

Beyond the language

Using REST API's
to automate
clinical trial analysis

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Agenda



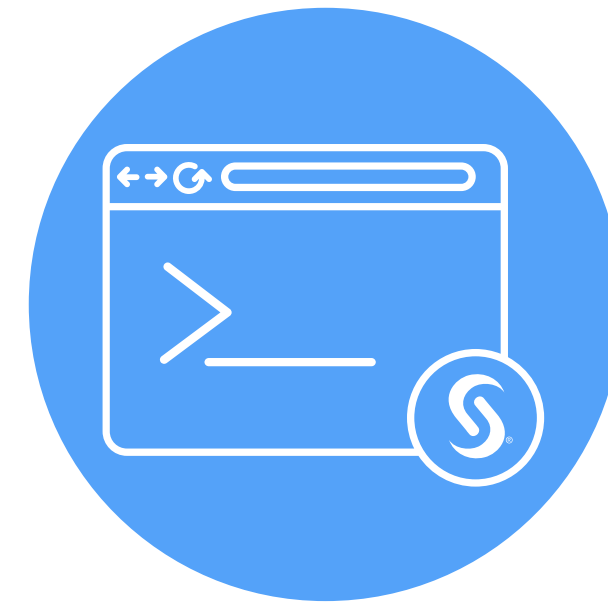
Introduction
and Trends



OPEN
Source and
REST APIs



Synthetic
Data
Case
example
LSAF – Viya
Integration



Remote
Access to
LSAF



Summary

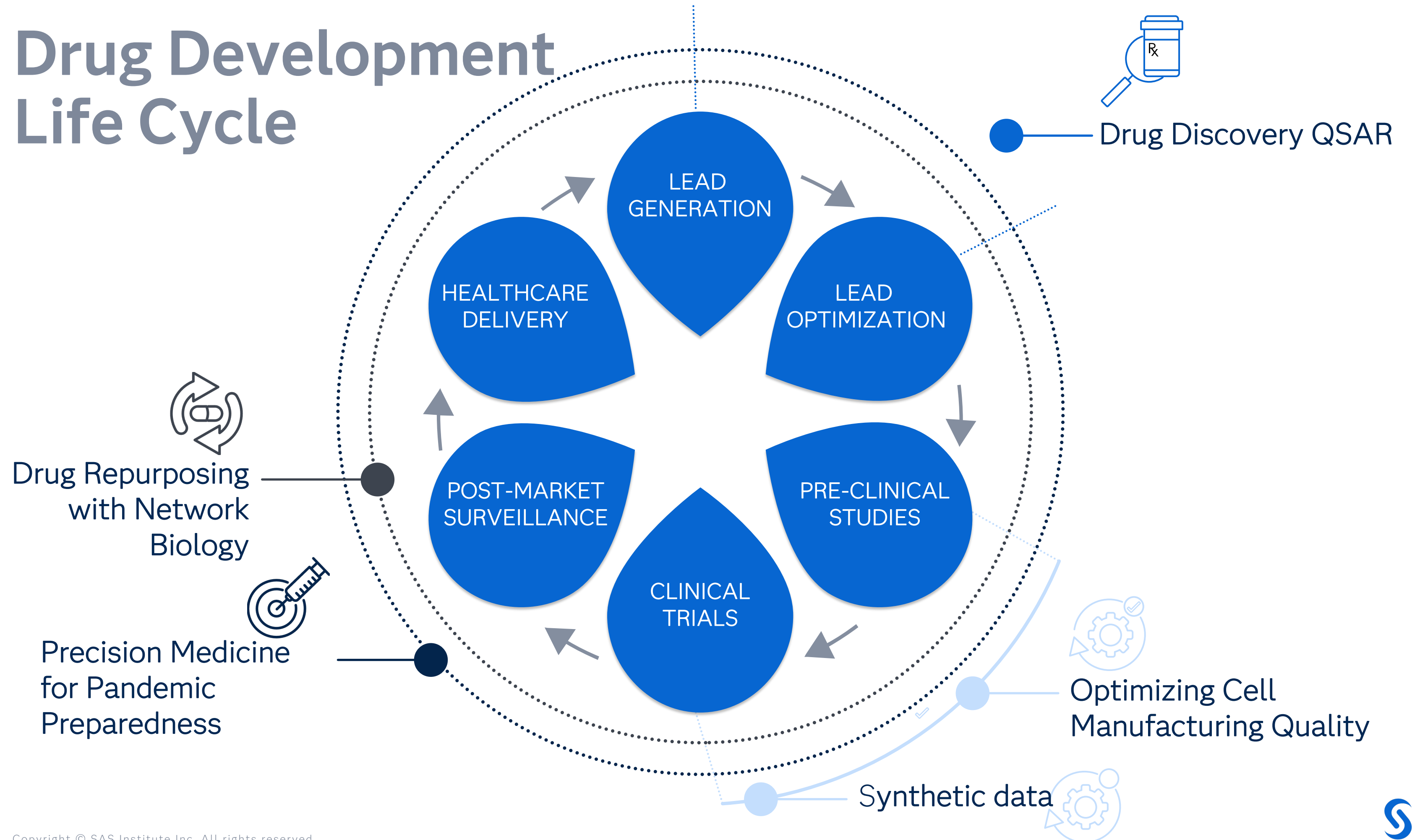
Technology is a means to an end



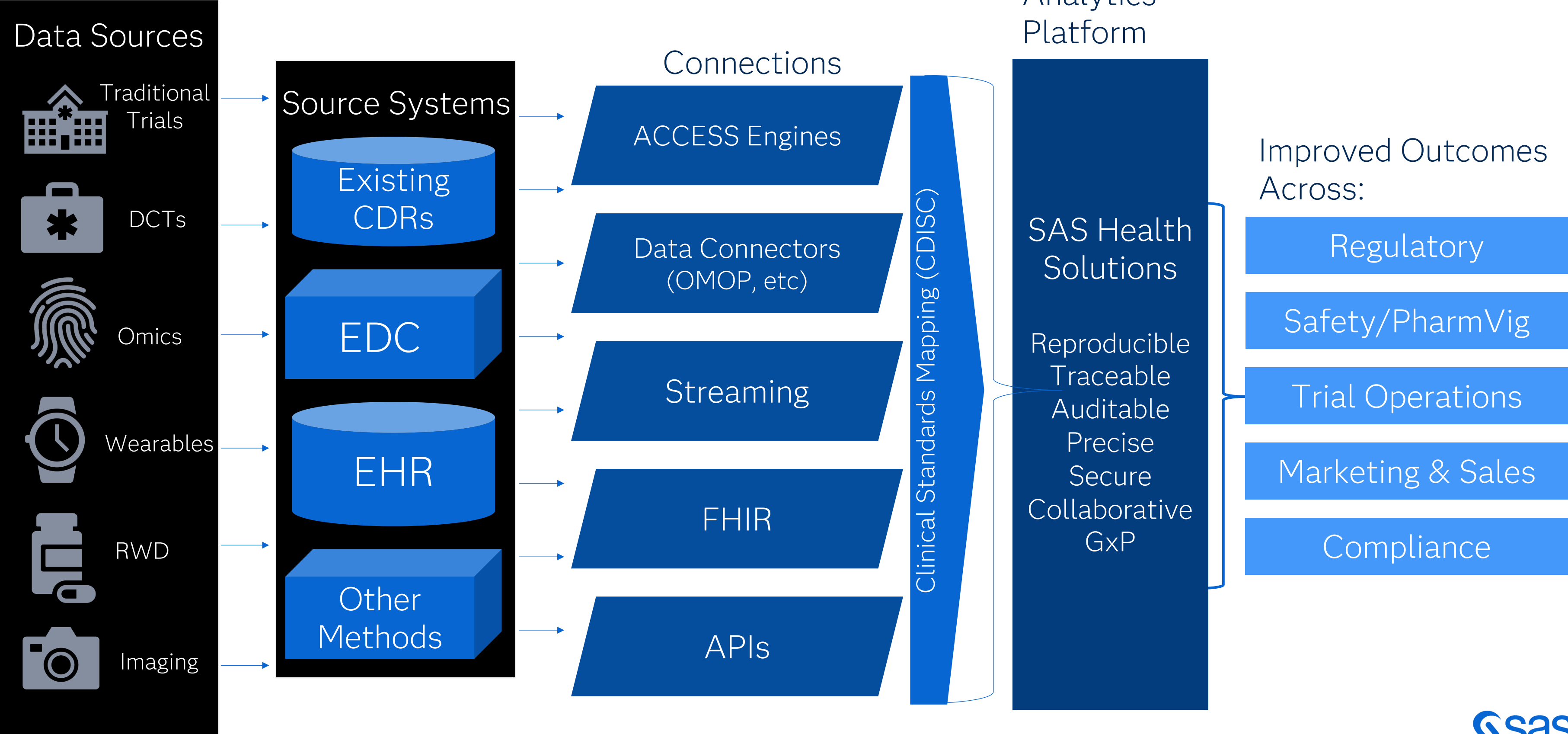
The real reason we are here is to deliver lifesaving medications to people

Introduction and Trends

Drug Development Life Cycle



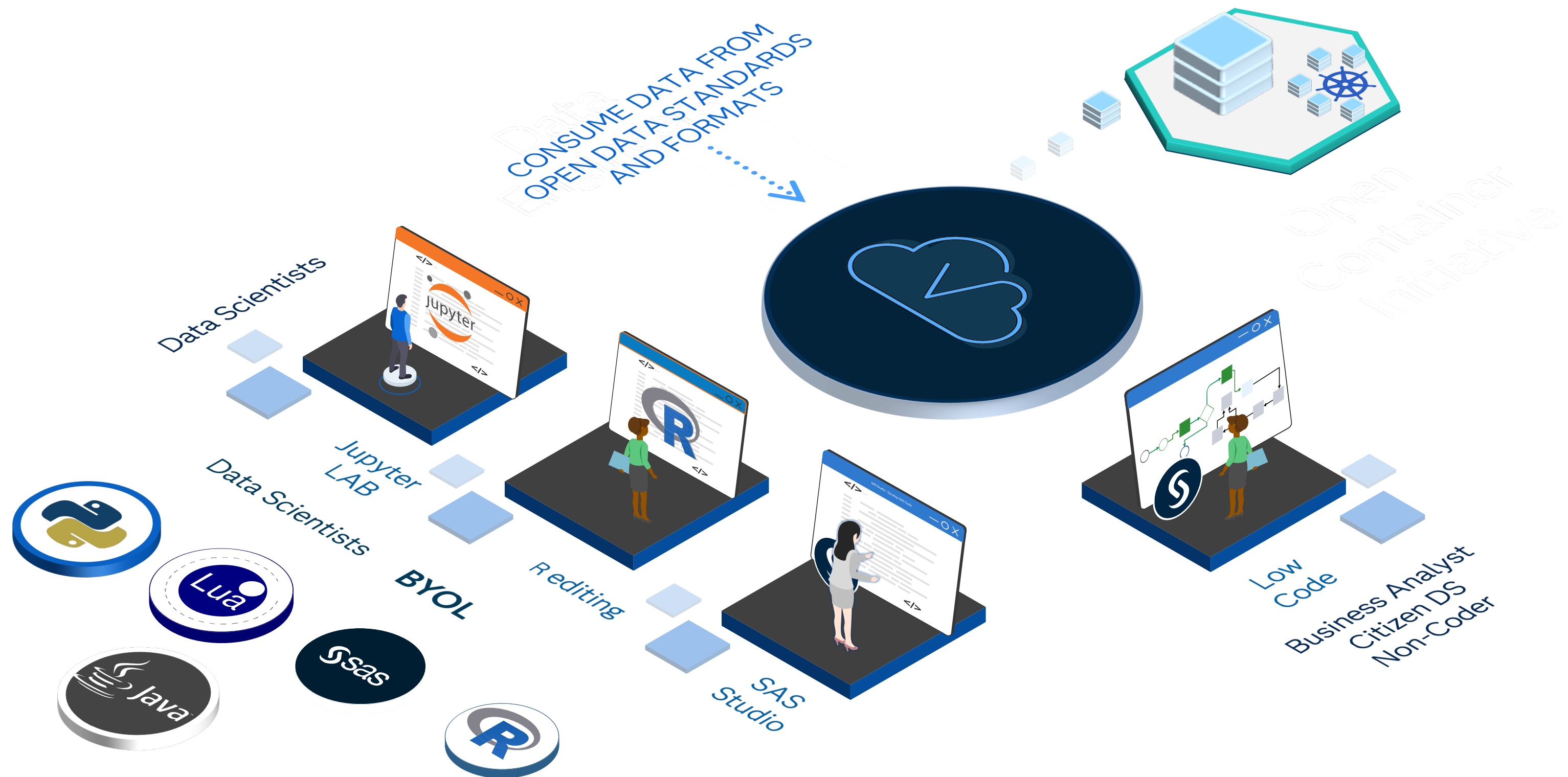
SAS Health Solutions



How these future trends will impact automation in clinical trials

What to look for in a platform

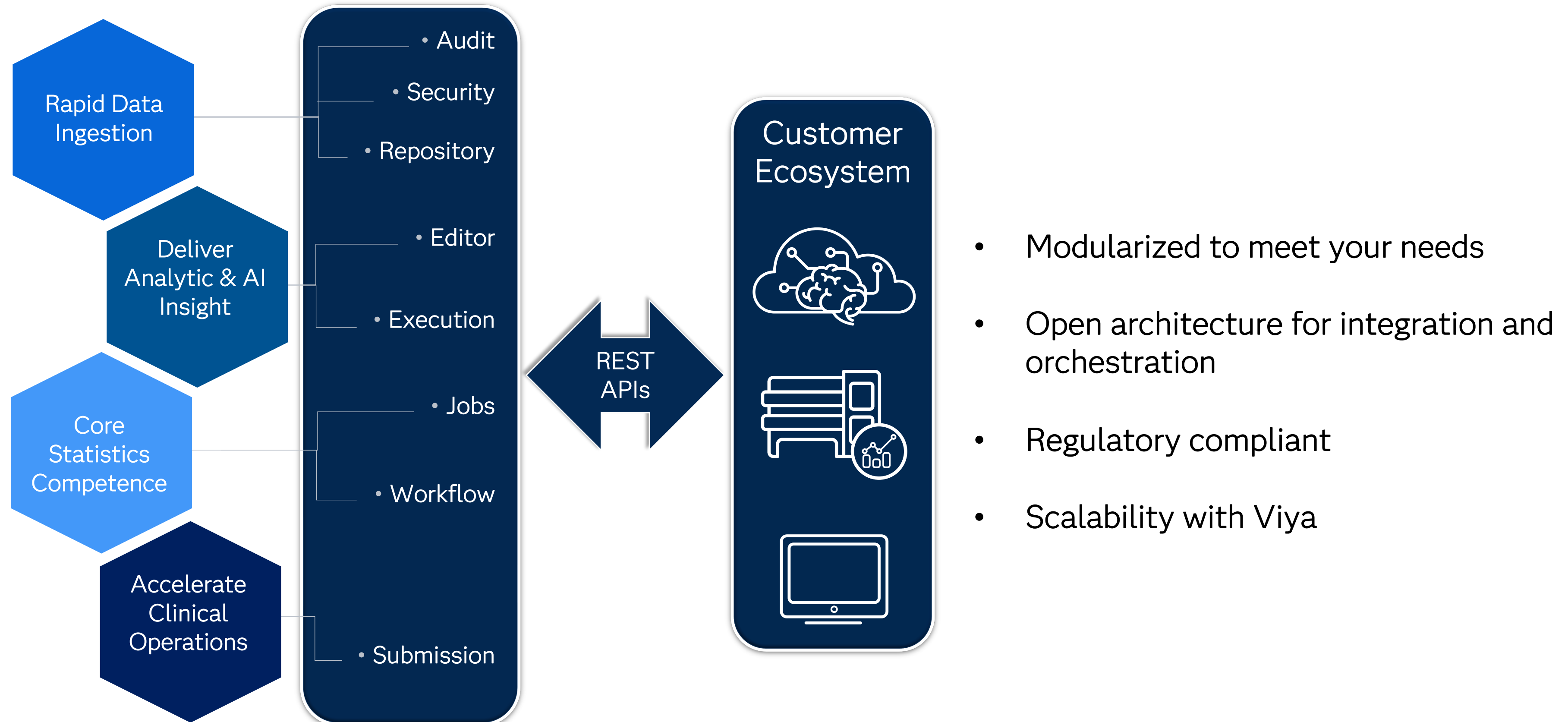
Working with the language of your choice – interoperability is key



Integration between GxP and Non GxP environments

Case example LSAF - VIYA

The SCE of the Future: Modular and Open Design



**Using REST APIs
to Automate Clinical Trial Analysis:**

**Validation and Visualization of
Synthetic Data Generated by
Machine Learning Approaches**

Synthetic Data

In general:

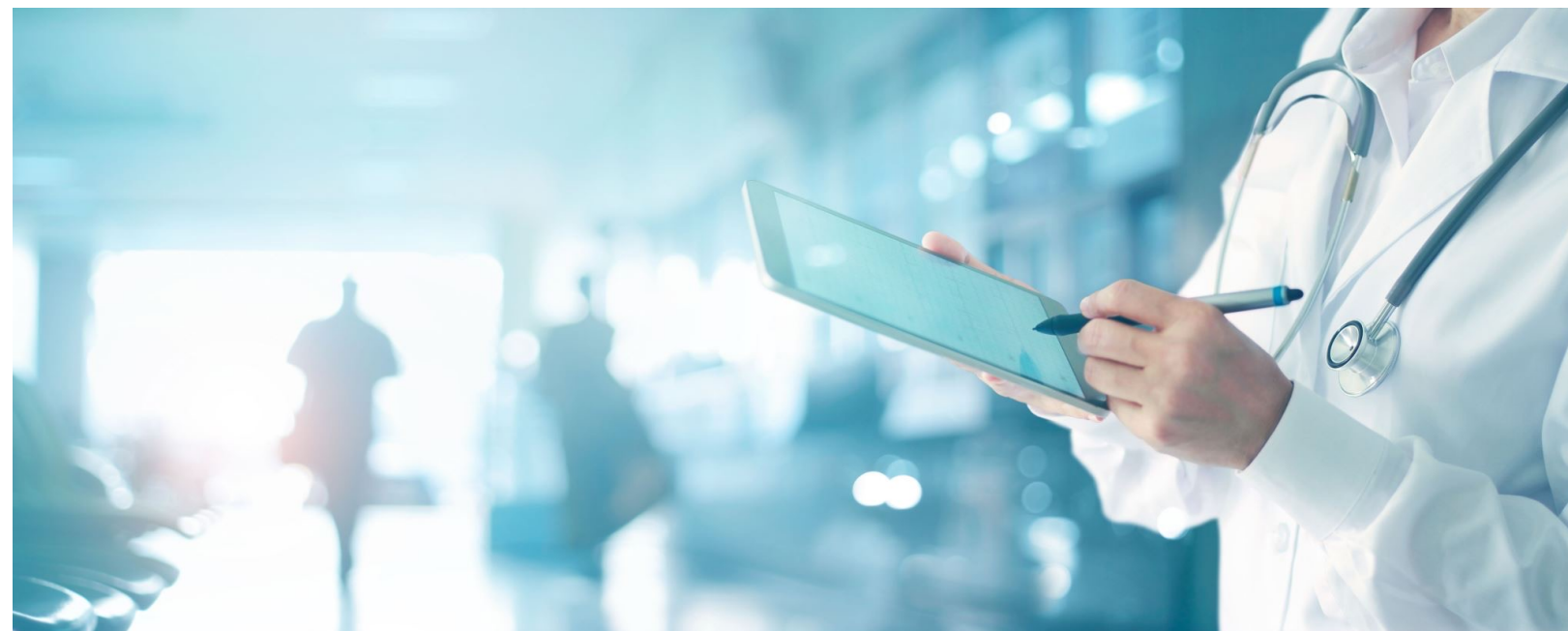
Synthetic data is on demand, self-service data generated by algorithms or rules, vs gathered in the real world, to meet conditions that are lacking in real data. The objective of synthetic data is to reproduce the same statistical properties and characteristics of the original, real dataset from which the synthetic data is trained.

Synthetic Data in clinical development:

Existing trial data or fabricated data that supplements or replaces the control arm of a clinical trial

Benefits:

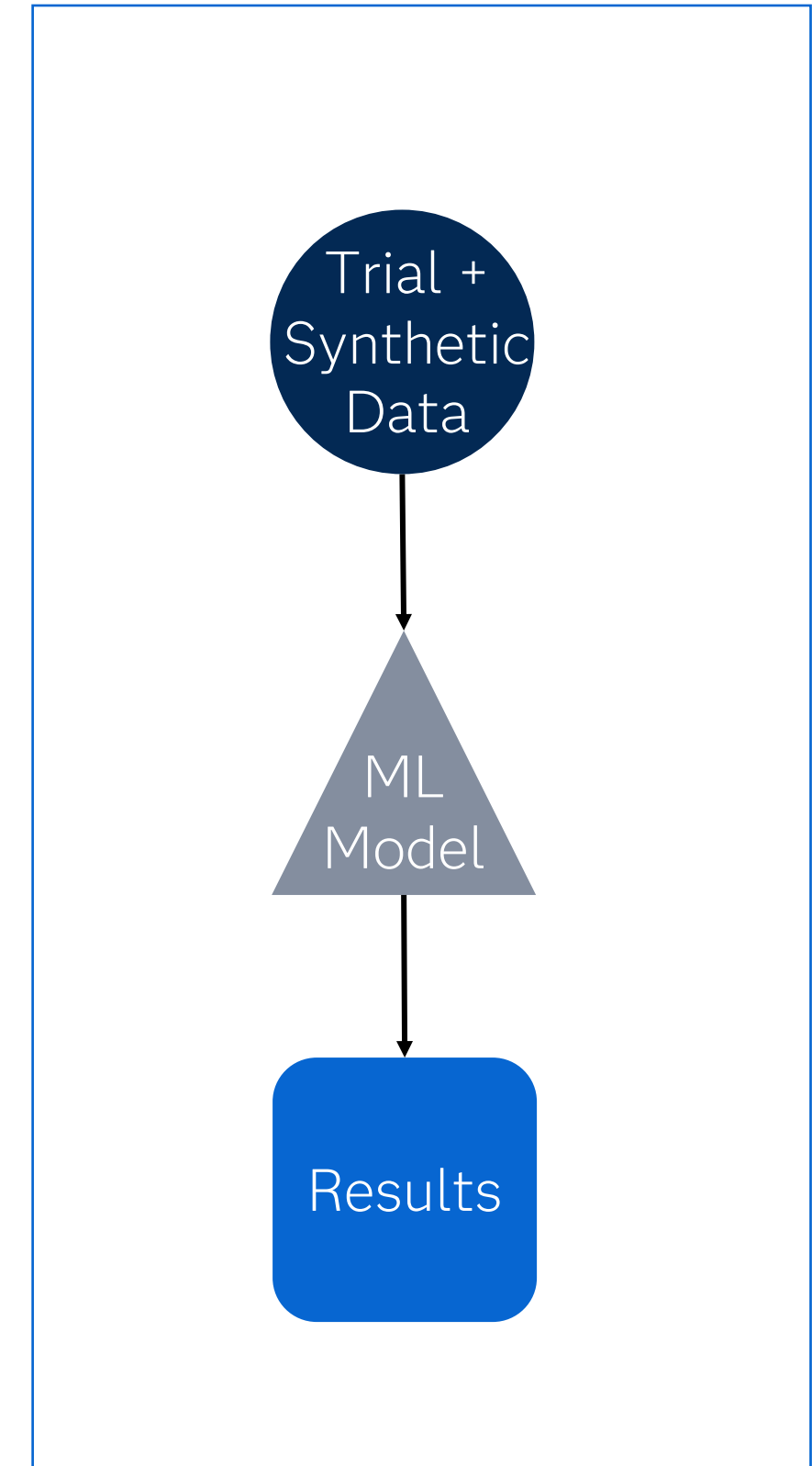
- Less patients
- Lower costs
- Faster trial



Synthetic Data

Forest Model:

- Input: Trial Data and Synthetic Data
- Forest model built to predict which source each patient record comes from
- Output: Statistics from the forest model



Synthetic Data Validation

Output Data Set

Repository.proc_forest_results.DATASET x +

Columns:5 Rows:10418 Filtered rows:10418

Enter expression Filters...

#	Info: source	Ⓜ _MissIt_	Ⓜ _Vote_	Ⓜ Predicted: source=real	Ⓜ Predicted: source=synthetic
1	synthetic	0	62.067726399	0.379322736	0.620677264
2	synthetic	0	70.630723409	0.2936927659	0.7063072341
3	real	0	59.147212724	0.5914721272	0.4085278728
4	real	0	80.043605404	0.800436054	0.199563946
5	synthetic	0	62.555239395	0.3744476061	0.6255523939
6	synthetic	1	51.390039081	0.4860996092	0.5139003908
7	synthetic	0	61.778790699	0.382212093	0.617787907
8	synthetic	1	59.913280826	0.4008671917	0.5991328083
9	synthetic	0	80.891863865	0.1910813613	0.8089186387
10	real	0	53.974768081	0.5397476808	0.4602523192
11	synthetic	0	65.015382395	0.349846176	0.650153824
12	synthetic	1	64.193665224	0.3580633478	0.6419366522
13	synthetic	1	54.411700102	0.455882999	0.544117001

Summary of Analysis

Misclassification Rate of 50% means data sets are equivalent

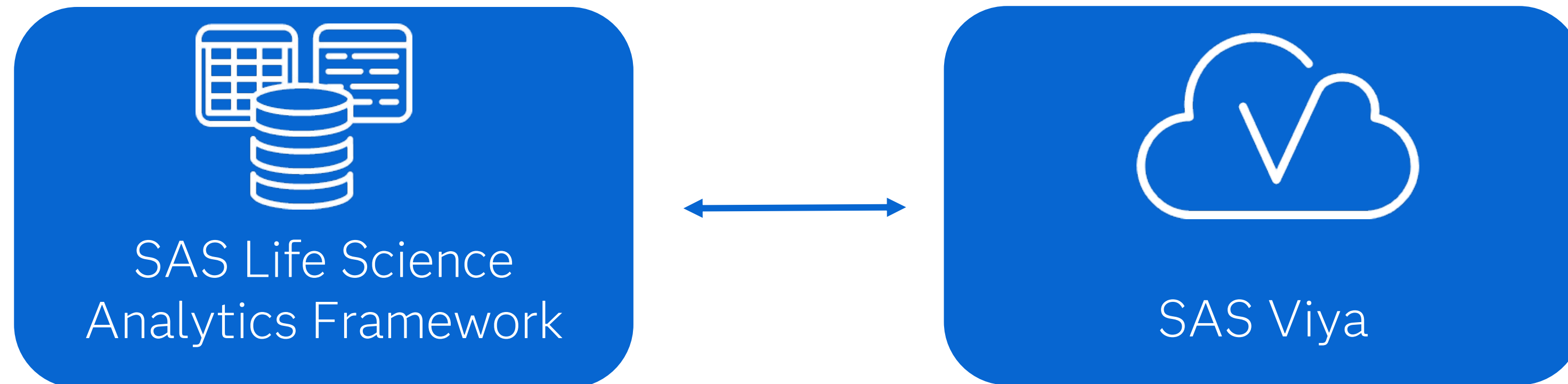
The FOREST Procedure

Model Information	
Number of Trees	100
Number of Variables Per Split	3
Seed	683052172
Bootstrap Percentage	60
Number of Bins	50
Number of Input Variables	7
Maximum Number of Tree Nodes	1039
Minimum Number of Tree Nodes	651
Maximum Number of Branches	2
Minimum Number of Branches	2
Maximum Depth	20
Minimum Depth	20
Maximum Number of Leaves	520
Minimum Number of Leaves	326
Maximum Leaf Size	1907
Minimum Leaf Size	5
OOB Misclassification Rate	0.36321751
Average Number of Leaves	419.65

Variable Importance

Variable	Importance	Std Dev Importance	Relative Importance
Diastolic	282.92	33.7260	1.0000
Systolic	256.91	40.2420	0.9081
Height	193.28	25.2916	0.6832
AgeAtStart	165.47	24.9813	0.5849
Weight	130.86	22.6324	0.4625
Status	16.6853	5.5510	0.0590
Sex	12.6053	5.6579	0.0446

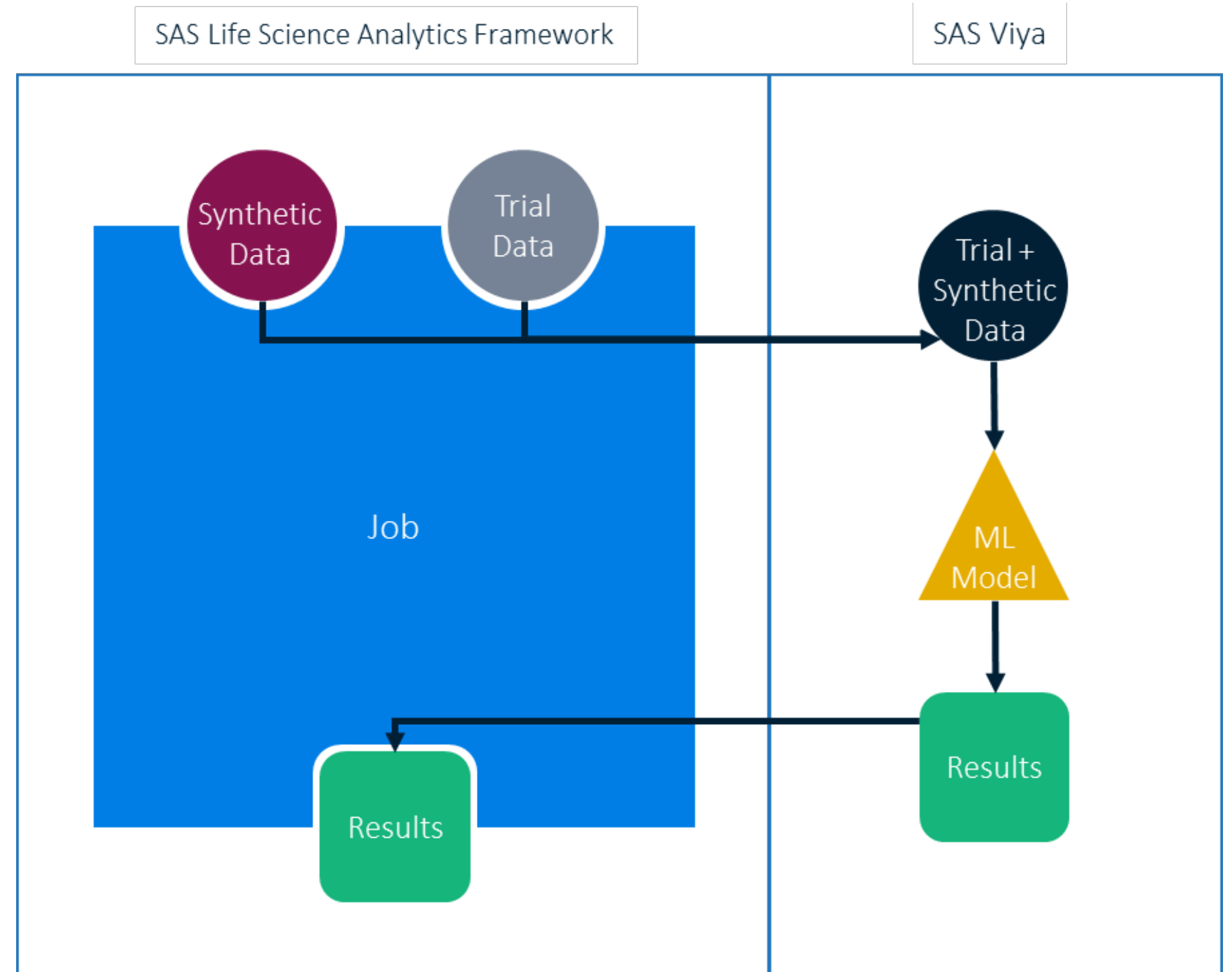
How can we evaluate the equivalence of synthetic data to real data while keeping audit records of the process?



A cloud-based CDR and SCE with audit records for regulatory compliance

LSAF – Viya Integration

- SAS Viya authentication file hidden in LSAF for security
- SAS LSAF job uses authentication file to connect SAS LSAF libraries to Viya libraries to transfer data sets
- Data that originates in LSAF can be processed using Viya machine learning procedures
- Every action is recorded in the LSAF Audit History



Audit Trail Possible

Object	Name	Location	Action	Acted On By (Display Name)	Mode	Date Acted On
SAS Data Set	proc_forest_results.sas7bdat	/LSAF-Viya/Remote_Access/Outputs	Created	behowe (Ben Howell)		Mar 27, 2023, 4:50:41 PM GMT-04:00
Folder	Outputs	/LSAF-Viya/Remote_Access	File added	behowe (Ben Howell)		Mar 27, 2023, 4:50:41 PM GMT-04:00
SAS Data Set	proc_forest_results.sas7bdat	/LSAF-Viya/Remote_Access/Outputs	Associated	behowe (Ben Howell)		Mar 27, 2023, 4:50:41 PM GMT-04:00
File	Validation_Summary.htm	/LSAF-Viya/Remote_Access/Outputs	Checked in	behowe (Ben Howell)		Mar 27, 2023, 4:50:41 PM GMT-04:00
File	Validation_Summary.htm	/LSAF-Viya/Remote_Access/Outputs	Permissions created	behowe (Ben Howell)		Mar 27, 2023, 4:50:41 PM GMT-04:00
File	Validation_Summary.htm	/LSAF-Viya/Remote_Access/Outputs	Owner changed	behowe (Ben Howell)		Mar 27, 2023, 4:50:41 PM GMT-04:00
File	Validation_Summary.htm	/LSAF-Viya/Remote_Access/Outputs	Created	behowe (Ben Howell)		Mar 27, 2023, 4:50:41 PM GMT-04:00
Folder	Outputs	/LSAF-Viya/Remote_Access	File added	behowe (Ben Howell)		Mar 27, 2023, 4:50:41 PM GMT-04:00
File	Validation_Summary.htm	/LSAF-Viya/Remote_Access/Outputs	Associated	behowe (Ben Howell)		Mar 27, 2023, 4:50:41 PM GMT-04:00
File	validate_synthetic_data.lst	/LSAF-Viya/Remote_Access/Jobs	Checked in	behowe (Ben Howell)		Mar 27, 2023, 4:50:41 PM GMT-04:00
File	validate_synthetic_data.lst	/LSAF-Viya/Remote_Access/Jobs	Checked out	behowe (Ben Howell)		Mar 27, 2023, 4:50:41 PM GMT-04:00
File	validate_synthetic_data.log	/LSAF-Viya/Remote_Access/Jobs	Checked in	behowe (Ben Howell)		Mar 27, 2023, 4:50:41 PM GMT-04:00
File	validate_synthetic_data.log	/LSAF-Viya/Remote_Access/Jobs	Checked out	behowe (Ben Howell)		Mar 27, 2023, 4:50:41 PM GMT-04:00
SAS Data Set	compare.sas7bdat	/LSAF-Viya/Remote_Access/Data	Checked in	behowe (Ben Howell)		Mar 27, 2023, 4:50:41 PM GMT-04:00
SAS Data Set	compare.sas7bdat	/LSAF-Viya/Remote_Access/Data	Checked out	behowe (Ben Howell)		Mar 27, 2023, 4:50:41 PM GMT-04:00
Job	validate_synthetic_data.job	/LSAF-Viya/Remote_Access/Jobs	Ran	behowe (Ben Howell)		Mar 27, 2023, 4:50:33 PM GMT-04:00
....						
Attribute	From		To			
Size			768 KB			
Copy to workspace			Allow all			
Comment			Checked in on completion of job: /LSAF-Viya/Remote_Access/Jobs/validate_synthetic_data.job			

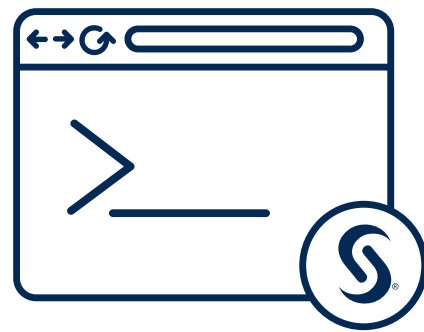
How can an end user from a remote environment develop synthetic data, validate it, and ensure repeatability and traceability with audit records?



Remote Access to SAS Life Science Analytics Framework

Using REST APIs

Remote Environment



HTTP Request

HTTP Response

SAS LSAF



Request: GET, PUT, POST, DELETE

Response: results of the request, usually in JSON format

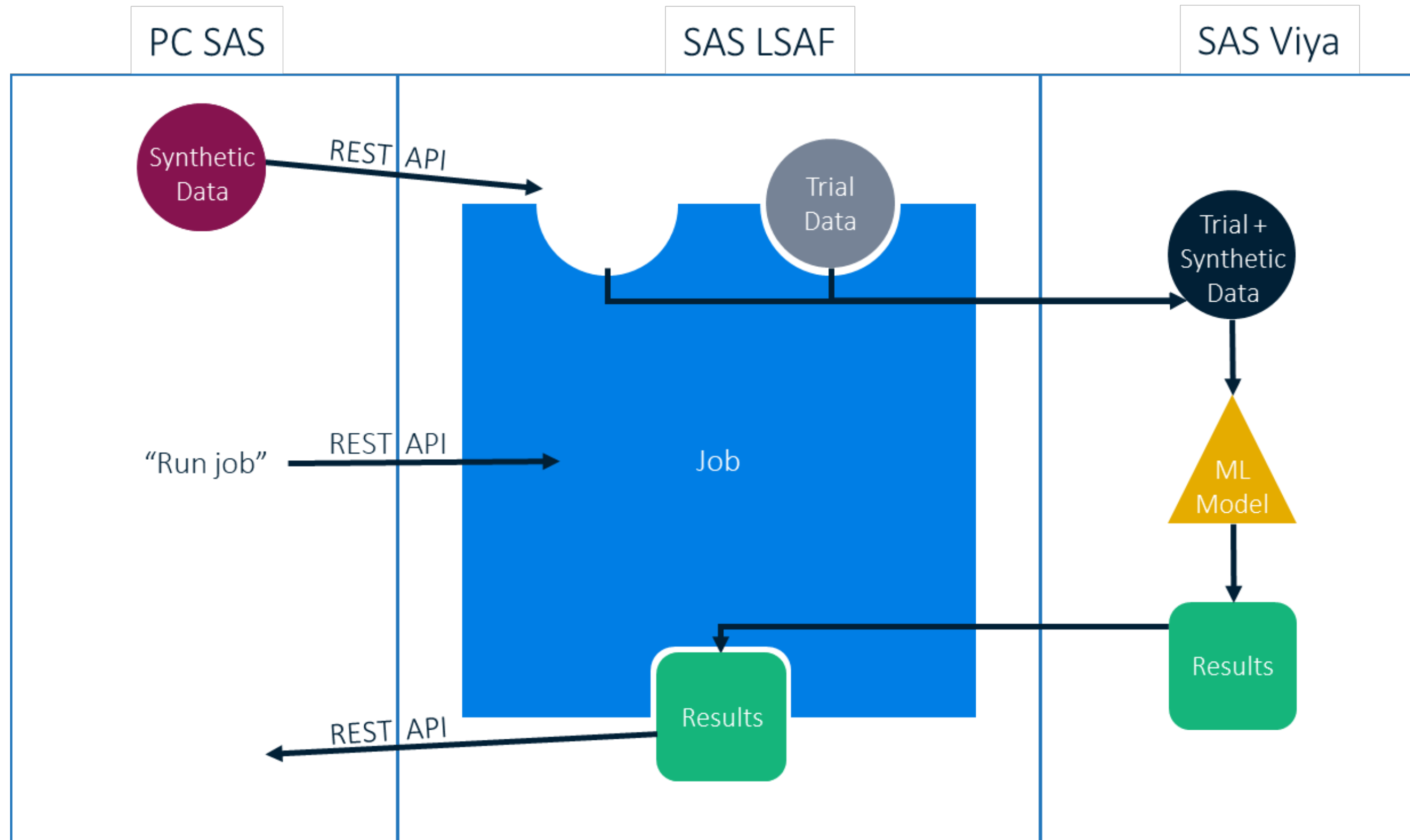
Can be called from any programming language that supports HTTP requests

Remote Access to LSAF

REST API SAS Macros

1. Logon to LSAF and store authentication token in local file
2. Make the REST API request using the token
3. Capture the response
4. If the initial request failed due to authentication, logon and try again with the new token
5. If the initial request still fails, errors are written to the log and/or specified data sets
6. If the request is successful, results are written to the log and/or specified data sets

REST API overview



Remote Access to LSAF

Audit History

Remotely executed jobs capture the same audit records as interactive job runs, with additional records for upload and download actions.

Object	Name	Location	Action	Acted On By (Display Name)	Mode	Date Acted On	↓
SAS Data Set	synthetic_data.sas7bdat	/LSAF-Viya/Remote_Access/Data	Uploaded	behowe (Ben Howell)		Mar 27, 2023, 10:38:58 AM GMT-04:00	

Object	Name	Location	Action	Acted On By (Display Name)	Mode	Date Acted On	↓
File	Validation_Summary.htm	/LSAF-Viya/Remote_Access/Outputs	Downloaded	behowe (Ben Howell)		Mar 27, 2023, 10:39:09 AM GMT-04:00	
SAS Data Set	proc_forest_results.sas7bdat	/LSAF-Viya/Remote_Access/Outputs	Downloaded	behowe (Ben Howell)		Mar 27, 2023, 10:39:09 AM GMT-04:00	

Attribute	↑	From	To
Client used			Public REST API
Destination IP			10.225.127.70
File source			Repository

To sum up

1. Forest model can validate synthetic data.
2. Integration of LSAF and Viya records synthetic data validation in the audit history.
3. REST APIs allow remote users to upload synthetic data to LSAF, remotely execute the validation job, and download the results.
4. It's possible to change the programming language used to make REST API calls that push your synthetic data into LSAF, and to select a different machine learning procedure to build your model in Viya.

Don't take our word

- when adopting new automation tools in clinical development

Futurum - Competitive Benchmarking Study

Faster AI & Analytics: SAS Viya Outperforms the Competition

The importance of Artificial Intelligence (AI) for businesses is clear. Companies that leverage AI tools have distinct advantages over their peers, with AI Machine Learning (AI/ML) proving invaluable for finding and enabling insights buried within corporate data.

SAS asked The Futurum Group to independently analyze and review the performance results of SAS Viya and several leading commercial and open-source AI/ML alternative options. The Futurum Group Lab worked together with SAS engineering teams to compare SAS Viya against competitive offerings. We ran over 1500 tests across different Azure Cloud architecture using identical instance types to provide accurate comparisons.

"The Performance of SAS Viya was impressive, they didn't just outperform competing AI/ML libraries, they crushed the competition." – Russ Fellows, Principal Analyst, The Futurum Group

SAS Viya Outperforms Competitors

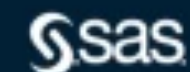
Performance is an important consideration, impacting business agility, efficiency and ultimately enabling business decisions and results faster. The Futurum Group Labs testing found multiple benefits compared to using alternative AI/ML options.

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SAS Viya Outperforms Competitors

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Thank you

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