NI Measurement Link

gRPC for Automated Measurements

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- Developing & Debugging automated measurements
- Mentoring Thesis Projects
- Collaboration with other NXP validation teams
- NI Tools Python, git, Instrumentation, Jenkins

Automation Technology (MSc, 2011)
Psychology (BSc, 2016)

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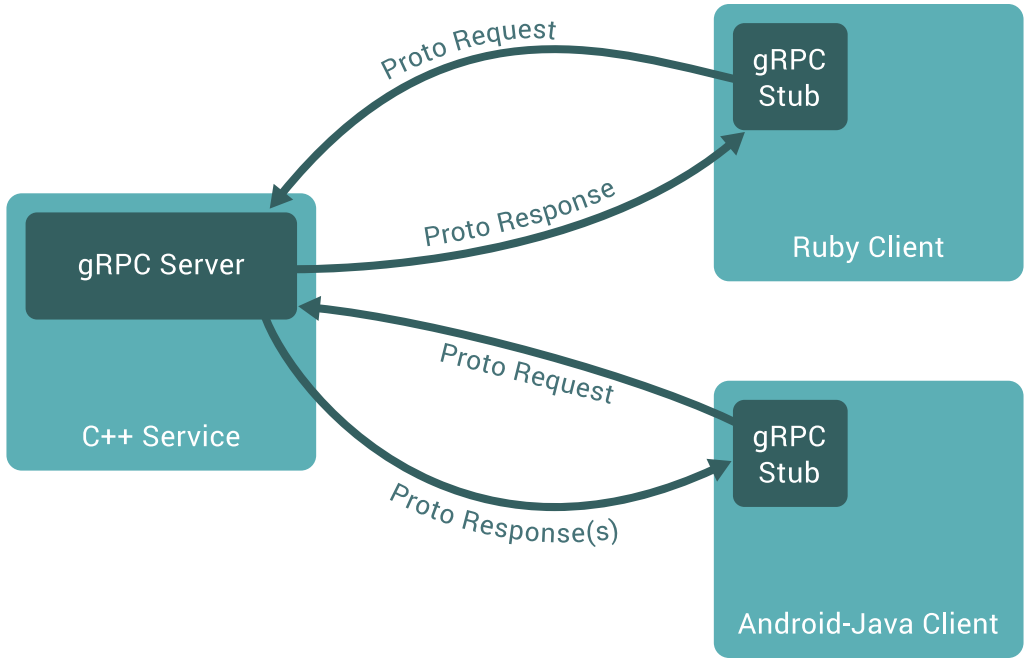
Outline

- What is gRPC?
  - Why do I need it
- What is *NI MeasurementLink*™?
  - Setup & Installation
  - Developing a Plug-In
- Demonstration
- Outlook

What is gRPC[1]

- **g**oogle **R**emote **P**rocedure **C**alls
- Open Source Client/Server Architecture
  - Connects microservices
  - Cross-platform communication
- Allows Distributed Services
  - Client → Server methods
- Uses *Protocol Buffers* to communicate

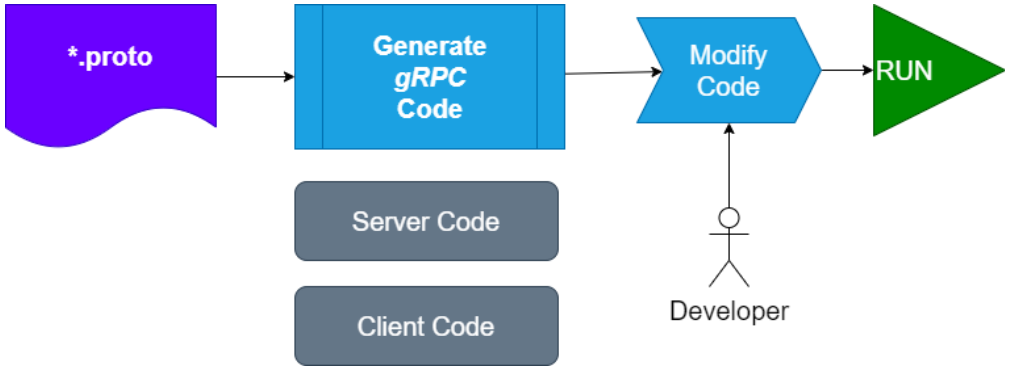


[1] https://grpc.io/docs/what-is-grpc/faq/

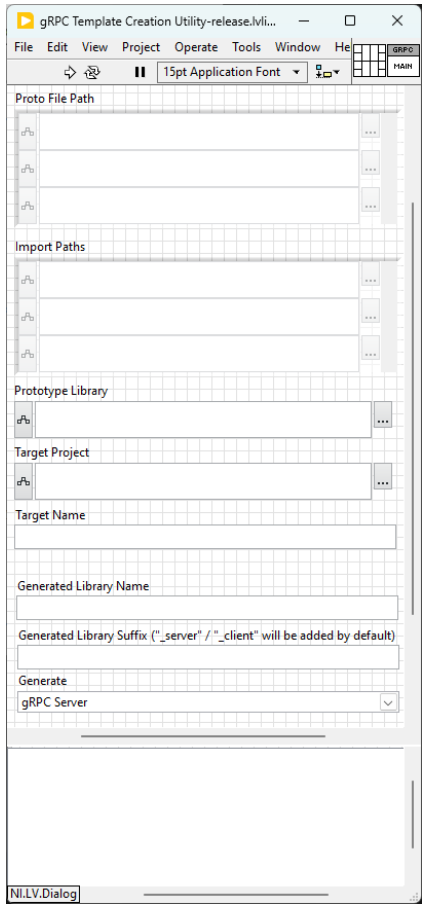
Protocol Buffers

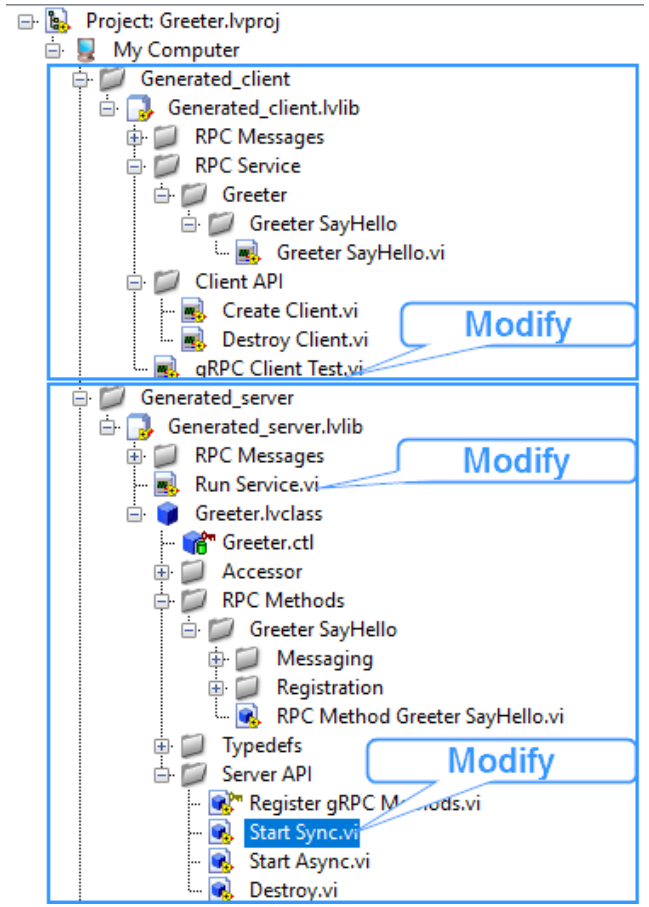
```
// The greeter service definition.
service Greeter {
  // Sends a greeting
  rpc SayHello (HelloRequest) returns (HelloReply) {}
}
// The request message containing the user's name.
message HelloRequest {
  string name = 1;
}
// The response message containing the greetings
message HelloReply {
  string message = 1;
}
```

- Data Serialization Structure
- Similar to JSON
- Defines Request/Response Structures



LabVIEW gRPC Generator





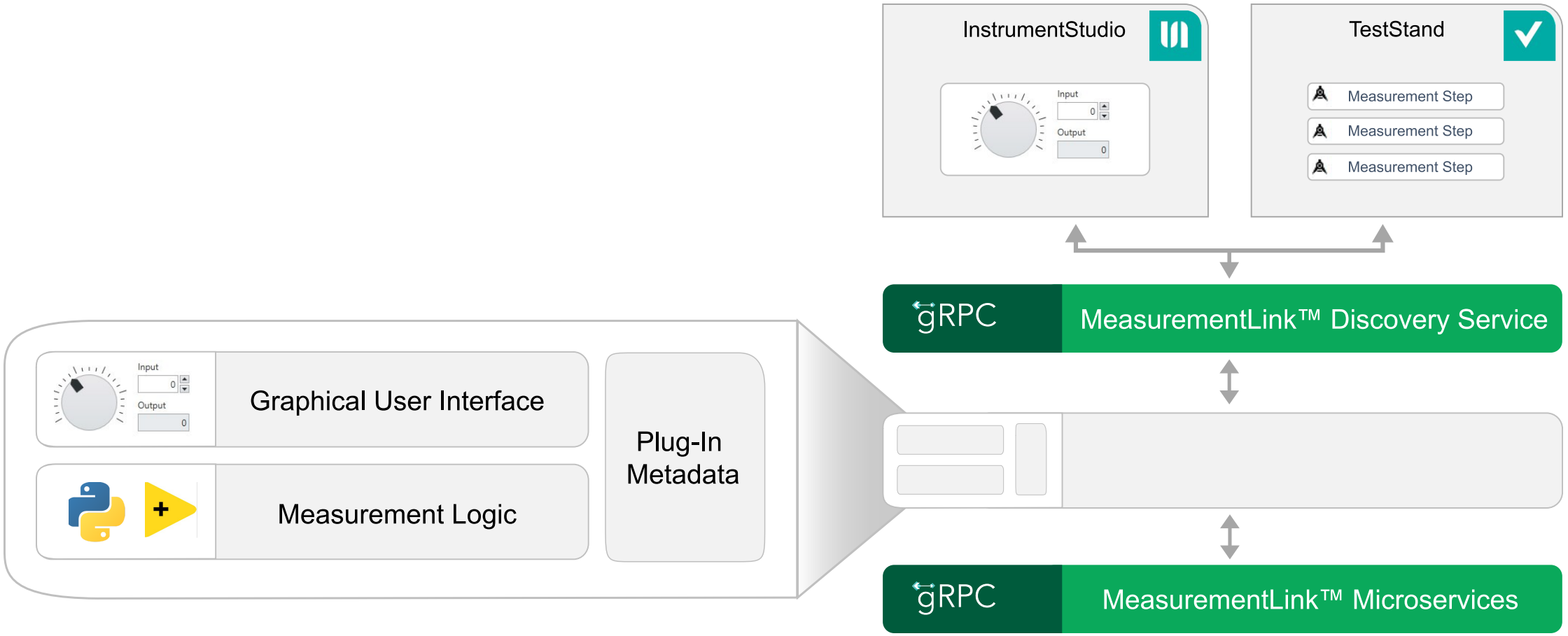
What is NI MeasurementLink

MeasurementLink is a **programming language agnostic** framework **based on gRPC**. It allows to create *reusable* measurements for any supported device.

It allows to use Python, C# or LabVIEW to generate a new measurement Plug-Ins and to define **measurement logic**.

The Plug-Ins can be deployed to access them from NI InstrumentStudio or TestStand for interactive validation and automated testing.

NI MeasurementLink™ Components



ML Plug-In Design 🔌

The MeasurementLink *discovery service* makes registered measurement plug-ins visible in supported applications. A registered measurement plug-in runs as a service. The measurement logic does not run when your measurement service starts.

Measurement Plug-Ins 🎉

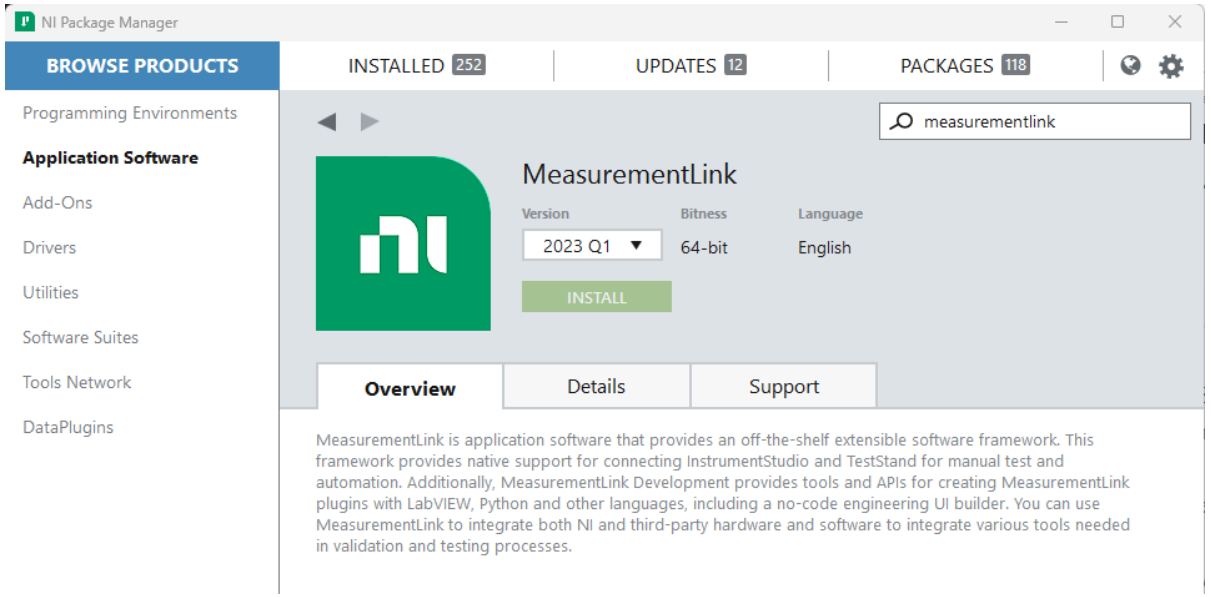
- Interactive & Automated Execution
- Sharing Resources
  - Cross-Process
  - Cross-Language
- Measurement Logic

Discovery Service 📡

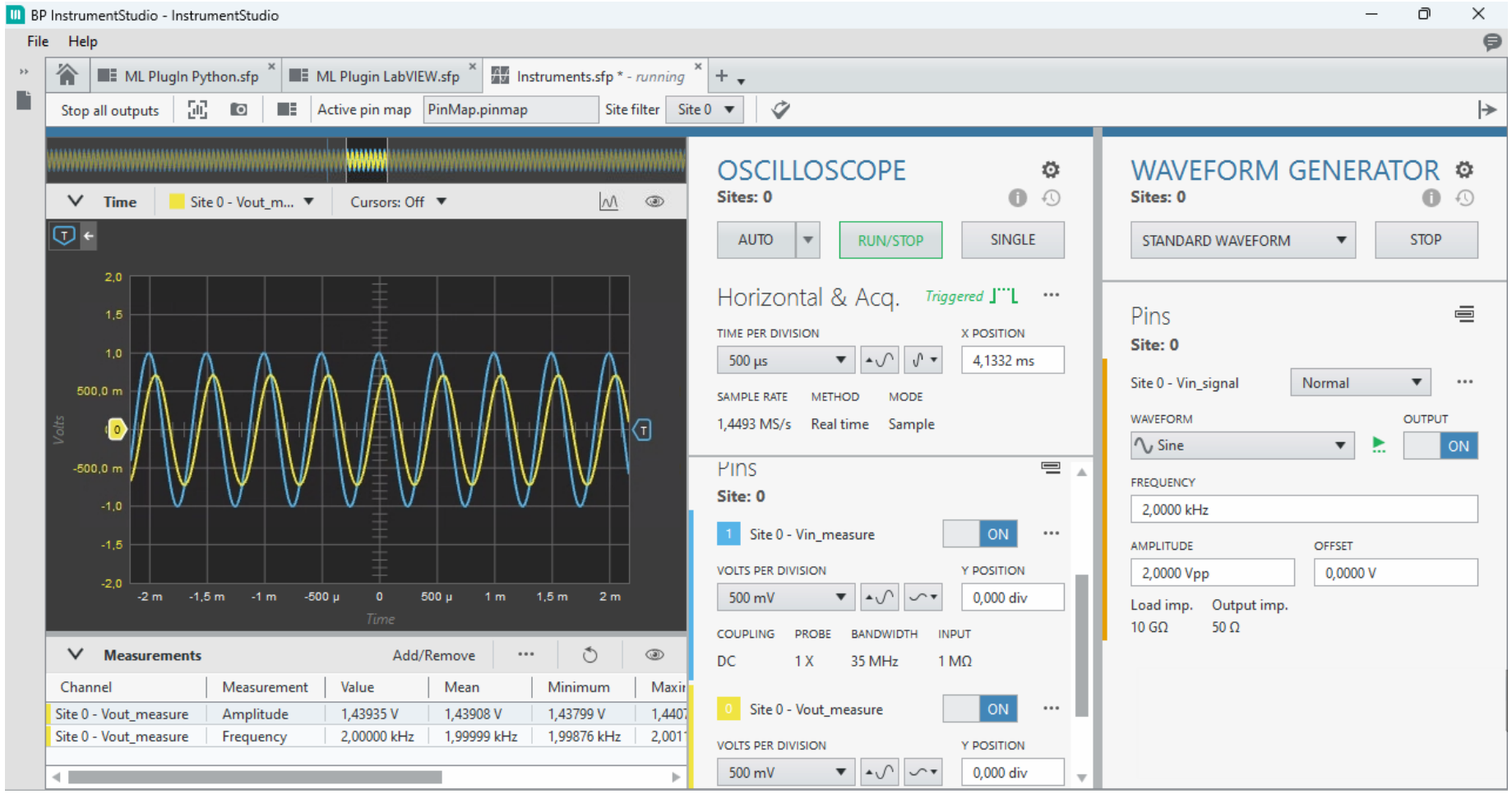
- Enumerates Plug-Ins
- Registers New Plugins
- Session Management

NI MeasurementLink™ Installation

- **Pre-Installation**
  - NI Package Manager ≥ 2023 Q1
  - NI Instrument Studio Qx/20xx
  - NI TestStand 64 Bit ≥ 2021 SP1
- Installation
  - MeasurementLink Qx/20xx
- Development Environments
  - Python
  - LabVIEW ≥ 2022

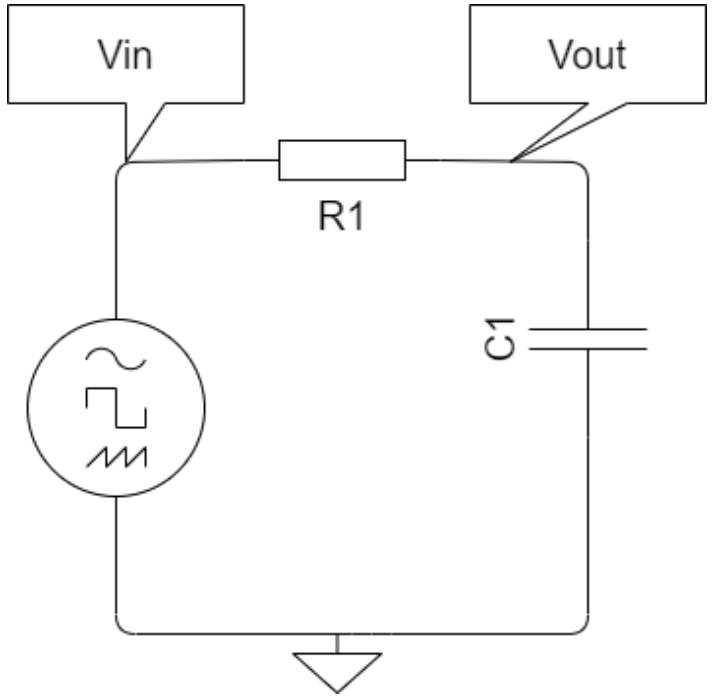


NI InstrumentStudio™

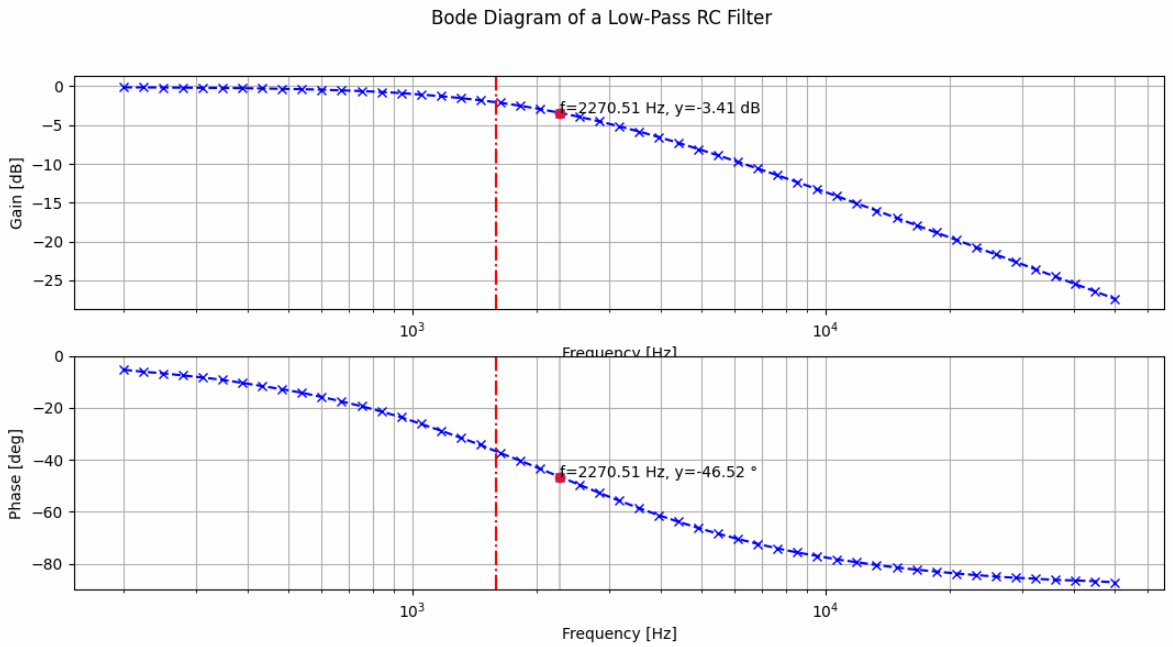


Developing a MeasurementLink Plug-In

Filter Characteristic

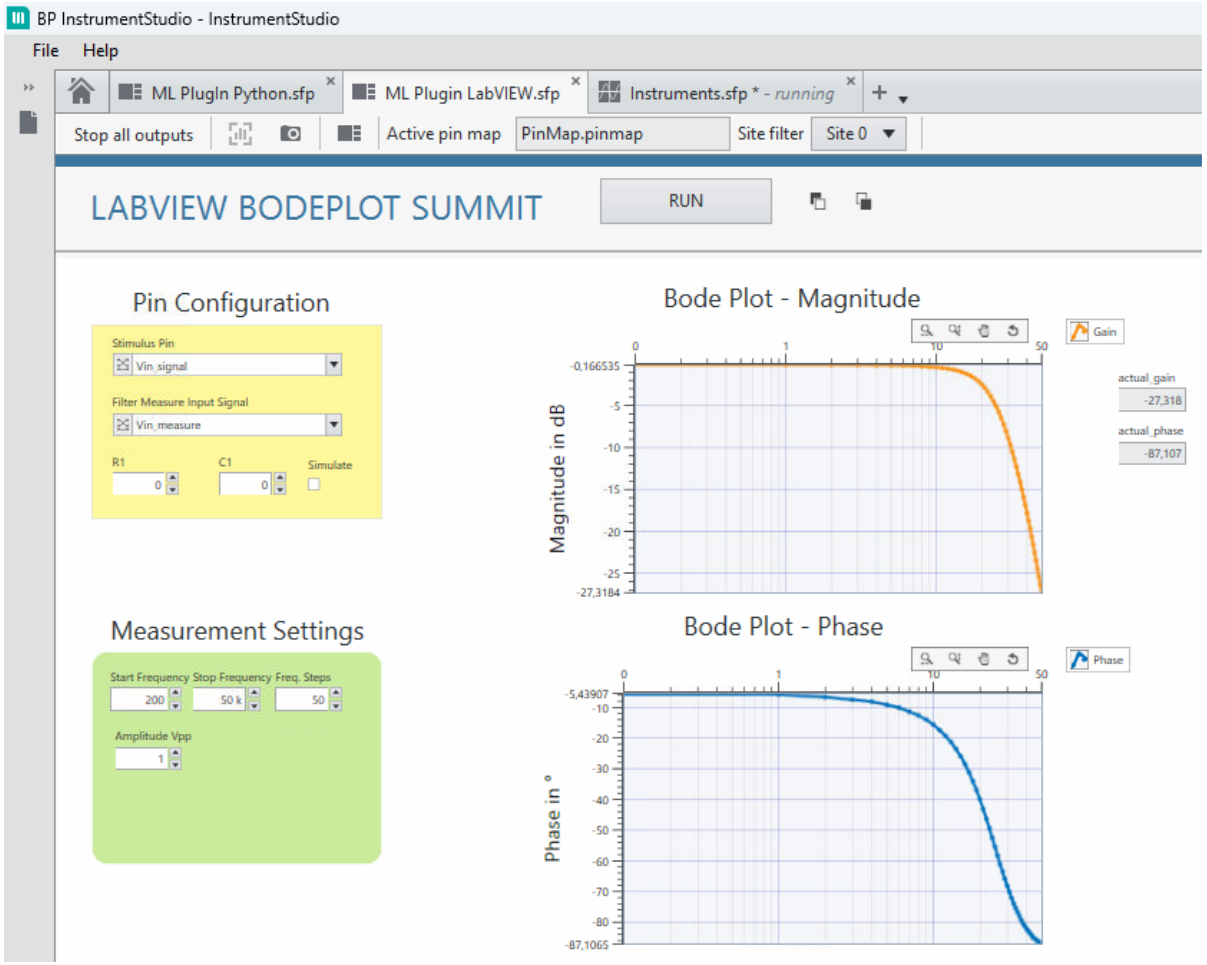


Bodeplot



Developing a MeasurementLink Plug-In

1. Create MeasurementLink PlugIn
2. Define Measurement Logic
   - Python & LabVIEW
3. Create **PinMap**
4. Create **Measurement UI**
5. Run/Deploy Service
6. Integrate in TestStand



1. Create MeasurementLink PlugIn

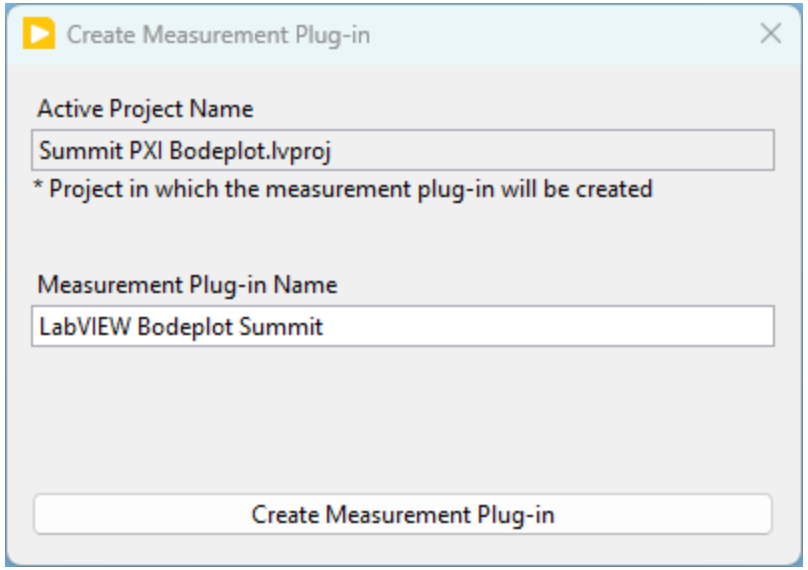
Python

```
pip install ni-measurementlink-service
pip install ni-measurementlink-generator

ni-measurementlink-generator BodePlot
```

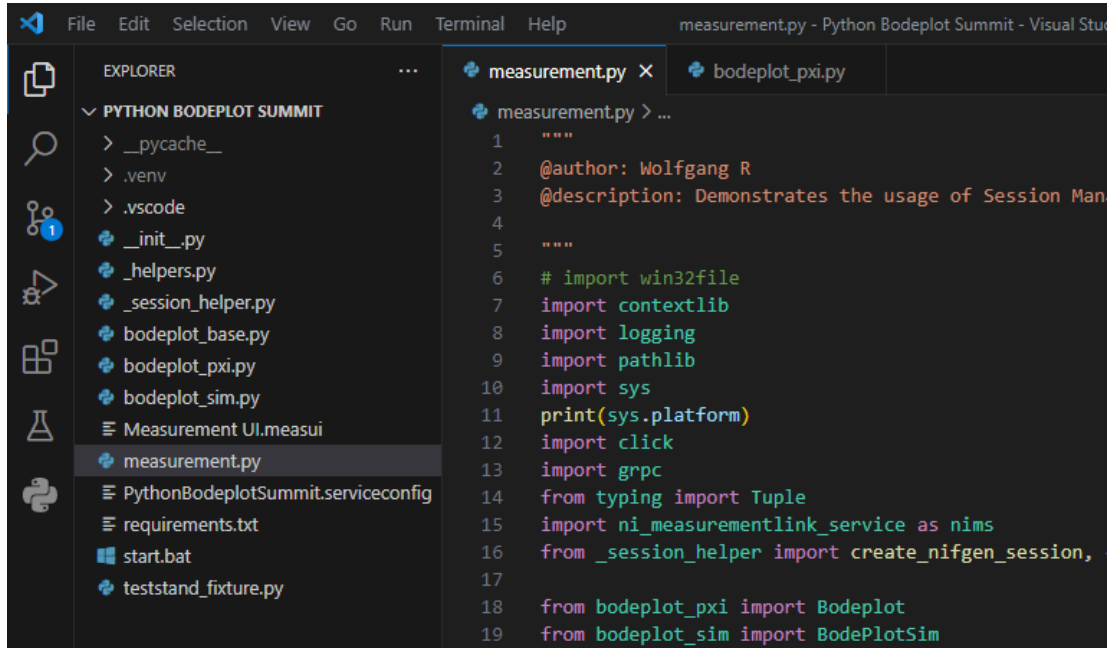
NI LabVIEW

1. Create an Empty Project
2. Tools → MeasurementLink → Create

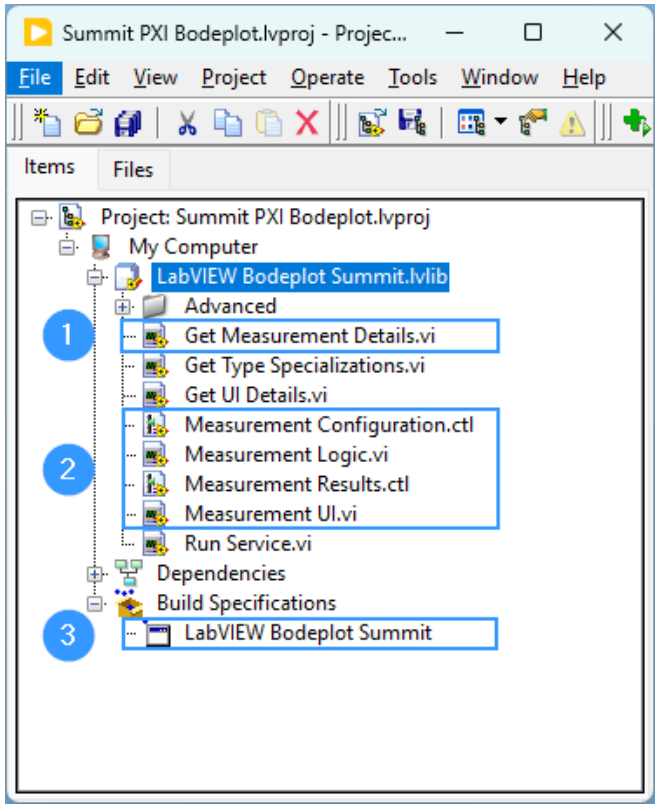


1. MeasurementLink PlugIn Structure

Python



NI LabVIEW



2. Creation of Measurement Logic

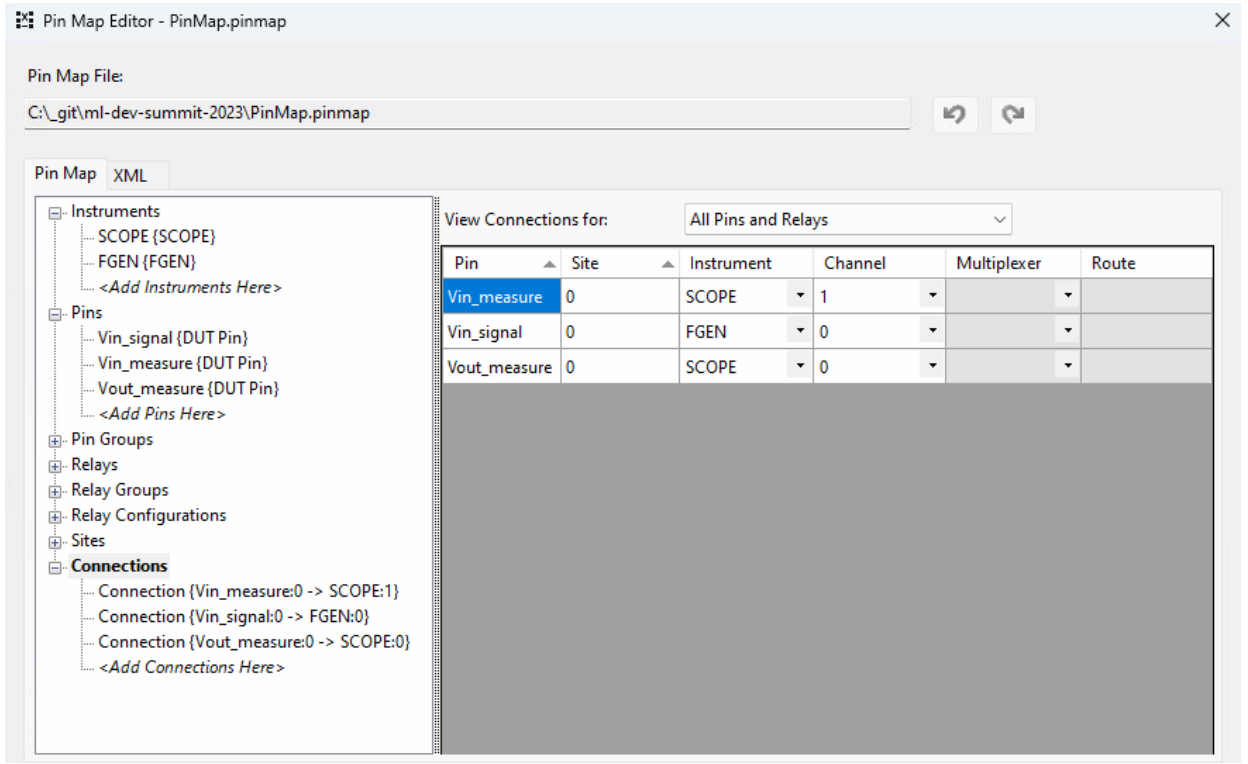
Requires to integrate *framework* code into the measurement code and to define the interface of a measurement code:

1. Reserve Sessions → returns instrument references
2. Perform Measurement
3. Release Session
4. Return Results

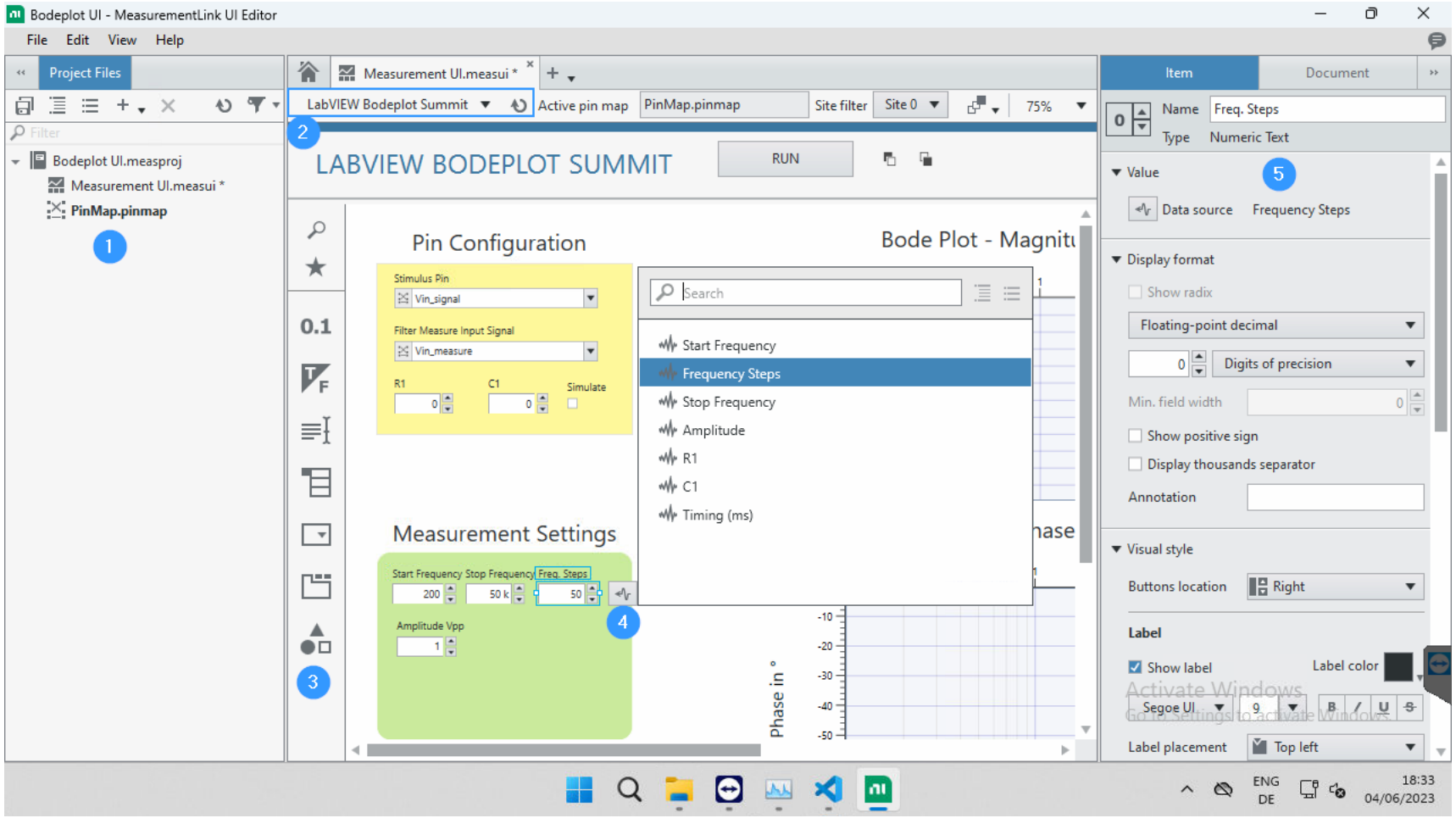
REMARK: We will explore the code during the demonstration. All code can be found here:

3. Create PinMap from InstrumentStudio

A pin map is DUT centric a configuration which maps instrument channels to DUT pins.



4. The MeasurementLink UI Editor™



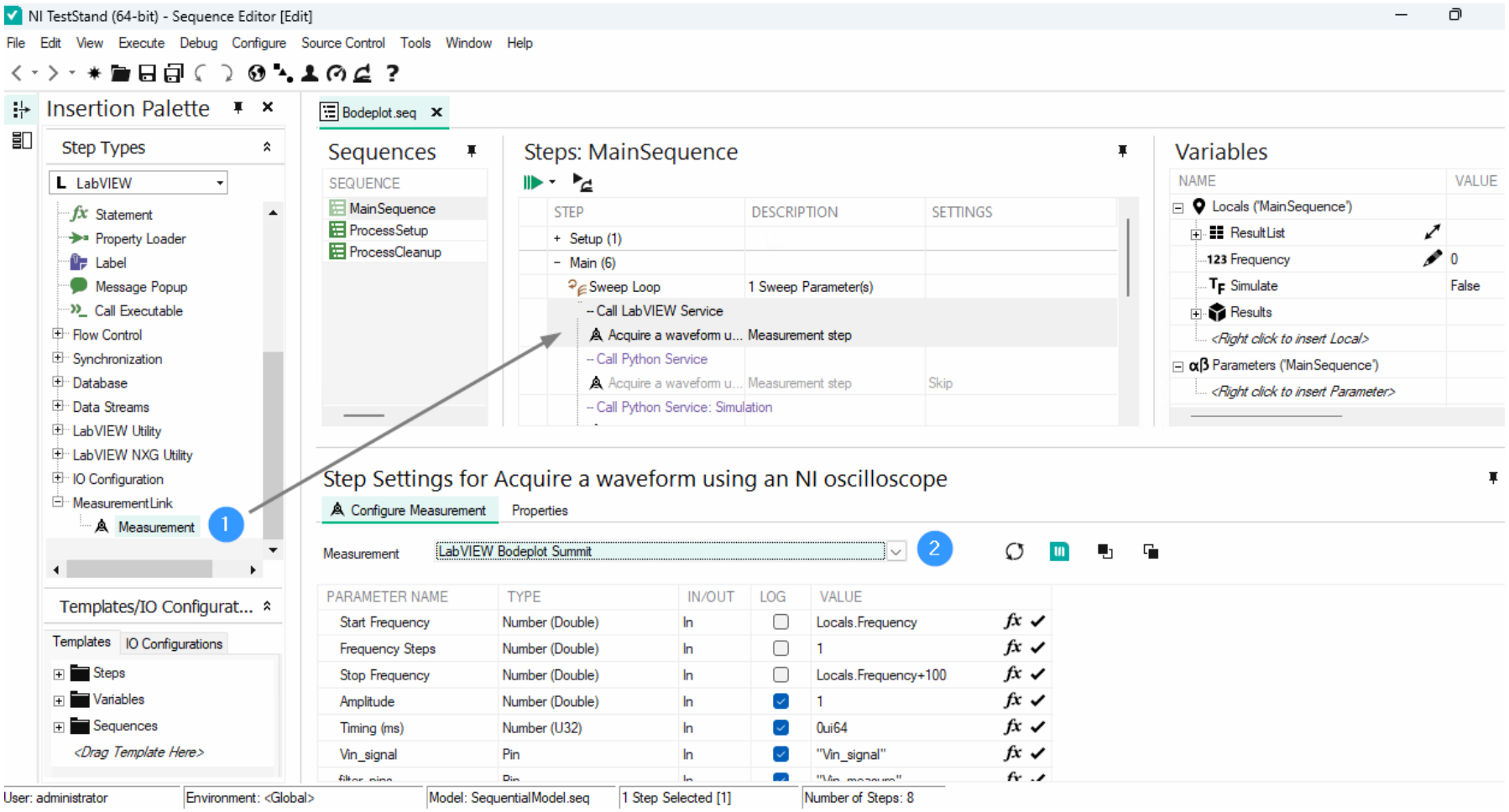
5. Run Service

To debug and run the MeasurementLink PlugIn in LabVIEW run the *Run Service.vi* and in Python run the *measurement.py*.

To deploy a service in LabVIEW an executable can be generated by the build specifications. The output folder of the build specification needs to be copied to `%ProgramData%\National Instruments\MeasurementLink\Services`.

For Python the entire source code can be copied to a folder in the above mentioned directory.

6. Integrate in TestStand



Take Away

Language Agnostic / Microservices

MeasurementLink is a **powerful framework**, where measurements can be developed and deployed in any programming language into a common framework for interactive and automated workflows.

Complexity vs. Simplicity

The user/test developer experience needs to be improved, since **Session Management** complexifies *Measurement Logic* development. Therefore, framework code has to be added to measurements.

Debug/Deploy workflow

It is seamlessly possible to switch between development and deployment code.

Disclaimer

All code is publicly available and based on documentation provided by NI (see references).

Software Versions	Library Versions
• LabVIEW 2023 Q3 (64-Bit) • MeasurementLink 2023 Q2 • InstrumentStudio 2023 Q2 • NI TestStand 2022 Q4 (64-Bit) • Python 3.9	• LabVIEW gRPC Library 1.0.0.1 • LabVIEW gRPC Servicer 1.0.0.1 • MeasurementLink Generator 1.0.0.1 • MeasurementLink Service 1.1.0.1

Acknowledgments

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- Andreas Kreiseder
- Erik Pirolt, NXP
- Marvin Landrum, NI
- Ryan Friedman, NI

References

[1] GRPC.io. (2023) Introduction to gRPC | gRPC. Retrieved June 04, 2023, from https://grpc.io/docs/what-is-grpc/introduction/

[2] NI (2023) GitHub - ni/grpc-labview: gRPC client and server support for LabVIEW. Retrieved June 04, 2023, from https://github.com/ni/grpc-labview

[3] NI (2023) Releases · ni/measurementlink-python. Retrieved June 04, 2023, from https://github.com/ni/measurementlink-python

[4] NI. (2023) GitHub - ni/measurementlink-labview: LabVIEW client, template, and examples for MeasurementLink. Retrieved June 04, 2023, from https://github.com/ni/measurementlink-labview

[5] NI. (2023) MeasurementLink Overview - NI. Retrieved June 04, 2023, from https://www.ni.com/docs/de-DE/bundle/measurementlink/page/measurementlink.html

[6] NI. (2023) Was ist InstrumentStudio. Retrieved June 04, 2023, from https://www.ni.com/de-at/shop/electronic-test-instrumentation/application-software-for-electronic-test-and-instrumentation-category/instrumentstudio.html