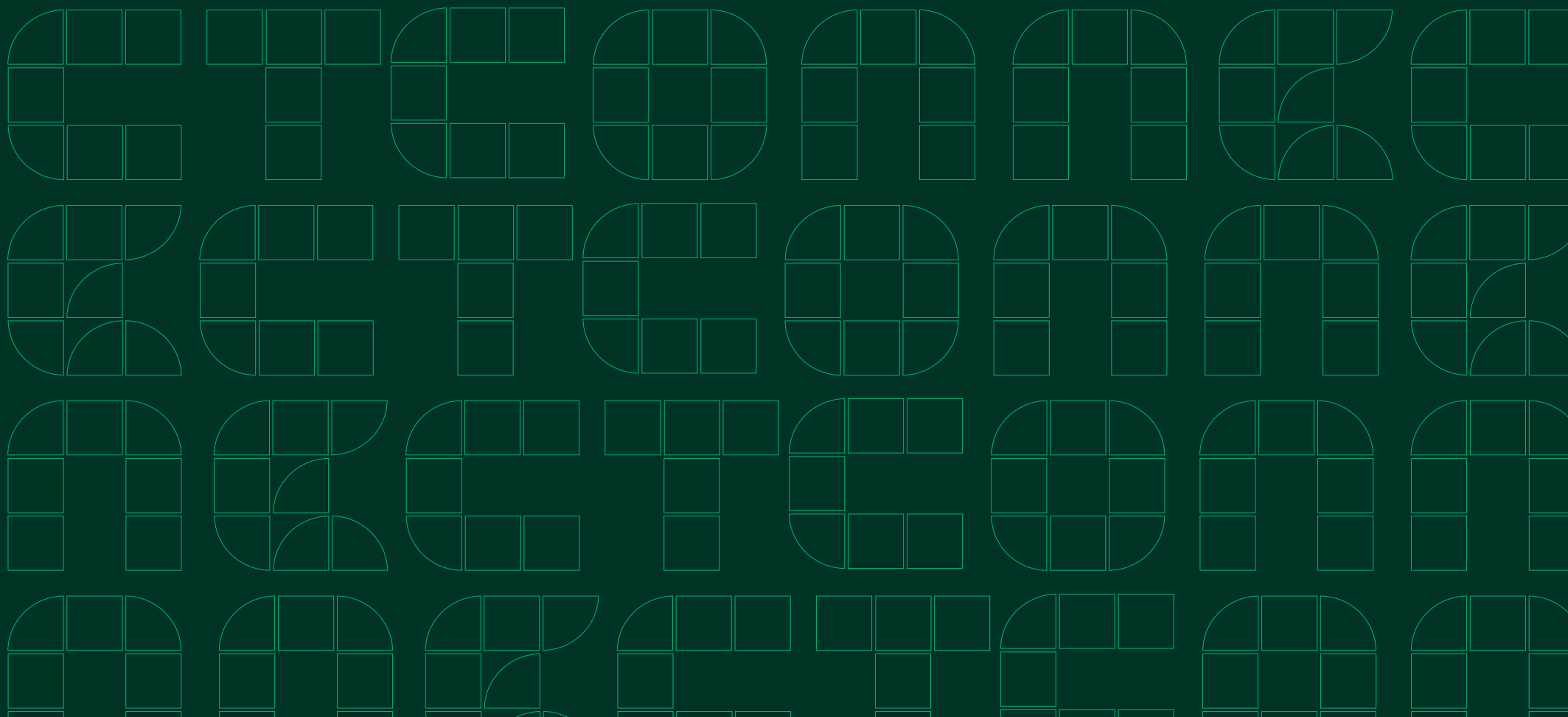


CONNECT



Easing in to SystemLink From LabVIEW!

Who am I?

Matt Holt, Principal Solutions Architect; CLA, CPI, E.I.T.

I enable digital transformation initiatives and data-driven decision making.

2022: Joined NI Digital Transformation Practice

2020: Global Digitalization Director; Celanese

2019: Sr. Staff Systems Architect; IIoT Implementation Board Lead – Lockheed Martin

2017: Sr. Staff Engineer; MFC Test Engineering – Lockheed Martin

2014: CTO; IIoT and Microgrid Control – ELM FieldSight, LLC

2010: Lead Architect; Test and Automation / IIoT – Dell Engineering Services

2007: Passed CLA Practical Exam

2006: Passed CLAD and CLD Exams

2004: Programming Supervisor; Manufacturing Smart Factory – Toshiba International Corporation

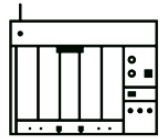
Why are we here?

- Overview of SystemLink
- Introduction to SystemLink APIs
- Examples and Demos
- Closing

SystemLink Overview



Streamline lab operations and amplify engineering insights in an integrated, scalable, enterprise solution.



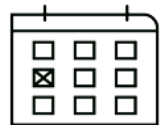
Manage Systems and Assets

Manage and install software for your entire test fleet, monitor test system health, and manage and track NI and 3rd Party instrument utilization



Monitor and Analyze Parametric Tests

Collect and view test results, files and parametric data; filter data for additional insights and track KPIs with dashboards and ad-hoc analysis



Plan Tests and Work Orders

Track incoming test requests, define test requirements, schedule, deploy, and remotely execute tests



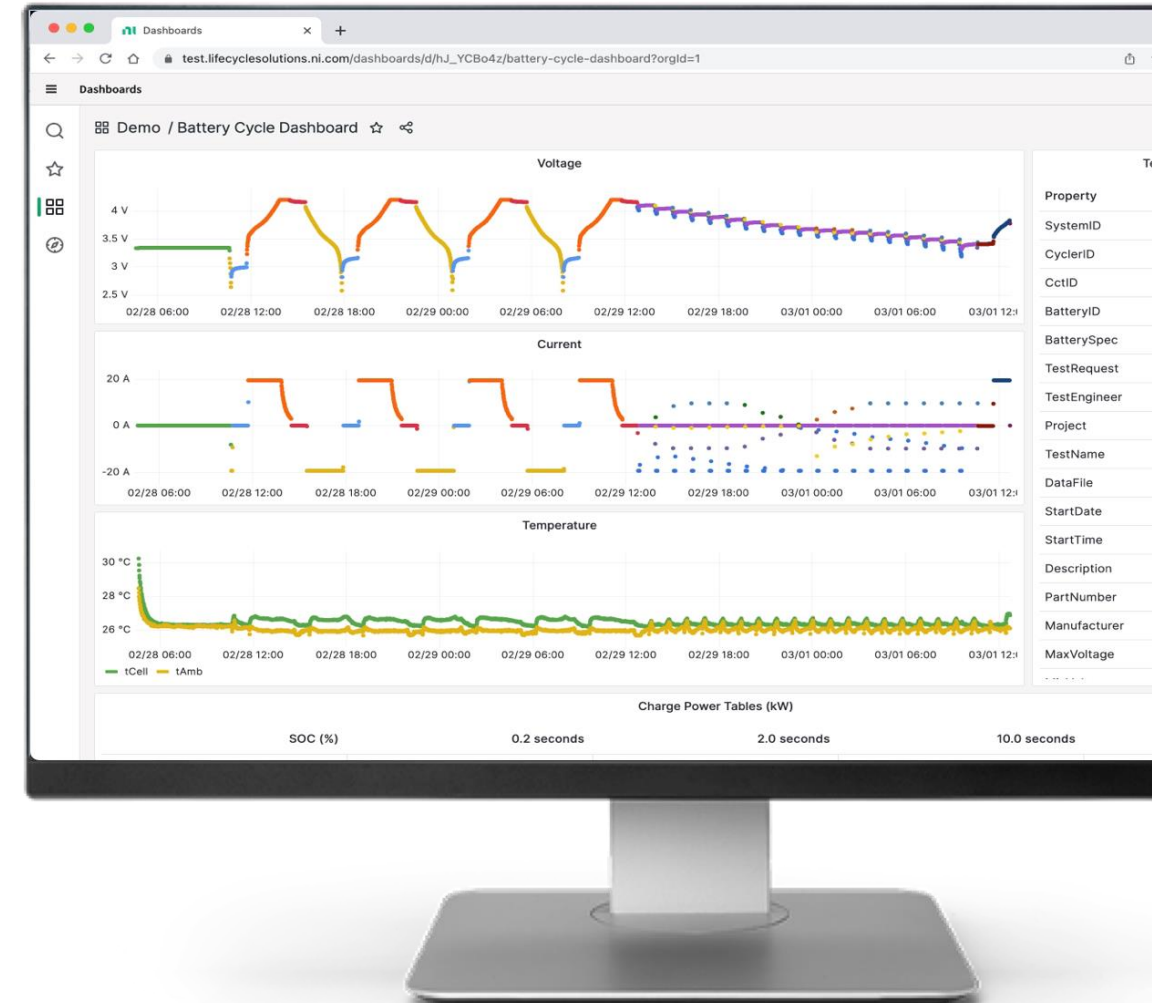
Track Product Specification Compliance

Elaborate requirements into engineering specifications to drive test consistency, quickly discover product issues, and track test progress



Automate Analysis and Reporting

Fully integrated Jupyter Notebook development environment to create Python scripts to extract, transform, and analyze data



Connect SystemLink



With **TestStand** to complete the loop from specifications to measurement



With **LabVIEW** to centrally manage test data and test system status

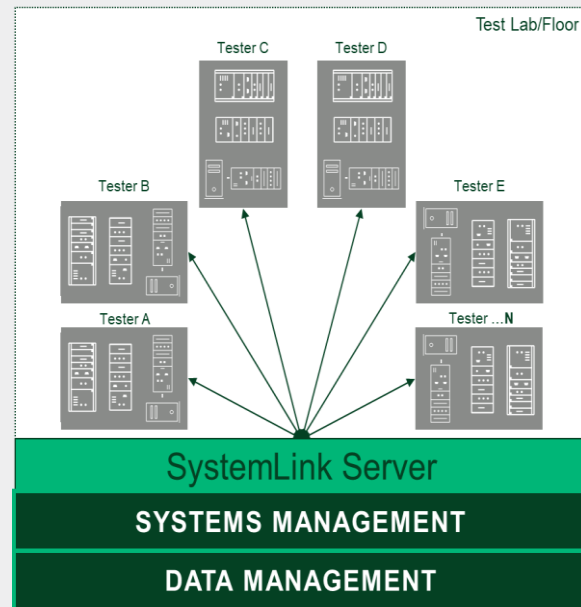


With **DIAdem** for further analysis and powerful report generation



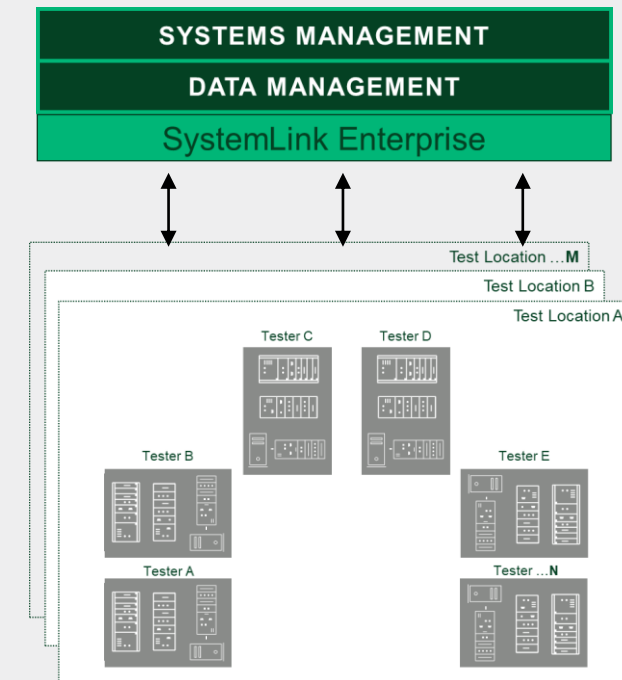
SystemLink Deployment Options

SystemLink Server



Designed for
Individual Labs / Cells

SystemLink Enterprise

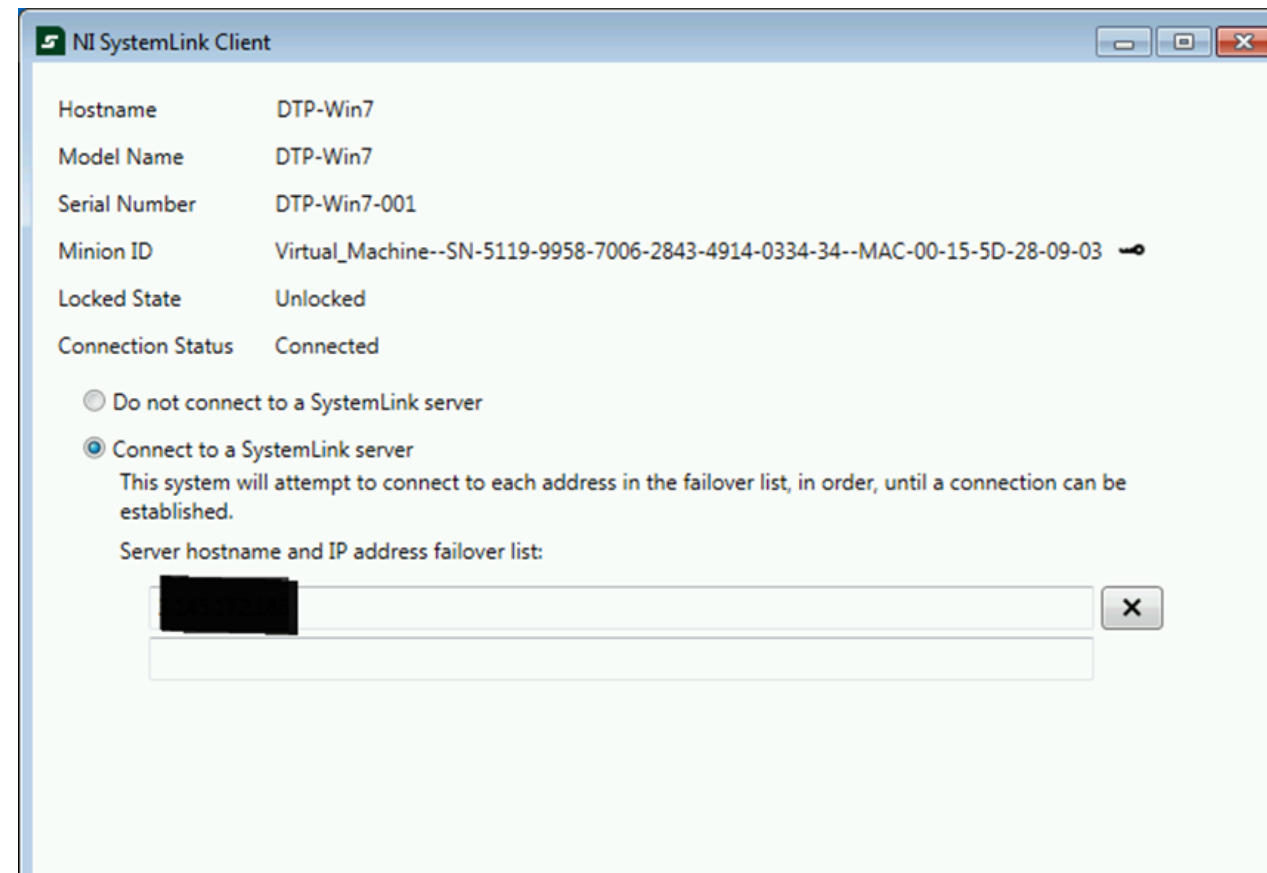


Designed for
Scalability

Scale of implementation and standardization

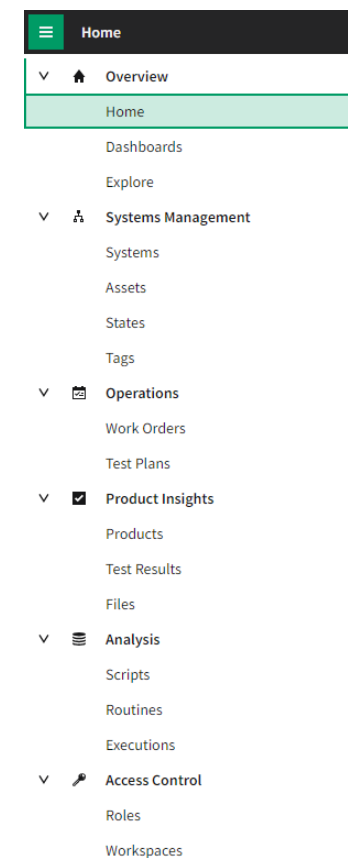
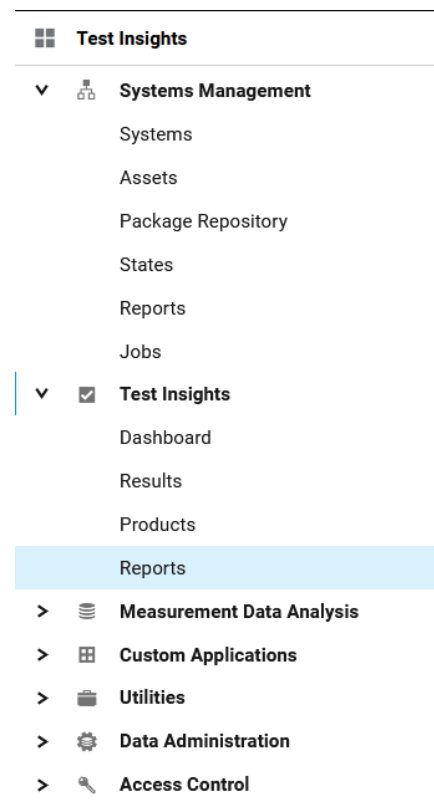
What is the SystemLink Client?

- SystemLink Client provides local device processing and configuration for hardware systems managed by a SystemLink server.
- SystemLink Client is application software that includes processing services and APIs to help you enable remote configuration functions and data services in SystemLink. Each hardware device managed by a SystemLink must have the SystemLink Client installed to manage communications with the server.
- The SystemLink Client is the same for both SystemLink Server and SystemLink Enterprise.



Modules and Navigation

SystemLink Navigation begins with the “Navigation” button on the top left of the web application after you’re logged in. This allows access to all modules assigned to your role.



Most SystemLink users will work primarily from the Systems Management and Test/Product Insights modules.

Systems

186 Systems 27 Connected 159 Disconnected 177

Add systems Search Workspa

Name	IP address	Model	Serial n...	Workspace ↑	Syste
APAC (1)					
LVTEST068	10.1.128.233	Precision ...	2L8VNL1	APAC	Marc
BATS Cell Lab (7)					
AM-gjanir	10.116.6.55	Precision ...	D9HQL63	BATS Cell ...	Sept
USAUSLT-PQ8F6N9	10.0.0.2	20UCS1L10N	PF2F1...	BATS Cell ...	Nov
DTP-Win10	172.24.50....	Virtual Ma...	8625-8...	BATS Cell ...	June
EC2AMAZ-M09DALH	10.0.28.2	HVM domU	ec2b35...	BATS Cell ...	June
EC2AMAZ-PMG4KRS	10.0.20.153	HVM domU	ec25cb...	BATS Cell ...	June
EC2AMAZ-LEIIK2T	10.0.30.98	t3.2xlarge	ec2eb0...	BATS Cell ...	Nov
EC2AMAZ-E921BIO	10.0.25.204	HVM domU	ec22e7...	BATS Cell ...	Augu
BATS Historical Ingestion (1)					
USAUSLT-9F3Z542	10.0.0.11	20UCS1L10N	PF2N6...	BATS Histo...	May
BATS Pack Lab (5)					
EC2AMAZ-8H342HM	10.0.28.87	c5.4xlarge	ec27e7...	BATS Pack...	June
EC2AMAZ-THSJNFV	10.0.23.117	HVM domU	ec2049...	BATS Pack...	June
EC2AMAZ-VD4KARS	10.0.22.154	HVM domU	ec27e9...	BATS Pack...	June
EC2AMAZ-H8F069A	10.0.31.153	HVM domU	ec27ac...	BATS Pack...	June
EC2AMAZ-FTQJJ0I	10.0.27.130	HVM domU	ec2462...	BATS Pack...	June
BATS Shared (1)					
USAUSLT-N89G4AS	192.168.1....	20LES11000	R90QF...	BATS Shared	July
BATS Staging (2)					
TestStand25	10.0.1.216	HVM domU	ec2045...	BATS Stagi...	Janu
EC2AMAZ-N478PAL	10.0.29.25	HVM domU	ec2754...	BATS Stagi...	Janu
Battery Process Analysis (1)					
EC2AMAZ-AHMBORQ	10.0.17.160	HVM domU	ec2374...	Battery Pr...	Nov
stHW	130.164.18...	NI cRIO-9045	01CEE...	BTS	Marc
naca	fe80::280...	NI cRIO-9047	01E13...	BTS	Marc
-3	130.164.18...	Virtual Ma...	4728-2...	BTS	Febr
emo (10)					
owling.vm	10.2.126.65	Standard		BTS Demo	Nov

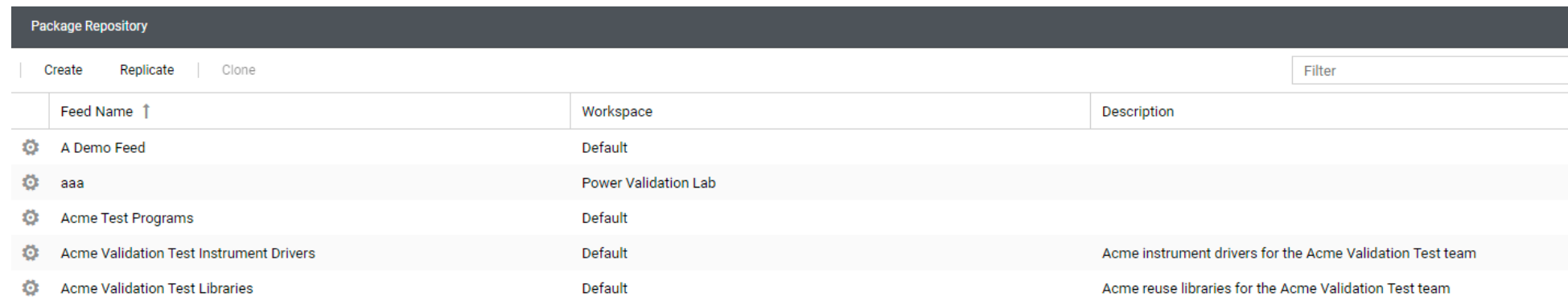
Systems Management

- Manage and install software for your entire test fleet from a central web interface
 - Reduce time required to keep test equipment up to date
 - View and report job history, including software updates and system errors
- Monitoring test system health with support for alarms and notifications from customizable dashboards
 - Out of the box monitoring for CPU, Memory, and Disk Utilization
 - Extend health and monitoring capabilities with the SystemLink Tag API
- Manage and track the assets connected to your test systems
 - Execute remote diagnostics, such as self-test, self-calibrate, and device reset
 - Manage date/time, network settings, and admin passwords for RT systems
- Track system utilization

Systems Management: Feeds and States

Feeds are created in “Package Repository” to expose software packages to clients.

A feed can include NI supplied software packages, custom-built software packages, and required dependencies

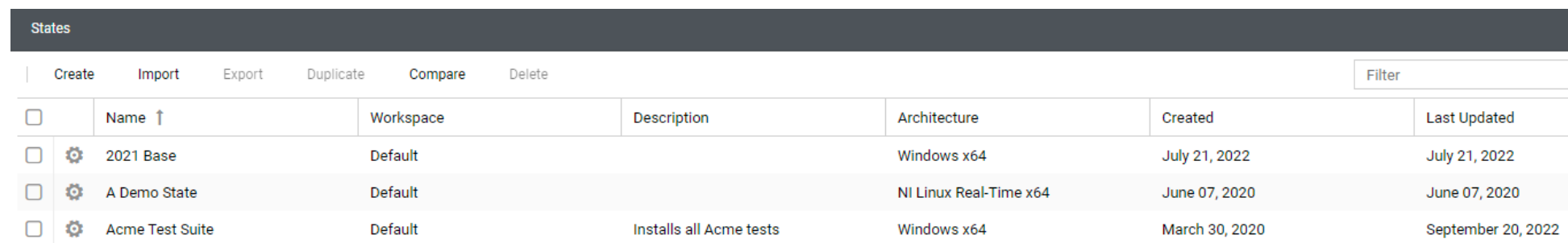


The screenshot shows the 'Package Repository' interface. At the top, there are buttons for 'Create', 'Replicate', and 'Clone', and a 'Filter' input field. Below is a table with columns for 'Feed Name', 'Workspace', and 'Description'. The table contains five rows of feed data.

Feed Name ↑	Workspace	Description
A Demo Feed	Default	
aaa	Power Validation Lab	
Acme Test Programs	Default	
Acme Validation Test Instrument Drivers	Default	Acme instrument drivers for the Acme Validation Test team
Acme Validation Test Libraries	Default	Acme reuse libraries for the Acme Validation Test team

States are a collection of packages (hosted in feeds) that can be deployed as a set.

This can be used to duplicate software versions and configuration on multiple clients.



The screenshot shows the 'States' interface. At the top, there are buttons for 'Create', 'Import', 'Export', 'Duplicate', 'Compare', and 'Delete', and a 'Filter' input field. Below is a table with columns for 'Name', 'Workspace', 'Description', 'Architecture', 'Created', and 'Last Updated'. The table contains three rows of state data.

Name ↑	Workspace	Description	Architecture	Created	Last Updated
2021 Base	Default		Windows x64	July 21, 2022	July 21, 2022
A Demo State	Default		NI Linux Real-Time x64	June 07, 2020	June 07, 2020
Acme Test Suite	Default	Installs all Acme tests	Windows x64	March 30, 2020	September 20, 2022

Assets

736 Assets 108 Connected 628 Disconnected

Add asset Search Refresh: 10 seconds

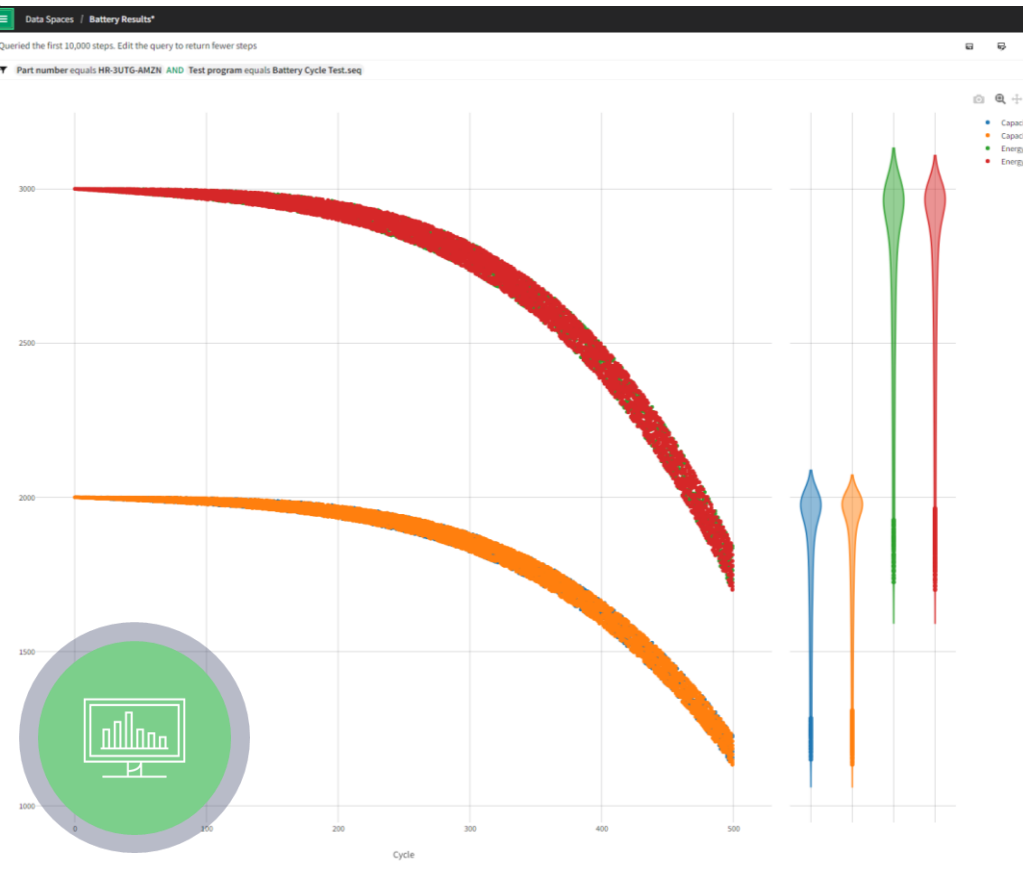
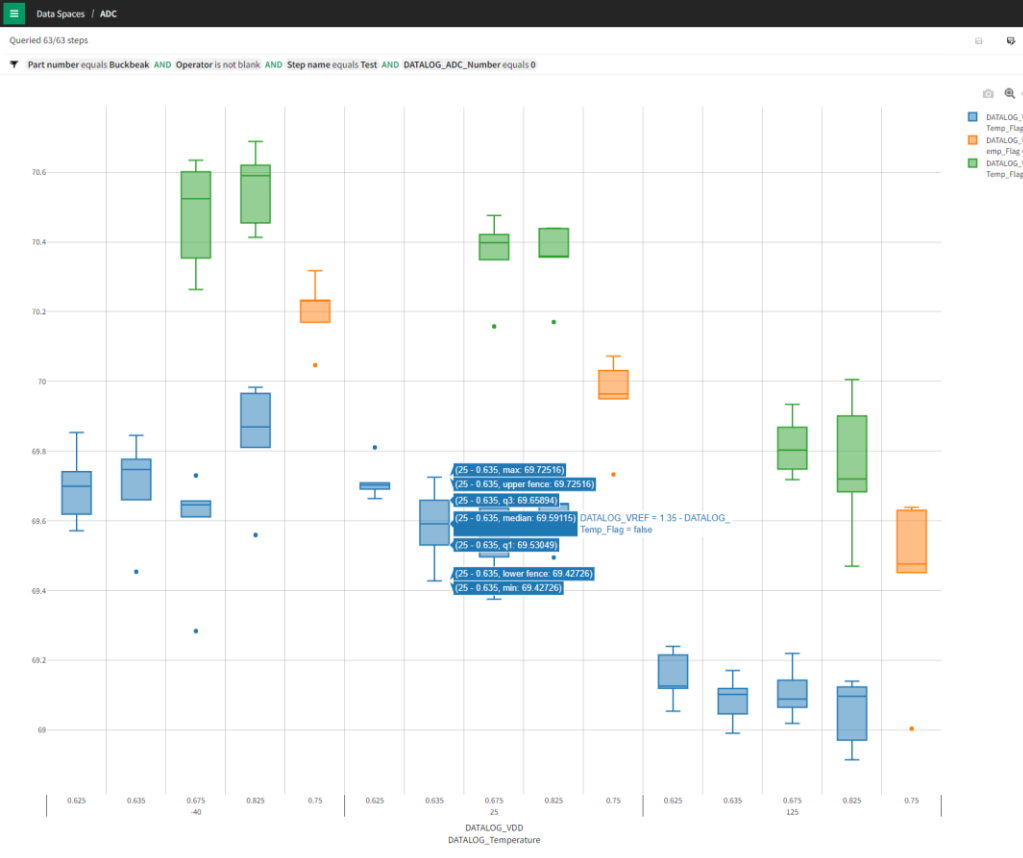
Name	Model	Serial nu...	Location	Presence	Last self c...	Calibrati...
^ NI-sbRIO-9629-01E3834F (10)						
Cell1	234235r	123213	NI-sbRIO...	Present		
Conn0_DIO0-3	DIO 0-3	01E3834F	NI-sbRIO...	Present		
RIO0	NI sbRIO...	1E3834F	NI-sbRIO...	Present		
Conn0_AO	AO 0-3	01DDD051	NI-sbRIO...	Present		
sbRIO1	NI sbRIO...	01E3834F	NI-sbRIO...	Present		
NI-sbRIO-9629-01...	sbRIO-9629	01E3834F	NI-sbRIO...	Present		
Tower1	NI-Cyclcr	1234567	NI-sbRIO...	Present		
sbrio1	123324	23124	NI-sbRIO...	Present		
Tray1	12343235	123124	NI-sbRIO...	Present		
Conn0_AI	AI 0-15	01DDD051	NI-sbRIO...	Present		
^ FL-PowerSeat (14)						
Seat_Heater	NI cDAQ-...	01D1961C	FL-Powe...	Present		
cDAQ9185-1D196...	NI 9229	0123EA42	FL-Powe...	Not pres...		
cDAQ9185-1D196...	NI 9214	01D0A02C	FL-Powe...	Not pres...		
Power_Seat_2	NI cDAQ-...	01D195D6	FL-Powe...	Present		
cDAQ9185-1D195...	NI 9401	013407EB	FL-Powe...	Present		
cDAQ9185-1D196...	NI 9239	01C879EE	FL-Powe...	Not pres...		
cDAQ9185-1D195...	NI 9401	0170495C	FL-Powe...	Present		
Power_Seat_1	NI cDAQ-...	01D195E8	FL-Powe...	Present		
Cell ID4	ID4	123456789	FL-Powe...	Present		
cDAQ9185-1D195...	NI 9229	016A2878	FL-Powe...	Present		Jan 4, 20...
cDAQ9185-1D195...	NI 9239	019E8825	FL-Powe...	Present		Nov 21, ...
cDAQ9185-1D195...	NI 9234	01CCA52B	FL-Powe...	Present		Dec 6, 20...
cDAQ9185-1D195...	NI 9214	01D0A055	FL-Powe...	Present		Mar 7, 20...
cDAQ9185-1D195...	NI 9234	01D17BC1	FL-Powe...	Present		Mar 22, ...
NI PXIe-8...	21A28B8		g1kam109	Not pres...		
4,Unkn...	NI PXIe-8...	020B2DDA	g1kam109	Present		
1,CAN2,Unkn...	NI PXIe-8...	020B2E4F	g1kam109	Present		
ENET1,ENET2,EN...	NI PXIe-8...	01E9C8D2	g1kam109	Present		

Asset Traceability

Automatic asset tracking for NI and 3rd party LXI, USB-TMC, and GPIB instruments

- Search and locate test assets across all systems
- Tracks asset connection and location history over time
- 3rd party assets through programmatic APIs and web interface
- Add custom properties and keywords to assets that can be used when grouping or filtering assets
- Export asset data for external reporting

	B	C	D	E	F	G	H	I
1	System	System Connection	Name	Vendor	Model	Serial Number	Bus Type	Resource URI
2	PXI-ATDEMO-1	Connected	PXIChassis1	National Instruments	NI PXIe-1062	V08X145D2	PciPxi	0/National Instruments/NI PXIe
3	PXI-ATDEMO-2	Connected	PXIChassis1	National Instruments	NI PXIe-1062	V08X191C9	PciPxi	0/National Instruments/NI PXIe
4	NI-WTS	Disconnected	PXIChassis2	National Instruments	NI PXIe-1071	154EE6D	PciPxi	0/National Instruments/NI PXIe
5	ATDEMOKITNIWK18	Disconnected	Chassis 1	National Instruments	NI PXIe-1082	16D9B99	PciPxi	0/National Instruments/NI PXIe
6	DESKTOP-NK98GAG	Connected	PXIChassis1	National Instruments	NI PXIe-1082	318EF6E	PciPxi	0/National Instruments/NI PXIe
7	ni-NI	Disconnected	Chassis 1	National Instruments	NI PXIe-1082	V08X18028	PciPxi	0/National Instruments/NI PXIe



Data Management

- Collect, store and view test results, files and parametric data
 - Ingest data from TestStand or 3rd party sequencers using SystemLink's Test Monitor LabVIEW, Python, .NET, or HTTP APIs
- Quickly search and filter data to analyze past results and gain additional insights
 - View waveform and parametric measurement data from a web-based user interface
- Interactive web-based data visualization and analysis
 - Plot and group measurement data across different conditions
 - View distributions using box and violin plots as well as histograms

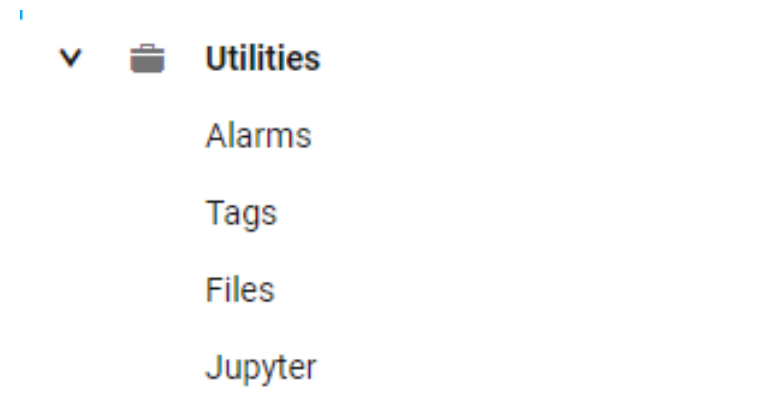
Alarming and Notifications

SystemLink enables **alarms** and **notifications** to be sent based on **Tags**.

Tags in SystemLink transmit and store slow-moving measurement data like system status or health.

Use **tags** to track measurements, system/equipment states and transitions, monitor system health, create alarms, and visualize data on dashboards.

Tags can be collected by clients, OPCUA, or through SystemLink APIs by any client capable of consuming HTTP APIs.

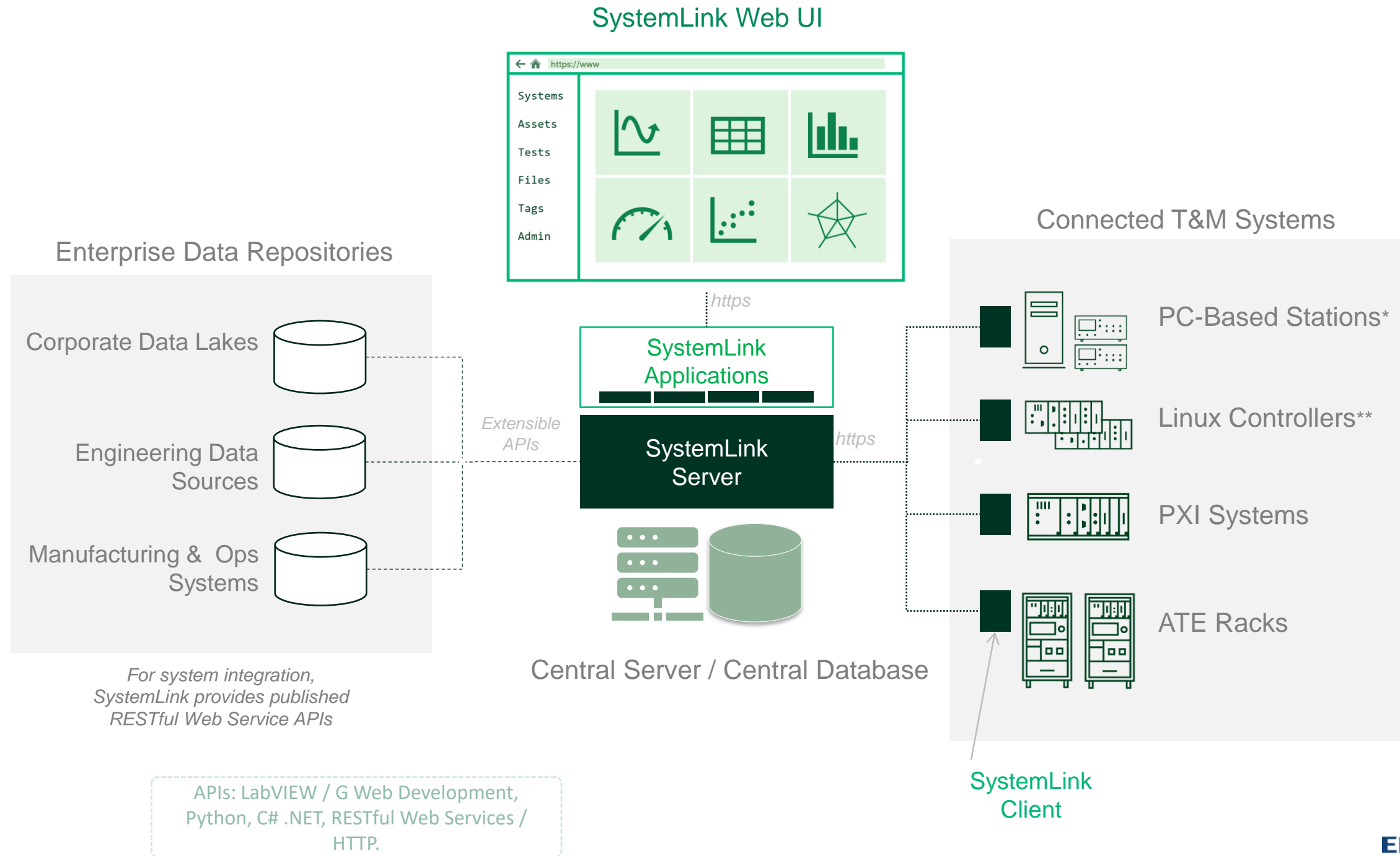


Alarms are configured per **tag** and can be triggered by value or last update. **Notifications** are emails that can be sent to individuals or groups when an **alarm** is triggered.

SystemLink Connectivity

RESTful APIs

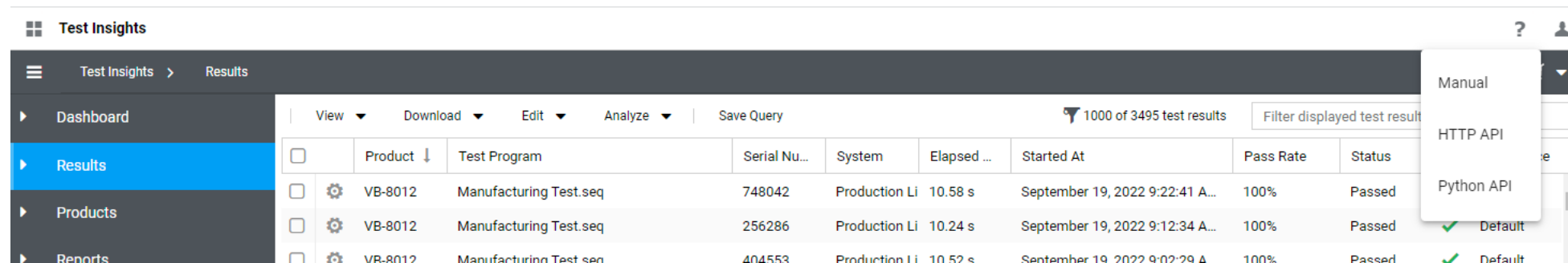
SystemLink: Enterprise Connectivity



SystemLink API Overview

SystemLink provides two well-documented APIs:

1. HTTP/s (LabVIEW!)
2. Python



The screenshot displays the 'Test Insights' web interface. On the left is a navigation sidebar with 'Results' selected. The main area shows a table of test results with columns for Product, Test Program, Serial Number, System, Elapsed Time, Started At, Pass Rate, and Status. A dropdown menu is open over the table, listing 'Manual', 'HTTP API', and 'Python API' options. The table contains three rows of test data, all with a 'Passed' status and a '100%' pass rate.

	Product	Test Program	Serial Nu...	System	Elapsed ...	Started At	Pass Rate	Status	
<input type="checkbox"/>	VB-8012	Manufacturing Test.seq	748042	Production Li	10.58 s	September 19, 2022 9:22:41 A...	100%	Passed	
<input type="checkbox"/>	VB-8012	Manufacturing Test.seq	256286	Production Li	10.24 s	September 19, 2022 9:12:34 A...	100%	Passed	✓ Default
<input type="checkbox"/>	VB-8012	Manufacturing Test seq	404553	Production Li	10.52 s	September 19, 2022 9:02:29 A...	100%	Passed	✓ Default

SystemLink HTTP API: Swagger

To access details around specific functionality, expand the desired section and review the parameters, example response values, and response data model. You can test DIRECTLY from this interface.

GET /v2/results/{resultId} Gets a test result

Gets a single test result.

Parameters

Name	Description
resultId * required string (path)	The id of the result to get.

Responses

Code	Description
200	Get Test Result Response

Example Value | Model

```
{
  "status": {
    "statusType": "PASSED",
    "statusName": "Passed"
  },
  "startedAt": "2018-05-07T18:58:05.219692Z",
  "updatedAt": "2018-05-09T15:07:42.527921Z",
  "programName": "My test program",
  "id": "02600cf8-c2bb-4ff9-a139-031e943fb0c0",
  "systemId": "5e30931993cac8046850a996",
  "hostName": "My-Host",
  "operator": "admin",
  "partNumber": "cRIO-9030",
  "serialNumber": "abc-123",
  "totalTimeInSeconds": 29.9,
  "keywords": [
    "keyword1",
    "keyword2"
  ],
  "properties": {
    "key1": "value1"
  },
  "fileIds": [],
  "statusTypeSummary": {
    "FAILED": 5
  },
  "workspace": "f94b178e-288c-4101-afb1-833992413aa7"
}
```

Example Value | Model

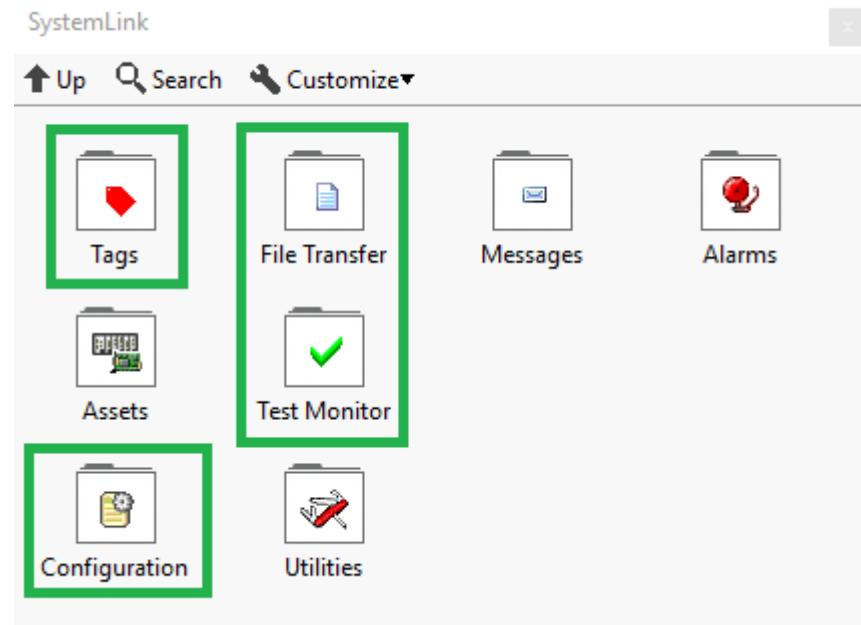
Test Result Response {

- status: Status Object > {...}
- startedAt: string(\$date-time)
example: 2018-05-07T18:58:05.219692Z
ISO-8601 formatted timestamp indicating when the test result began
- updatedAt: string(\$date-time)
example: 2018-05-09T15:07:42.527921Z
ISO-8601 formatted timestamp indicating when the result was last updated
- programName: string
example: My test program
Program name
- id*: string
example: 02600cf8-c2bb-4ff9-a139-031e943fb0c0
Id of the test result
- systemId: string
example: 5e30931993cac8046850a996
Id of the system
- hostName: string
example: My-Host
Host name of the system
- operator: string
example: admin
Name of the operator running the test
- partNumber: string
example: cRIO-9030
The part number of the device under test.
- serialNumber: string
example: abc-123
Sequential number of the device under test
- totalTimeInSeconds: number(\$double)
example: 29.9
Total run-time of the test in seconds
- keywords: > [...]
- properties: > {...}
- fileIds: > [...]
- statusTypeSummary: > {...}
- workspace: string
example: f94b178e-288c-4101-afb1-833992413aa7
The workspace the test result belongs to

}

LabVIEW SystemLink Toolkit

The LabVIEW SystemLink™ Toolkit helps you communicate with SystemLink software.



- **Configuration** –
 - Manages the connection to SystemLink
- **Test Monitor** –
 - Create and update Test Results and Test Steps
- **File Transfer** –
 - Upload, download, and manage file meta data for files stored on SystemLink
- **Tags** –
 - Create, configure, and manage tags stored on SystemLink

DEMO

To the Code!

Other “Connectivity, Data, and Insight” Activities

May 21

Modernizing Your Lab Operations
10:15-11:15



Automating the Lab with SystemLink (Automotive Track)



Gaining Product Insight From Your Test Data
11:30-12:30

Generative AI to Accelerate Test Workflows
2:00-3:00



Modern Lab Operations with SystemLink: Hands-On
2:00-4:15



Maximize Your Lab with SystemLink Software
3:15-4:15

May 22

Analytics From Wafer To Reel To Strip (Semiconductor Track)
10:15-11:15



Modern Lab Operations with SystemLink: Hands-On
10:15-12:30



Modernizing Your Lab Operations
11:30-12:30

AI at the Edge
1:30-2:30



From Concept Through Execution: Analytics in Action

Analytics From Wafer to Reel to Strip

SystemLink Ask Me Anything
2:45-3:45



May 23, NIC

9:00-1:00

SystemLink User Group Meeting

0+ User Forum

New

SystemLink Learning Courseware (V/ILT)
Managing Systems and Assets with SystemLink Enterprise