

W  **L** 20142758  **ME**  **TO** **AUST**  **N**



CONNECT

Make Test Strategy a Differentiator for Your Business



AUTOMATION

Increase test coverage with software-connected and model-based test methodologies.

STANDARDIZATION

Drive organizational consistency in test processes, systems, software, and data.

DIGITAL TRANSFORMATION

Deploy and connect enterprise-wide tools for asset and data management and analytics.

BUSINESS PERFORMANCE

Realize the benefits of an intentional test strategy.



Reduce time to market



Deliver customer satisfaction



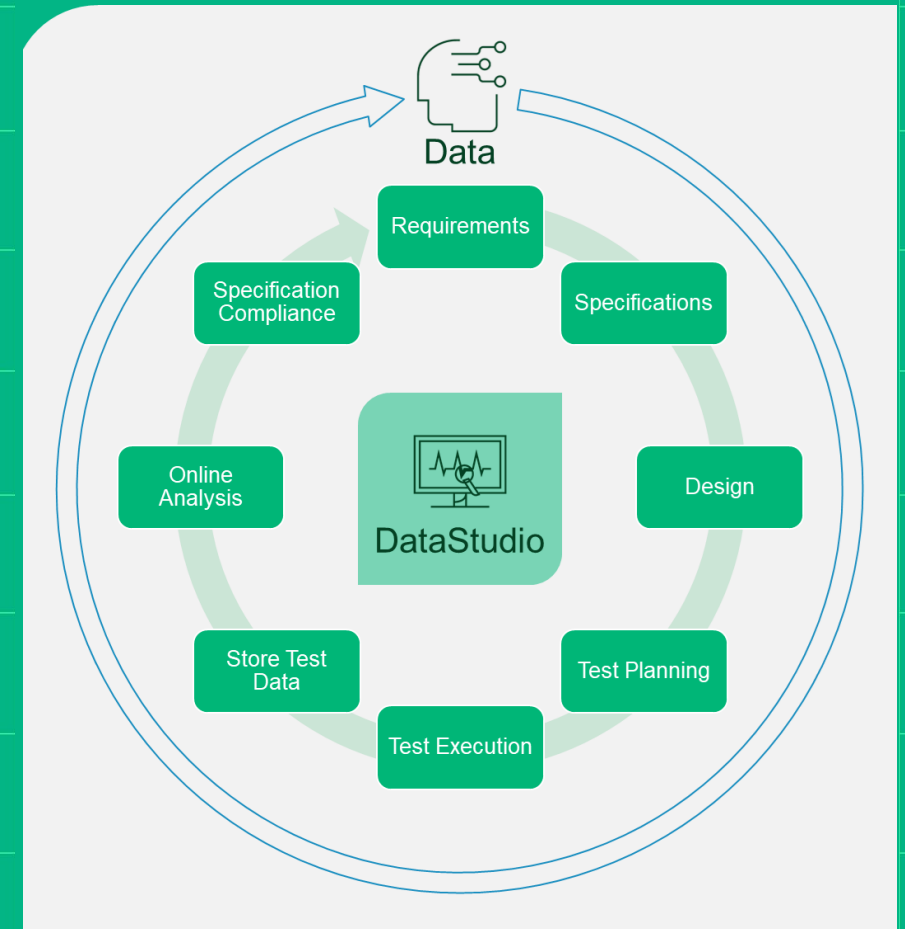
Improve the bottom line



Prepare for the future

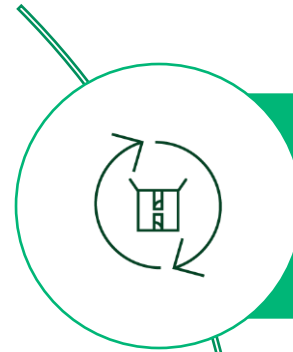
Data, Analytics, & Specification Management with DataStudio

Adam Arnesen
Chief Software Engineer



Agenda

A Product Lifecycle
Perspective



Product Engineering Lifecycle

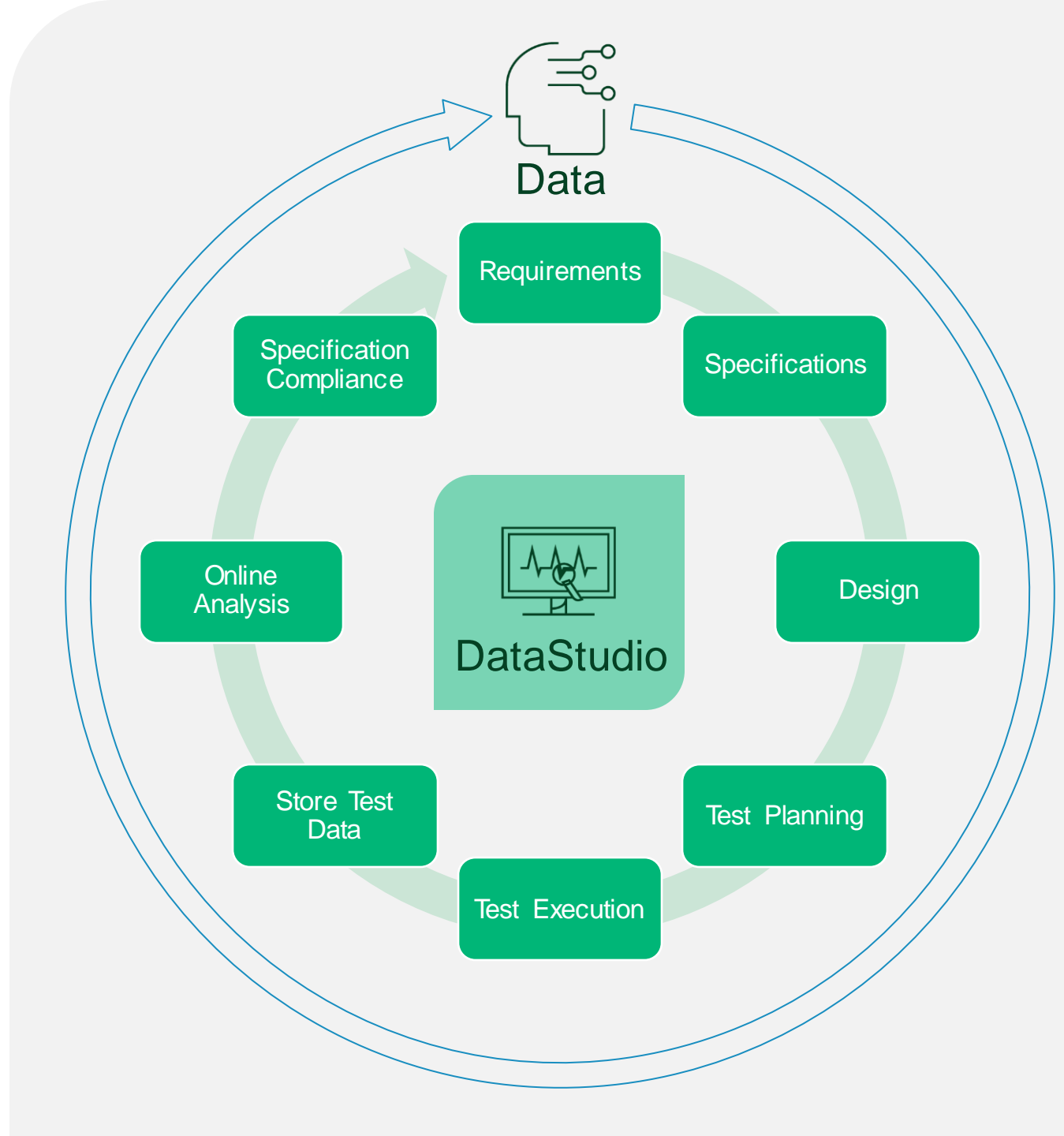


The Role of Data



Where DataStudio Fits

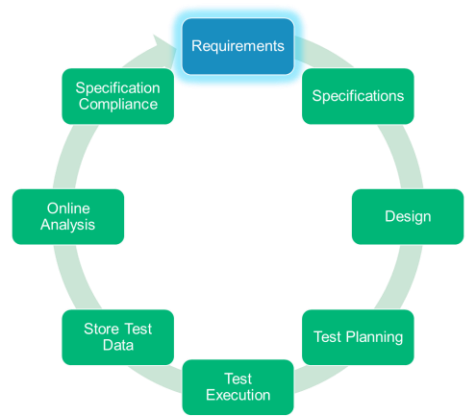
The Product Engineering Lifecycle





Requirements

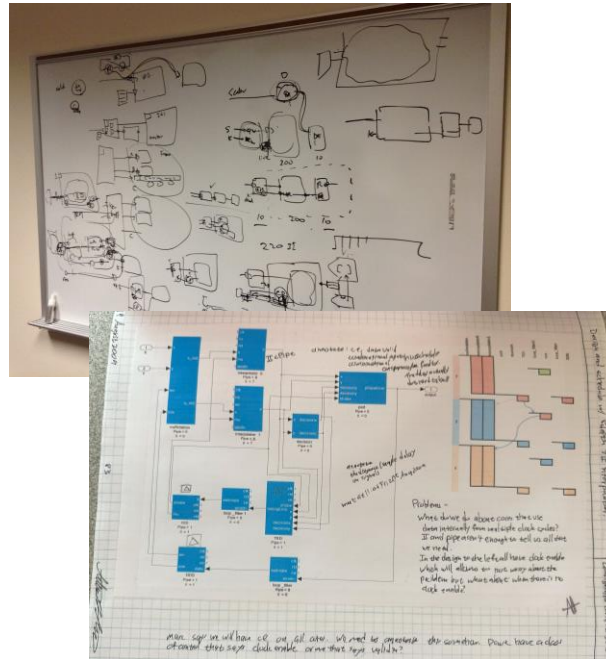
What is the product supposed to do?



Gather from Customer



Whiteboard + Paper



Requirements Software Tools



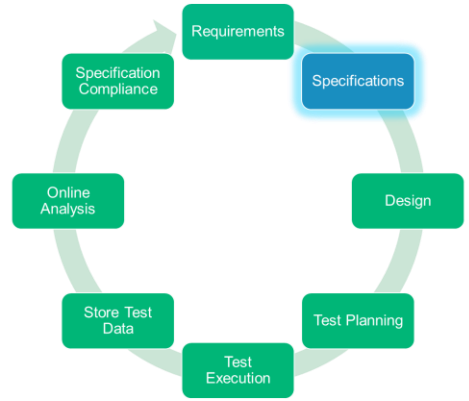
Not engineering centric

Tools not integrated with test systems.

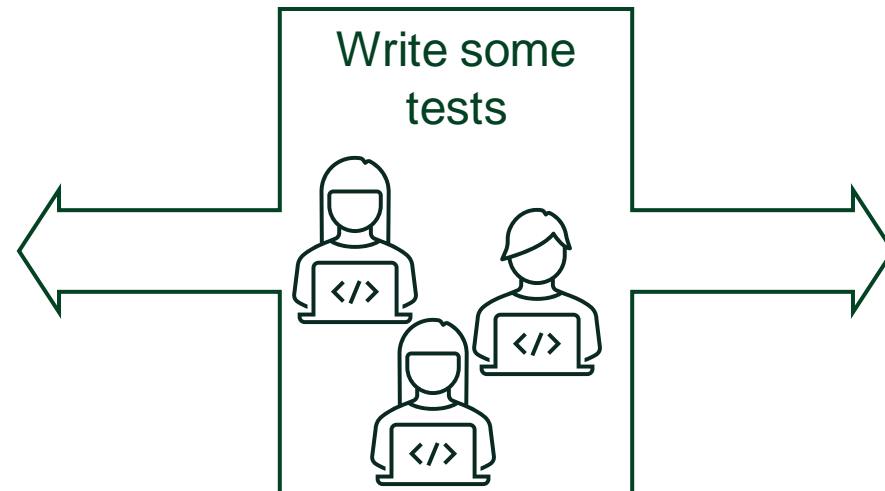
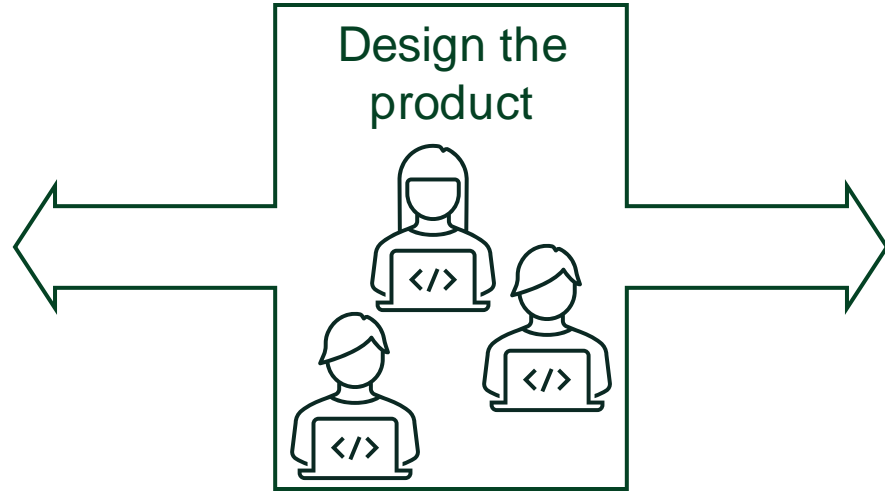
Often required by corporate for standards compliance (ex. ISO 26262)



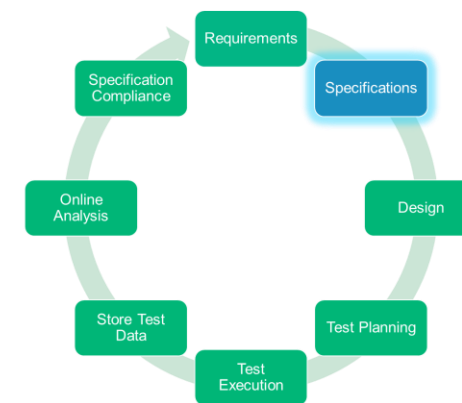
Just write some code



Requirements
Software Tools



Specifications – A better way



Requirements Software Tools



Specification Management Software



...engineering centric.

...numeric or functional.

...testable.

...connected to design and test.

Design Software

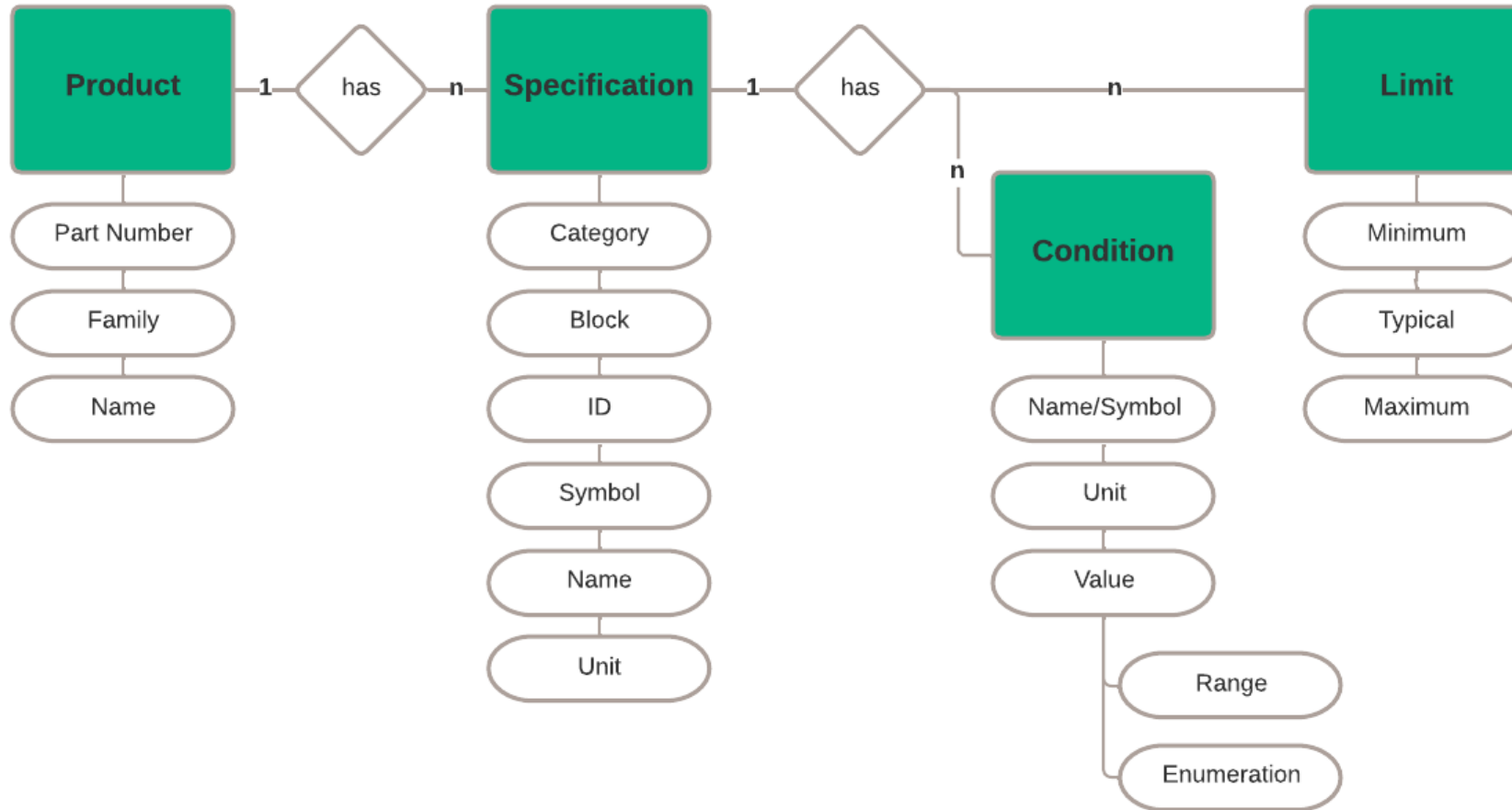
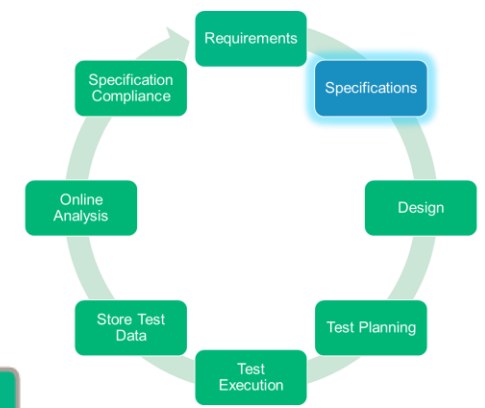


Test Software





The Spec Data Model





Specifications

Spec Compliance Manager

Team Edition

Create and Manage Specifications

Upload parametric test data

Automatically compute compliance

Built-in and custom statistics

Custom Reporting



All Products > Example Opamp

→ View Categories ✓ Compliance View 🕒 23 Mar 2023, 09:22 🔄

Input ⓘ Parametric

		VA Validation					
		Health	Coverage	Cpk	Min	Max	Mean
<input type="checkbox"/>		✓	NA	2.065440582...	4.5647524761...	14.070464891...	9.75
<input type="checkbox"/>	█	⚠	NA	0.671660439...	-13.00051275...	57.55309894...	11.120689655...
<input type="checkbox"/>	█	⚠	NA	1.0294117647...	-2.75646620...	36.256320871...	8.8653846153...
<input type="checkbox"/>		✓	NA	4883605.166...	2.1790522663...	4.093288553...	3.4e-07
<input type="checkbox"/>		✓	NA	2.0368714756...	7.61488418138...	13.2903011601...	10.3
<input type="checkbox"/>		✓	NA	2.11623010459...	9.0843291563...	11.09318831164...	9.999999999...
<input type="checkbox"/>		✓	NA	2.0610241018...	8.965970500...	10.1575134886...	9.599999999...

Create Specifications

All Products > Example Opamp Adam Arnesen

Specifications View READ-ONLY Spec Source: Excel UPDATE SPECS

Input Parametric

Spec Details			Spec Conditions		Spec Limits				
Spec ID	Block	Spec Symbol	Spec Name	Vs (V)	Temp (°C)	Min	Typical	Max	Unit
Spec_01	-	Vos	Input Offset Vol.	[15]	[25]	-	10	25	µV
Spec_02	-	Vos	Input Offset Vol.	[15]	[-55,25,155]	-	25	60	µV
Spec_03	-	Vos	Input Offset Vol.	[15]	[-25,25,85]	-	10	45	µV
Spec_04	-	enp-p	Input Noise Volt.	[15]	[25]	-	0.35	0.6	Vpp
Spec_05	-	en	Input Noise Volt.	[15]	[25]	-	10.3	18	nV/rHz
Spec_06	-	en	Input Noise Volt.	[15]	[25]	-	10	13	nV/rHz

Output Parametric

Drill Down to Compliance Details

Input Parametric VA Validation

Vos - Input Offset Voltage

Health: **Fail** Coverage: NA Cpk: **0.671660439665678**

Compliance

Min	-13.0005127576655	Max	57.5530989436452	Mean	11.120689655172
Median	8.15484713891006	% Spec Range Used	-	Standard Deviation	13.873706139661

Drilldown Activity

The conditions will be included/excluded for health calculation based on the condition mapping: [Map Conditions](#)

Conditions		Compliance parameters				
Ta (°C)	Supply Voltage (V)	Min	Max	Mean	Cpk	Standard Deviation
Included (8)						



Demo

Specification Creation

Specification Compliance Manager

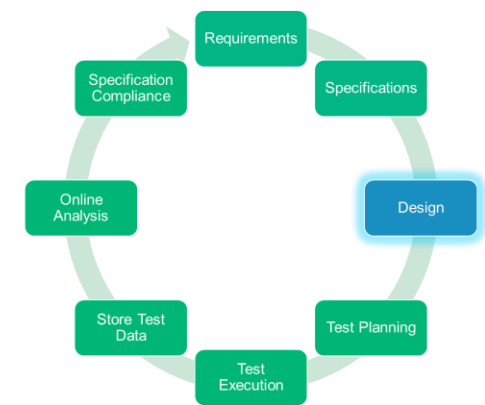


Demo

Specification Creation

1. Create specifications in Excel
2. Upload specifications
3. View specifications
 1. Name
 2. Symbol
 3. Conditions
 4. Limits
4. Access specifications via API

Data during product design



Specification Management Software

Measurements to simulate

Conditions to simulate under

Limits to apply

Design Software

cādence®  SOLIDWORKS

SYNOPSYS®



- Limits and conditions are variables in simulation
- Simulated data is associated with spec id
- Log in standard formats
- Include simulation metadata
- Upload to central storage

Engineering Data Management Software

Store simulated parametric values

Store simulated raw data

Map data to specifications

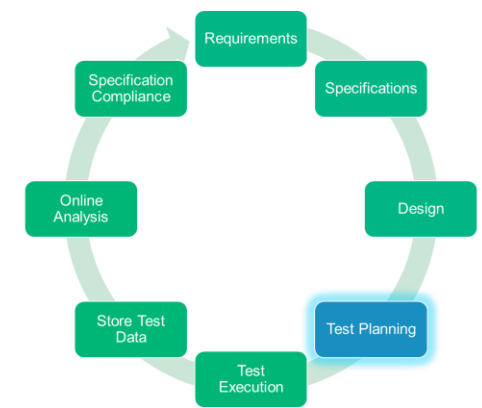


Validation Test Planning

Based on specifications

Which conditions do I need to test under?

Create / reuse / compose actual test code



All Products > Example Opamp Adam Arnesen

Specifications View READ-ONLY Spec Source: Excel UPDATE SPECS

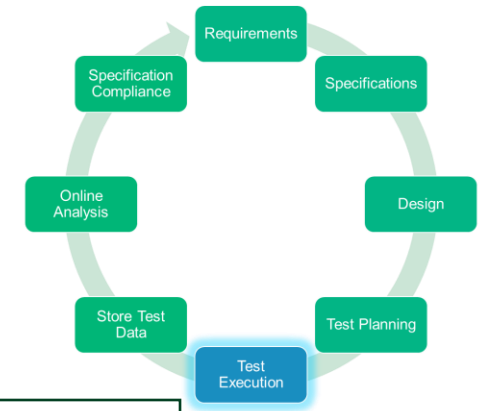
Input Parametric

Show/Hide Columns

Spec Details				Spec Conditions		Spec Limits			
Spec ID	Block	Spec Symbol	Spec Name	Vs (V)	Temp (°C)	Min	Typical	Max	Unit
Spec_01	-	Vos	Input Offset Volt...	[15]	[25]	-	10	25	µV
Spec_02	-	Vos	Input Offset Volt...	[15]	[-55..25..155]	-	25	60	µV
Spec_03	-	Vos	Input Offset Volt...	[15]	[-25..25..85]	-	10	45	µV
Spec_04	-	enp-p	Input Noise Volt...	[15]	[25]	-	0.35	0.6	Vpp
Spec_05	-	en	Input Noise Volt...	[15]	[25]	-	10.3	18	nV/rHz
Spec_06	-	en	Input Noise Volt...	[15]	[25]	-	10	13	nV/rHz

Output Parametric

Validation Testing



Specification Management Software

- Measurements to take
- Conditions to test under
- Limits to apply

Test Software

- Limits and conditions are variables in test code
- Test data is associated with spec id
- Log in standard formats
- Include test metadata
- Upload to central storage

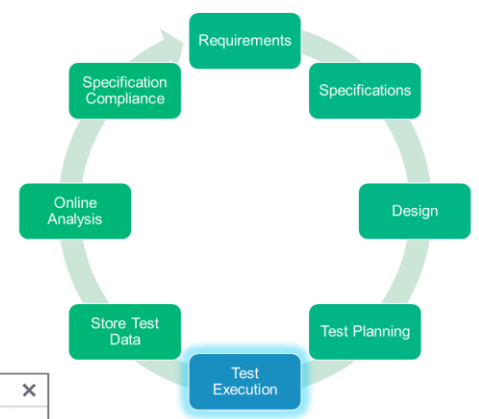
Engineering Data Management Software

- Store parametric test data: measurements, etc.
- Store raw measurements
- Map parametric data to specs



Validation Testing

DataStudio + TestStand



All Products > Example Product

Adam Arnesen

Specifications View | READ-ONLY | Spec Source: Excel | UPDATE SPECS

Input Parametric

Spec Details			Spec Conditions		Spec Limits			
Spec ID	Block	Spec Symbol	Spec Name	Vs (V)	Temp (°C)	Min	Typical	Max
Spec_01	-	Vos	Input Offset Vo...	[15]	[25]	-	10	25
Spec_02	-	Vos	Input Offset Vo...	[15]	[-55.25.155]	-	25	60
Spec_03	-	Vos	Input Offset Vo...	[15]	[-25.25.85]	-	10	45
Spec_04	-	enp-p	Input Noise Vol...	[15]	[25]	-	0.35	0.6
Spec_05	-	en	Input Noise Vol...	[15]	[25]	-	10.3	18

Output Parametric

Manage Specifications...

Connect to DataStudio

Server:

API Key:

Connect

Help OK Cancel

Manage Specifications...

Select product and categories.

Product:

Categories:

Fetch

Success! Click OK to add the following product information to your sequence.

Product: SimplePart

Categories: mechanical characteristics, amet

Help OK Cancel

Simple Text Report Options

Report Directory:

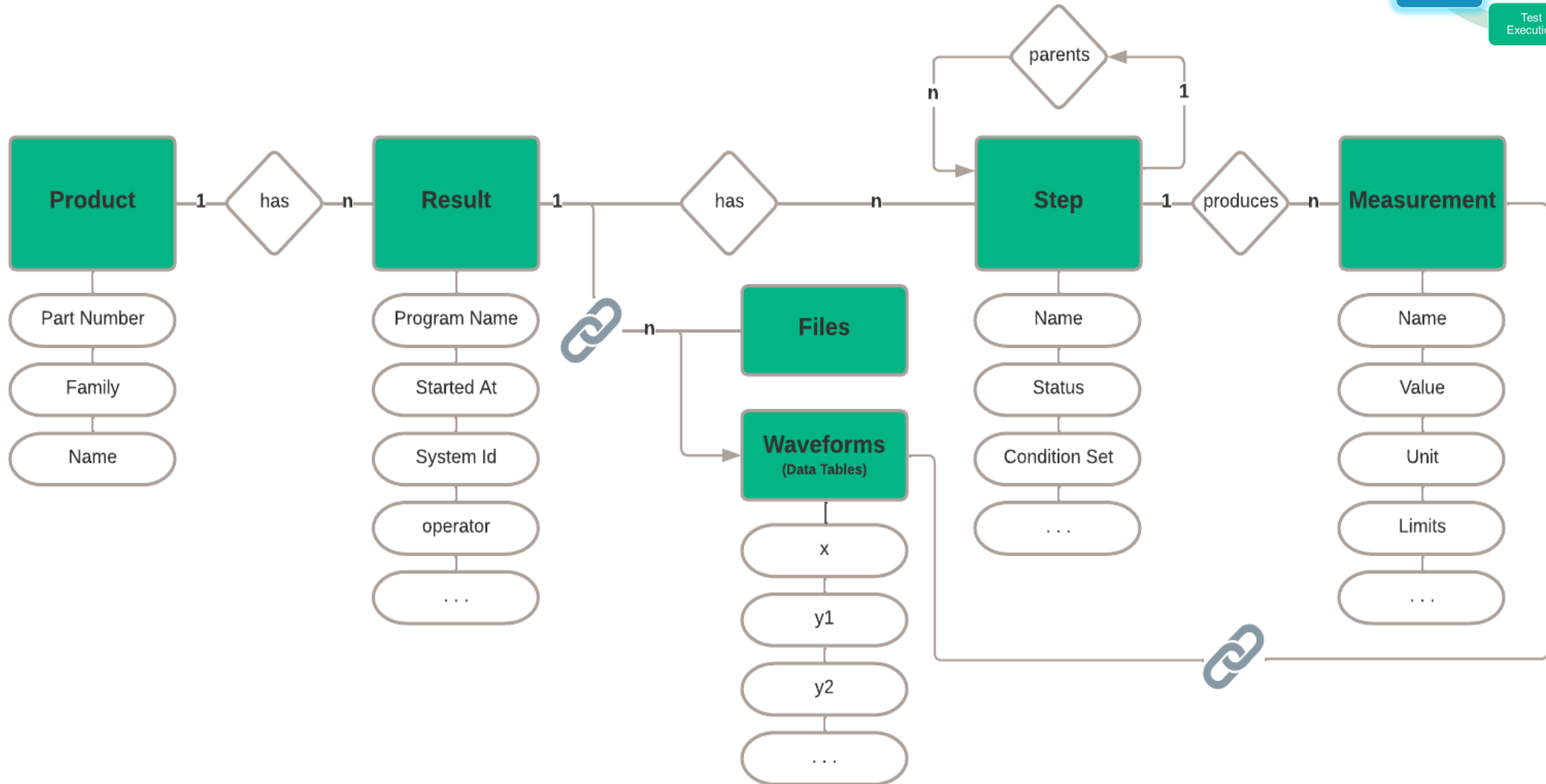
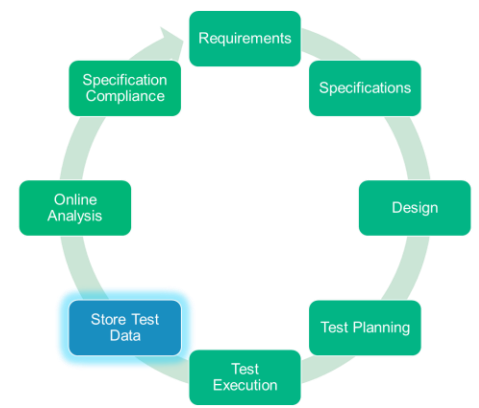
Report Filename:

Upload File To SCM

Help OK Cancel

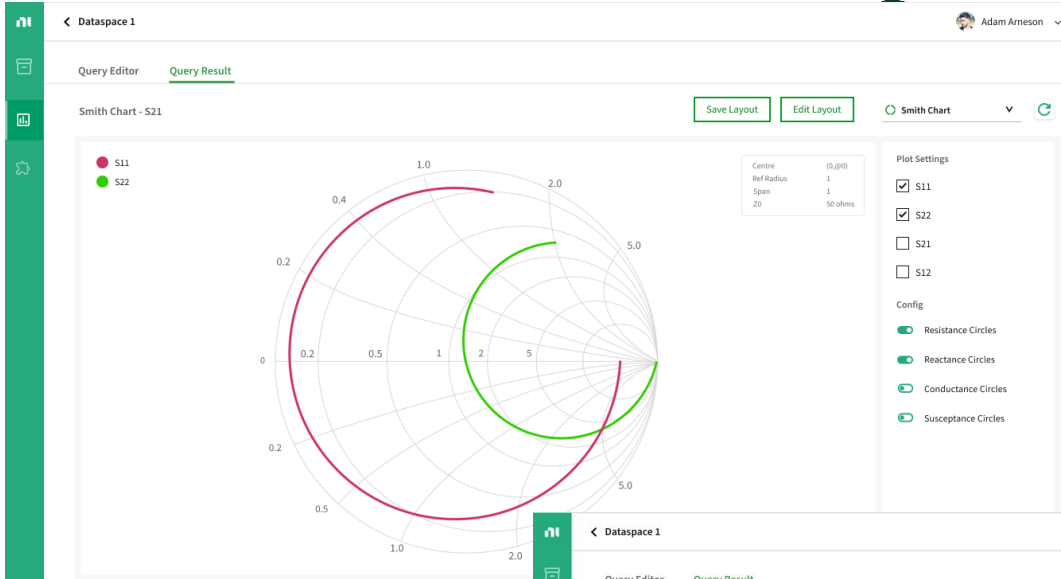
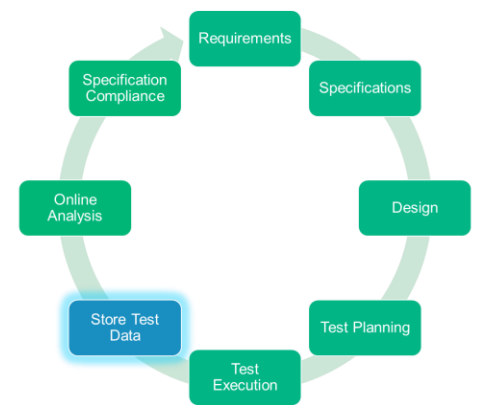


The Test Data Model

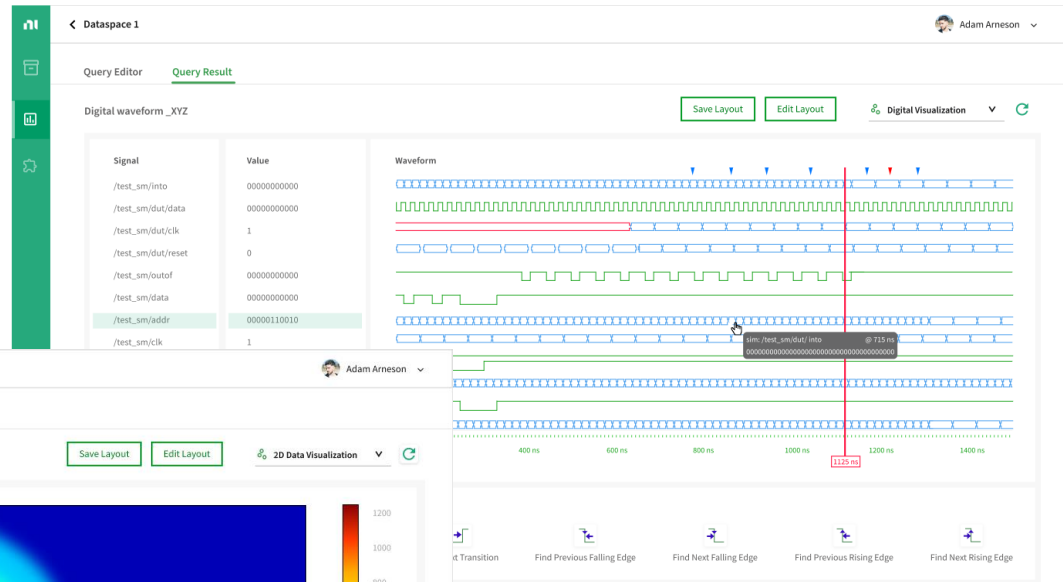




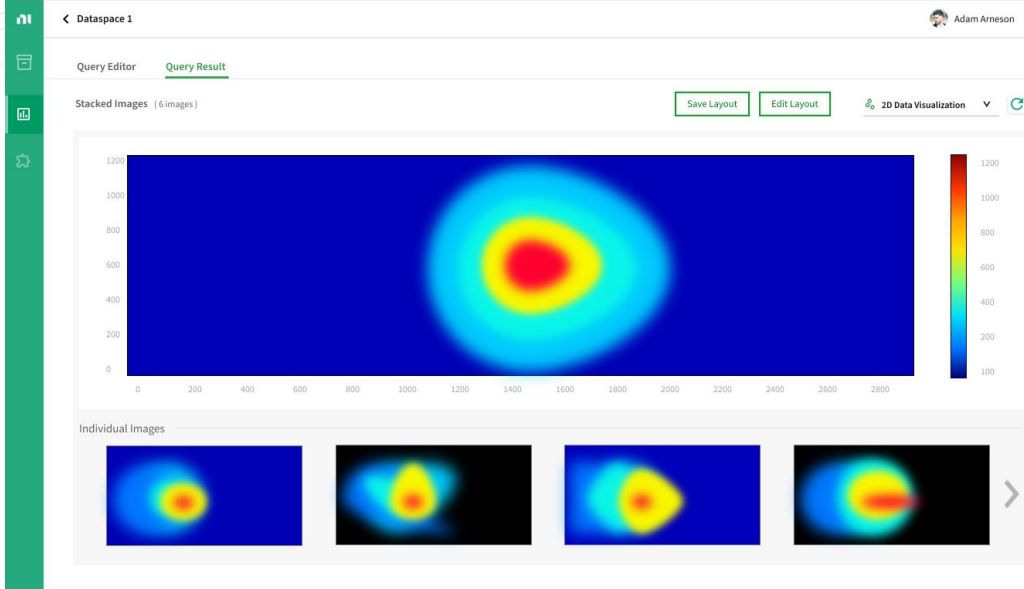
Other Raw Data Shapes



S-Parameters



Digital Waveform



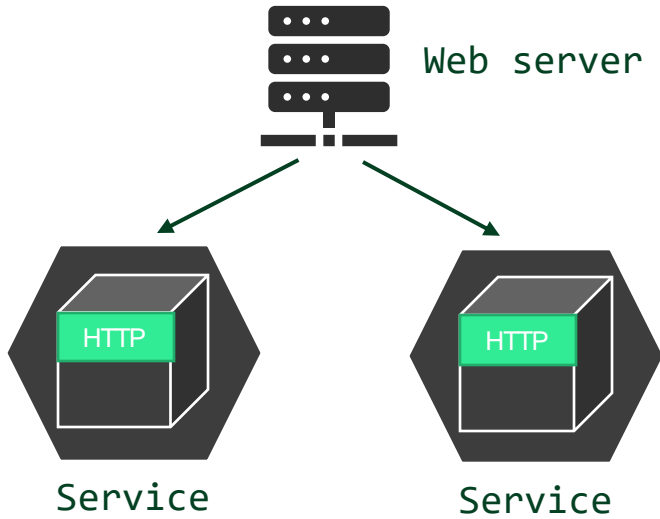
2D Arrays (Images)



The Enterprise Architecture

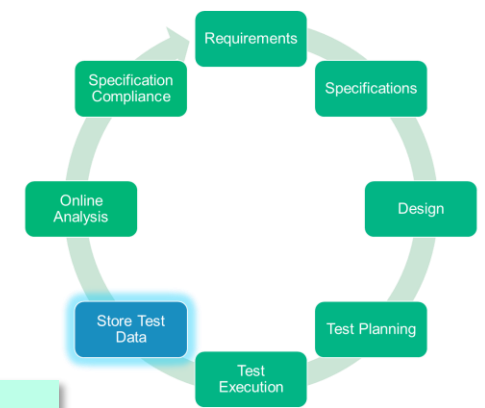
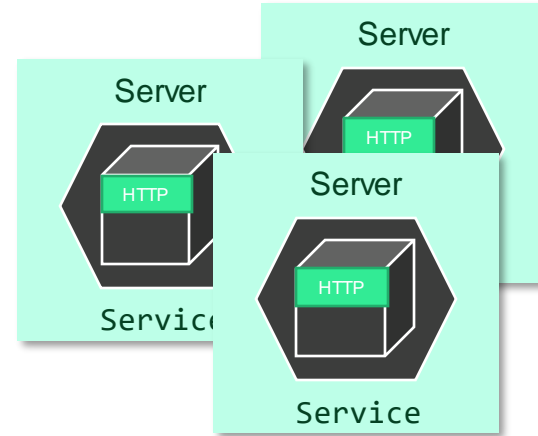
Dynamic Load Balancing

for Reliability & Failover/Continuity



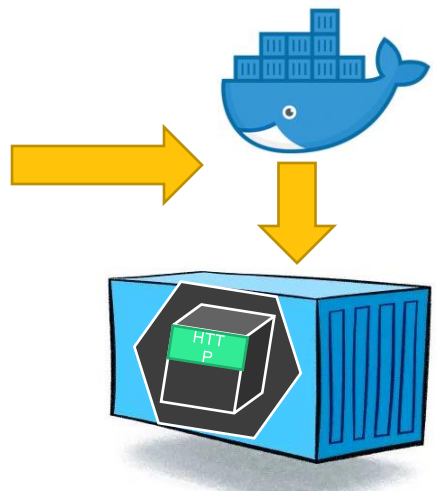
Distributed Services

for Scalability & Performance



Containers

for Modularity / Quality / Efficiency



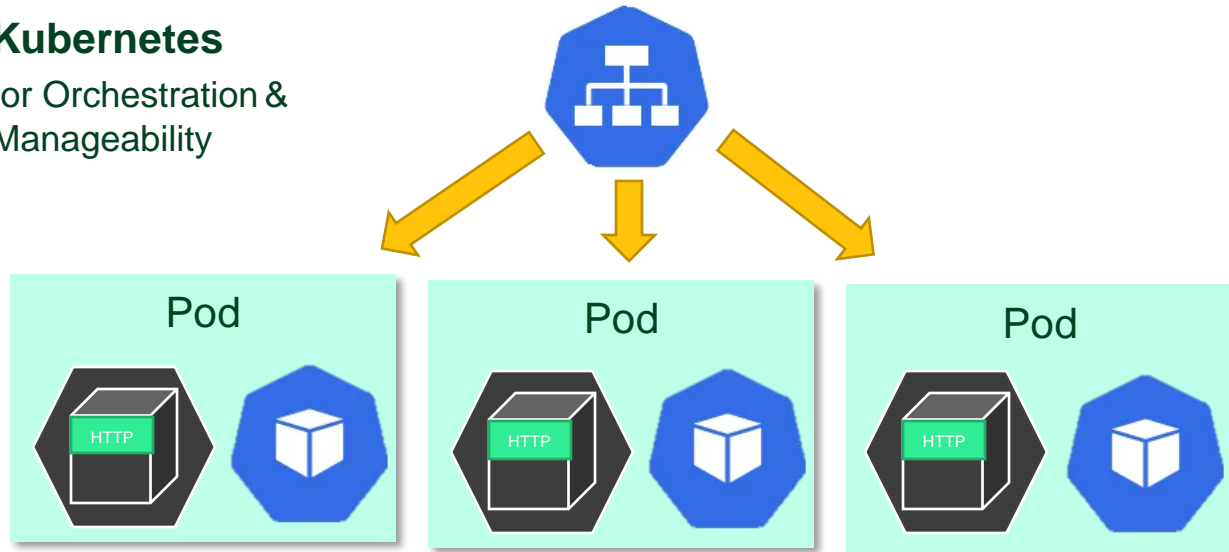
```

DockerfileLinux X
SystemsManagementService > DockerfileLinux X ...
1 FROM mcr.microsoft.com/dotnet/core/sdk:3.1-focal AS builder
2 COPY NuGet.Config /app/
3 COPY NuGet-Config /root/.nuget/NuGet/
4 COPY VersionInfo.targets /app/
5 COPY BuildTools /app/BuildTools/
6 COPY *.csproj /app/SystemsManagementService/
7 COPY *.sln /app/SystemsManagementService/
8
9 WORKDIR /app/SystemsManagementService
10
11 RUN dotnet restore
12
13 COPY SystemsManagementService /app/SystemsManagementService/
14 RUN dotnet build
15
16 FROM mcr.microsoft.com/dotnet/core/aspnet:3.1-focal
17 WORKDIR /app
18 COPY --from=builder /app/SystemsManagementService/SystemsManagemen
19
20 EXPOSE 13100
21 CMD [" /app/NationalInstruments.SystemsManagementService.WebApi"]

```

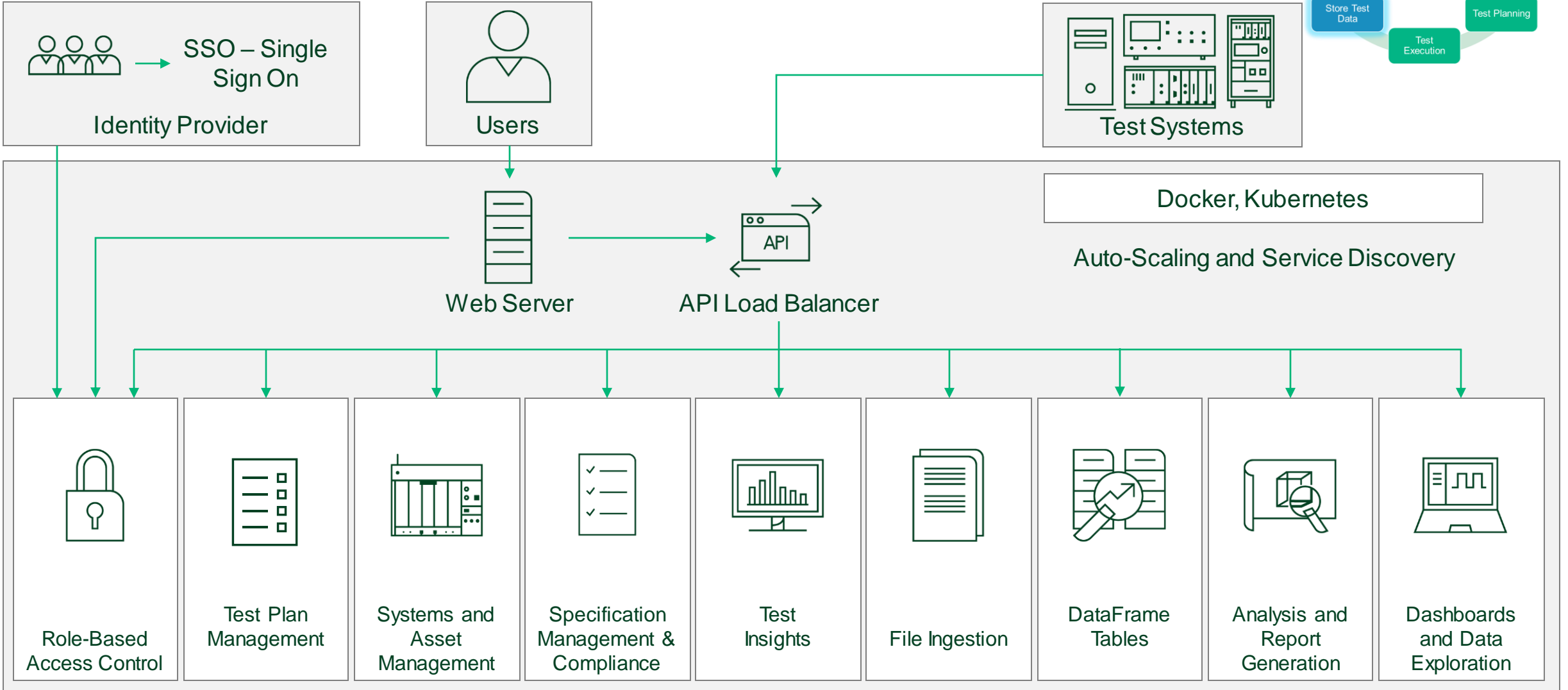
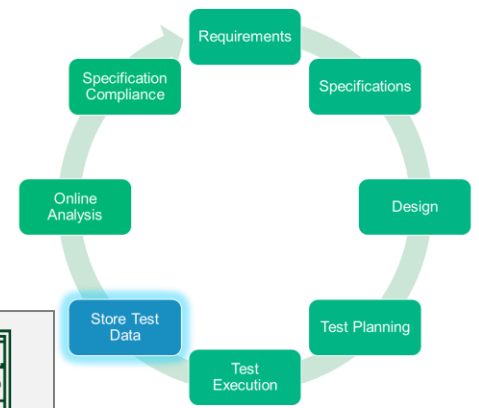
Kubernetes

for Orchestration & Manageability





The Enterprise Architecture





Enterprise IT Integration

Aligned with IT and industry-standard best practices

Scalable to support big data, 1000s of users, and 1000s of connected systems

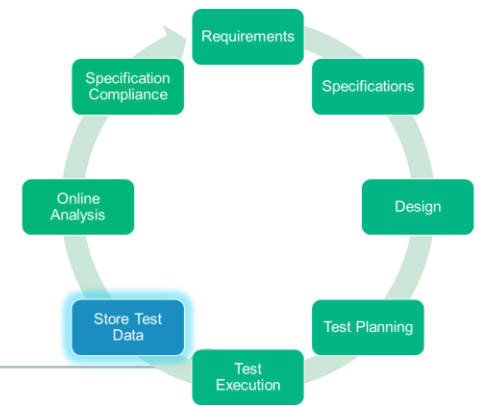
Services and web applications hosted in Linux containers

Support for high availability and horizontal scalability out of the box

Execute 100s of concurrent analysis routines to transform data & produce reports

RBAC to limit access to data sets to different groups of users

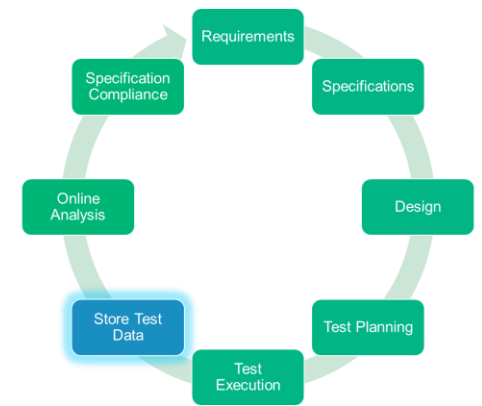
Integrates with standard off the shelf observability tools and single sign on (SSO)





Store Test Data

Data Ingestion



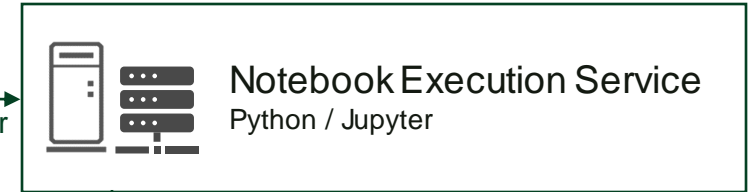
File-based Ingestion



Upload

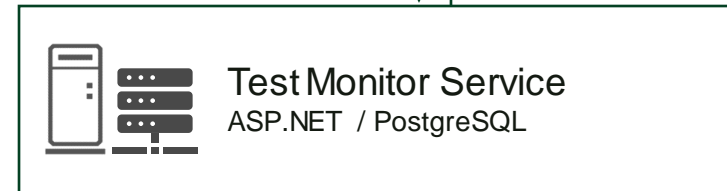


Trigger



Parametric Data

Waveforms

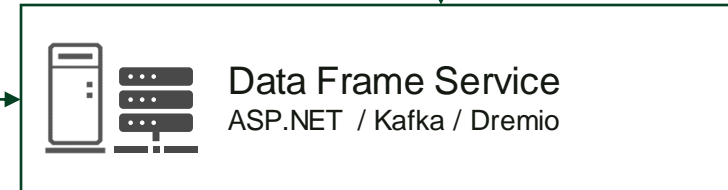


API Based Ingestion

TestStand, LabVIEW,
.NET, Python
SystemLink Client



HTTP(s)





Viewing Test Data



Products



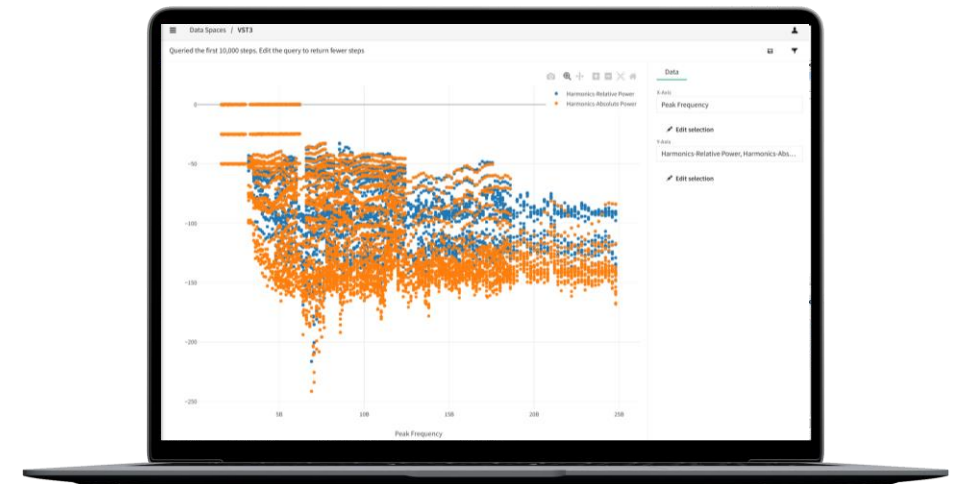
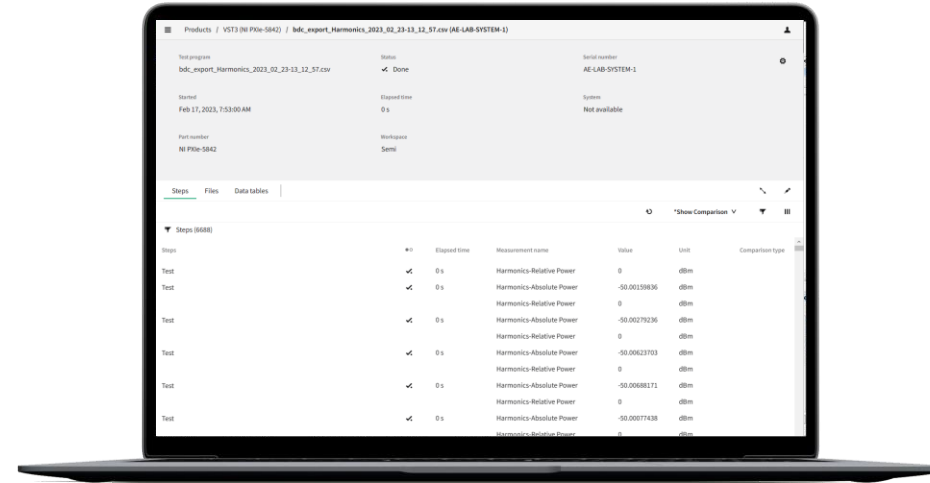
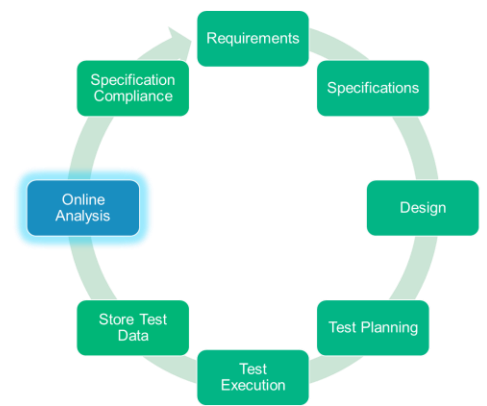
Results



Steps



Charts and Graphs

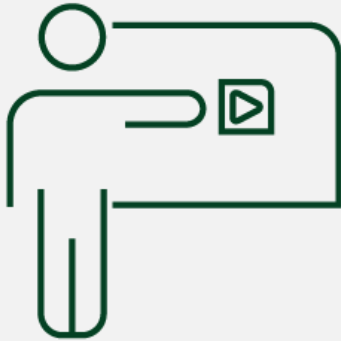




Demo

File, Ingestion, Test Results, Steps, Charts
and Graphs

Engineering Data Management



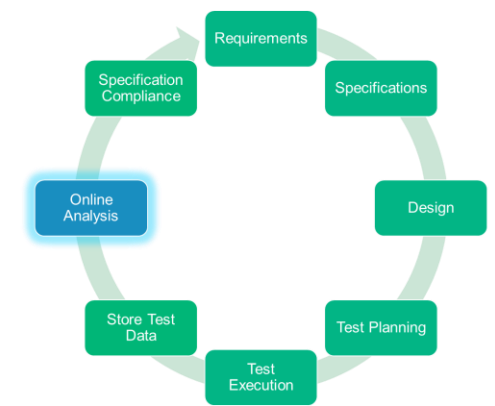
Demo

Data Management

1. Ingest files
2. Tabular Views
 1. Test Results
 2. Test Steps
3. Charts & Graphs
 1. Data spaces
 2. Any-vs-any plotting



Roadmap – Enterprise Data Scales



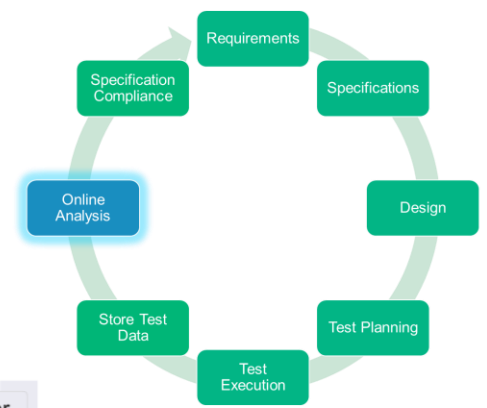
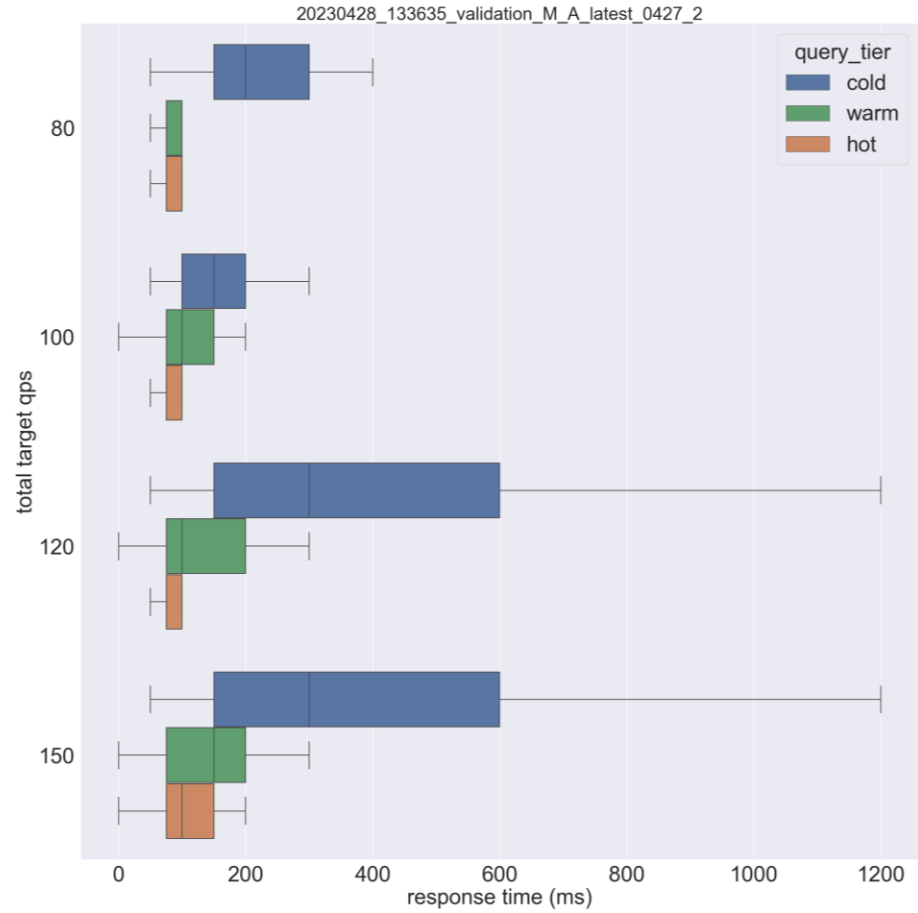
Metric	Min	Small	Medium	Large
Concurrent Users	100	200	500	1000
Products / year	2	20	40	400
Results / year	5k	50k	100k	1M
Measurements / year	40M	100M	1B	25B
Ingestion peak (measurements / sec)	100	200	400	2000
3 Year Retention Totals				
Results	15k	150k	300k	3M
Measurements	120M	300M	3B	75B



Validation Medium - 3 Billion Measurements

Data Size	3 B Rows
QPS Target	100
vCPU	68
RAM	237 GB
Disk	3 TB
S3	300GB

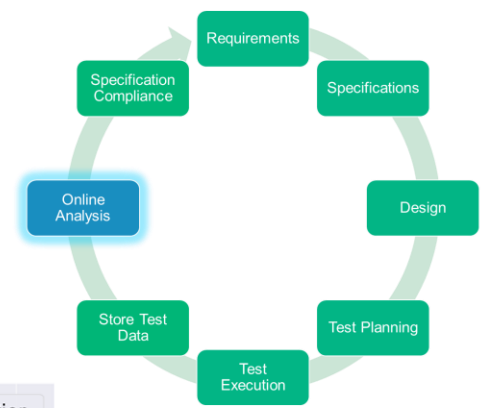
Validation Medium PDV queries



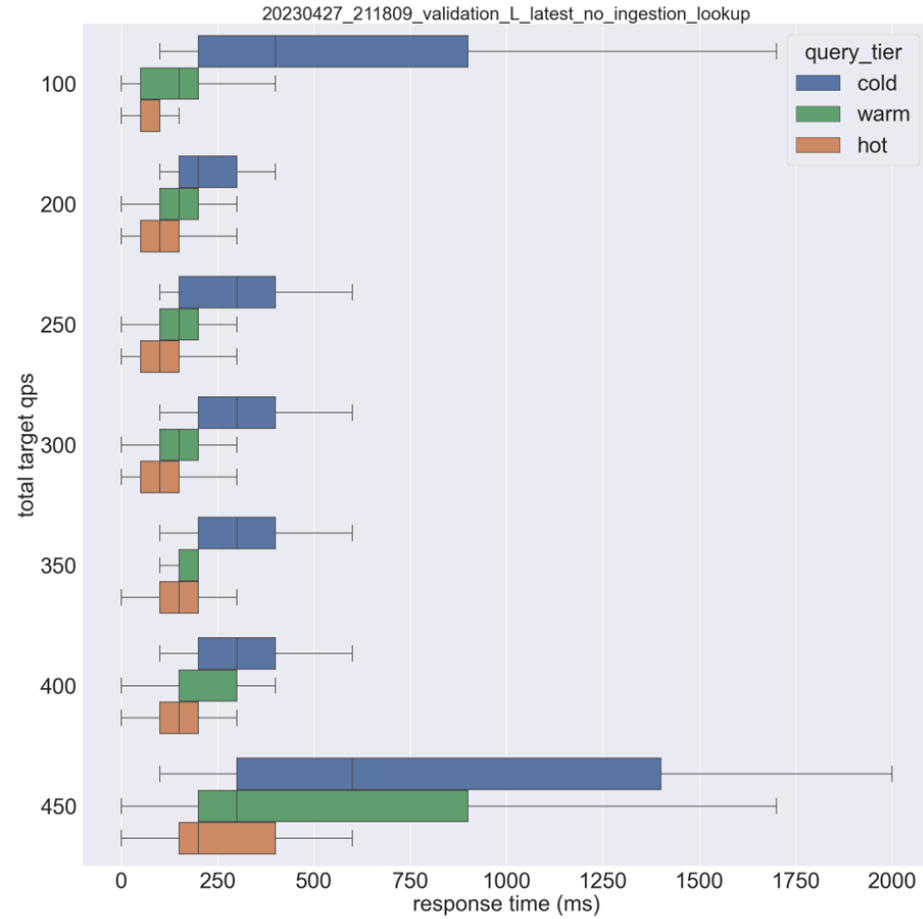


Validation Large - 75 Billion Measurements

Data Size	75 B Rows
QPS Target	300
vCPU	444
RAM	4 TB
NVMe	76 TB
S3	7 TB



Validation Large PDV queries



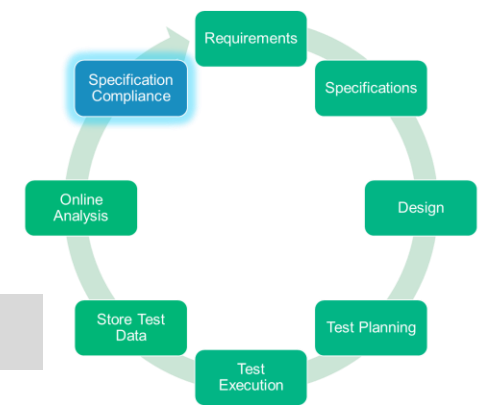
Spec Compliance and Coverage

Compliance

- Are all the measurements that I've captured for this device within the limits set by the specs?
- Under what conditions does this device...
 - ... fail to meet specifications?
 - ... come too close to limits?
- Should we ...
 - ... adjust specifications?
 - ... revisit aspects of the design?
 - ... double check test parameters?

Coverage

- Did I test under all condition combinations?
- How much more testing do I need to do?





Demo

Specification Compliance

Specification Compliance Manager



Demo

Specification Compliance

1. Connect measurement data
2. Compliance against limits
3. Coverage of condition space
4. Error case drill-down

Data...

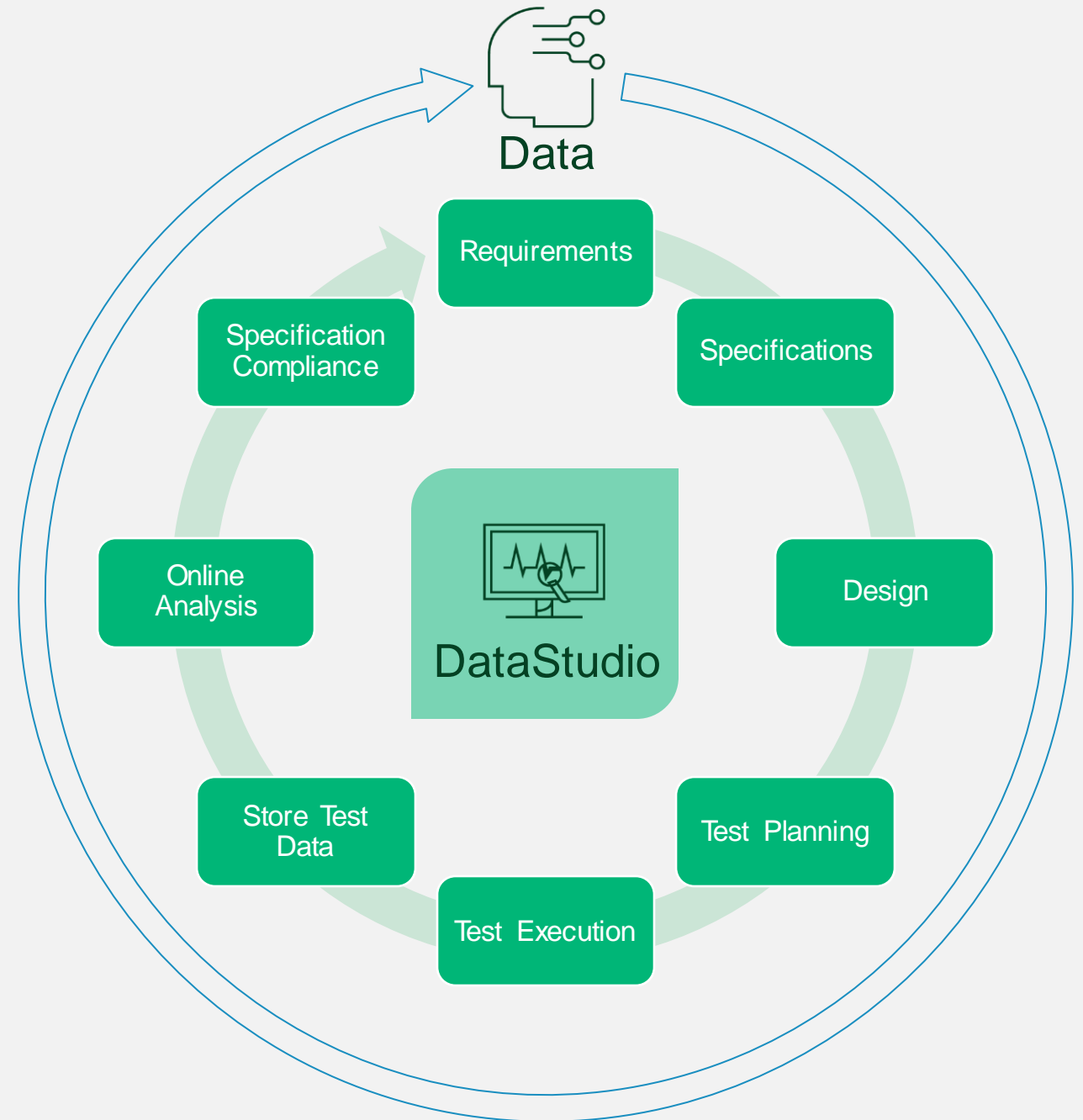
...is the common thread through the product lifecycle.

...should be considered before, during, and after each phase.

... should be managed with connected management systems.

... scale requirements need to be well understood.

... should conform to a structured, intentional model.





Questions?



SystemLink Expert Panel and AMA (Ask Me Anything)

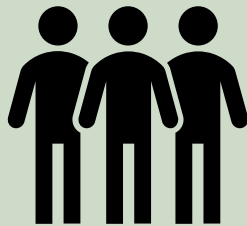
Join SystemLink experts from NI partners, R&D, product marketing, and services to discuss the current and future state of SystemLink. Hear perspectives on data management best practices, the role of AI in the future of test and measurement, and exciting features on the SystemLink roadmap.

When: Wednesday, May 24th
3:30 to 4:30 PM

Where: Ballroom G, ACC

Audience:

- Existing SystemLink customers interested in expanding their skills and hearing from experts on best practices
- Validation and production engineers interested in understanding more about data management, analytics, or asset management
- Anyone with curiosity or questions around the future of software-driven test, validation and production



Panelists:

Joshua Prewitt, Chief Product Manager at NI

Barry Hutt, CRO and Co-Founder for Viviota Software

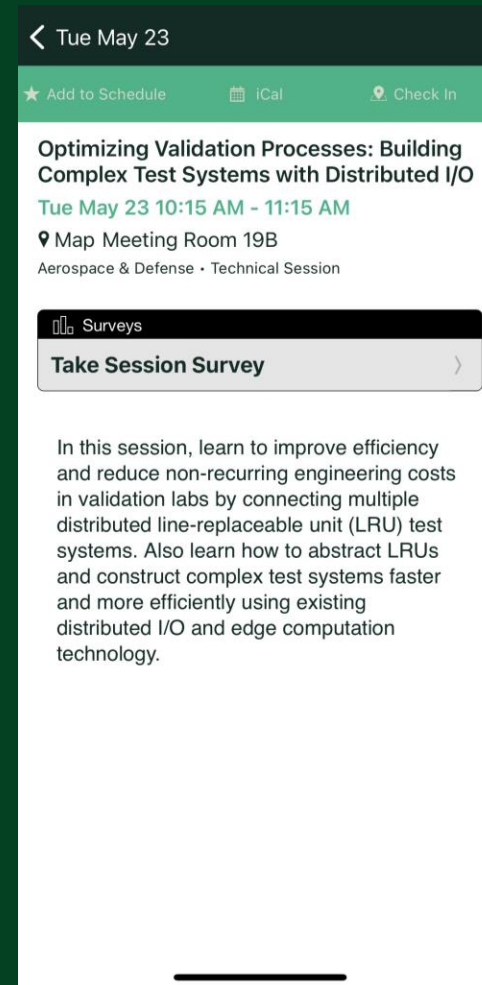
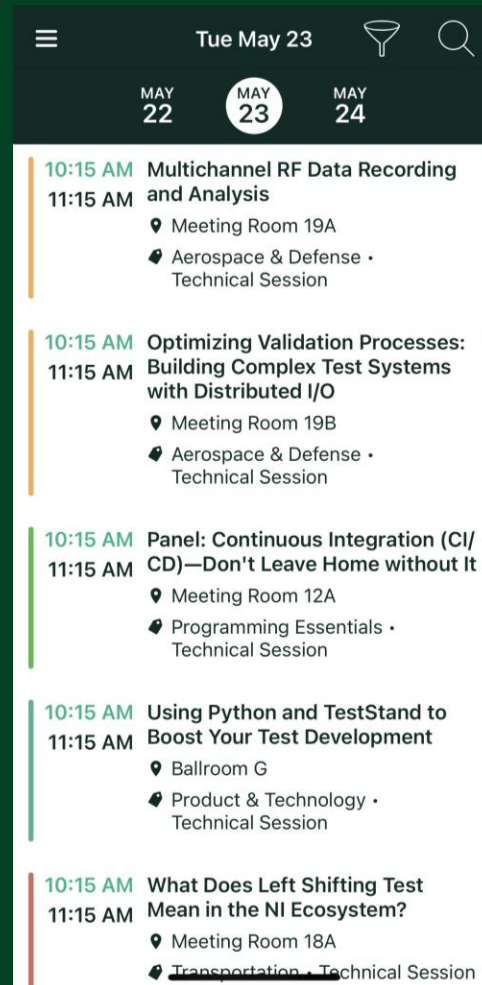
Matthew Vaterlaus, Chief Engineer for SystemLink

Matt Holt, Principal Solutions Architect

Panel Moderator: Zoe Bohnen, Manager of Customer Success

Give us your feedback! Quick 2 Question Survey

In the mobile app,
click into the
session you would
like to provide
feedback for



Click “Take the
Session Survey”