Techniques for Efficient Measurement Automation

Goals of Today

1. Learn about the benefits of standardizing on a scalable hardware platform.

2. Know the options for automating measurement hardware.

3. Understand the importance of improving your proficiency with whatever tool you choose.

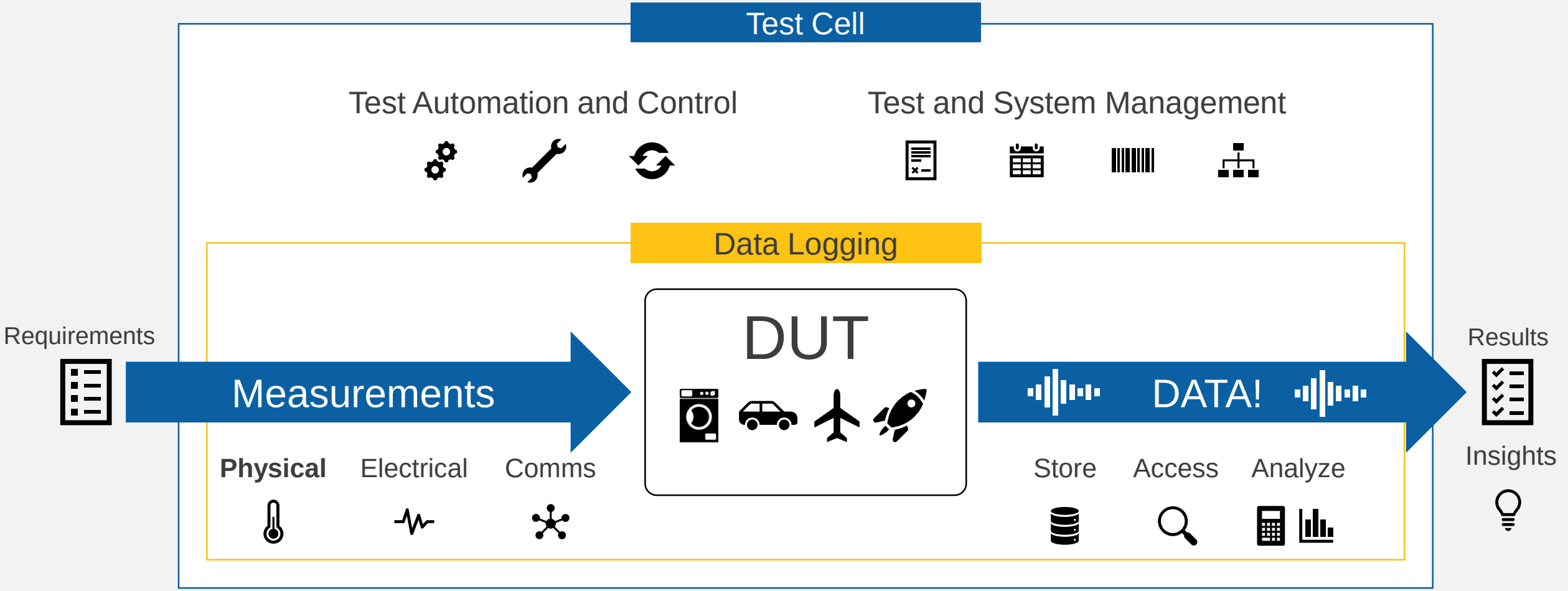
4. Get hands-on with different software

Agenda

- Why automate?
- Challenges with test and measurement automation
- Why is standardisation important?
- NI DAQ platform
- Different ways to work with NI hardware
  - LabVIEW
  - Python
  - C, .NET
  - FlexLogger

Test Labs Are Becoming More Automated

What Do We Mean By Automated Measurements?



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Benefit of Automation For Product Design Teams

- Tests run independently
- Reuse tests
- Can speed up setup with configuration files

Improve Repeatability

Spend More Time Improving
Device Under Test

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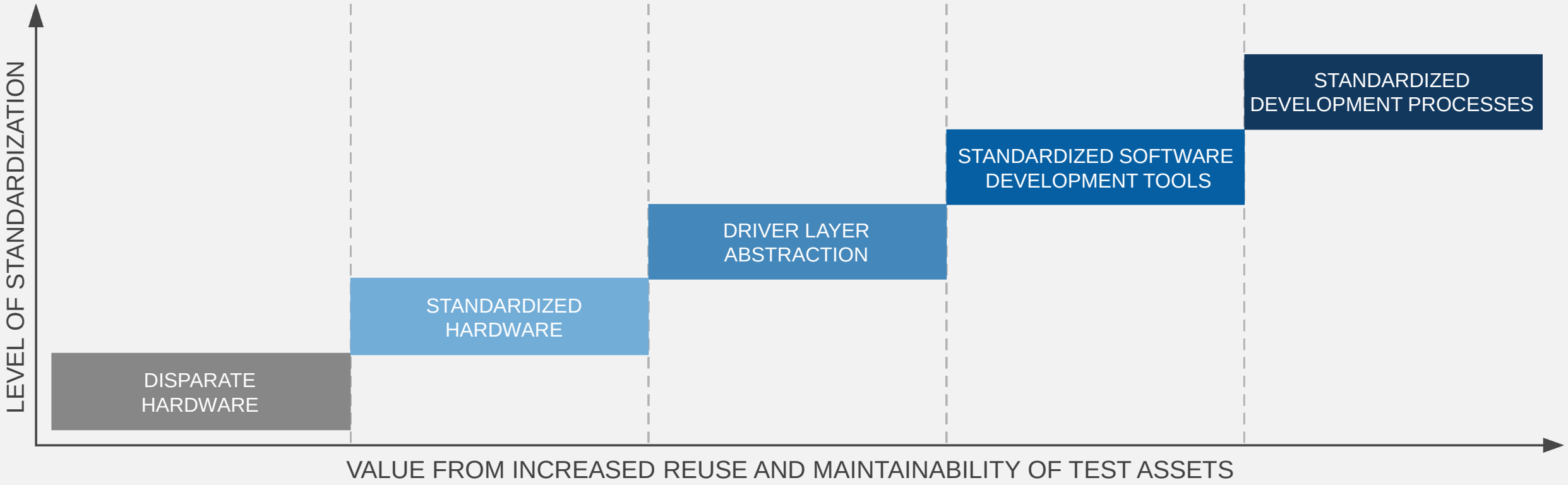
Challenges With Automated Measurement Systems

- Hard to combine mixed-signals from disparate hardware
- Fixturing
- Different data and config file formats
- Duplication of automation code
- Passing work between colleagues
- Programming skills of engineers

Increased Value of Standardization



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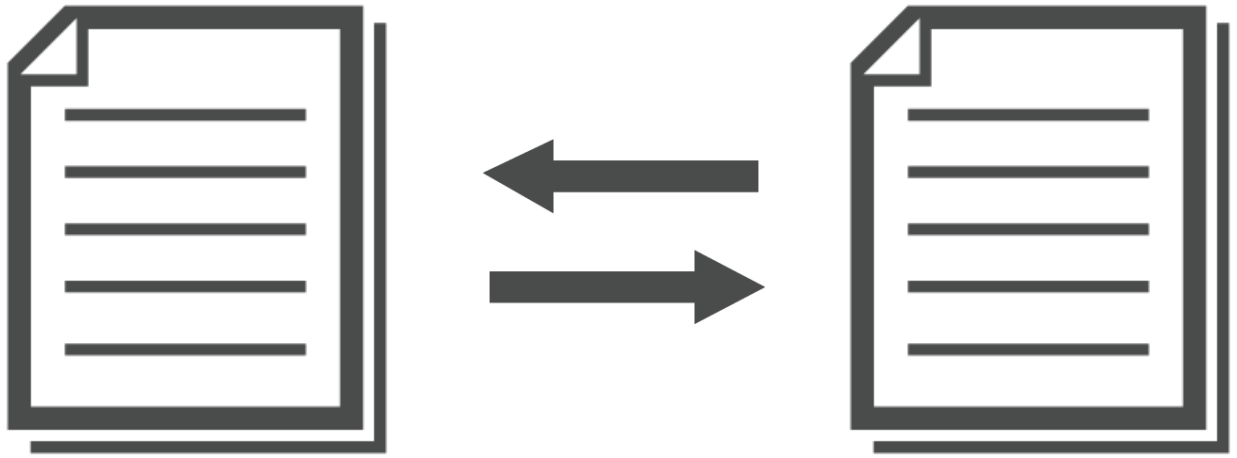
Benefits of Hardware Standardization

Improve communication between teams with a common language

Benefits of Hardware Standardization

Increase code reuse with shared software libraries



Benefits of Hardware Standardization

Save time and increase repeatability with a standardized device fixture

Improve Repeatability

Common Test Points
For Debugging

Spend More Time Improving
Device Under Test

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Benefits of Hardware Standardization

Reduced Number of
Data File Types

Reduced Training Time

Lower Support &
Maintenance Costs

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Challenges With Automated Measurement Systems

- Hard to combine mixed-signals from disparate hardware
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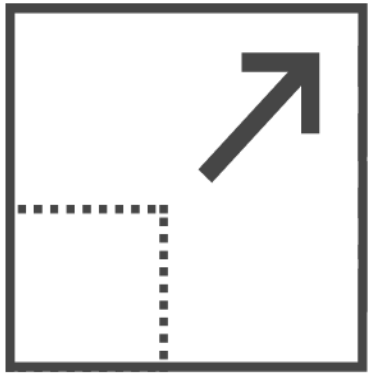
Standardising on a Modular System

What is a Modular System?

Flexible

User-Defined Software



Scalable

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One Platform to Scale Throughout Product Development

Design			Prototyping				Deployment	
Fundamental Research	Formulation of Technology Concept	Feasibility of Concept & Technologies	Prototype Lab Validation	Prototype Field Test	Pre-Production Product	Pilot Production	Fully Tested, Validated and Qualified	Production & Final Deployment

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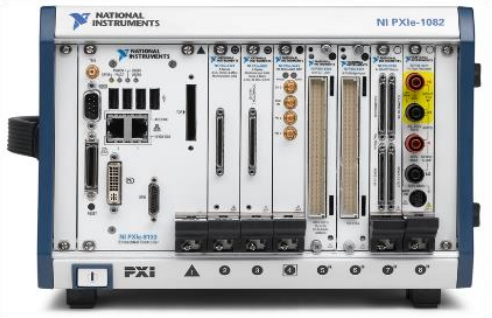
NI Modular Test & Measurement Platform



NATIONAL INSTRUMENTS

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Design			Prototyping				Deployment	

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How to Choose the Right Hardware

- Step-by-step guides
- Online configuration advisors
- Speak to Alex Floor

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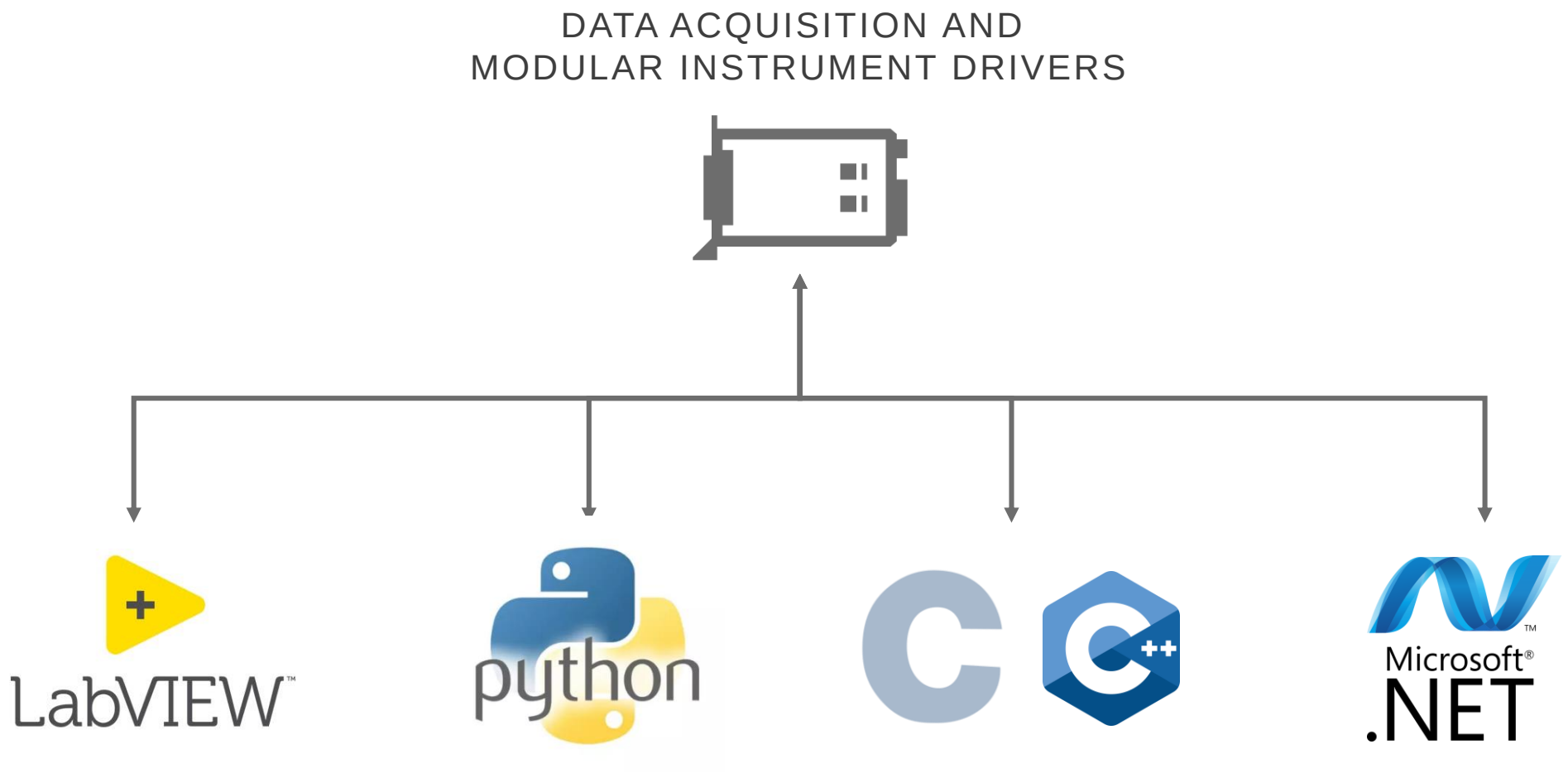
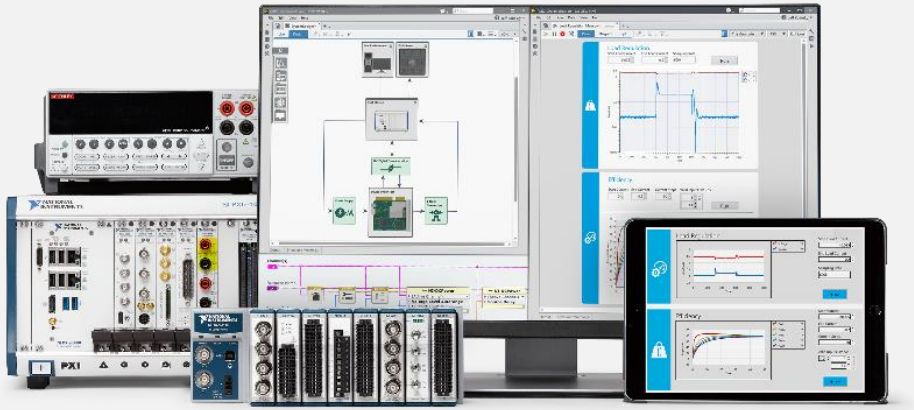
Different Options for Automating NI Hardware

What Should I Use?



LabVIEW™



LabVIEW NXG

LabVIEW 2018

Two Versions. One Price.

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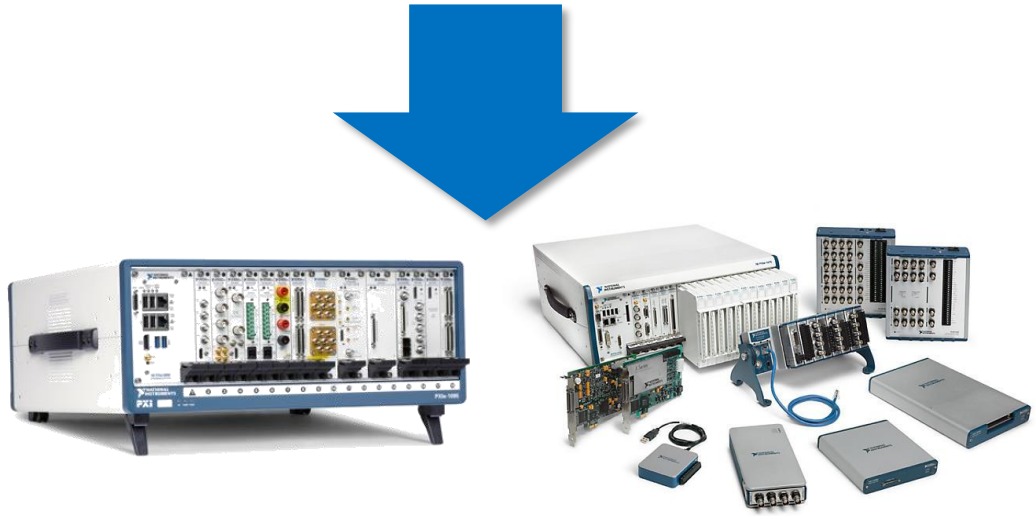
Python APIs for NI Hardware

- Automate and control NI hardware using the Python
- Interface with the Python drivers through a concise, object-oriented Python API
- Easy access to properties, device-specific parameters, exception handling, and more
- Get dynamic, real-time device feedback through interactive scripting

```
import nidaqmx


task = nidaqmx.Task()
task.ai_channels.create_voltage_channel('cDAQ1Mod1/ai0')
print task.read(number_of_samples_per_channel=10)
task.clear()
```



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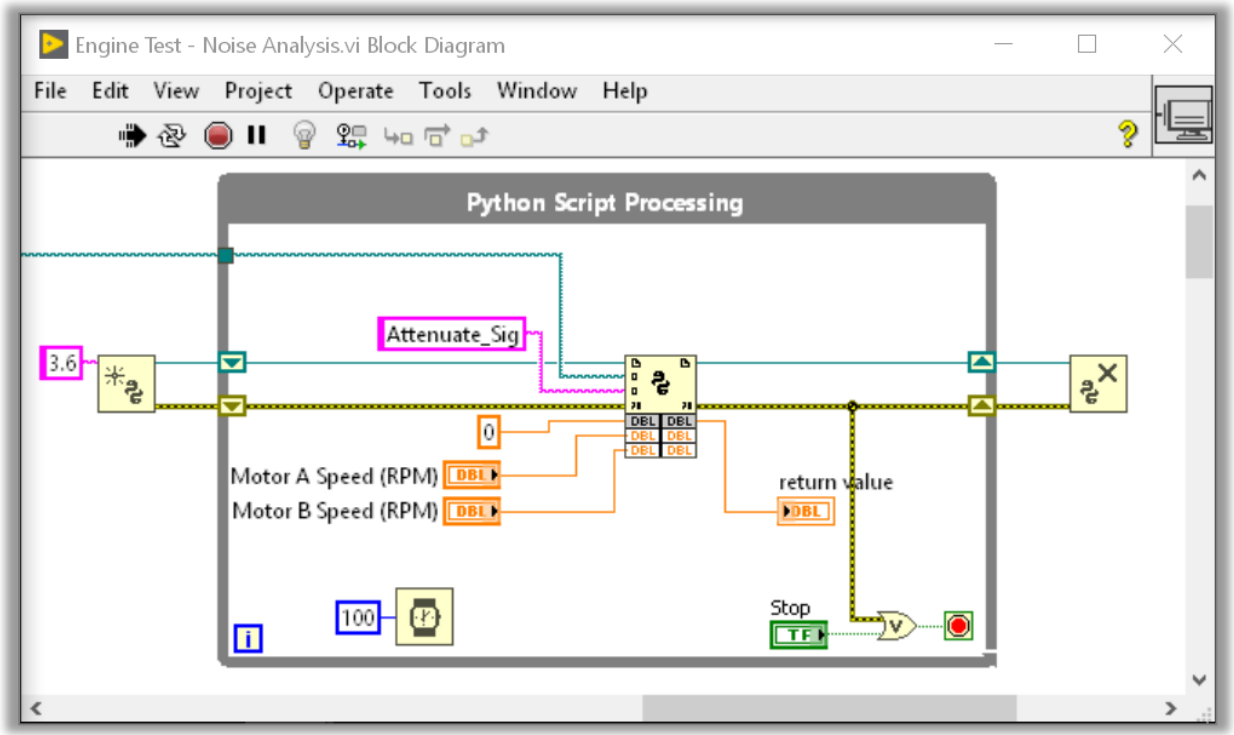
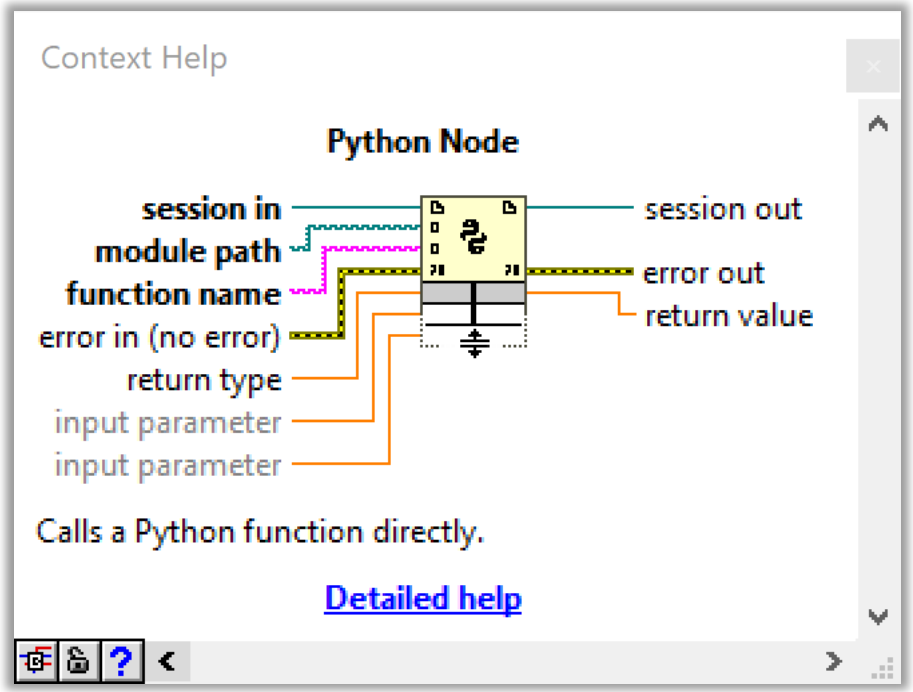
Python APIs for NI Hardware

- NI Maintained APIs (Open Source)
  - NI-VISA (General Instrument Control)
  - NI-DAQmx (Data Acquisition - Analog In/Out and Digital)
  - NI-RIO (User-programmable FPGA Devices)
  - NI-XNET (Automotive Busses)
  - NI-SCOPE (Oscilloscopes and Digitizers)
  - NI-FGEN (Waveform Generators)
  - NI-DMM (Digital Multimeters)
  - NI-SWITCH (Switches)
  - NI-DCPower (Programmable Power Supplies and Source Measure Units)
- Community Developed APIs (Open Source)
  - NI-VISION (Frame Grabbers and Camera Interfaces)
  - NI-VirtualBench (All in one instrument)

Python Node

Natively call Python functions and pass parameters within the LabVIEW environment





Available in LabVIEW 2018
Coming for LabVIEW NXG soon

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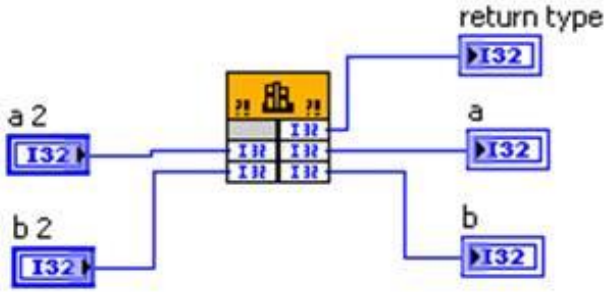
Working with C/C++

- Vast majority of drivers have a C version
- LabWindows/CVI - dedicated test and measurement environment
- Natively call DLLs from LabVIEW

```
#include <stdio.h>
#include <NIDAQmx.h>
#define DAQmxErrChk(functionCall) if( DAQmxFailed(error=(functionCall)) ) goto Error; else
int main(void)
{
	int32		error=0;
	TaskHandle	taskHandle=0;
	int32		read;
	float64		data[1000];
	char		errBuff[2048]={'\0'};
// DAQmx analog voltage channel and timing parameters
  DAQmxErrChk (DAQmxCreateTask("", &taskHandle));
  DAQmxErrChk(DAQmxCreateAIVoltageChan(taskHandle, "Dev1/ai0", "", DAQmx_Val_Cfg_Default, -10.0,
10.0, DAQmx_Val_Volts, NULL));
DAQmxErrChk(DAQmxCfgSampClkTiming(taskHandle, "", 10000.0, DAQmx_Val_Rising,
DAQmx_Val_FiniteSamps, 1000));
// DAQmx Start Code
 DAQmxErrChk(DAQmxStartTask(taskHandle));
// DAQmx Read Code
 DAQmxErrChk(DAQmxReadAnalogF64(taskHandle, 1000, 10.0, DAQmx_Val_GroupByChannel, data, 1000,
&read, NULL));
// Stop and clear task
Error:
	if( DAQmxFailed(error) )
		DAQmxGetExtendedErrorInfo(errBuff,2048);
	if( taskHandle!=0 )  {
		DAQmxStopTask(taskHandle);
		DAQmxClearTask(taskHandle);
	}
	if( DAQmxFailed(error) )
		printf("DAQmx Error: %s\n",errBuff);
		return 0;
}
```



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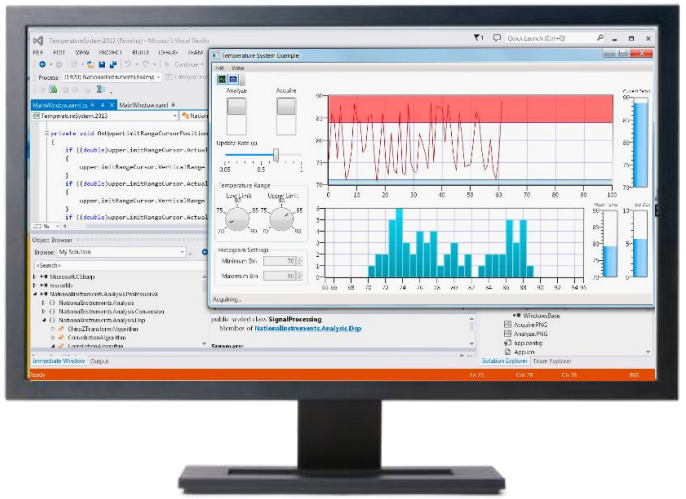
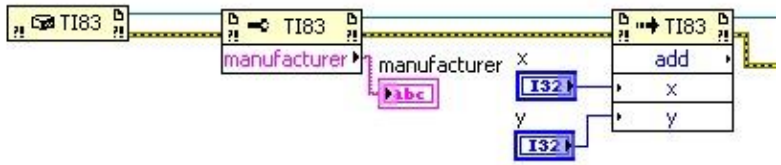
Working with .NET

- Majority of drivers have a .NET Framework library for VB and C#
- Measurement Studio - dedicated test and measurement add-on for Visual Studio
- Various ways to call .NET from LabVIEW

```
// Create a channel
  myTask.AIChannels.CreateVoltageChannel(physicalChannelComboBox.Text, "",
(AITerminalConfiguration)(-1), rangeMinimum, rangeMaximum, AIVoltageUnits.Volts);
// Configure timing specs
myTask.Timing.ConfigureSampleClock("", sampleRate, SampleClockActiveEdge.Rising,
SampleQuantityMode.FiniteSamples, samplesPerChannel);
// Verify the task
  myTask.Control(TaskAction.Verify);
// Prepare the table for data
InitializeDataTable(myTask.AIChannels, ref dataTable);
acquisitionDataGrid.DataSource = dataTable;
// Read the data
  reader = new AnalogMultiChannelReader(myTask.Stream);
// clear task
  myTask.Dispose();
```





MeasurementStudio™

FlexLogger™

Data Logging Software for Characterization and Durability V&V

Reduce test setup time with configuration-based workflows
Quickly find and share results across your organisation with traceable data

Product Features:

- Wide breadth of I/O with NI DAQ hardware
- Automatically synchronized, distributed measurements
- Comprehensive metadata capture for traceability
- Interactive data review in integrated TDMS Viewer

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Philips Innovation Services

Getting Hands-On