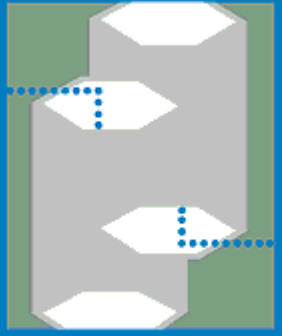


C A P E



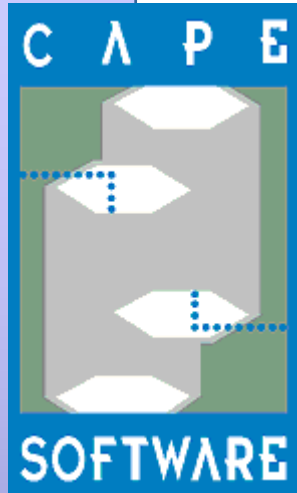
SOFTWARE

A collage of images in the background, including a green field with white circles, a glowing industrial structure, a person at a control panel, and various industrial equipment.

# *The Virtual Process Overview and Applications*

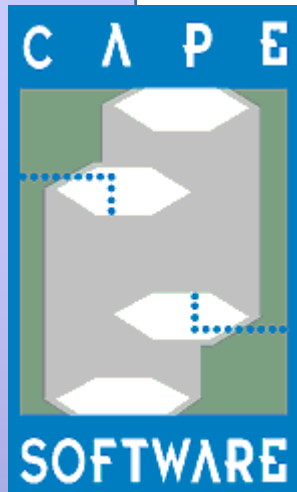
Cape Software Inc.

Houston TX



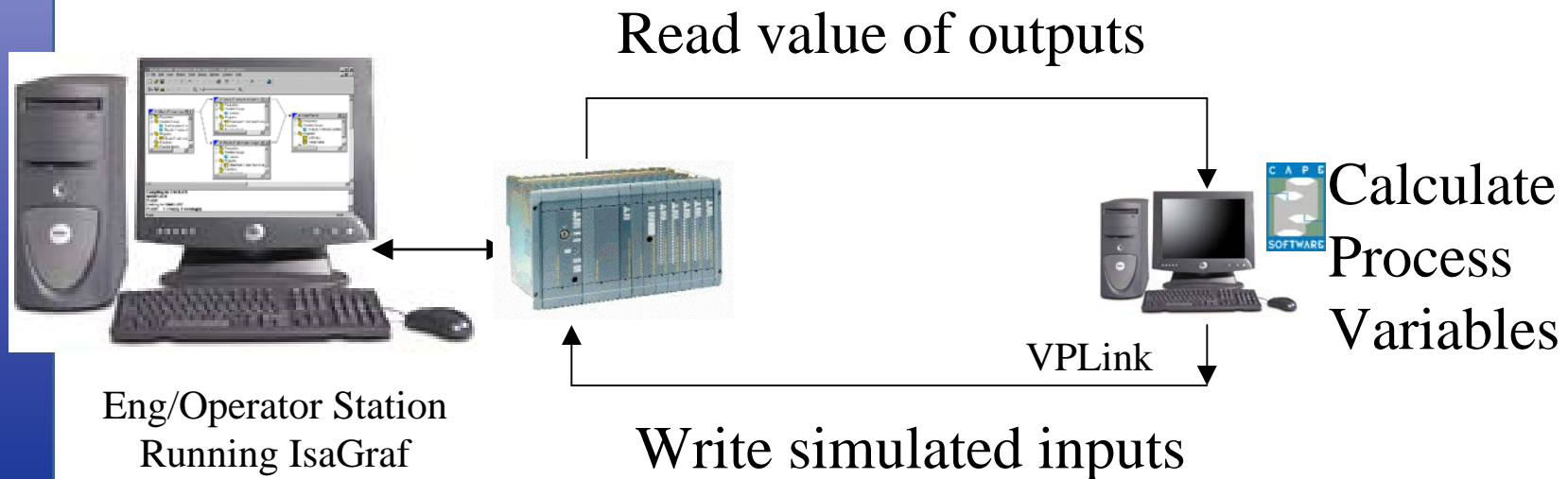
## *What is VP Link ?*

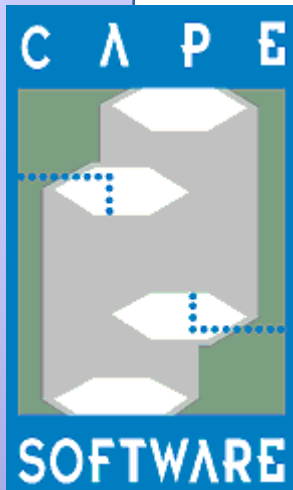
- A dynamic **representation** of the process **inputs** to an **offline** control system



## *Virtual Process Overview*

- Windows based interface: intuitive
- No Changes to the Triplex program: non-invasive
- I/O board Hardware not required: Cost Effective
- Multiple interface to ICS Triplex, including
  - Modbus over Ethernet, Serial and TCP to Isagraf Kernel





## *Some of our customers...*

**TOTAL**– Vlessingen, Netherlands

**Eastman** – several systems within Kingsport, TN

**Shell** – several systems W/W

**ConocoPhillips** –San Francisco, CA

**Phillips Refining** – Several Sites Licenses

**BASF** – Geismar, LA

**Dow Chemicals** – Several sites W/W



**Lubrizol** – several licenses within Deer Park, TX

**BP** – several licenses at several sites

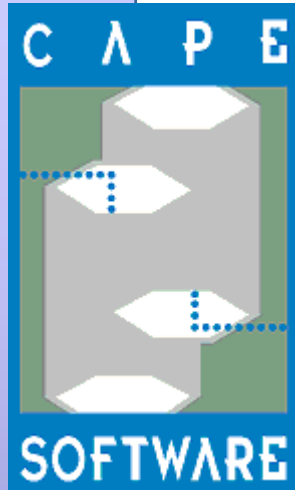
**Shell Deepwater / Shell Chemicals, UK**

**Eli Lilly** – Corporate licensing

**Genentech** – several licenses at different sites

**General Mills** – W/W licensing

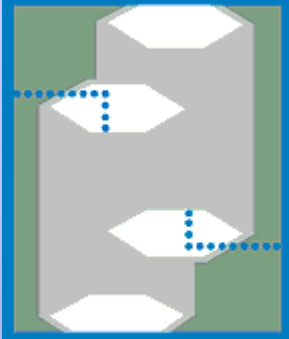
**Murphy Oil** - Mereaux, LA



## *Some Supported Systems*

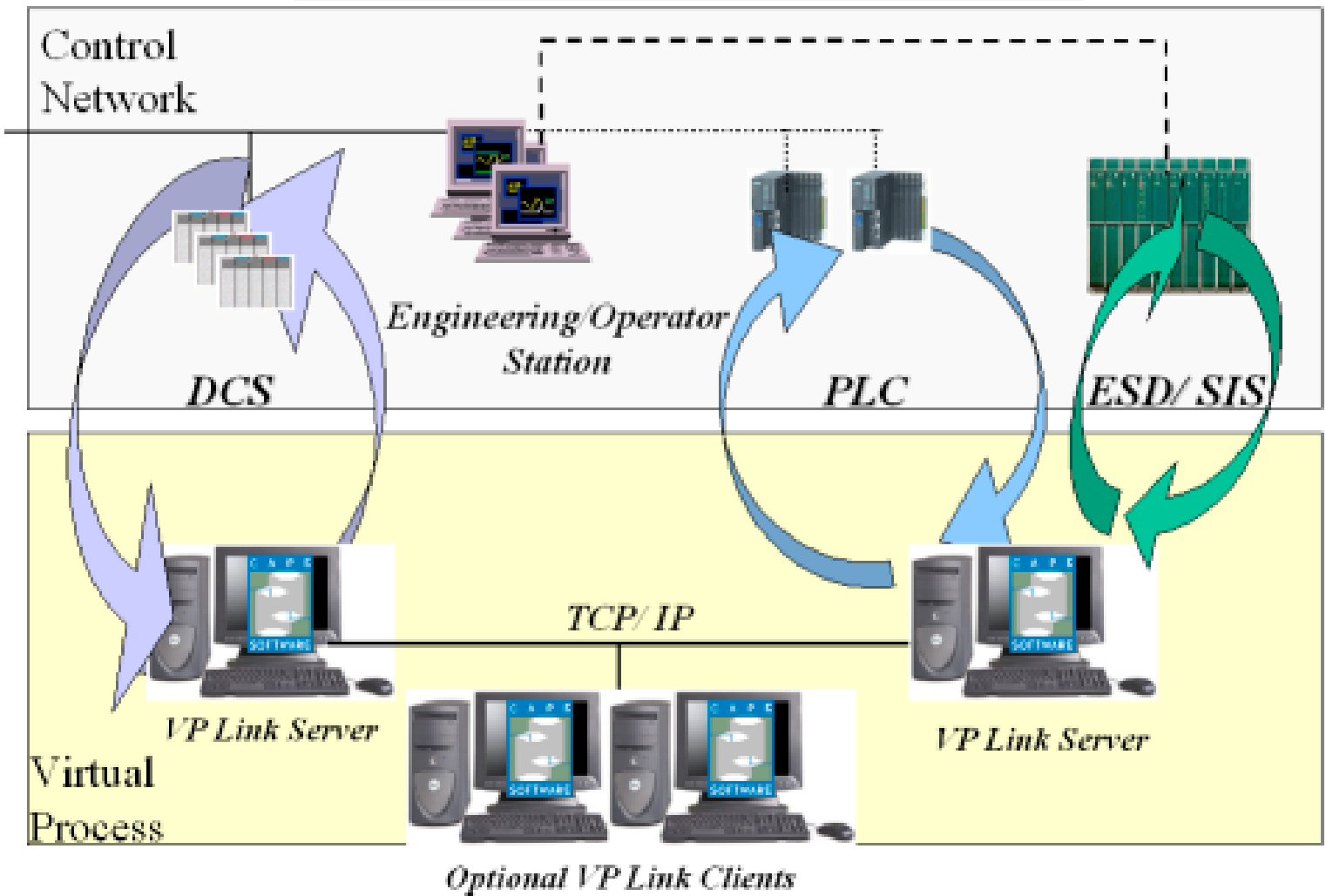
- **ICS Triplex Trusted System**
- **Triconex:Tricon/Trident**
- **Honeywell FSC**
- Foxboro I/A,Archestra
- Honeywell Plantscape / Rockwell ProcessLogix
- Honeywell TPS,PKS
- A-B PLC5/SLC500,CLX, Modicon,Siemens-Ti 505
- Emerson DeltaV,PROVOX
- Siemens APACS, PCS7, S7
- ABB Mod300, Advant
- Yokogawa CS3000/R3/ ProSafe
- Etc...

C A P E

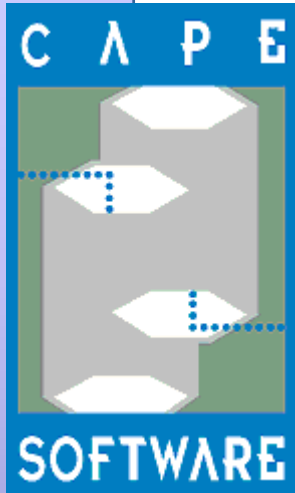


SOFTWARE

## VP LINK 3.0 Sample Network

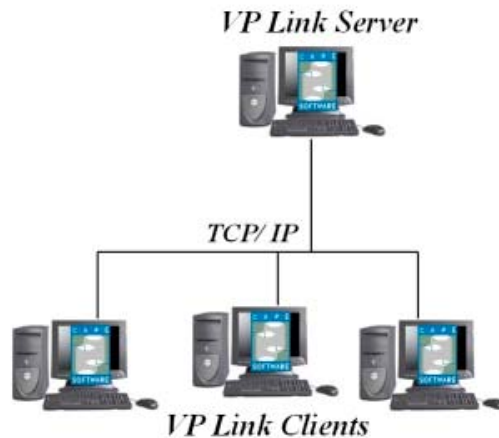


Control Network Systems are solving the logic, responding to simulated VP Link inputs



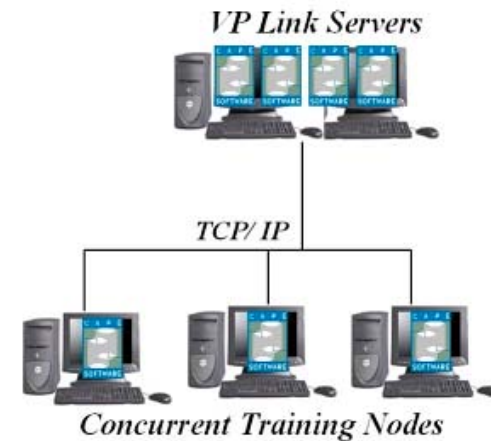
# *Different Architectures for different Applications*

## **Training /Testing Setup**

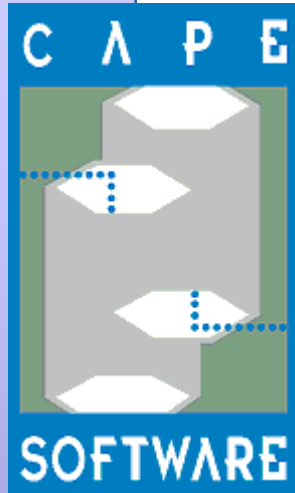


Engineers manipulate units PVs, sharing a chassis and simulation server

## **Parallel Training Setup**

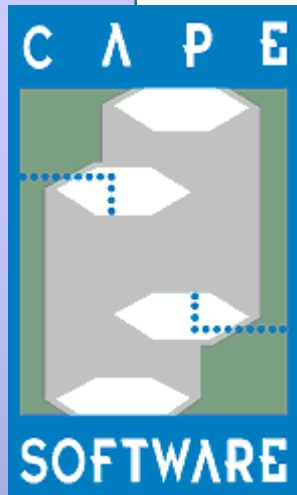


Engineers test identical units, in parallel simulation servers



## *5 steps to Logic Validation with VP Link 3.x*

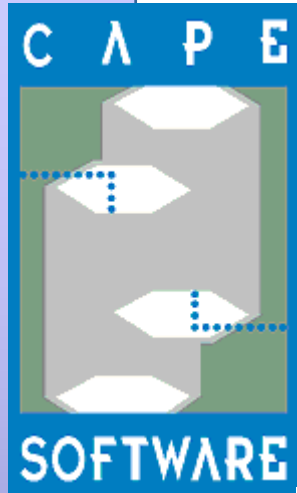
- Extract the control systems I/O image, using platform specific tools
- Import the image in VP Link
- Write training/failure scenarios
- Connect to ESD
- Execute validation test (scenario based or manually)



## *VP Link Ease of Use with Triplex systems*

- Extraction utility creates the VP Link Tag Database, in a spreadsheet format
- **Fast:** Import and connect to all the points in a matter of minutes
- **Functional :** VP Link utilities automate tie-backs, or assist in creating more complex Dynamics
- **Convenient:** Drag and drop Graphic interface makes VP Link a practical, customizable testing environment
- **Adaptive:** Can be used to simply metaphor a Hardware Panel (Testing) or a rigorous process model (Operator Training)
- **Scalable:** Can interface with various DCS (Honeywell/Invensys ) for thorough integrated Testing

# Virtual Process Network Topology with Triplex Platform



VP Link 3.x  
Server(s)

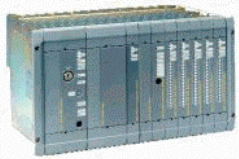


Optional  
DCS Interface

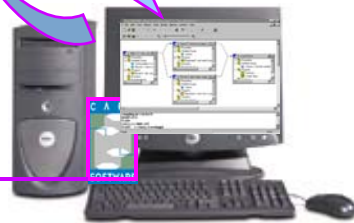


- **DCS** Connectivity
- **Specific VP** driver

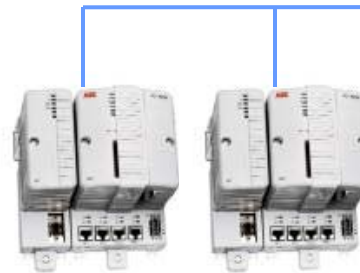
TCP  
Connectivity



Triplex  
Chassis



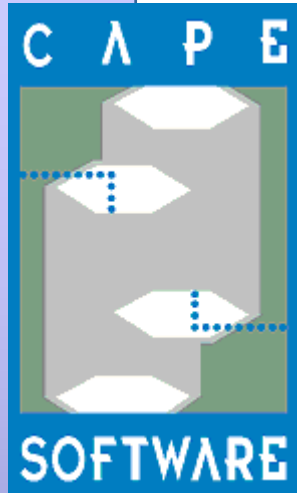
- Isagraf or Control Application platform
- **VP Link** driver for Triplex system



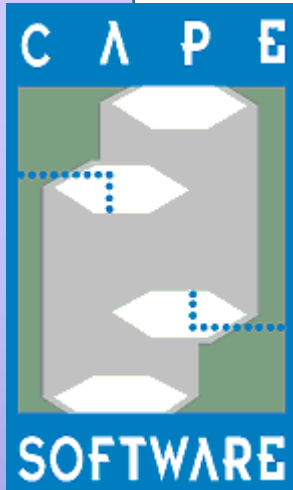
Controllers



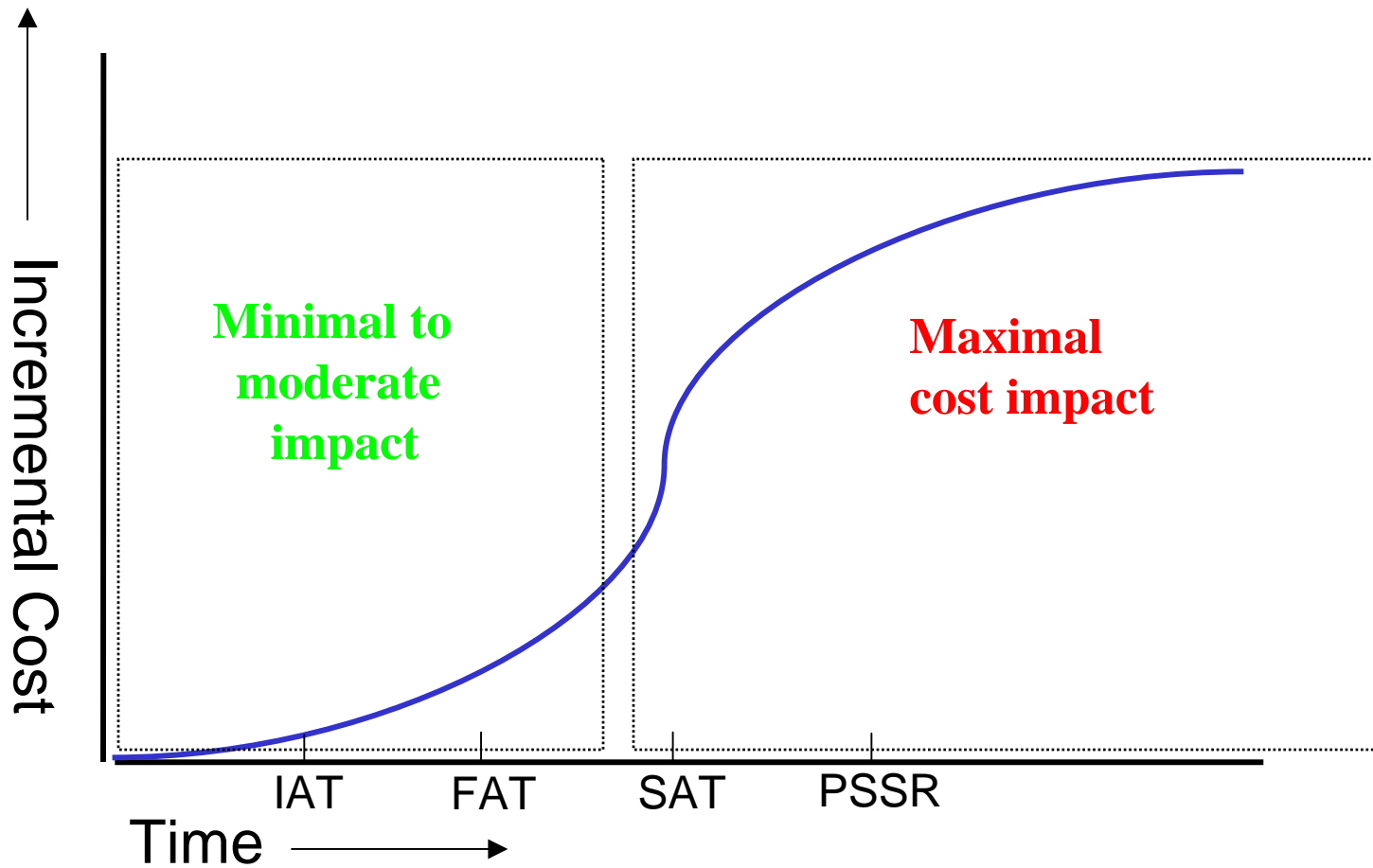
Operator Station  
MMI

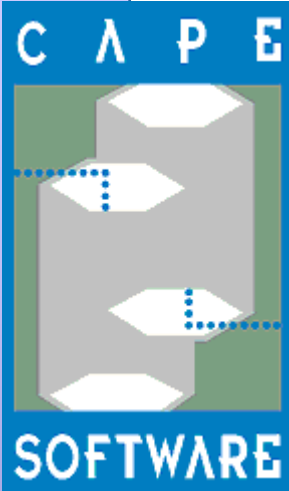


*SIS Validation :*  
*Cape Software's **T**est **C**ompiler*

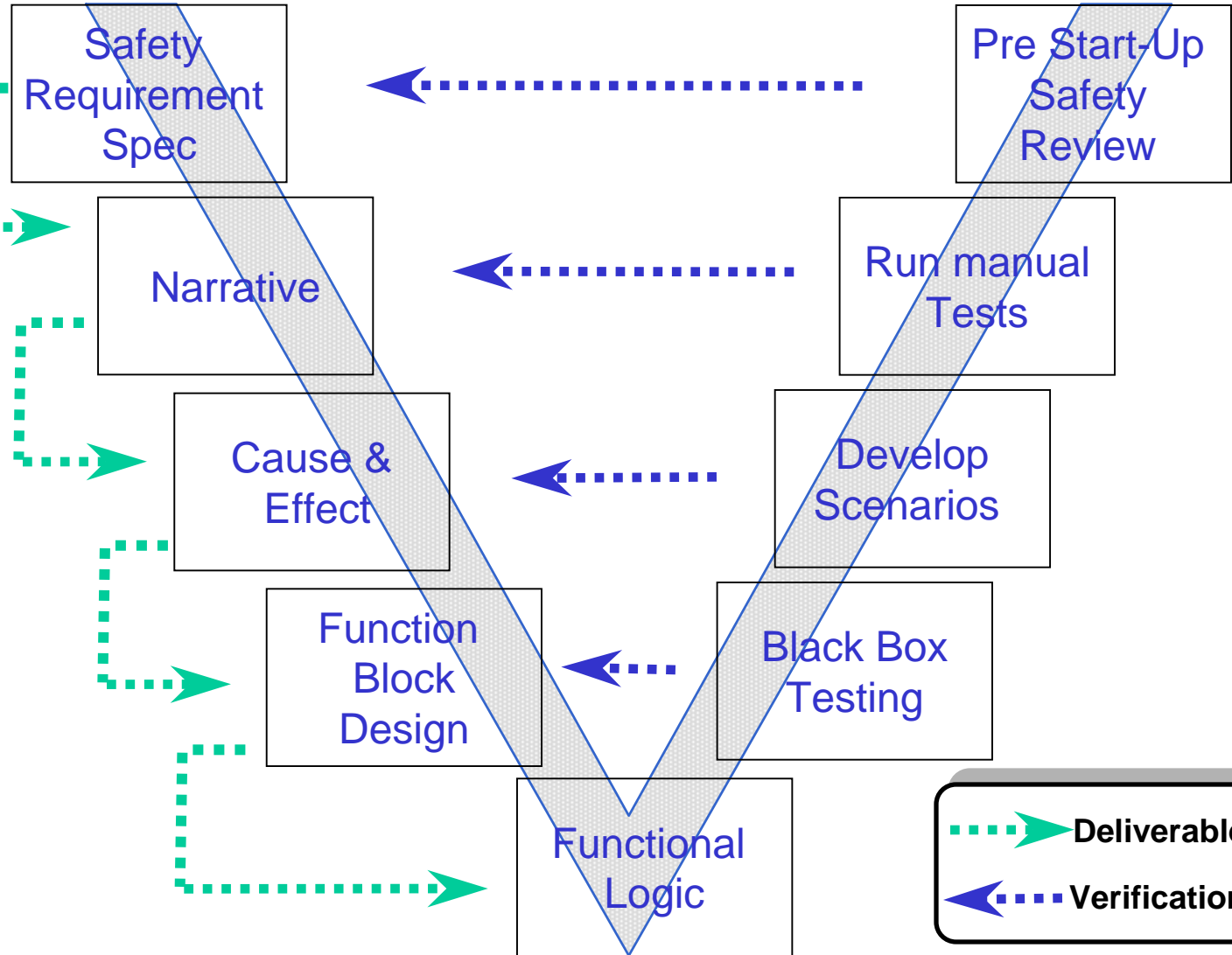


# *Cost of changes over a typical project development cycle*

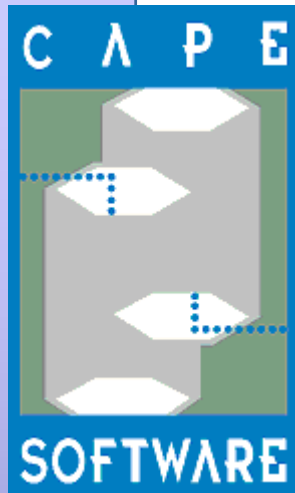




# *V-Approach methodology: application to validation*

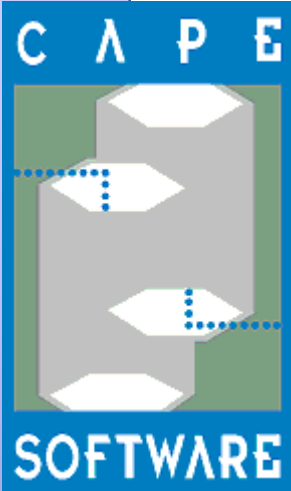


VP Link



## *VP Link **Test Compiler***

- Generates Test Scripts, using an Excel front-end
- Scripts Based on Customer Test Plan and Functional Specifications
- A Script is a stand alone entity that:
  - **Forces** inputs to a specified State
  - **Compares** the outputs to an expected state table (Cause and Effect Matrix)
  - **Logs** errors to HTML format
- Runs and documents entire test plan **unattended**
- **Results Summarizer** utility



# *Automatic Integrated Testing of Distributed Program*

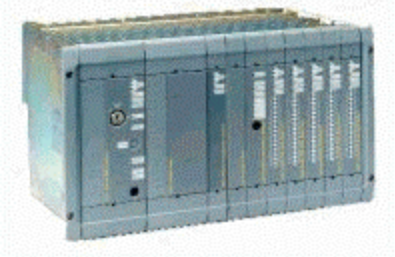
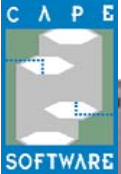
DCS



SIS MMI Isagraf

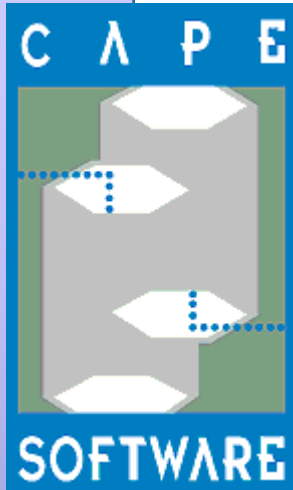


VP Link



ICS Triplex  
Trusted

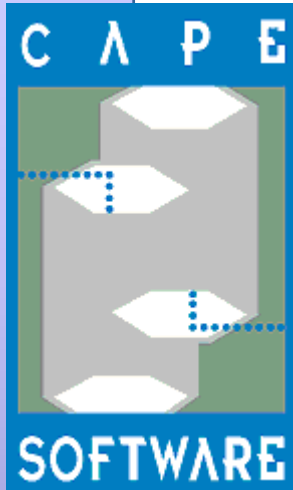
VP Link



# *Test Compiler Master Document*

- Similar to a Cause and Effect Matrix
- Copy and paste from original C&E
- Scenario Template generator

|  |   |                                    |   |    |    |             |           |           |        |
|--|---|------------------------------------|---|----|----|-------------|-----------|-----------|--------|
| SET_PAUSE                                | 0 | tag/label                          | setpoi  | pr | pc | postexecute |           |           |        |
| startscenario                            |   | SCENARIO                           | H1_Purge.sce  |    |    |             |           |           |        |
|  |   | OUTPUTS                            |   |    |    |             | i17XY1904 | i17XY2419 | YL1915 |
|  |   | COMMENT                            | ...   |    |    |             |           |           |        |
| 17H-1 Purge Sequence                     |   | COMMENT                            | ... 17H-1 Purge Sequence  |    |    |             |           |           |        |
| Turn i17HS1914B, i17XSC1904 OFF, to b    |   | COMMENT                            | ... Turn i17HS1914B, i17XSC1904 OFF, to be sure heater is tripped   |    |    |             |           |           |        |
| OFF                                      |   | i17HS1914B, i17XSC1904             |   |    | 3  |             |           |           |        |
| ON                                       |   | i17HS1914B, i17XSC1904             |   |    |    |             |           |           |        |
| SETAUTO                                  |   | i17HS1914B, i17XSC1904             |   |    |    |             |           |           |        |
| Get Heater Ready to Purge                |   | COMMENT                            | ... Get Heater Ready to Purge                                       |    |    |             |           |           |        |
| Turn i17XSC1904, i17XSC2419, i17BXL      |   | COMMENT                            | ... Turn i17XSC1904, i17XSC2419, i17BXL1909 ON, and i17BSLL1909 OFF |    |    |             |           |           |        |
| ON                                       |   | i17XSC1904, i17XSC2419, i17BXL1909 |   |    |    |             |           |           |        |
| OFF                                      |   | i17BSLL1909                        |   | 0  |    |             |           |           |        |
| Verify Limits Are Satisfied              |   | COMMENT                            | ... Verify Limits Are Satisfied                                     |    |    |             |           |           |        |
| ASSERT                                   |   |                                    |   |    |    |             |           |           | 1      |
| Start Purge                              |   | COMMENT                            | ... Start Purge   |    |    |             |           |           |        |
| ON                                       |   | i17HS1916                          |   |    | 3  |             |           |           | 0      |
| Pause Scenario Until Purge is Done, i17Y |   | COMMENT                            | ... Pause Scenario Until Purge is Done, i17YL1918                   |    |    |             |           |           |        |
| LABEL                                    |   | :PURGEDONE                         |   |    |    |             |           |           |        |
| PAUSE                                    |   |                                    |   | 1  |    |             |           |           |        |



# *Test Compiler Logs and Documentation - 1*

## Scenario Log Sample

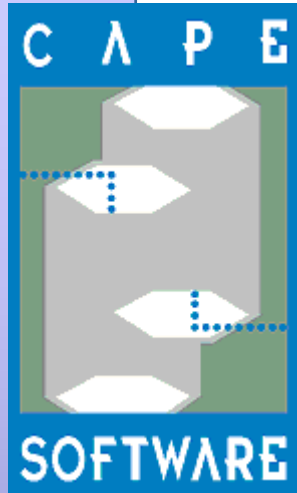
**Time stamps**

**Assertion passed**

**Assertion Failed**

```
0 Starting test 'D:\TB40\BOOKS\FLINT\PLC5\H1_BRNR.SCE'
at Wed May 28 18:23:48 2003
1181 # ...
1181 # ... 17H-1 Start Main Burner Sequence
1181 # ... Satisfy and Reset Fuel Gas Trip
1181 # ... Turn i17HS1964, i17HS1964A ON to Satisfy FG Trip
5397 # ... Turn i17HS1964RST ON to Reset FG Trip
9614 # ... Turn i17HS1923 ON to Start Main Burner
13830 # Test at line 10 of 'H1_BRNR.SCE' ON i17HS1923
13830 Verification <i17XY1904> = 1.000000 passed
13830 **Verification <i17XY2419> = 1.000000 FAILED Value is 0.000000
13830 Verification <i17YL1906> = 0.000000 passed
13830 Verification <i17XY1907> = 0.000000 passed
13830 Verification <i17YL1921> = 0.000000 passed
13830 # ...
13830 Closing test log after 0 mins 13.8 secs at Wed May 28 18:24:02 2003
```

```
0 Starting test 'D:\TB40\BOOKS\FLINT\PLC5\H1_BRNR.SCE'
at Wed May 28 18:26:34 2003
851 # ...
851 # ... 17H-1 Start Main Burner Sequence
851 # ... Satisfy and Reset Fuel Gas Trip
```

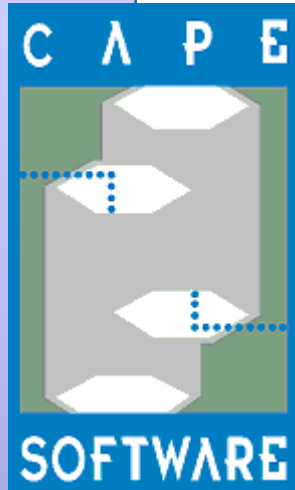


# *Test Compiler Logs and Documentation - 2*

## **HTML Test documentation sample**

[Open the Documentation](#)

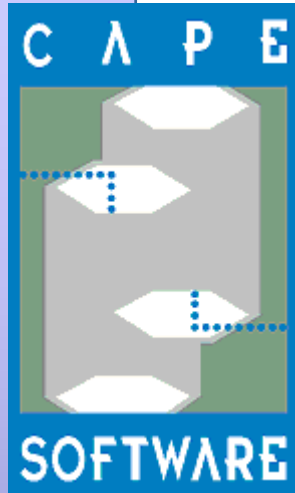
- Exhaustive
- Automated documentation
- Practical:
  - Hyperlinks between nested scenarios
  - Hyperlinks to scenario tags table
- Standardized documentation format through programmatic generation



# *Test Compiler*

## *Upcoming developments*

- Unique, trackable checksum over the various file formats
- Project integrity (source, scenarios, logs and documentations) authentication tool ensuring a valid set of self sufficient data



## *Conclusion*

- **Cross platform** functionalities makes it an **evolutive investment**
- Excel Front end makes it **easy to** write exhaustive scenarios based on specific test requirements
- High Quality tests with extensive documentation of what has passed and what failed
- **Reproducible** tests with black box approach
- Automated Validation scheme complies with **IEC 61508 / 61511 guidelines**
- Simulation Investment recoupment **over the course of the plant lifecycle**