A Test Suite for Compliance Testing of Software Support for the Synthetic Biology Open Language

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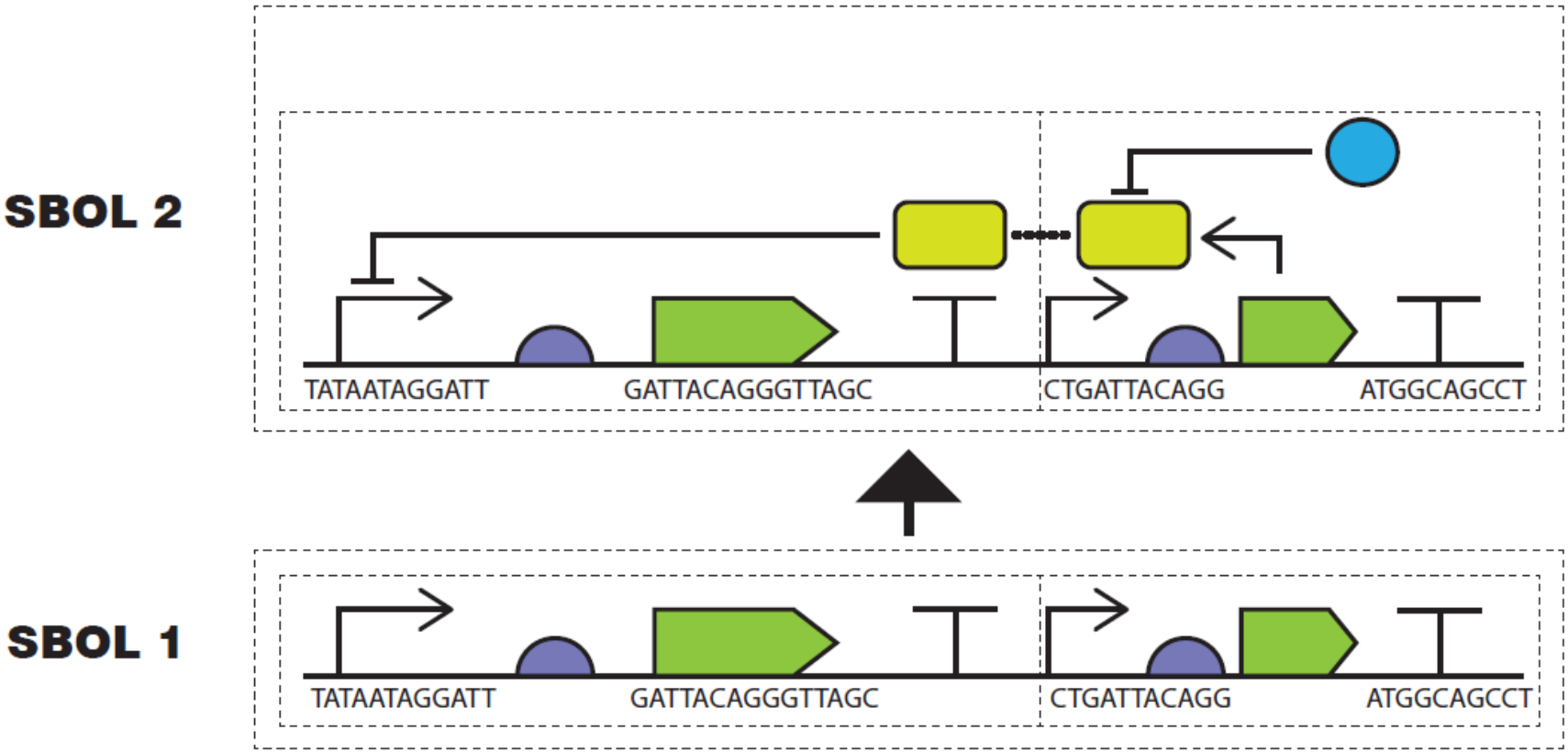
9th International Workshop on Bio-Design Automation
August 10th, 2017

Introduction

- Standards establish guidelines for data to be easily exchanged.
- They allow data reproducibility and seamless communication of data between software applications.
- Compliance testing ensures correct usage within applications.
- This talk describes a methodology for compliance testing for the *Synthetic Biology Open Language* (SBOL) standard.

Synthetic Biology Open Language Standard (SBOL)

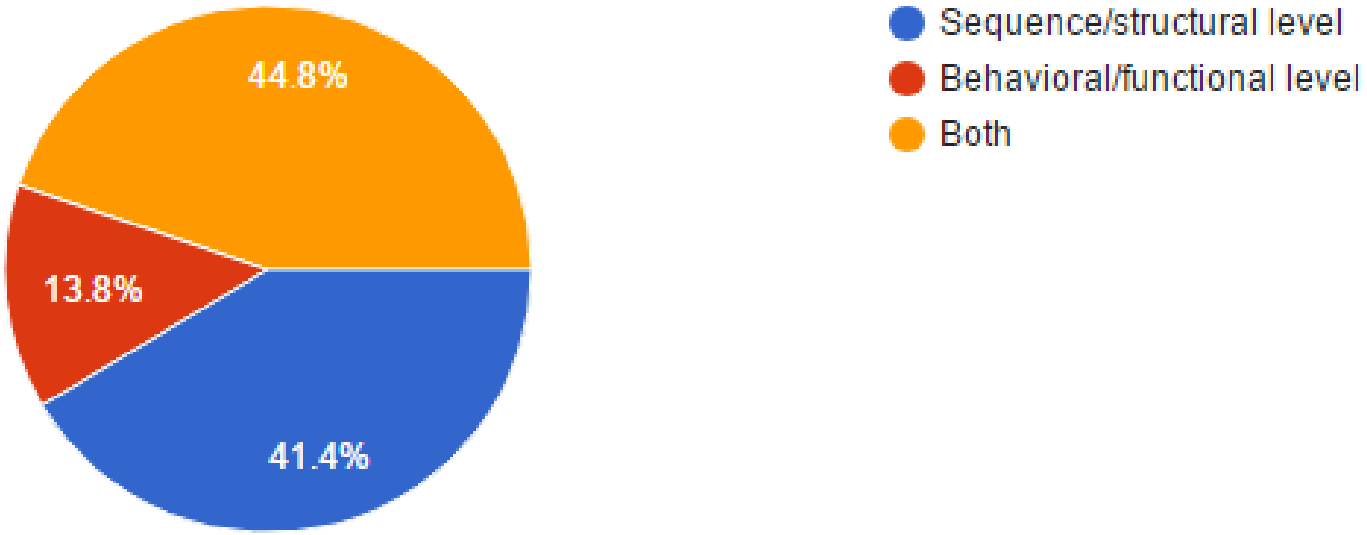


SBOL Software Survey

- Distributed to application developers within the SBOL Community.
- The purpose of this survey is to gain an accurate and current list of applications that support SBOL.
- These results will be used as the applications to evaluate the created methodology for software compliance.
- The survey is still open for new responses:
  - `http://sbolstandard.org/software/tools/`
- The survey contains three main types of questions:
  - General overview information of the application,
  - The functionality and usage of the application, and
  - Current support of SBOL within the application.

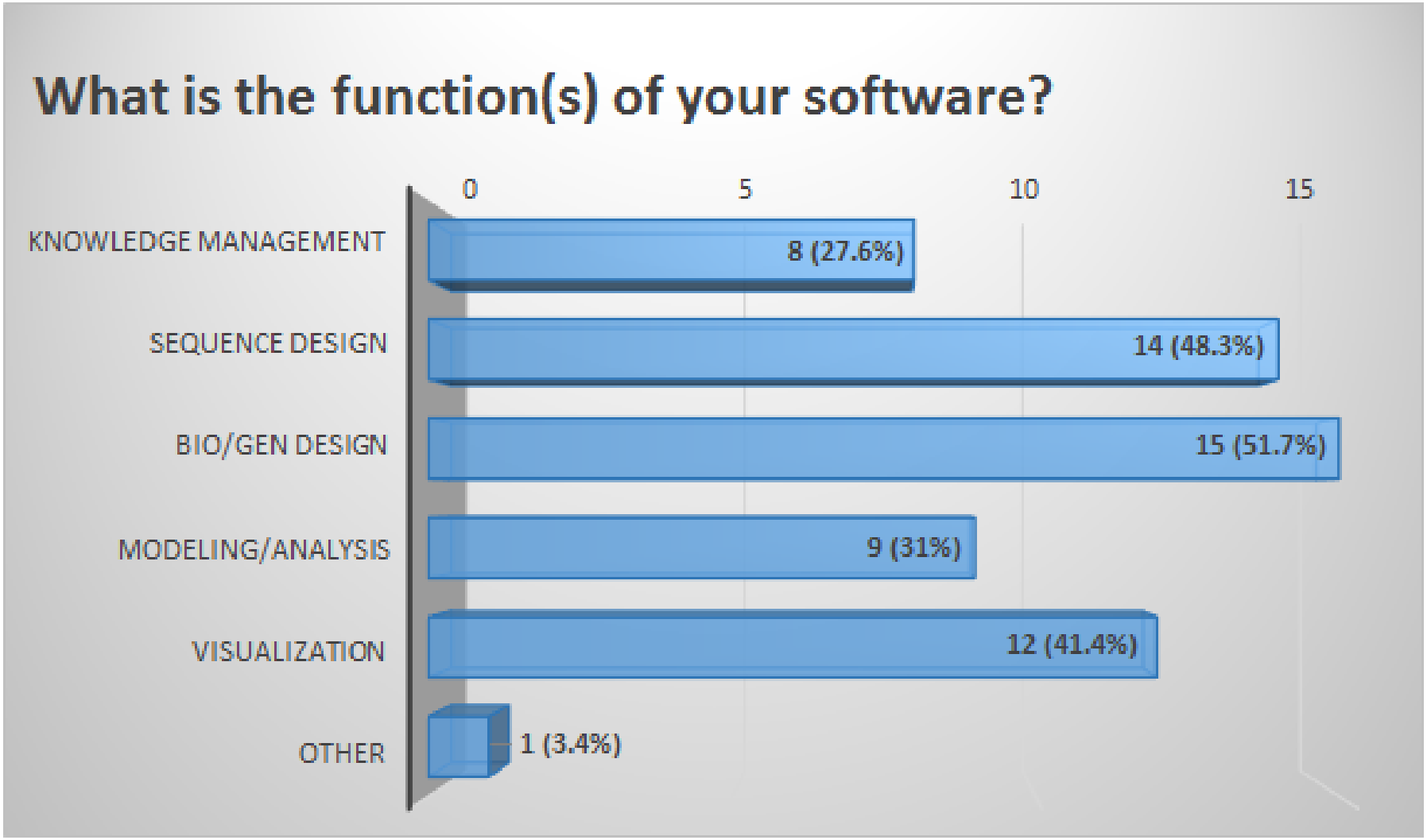
Structural vs Functional Support within Applications

What level does this software work at?

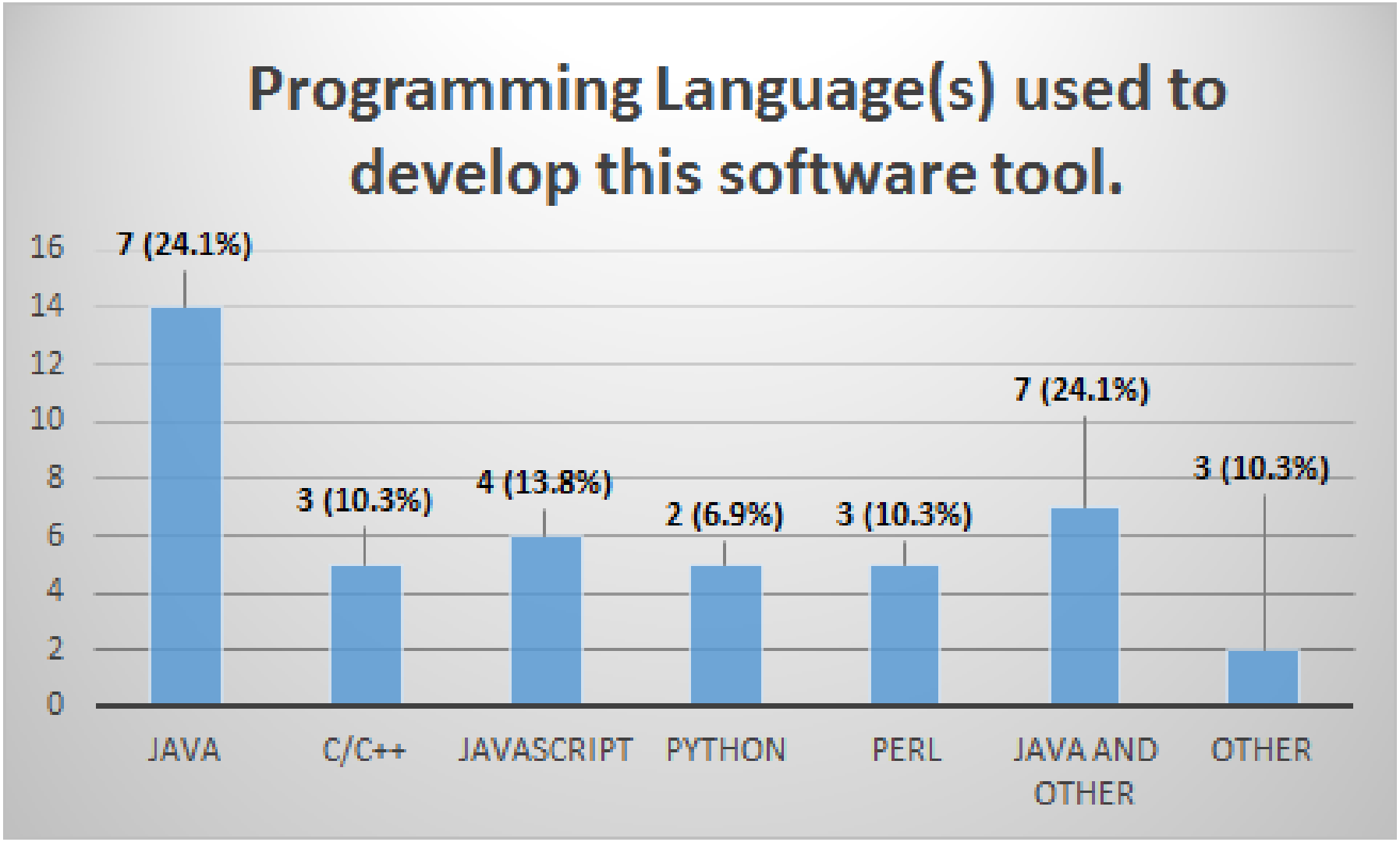


29 responses

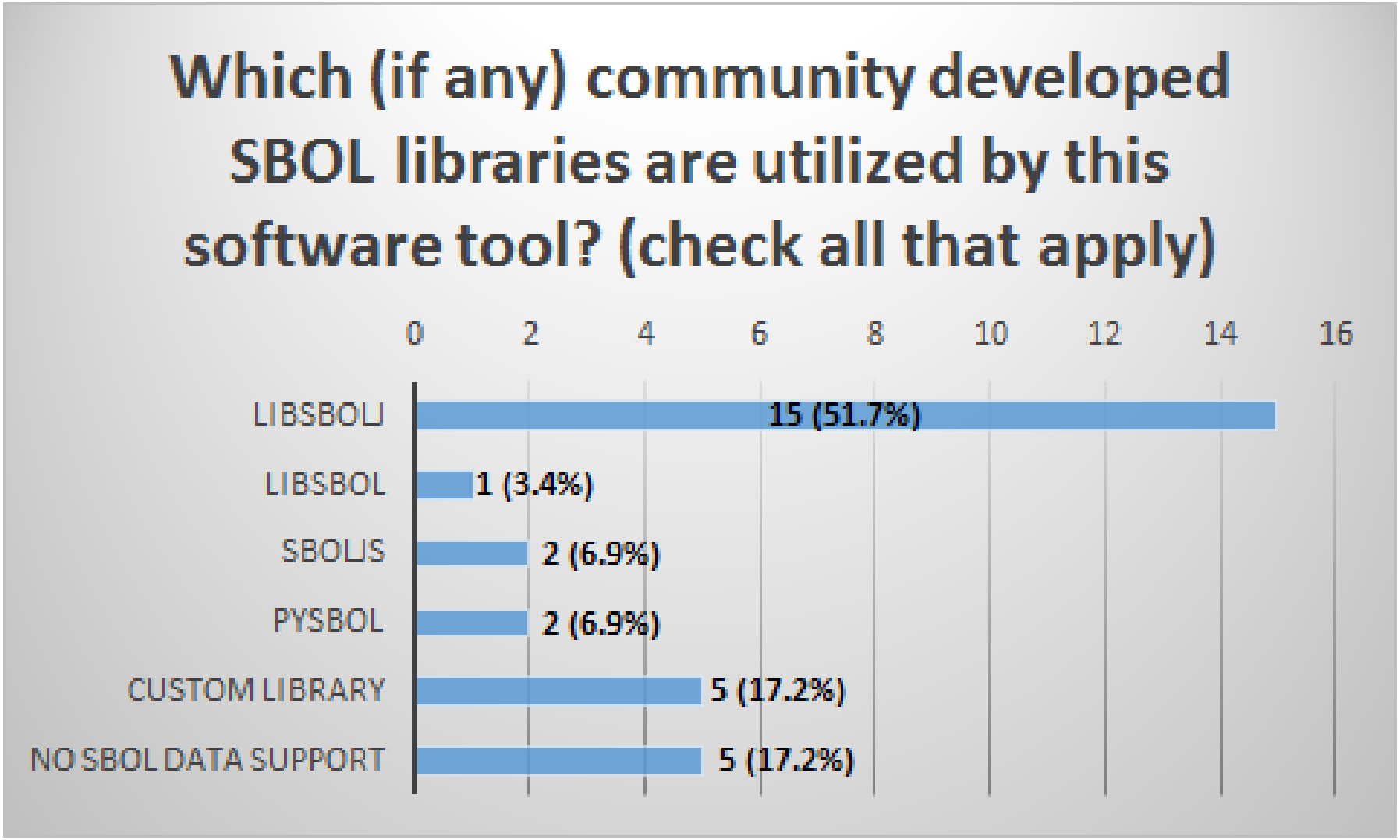
Software Application Functionality



Programming Languages Used

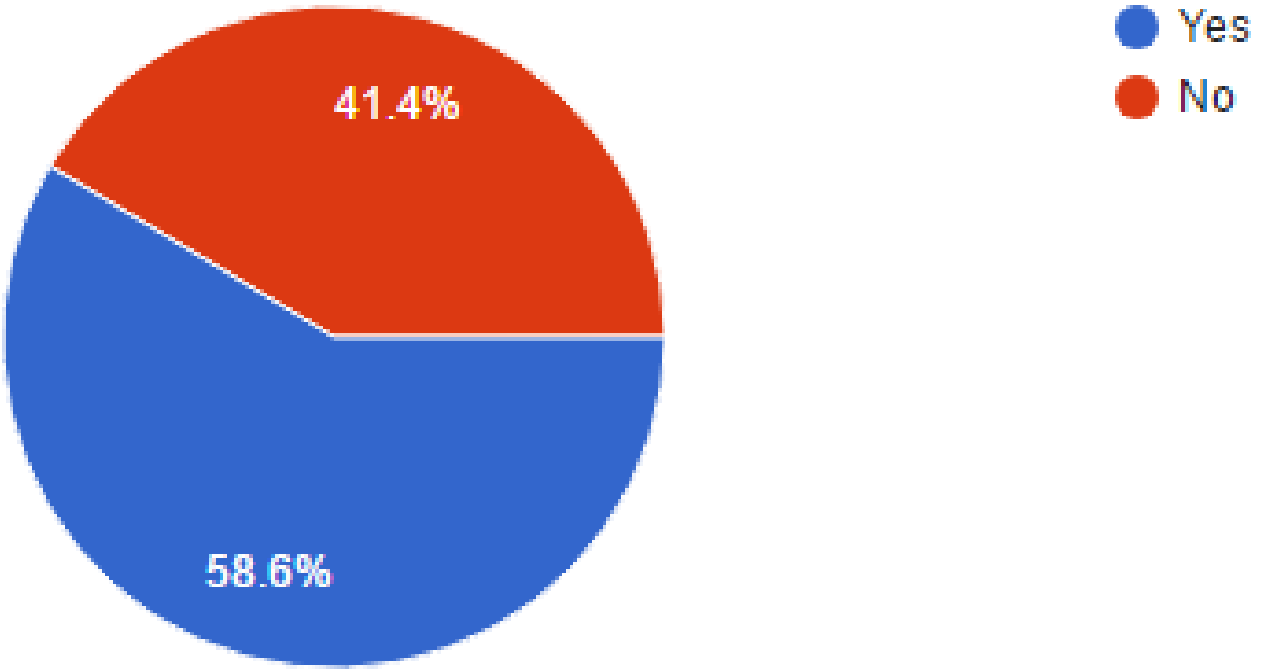


Software Libraries



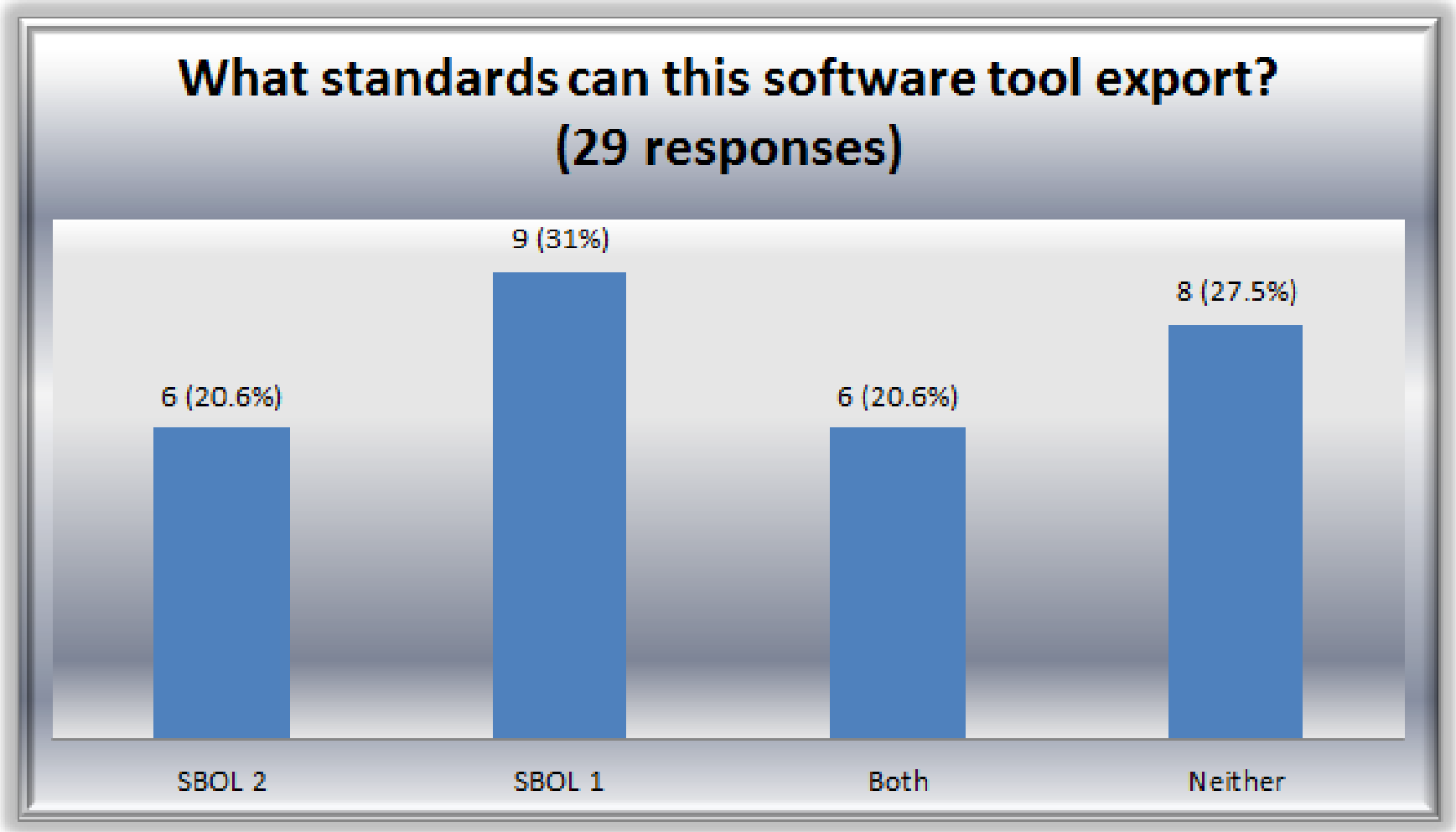
SBOL Visual Support

Does this software tool support SBOL Visual?

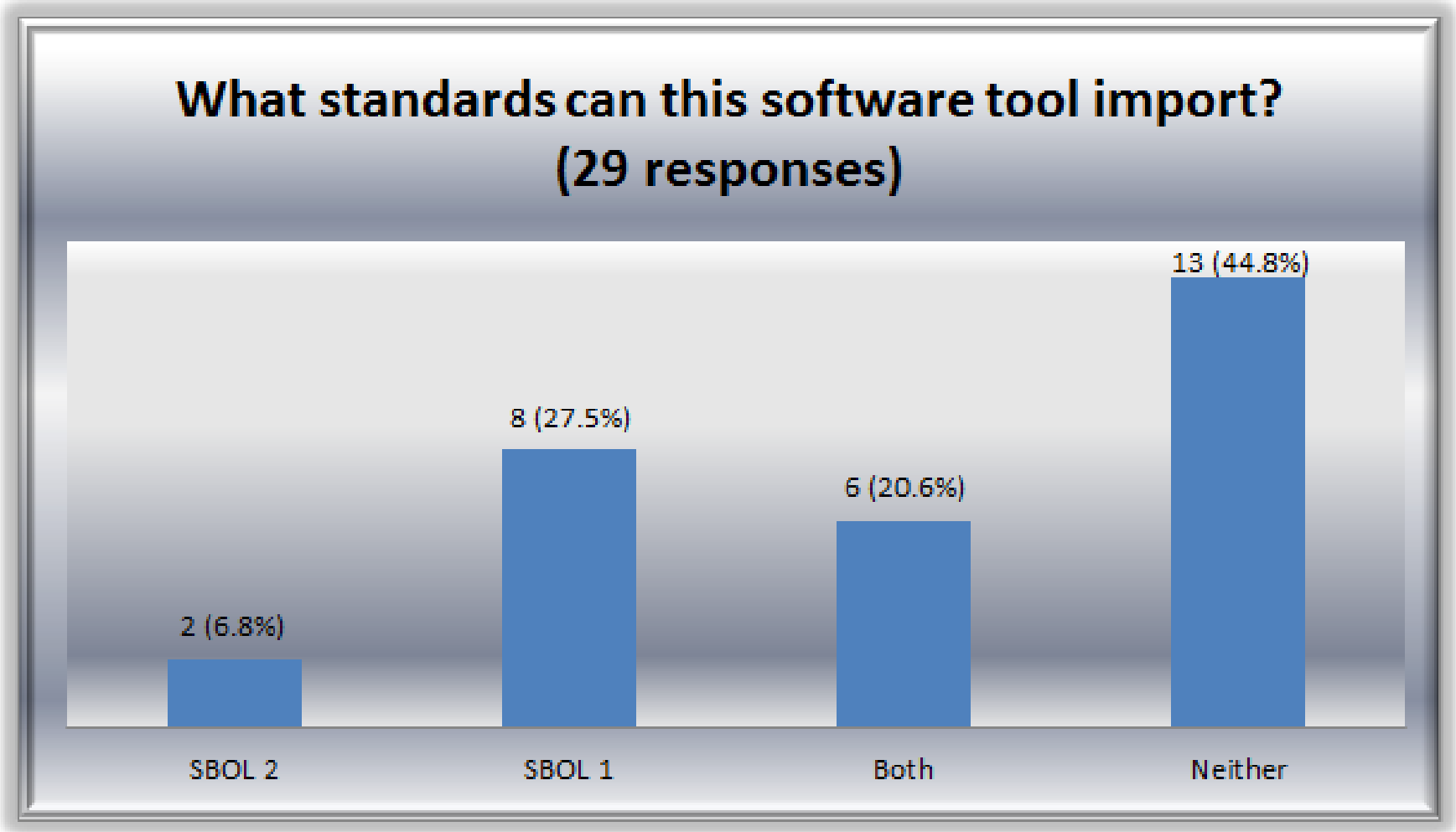


29 responses

Applications Able To Export SBOL Data



Applications Able To Import SBOL Data



Software Survey Summary

	Function					SBOL				
							Import		Export	
Name	K	S	V	G	M	V	1	2	1	2
BOOST		●					●	●	●	●
Cello				●	●	●				●
DeviceEditor		●	●	●	●	●		●		
DNAPlotLib			●			●	●	●	●	●
D-VASim					●					
Eugene		●		●		●	●		●	
Finch	●	●	●	●		●				●
GeneGenie		●							●	
GenoCAD	●	●		●		●		●		●
Graphviz			●			●				
iBioSim			●	●	●	●	●	●	●	●
ICE	●	●	●			●		●		●
j5		●			●	●	●		●	
MoSeC		●		●					●	
Parts&Pools				●	●					
Pigeon			●			●				
Pinecone	●	●				●		●		●
Pool Designer		●					●	●		
Proto BioCompiler			●	●	●	●			●	
SBOL-GB Converter							●		●	
SBOL Validator	●						●	●	●	●
SBOLDesigner	●	●	●			●	●	●	●	●
SBOLme				●						●
ShortBol		●		●						●
SynBioHub	●		●			●	●	●		●
Tellurium		●		●	●			●	●	
TinkerCell			●	●	●	●	●		●	
VisBOL			●			●		●		
VirtualParts	●			●	●	●	●		●	●

LEGEND

K - Knowledge Management

S - Sequence Design

V - Visualization

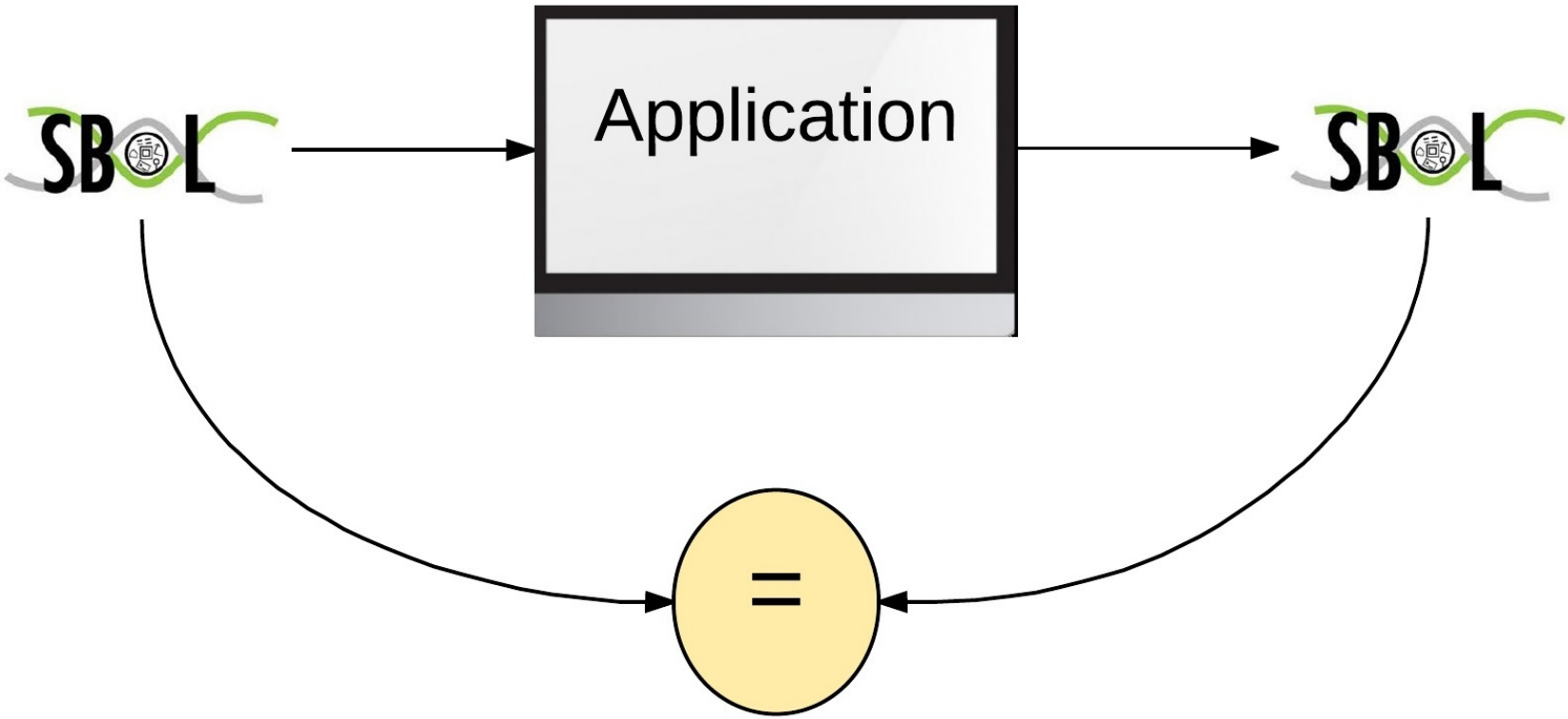
G - Genetic Design

M - Modeling

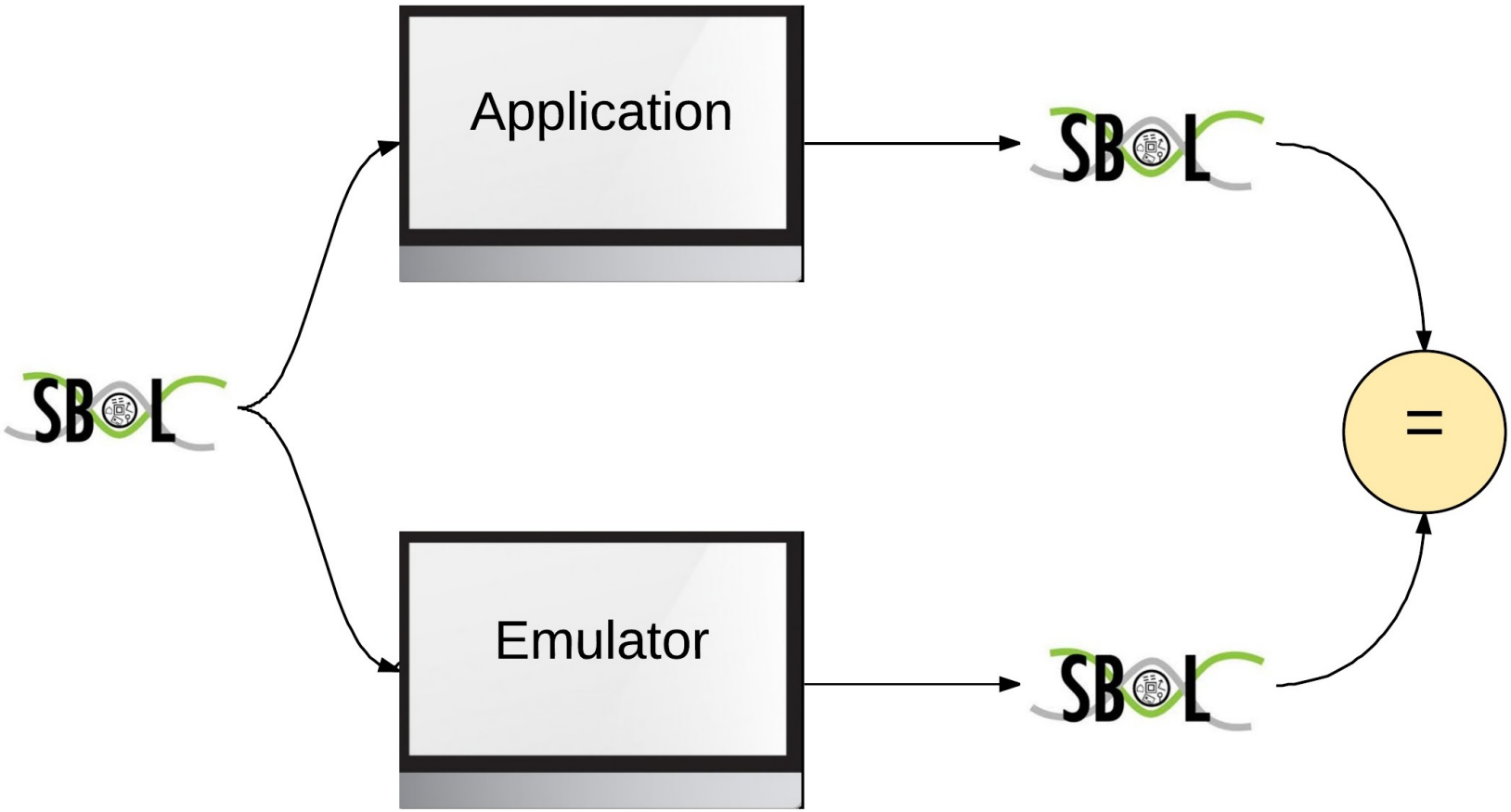
Testing SBOL Compliance

- Survey responses self-reported by application developer.
- Methodology required to test software compliance.
- SBOL Visual must be manually inspected.
- SBOL export can be checked using the *SBOL Validator*.
- SBOL import best done using a round-trip test.

Simple Round-trip Test



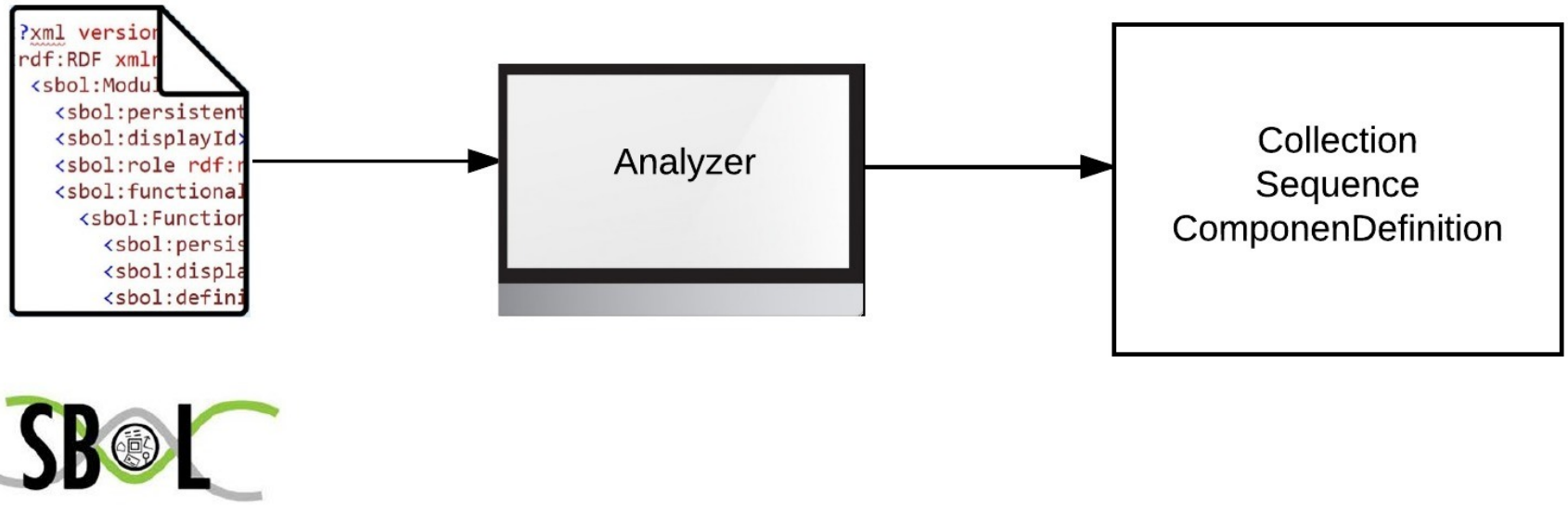
Extended Round-trip test



Analysis of Current SBOL Example Test Suite

- Mixture of published SBOL files and files created to test *libSBOLj*.
- Analyzed it to determine proportion of SBOL data model covered.
- Organized the examples within groups of clusters based on the same type of data contained.
- Created a partially order set relationship between the clusters.

Algorithm for Analyzing SBOL Examples



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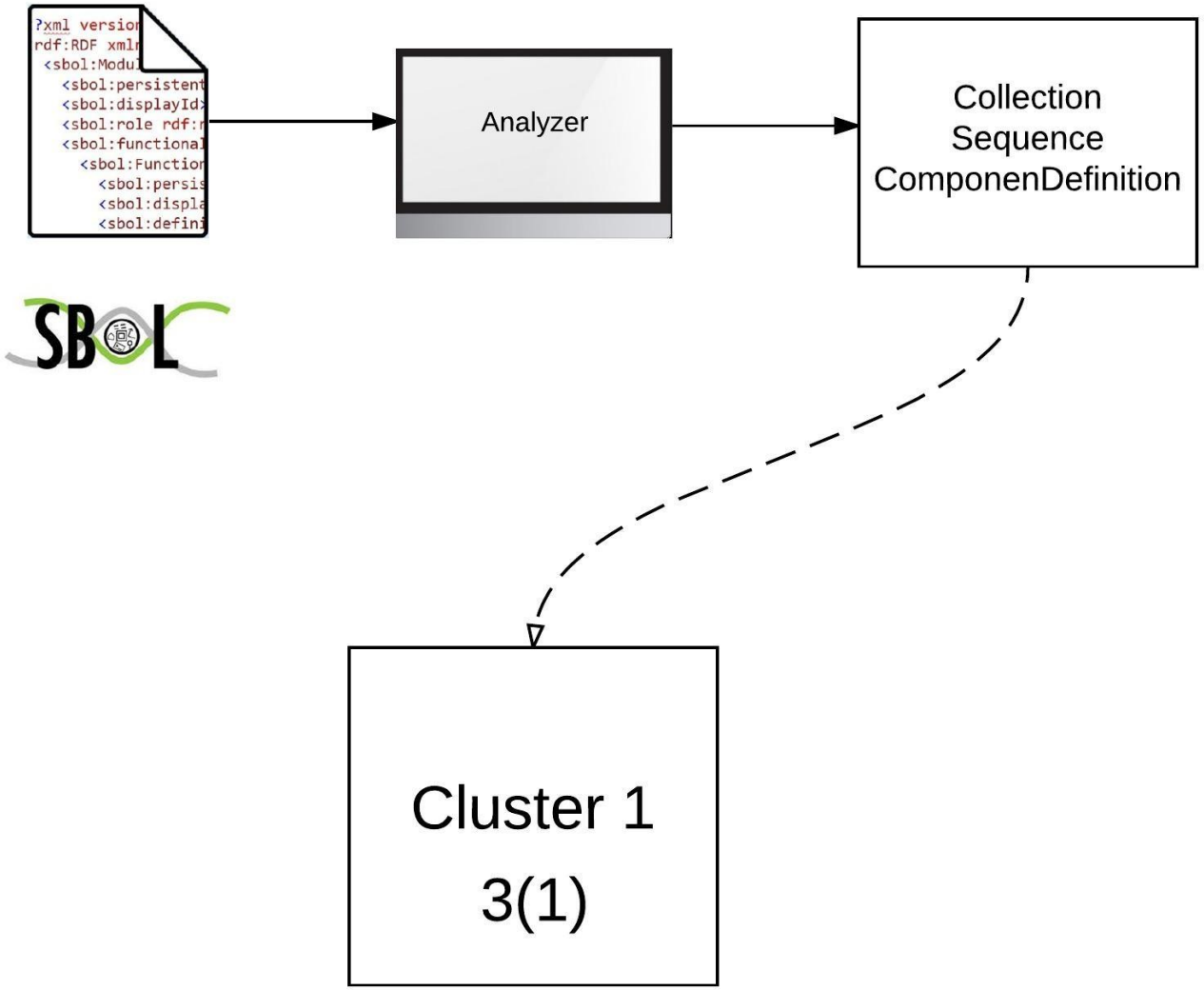

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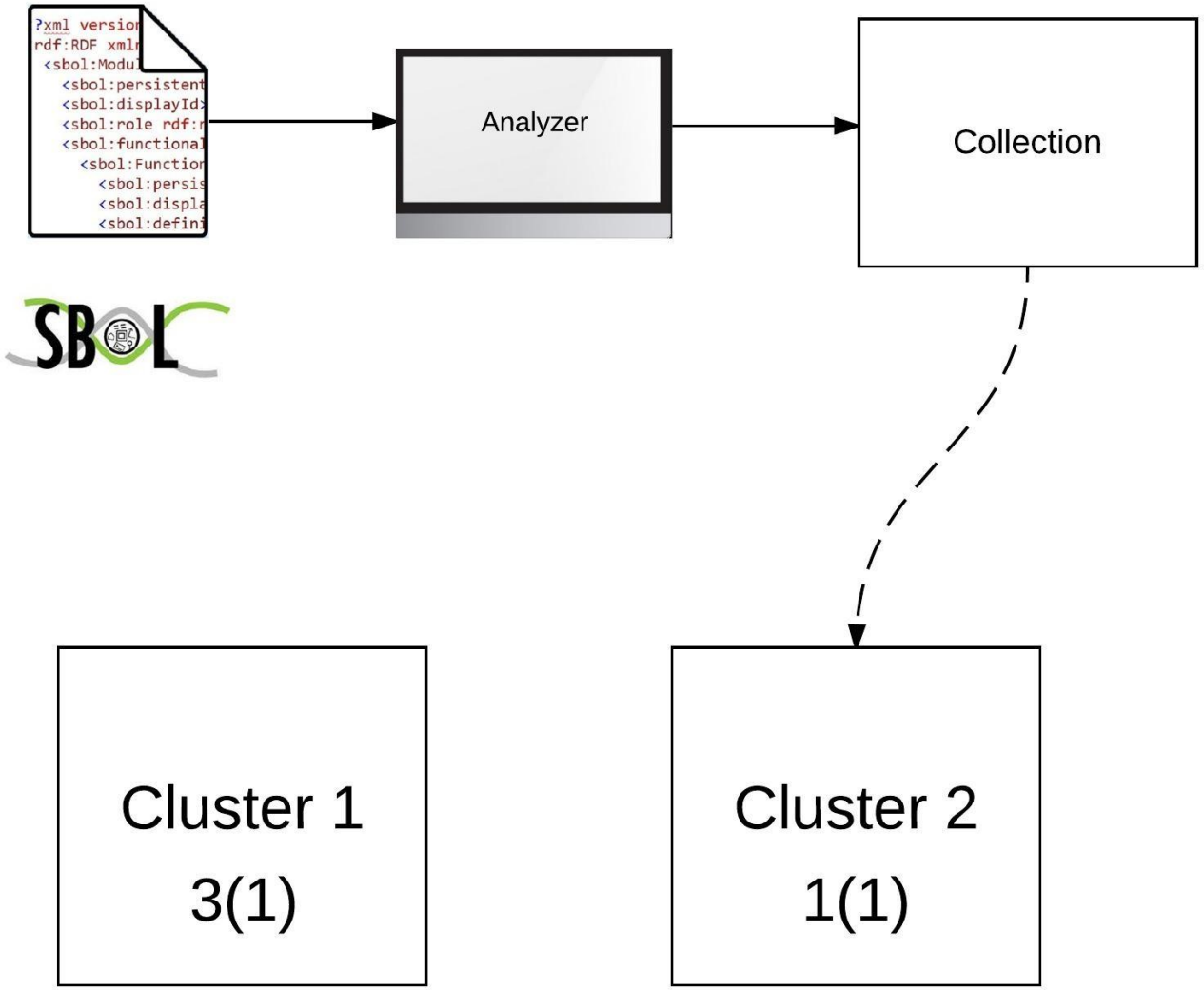

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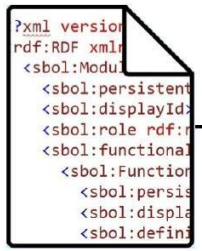

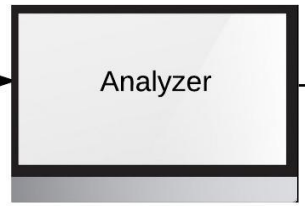

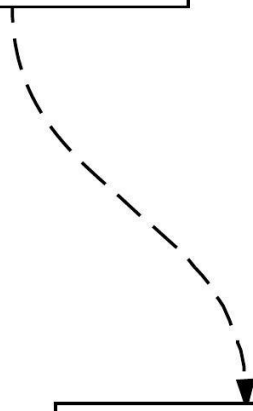

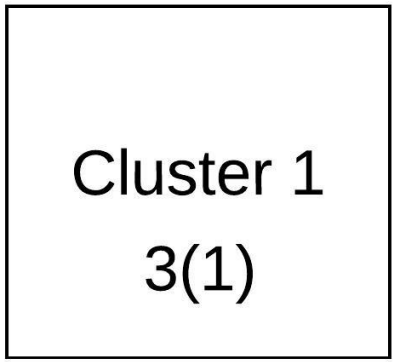

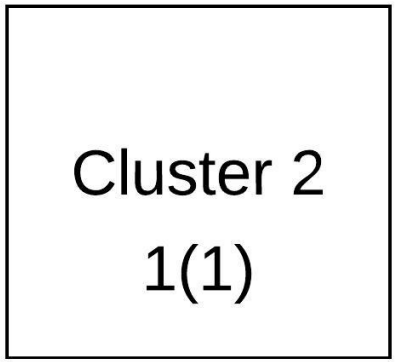

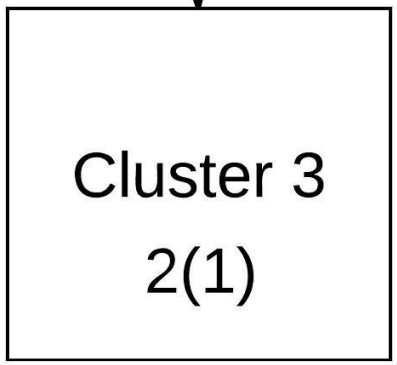

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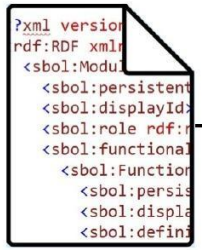

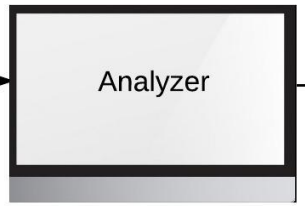

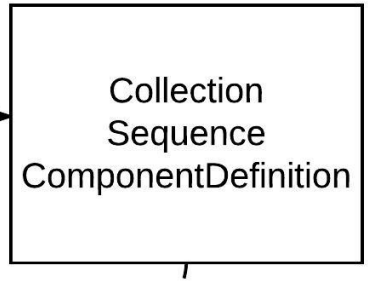

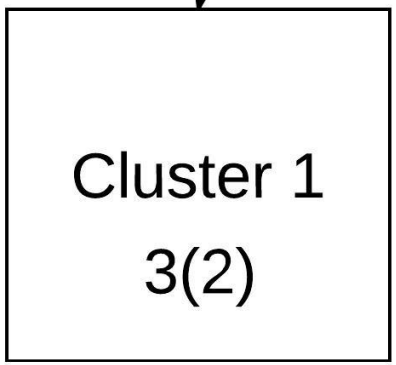

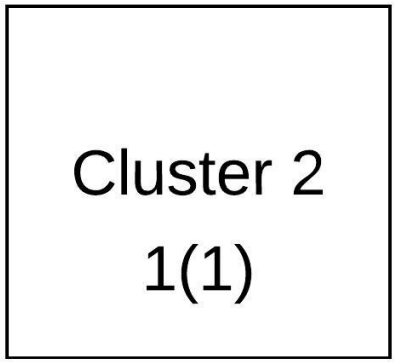

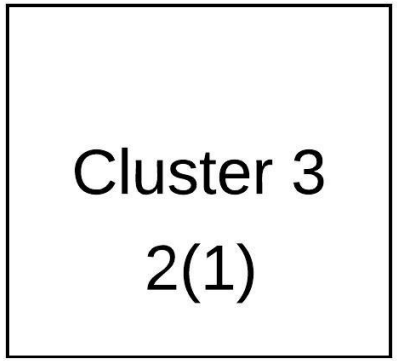

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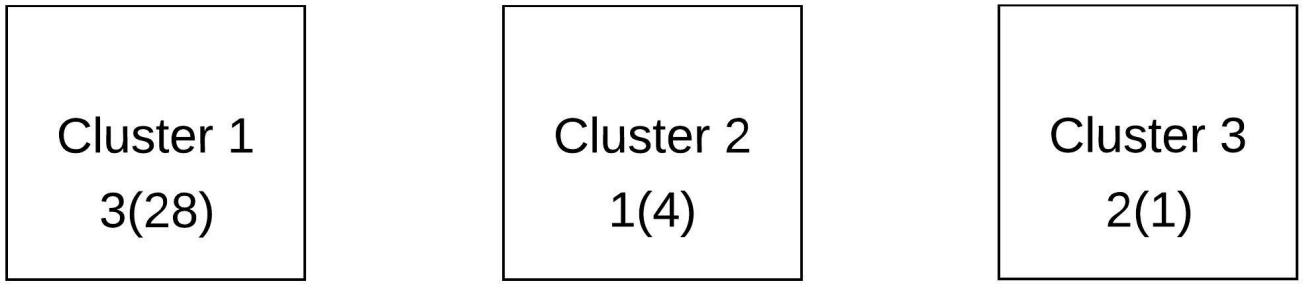

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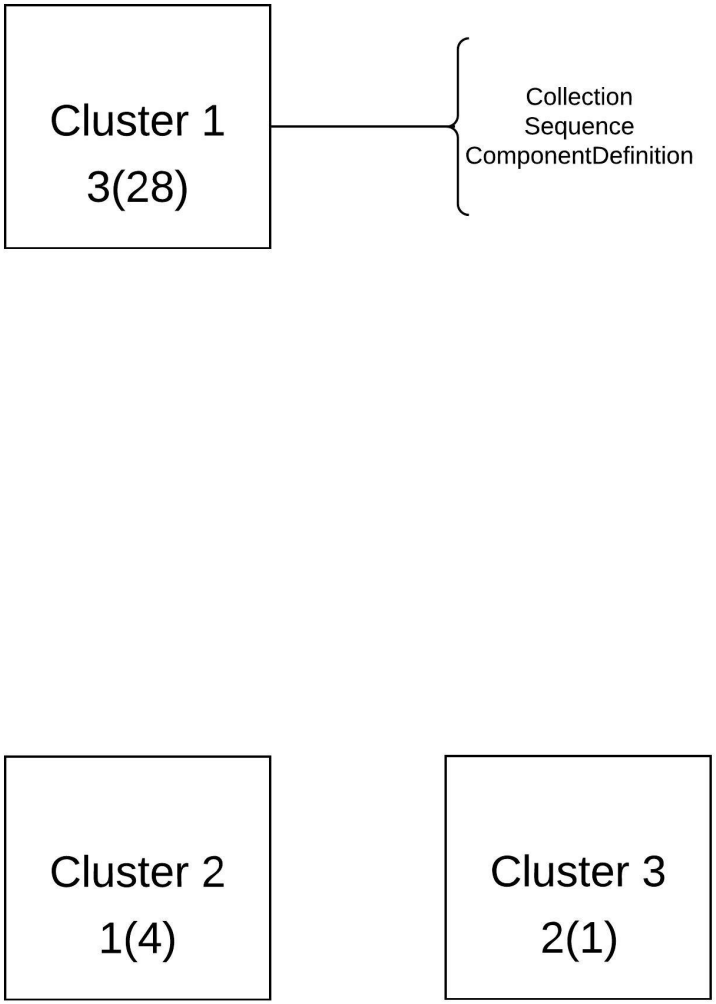

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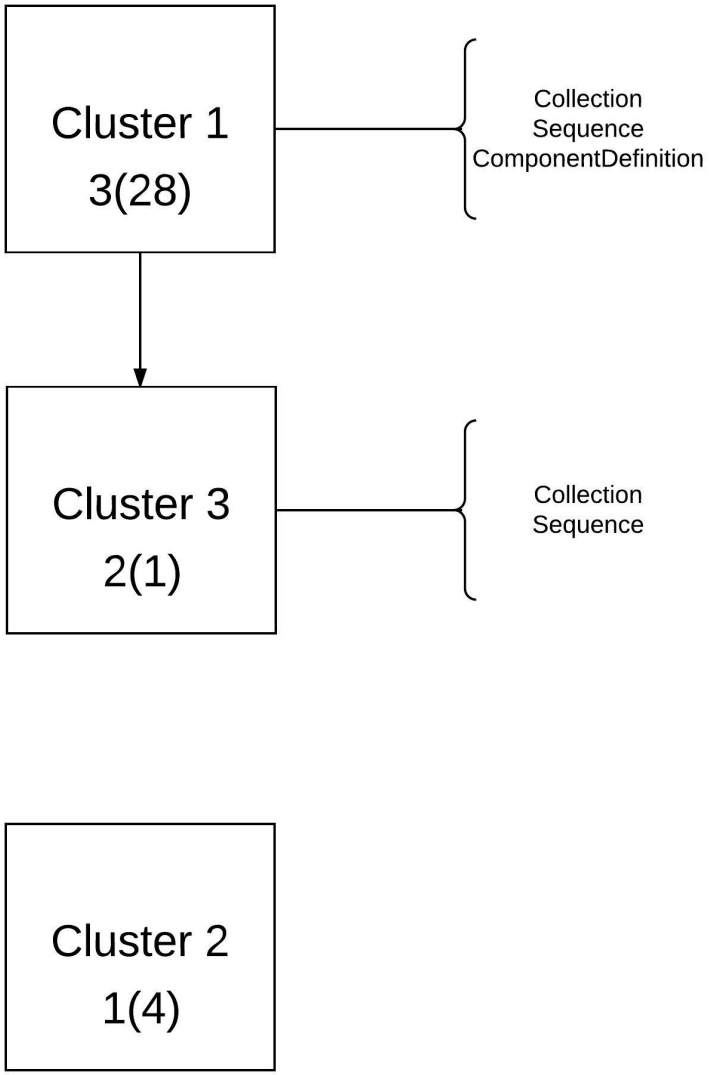

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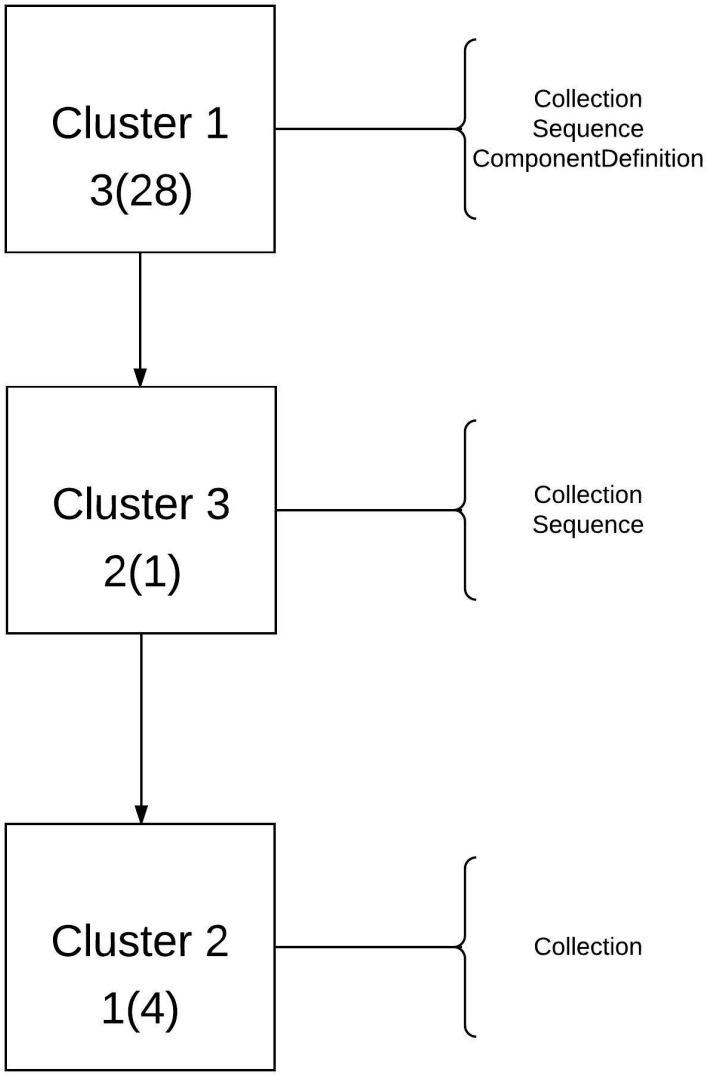
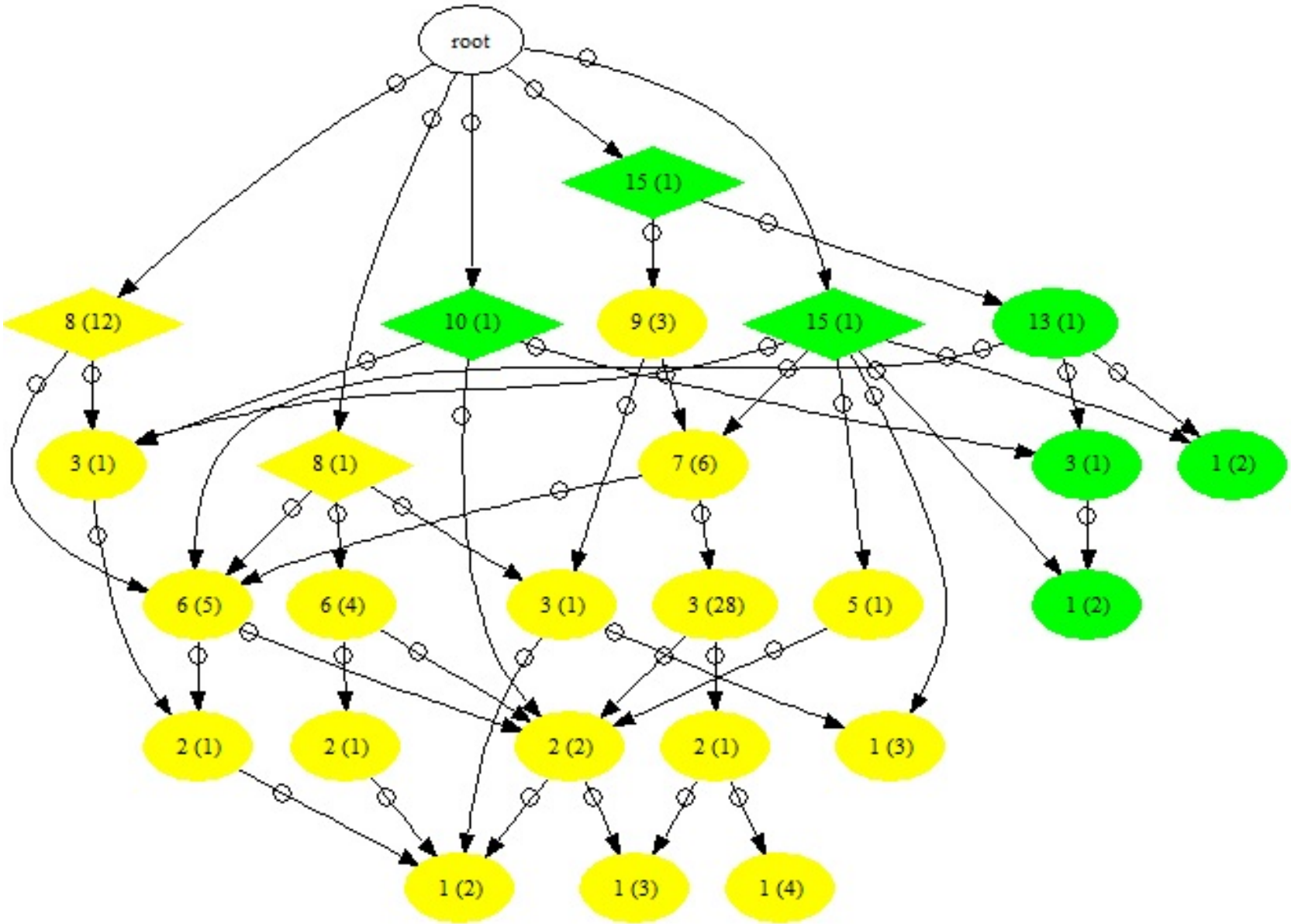


Analysis Result for the SBOL Test Suite



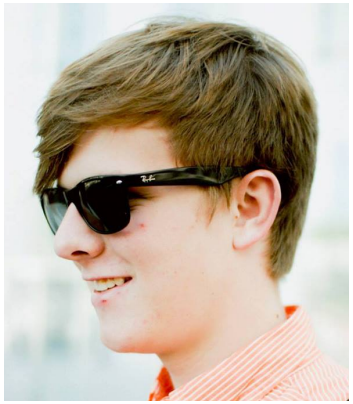
Analysis Result Summary

Graph Statistics	
SBOL Examples	88
SBOL Data Classes	19
Maximum Data Classes	15 (79%)
Data Classes Tested	19 (100%)
Structural Only Examples	61 (69%)
Functional Examples	27 (31%)

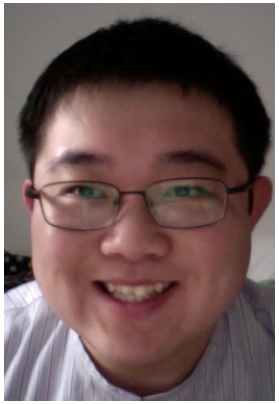
Future Work

- Create more examples representing different data class combinations.
- Collect more examples using functional data classes.
- Apply testing methodology to various SBOL applications to accurately and automatically determine their compliance to the SBOL standard.
- TOMORROW: Please join us at the 2nd Annual SBOL Introductory Workshop.

Acknowledgments



Zach Zundel (Utah)



Zhen Zhang (Florida)

Chris Myers

The National Science Foundation under Grant No. CCF-1218095 and DBI-1356041.