

AVEVA PI WORLD

Asset Development, Management and Analytics

Mixing the three worlds with PI AF

Presented By: Andrea Carlini

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LyondellBasell at a glance

LyondellBasell is a strong, global company delivering outstanding performance

LEADING⁽¹⁾

#1

Producer of **polypropylene compounds** globally
 Licensor of **polyolefin technologies** globally
 Producer of **polyethylene** in Europe
 Producer of **polypropylene** in Europe and North America
 Producer of **oxyfuels** in Europe and North America

DIVERSE



Many of our **materials** go into products that people use every day, such as food packaging, electronics, children's toys and fuels.

GLOBAL



Every day, our **employees** work around the clock to safely **advance solutions** to our world's biggest challenges.

GROWING



Increased U.S. ethylene capacity by **40%** since 2012
 Startup in 1Q20 of our **Hyperzone HDPE** plant
 Building the world's largest **PO/TBA plant**
 Expanding in China with **integrated cracker JV** and **PO/SM JV**
 Expanded footprint in Louisiana in 4Q20 with **Integrated PE JV**

(1) Sources: LyondellBasell and IHS Markit. Note: Product rankings are as of December 31, 2020.

(2) Note: Includes all wholly-owned capacity and our proportionate share of joint venture capacities

LyondellBasell has the scope and scale to serve global markets



Note: Information as of December 31, 2020.

LyondellBasell delivers innovative products and solutions in five key areas



CHEMICALS

We produce the chemical building blocks for:

- Furniture / household goods
- Coatings / adhesives / cleaners
- Cosmetics / personal care products
- Industrial fluids
- Fuel additives



POLYMERS

Our versatile plastic resins are used to create a variety of products including:

- Rigid and flexible packaging
- Textiles
- Automotive parts
- Healthcare
- Pipe
- Agricultural films / irrigation



ADVANCED POLYMERS

Our diverse portfolio is used to create customizable products including:

- Automotive parts
- Differentiated packaging
- Electronics / appliances
- Building and construction materials
- Oil field services
- Aerospace
- Pipe
- Agriculture
- Wire and cable



FUELS

Our refinery in the U.S. produces:

- Gasoline / fuel components
- Low-sulfur diesel
- Jet fuel

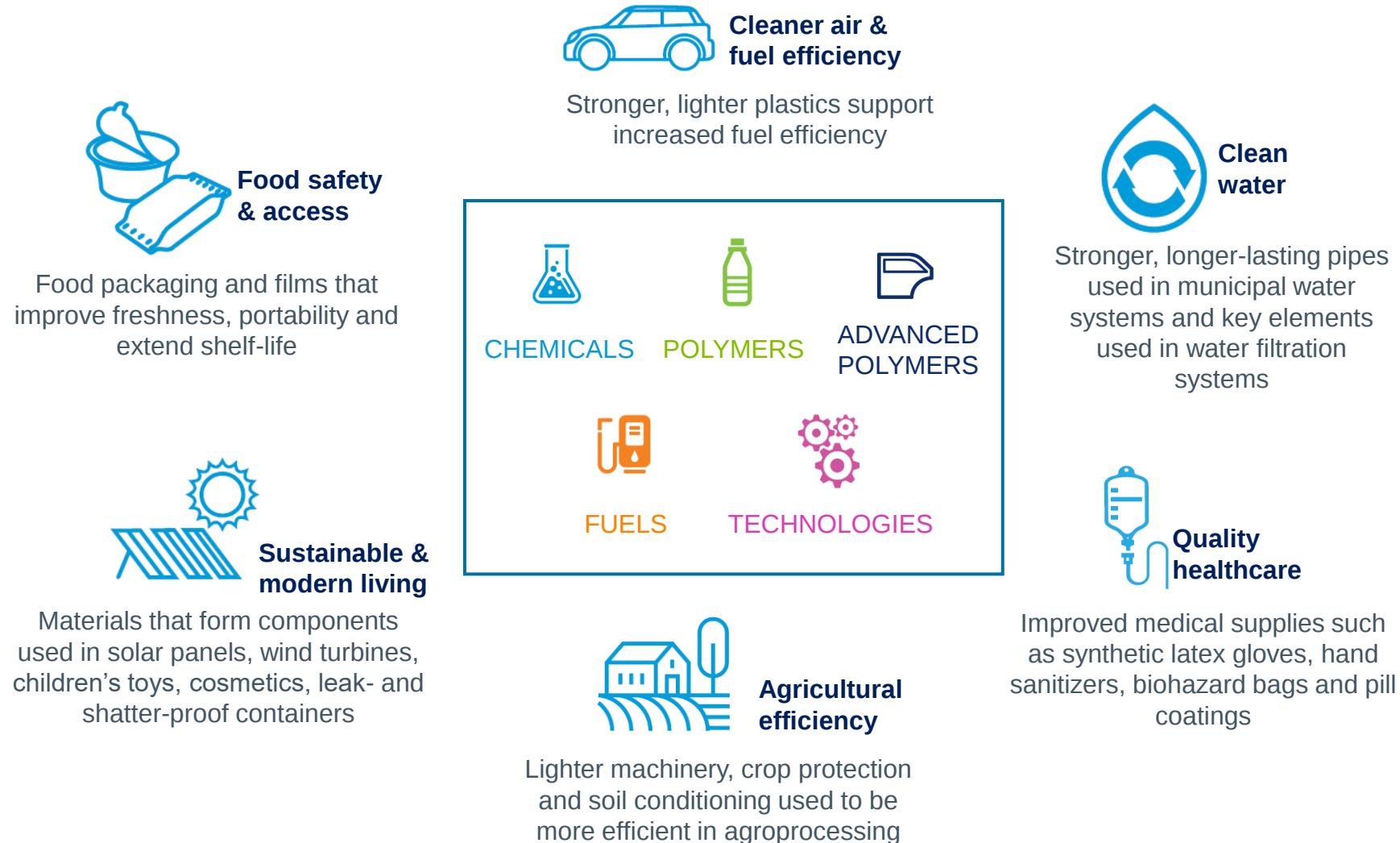


TECHNOLOGIES

We license our state-of-the-art manufacturing and process technologies:

- Polyolefin catalysts
- Petrochemical process licenses

LyondellBasell products are advancing a range of solutions in nearly every geography and sector of the economy



LyondellBasell is working to make meaningful progress to address some of the world's most pressing challenges



Eliminating Plastic Waste

Targeting production and marketing of 2 MM tons of recycled and renewable-based polymers annually by 2030



Addressing Climate Change

Targeting a 15% reduction in CO2 equivalent emissions per ton of product by 2030



Supporting a Thriving Society

Focusing on operating safely and with zero incidents, zero injuries and zero accidents



Introduction

Introduction / Preface

- LyondellBasell has been using the AVEVA OSISOFT PI System on several sites for many years, most of which are still using it as a Process Historian only
- Users make an extensive use of Excel Spreadsheet integration with PI Datalink and the PI ProcessBook tools, some of them started using it way back in '90.
- In today's presentation we are focusing on what happened in our Ferrara Site (R&D and Manufacturing)
- In late 2017 the Ferrara R&D and Manufacturing Site have started using AVEVA OSISOFT PI AF to implement asset analytics. Today we have several Analysis in place for common use cases :
 - Process and Product Quality Control
 - Predict process anomalies
- In 2018 the Process Technology Development department started the study of an Asset Management system integrated with PI AF. This presentation is focusing the implementation of this framework and how PI AF play the main role in new system.

FERRARA SITE

Ferrara, Italy

PRINCIPAL PRODUCTS

Polypropylene and Catalysts

SAMPLE PRODUCT END USES



Healthcare
packaging



Automotive
exteriors



Automotive
interiors



Construction and
roofing materials



Food
packaging



Pharmaceuticals



Textiles

information about LyondellBasell can be found
at www.lyondellbasell.com.

Process Technology Development



CHALLENGE

- The Process involves many data to be generated, processed and analyzed from the design phase to the asset implementation.
- The way Engineers manage and work with this data is not controlled by any system.
- Due to this problem the traceability and monitoring of assets changes is difficult



SOLUTION

- Implementation of a comprehensive Engineering Model in PI AF through the definition of a set of Asset Templates, including static and dynamic attributes
- Design of an MVC App based on PI AF SDK to implement specific Actions & Displays in support to the asset lifecycle management process



BENEFITS

- Simplification of the whole Development Process.
- Increased efficiency in tracking and monitoring asset changes due to the integration of Asset Attributes, Process Variables/RT Data, Analyses, Event Frames
- Improved Data Entry & Visualization

Business Challenge

- Ensure that all technical information entered during the design, implementation and validation phase are correct
- Proper identification and classification of the new assets categories
- Enforce mandatory information are entered
- Monitor and control the asset lifecycle providing stage gates and approvals
- Enforce tracking/auditing of changes down to Asset Attributes level
- Ensure that collection of real time data of the Asset is configured properly
- Ensure that the user experience is good enough to embrace the new system naturally
- WYSIWYG Interface for data entry and visualization
- Provide a fast and comprehensive search tool
- Seamless integration between static (design) and dynamic (operative) asset information

Solution

Strategy & Design

- Establishing a team of experts
- Requirements and Functional Specifications
- Select the Technological Platform
- Review Processes & Procedures

Implementation

- Platform Implementation (AVEVA OSISOFT PI System)
- Engineering Model Design (PIAF Element Templates)
- Front End App **SmartAF** (.NET MVC) & DataSheet Views and CI/CD

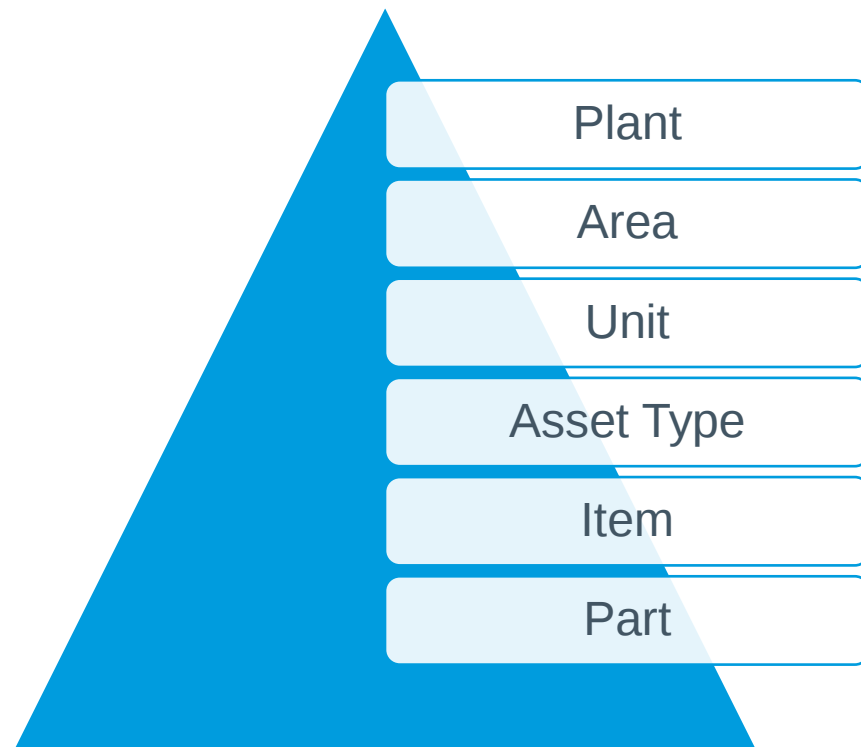
Rollout

- Fill the asset library with current data
- Map RealTime attributes with PI Points
- Establish a continuous improvement program with rapid application development

Implement the Engineering Model into PIAF through PI AF Element Templates

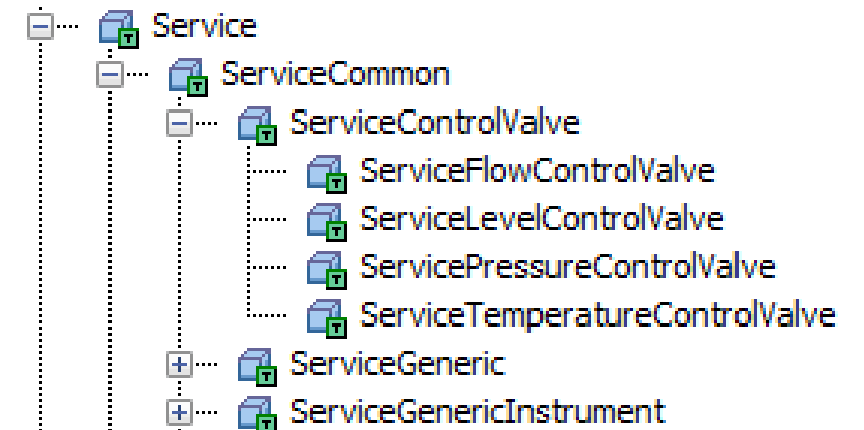
ENGINEERING MODEL

- The engineering model of our Plant or a Service Facility is a set of information arranged as per taxonomy classification ISO 14224

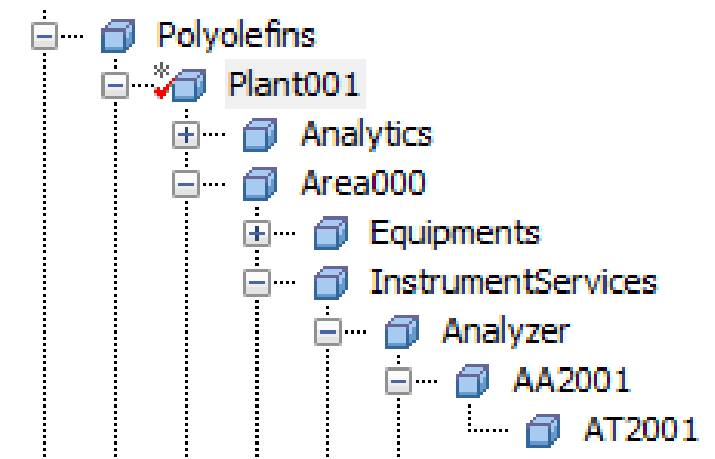


PI AF Element Templates

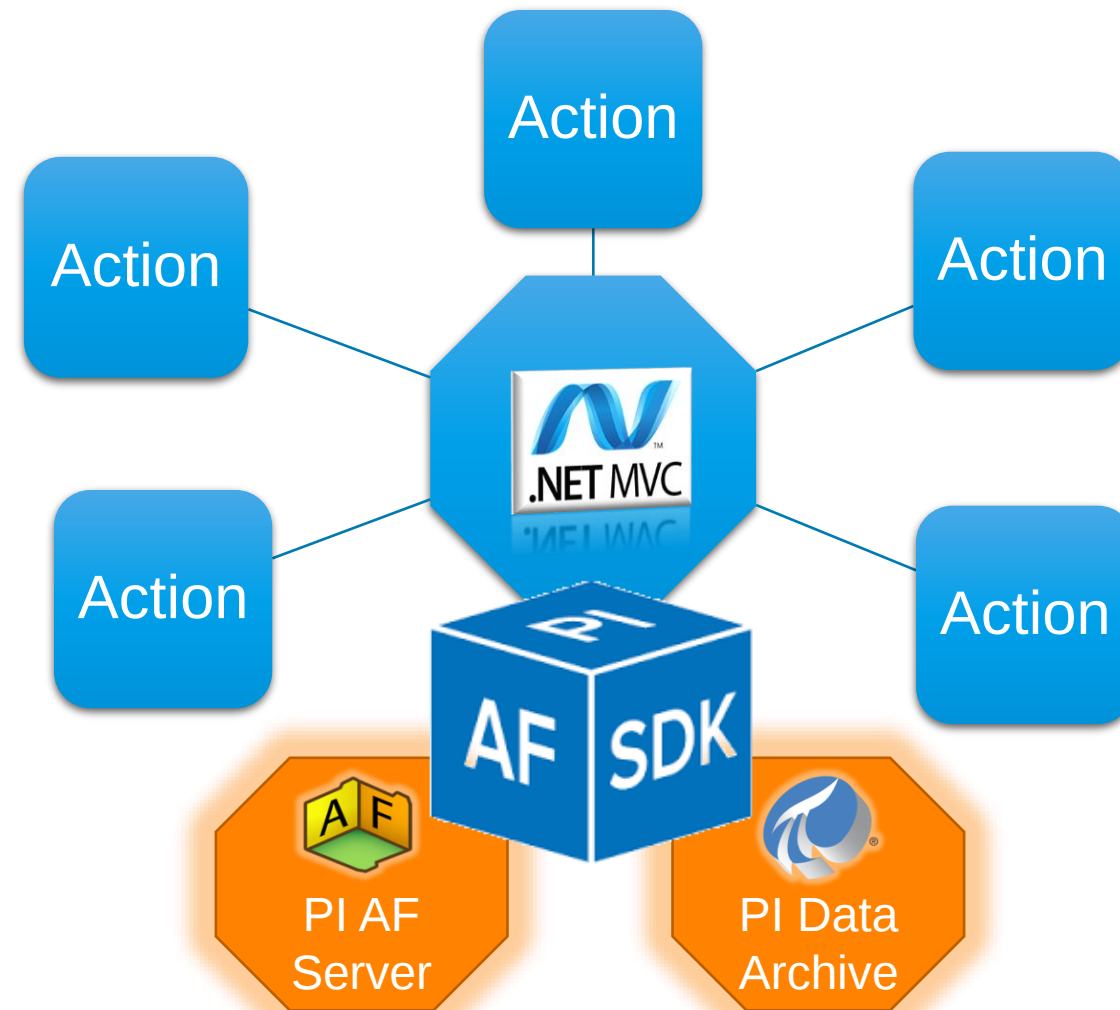
Asset Element Templates



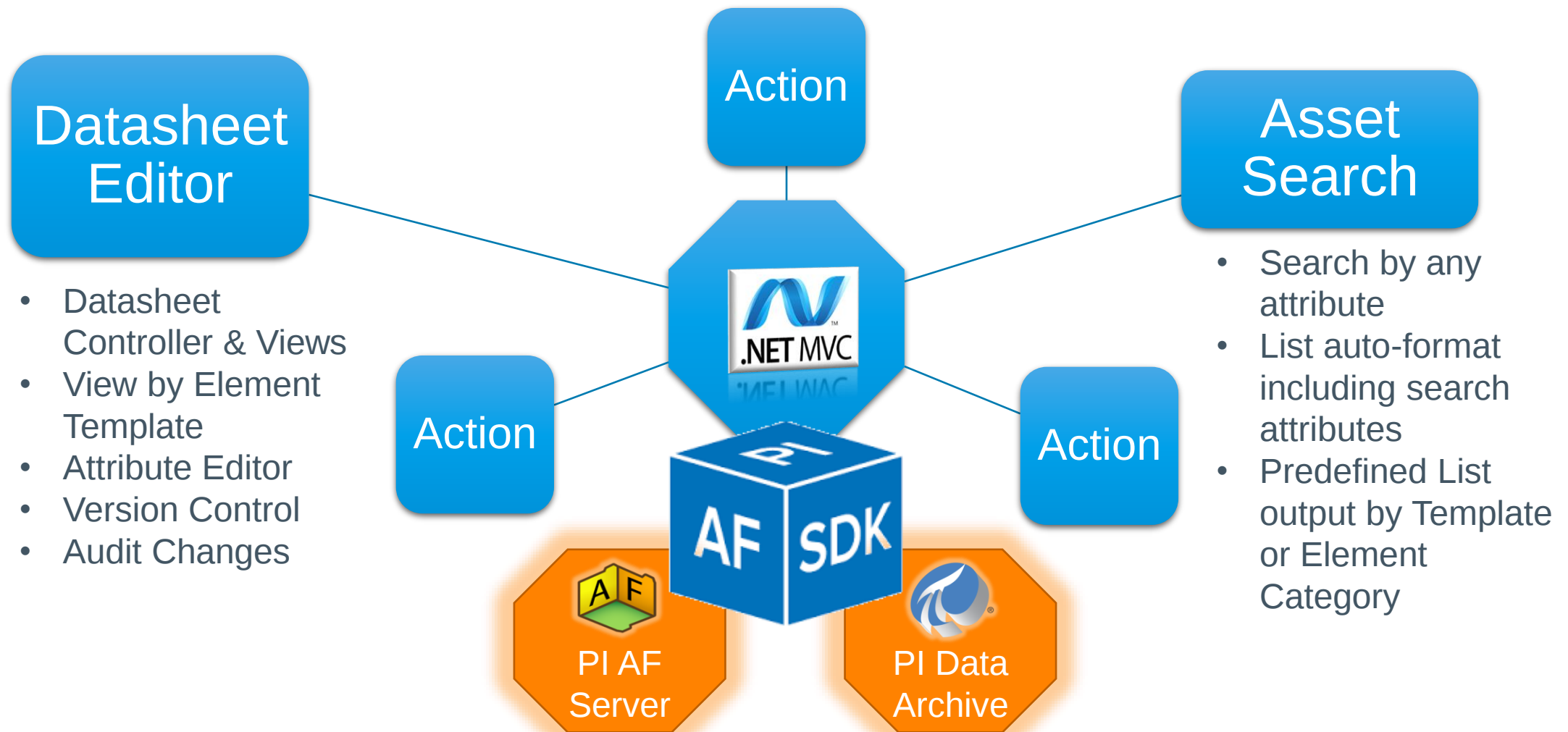
Element Hierarchy



SmartAF : User Interface for Asset Management



SmartAF : User Interface for Asset Management



Representing an Element into a Datasheet View

PI AF ELEMENT TEMPLATE

- Hierarchical structure of element templates enable complex engineering models to be replicated
- Element and Attribute categories are used to control the editing and visualization behaviour
- Enumeration Lists or Linked Data to guide users to select the appropriate values during data entry
- Static and Dynamic attributes
- Reference documents (i.e. Supplier Specification and/or Drawings) are not stored in the AF Database but a set of attributes keep the external link to the controlled documents (Corporate Sharepoint Site)

DATASHEET CONTROLLER AND VIEWS

- Function as a unified interface for Asset Management and Visualization in DataSheet Style format
- Map attributes in a paper view (multi-page)
- One or more templates can share the same View
- Three datasheet types :
 - Process Datasheet
 - Engineering Datasheet
 - As Built Datasheet
- Datasheet Actions are MVC Actions: access is restricted by User Roles
- Version Management & Status Change Control
- Audit value changes in a dedicated database
- A set of PI AF Tables are used to store configuration items and user preferences

Representing an Element into a Datasheet View

RAW ELEMENT ATTRIBUTES

Attribute	Attribute Name	Description	Value	Units	Categories
_TemplateName	_TemplateName				
_VersionedID	_VersionedID				
_VersionNumber	_VersionNumber		2		007_ReadOnly;
Agitator	Agitator	062 - Agitator	Yes		000_All;003_Design;
AgitatorItem	AgitatorItem	063 - AgitatorItem	HPA2305		000_All;003_Design;
Area	Area		300		007_ReadOnly;PR001;
AreaService	AreaService		Equipments\Vessel		
AtexRating	AtexRating	900 - AtexRating			000_All;003_Design;
AttributeNotes	AttributeNotes	Attribute Notes			
AttributeNotes[Diameter]	Diameter	107 - Diameter	Note 1		009-Notes;

Showing 1 to 10 of 211 entries

Previous 1 2 3 4 5 ... 22 Next

DATASHEET VIEW



D2363C

PROCESS DATA SHEET

Page : 1 Of : 4

Plant: P02

Project: ...

EquipCategory: M

Sub-Category: Vessel

Status: AD

Version: 2 Date: 03 Jun 2021

Area: 300

P&ID: 301730/382

3200010/30

(1)

Service : [TEST] Separator of lights from C6/C8 mixture

[Link to Sketches](#)

[Link to Notes](#)

GENERAL INFORMATION

SERVICE DATE		ROTATIVE EQUIP.	False (2)
TYPE	Vertical	INCLUDED IN	
HEAD TYPE	Cone (4)	SERVICE TYPE	Continuous
INSULATION	HOT	DIAMETER	980 mm (5)
INSTALLATION	Outdoor (6)	HEIGHT OF LENGTH	1850 mm
AGITATOR	Yes	FIRE PROOFING	No
AGITATOR ITEM	HPA2305	BAFFLE	(See drawings or notes)

ATEX RATING : ...

NOTES (Process) : These are notes in the Process DataSheet (Notes page)

OPERATING CONDITIONS

	VESSEL	JACKET
TEMPERATURE (min/norm/max)	50 °C (13) / 55 °C / 60 °C	... / ... / ...
PRESSURE (min/norm/max)	... / 0.2 barg / 3.5 barg	... / ... / ...
DENSITY (min/norm/max)	... / ... / ...	... / ... / ...
FLUID	Butene (7)	...
FLUID PHASE	...	...

DESIGN CONDITIONS

	VESSEL	JACKET
CAPACITY	...	...

AVEVA

PIWorld

DIGITAL

Display and Edit Element in a Data Grid View

Copy Excel

Show 10 entries

Search:

Row	Name	Status	Description	Cat	SubCat	P&I	Last Version	Key	Camera	Capacity m³	Gaskets	Design Conditions				Operating Conditions										Fluid	HoldUp(Kg)	
												Density(Max) Kg/m³	Temperature °C		Pressure barg		Temperature °C			Pressure barg			Density Kg/m³					
													Min	Max	Min	Max	Min	Normal	Max	Min	Normal	Max	Min	Normal	Max			
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
1	C4910	AD	Colonna Purificazione Propano - Taglio Pesanti	M	...	03200/436	15-Jun-2021	1	1	80	As per supplier specs	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Steam	🔒	
2								1	JACKET	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	🔒	
3																											🔒	
4	D2363	AD	Depositor of light from C6/C8 mixture	M	...	339999/10 339998/20	01-Jun-2021																				🔒	
5																											🔒	

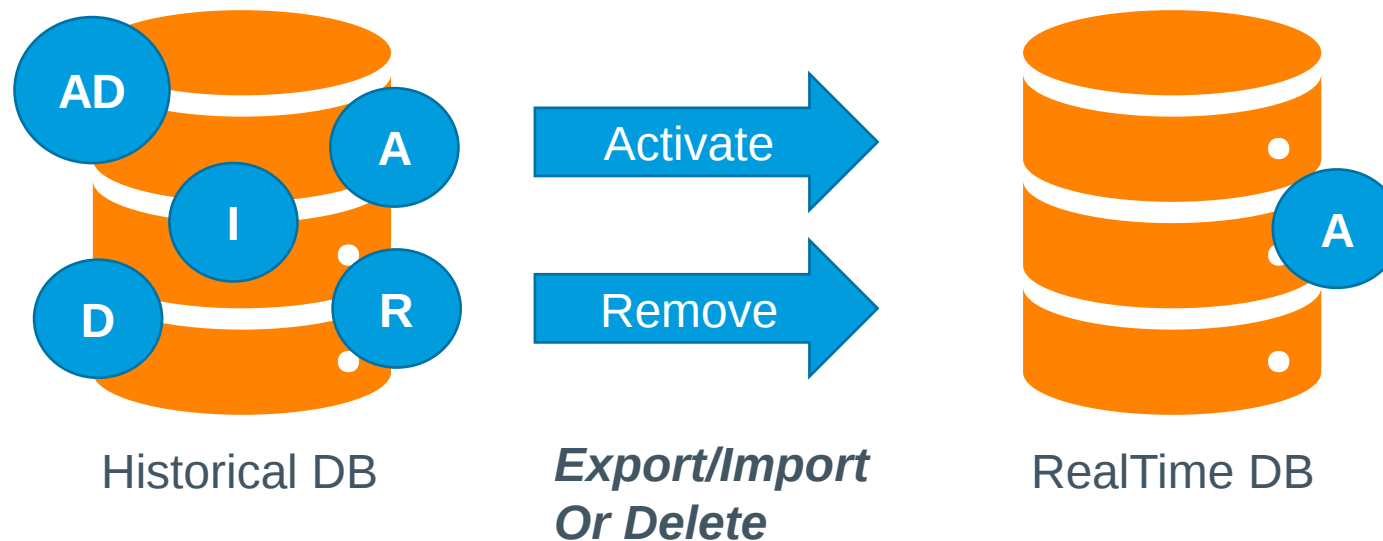
Showing 1 to 5 of 5 entries

Previous 1 Next

	Density(Max) Kg/m³	Design Conditions				Operating Conditions									
		Temperature °C		Pressure barg		Temperature °C			Pressure barg			Density Kg/m³			
		Min	Max	Min	Max	Min	Normal	Max	Min	Normal	Max	Min	Normal	Max	
↑↓	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
olier	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
olier	1.7	22	85	3.2	1.2	25	28	30.2	1.6	3	2.5	...	5.99	...	
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

Moving data between Historical and RealTime AF Databases : Speed up realtime analytics

- We keep two AF database online
- The “Historical” AF database keep all element versions forever and it is used by SmartAF to manage the asset elements. Elements cannot be physically removed.
- The “RealTime” AF database keep only “Active” elements, the ones that are active in the plant. No changes can be made to the RealTime AF Database. No versions are kept. Only the current live assets and RealTime Analysis are there to keep the system light and fast.
- When an asset element in the “Historical” DB is set to “Active” it will override its “RealTime” copy (or just create itself). When it is set to “Removed” the equivalent element in the “RealTime” DB will be removed.



Demo