



# Challenges in Software Development for Test Stations

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# DEMOCRATIC(?) SOFTWARE DEVELOPMENT

**Disclaimer: there are always exceptions**



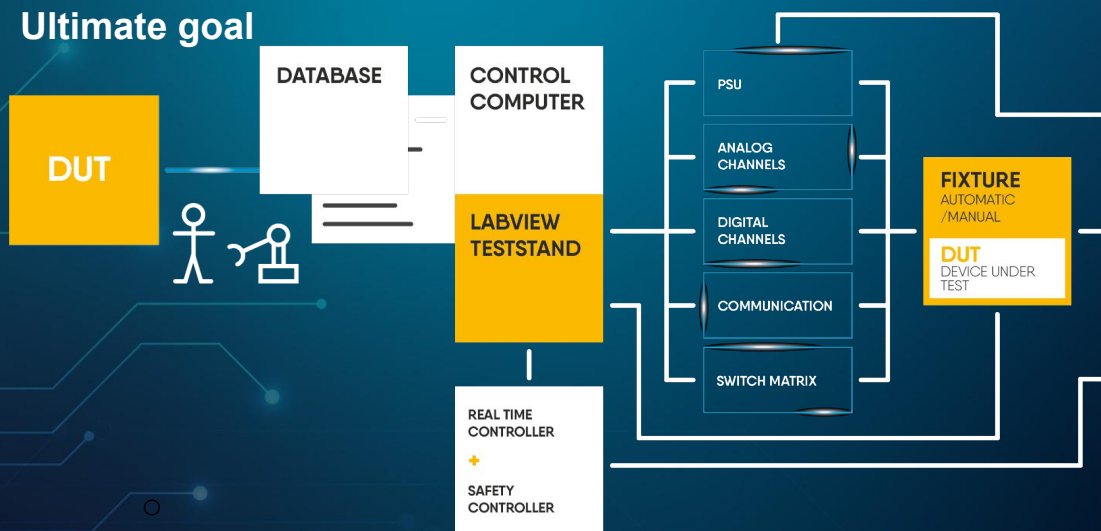
**How to evaluate?**



# SCOPE

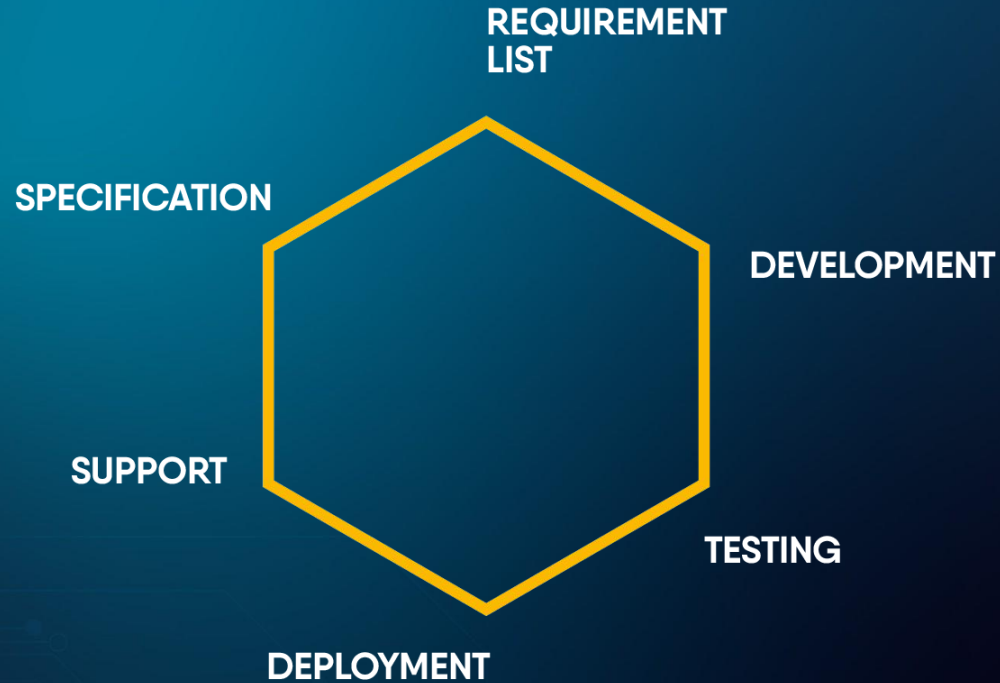
## Software development for test stations

### Ultimate goal

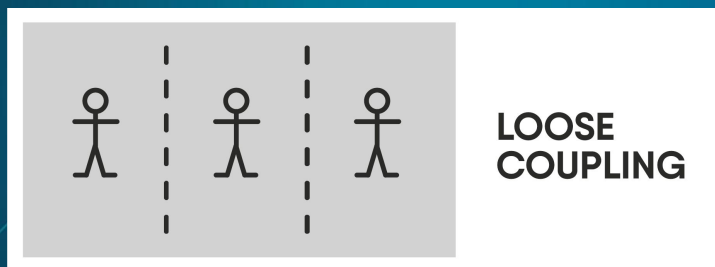


# ACTIVITY

## Test Driven Development

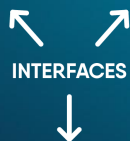


# TEAM AND DEVELOPMENT ORGANIZATION



UI  
Sequence  
Instrument drivers  
PLC

V model    one release



Custom  
Instrument/Peripheral  
Sensor

Agile    multiple release



# PRACTICES

Practice/tool	<b>Loose Coupling Team</b> Sequence, Instrument Drivers, PLC	<b>Tight Coupling Organization</b> Instrument, Sensor
<b>Requirement List</b>	Detailed	Mainly concentrate on usage
<b>Code review</b>	Yes	Yes
<b>Unit test</b>	Rarely	Yes
<b>Test</b>	Manual	Automatic
<b>CI/CD</b>	No	Yes
<b>Documentation</b>	Manual (how to use)	Generated



XILINX



eclipse



- **Embedded Systems**
  - uC (STM, Atmel, ESP32, ....)
  - CPLD / FPGA
  - Linux
- **UI**
  - Labview
  - Qt
  - .NET

SW release frequency

Weeks / 1-2 Months



6-12 Months



# BENCH VARIATIONS



Production Volume

FEW



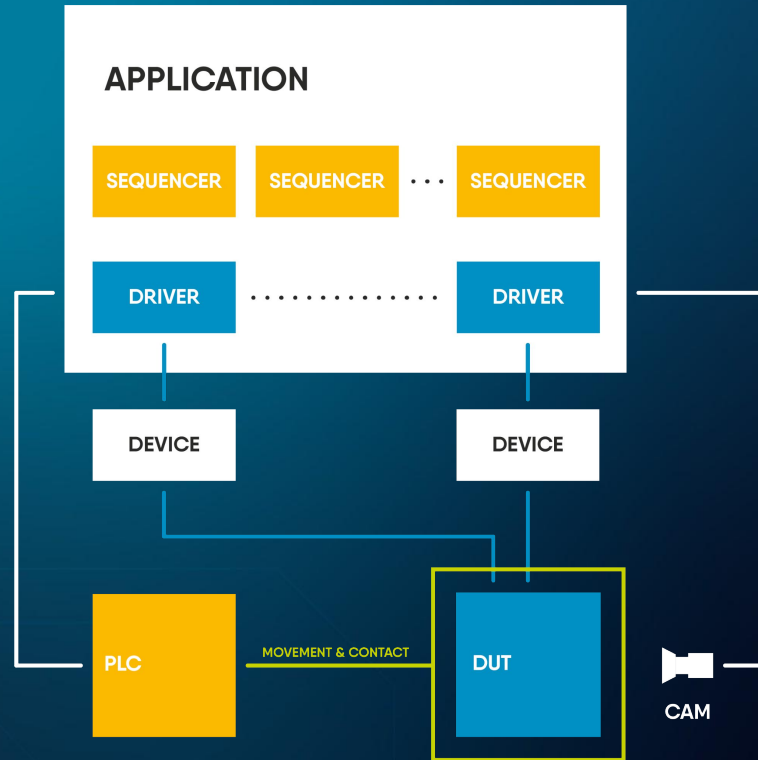
SEVERAL



- **PC + Gateway**  
manual feed,  
manual contact
- **PC + PLC**  
manual feed,  
automatic movement
- **PLC + PC**  
full automatic operation

# TEST BENCH - SOFTWARE TYPES

- **UI**
  - Labview
- **Sequence**
  - TestStand
  - Python
- **Instruments drivers**
  - Labview
  - Egyedi dll
- **Movement**
  - PLC
- **Safety**
  - Safety PLC
- **Vision**
  - NI
  - Cognex
  - Keyence



# TEST BENCH - FRAMEWORK

Software development and testing = high cost

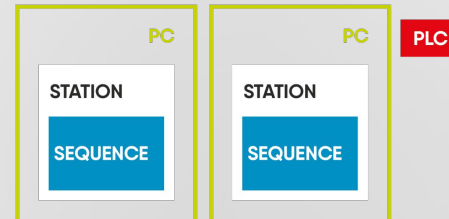
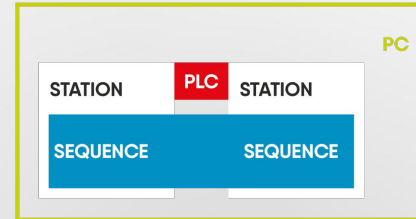
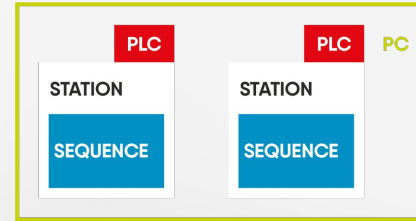


- Decomposition (SOLID)
- Full sequence integration
- Deployment support

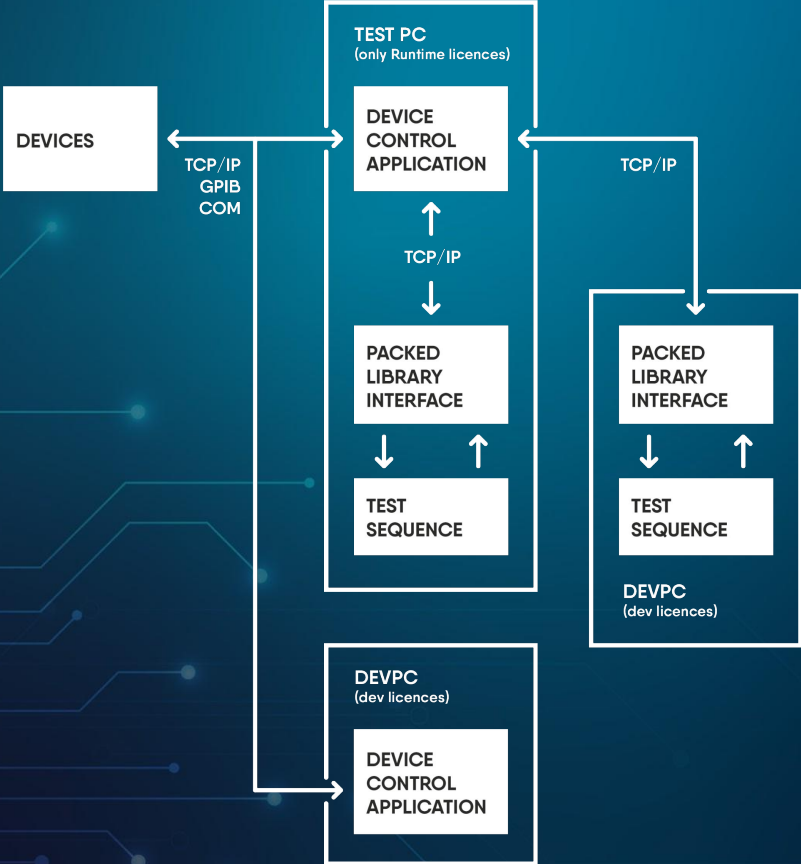
## Do not reinvent the wheel!

- User management
- Parameter store and reload
- Error handling and log
- Remote control
- Diagnostic

Same Framework  
for all the configurations



# REMOTE SEQUENCE DEVELOPMENT



# TESTING OF A TEST BENCH



- During production (without DUT)
  - Short circuit tests, etc.
  - Checking functionality, accuracy, etc.
- Self test
  - May be part of maintenance
  - Even during production
- Golden sample (also part of the maintenance)
  
- Testing  $\neq$  Calibration

## When?

- More than 3 almost identical benches
- Several signals
- Typically the bench controls it, part of the operator interface

# REQUIREMENT LIST

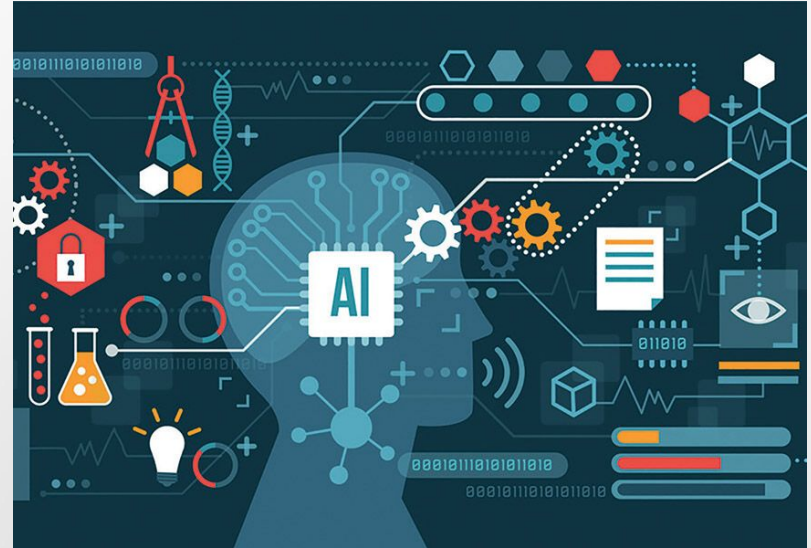


- Specification => Requirement List
  - Fixed format spreadsheet
- Machine Dashboard
  - Mechanical engineering
  - Electrical engineering
  - Software
    - PLC
    - LV
    - TS
  - Test point list, test steps
  - Movement phases

Instruments				link		assembly type		assembly place		height		interface		BOM responsible		not	
nr	designator	Function	type	link	supplier	assembly type	assembly place	height	interface	BOM responsible	not						
1		DMM	Keysight 34470A		RS online	half 19" rack		2U 88.3mm	GPIB	ELEC							
2		Keysight Technologies Rack Mount Kit	Keysight 34191A							MECH							
3	P_25V	DC Supply N1	Keysight N6734B DC Power Module, 35 V, 1.5 A, 50 W							ELEC							
4	P_16V	DC Supply N2	Keysight N6734B DC Power Module, 35 V, 1.5 A, 50 W							ELEC							
5	S_25V	DC Supply N3	Keysight N6734B DC Power Module, 35 V, 1.5 A, 50 W							ELEC							
6		DC Supply Mainframe	Keysight N6760C Series Modular System Power Supplier	link		19" rack + alátmasztani		1U	GPIB	ELEC							
7		DC Source	EA-PSI 91000-30 10kW			19" rack + alátmasztani		3U	GPIB	ELEC							
8		DC Source GPIB interface card	EA-IF-G1							ELEC							
9		MXI Chassis	NI PXle-1073 (781163-01), (3 Hybrid Slots, 2 PXI Express Slots)	NI				4U		ELEC	Par						
10		Rack mount kit	Rack Mount Kit For 3-6 Slot PXI/PXIe Chassis	NI						MECH							
11		MXI Chassis cable	MXI-Express Cable, Gen 1 x1, Copper, 3m	NI						ELEC	Par						
12		MXI PC card	NI PCIe-8361	link	NI					PCle	ELEC						
13		CAN Card	NI PXI 8512	NI						PXI	ELEC						
14		DIO Card	NI PXI 8513	NI						PXI	ELEC						
15		DIO Card Breakout	SCS-100A Noise Rejecting, Shielded I/O Connector Block	NI							Par						
16		DIO Card IO cable	Cable Assy, Type SH100-100-Flex, 1 m	NI						ELEC	Par						
17		PC GPIB Card	NI PCIe-GBIB	NI						ELEC	Par						
18	DSP1	JTAG1	INFINEON, TC364							ELEC							
19	DSP2	JTAG2	MICROCHIP DSPIC33CK260MP508							ELEC							
20		Signal Multiplexer	RLCD SMP ControlCard		ProDSP					ELEC							
21		GPIB cable, 0.5 m	X2 GPIB Cable, Double-Shielded, Shielded Plug/Receptacles 0.5 m	NI						ELEC	Par						
22		GPIB cable, 0.1 m	X2 GPIB Cable, Double-Shielded, Shielded Plug/Receptacles, 1 m	NI						ELEC	Par						
23		GPIB cable, 0.5 m	X2 GPIB Cable, Double-Shielded, Shielded Plug/Receptacles 0.5 m	NI						ELEC	Par						
24		UPS	APC Smart-UPS X, Line Interactive, 1500VA, Racktower convertible 2U, 230V, 8x C13 IEC, SmartSlot, Extended runtime	link	APC	are extra rails required?		2U		ELEC							
25		IPC		link				2U		ELEC							

# ARTIFICIAL INTELLIGENCE

- Takes away our job?
- AI = Statistic
- Vision
- Production Statistic => ERP System
- Specification & Requirement is not a black box!



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TECHNOLOGIES



**Thank you for the attention!**

