Innovative clinical research using a visionary SCE – The future of clinical trials

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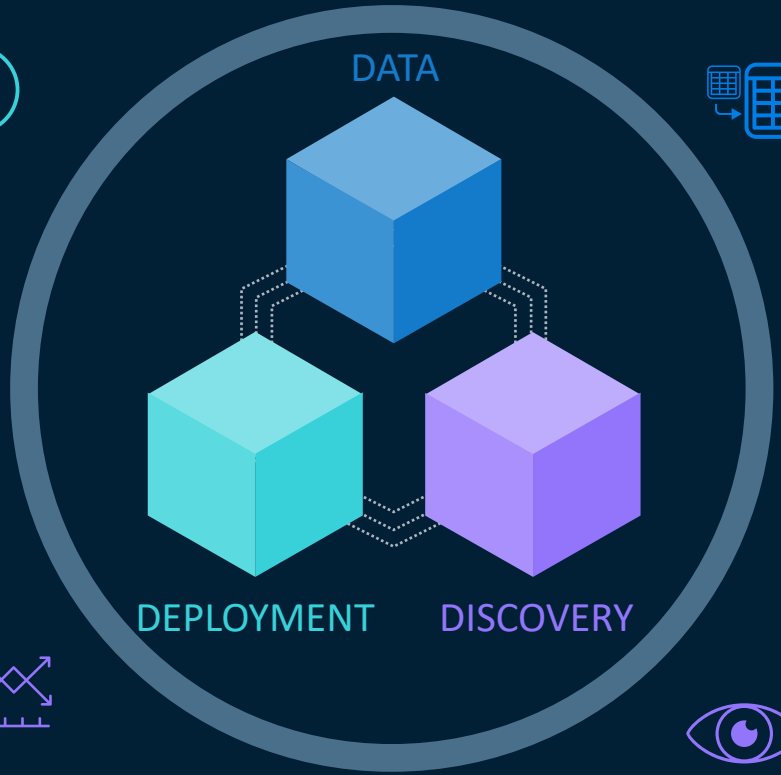
Michael Gomes – Manager & Group Sales, OCS Consulting

SAS Supports the Entire Analytics Lifecycle



Investigation

Decision Management

Model Management & Deployment

Forecasting and Optimization

Natural Language Processing

Data Management
- Profiling, Standardization, and Cleansing

Data Visualization

Statistics – Supervised and Unsupervised Analysis

Machine and Deep Learning

SAS® Health

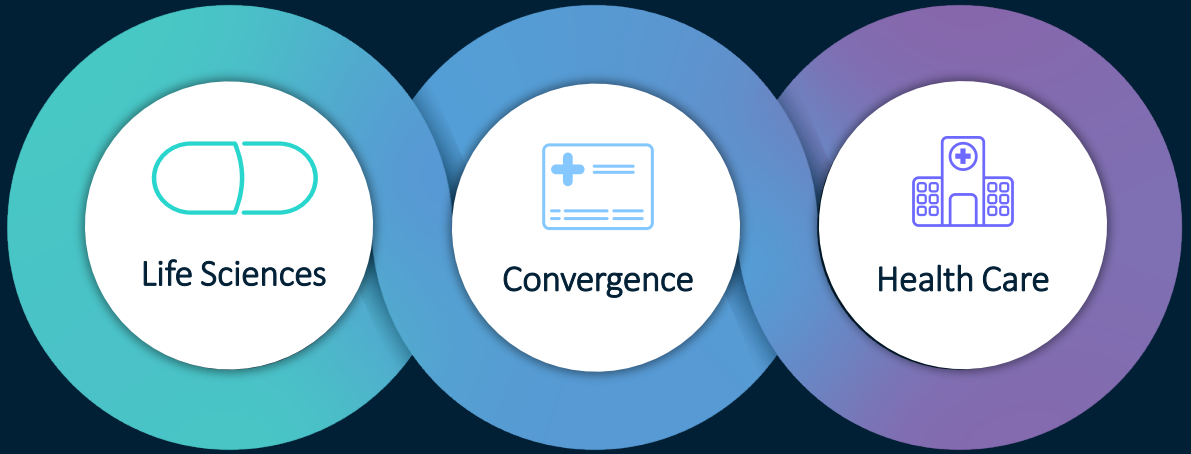
Empower Innovation. Improve Lives. Powered by SAS Viya.

Clinical Research Analytics
Reimagining drug development.

Clinical Trial Operations
Comprehensive insight for patient-centric clinical trials

Connected Quality
Improving quality and inventory in manufacturing and supply chain.

Outcomes Research & Epidemiology
Maximize RWD to support product strategy.



Market Access & Commercial
Optimize decisions across the product life cycle.

Patient and Member Engagement
Proactive customer-centric communication, outreach and case management.

Population Health
Building healthier communities through analytics

Health Care Financial Insights
Use analytics to adjust for risk and reduce costs, such as fraud, waste and abuse.

Health Care Operations
Actionable insights leads to more efficient health care.

Business Outcomes

Accelerate
clinical trials to deliver new therapies to submission faster and more efficiently.

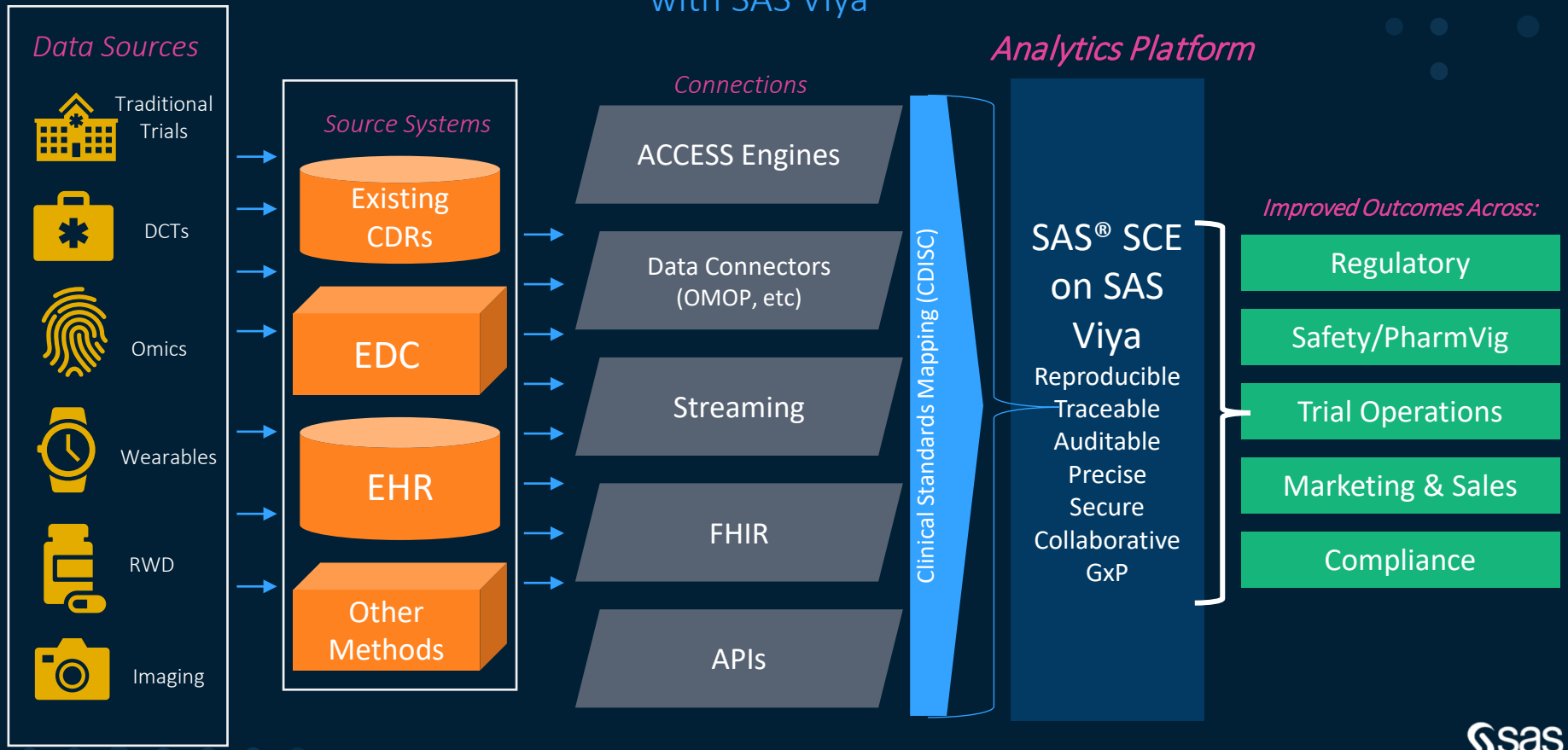
Maximize
real world data to better understand product safety, effectiveness, adherence, and value.

Improve
quality and efficiency of pharmaceutical manufacturing, predict demand and optimize the supply chain.

Optimize
market access and commercial strategy and improve digital engagement.

The Future of Efficient, Data-Driven Clinical Trials

with SAS Viya



Requirements for a data driven R&D in Pharma

Advanced analytical & Data Management

- can serve the needs of all user roles
- For traditional persona: Stat prog, CDM….
- & Even Beyond : manufacturing & supply chain, operations
- On a quality Architecture

Data Science Environment

- Modern, scalable , cloud enabled
- To tackle various data problems (federated analysis)

Robust data Model

- Built on Microsverices
- Regulatory sensitive with GxP “on” for all data insights
- security / consent management according to clinical trial governance & stage

Flexibility on Trials Complexity

- Inferential trials (protocol-driven)
- Retrospective (AI/ML) trials
- Observational research

Multimodal Data

- Patient data is observational, experimental and circumstantial
- RCT / RWD

LLMs & DataViz

- Integrated with GenerativeAI
- Various DataVisualization capabilities
- Monitor data quality in an end-to-end manner – automation, alerting and “where it happens”

Integrated Environments

- Trusted Collaborative / Research Environments
- Test out approaches for TA questions
- Speed up algorithmic / statistical method development for digital biomarker & digital health

Platform Archi. & HPC

- Interoperability, integration & scalability
- Impact / Connect to other systems *(EDC, CTMS, MDR, MES, random. …)*
- Sequential processes (*trial*) as well as parallelized (*combining data*)

Attract New Talents

- Open to other languages (SAS, R, python)
- Open to methods, data, personas (clinicians!)
- Think increase your Ecosystem (partner data…)

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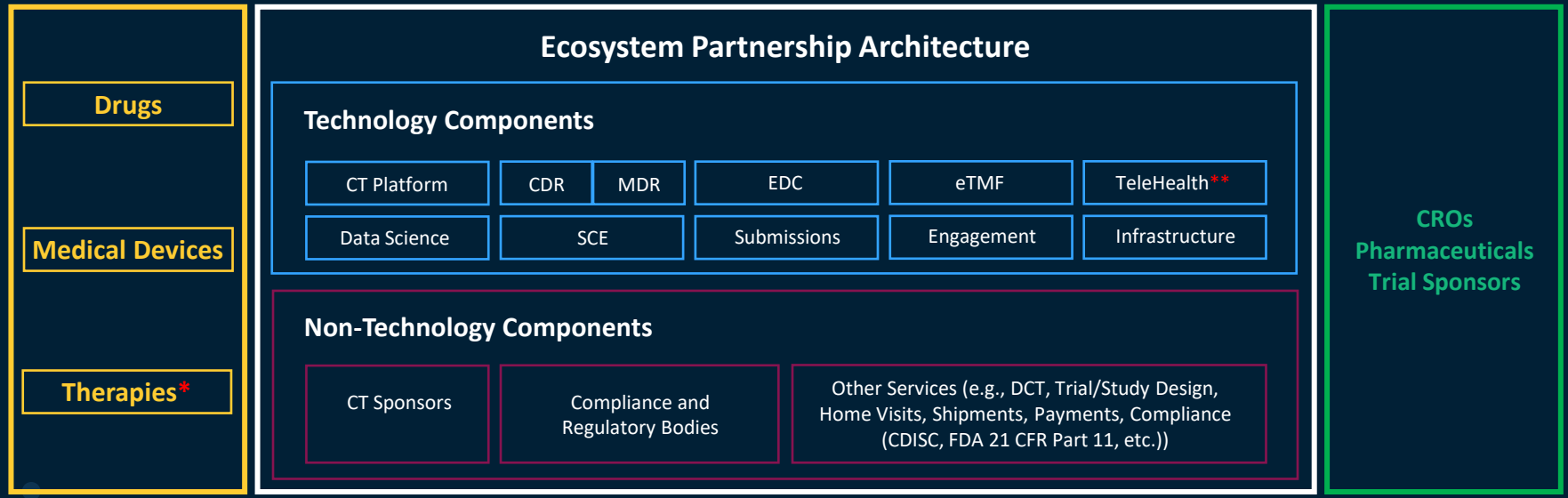
Next-gen clinical trials

SAS Partner Ecosystem Approach



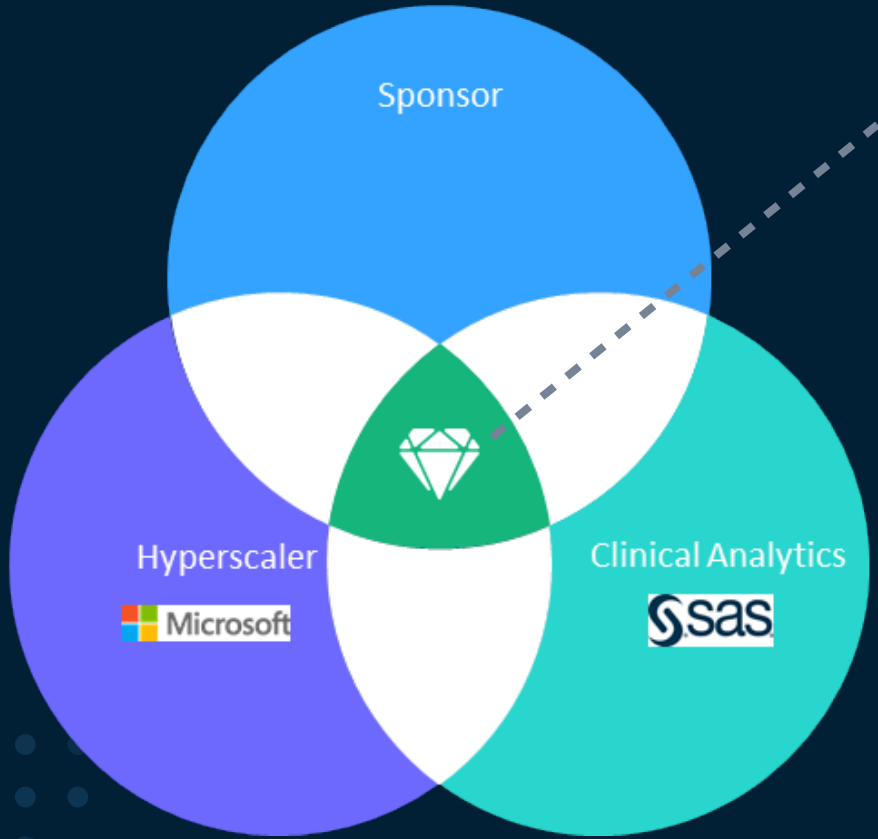
CDR = Clinical Data Repository
MDR = MetaData Repository
EDC = Electronic Data Capture
eTMF = electronic Trial Master File
SCE = Statistical Computing Environment

Data Science = Model Design, Development, Deployment, and Governance
Submissions = Clinical (Research/Study) Submissions
Infrastructure = Hardware OEMs, and Private/Edge Cloud Service Providers

*There can be scenarios where the accompanying device together with the drugs may be a key partnership

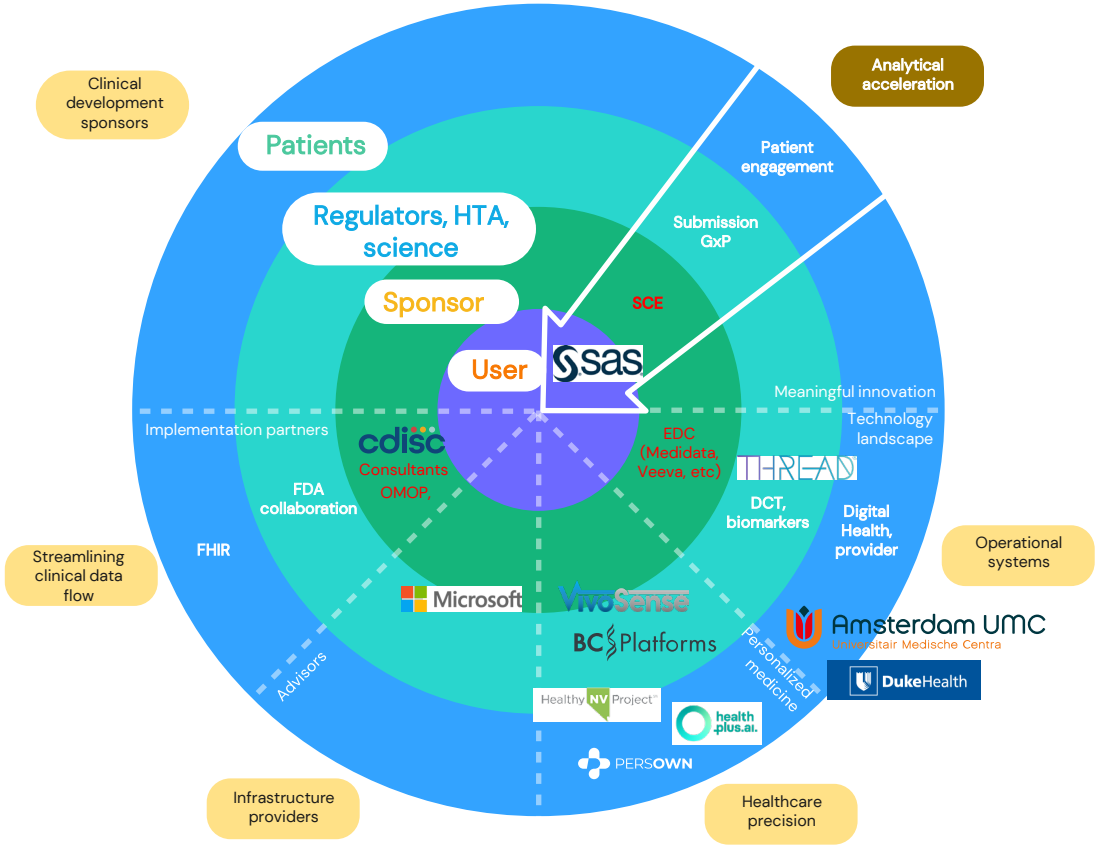
**Investigators and Study Coordinators supporting through TeleMedicine / Video-enabled "virtual visits", medication management, specialist consultation, and related supports

Collaboration between industry leaders



- LLMs in clinical development
- Infrastructure : federated data, security
- Science use cases
- Cloud analytical environments for innovation
- Drug discovery of compounds with potential – GNN

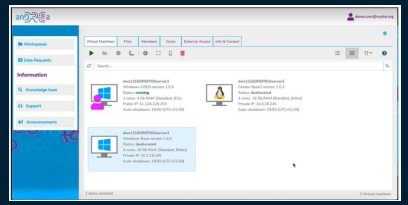
Partner clinical ecosystem



Microsoft Dynamics 365 | Power Apps | Power Automate | Power BI

Consumption Layer

Digital/Trusted Research Environment - **WORKSPACES**
Open Source and SAS ("following anDREa reinforcing principles")



In Silico Research Scientist

External Researchers through partnerships

Subscription External Research Institution "A"

IMPORTANT: the research Data never leaves owners subscription in MSFT cloud

Subscription External Research Institution "B"

Azure — Research — Research Governance

Data Scientist

Business Analyst (Visual Interfaces/ no – limited coding skills)

sas viya
- SAS Studio (Coding)
- SAS Visual Statistics (GUI)
- SAS Model Studio (GUI)
- SAS Intelligent Decisioning
- SAS Studio Engineer
- SAS Compute Server SAS CAS
- SAS ACCESS Interfaces and Data Connectors
- SAS Analytical Data — SingleStore

Register / Re-Use/Re-Train

SAS Model Manager
Model Repository
Model Monitor

CI/CD approach - MONTHLY automated updates on SAS Viya

Clinical Development
1/ Biometrics (DM, Stats Programming, BioStats); 2/ Quantitative Sciences (Modeling & Simulations); 3/ Real World Evidence use cases.

Azure

Stats Programmer/ Bio-Statistician/ Data Scientist

Business Analyst (Visual Interfaces/ no – limited coding skills)

Non-GxP qualified DEV (integrations, apps, ...) environment	*GxP qualified TEST (UAT of new Viya releases) environment*	*GxP qualified PROD environment (dev. and validation of submission programs, IA/Final analysis)*
SAS Health Cohort Builder on Viya (DEV) - RWE use Cases	SAS Health Cohort Builder on Viya (TEST/UAT) - RWE use Cases	SAS Health Cohort Builder on Viya (PROD) - RWE use Cases
SAS Life Science Analytics Framework on Viya (DEV)	SAS Life Science Analytics Framework on Viya (TEST/UAT)	SAS Life Science Analytics Framework on Viya (PROD)
sas viya	sas viya	sas viya
SAS Studio (Coding)	SAS Studio (Coding)	SAS Studio (Coding)
SAS VA / VS / VML (GUI)	SAS VA / VS / VML (GUI)	SAS VA / VS / VML (GUI)
SAS Model Studio (GUI)	SAS Model Studio (GUI)	SAS Model Studio (GUI)
SAS Intelligent Decisioning	SAS Intelligent Decisioning	SAS Intelligent Decisioning
SAS Studio Engineer	SAS Studio Engineer	SAS Studio Engineer
SAS Compute Server SAS CAS	SAS Compute Server SAS CAS	SAS Compute Server SAS CAS
SAS ACCESS Interfaces and Data Connectors	SAS ACCESS Interfaces and Data Connectors	SAS ACCESS Interfaces and Data Connectors
SAS Analytical Data — SingleStore	SAS Analytical Data — SingleStore	SAS Analytical Data — SingleStore
CI/CD approach - **MONTHLY automated updates** on SAS Viya	CI/CD approach - **YEARLY or every 2 year** updates on SAS Viya	CI/CD approach - **YEARLY or every 2 year** updates on SAS Viya

+ OHDSI Toolbox / OMOP Standards
+ CDISC Open Rules Engine (CORE)
+ CDISC Open-Source Alliance (COSA)
+ Integration with 3rd party application(s) / data sources.

Register / Re-Use/Re-Train

SAS Model Manager
Model Repository
Model Monitor

Data Layer

Azure Data Lake(s)
e.g., RWD OMOP, OMICS, Imaging, ...

Azure Synapse Analytics

Data Governance & Access Layer

Azure Purview ⟷ SAS Information Governance

HL7 FHIR — Access to Electronic Health Records (EHR)

ExpressRoute Gateway | VPN Gateway

Management Jumpbox
E.g Standard_D2_v3
(2 vCPUs, 8 GB RAM)
Linux Red Hat 7.x
Mgmt Hub

Active Directory DS Server
adds

Azure KeyVault
Certificates
Encryption Keys

Azure Monitor
Log Analytics Workspace

Azure Automation
Webhook-based Runbooks

Azure Site Recovery
Failover Replicas

hub-network
Virtual Network

sas

FDA NEWS RELEASE

FDA Announces Additional Steps to Modernize Clinical Trials

Agency Requesting Feedback on the Draft Recommendations and How They Should Be Applied to Increasingly Diverse Trial Types and Data Sources

Share | Tweet | Linkedin | Email | Print

For Immediate Release: June 06, 2023

"A more robust clinical trial ecosystem that is capable of producing reliable evidence more efficiently may support more informed decision-making in developing medical products to help patients," said FDA Commissioner Robert M. Califf, M.D. "These draft recommendations propose a major step forward in this work. Building quality into the design and conduct of trials and encouraging the use of innovative trial designs and health technologies are essential to truly advance clinical trials and generate meaningful results."

SAS Health Clinical Acceleration - At A Glance

Overview

SAS Health Clinical Acceleration delivers a modular, open, cloud-native content repository and statistical computing environment for clinical research. It is the successor to LSAF in Viya 4.

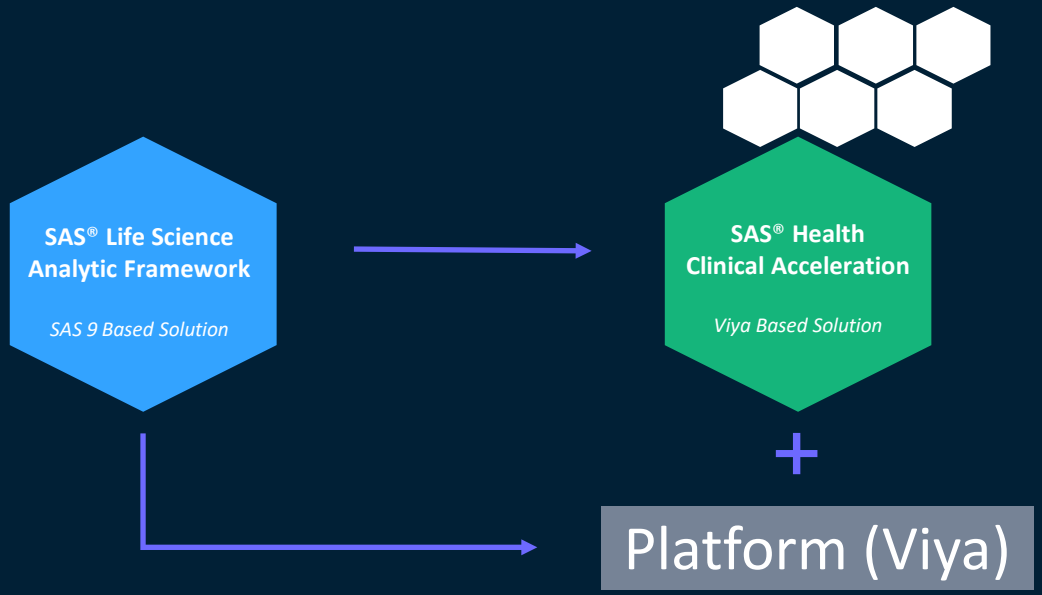
Product Goals:

- Improve User Engagement and Efficiency
- Modularize and Simplify Offering
- Transition to Viya and Leverage SAS IP
- Embrace Integration and Open source

Value Propositions:

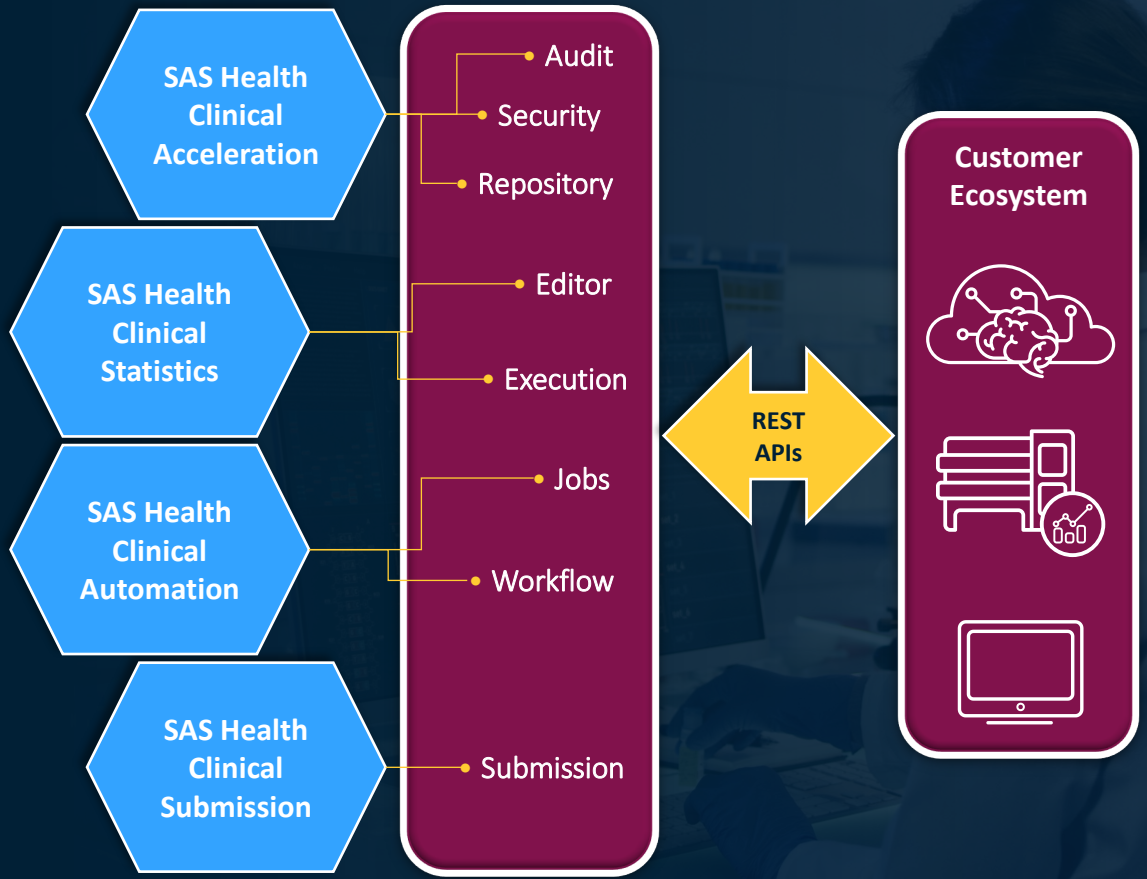
- Improve the Efficiency of How People Work
  - Faster Clinical Analysis and Submission
- Validated Clinical Trial Operations
  - Regulatory Compliance / Single Source of Truth
- Viya Enabled Analytics & Automation
- Open Integration / Bring your own Tool

SAS Health Clinical Acceleration Background



SAS Health Clinical Acceleration

Modular and Open Design



- Modularized to meet your needs
- Open architecture for integration and orchestration
- Regulatory compliant
- Scalability with Viya

SAS® Clinical Enrollment Simulation

Subject Recruitment Challenges & Impact

- Up to 90% of clinical trials do not meet their patient enrollment targets on time
- A delay in a drug’s approval due to missing clinical trial completion costs sponsors millions of dollars
- Missing clinical subject recruitment milestones can negatively impact the Organization's reputation

SAS® Clinical Enrollment Simulation

Applying Analytics to Improve Recruitment

- **Develops Enrollment Projections**
  - Users enter all assumptions and simulate multiple replications of the enrollment
  - Shows how likely it is to achieve enrollment target with the current scenario

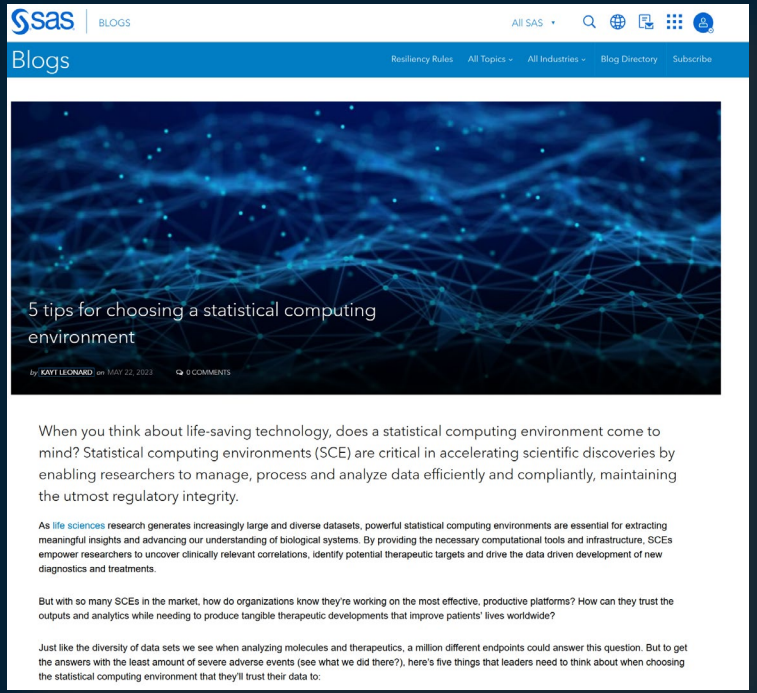
- **Capture Variability**
  - **Allows** for capturing the variability inherent in the real-world situation
  - Provides likely outcomes and produces accurate predictions for achieving targets

- **Scenario Tracking**
  - Compare and track multiple intervention scenarios with varying inputs
  - Simulates impact of impact factors such as: adding new countries, sites, increased advertising…
  - Identify most effective strategy to achieve milestones

Requirements for a modern SCE

https://blogs.sas.com/content/sascom/2023/05/22/choosing-a-statistical-computing-environment/

1. First things first? It's the about data security
2. It's secure, but is it available? Openness is key.
3. It worked! But reproducing it – and explaining it – is a challenge
4. It's great, but no one can use it
5. Pick your statistical computing environment for now and for the future



Comprehensive insight to deliver more patient-centric clinical trials and achieve operational excellence.

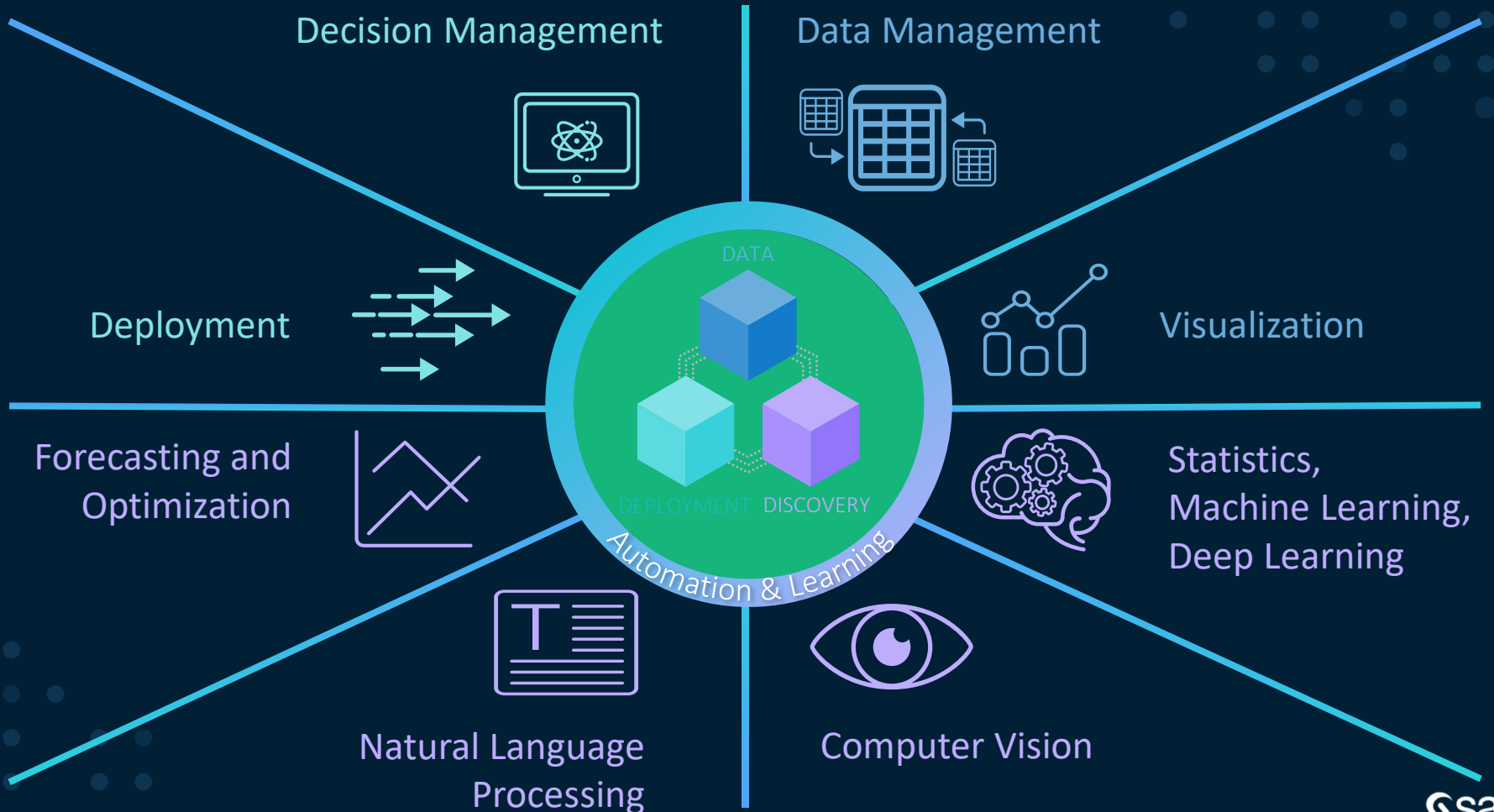
With SAS, you can…

Optimize study start-up and progress

Improve patient centricity

See the whole picture of study operations

Embrace innovation with confidence



How FDA embraces digital transformation with SAS

U.S. FOOD & DRUG ADMINISTRATION

sas

40 years

SAS has been a partner in many key initiatives in FDA's ongoing digital innovation journey

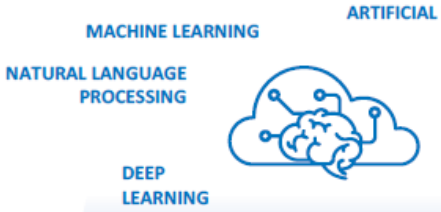
4000 SAS users systemwide

- Clinical Trial Submission
- Regulatory Review
- Adverse Events Reporting
- Supply Chain Surveillance for pharmaceuticals
- Risk Analysis of manufacturing facilities

FDA is embarking on a bold five-year initiative with SAS to leverage the benefits of digital transformation

- Identify and execute high-value driver projects for individual centers and the Agency
- Develop consistent and repeatable data practices across the Agency
- Combine internal strengths with key external partnerships

SAS supports the FDA with market-leading, cloud-ready technology designed to enable modernization while reducing risk



ADVERSE EVENT REPORTING

Rapidly flag safety issues in patient narratives

WHAT: Automated coding improves post-market safety reviews of regulated drugs

HOW: Disease-specific algorithms enable medical coding of adverse events to become faster, more accurate & easier to interpret

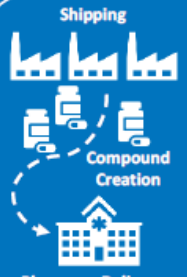
14,976	50%	98.88%	94.4%
narrative observations in clinical trial reports	of reports contained indications of serotonin syndrome	correct classification of serotonin syndrome via Deep Learning	accurate interpretation of associated symptoms via Machine Learning

Use Case Example

DEEP LEARNING · MACHINE LEARNING

MANUFACTURING SITE SURVEILLANCE

End-to-end analytics ensure manufacturing & supply chain quality



WHAT: FDA ensures drug ingredient quality throughout the supply chain using a 'cradle to grave' SAS analytics process

HOW: Data integration, data governance & risk scoring allow a granular view of the process

OUTCOME: Manufacturing options can be optimized based on performance or external disruption

TEXT ANALYTICS · DATA-DRIVEN DECISIONING

DRUG REPURPOSING

Identify drug candidates for COVID-19 treatments

WHAT: Machine Learning rates existing drugs as potential COVID-19 treatments

HOW: This 'AI-powered network pharmacology' accelerates early insights into drug repurposing

OUTCOME: Accelerating the substantial data analysis associated with drug and target discovery

NATURAL LANGUAGE PROCESSING · ARTIFICIAL INTELLIGENCE

Patient Risk Profile_new

Page 2

Patient Population Risk Summary:

Select Event:

- [x] CareGap
- [x] dropOut
- [x] erVisit
- [ ] noShow
- [ ] reAdmit
- [x] rxFill
- [ ] seriousAE

Select Risk Range:

88.8%
88.8%
31.7%
0.0%

Average Risk:

44.1%

Patient Count:

20,510

	Confirmed	Not Confirmed	Removed
	Patient Count	Patient Count	Patient Count ▲
Total	5,967	40,143	1,051
FETAL CONSULT	20	66	3
FOLLOW UP	20	66	3
FOLLOW UP	78	3,872	3
FOLLOW UP	78	3,872	3
NURSE VISIT	146	1,915	11
FOLLOW UP	146	1,915	11
POST OPERATIVE	330	2,400	58
FOLLOW UP	330	2,400	58
URO Problem	5,393	31,890	976
NEW PATIENT	2,327	13,119	480
FOLLOW UP	3,066	18,771	496

Patient Risk Detail and Risk Trend:

P00000000015 (51.2%)

patient_ID ▲
P00000000021
P00000000028
P00000000032
P00000000061
P00000000064
P00000000081
P00000000084
P00000000105
P00000000112
P00000000115
P00000000117
P00000000131

Risk Event	Risk Score ▲
noShow	0.0%
seriousAE	1.9%
rxFill	1.9%
CareGap	12.3%
reAdmit	27.7%
erVisit	45.1%
dropOut	57.3%
Average:	20.9%

ACTIONS for Patient P00000000015 :

re-score: trend: confirm:

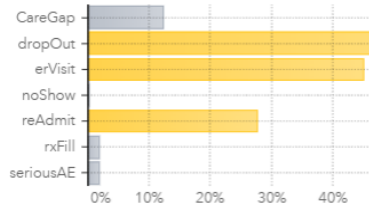
Set Threshold for High Risk:

0.593
0.0% 100.0%

Set Threshold for Medium Risk:

18.0%
0.0% 100.0%

Patient Risk by Event:



SAS® Visual Analytics - Explore and Visualize

Presentation (AI & Health) 23-10-2020

Intro | CRLM | RECIST | Objectives | Study data | Automatic response pipeline | CNN U-net | Auto segmentation model | Tumor volume vs RECIST | Overview | Tumor response | Patient level | Lesion specific | Resectable patients | Pathologic resp

Diameters change RECIST (%)

-2.4

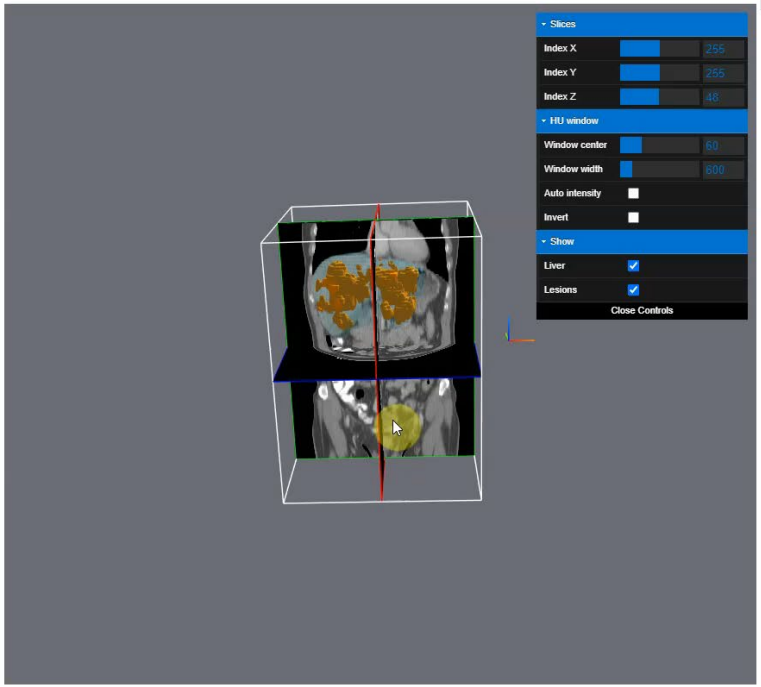
Patient number

323

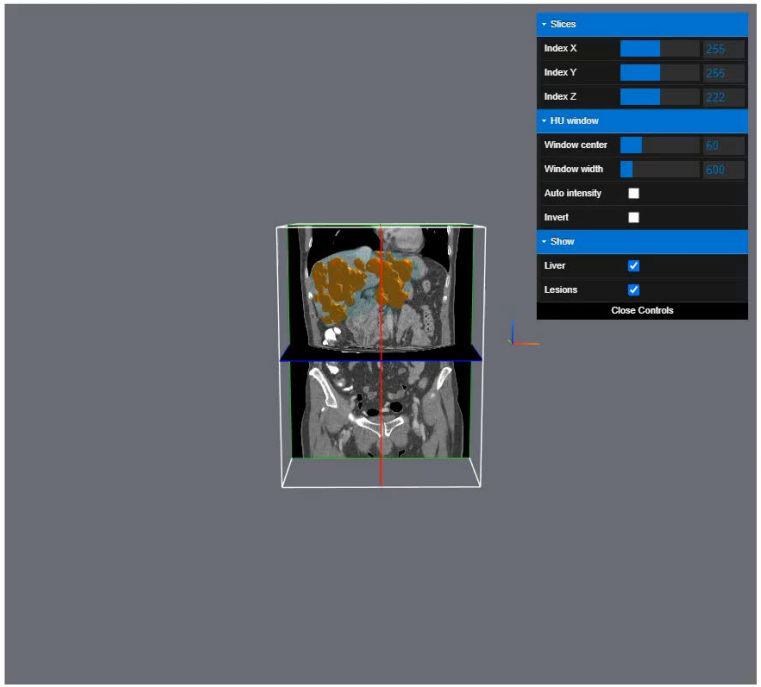
Total tumor volume change (%)

-88

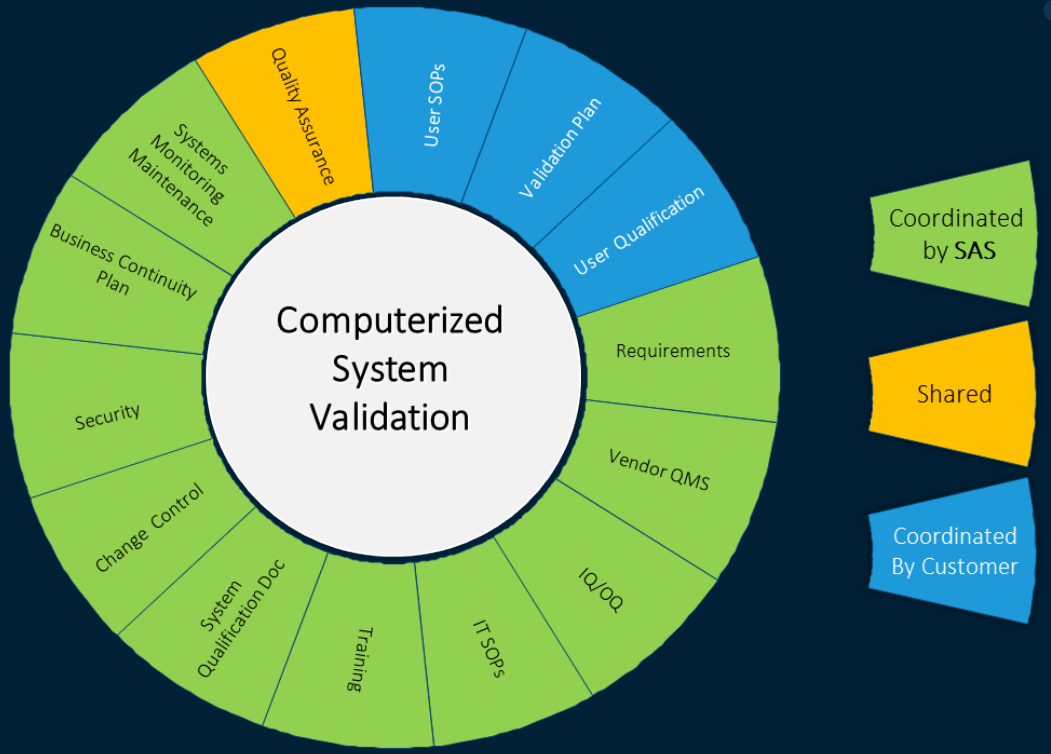
Scan 0



Scan 1



How we deliver GxP validated Software in the cloud?




Debiopharm
WE DEVELOP FOR PATIENTS
SAS Viya Implementation on Azure Cloud
Insights into Strategic Choices and Validation
OCS LIFE SCIENCES
A DIVISION OF OCS CONSULTING

An Introduction

Debiopharm Int SA

- Family owned, Swiss based pharma company with approx. 500 employees
- Therapeutics areas Oncology and Bacterial Infections (multi-resistant), with modalities of products in small molecules and biologics
- B2B model with a focus on research, pre-clinical candidates to clinical phase I and II

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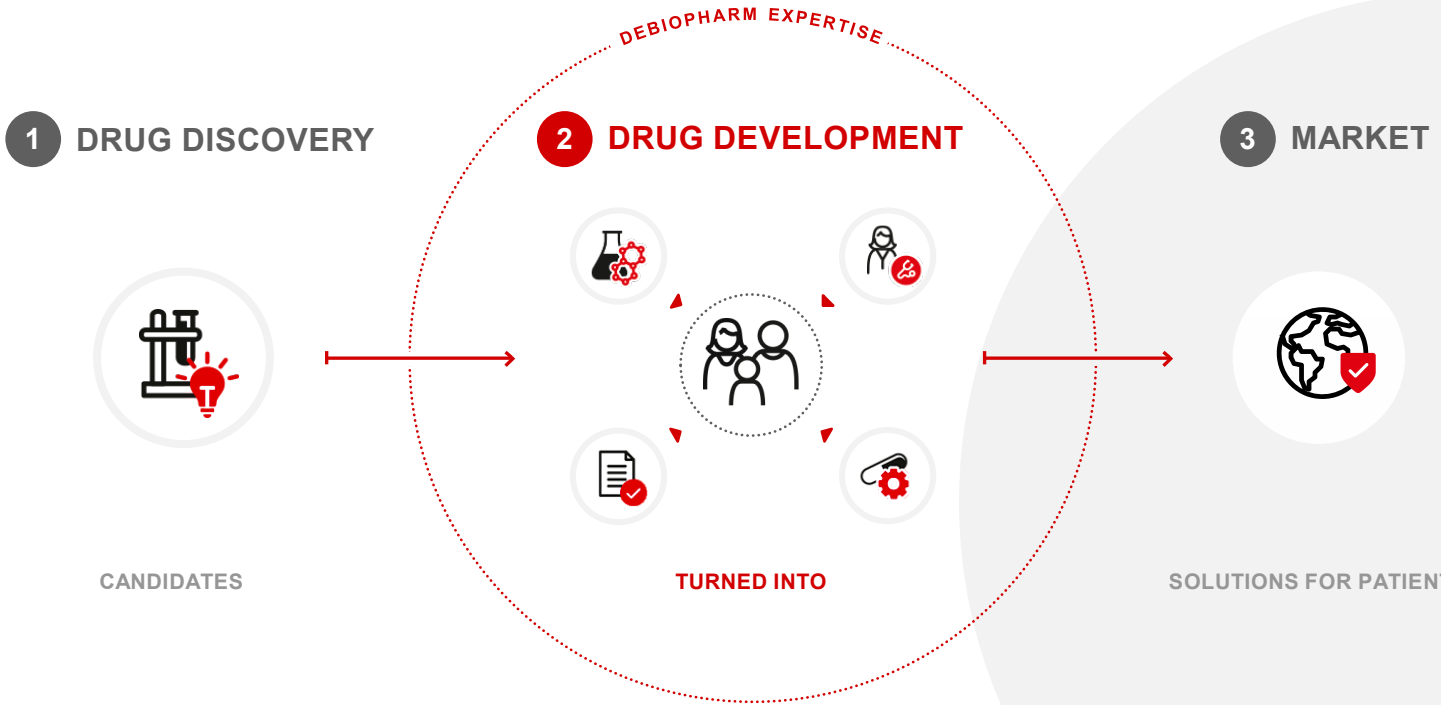
Patient-centric business model

Debiopharm B2B model



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Digital Health

strategic investments

Investing in future patient care

BC Platforms

Oncomfort Digital Sedation

nova DISCOVERY

carevive

nucleai

Mekonos

VERISIMLife

VivoSense

Mika

PAST INVESTMENTS

EXITED Kaiku HEALTH

EXITED OSE IMMUNO THERAPEUTICS

EXITED GenePOC™

EXITED spinomix

Fondation Eclosion Sciences de la Vie

agendia decoding cancer

diagnoplex Fighting Cancer Earlier

EXITED VeoVacs

EXITED BIOCARTIS

Immunexpress the signature diagnostics for sepsis

ABAC Therapeutics Precision antimicrobial agents

EXITED VOLUNTIS

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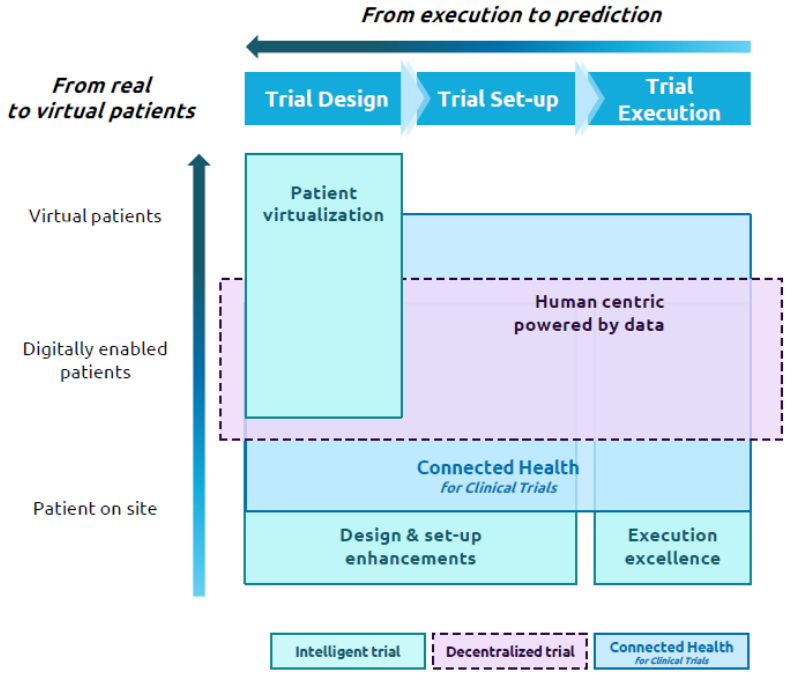
Debiopharm WE DEVELOP FOR PATIENTS

Accelerating patient centric care

CLINICAL TRIALS DISRUPTION DRIVEN BY:

- INTELLIGENCE
- DECENTRALIZATION
- CONNECTED HEALTH



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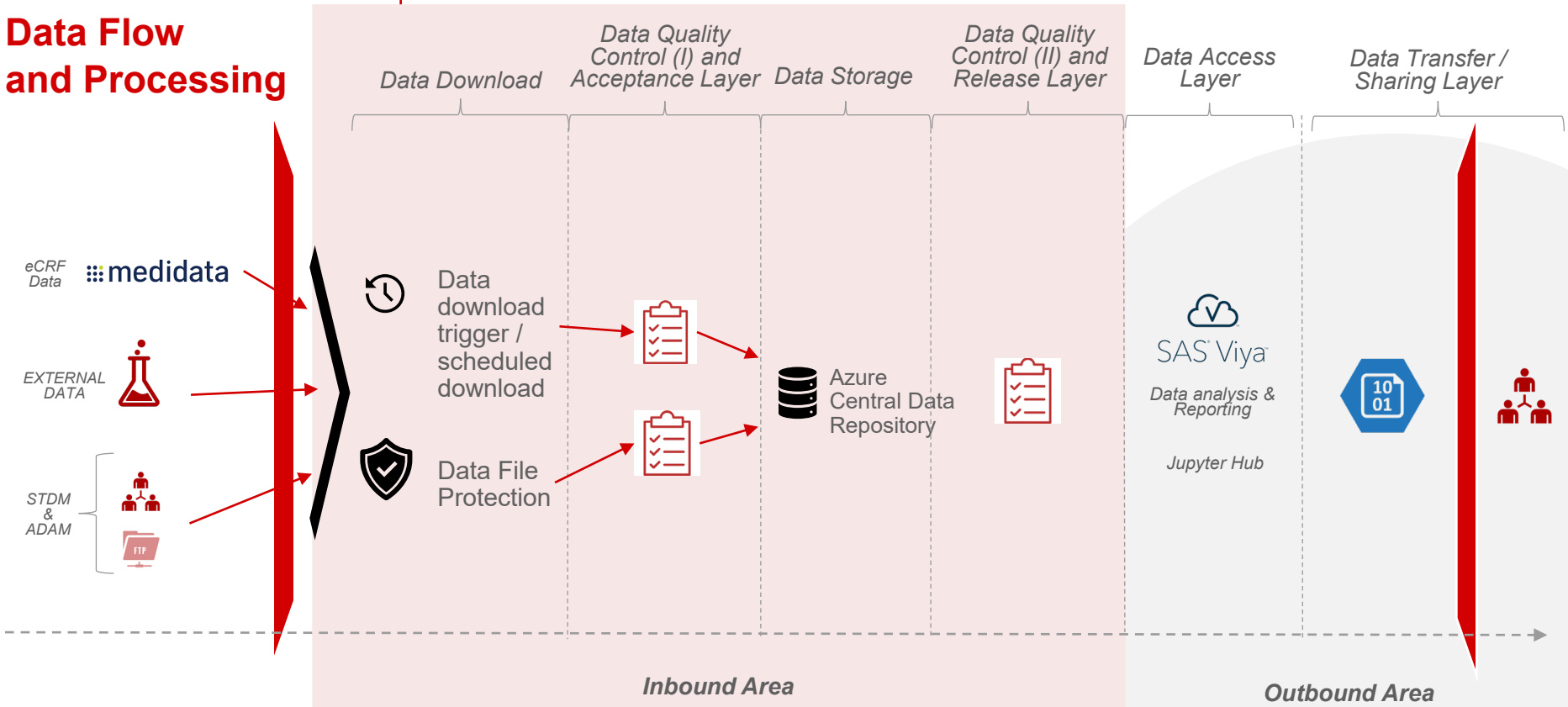
Background and Scope

- Current data flow and challenges
  - Multiple data sources
  - Multiple data transfer solution
  - No standard structure for data storage
  - No controlled/validated environment that guarantees clinical data integrity from receipt to processing
  - Data acceptance checks embedded in the data processing step causing late issues detection

- The main root causes are the following:
  - Multiple Contract Research Organisations (CROs) each having their own processes and standards
  - No end-to end validated environment (from data transfer to statistical analysis)
  - No standard procedure applied for the data flow.

Clinical Data Flow and Processing

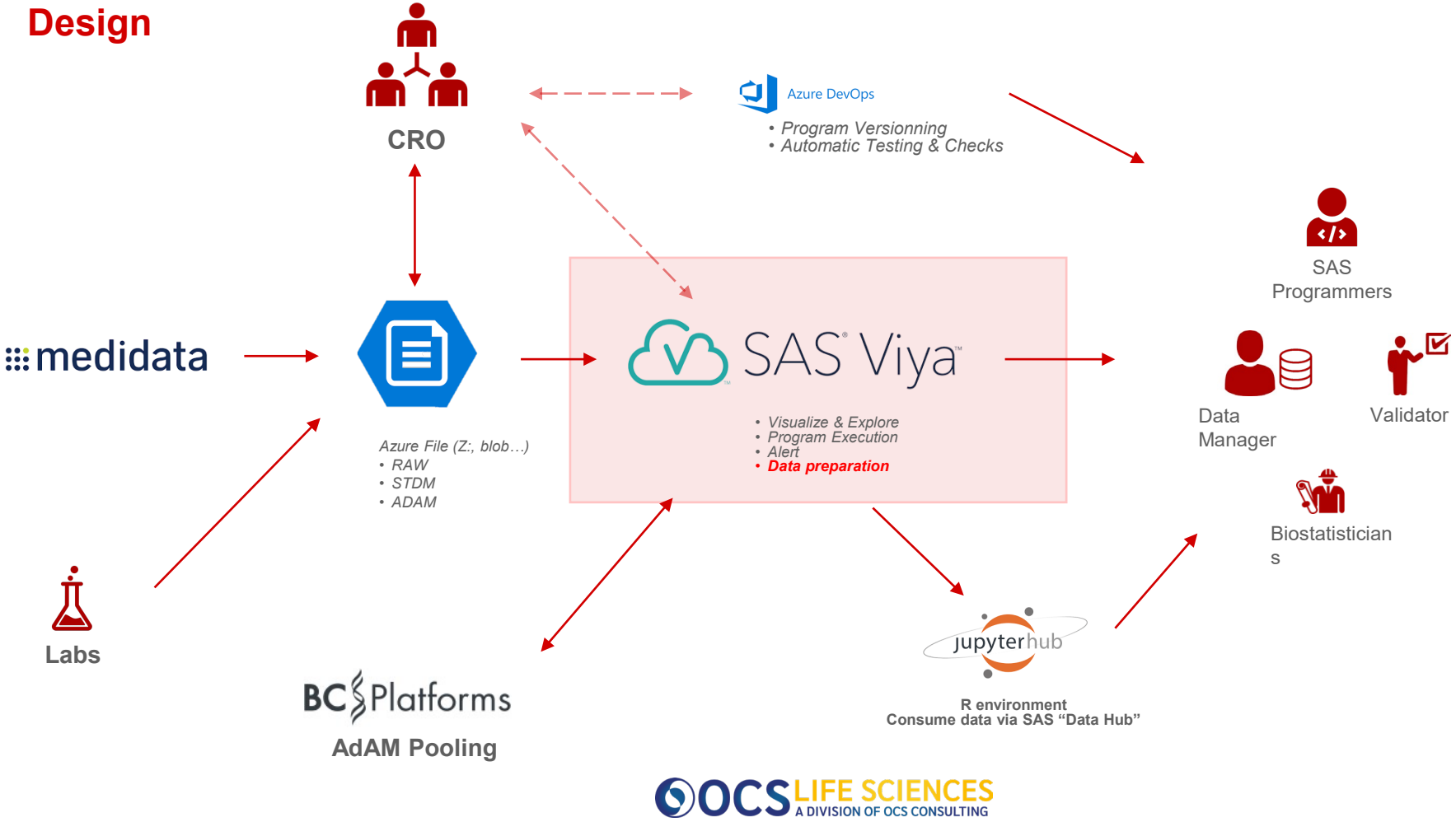


SAS Viya 4 license

Viya 4 bundle:

- SAS VISUAL STATISTICS WITH SAS ECONOMETRICS
- LICENSE IS LIMITED TO 13 USERS (SAS STUDIO USERS AND REPORT DEVELOPERS)
- LICENSE IS UNLIMITED FOR REPORT VIEWERS, NUMBER OF ENVIRONMENTS AND CORES
- THE SYSTEM WILL HAVE 13 CONCURRENT HEAVY USERS (SAS STUDIO AND REPORT DEVELOPERS),
  - WHICH MAY HAVE UP 2 TWO SESSIONS EACH, AND UP TO 50 CONCURRENT REPORT VIEWERS

Design



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Added Value

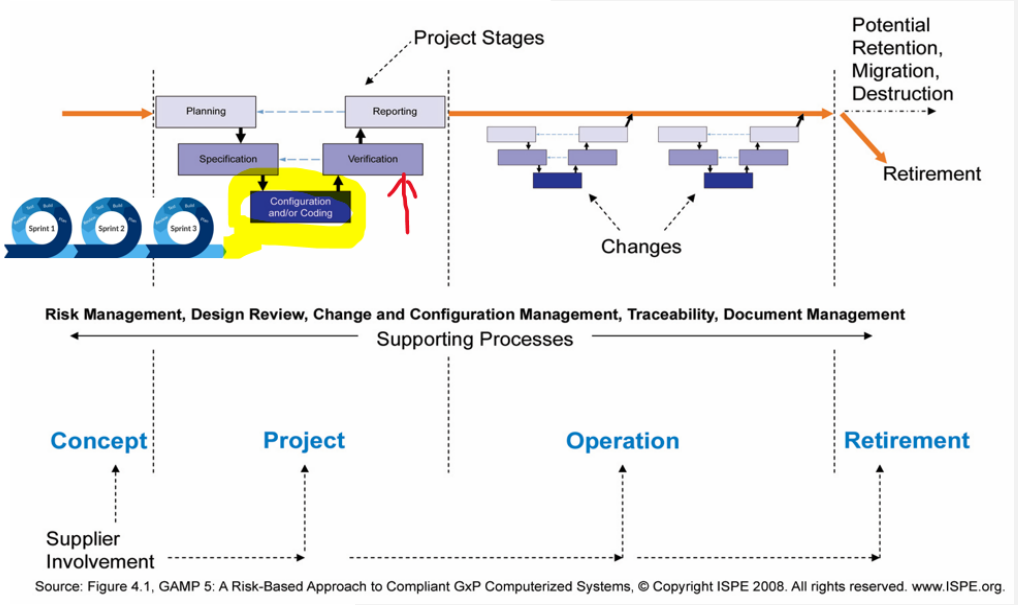
SAS Viya : Modern Analytics Platform

Implement a **shared**, **scalable** and **reproducible** Data Management Biometrics Development Environment

- Unlimited number of SAS viewers
- Improved collaboration – internal & external (CROs)
- Installation, implementation, validation - Azure Kubernetes
- Integrated Environment for SAS & Open-Source programming
- Improved Scalability & performance
- Easy Access

Agile methodology inside Waterfall

- Method of project management, used especially for software development, following industry standard CFR 21 Part 11
- Only through iteration we could find the correct SAS Viya configuration process
- Total build phase 7 months
  - total throughput time 11 months
- Team: Syst Owner, BPO, CSV Lead, PM, OCS / SAS consultancy



Source: Figure 4.1, GAMP 5: A Risk-Based Approach to Compliant GxP Computerized Systems, © Copyright ISPE 2008. All rights reserved. www.ISPE.org.

SAS Viya CSV Documentation

1. SAS Viya Architecture D30 Document
2. SAS Viya CSCIA (critical assessment)
3. SAS Viya CSVP CSCR (validation plan & change request)
4. SAS Viya User requirements
5. SAS Viya Installation Protocol
6. SAS Viya configuration specification
7. SAS Viya OQ, IQ, UAT documentation
8. SAS Viya Kubernetes Infrastructure Qualification Document
9. Validation Report

Questions?

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