

Digital Transformation in Substation HMI Engineering

The logo consists of a white square with a stylized, wavy line in shades of orange and red that curves across it from left to right.

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What is digital transformation?



What is digital transformation?

Innovation:

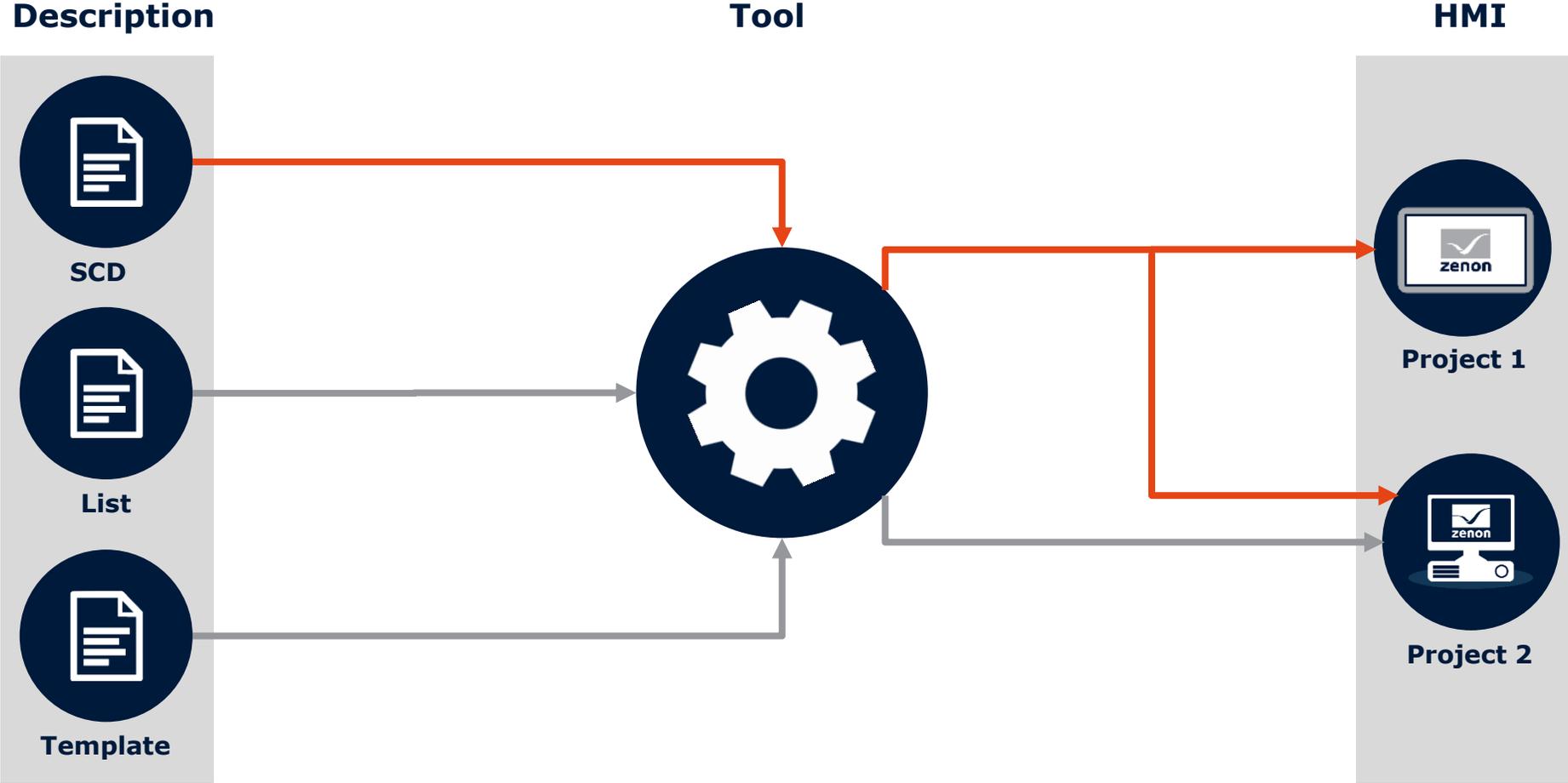
- ▶ Make existing things better
- ▶ Digitizing existing services

Transformation:

- ▶ Make things that do not exist yet
- ▶ Rapid adoption of technology
- ▶ Create new sustainable competitive advantage

What about Substation HMI Engineering?

► Are we able to transform this?



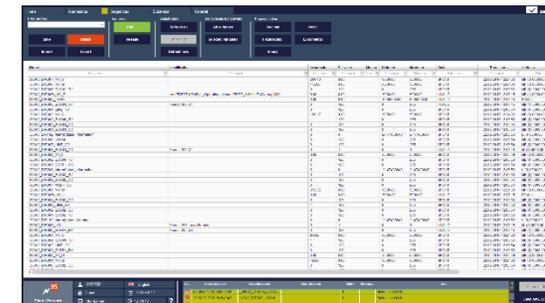
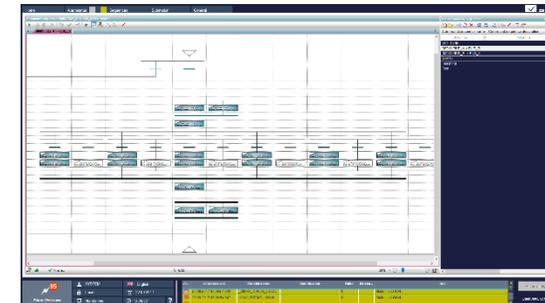
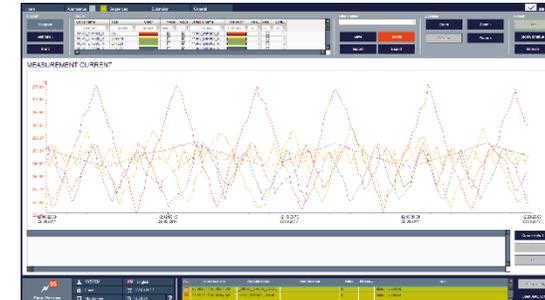
One-Click-HMI-Engineering (OCHE:-)

▶ Project Template

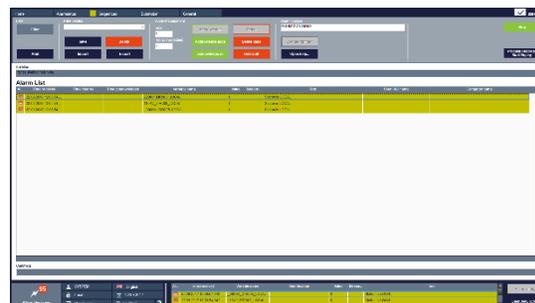
- Data types (alarming, events, commands)
- Standard displays for static content (and calling functions)
- Empty display for variable content (single line, alarm panel)
- Symbol library

▶ Configuration package

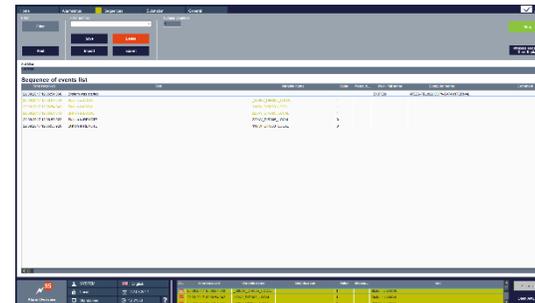
- SCD file (from SCT) [.scd]
- Signal list (from SCT) [.xlsx]
- Symbol library (from HMI tool) [.xml]



A screenshot of an HMI software interface showing a detailed data table. The table has multiple columns and rows of information, likely representing system parameters or data points. The interface includes a toolbar with buttons for 'VIEW', 'PRINT', 'HELP', and 'EXIT'.



A screenshot of an HMI software interface showing an 'Admin List' table. The table has columns for 'NAME', 'ID', 'PASSWORD', 'STATUS', and 'ACTION'. The interface includes a toolbar with buttons for 'VIEW', 'PRINT', 'HELP', and 'EXIT'.



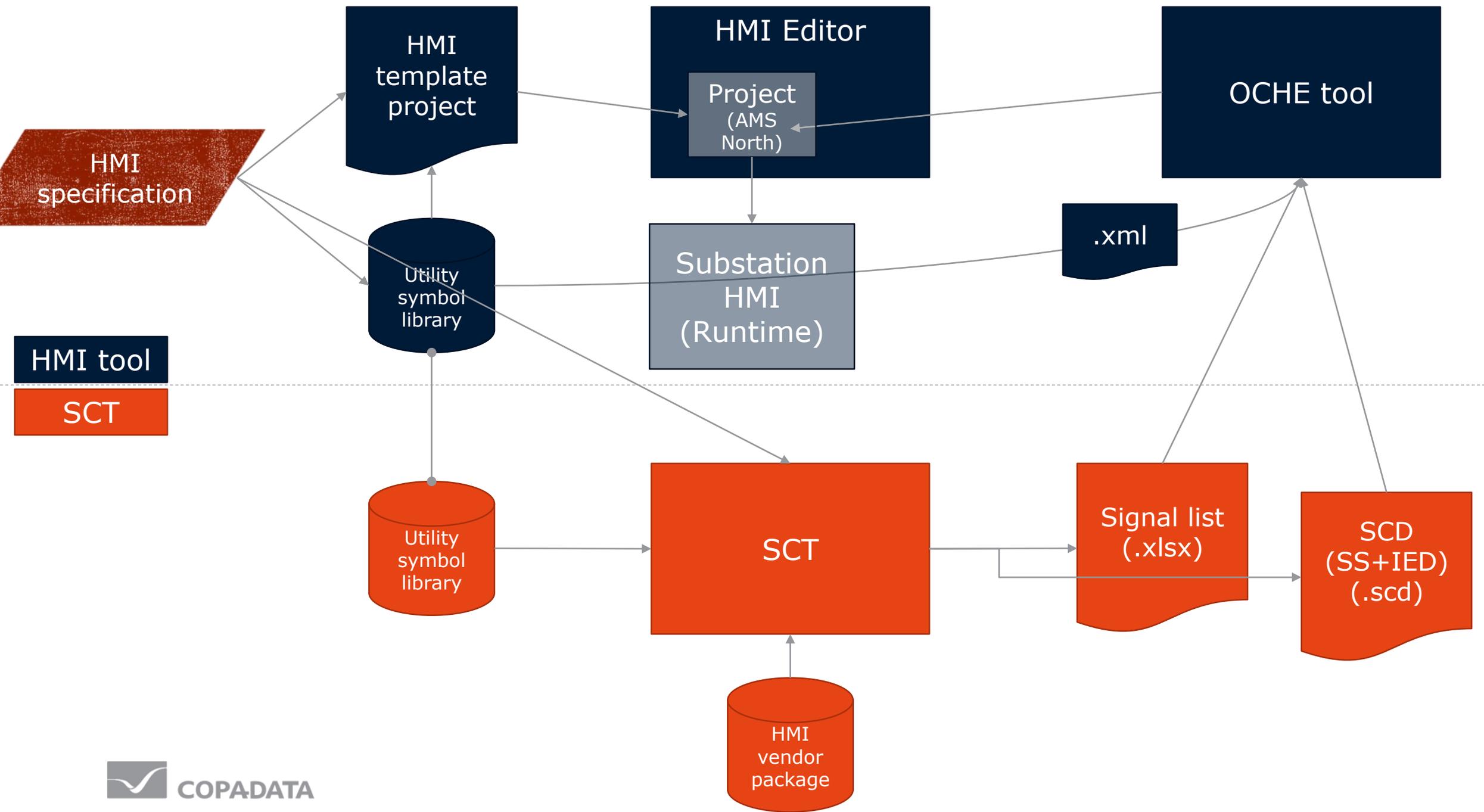
A screenshot of an HMI software interface showing a 'Sequence of events list' table. The table has columns for 'EVENT ID', 'TIME', 'DESCRIPTION', and 'ACTION'. The interface includes a toolbar with buttons for 'VIEW', 'PRINT', 'HELP', and 'EXIT'.



A screenshot of an HMI software interface showing a 'Daily Feeder Report' table. The table has columns for 'Feeder ID', 'VOLTAGE', 'CURRENT', 'POWER', 'STATUS', and 'ACTION'. The interface includes a toolbar with buttons for 'VIEW', 'PRINT', 'HELP', and 'EXIT'.

Configuration Steps

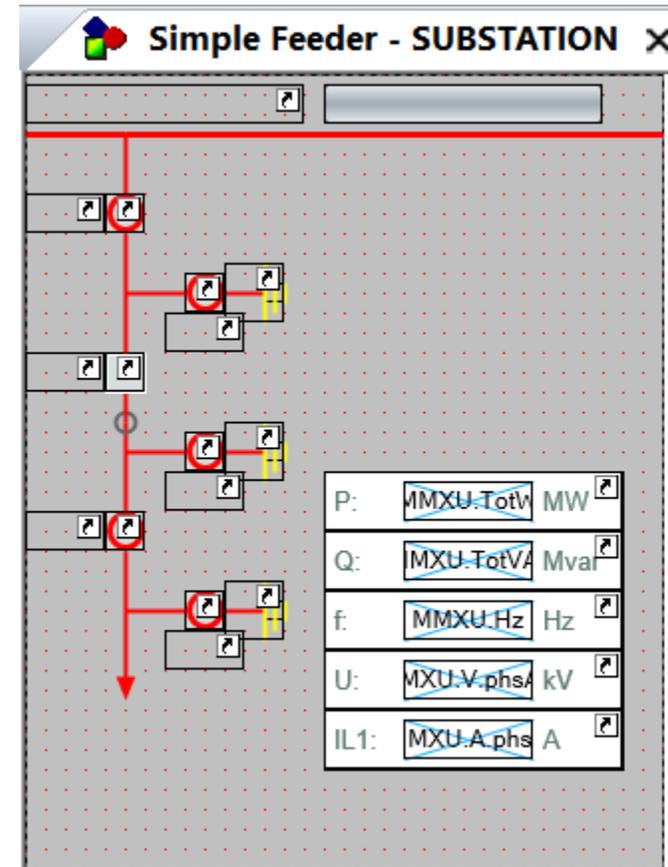
- ▶ Start HMI tool with template project (TEMPLATE.zip → Substation “Amsterdam North”)
- ▶ Start OCHE tool
- ▶ Import configuration package (.scd, .xlsx, .xml)
 - Automatic assignment of symbols if match
 - Otherwise: manual assignment
 - Automatic arrangement of symbols using X/Y-coordinates from.scd
 - Automatic configuration of RCBs
 - Automatic assignment of signal list ↔ .scd → has link to data types
- ▶ Creates variable content of HMI application
 - Driver
 - Variables (data base)
 - Displays (single line)



Defined Rules

- ▶ `<LN><switch name><DO><DA>` is standard format for variable reference in symbol.
e.g.:
 - `XCBR.QA1.Pos.stVal`
 - `XSWI.QB1.Pos.stVal`
- ▶ If Bay desc and bay symbol name match: automatic assignmet:
`</Bay>`

```
<Bay sxy:x="2" sxy:y="2" name="01"  
desc="Simple_Feeder">
```



Tool

SUBSTATION HMI WIZARD

File Style Creation

Substation Single Line Communication Variables Gateway SNMP Summary

Import...

Substation Hierarchy

- CH-S032
 - Unterwerk Filisur
 - C00
 - W01
 - W001
 - AIS Leitungsabgang ES
 - W002
 - AIS Leitungsabgang ES
 - W003
 - AIS Trafoabgang VN

New

- CH-S032
 - Drag Template Box here
 - AIS Leitungsabgang ES
 - W001
 - AIS Leitungsabgang ES
 - W002
 - AIS Leitungsabgang ES
 - W003
 - AIS Trafoabgang VN

Import...

BoxTemplates

- AIS Leitungsabgang ES
- AIS Trafoabgang VN
- BayType_Leitungsabgang
- Simple_Feeder
- Simple_Feeder_2

Other Templates

0 Error
0 Warning
0 Info
0 Debug
– Select type

Box	Scaling	40	Relative position X	640	Trend labels	Group	Function	TemplateName	InstanceName	Height	Width	RelativePositic	Labels
	Height	400	Relative position Y	200	Linking rules	Source	Target						
	Width	320				XSWI.QC2.Pos.stVal	CH-S032.C00.W002.QC2.AE1.-QC2 2 ARBEITSERDER RM						
						XSWI.QC9.Pos.stVal	CH-S032.C00.W002.QC9.AE1.-QC9 ABGANGSERDER RM						
						XSWI.QB9.Pos.stVal	CH-S032.C00.W002.QB9.AE1.-QB9 ABGANGSTRENNER RM						
						XCBR.OA1.Pos.stVal	CH-S032.C00.W002.OA1.AE1.-OA1 LEISTUNGSSCHALTER F						

Output

The screenshot displays the zenon Energy Edition interface for a project named "Process_380kV - SUBSTATION".

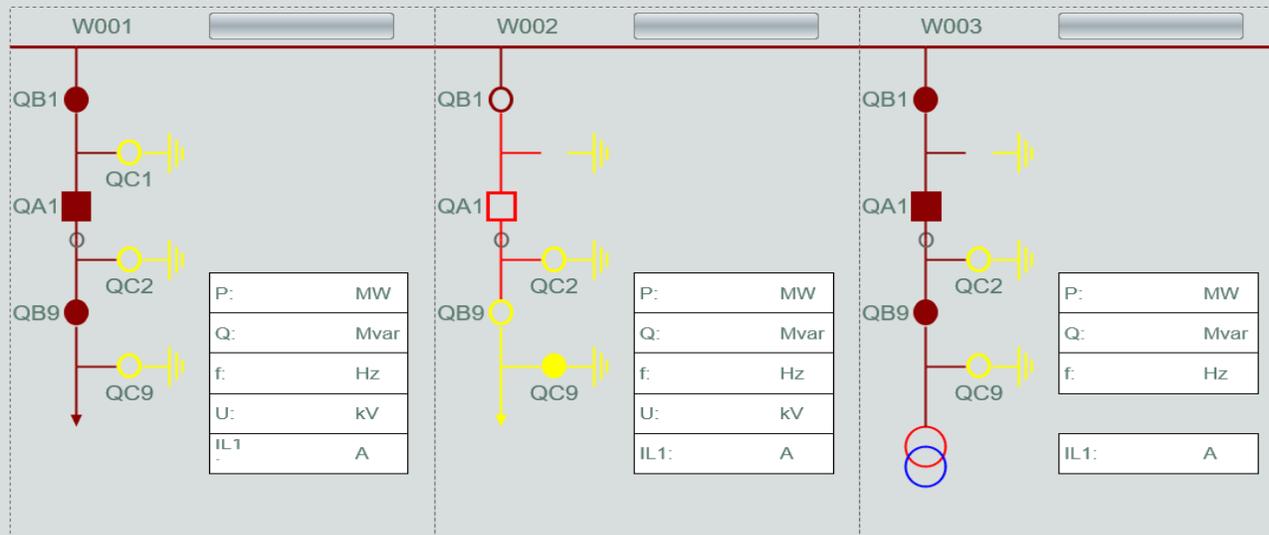
- Project Manager:** Shows a tree view of project elements including EE_PRO_SUBSTATION, TEST, and various sub-elements like Variables, Screens, Functions, etc.
- Network Topology:** A diagram showing three busbars (W001, W002, W003) connected to various components (QB1, QA1, QB9, QC1, QC2, QC9). A red arrow points from the "Source" field in the linking rule to the QB1 component in the diagram.
- Linking rule:** A red box highlights the source and target fields:
 - Source: XSWI.QB1.Pos.stVal;XSWI.QB9.Pos.stVal;XSWI.QC2.Pos.stVal;XSWI.QC9.Pos.stVal;XCBR.QA1.Pos
 - Target: CH-S032.C00.W001.QB1.AE1.-QB1 SS1 TRENNER RM;CH-S032.C00.W001.QB9.AE1.-QB9 ABG/
- Output window:** Displays a list of files and a message:

```
Scrollbar_vert.png
Scroll_down.png
Scroll_horz.png
Scroll_left.png
Scroll_right.png
Scroll_up.png
Scroll_vert.png
zenon_logo-CENTRE_grey40.png
ZENONSTR.TXT
project.ini
monitor.mon
\data.rgm File will not be overwritten!
IEC850_IEC 61850 driver.txt
*** 57 Runtime files of project "SUBSTATION" were created in the Runt.
```

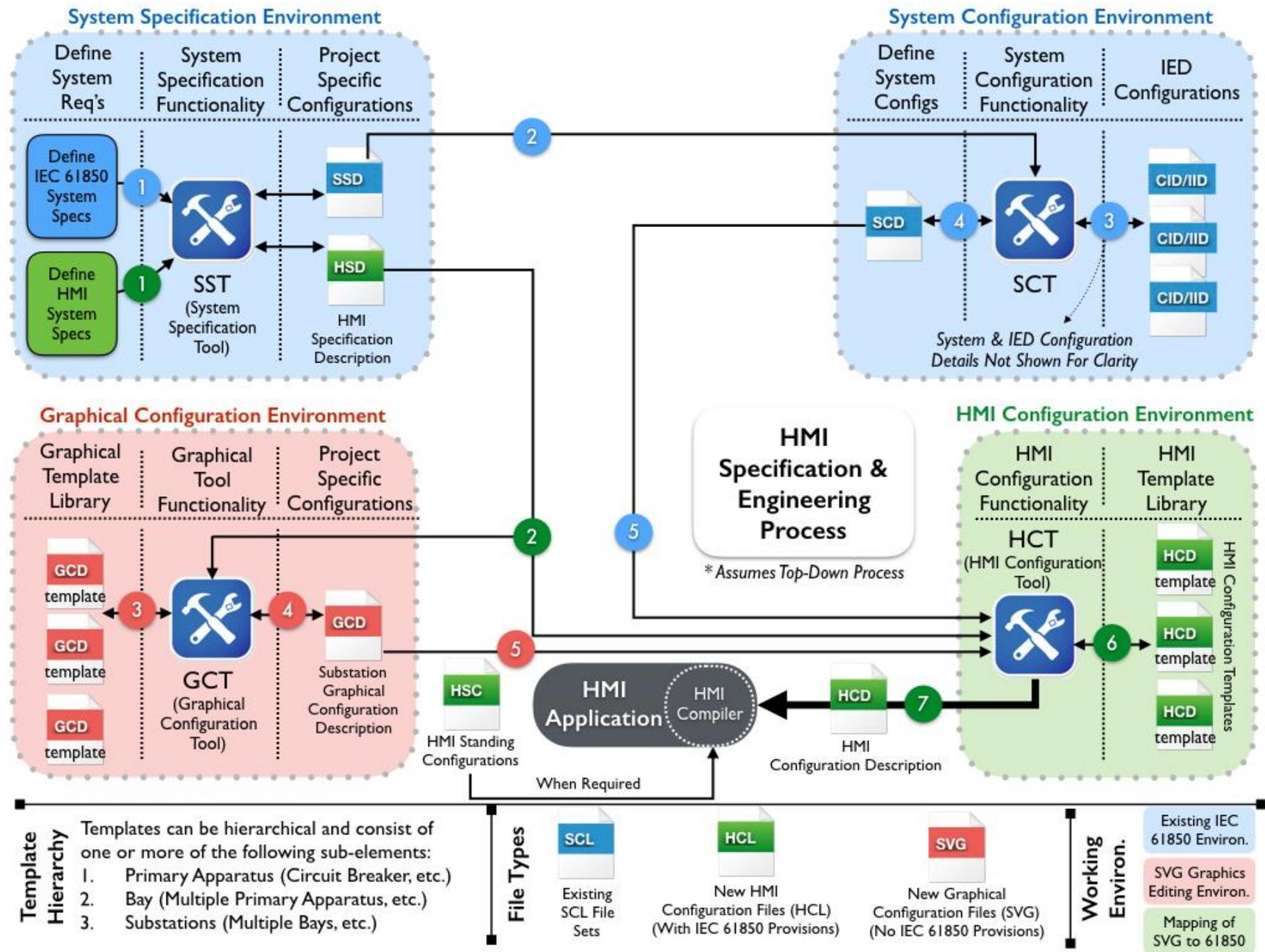
At the bottom, the status bar shows: Ready, Mouse pointer: 575/433 Symbol: BOX_AIS Leitungsbang ES_2, Starting point X/Y: 320/200 Width/Height: 320/4

Output

zenon **Filisur** Fernzugriff Schalthoheit holen **380 kV** W001 W002 W003 Alarmliste Sammelmelder Anwahlsystem Trend Event List 19:56:10 08.09.2017



Outlook

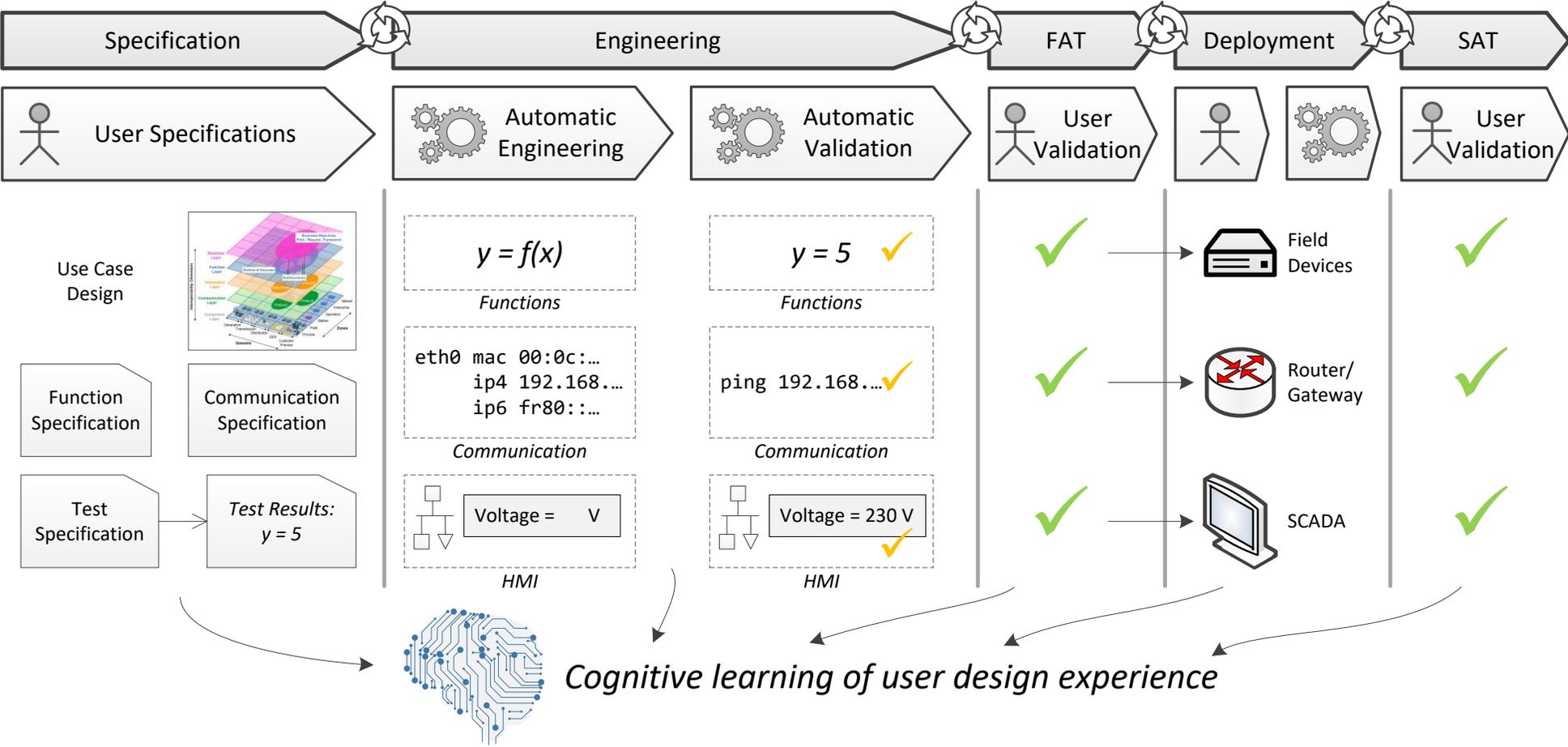


- Template Hierarchy**
- Templates can be hierarchical and consist of one or more of the following sub-elements:
1. Primary Apparatus (Circuit Breaker, etc.)
 2. Bay (Multiple Primary Apparatus, etc.)
 3. Substations (Multiple Bays, etc.)

- File Types**
- SCL:** Existing SCL File Sets
 - HCL:** New HMI Configuration Files (HCL) (With IEC 61850 Provisions)
 - SVG:** New Graphical Configuration Files (SVG) (No IEC 61850 Provisions)

- Working Environ.**
- Existing IEC 61850 Environ.
 - SVG Graphics Editing Environ.
 - Mapping of SVG to 61850

Outlook



Digital Transformation?

- ▶ Make things that do not exist yet? kind of
- ▶ Rapid adoption of technology? with cognitive learning
- ▶ Create new sustainable competitive advantage? definitely!

Thank you!



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