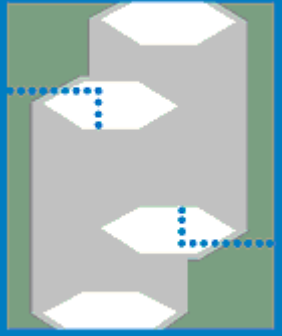


C A P E



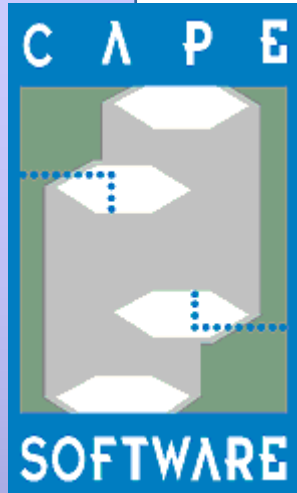
SOFTWARE

A collage of images in the background, including green pipes, industrial structures, a person at a control panel, and a 3D model of a refinery.

The Virtual Process Overview and Applications

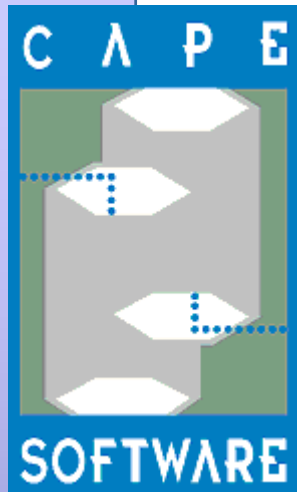
Cape Software Inc.

Houston TX



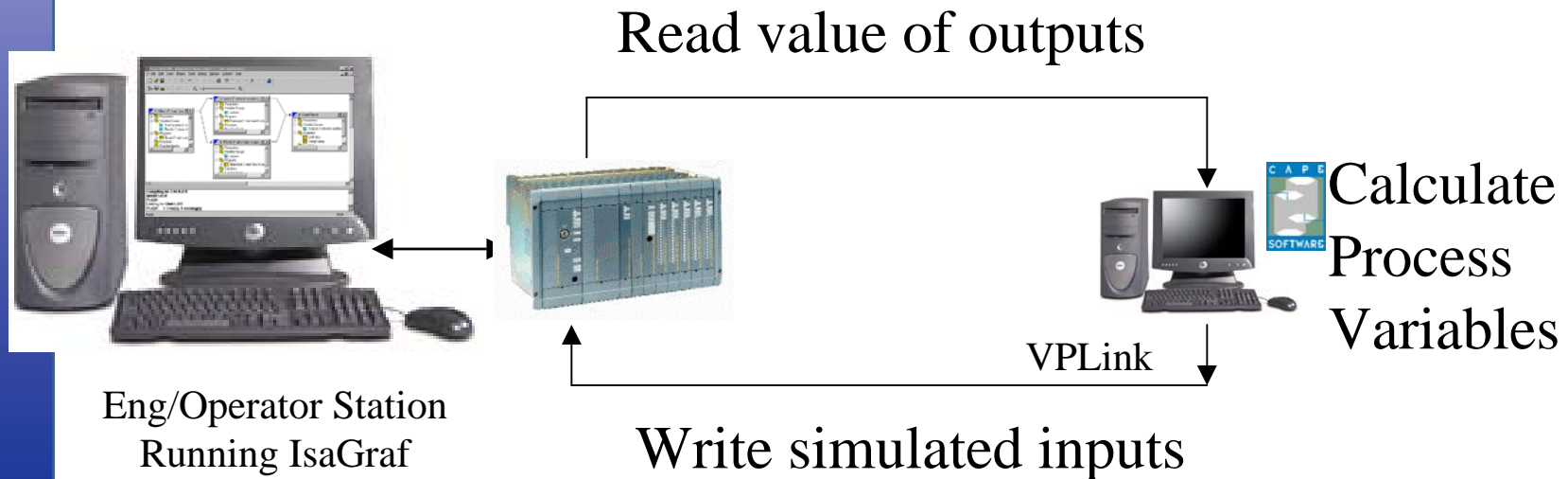
What is VP Link ?

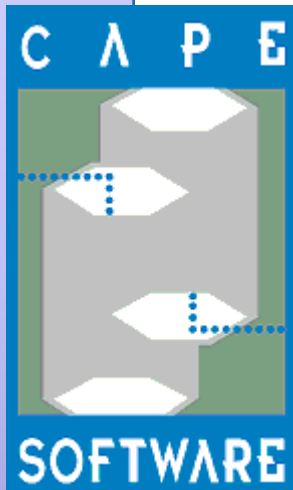
- A dynamic **representation** of the process **inputs** to an **offline** control system



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

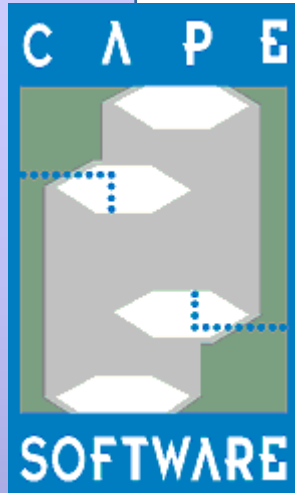
Shell Deepwater / Shell Chemicals, UK

Eli Lilly – Corporate licensing

Genentech – several licenses at different sites

General Mills – W/W licensing

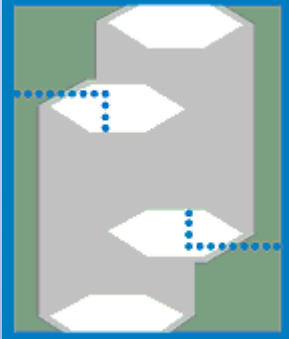
Murphy Oil - Mereaux, LA



Some Supported Systems

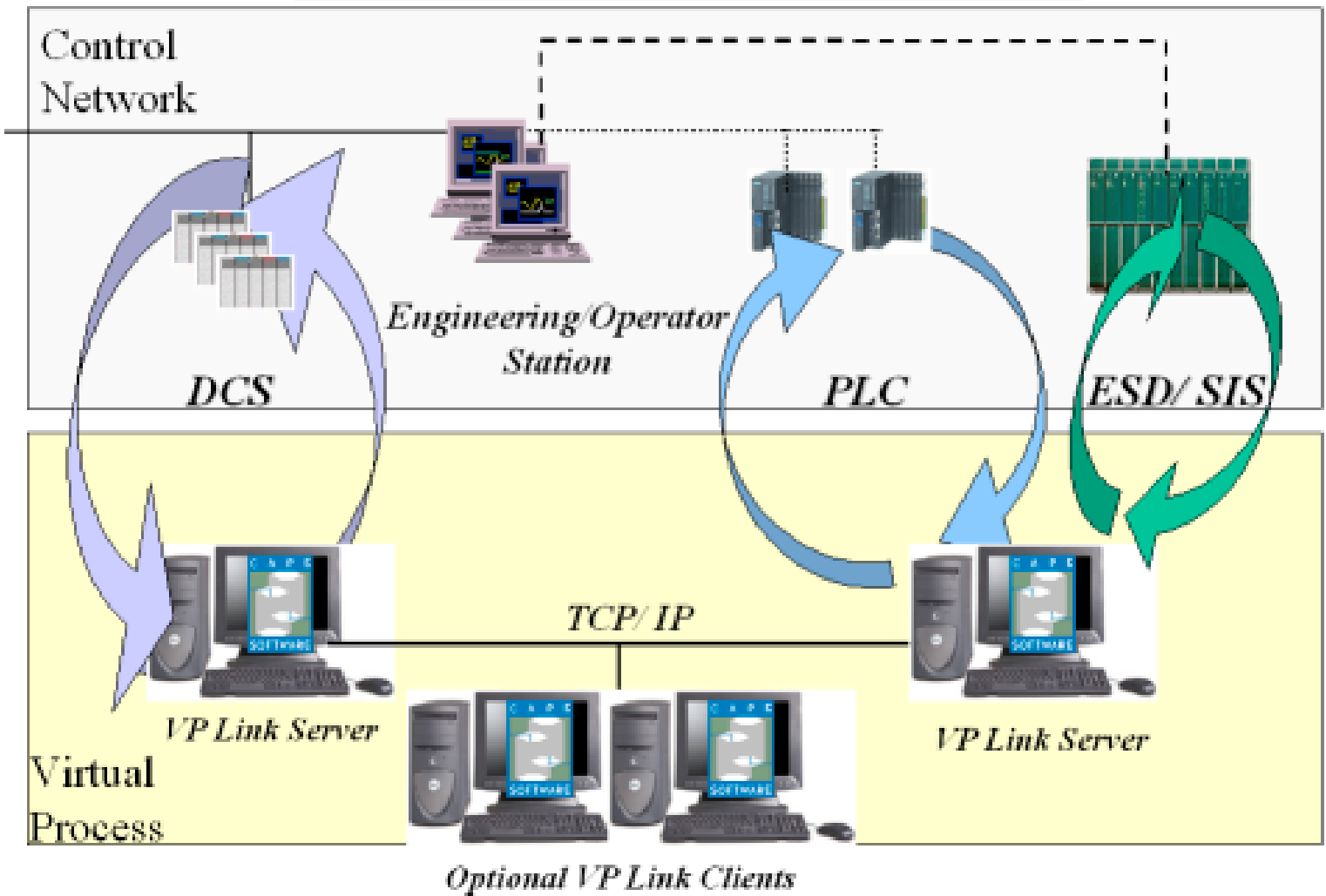
- **ICS Triplex Trusted System**
- **Triconex:Tricon/Trident**
- **Honeywell FSC**
- Foxboro I/A,Archestra
- Honeywell Plantscape / Rockwell ProcessLogix
- Honeywell TPS,PKS
- A-B PLC5/SLC500,CLX, Modicon,Siemens-Ti 505
- Emerson DeltaV,PROVOX
- Siemens APACS, PCS7, S7
- ABB Mod300, Advant
- Yokogawa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

C A P E

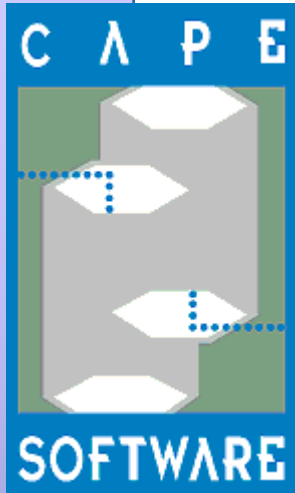


SOFTWARE

VP LINK 3.0 Sample Network

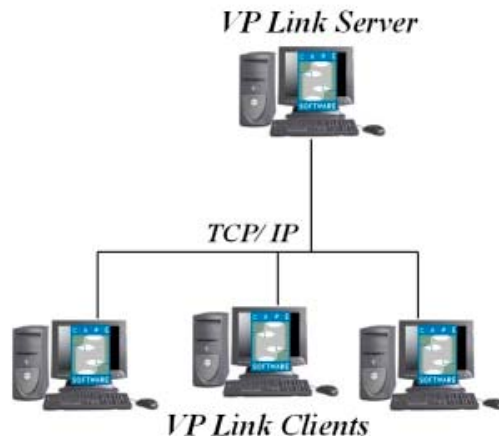


Control Network Systems are solving the logic, responding to simulated VP Link inputs



Different Architectures for different Applications

Training /Testing Setup

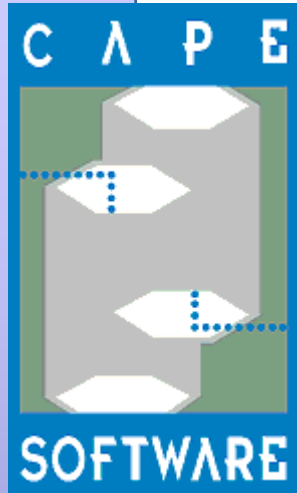


Engineers manipulate units PVs, sharing a chassis and simulation server

Parallel Training Setup

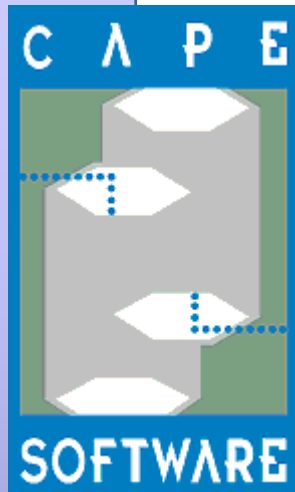


Engineers test identical units, in parallel simulation servers



5 steps to Logic Validation with VP Link 3.x

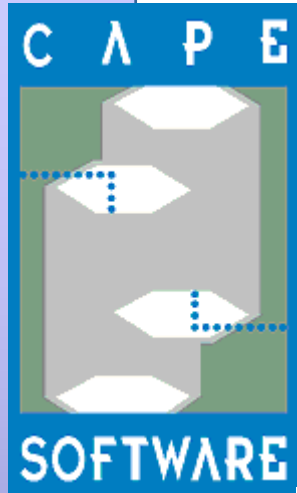
- Extract the control systems I/O image, using platform specific tools
- Import the image in VP Link
- Write training/failure scenarios
- Connect to ESD
- Execute validation test (scenario based or manually)



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)

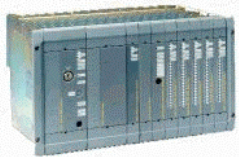


Optional
DCS Interface

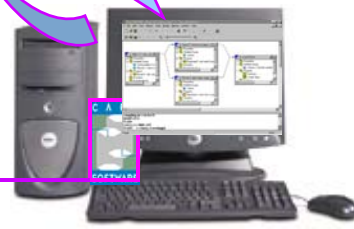


- **DCS** Connectivity
- **Specific VP** driver

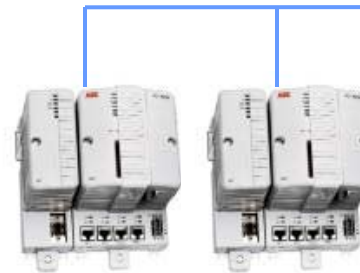
TCP
Connectivity



Triplex
Chassis



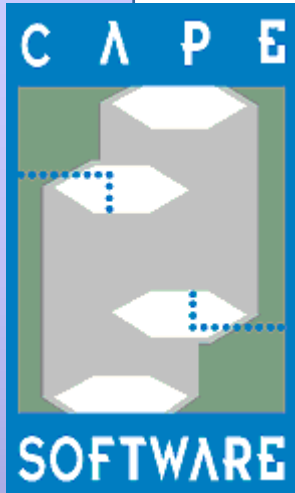
- Isagraf or Control Application platform
- **VP Link** driver for Triplex system



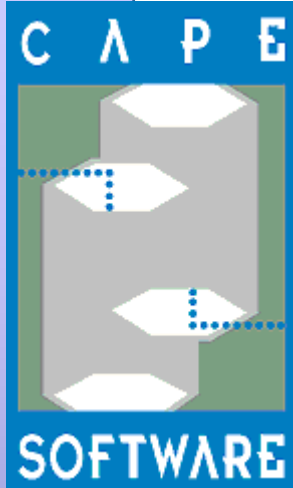
Controllers



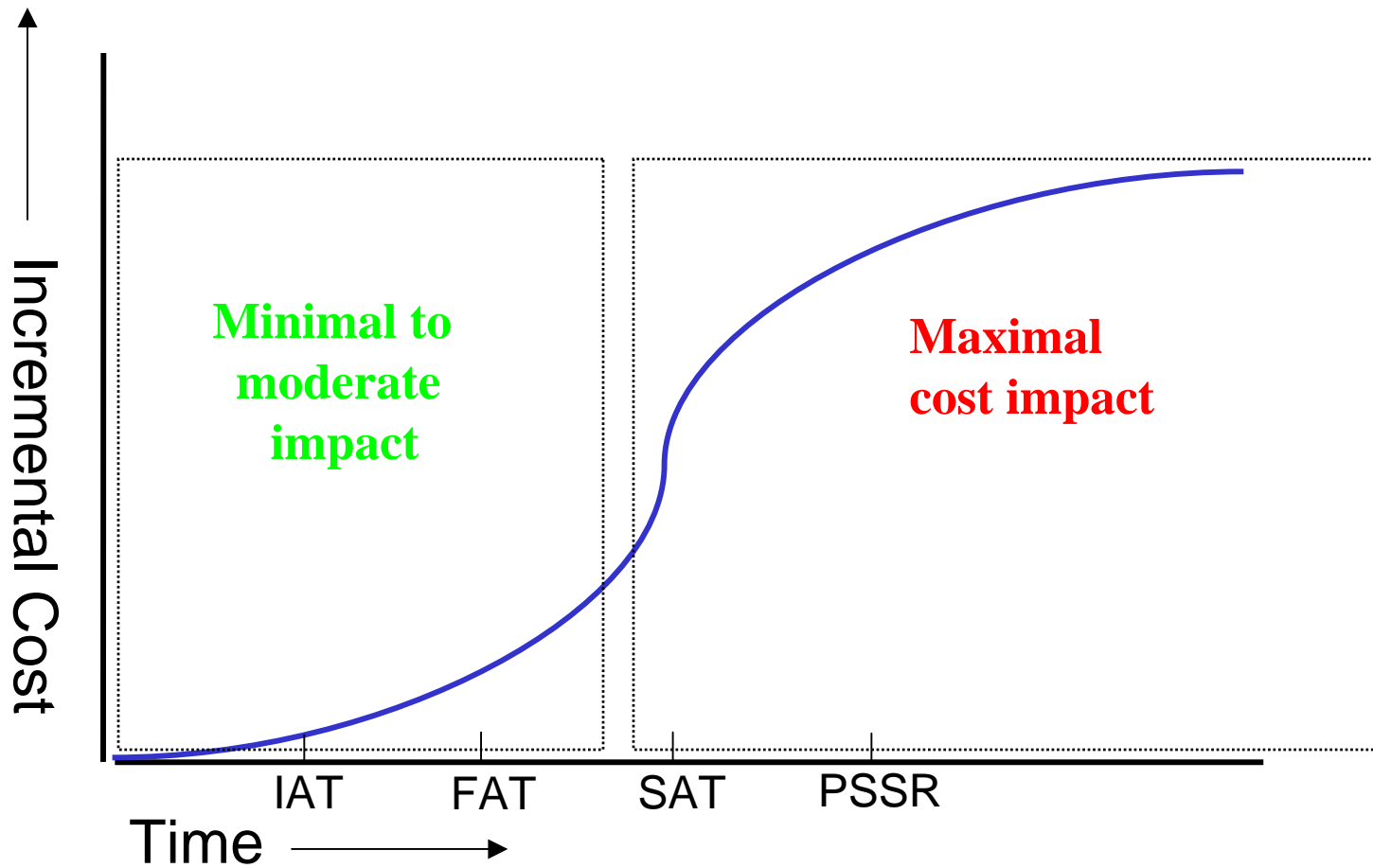
Operator Station
MMI

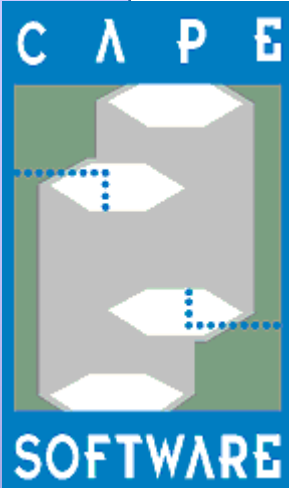


SIS Validation :
*Cape Software's **T**est **C**ompiler*

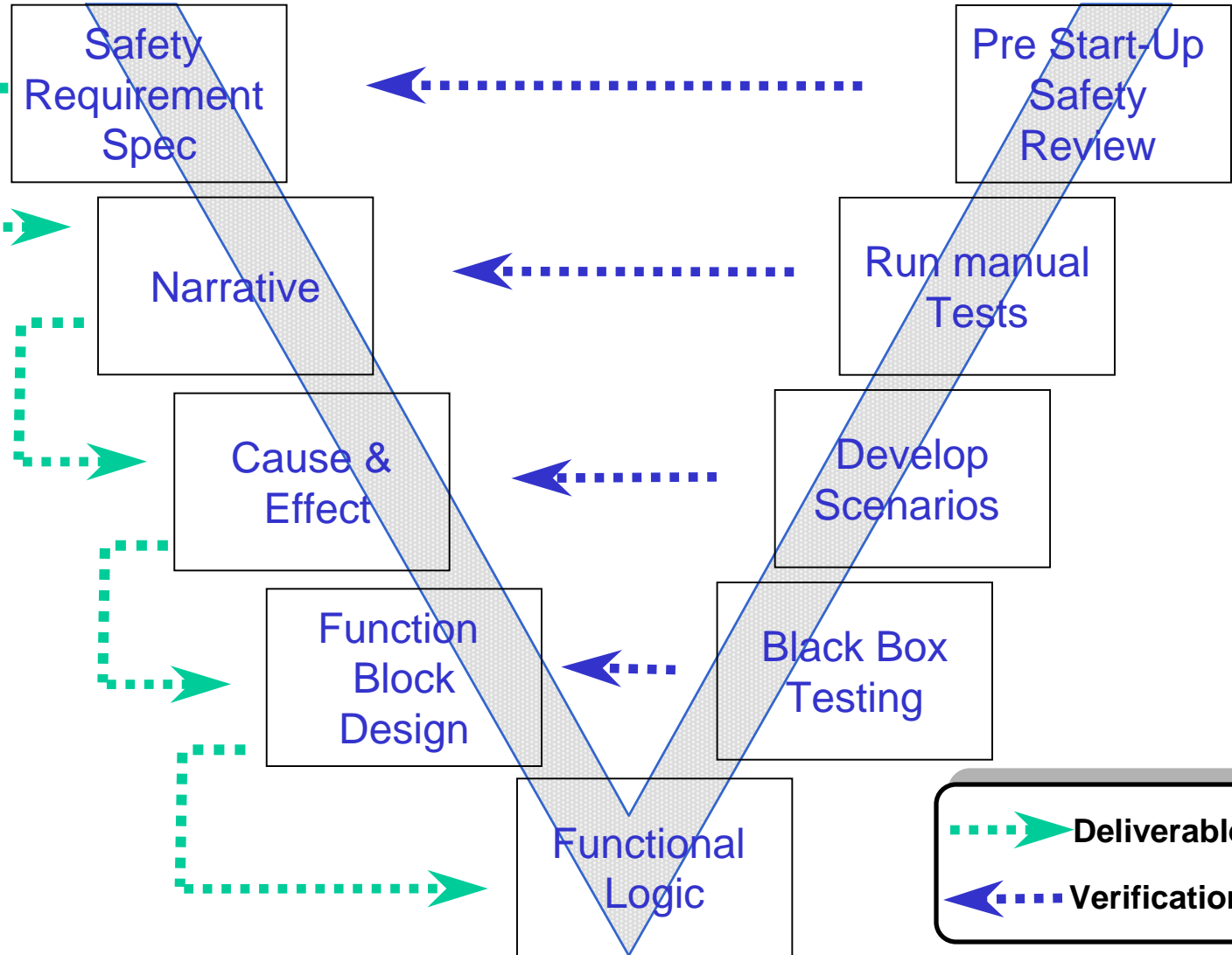


Cost of changes over a typical project development cycle

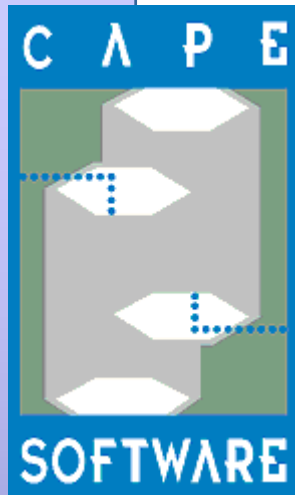




V-Approach methodology: application to validation



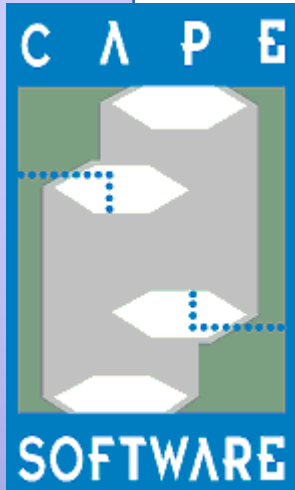
VP Link



*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



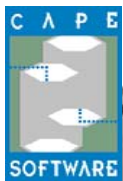
DCS



SIS MMI Isagraf

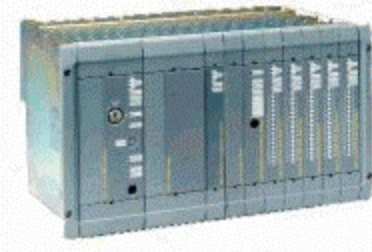


VP Link



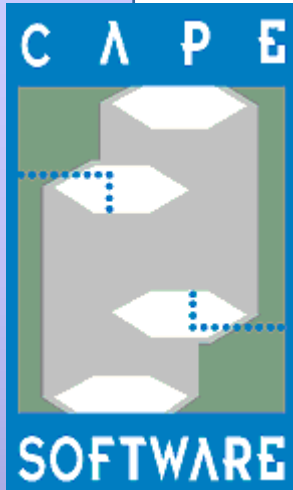
Force

Validate



ICS Triplex
Trusted

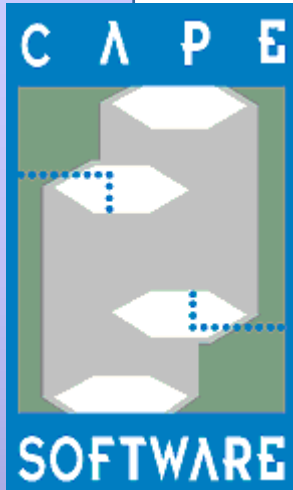
VP Link



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

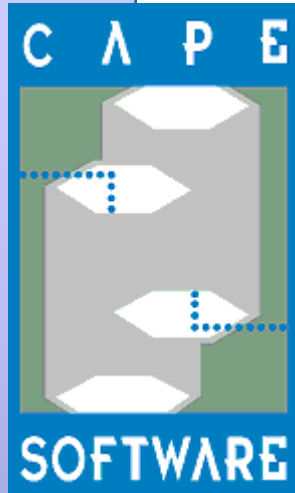
Time stamps

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
```

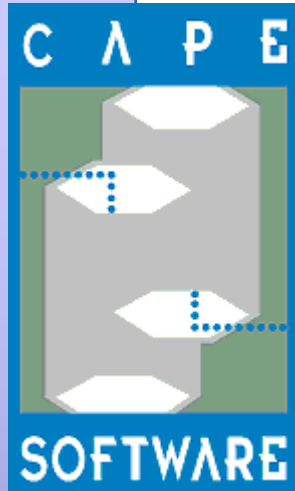


Test Compiler Logs and Documentation - 2

HTML Test documentation sample

[Open the Documentation](#)

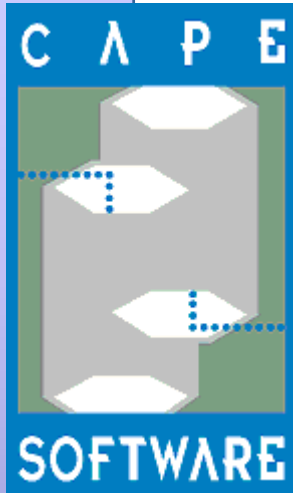
- Exhaustive
- Automated documentation
- Practical:
 - Hyperlinks between nested scenarios
 - Hyperlinks to scenario tags table
- Standardized documentation format through programmatic generation



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**