



**SAS Drug Development in action:  
efficient standards libraries and study management  
modules together called CDmation.**

Mark Lambrecht (SAS)

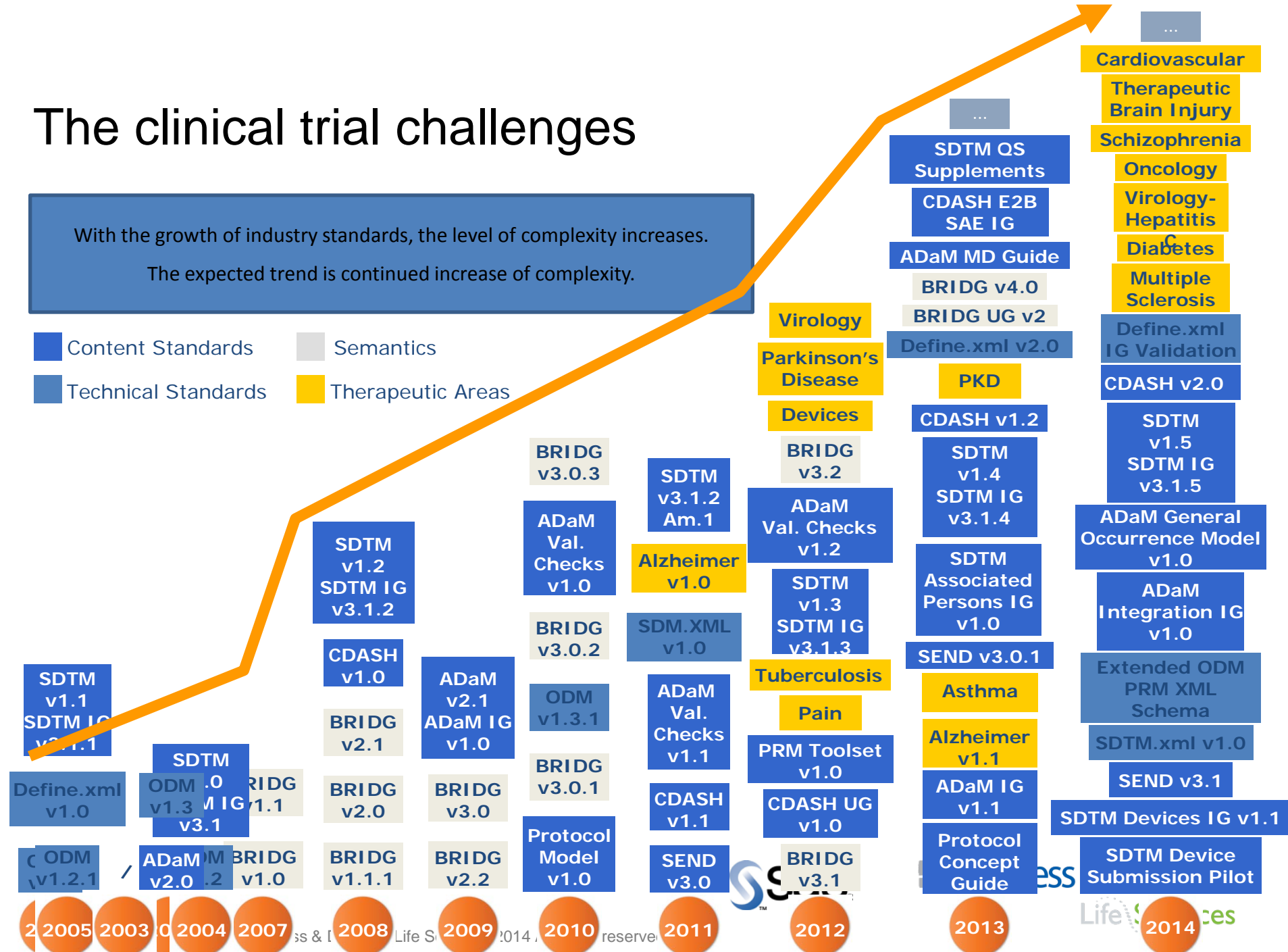
Peter Van Reusel (Business & Decision Life Sciences)



# The clinical trial challenges

With the growth of industry standards, the level of complexity increases.  
The expected trend is continued increase of complexity.

- Content Standards
- Technical Standards
- Semantics
- Therapeutic Areas

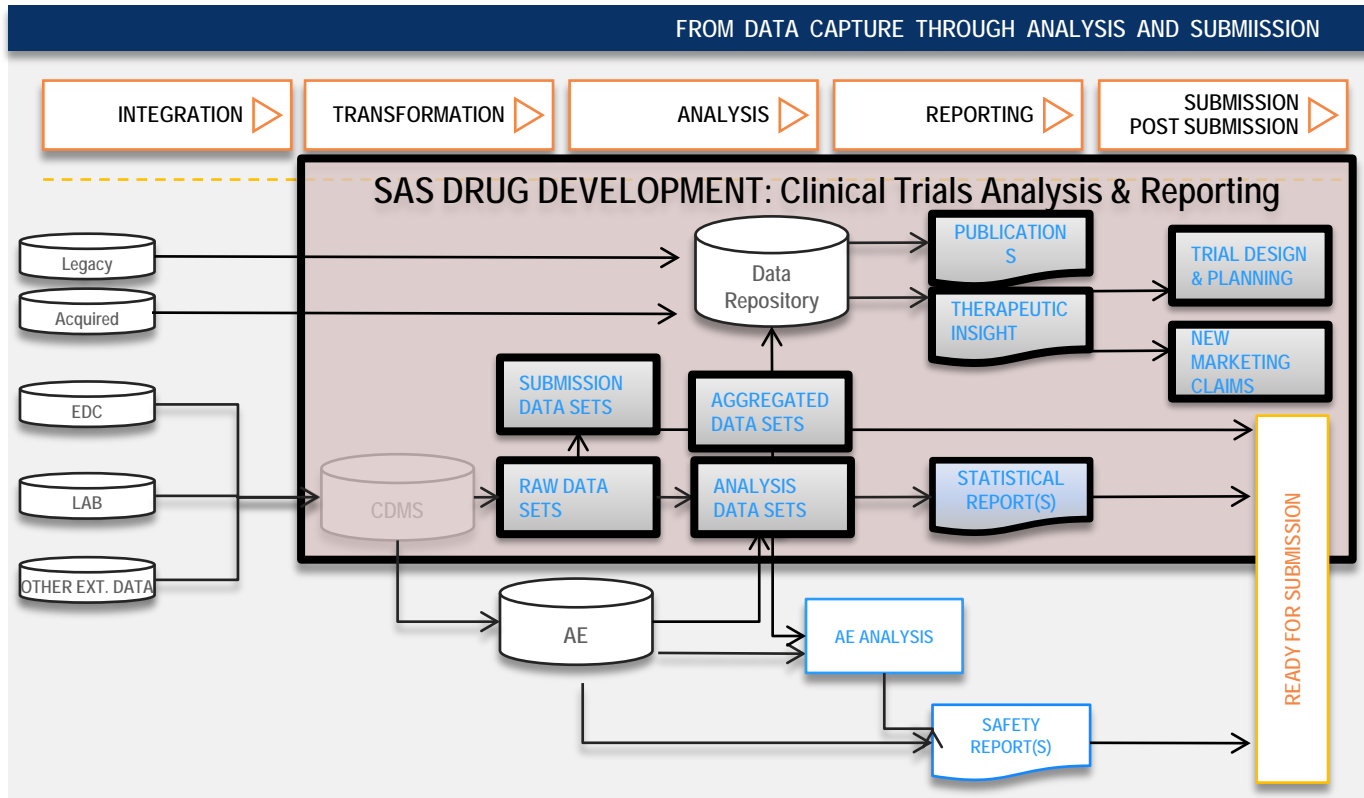


# Agenda

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# Clinical Trials Process



# SAS and the Next Generation of Clinical Research

## Collaboration and Access

- Access-anywhere web interface
- User, team and role-based access
- Messaging and alerts
- Shared libraries

## Confidence and Control

- Compliant, regulated environment
- Activity traceability
- Transparency
- Reproducibility

## Process Improvements

- Workflow support and process orchestration
- eProtocol, EDC and eSubmission integration
- Automated work assignments and transitions

## Advanced Analytics

- Scientific analytics
- Business analytics
- Data exploration
- Data visualization



# Clinical Data Analysis and Reporting Business Needs



# Needs for a metadata management solution versus SDD

OK

- Robust platform to cover other parts of clinical data management and statistics
- Need to store data
- Need to have several workflows
- Capability to execute SAS code
- Traceability, security and audit
- Reporting capabilities



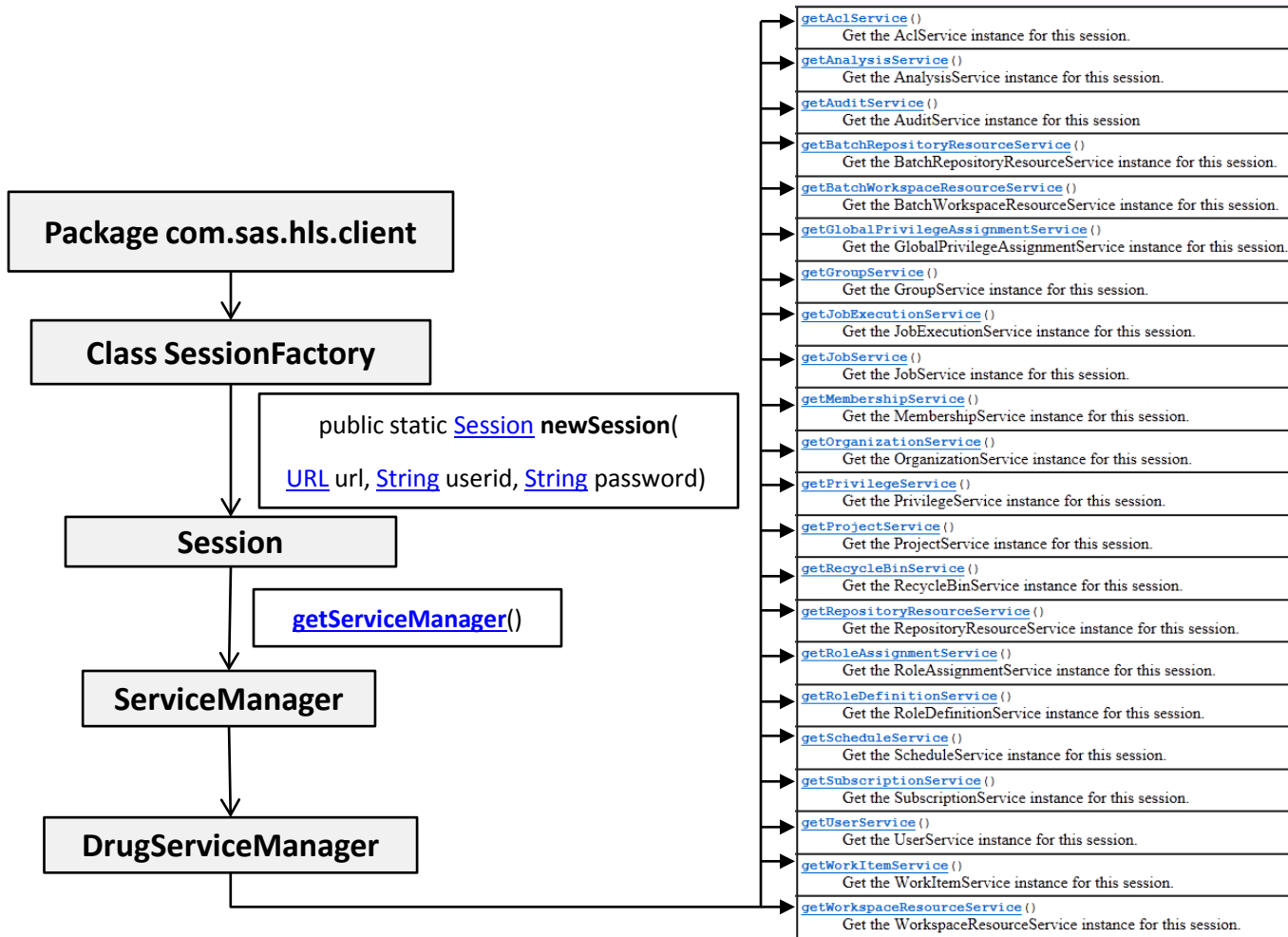
But...

- *UI for granular data standards management*
- *Study specification process*
- *Study validation process*



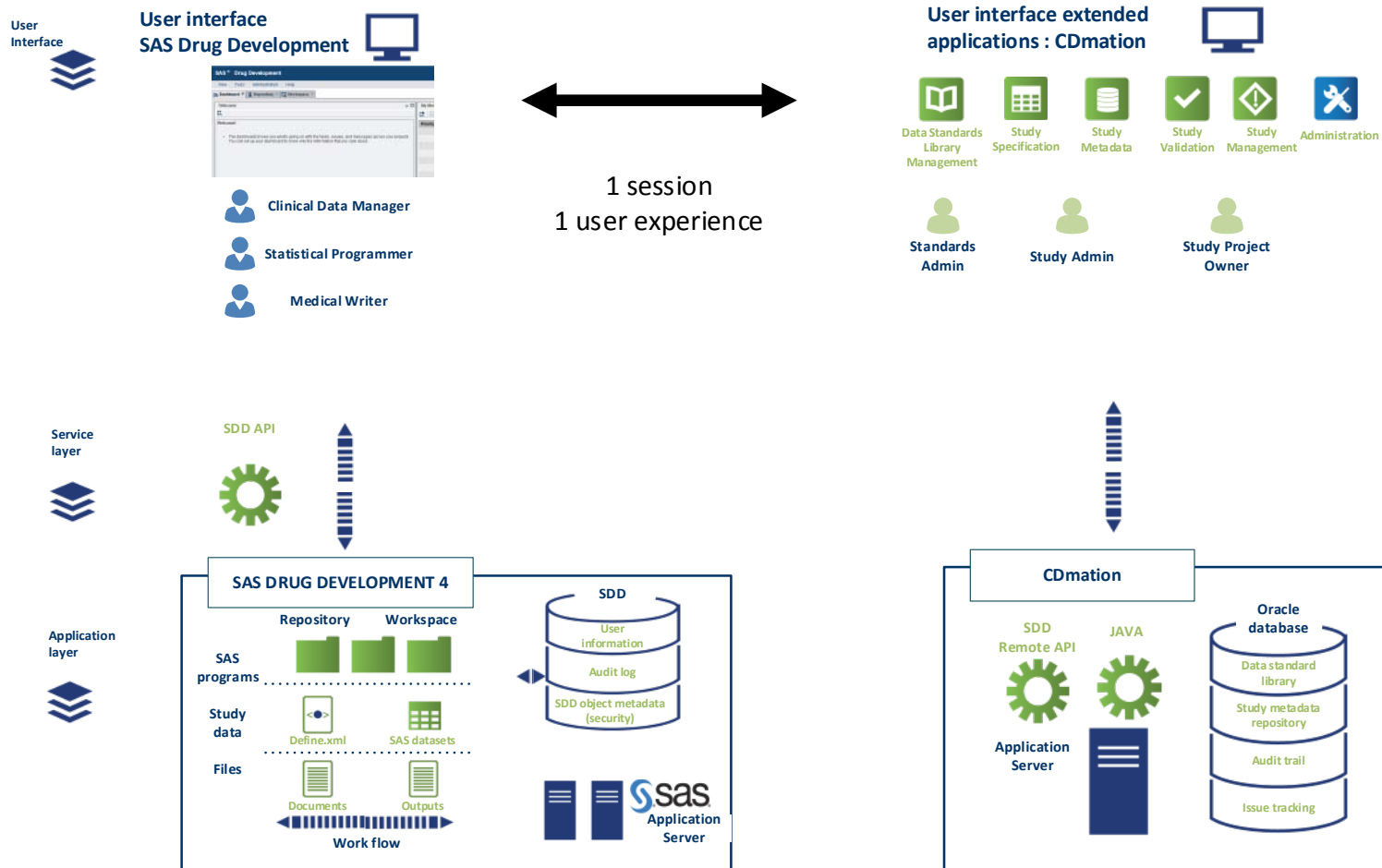
# Come to the rescue... Robust SDD Application Programming Interface

SDD 4.X JAVA API OVERVIEW





# SDD = extensible and modular



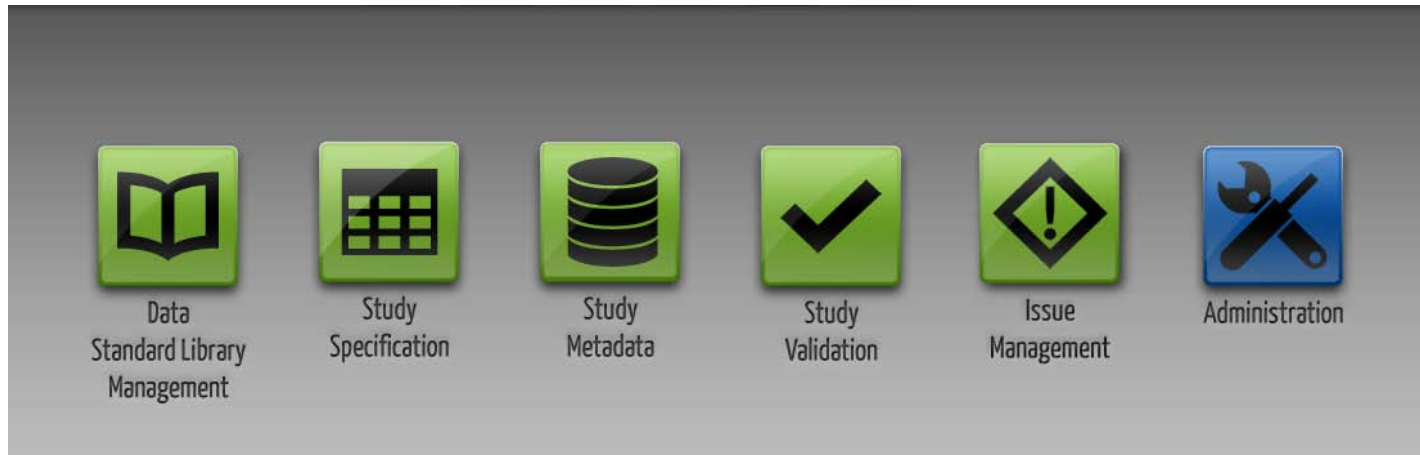
# Agenda

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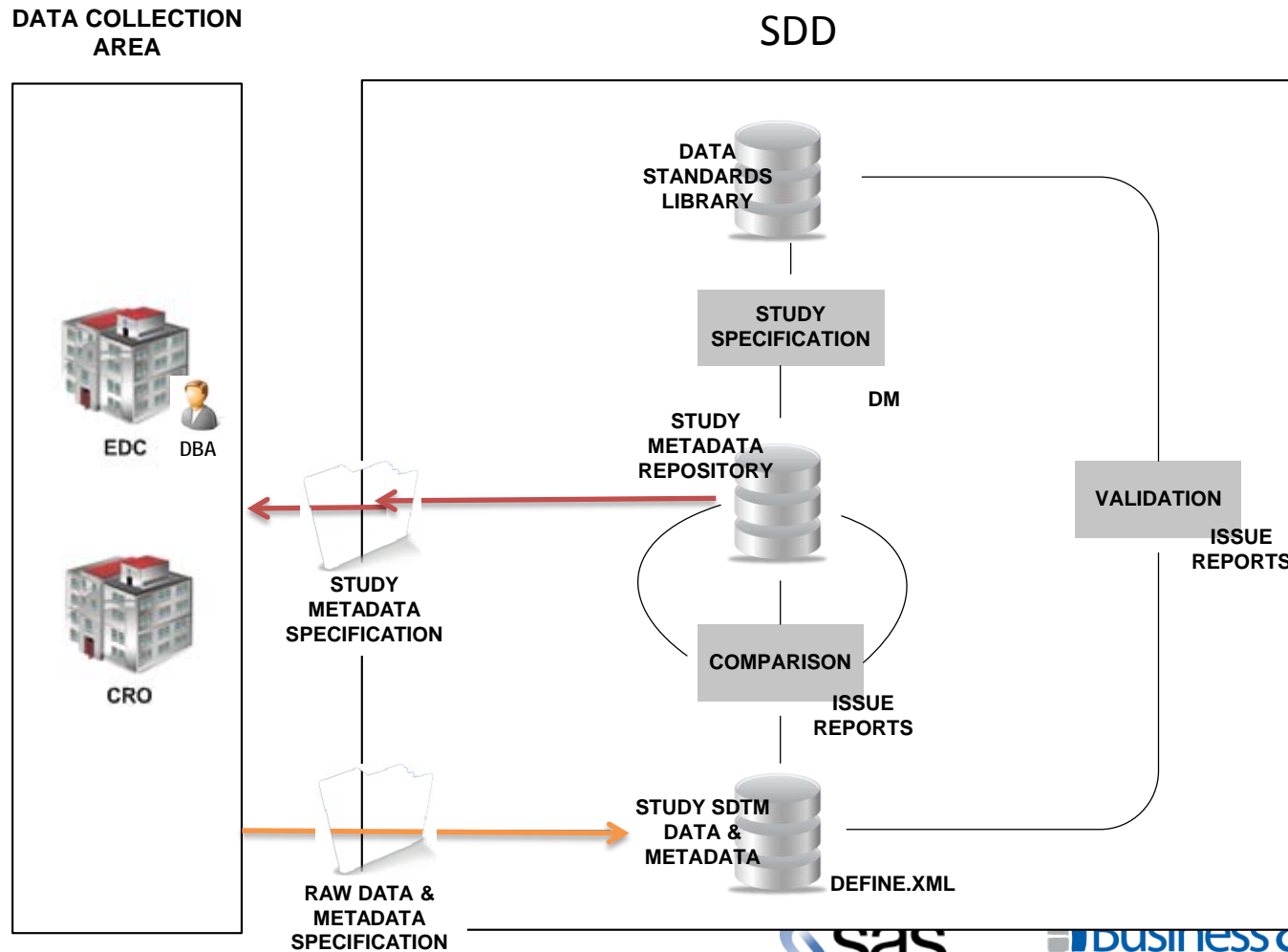


# CDmation

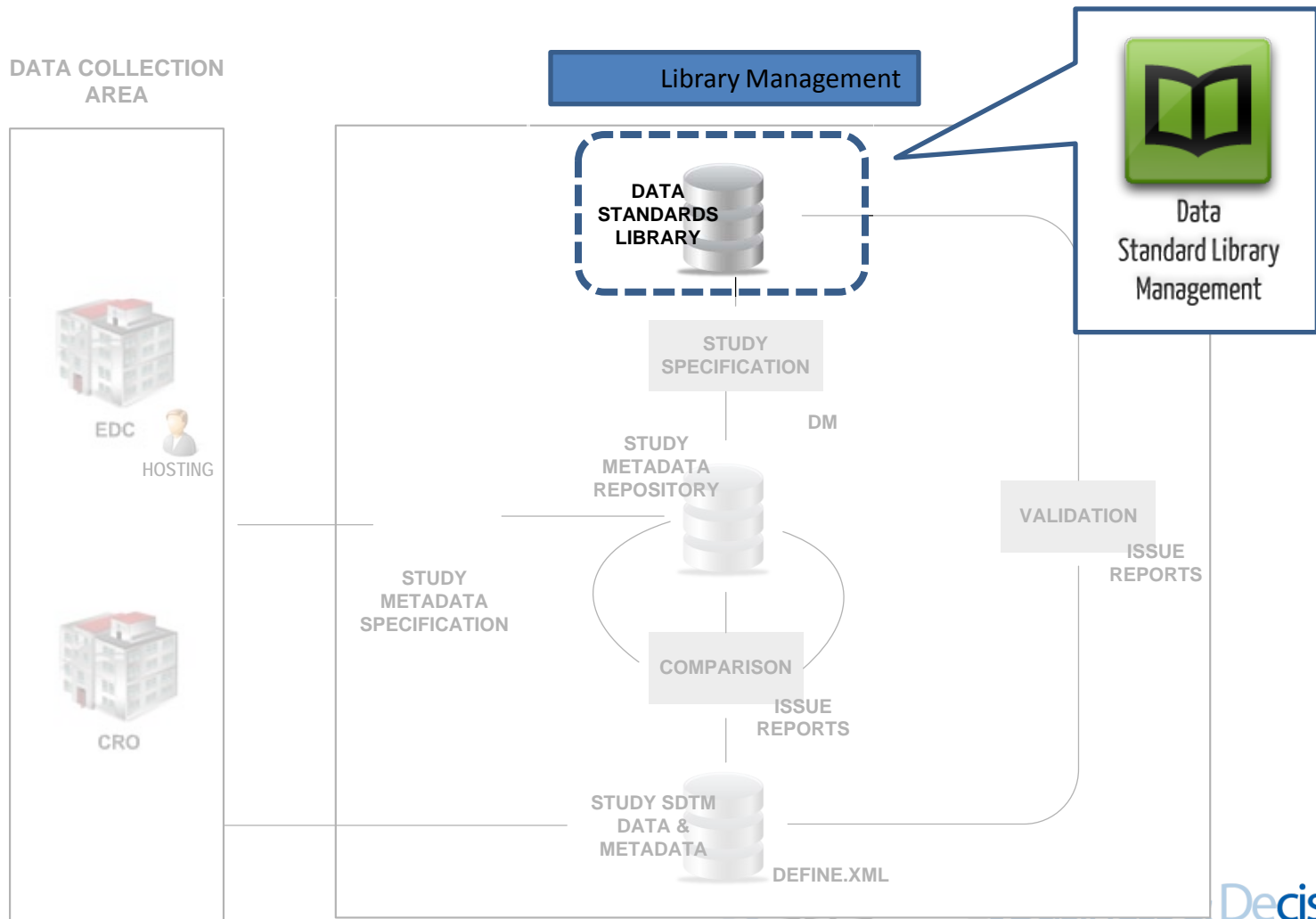
- An integrated solution with six components:



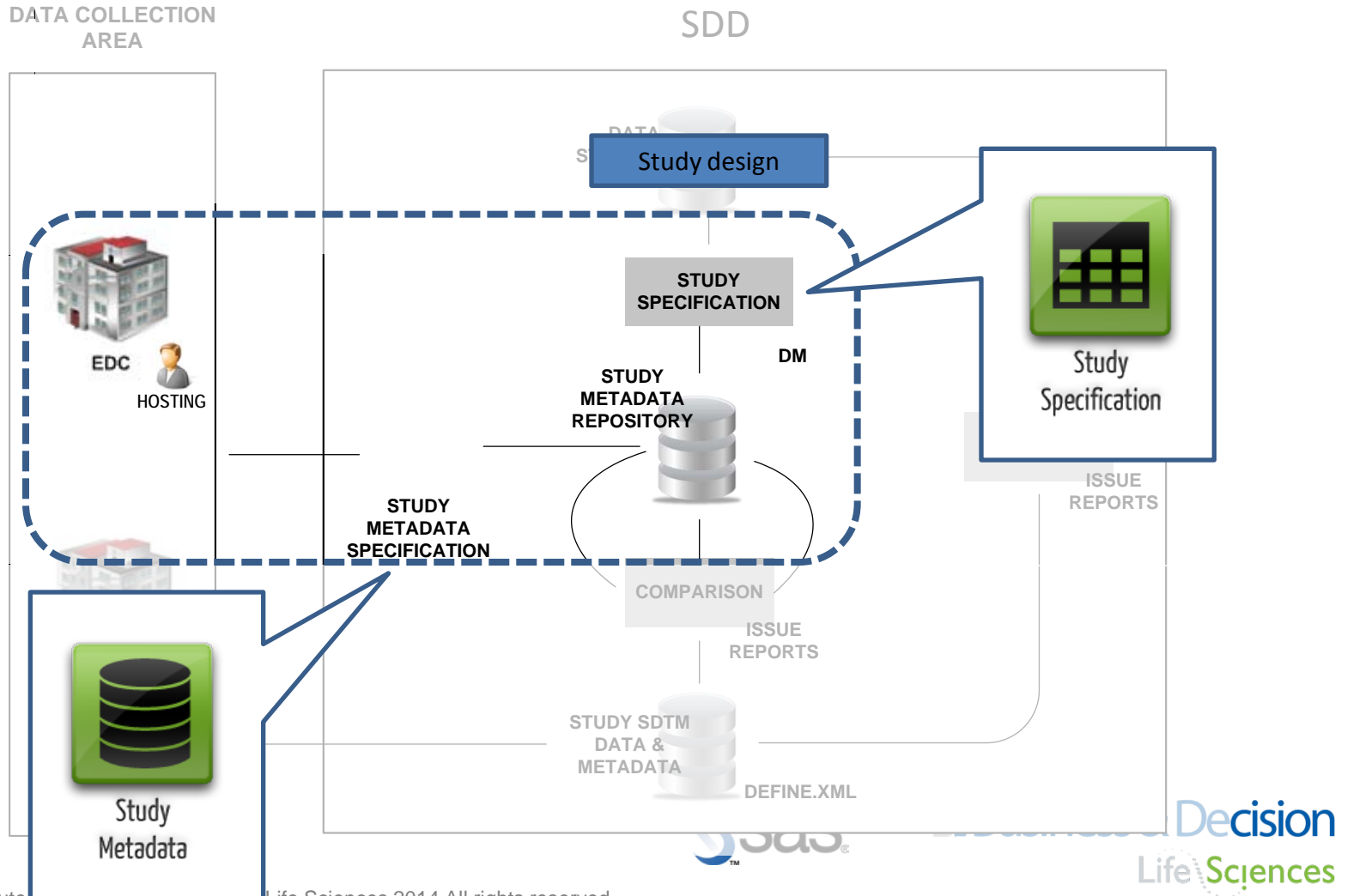
# CDmation's playing field



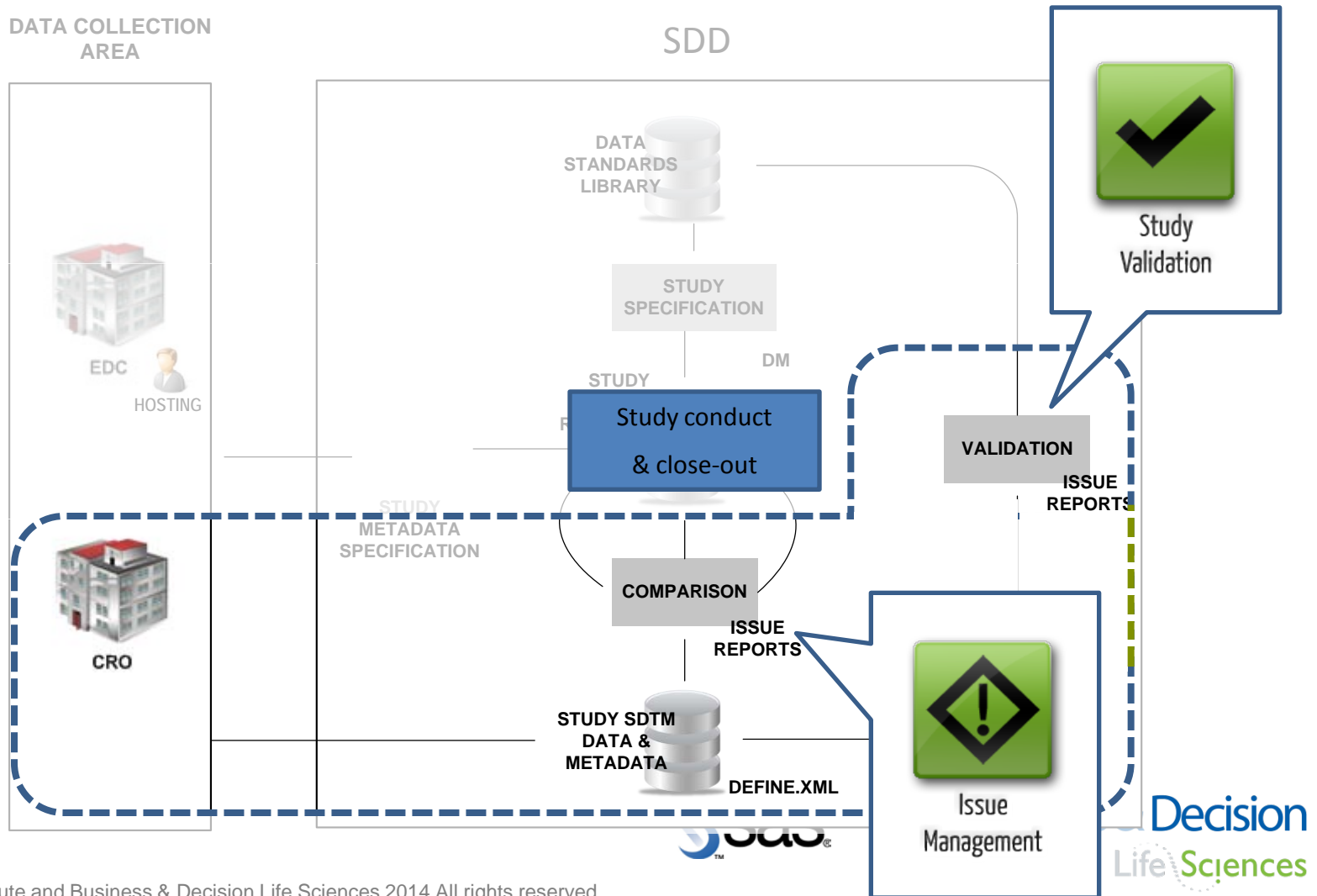
# Functionalities



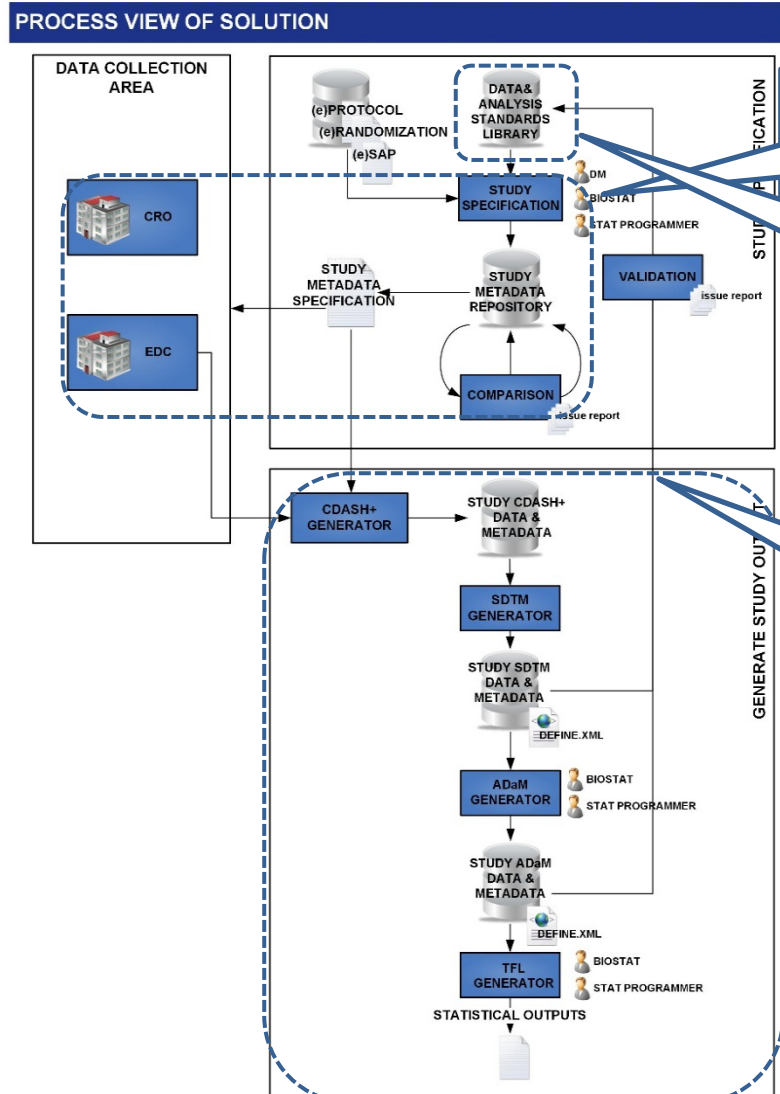
# Functionalities



# Functionalities



# CDmation Roadmap



EDC Build

Extend library to include Analysis Standards

Generate Analysis



# Agenda

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# Use Case 1 – Study Specification

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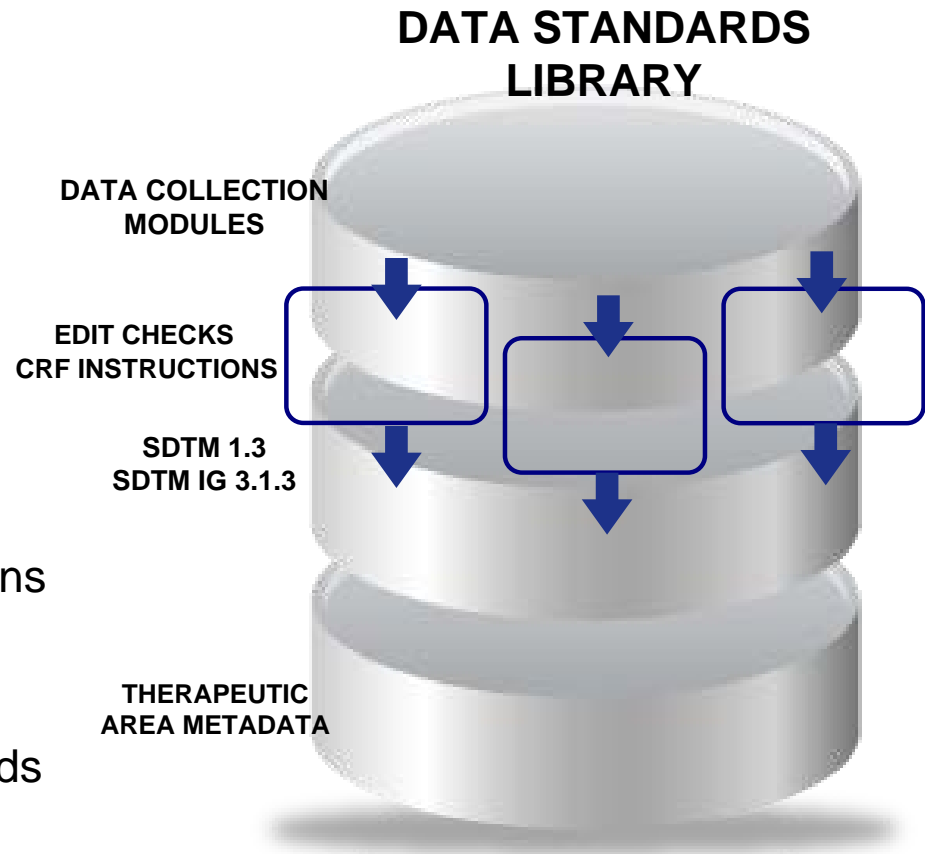
## Study Specification and Metadata Repository

- Pick and Select study creation
  - Creation of Trial Design specifications
  - Defines all study specifications in a controlled manner
  - Allows generating a study metadata repository for comparison reporting within and across studies
  - Generates a define.xml upfront
- **Ensures CDISC compliant study specifications for your CRO early in the process, maintains data consistency, facilitates submission activities and increases overall quality and reduces rework**



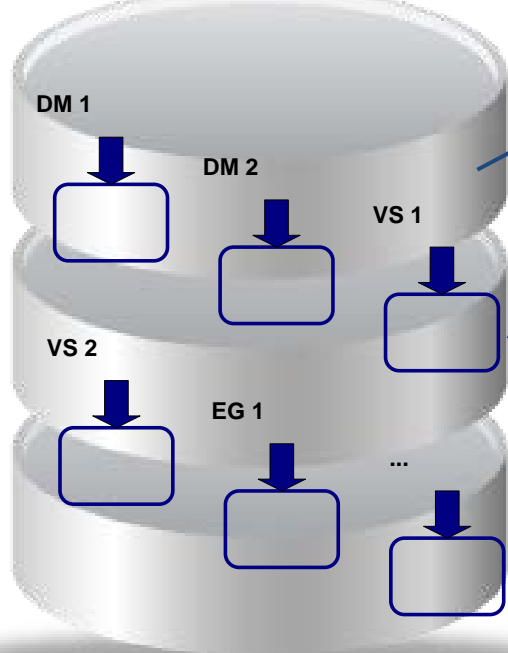
# Data Standards Library

- The Data Standards Library contains :
  - Data Collection Modules:
    - using CDASH metadata
    - with clustered SDTM metadata
    - annotated for CDASH
    - annotated for SDTM
    - front end edit checks
    - CRF completion Instructions
  - Metadata Definitions :
    - SDTM Standards
    - Therapeutic Area Standards



# Data Collection Modules - CDASH

## DATA COLLECTION MODULES LIBRARY



### Vital Signs

**Vital signs**

Date and time performed **VSDAT**       (24 h time clock)  
dd mmm yy **VSTIM**        
hh mm

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Weight **VSTEST**       kg **VSTEST** Height       cm **VSTEST**  
**VSORRES** **VSORRES**

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Pulse **VSTEST** Supine\*       beats/min **VSTEST**  
**VSORRES** **VSORRES**  
 Standing\*       beats/min **VSTEST**  
**VSORRES** **VSORRES**

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Blood pressure **VSTEST** Supine\*       /        systolic/diastolic (mmHg) **VSTEST**  
**VSORRES** **VSORRES**  
 Standing\*       /        systolic/diastolic (mmHg) **VSTEST**  
**VSORRES** **VSORRES**

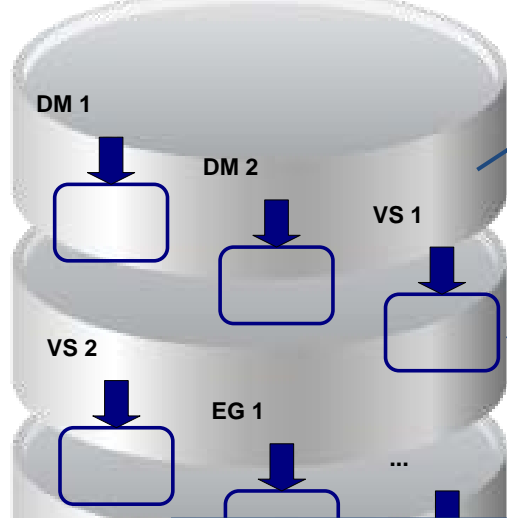
Collected CDASH Variables	CRF Prompt	Codelist	Preprinted values
VSDAT	Date		
VSTIM	Time		
VSPOS	Position	POSITION	
VSTEST	Test	VLM VSTESTCD	Height
VSTEST	Test	VLM VSTESTCD	Weight
VSTEST	Test	VLM VSTESTCD	Pulse
VSTEST	Test	VLM VSTESTCD	Systolic Blood Pressure
VSTEST	Test	VLM VSTESTCD	Diastolic Blood Pressure
VSORRESU	Unit	VSRESU	cm
VSORRESU	Unit	VSRESU	kg
VSORRESU	Unit	VSRESU	beats/min
VSORRESU	Unit	VSRESU	mmHg

CRF template using CDASH annotations



# Data Collection Modules - SDTM

## DATA COLLECTION MODULES LIBRARY



### Vital Signs

**Vital signs**

Date and time performed    **VSDTC**   (24 h time clock)

**VSORRES where VSTESTCD = "WEIGHT"**  kg **VSORRES where VSTESTCD = "HEIGHT"**  cm

Pulse **VSORRES where VSTESTCD = "PULSE"**

**VSPOS = "SUPINE", "STANDING"** Supine\*  beats/min Standing\*  beats/min

Blood pressure **VSORRES where VSTESTCD = "SYSBP", "DIABP"**

Supine\*  /  systolic/diastolic (mmHg) Standing\*  /  systolic/diastolic (mmHg)

\*(supine: after ≥ 5 min. rest; standing: after ≥ 1 min. standing)

Value Level Metadata (ValueList.VS.VSTESTCD)							
Source Variable	Value	Label	Type	Controlled Terminology	Origin	Role	Comment
VSTESTCD	DIABP	DIASTOLIC BLOOD PRESSURE	integer		CRF		
VSTESTCD	HEIGHT	HEIGHT	integer		CRF		
VSTESTCD	PULSE	PULSE RATE	integer		CRF		
VSTESTCD	SYSBP	SYSTOLIC BLOOD PRESSURE	integer		CRF		
VSTESTCD	WEIGHT	WEIGHT	integer		CRF		



# Study Specification

The screenshot displays the CDmation software interface for study specification. The top navigation bar includes the CDmation logo, a set of icons (book, grid, database, checkmark, warning, wrench), and the Business & Decision Life Sciences logo. The main content area shows a 'Study overview' table with columns for Visit, DCM, Questions, TPTNUM, TPT, TPTREF, and ORDER. A blue box labeled 'Pick and Select DCM' has arrows pointing to the 'DCM' tab in the 'Visit schedule' section and the 'DCM' column in the 'Study overview' table.

Visit	DCM	Questions	TPTNUM	TPT	TPTREF	ORDER
Screening	DM_800					
Screening	VS_800					
Screening	LB_900					
Randomization	DM_900					
VISIT 3	CM_900					
VISIT 3	VS_900					
VISIT 3	LB_900					

Pick and Select DCM



# Define.xml

Dataset	Description	Class	Structure	Purpose	Keys	Location
CM	<a href="#">Concomitant Medications</a>	Interventions	One record per recorded medication occurrence or constant-dosing interval per subject	Tabulation	STUDYID, USUBJID, CMTRT, CMSTDTC	...Tabulations_cm.xpt
EX	<a href="#">Exposure</a>	Interventions	One record per constant dosing	Tabulation	STUDYID, USUBJID,	...Tabulations_ex.xpt
AE	<a href="#">Adverse Events</a>					

Variable	Label	Type	Controlled Terminology	Origin	Role	Comment
STUDYID	Study Identifier	text		Protocol, CRF	<a href="#">IDENTIFIER</a>	The STUDYID variable has a fixed format: 'XXXX-YYYY', where 'XXXX' indicates the 4-digit compound code and the 'YYYY' the 4-digit study code
DOMAIN	Domain Abbreviation	<b>Value Level Metadata (ValueList.VS.VSTESTCD)</b>				
USUBJID	Unique Subject Identifier					
Source Variable	Value	Label	Type	Controlled Terminology	Origin	Comment
VSTESTCD	BMI	BODY MASS INDEX	integer		Derived	See Computational Method: <a href="#">VS.BMI</a>
VSTESTCD	DIABP	DIASTOLIC BLOOD PRESSURE	integer		CRF	
VSTESTCD	HEIGHT	HEIGHT	integer		CRF	
VSTESTCD	PULSE	PULSE	integer		CRF	
VSTESTCD	SYSBP	SYSTOLIC BLOOD PRESSURE	integer		CRF	
VSTESTCD	WEIGHT	WEIGHT	integer		CRF	

<b>POSITION, Reference Name (Codelist.POSITION)</b>	
Code Value	Code Text
STANDING	STANDING
SUPINE	SUPINE

<b>SEX, Reference Name (Codelist.SEX)</b>	
Code Value	Code Text
F	Female
M	Male
U	Unknown

<b>Computational Algorithms (VS.BMI)</b>	
Reference Name	Computation Method
VS.BMI	Equals to WEIGHT DIVIDED BY HEIGHT SQUARED

<b>Computational Algorithms (VS.VSDY)</b>	
Reference Name	Computation Method
VS.VSDY	Equals to (VS.VSDTC - DM.RFSTDTC) + 1 IF VSDTC is on or after RFSTDTC Equals to (VS.VSDTC - DMLRFSTDTC) IF VSDTC precedes RFSTDTC



# Use Case 2 – Study Validation

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## Study Validation

- Comparison reports against specifications
  - Validation performed on structural and content level
  - Output in Excel spreadsheet, HTML and PDF report
  - Output also stored in the Feedback Tracker
- **Ensures improved vendor communication, CDISC compliance and readiness, increases quality, reduces rework.**





# Select checks => Create Job

**CDmation** | Business & Decision | Life Sciences

Manage checks | **Create job** | Existing jobs

125 CHECKS SELECTED

Data model: \* Library selector Global\_Onco\_CDASH1.1\_SDTM3.1.3  
Library active date: 22/04/2014  
Project: \* BBBB  
Study: \* BBBB-00001  
Job name: \*  
Job description: \*  
Input Dataset Path: /SAS/BBBB/BBBB-00001/Files/Staging/DM\_CRO/SDTM\_SAS\_C

Job type: STAGING PRODUCTION

Type of checks:

- All
- All classes
- Data checks
- Metadata checks
- Events
- Interventions
- Findings
- Findings about
- Trial design
- Special

Save job | Reset selection | View selected checks

	Check name	Severity	Description	Error message	DM Version
<input type="checkbox"/>	Check3130000001	MEDIUM	Check if all the date variables (--DTC, --STDTC, --ENDTC, RFDSTDC, RFENDTC, --RFTDTC, BRTHDTC) have a ISO 8601 standard format.	DATE VARIABLE does not have a ISO 8601 format.	Global_Onco_CDASH1.1_SDTM3.1.3
<input type="checkbox"/>	Check3130000002	HIGH	Check per --TESTCD if the --STRESU is consistent within the trial limited to records where [-STRESN <> NULL].	The STANDARD UNIT is not consistent per TEST or EXAMINATION.	Global_Onco_CDASH1.1_SDTM3.1.3
<input type="checkbox"/>	Check3130000003	MEDIUM	Check if AESER =Y that [AESCAN=Y or AESCONG=Y or AESDISAB=Y or AESDTH=Y or AESHOSP=Y or AESLIFE=Y or AESMIE=Y or AESOD=Y] (Check only applies if serious criteria are completed). (&&) Check if [AESCAN=Y or AESCONG=Y or AESDISAB=Y or AESDTH=Y or	The AE is serious, but none of the serious criteria is answered 'Y'. (&&) The AE is not serious, but one of the serious criteria is answered 'Y'.	Global_Onco_CDASH1.1_SDTM3.1.3



# Run job => Review issues



## Reported Exception Record Identifiers Exception Attributes

CHECKID	ERRORMSG	SEVERITY	STUDYID	DOMAIN	USUBJID	KEY1CD	KEY1	VAR1CD	VAR1	VAR2CD	VAR2
1002	The STANDARD UNIT is not consistent per TEST or EXAMINATION.	High	1000-0000	LB				LBTESTCD	LIPASE	LBSTRESU	%
1002	The STANDARD UNIT is not consistent per TEST or EXAMINATION.	High	1000-0000	LB				LBTESTCD	LIPASE	LBSTRESU	mmol/L
1002	The STANDARD UNIT is not consistent per TEST or EXAMINATION.	High	1000-0000	LB				LBTESTCD	ALKP	LBSTRESU	U
1002	The STANDARD UNIT is not consistent per TEST or EXAMINATION.	High	1000-0000	LB				LBTESTCD	ALKP	LBSTRESU	U/L
1002	The STANDARD UNIT is not consistent per TEST or EXAMINATION.	High	1000-0000	LB				LBTESTCD	LIPASE	LBSTRESU	IU/L
1005	START DATE/TIME OF OBSERVATION falls after the END DATE/TIME OF OBSERVATION.	High	1000-0000	AE	1000-0000-00019	AESEQ	1	AESTDTC	1998-12-01T17:00	AEENDTC	1998-12-01T16:30
1005	START DATE/TIME OF OBSERVATION falls after the END DATE/TIME OF OBSERVATION.	High	1000-0000	AE	1000-0000-00037	AESEQ	1	AESTDTC	1998-12-15T07:40	AEENDTC	1998-11-25T08:00
1005	START DATE/TIME OF OBSERVATION falls after the END DATE/TIME OF OBSERVATION.	High	1000-0000	SE	1000-0000-00004	SESEQ	2	SESTDTC	1998-11-17T08:06:00	SEENDTC	1998-11-17T07:07:00
1005	START DATE/TIME OF OBSERVATION falls after the END DATE/TIME OF OBSERVATION.	High	1000-0000	SE	1000-0000-00009	SESEQ	2	SESTDTC	1998-11-24T08:00:00	SEENDTC	1997-11-24T08:01:00
1005	START DATE/TIME OF OBSERVATION falls after the END DATE/TIME OF OBSERVATION.	High	1000-0000	SV	1000-0000-00022			SVSTDTC	1998-12-03	SVENDTC	1998-12-02
1005	START DATE/TIME OF OBSERVATION falls after the END DATE/TIME OF OBSERVATION.	High	1000-0000	SV	1000-0000-00010			SVSTDTC	1998-11-24	SVENDTC	1998-11-22
1005	START DATE/TIME OF OBSERVATION falls after the END DATE/TIME OF OBSERVATION.	High	1000-0000	SV	1000-0000-00014			SVSTDTC	1998-11-16	SVENDTC	1998-10-16
1005	START DATE/TIME OF OBSERVATION falls after the END DATE/TIME OF OBSERVATION.	High	1000-0000	SV	1000-0000-00035			SVSTDTC	1998-12-17	SVENDTC	1997-12-17
1007	The LENGTH of the --TEST variable is more than 40 characters.	High	1000-0000	LB	1000-0000-00001	LBSEQ	35	LBTEST	ERY. MEAN CORPUSCULAR HB CONCENTRATION MEAS	LENGTH	43
1007	The LENGTH of the --TEST variable is more than 40 characters.	High	1000-0000	LB	1000-0000-00030	LBSEQ	54	LBTEST	PARTIAL THROMBOPLASTINE TIME MEASUREMENTS	LENGTH	41
1008	The --TESTCD starts with a number.	High	1000-0000	LB	1000-0000-00001	LBSEQ	3	LBTESTCD	2AMYL		
1009	An ORIGINAL RESULT is completed but the STANDARD RESULT (CHARACTERISTIC) is missing.	High	1000-0000	IE	1000-0000-00006	IESEQ	1	IEORRES	N	IESTRESC	
1009	An ORIGINAL RESULT is completed but the STANDARD RESULT (CHARACTERISTIC) is missing.	High	1000-0000	SC	1000-0000-00031	SCSEQ	1	SCORRES	R-K	SCSTRESC	
1009	An ORIGINAL RESULT is completed but the STANDARD RESULT (CHARACTERISTIC) is missing.	High	1000-0000	SC	1000-0000-00014	SCSEQ	1	SCORRES	W-B	SCSTRESC	
1009	An ORIGINAL RESULT is completed but the STANDARD RESULT (CHARACTERISTIC) is missing.	High	1000-0000	SC	1000-0000-00022	SCSEQ	1	SCORRES	M-U	SCSTRESC	



# Manage Issues

IDP / Study: TTTT / TTTT-00001 Unique Id: 246863

Feedback Created Manually:

Description \*: Check in define.xml in CO, DM, SE, SV, SUPPQUAL. Trial design that every variable listed in the \$DTMIG is listed in the dataset.

Error Message: Informative Check: Define.xml: The variable is omitted from the dataset while the domain is not in one of the three general observation classes (interventions, events, findings).

Status \*: NEW

Source: DATASETS: VSAS/TTTT/TTTT-00001/Files/Study/CO/CR/DTMIG/VSAS\_Combined/Combined - LIBRARY: ROGER\_COMB\_01

Assigned group: Select one

Category: SAS Datasets

subCategory: Content of the SAS datasets

Issue created: 2014-03-21 10:23:24

Domain Dataset: METADATA Select one

Check: Check3130000725

Feedback Position: Select one

Feedback Position Value:

Unique Subject Id: Assigner User: GDM01

Comments: [Add Comment](#)

Date	Author	Comments	Download Attachment
No records found			

Status History

Date	Author	Status
2014-03-21 10:29:12	GDM01	NEW

Variable Details

Date	Name	Value
2014-03-21 10:23:24	VARIABLE	NEW
2014-03-21 10:23:24	DOMAIN	SUPPQUAL

Issue Details

Comments

Status History

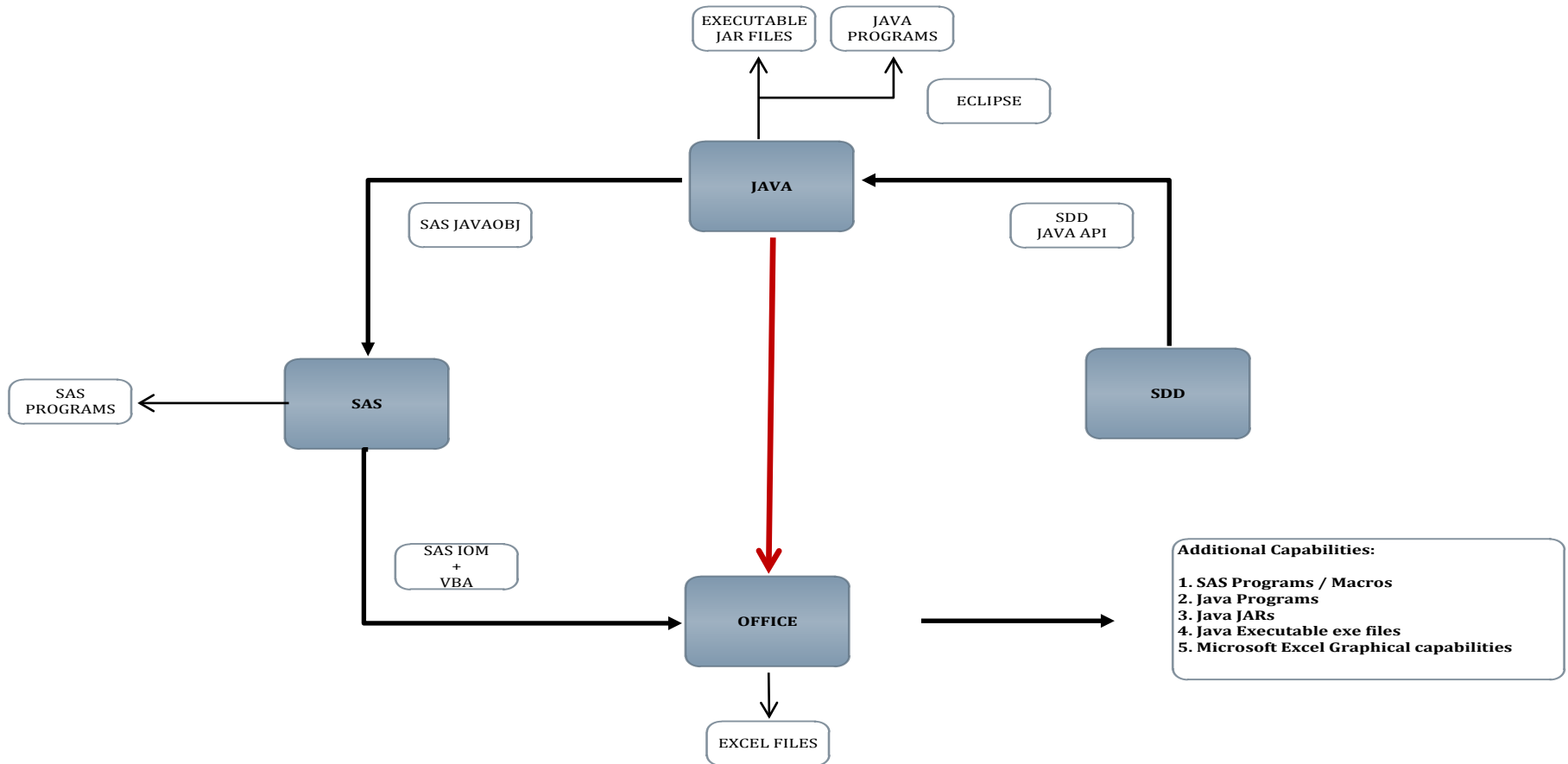
Variable Details

# Agenda

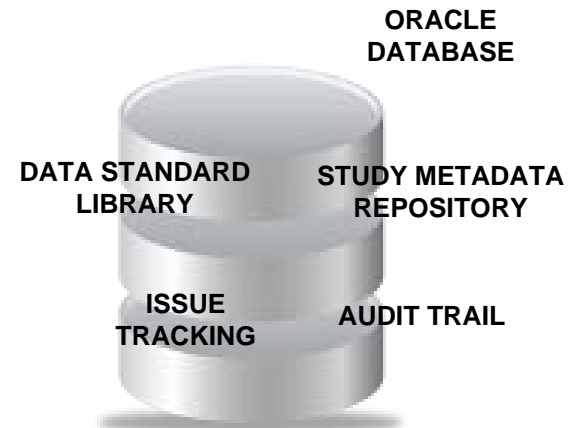
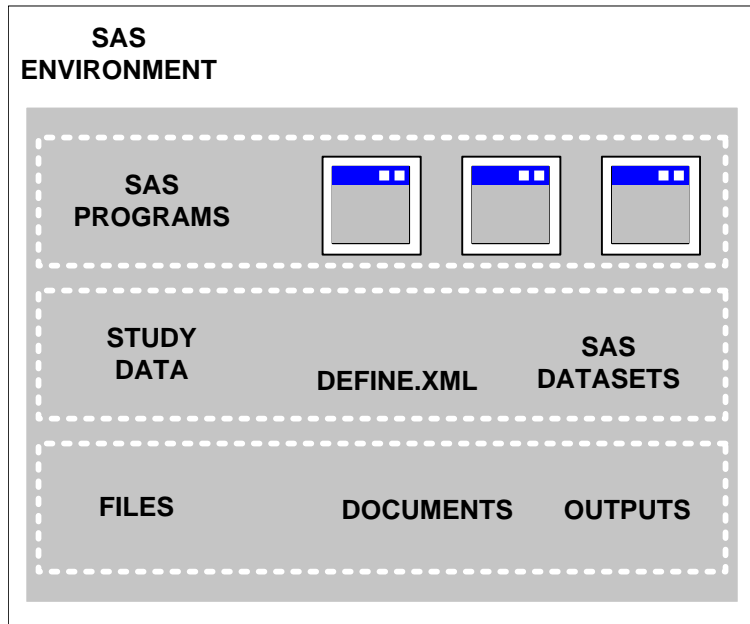
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# REPORTING possibilities



# Reporting capability



Data Standards Library Comparison  
Implementation Guides  
Completion Guides  
Trial summary-based search reports  
Metrics reports

Study metadata comparison across study versions  
Study metadata comparison across projects  
Define.xml  
Export of trial design datasets  
Study metadata-based search reports



# Reporting capability (1)

## Data Standards Library Comparison

SAS® Drug Development

View Tools Administration Help Log Off

Dashboard Repository Workspace CompareOracle (1.0) [read-o...

CHECK	NAME	DESCRIPTION	DATASET	v22MAY2013	v30MAY2013
Ok	AE_101	testing AE 101d	DEMO	X	X
Ok	AE_900	AE_900	AE	X	X
Ok	AIMSV76_QS_001		QS	X	X
Ok	AVETST2	Field that can be used to describe the DCM content	CM	X	X
Ok	CM_900	CM_900	CM	X	X
Ok	CO_900	CO_900	CO	X	X
Ok	DM_900	DM_900	DM	X	X
Error	DS_900	DS_900	DS	X	
Error	DS_900	DS_900_A	DS		X
Error	DS_901	DS_901	DS	X	
Error	DS_901	DS_901_B	DS		X
Ok	EX_900	EX_900	EX	X	X
Ok	LB_900	LB_900	LB	X	X
Ok	LB_901	LB_901	LB	X	X
Ok	MH_900	MH_900	MH	X	X
Ok	MH_901	MH_901	MH	X	X
Ok	PR_807	PR_807	PR	X	X
Ok	PR_900	PR_900	PR	X	X
Ok	SU_900	SU_900	SU	X	X
Ok	SV_800	SV_800	SV	X	X
Ok	SV_900	SV_900	SV	X	X
Ok	SV_901	SV_901	SV	X	X
Ok	TEST_001	Description test 001	DM	X	X

General  
SAS Programs  
Parameters  
Inputs  
Outputs  
Publish History

Variable Name	Label
START_PATH	Path of the programs
REPORTPATH	Path of the report
VERSION1	Date of version one
VERSION2	Date of version two
SOURCEWORD1	Name of source one
SOURCEWORD2	Name of source two
METADATA_LEVEL	Metadata Level (DOMAIN,VARIABLE,CODELIST,DC)
LIBRARY_NAME	Name of the library



# Reporting capability (2)

## Implementation Guides

**SAS® Drug Development**

View Tools Administration Help

Dashboard × Repository × Workspace × Create Implementation Guide [rea

Variable Name	Label	Type
DATA_MODEL	The data model	Character
DATE_VALID	Date on which the data is valid	Character
INSTALL_PATH	Path of program installation	Folder

SUPPSU	Supplemental Qualifiers for SU	Relationship	One record per IDVAR, IDVARVAL, GNAM per subject	42	Tabulation
Test		Events	dsdf	50	Tabulation
VS	Vital signs test AVE	Findings	One record per vital sign measurement per time point per visit per subject	70	Tabulation
VS	Vital signs test AVE	Findings	One record per vital sign measurement per time point per visit per subject	70	Tabulation
Hello	dsads	Findings	sgsda	80	Tabulation
TO	: Vital signs domain	Findings	One record per vital sign measurement per time point per visit per subject	99	Tabulation
DEMO	demo description	Findings		123	Tabulation

### 3.2 Variable metadata

This section describes for all variables the following

- Variable name
- Variable label
- Variable type (numeric or character) and length
- Controlled terminology used
- Origin (unique origin or combination of the following: CRF, eDT, derived, assigned and protocol)
- Role (identifier, topic, timing, grouping qualifier, result qualifier, synonym qualifier, record qualifier or variable qualifier)
- Core (required= req, expected= exp, permissible= perm)
- Comment (relevant information that further clarifies the variable)

11

#### Special purpose domains

DATASET	NAME	LABEL	LENGTH	ABBREVIATION	NAME	NAME	NAME	NAME
AE	STUDYID	Study Identifier	40	Req	Identifier	text		
AE	STUDYID	Study Identifier	40	Req	Identifier	text		
AE	STUDYID	Study Identifier	40	Req	Identifier	text		
AE	STUDYID	Study Identifier	40	Req	Identifier	text		





# Reporting capability (3)

## Study Metadata Comparison

- 2 different statuses:
  - **Ok** : no metadata conflict
  - **Difference** : difference in metadata value between studies

Status	Dataset	Label	A1000_0000	A1000_0001	A1000_0002
Ok	AE	Adverse Events	X	X	X

Status	Reference	Computational algorithm	A1000_0000	A1000_0001	A1000_0002
Difference	DM.AGE	Equal to (DS.DSSTDTC-DM.BRTHDTC)/365.25 where DSTERM = 'INFORMED CONSENT OBTAINED'		X	
Difference	DM.AGE	Equals to (DS.DSSTDTC-DM.BRTHDTC)/365.25 where DSTERM = 'INFORMED CONSENT OBTAINED'	X		X
Difference	DM	Demographic		X	
Ok	DS	Disposition	X	X	X



# SAS Drug Development – integration with CDMation

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- SAS Drug Development = open extensible platform
- Integration
  1. User access and security model
    - Re-use system metadata, login session of SDD
    - Integrated user experience (including single sign-on)
    - Integrated user roles & privileges
  2. Audit trail and permission reports
    - Access from SDD-executed SAS code to all metadata from SDD and CDMation (audit trail, permissions)
  3. Metadata validation flow across all parts
    - Jobs (SAS programs) running in controlled execution environment with complete access to CDMation standards and study metadata
    - One integrated repository for jobs, documents and other output





Thank you

Brussels, FSUG, May 22nd 2014





**Mark Lambrecht** | Principal Consultant ▪ Health and Life Sciences Global Practice ▪ SAS | T. +32 475 96 06 58 | [mark.lambrecht@sas.com](mailto:mark.lambrecht@sas.com)  
**Peter Van Reusel** | COO Business & Decision Life Sciences | T. +32 476 54 59 17 | [peter.vanreusel@businessdecision.com](mailto:peter.vanreusel@businessdecision.com)

**Business & Decision Life Sciences**

Sint-Lambertusstraat - 141 rue Saint-Lambert  
B-1200 Brussels  
T: +32 2 774 11 00  
F: +32 2 774 11 99  
[lifesciences@businessdecision.com](mailto:lifesciences@businessdecision.com)  
<http://www.businessdecision-lifesciences.com/>

**SAS Institute Inc.**

100 SAS Campus Drive  
Cary, NC 27513-2414, USA  
<http://www.sas.com>