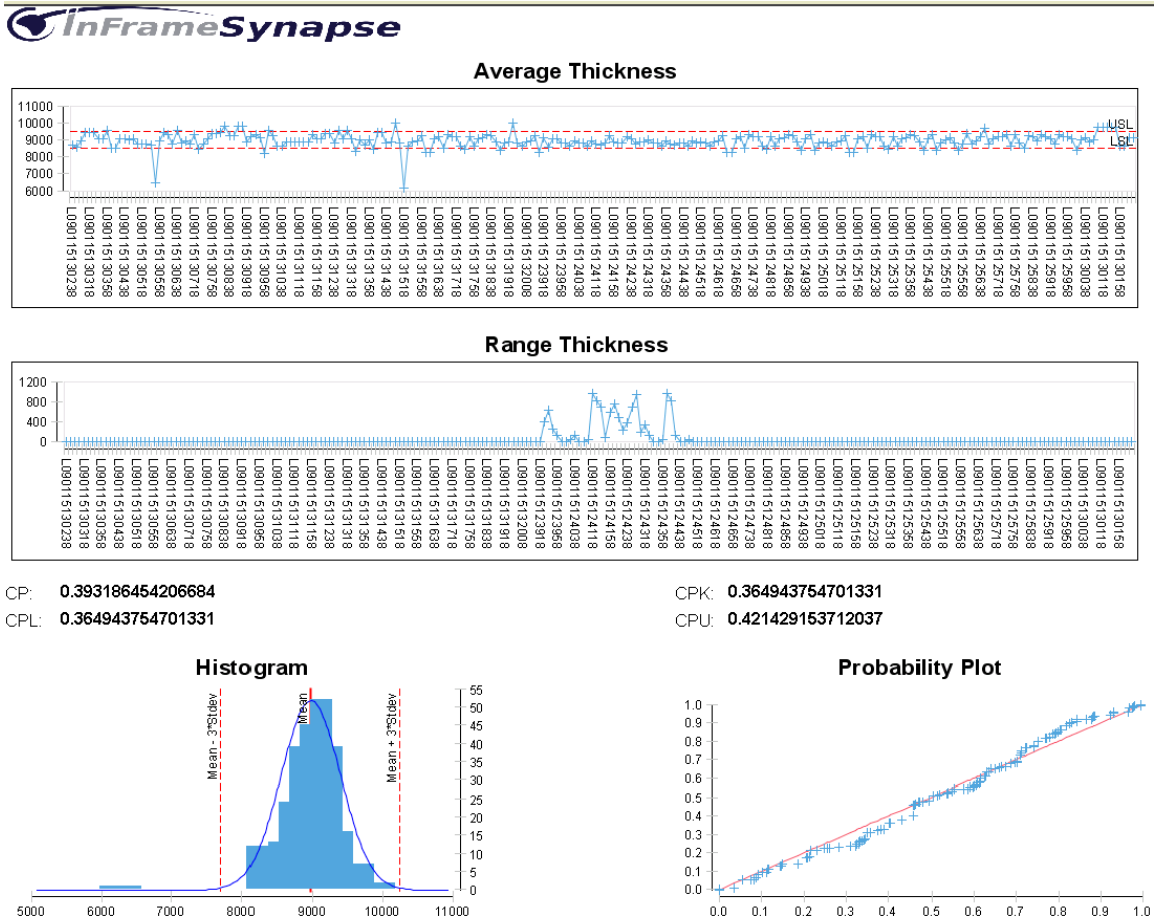
Customizable Web-Based Reporting

Consistency of Results due to Identical Calculation Base

Web-Based Reporting Freeware

One Scenario for Reporting and Online SPC Charts

Interface to be used by any Third-Party Application



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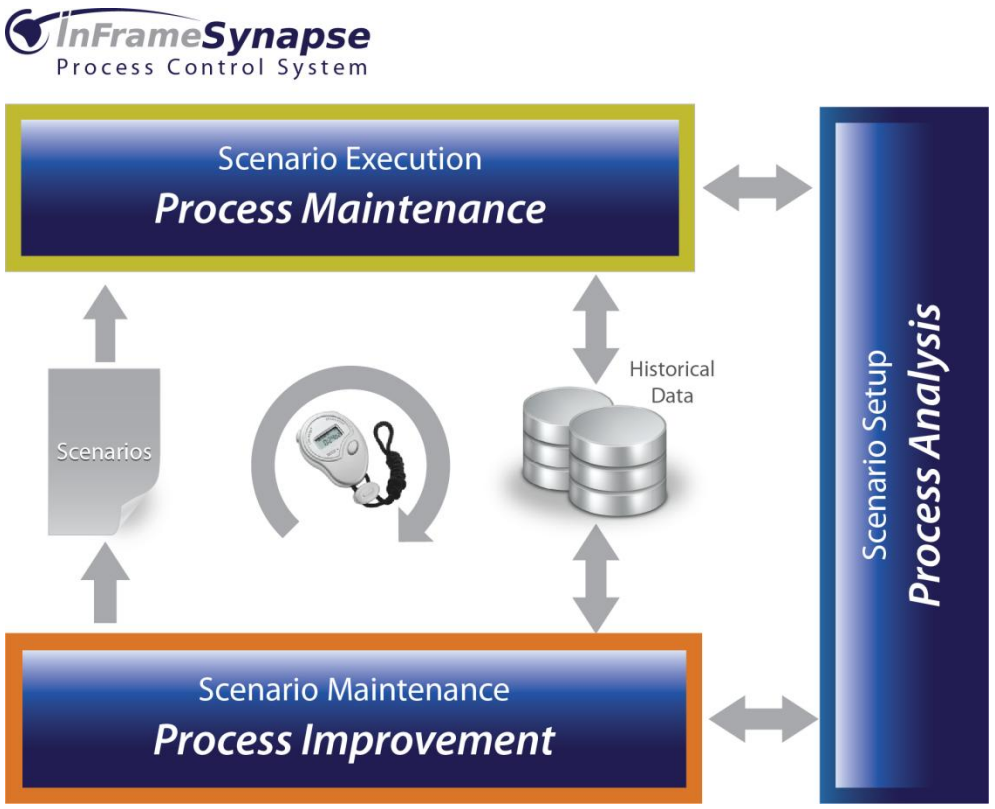
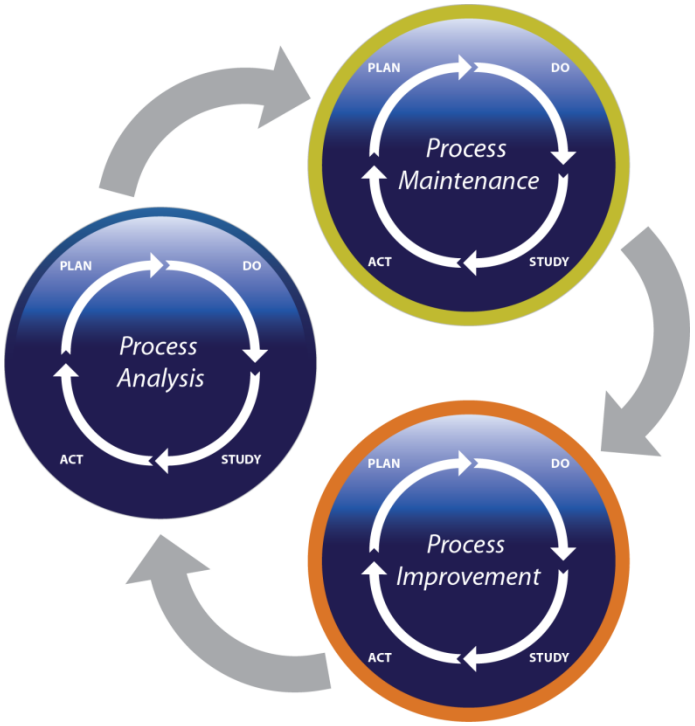
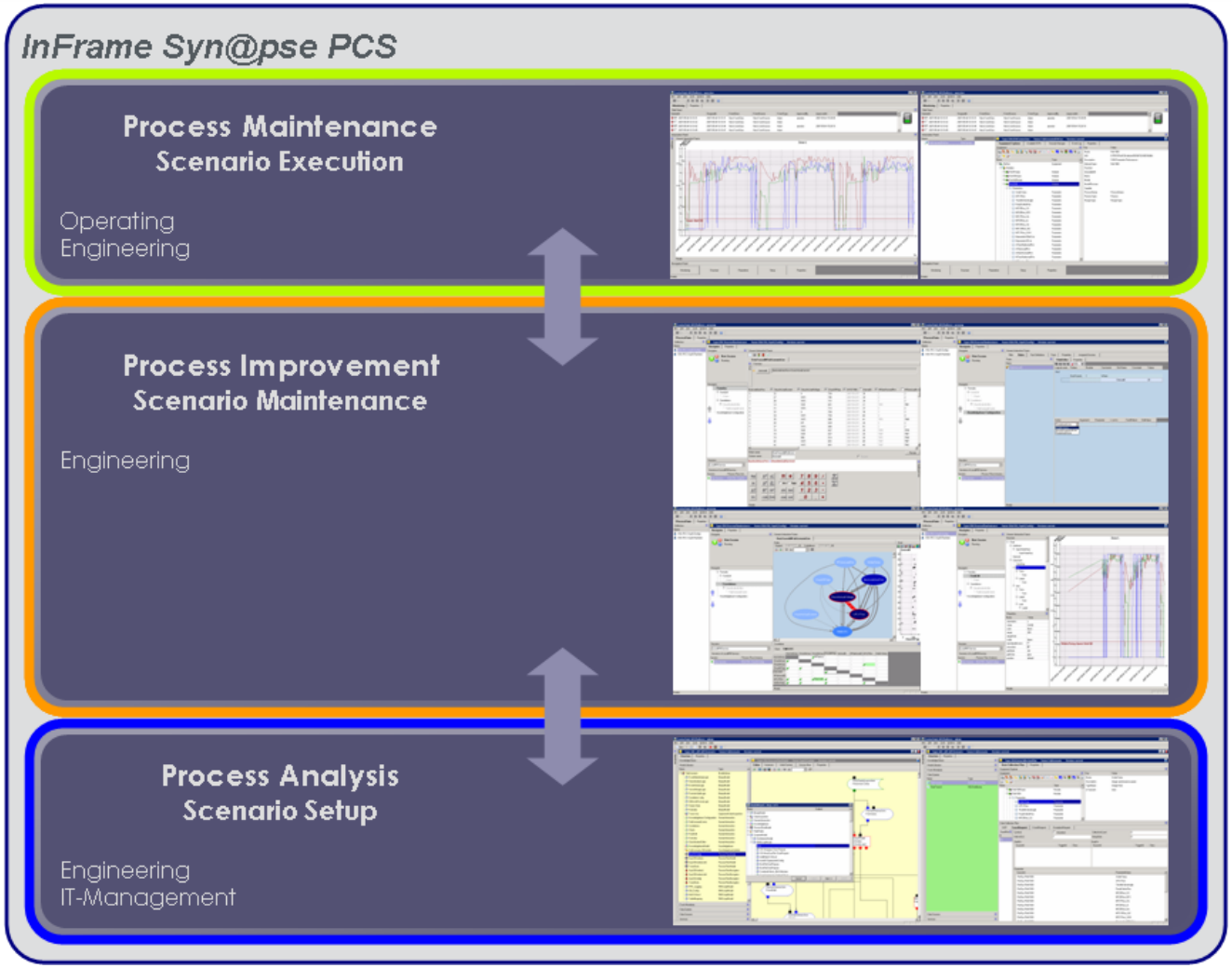
Integration within Continuous Improvement Process



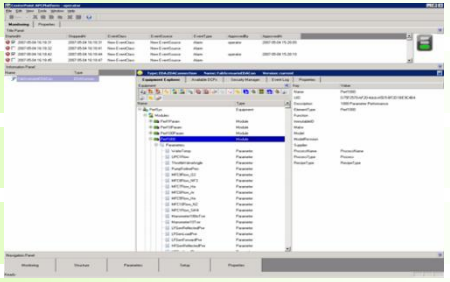


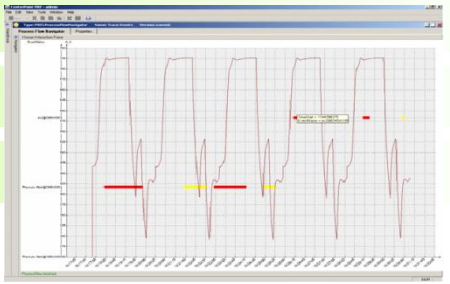
Placing the Core Process to the Top!



Process Maintenance – Scenario Execution

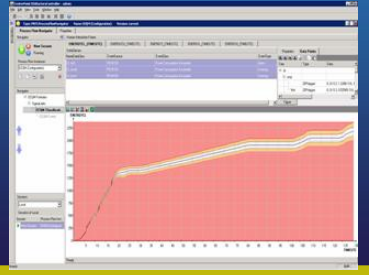
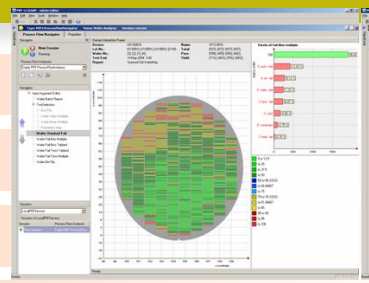
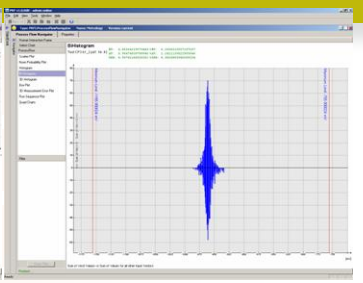
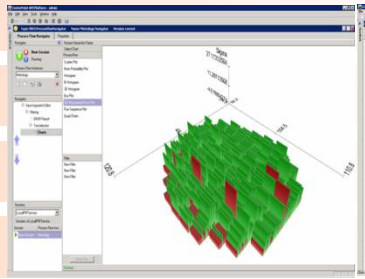
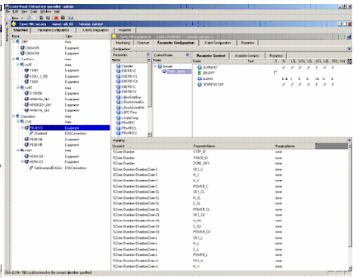
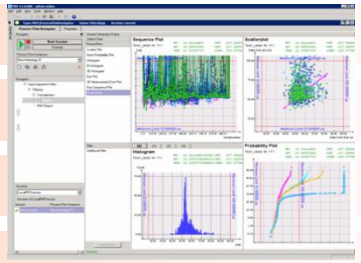
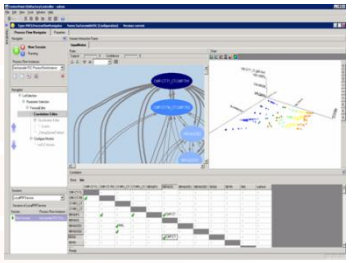
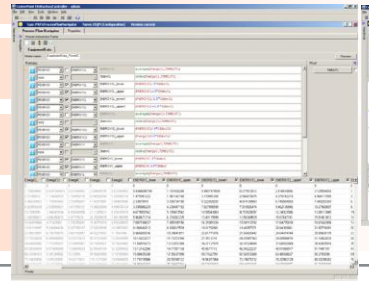
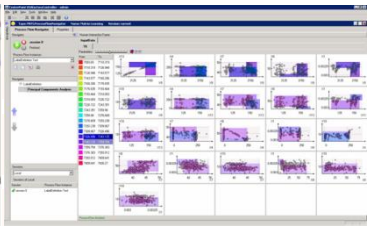
- Powerful Visualization Capabilities
- Automated Actions
- SEMI E95 Human Machine Interface
- Remotely Configurable
- Event and Alarm Management
- Merging Manufacturing Context Information
- Document Viewer
- Event-, Time- and Interactively Driven
- Factory-Wide Feed Foreward and Feed Backward
- Automatically Calculated Process Tunnels





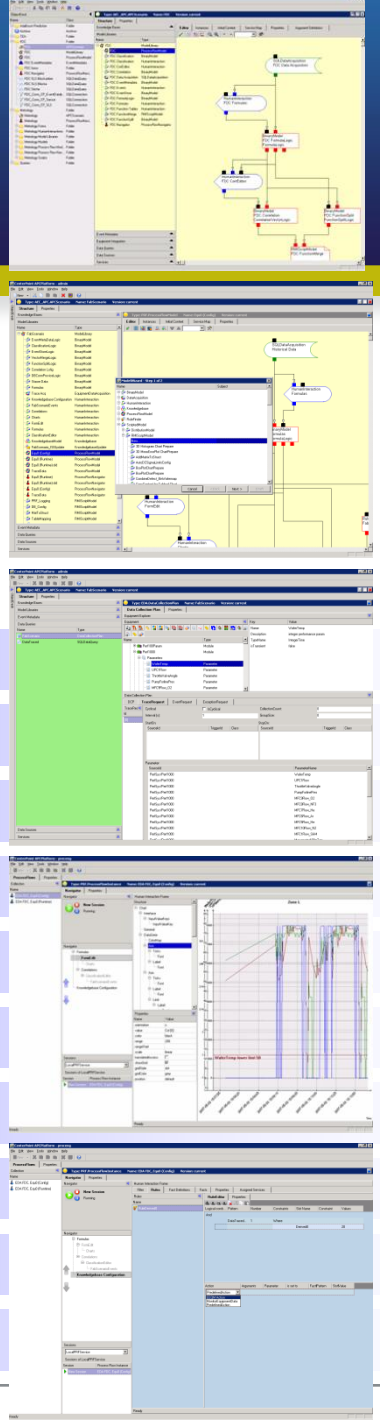
Process Improvement – Scenario Maintenance

- On-Demand Data Collection with SEMI EDA
- Wizard-Based Model Improvement
- Modelling of Logical Process Structures
- Logical Context-Based Parameters and Events
- Mapping of Physical to Logical Parameters and Events
- Virtual Parameters Based On Powerful Formula Editor
- Just-In-Time Data Mining for Correlation Analysis
- Merging of All Types of Semiconductor Data
- Multi-Way Principle Components Analysis (PCA)
- Defect Pattern Learning and Recognition
- Uni- and Multi-Variate Defect Classification
- Graphical User Interface Editor
- Integrated Expert-System Framework (Rule-Engine)
- Process Result Prediction (Inline, Yield)

Process Analysis – Scenario Setup

- Fully Integrated Interactive Scenario Workbench
- Model Library Concept
- Off-the-Shelf Mathematical and Statistical Libraries
- Integration of Third-Party Analytics and Control Products
- Wizard-Based Model Creation
- Interactive Data Collection Plan Editor
- Interactive Equipment Meta Data Builder
- Powerful Native Scripting Language and Python Script
- Parallel Computing and Load Balancing
- Centralized Scenario Destribution, Installation and Deployment



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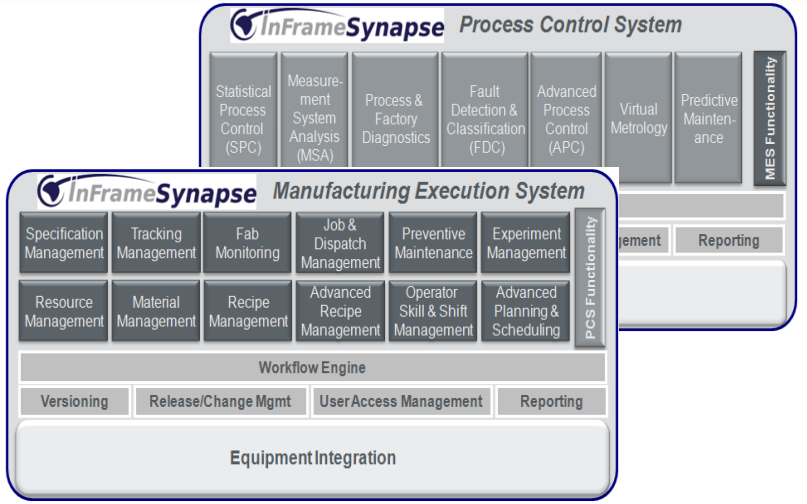
InFrame Synapse Architecture Highlights

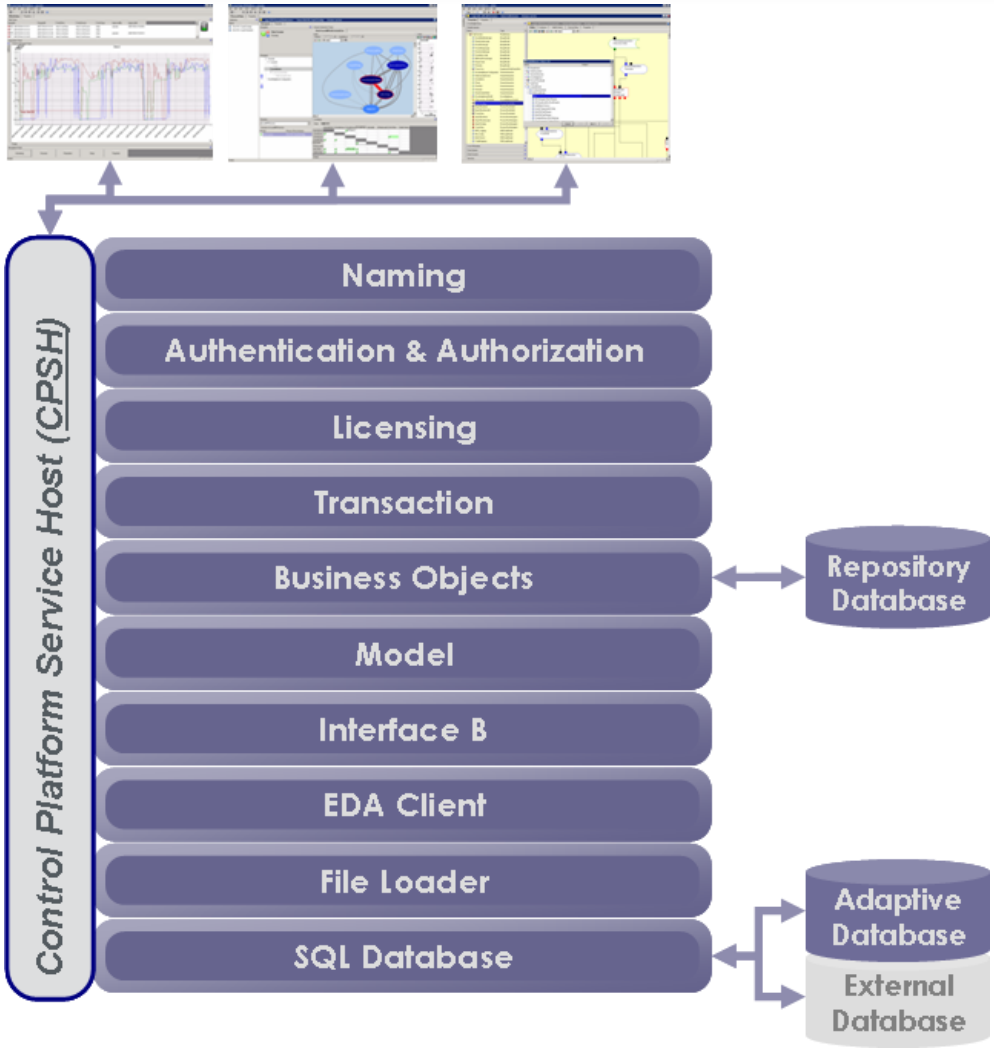
Service Oriented Architecture and

3-tier Architecture

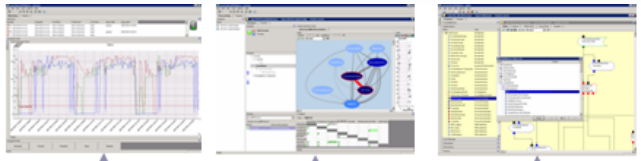
- Modular and flexible through strict separation of visual, logical and data layer
- Open for extension by well specified interfaces
- High scalability and reliability
- Database is exchangeable depending on customer request (e.g. Oracle, MySQL, …)
- Full change management through versioning of all persistent objects
- Workflow-Engine to customize and extend the basic functionality
- Easy to customize and configurable rich client user interface
- Configurable system views based on users and user roles

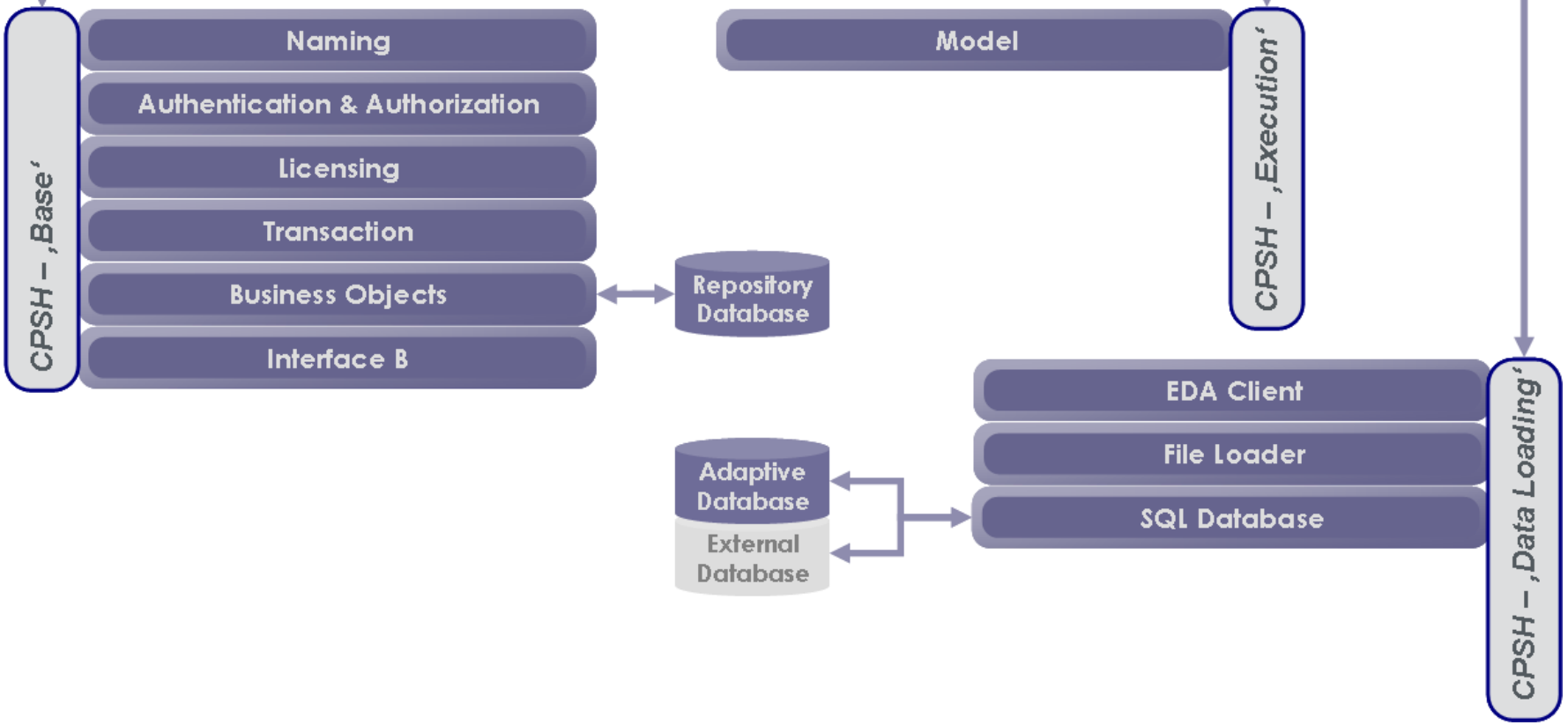


Overview of Available Services

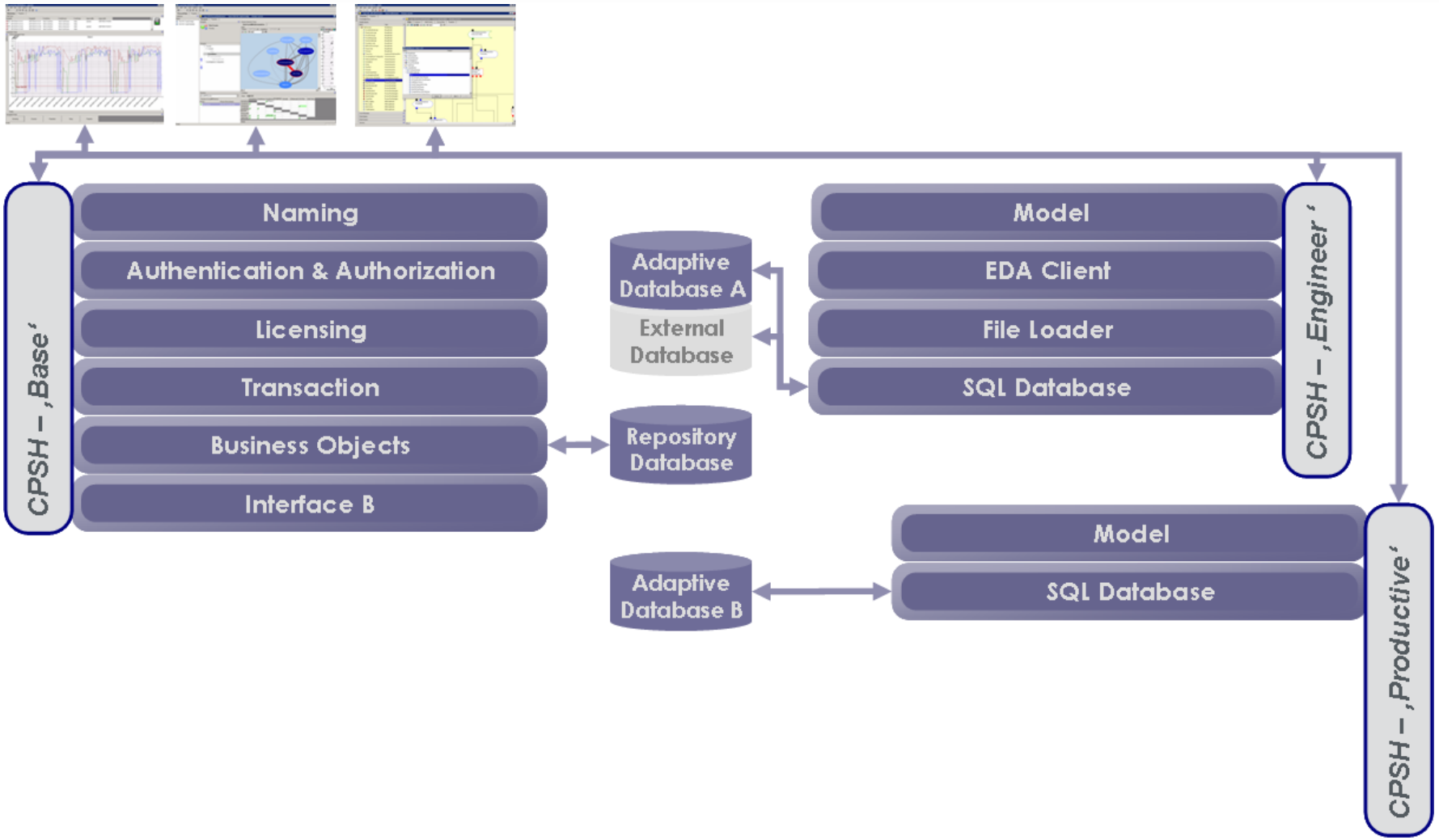


Optional Scalable on a Single or Multiple Host Computers





Optional Scaling of Services



Open System Interfaces and Integration Standards

Integration With Other Applications

SOAP/HTTP

MS COM+

MS.net

TIBCO®

Websphere MQ

SMTP

SECSII/GEM

SEMI Interface-A

PCS Native

Data File Formats

XML

CSV

ASCII

Network Protocols

TCP/IP

UDP

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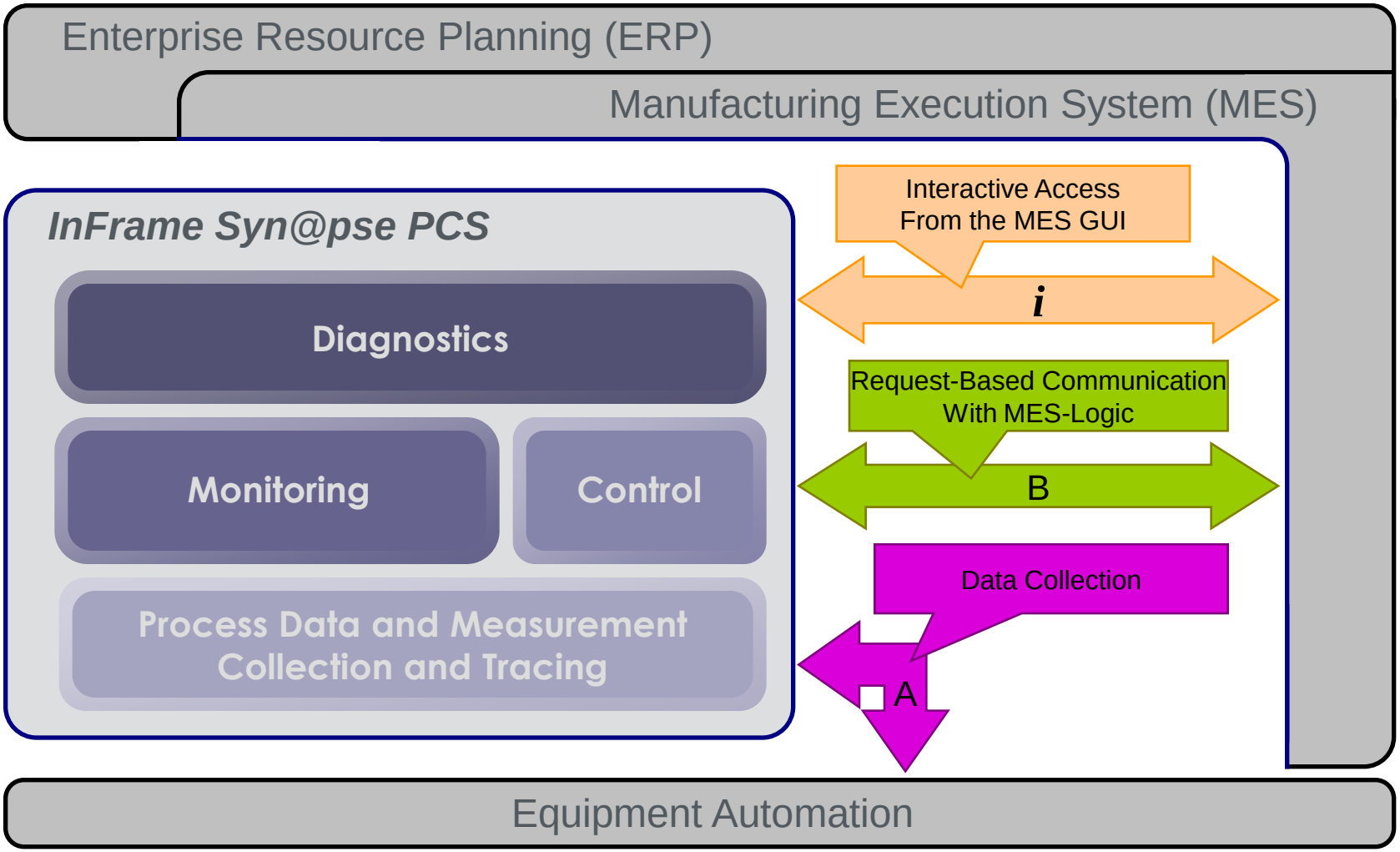
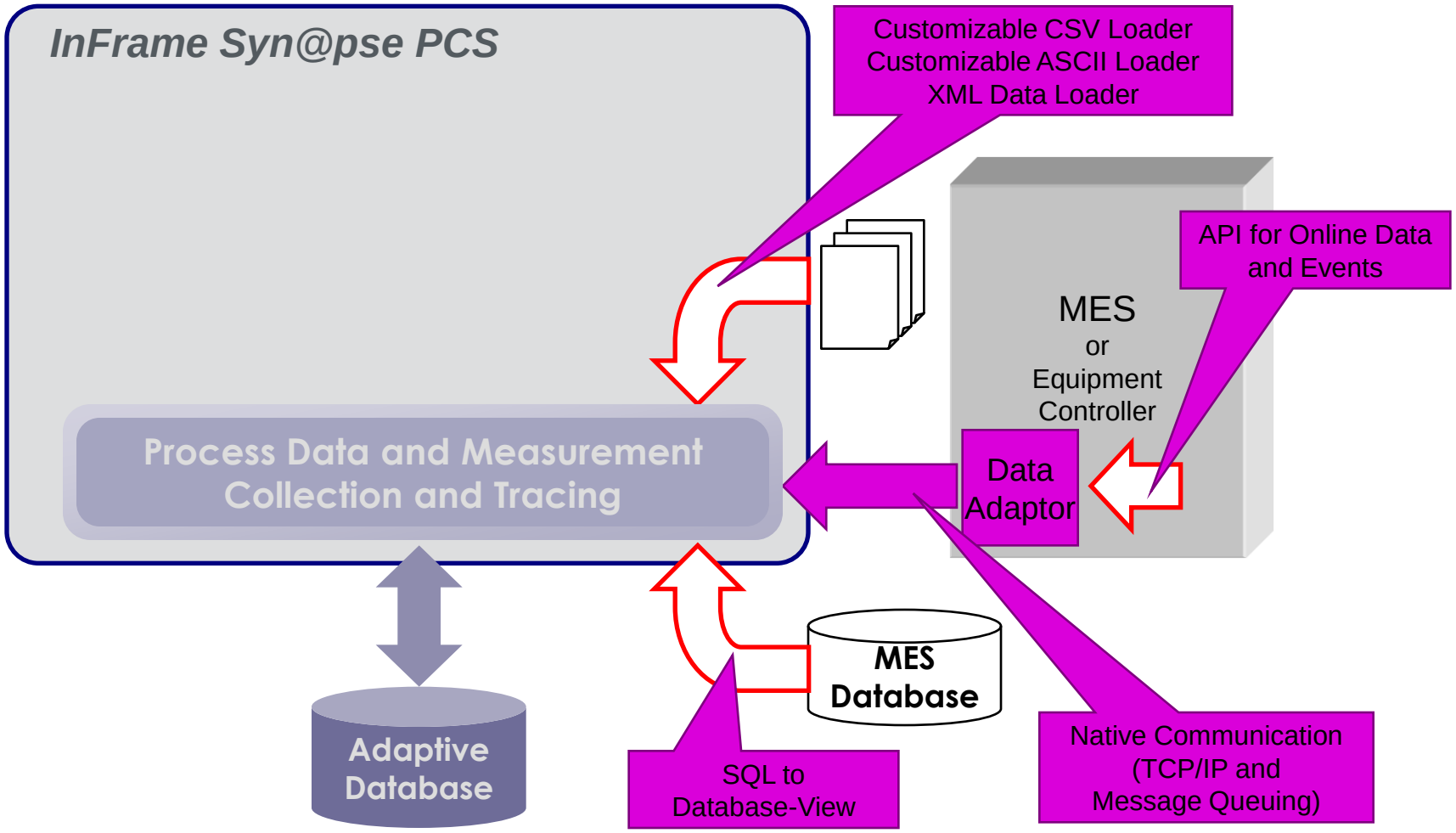
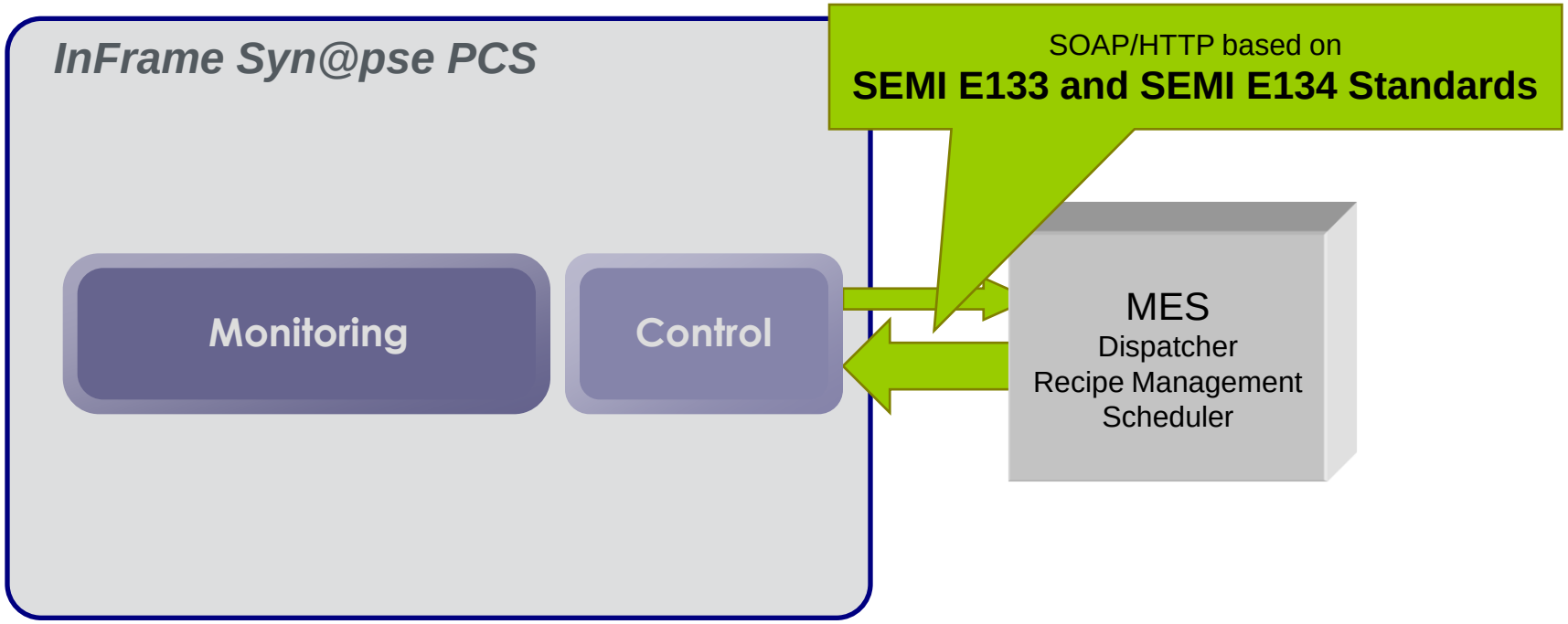
Interaction With MES - Overview



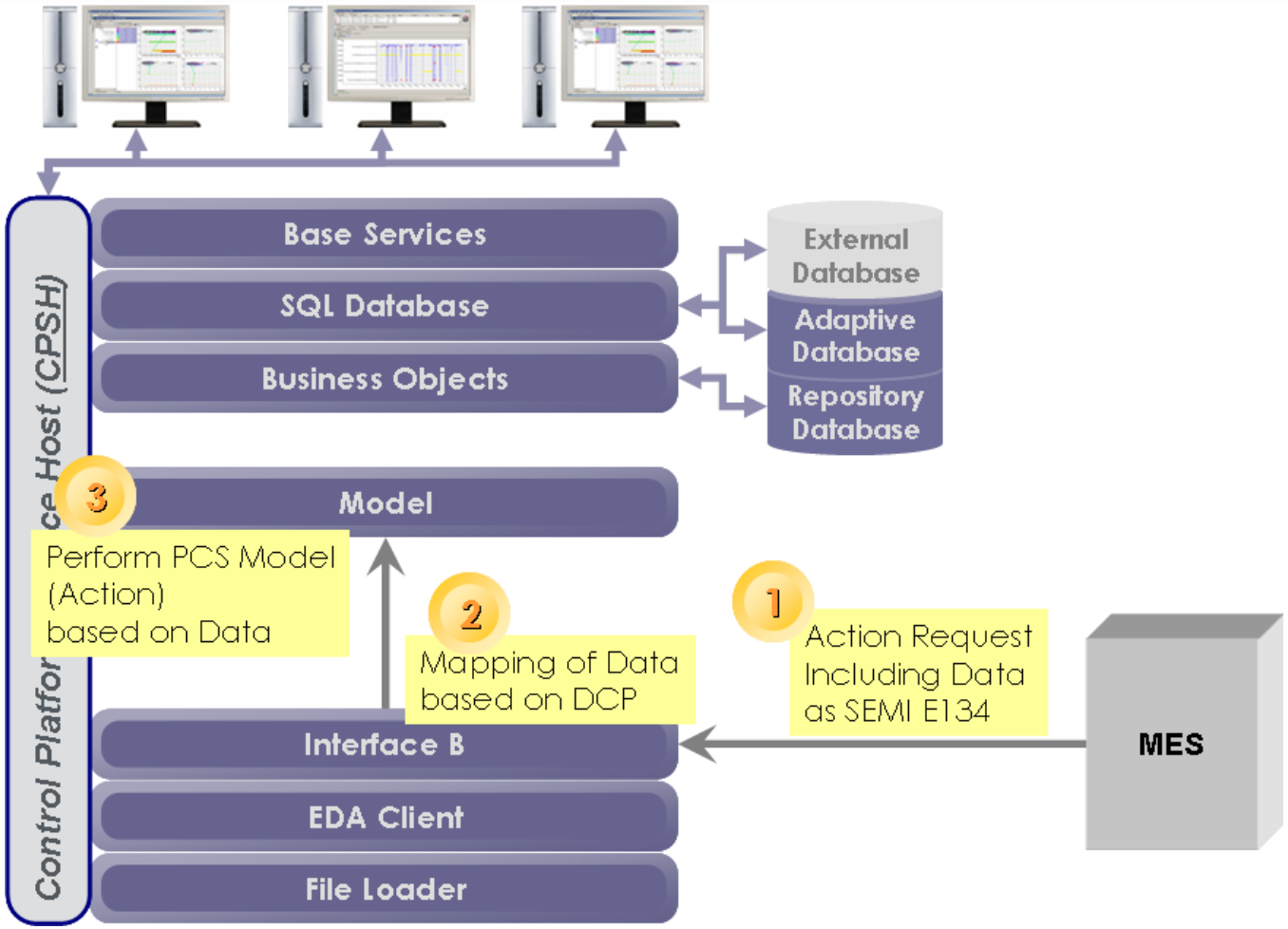
Interaction With MES – Data Collection Level - A



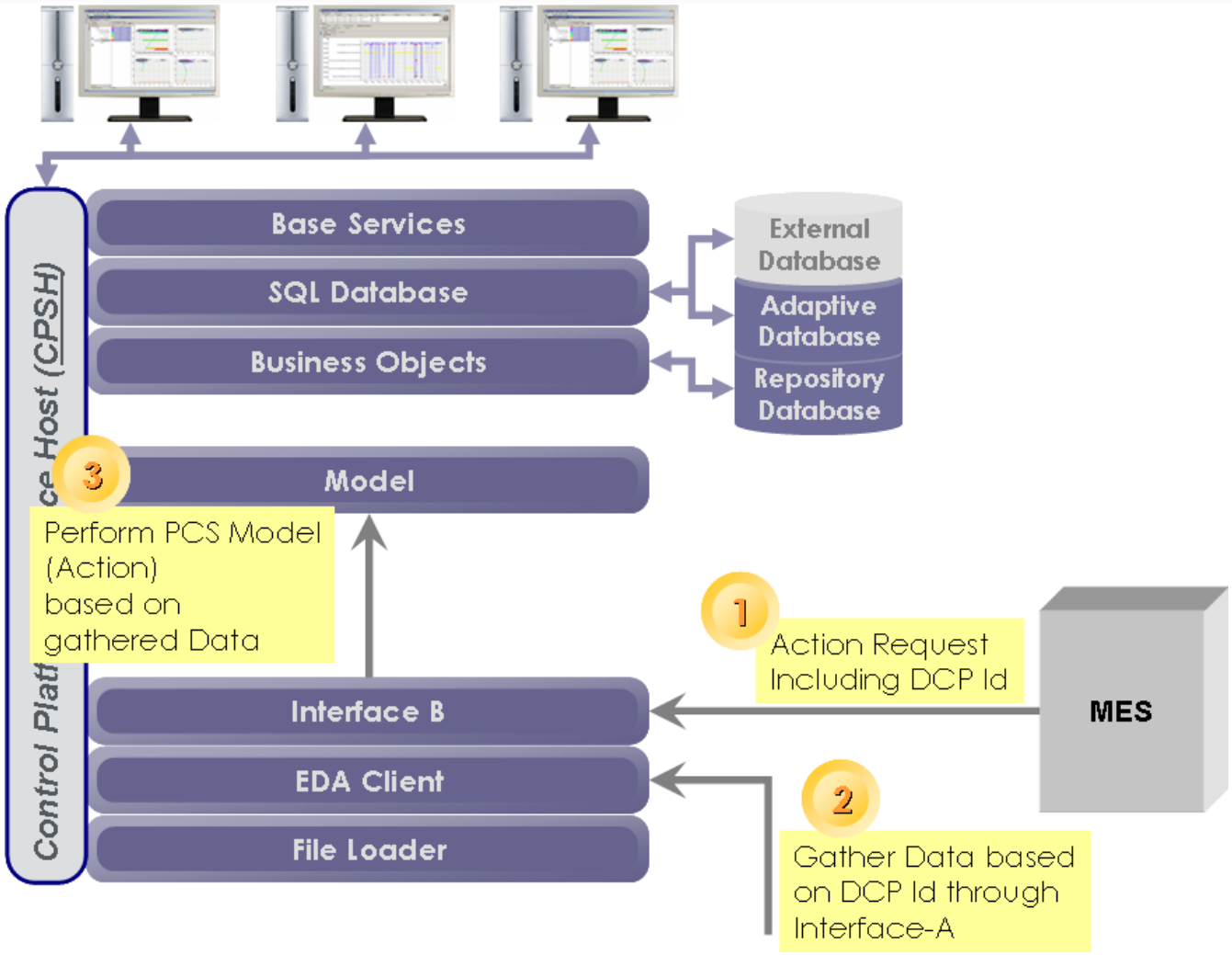
Interaction With MES – Business Logic Level - B



Interaction With MES – Business Logic Level – B – Passing Data



Interaction With MES – Business Logic Level – B – Passing DCP ID



Flexibility of Interface-B

Web-Service

→ Easy to implement in any development environment

→ Integration of any products of different vendors

SEMI E134 involved

→ Enables adoption of technologies approved from Interface-A (Metadata Editor, DCP-Editor)

→ Specification of data structures on meta-level (flexible) not XML-schema level

Using InFrame Synapse PCS

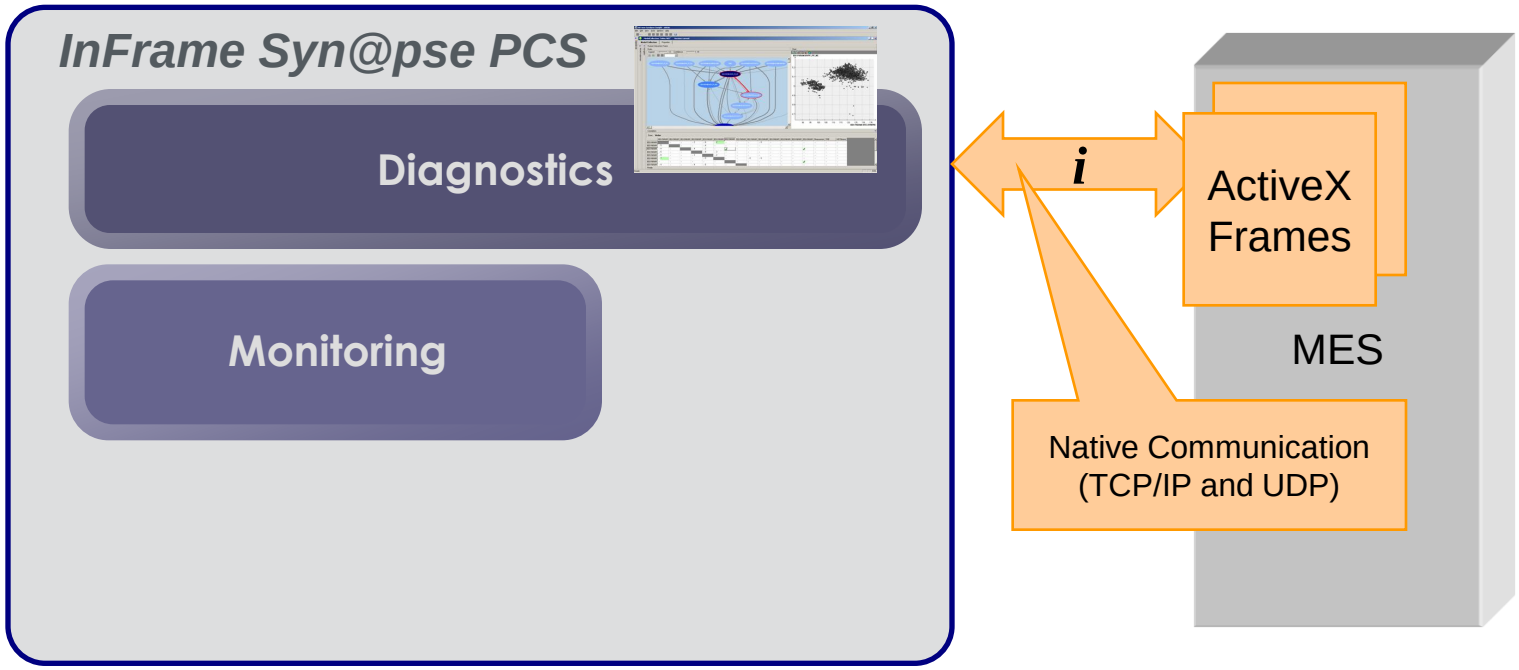
→ Interactive Metadata Editor to specify Metadata Model of passed data

→ Interactive Data Collection Plan Editor to specify passed Data Structures upon respective metadata model

→ Interactive Process Editor and Model Editor to specify Actions

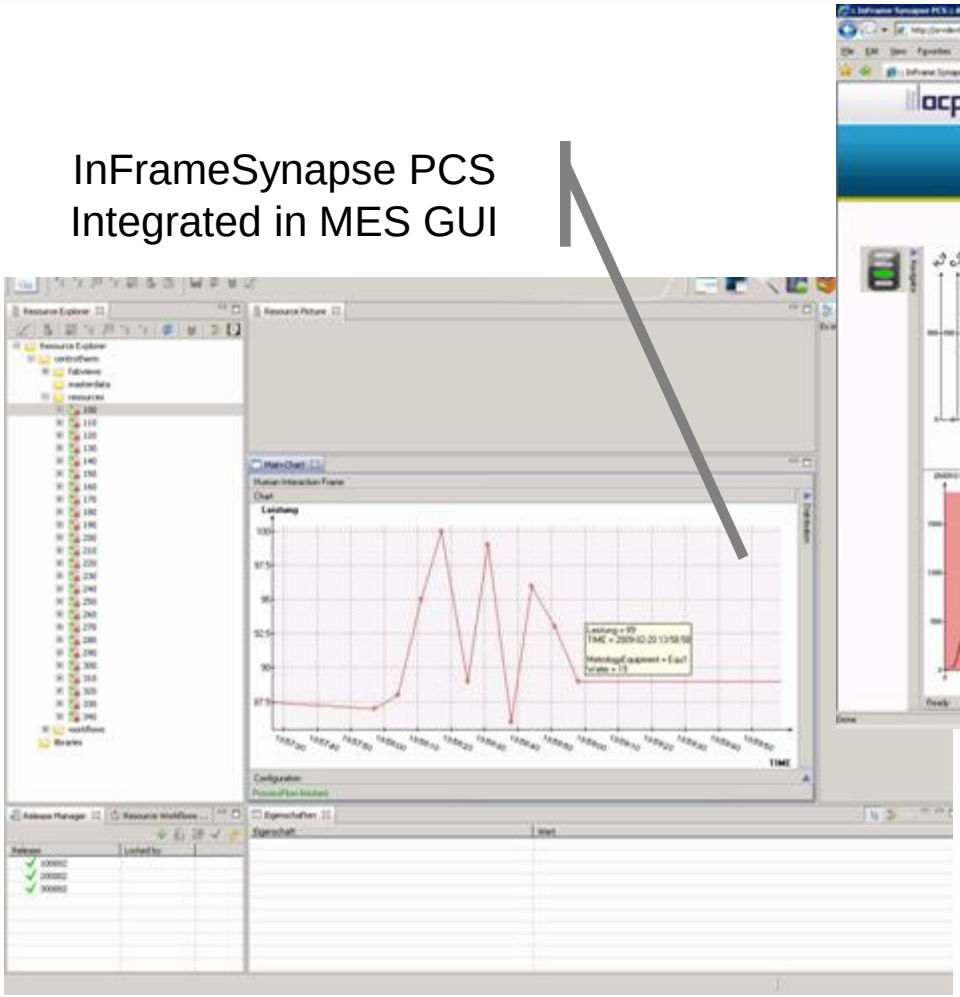
- ⇨ Data Collection on Equipments and Measurent Steps
- ⇨ Statistical Process Control on Measurement Steps
- ⇨ Fault Detection and Classification on Equipments
- ⇨ Feed Forward/Feed Backward, Run-by-run, Virtual Metrology on Process Sequences

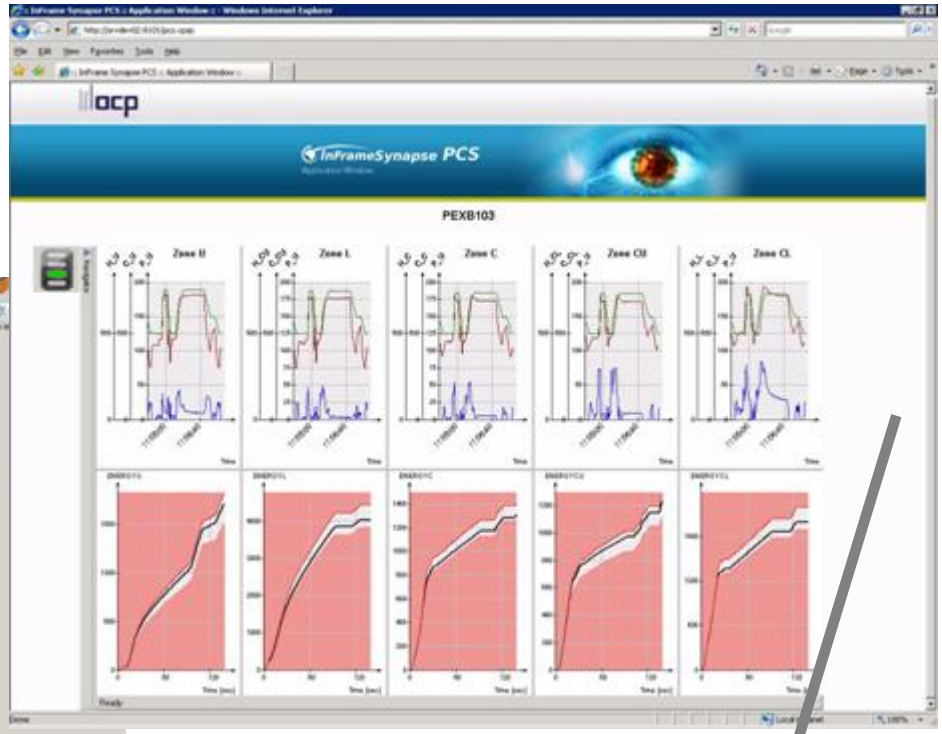
Interaction With MES – User Interface Level - *i*



Interaction With MES – User Interface Level – *i* – Examples

InFrameSynapse PCS
Integrated in MES GUI





InFrameSynapse PCS
Integrated in Web Browser

Thank You Very Much For Your Attention

Further Questions Please Address to **roland.willmann@acp-it.com**