SBOL Community
University of Washington
Bioengineering

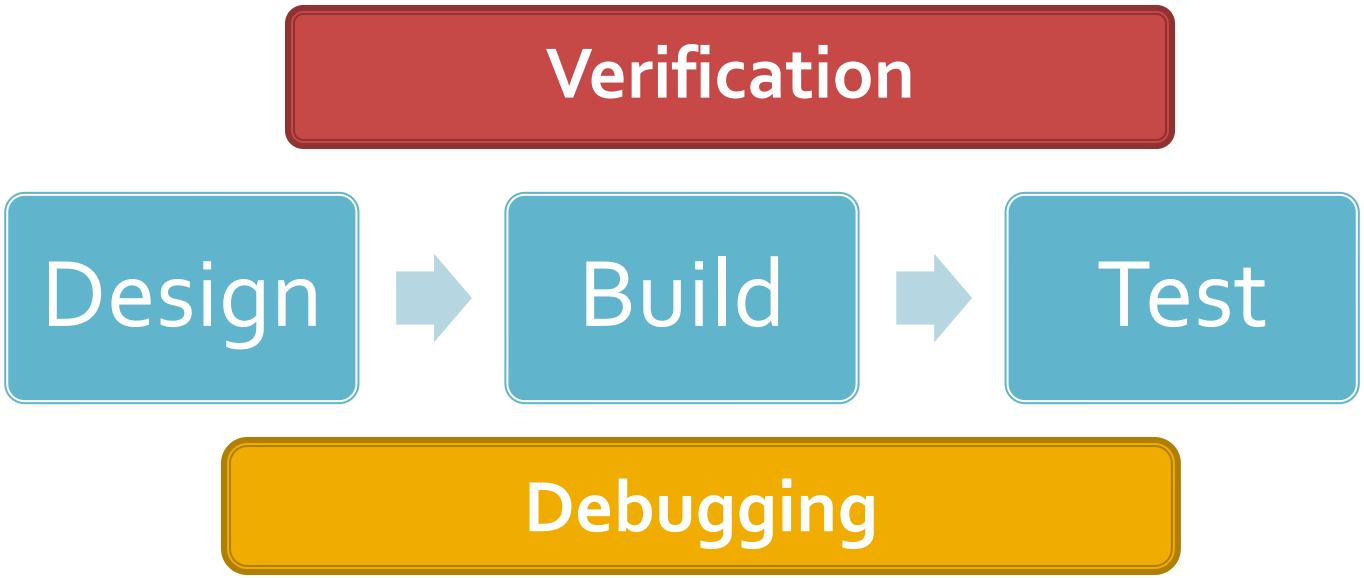
Synthetic Biology

A Circular Definition

- **Synthetic Biology** is the **engineering** arm of systems biology.
- **Systems Biology** is the **scientific** arm of synthetic biology.

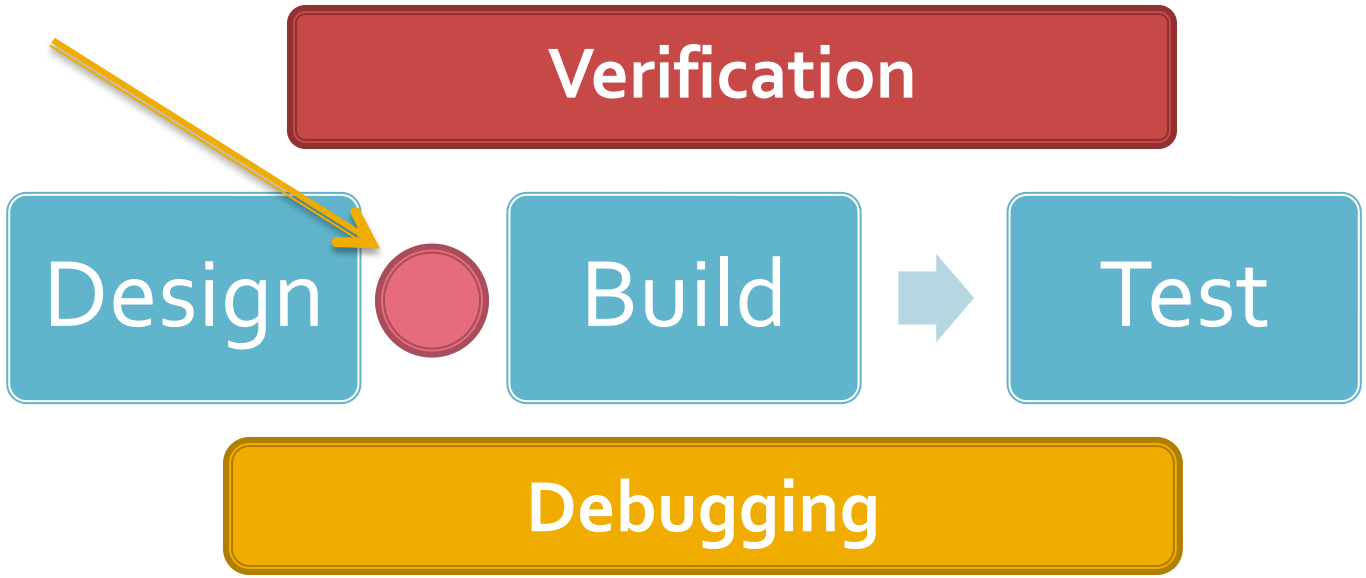
Synthetic Biology

Synthetic Biology



Synthetic Biology

The SBOL group is currently concerned with this



Overview

- Motivation and History
- SBOL 1.1
- SBOL 2.0
- Demo
- Future

Many Areas Requiring Standards

To support the synthetic biology workflow:

1. Assembly
2. Design
3. Distributed Repositories
4. Laboratory parts management
5. Simulation/Analysis

The Immediate Need

Take any current publication on a synthetic circuit and try to reproduce it, let me know how you get on.

NATURE BIOTECHNOLOGY | OPINION AND COMMENT | CORRESPONDENCE

Essential information for synthetic DNA sequences

Jean Peccoud, J Christopher Anderson, Deepak Chandran, Douglas Densmore, Michal Galdzicki, Matthew W Lux, Cesar A Rodriguez, Guy-Bart Stan & Herbert M Sauro

Affiliations | **Corresponding author**

Nature Biotechnology **29**, 22 (2011) | doi:10.1038/nbt.1753
Published online 10 January 2011

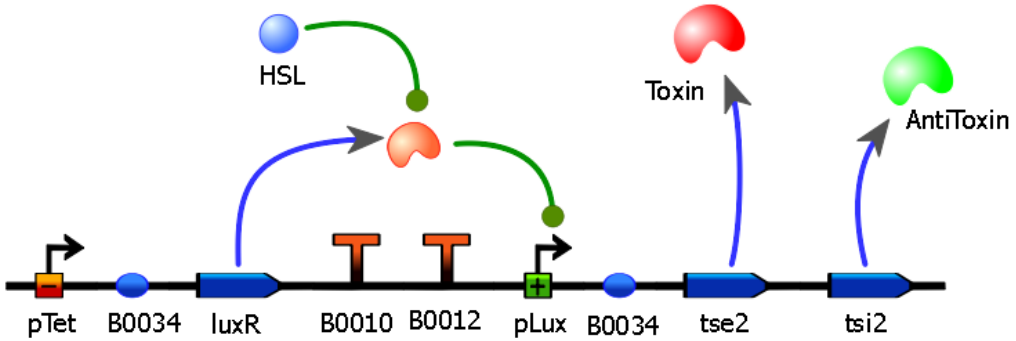
Practical Aims of the Standardization Effort

Specifically:

- To allow researches to electronically exchange designs with round-tripping.
- To send and receive designs to and from bio-fabrication centers.
- To allow storage of designs in repositories.
- To embed designs in publications.

Synthetic Biology Efforts

= Synthetic Biology Open Language



International Leadership Team

Mike Galdzicki

Some History

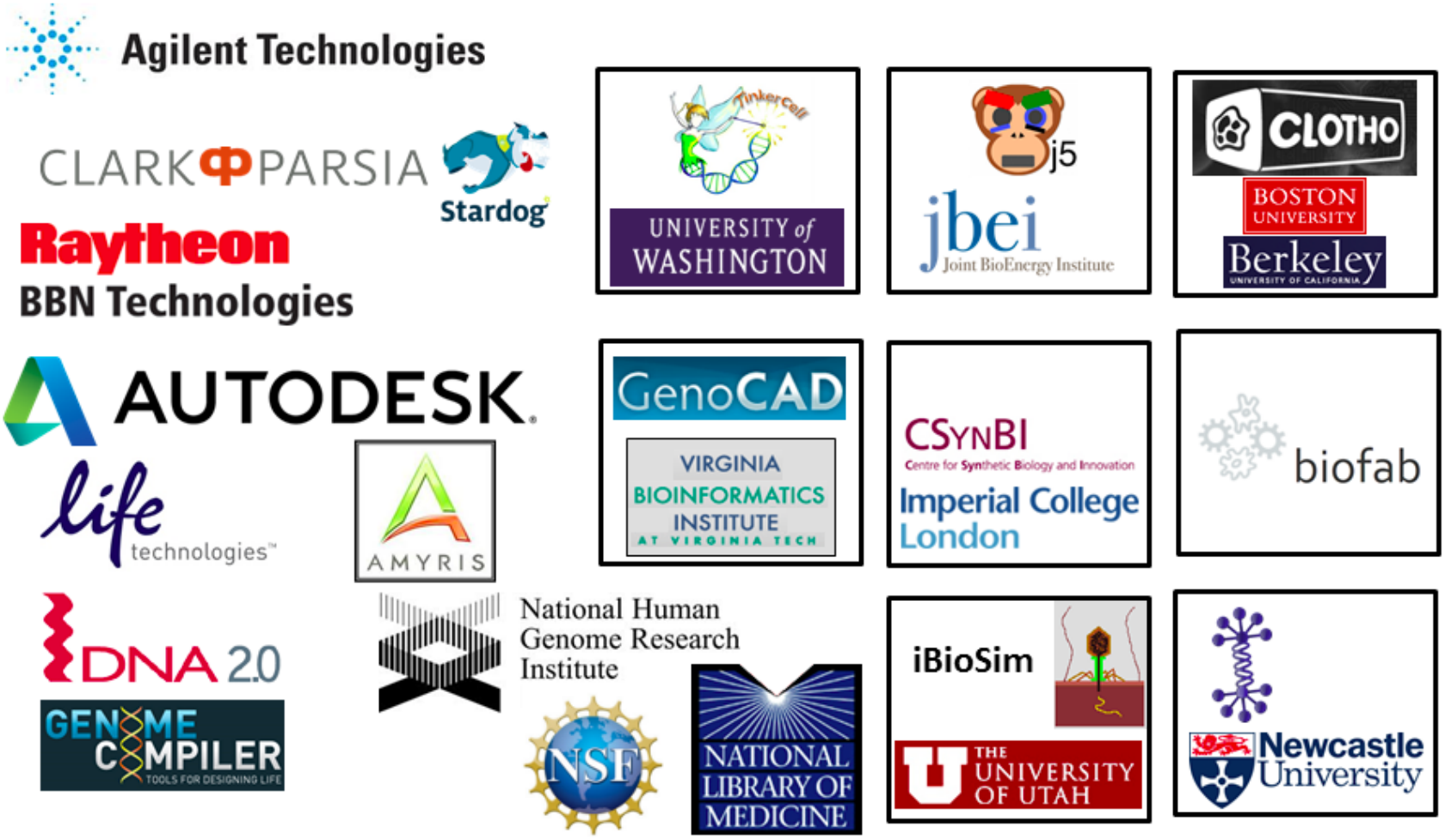
The synthetic biology standardization effort was started with a grant from Microsoft in 2008. The first meeting was held in Seattle.

The first draft proposal was called PoBoL but was since renamed to SBOL – Systems Biology Open Language

Since then the community has managed to organize two meetings a year . The project however has until now been largely unfunded.

This summer we were awarded (Sauro, Gennari and Myers) a 4 year NSF grant to support SBOL development by the community.

Who we are....



sbolstandard.org

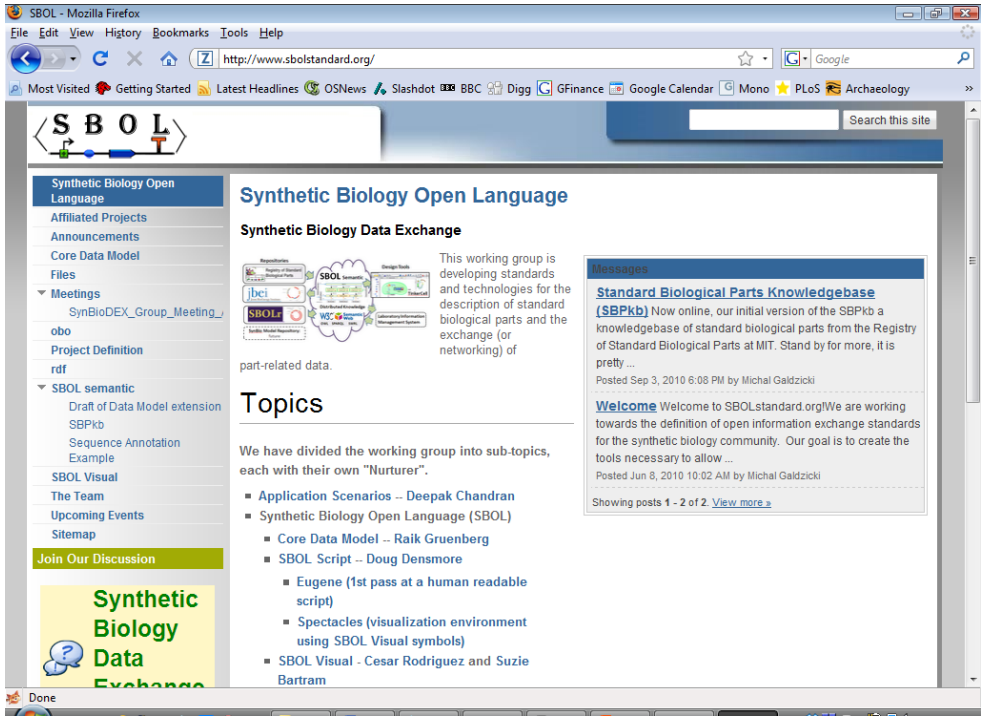
Synthetic Biology Open Language: SBOL

http://www.sbolstandard.org/

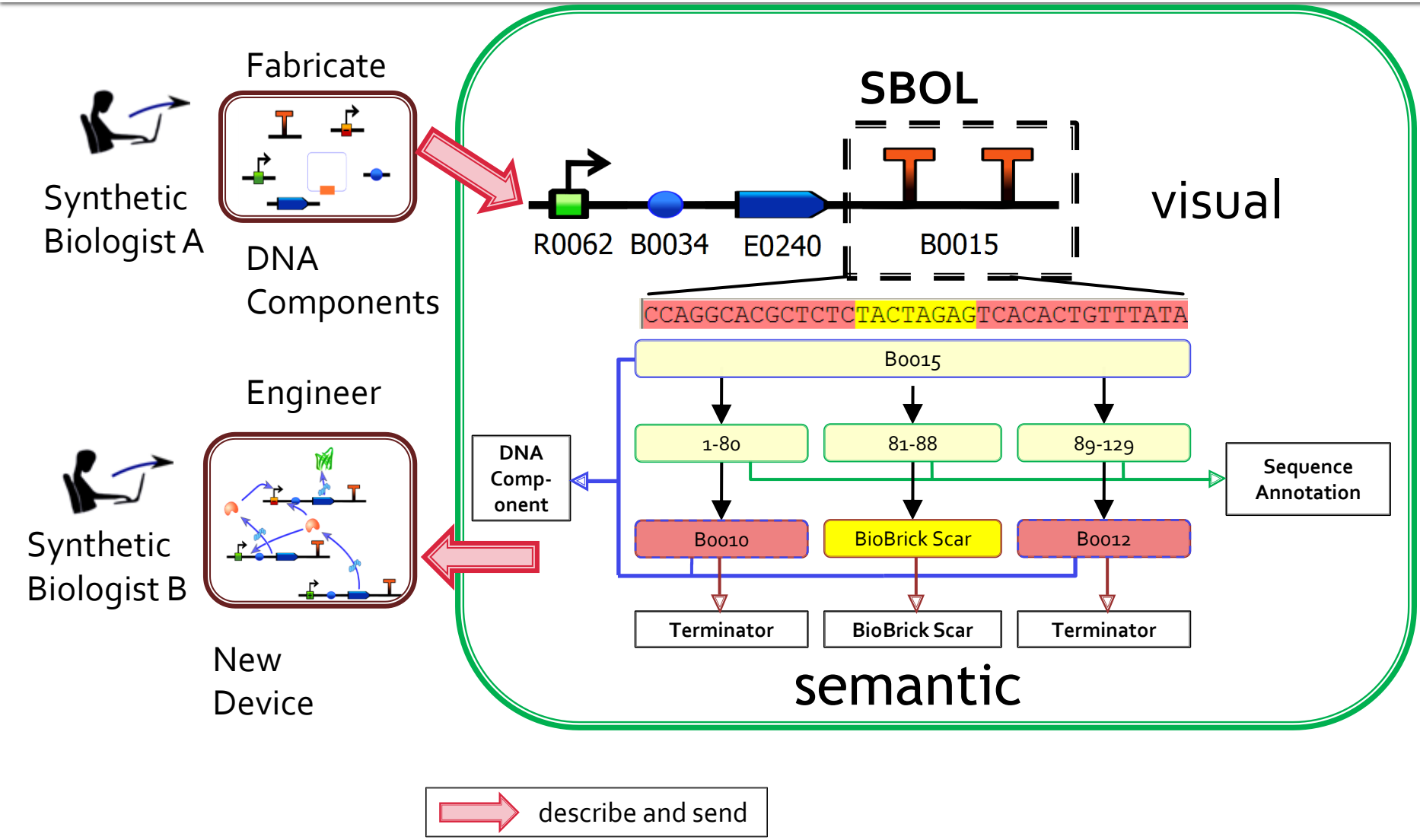
1. SBOL Semantic
2. SBOL Visual

Related:

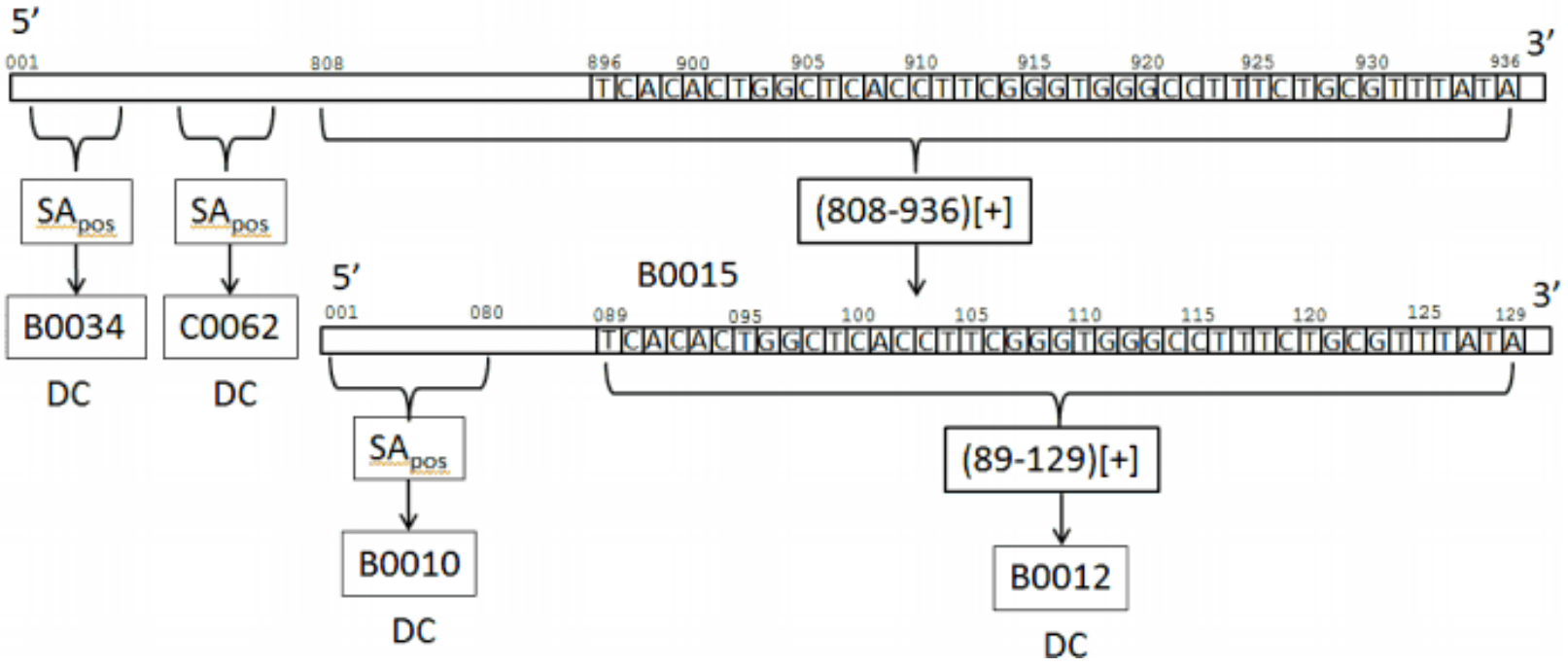
Eugene (BU)



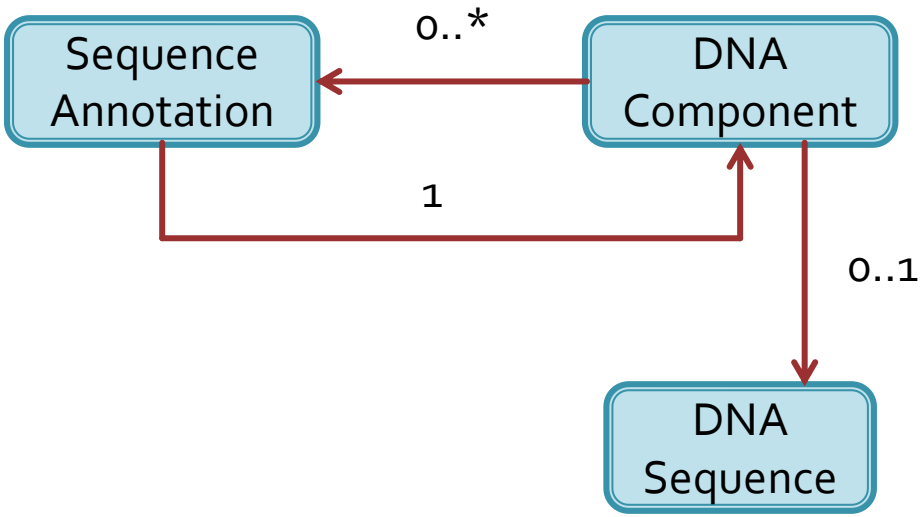
Synthetic Biology Open Language (SBOL) - *lingua franca* for SynBio data



Synthetic Biology Open Language (SBOL) – 1.1



Synthetic Biology Open Language (SBOL) – 1.1

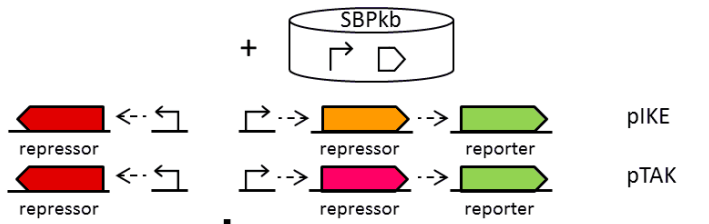


Current Status of Standard 1.1

- libSBOL 1.1 available at: http://www.sbolstandard.org
- Validation service at Newcastle
- Java and C/C++ Libraries, including Python bindings
- Import/Export: GenBank, RDF/XML, JSON (in dev)
- Supported by a growing list of tools (academic and industry)
- Mandated by DARPA
- Part of the European Strategic Plan in Synthetic Biology

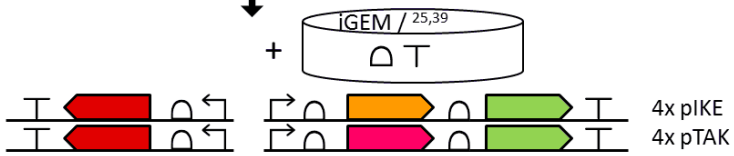
Demonstration (1.1) NBT Paper

Washington



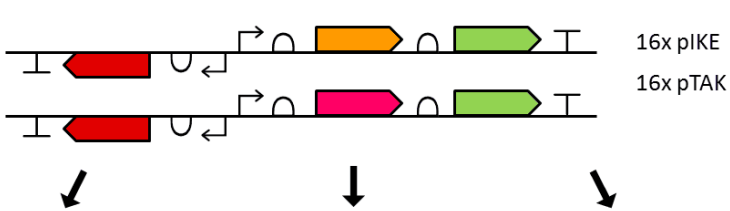
Designed four expression cassettes, leaving RBS and terminator components unspecified.

Boston



Generated four variant designs of each cassette using six RBS and six terminator components.

Utah



Assembled and modeled sixteen variant designs of the toggle switch.

Life Technologies

Received design file for codon optimization and gene synthesis.

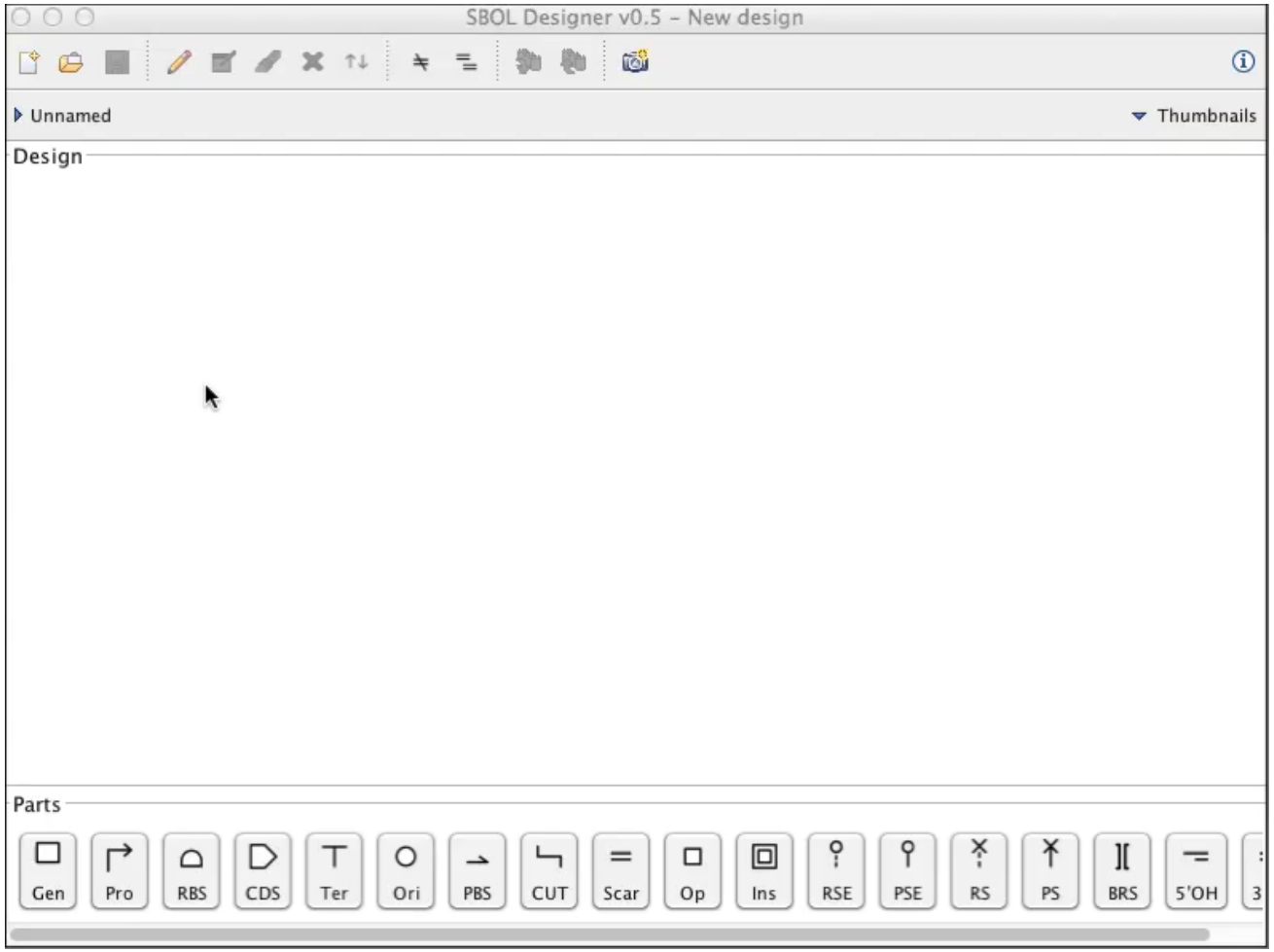
Newcastle

Stored design and model files in repository for dissemination.

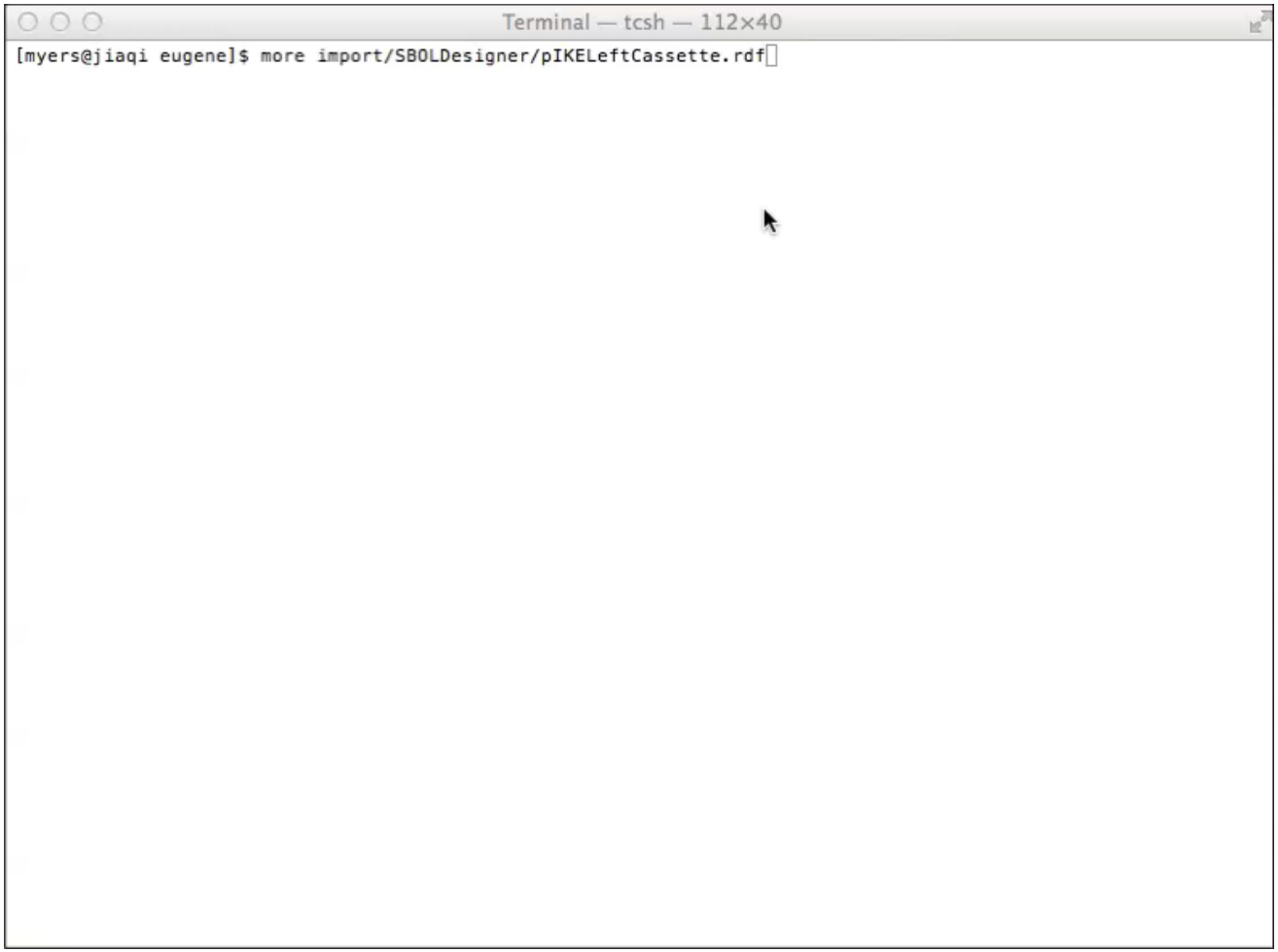
Joint BioEnergy Institute

Stored design files in repository for dissemination.

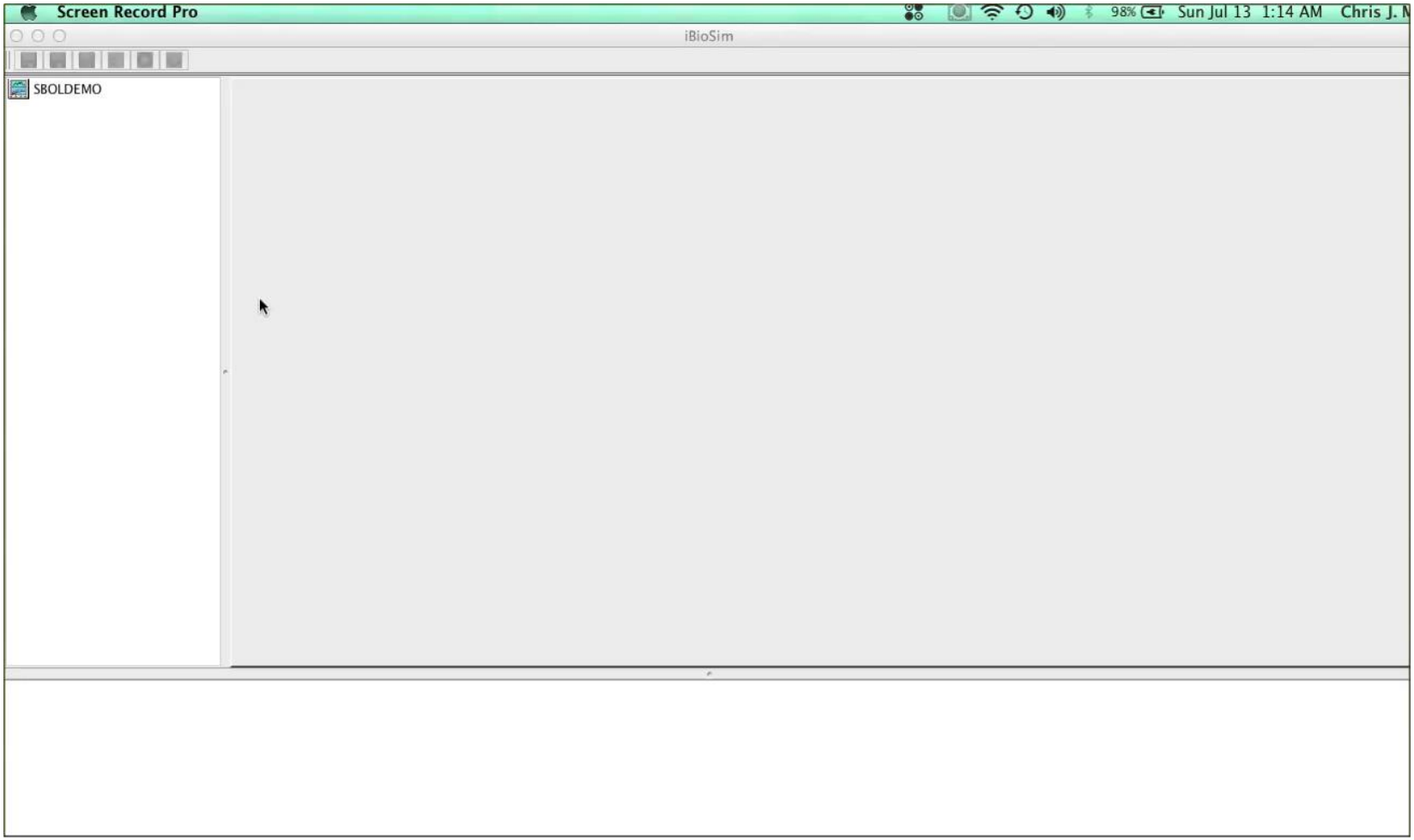
SBOL Designer



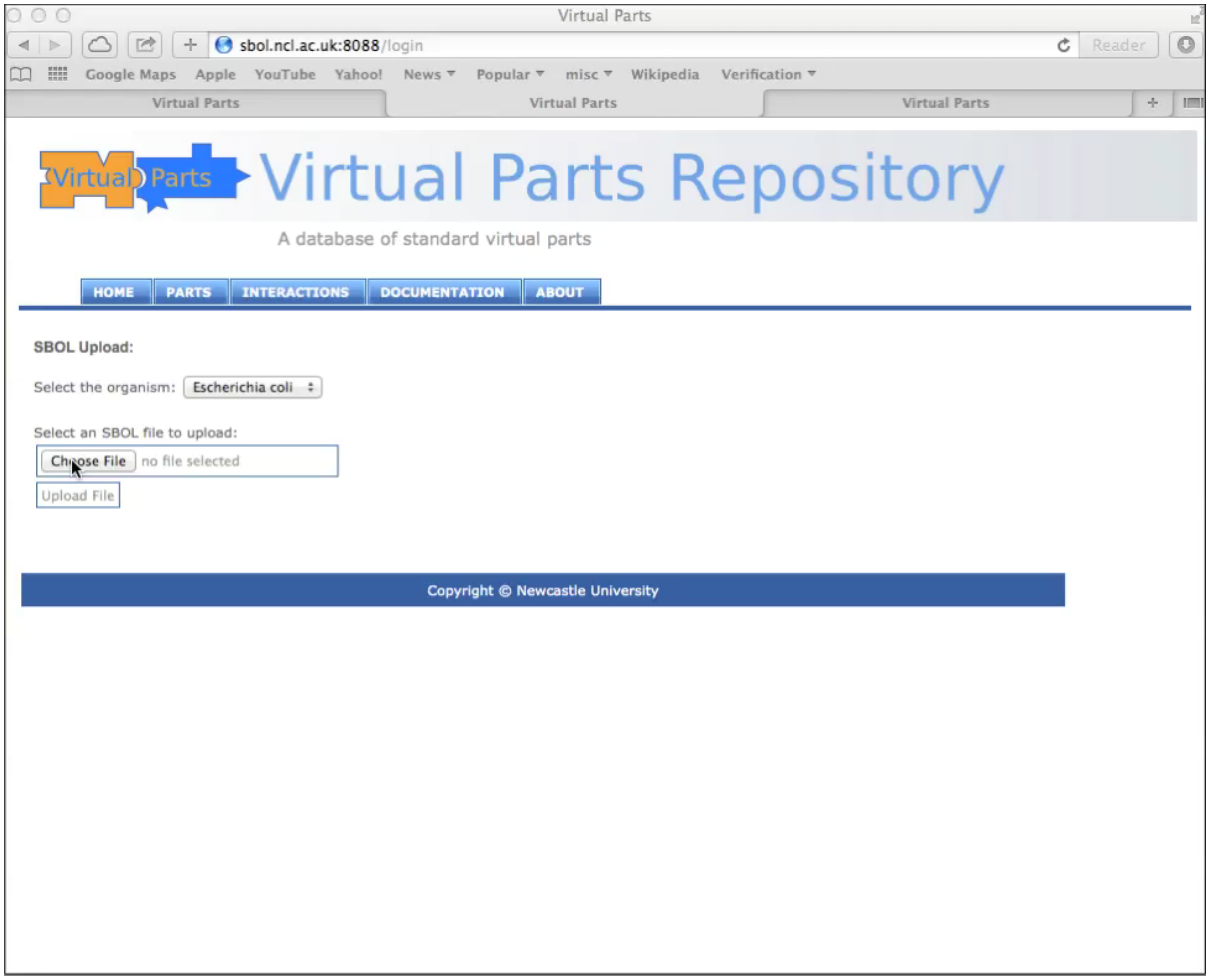
Eugene


Terminal — tcsh — 112×40
[myers@jiaqi eugene]$ more import/SBOLDesigner/pIKELeftCassette.rdf

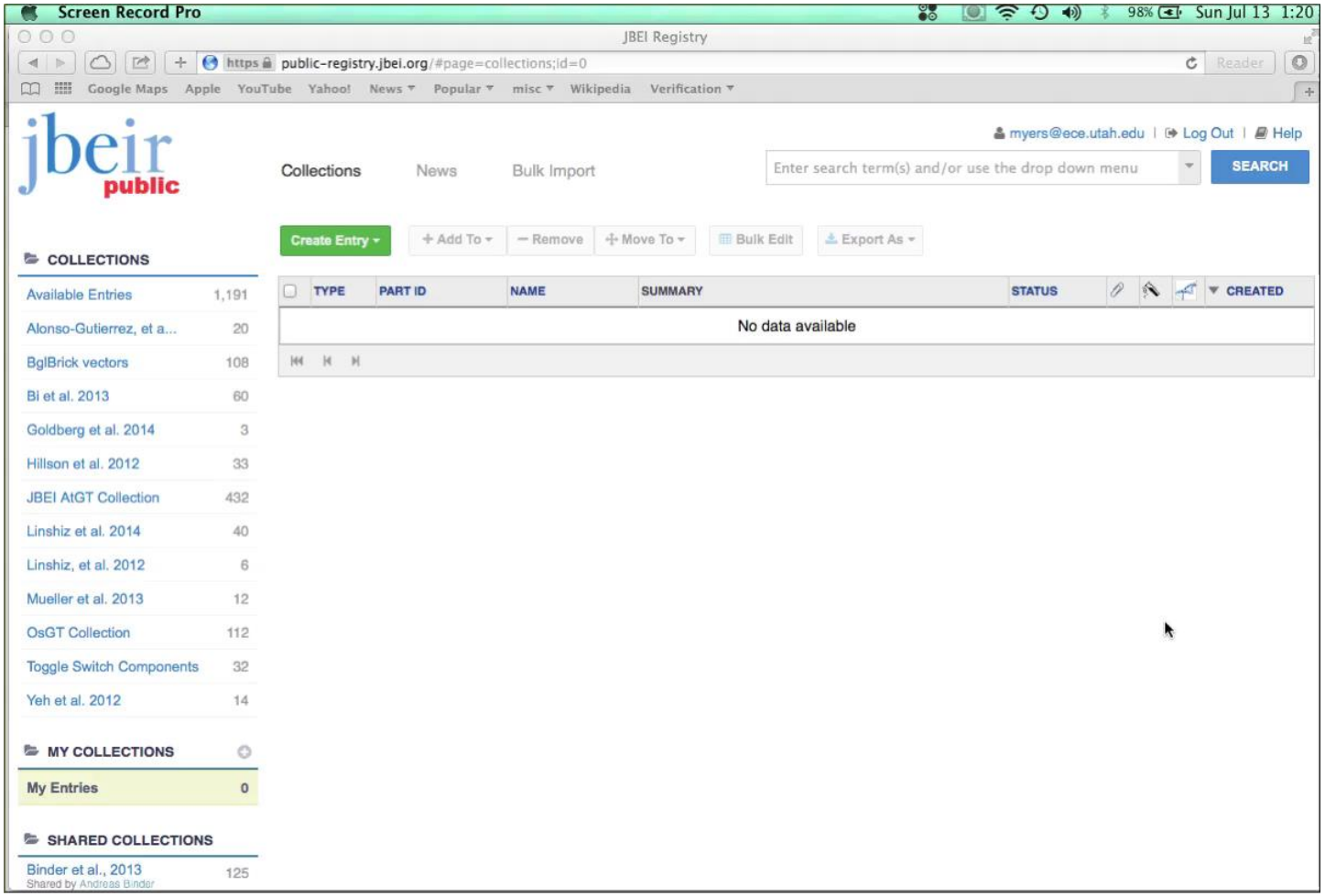
iBioSim



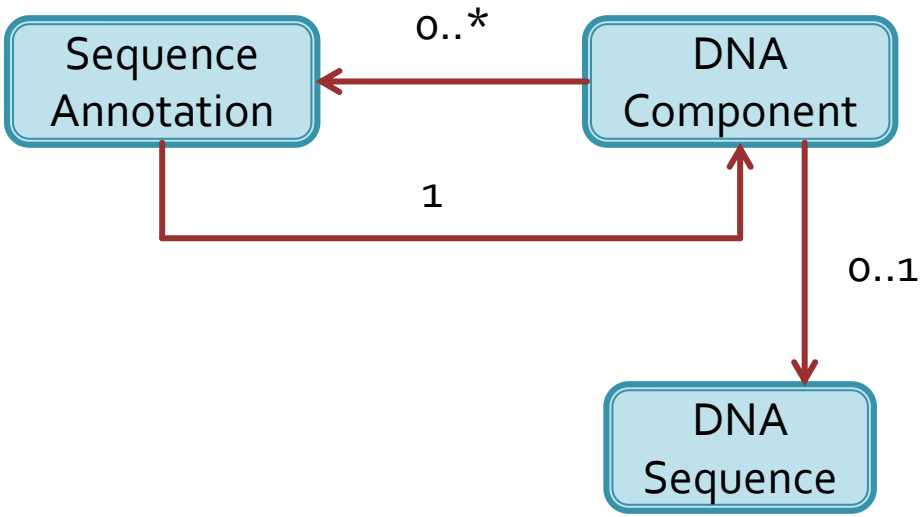
Newcastle Respository



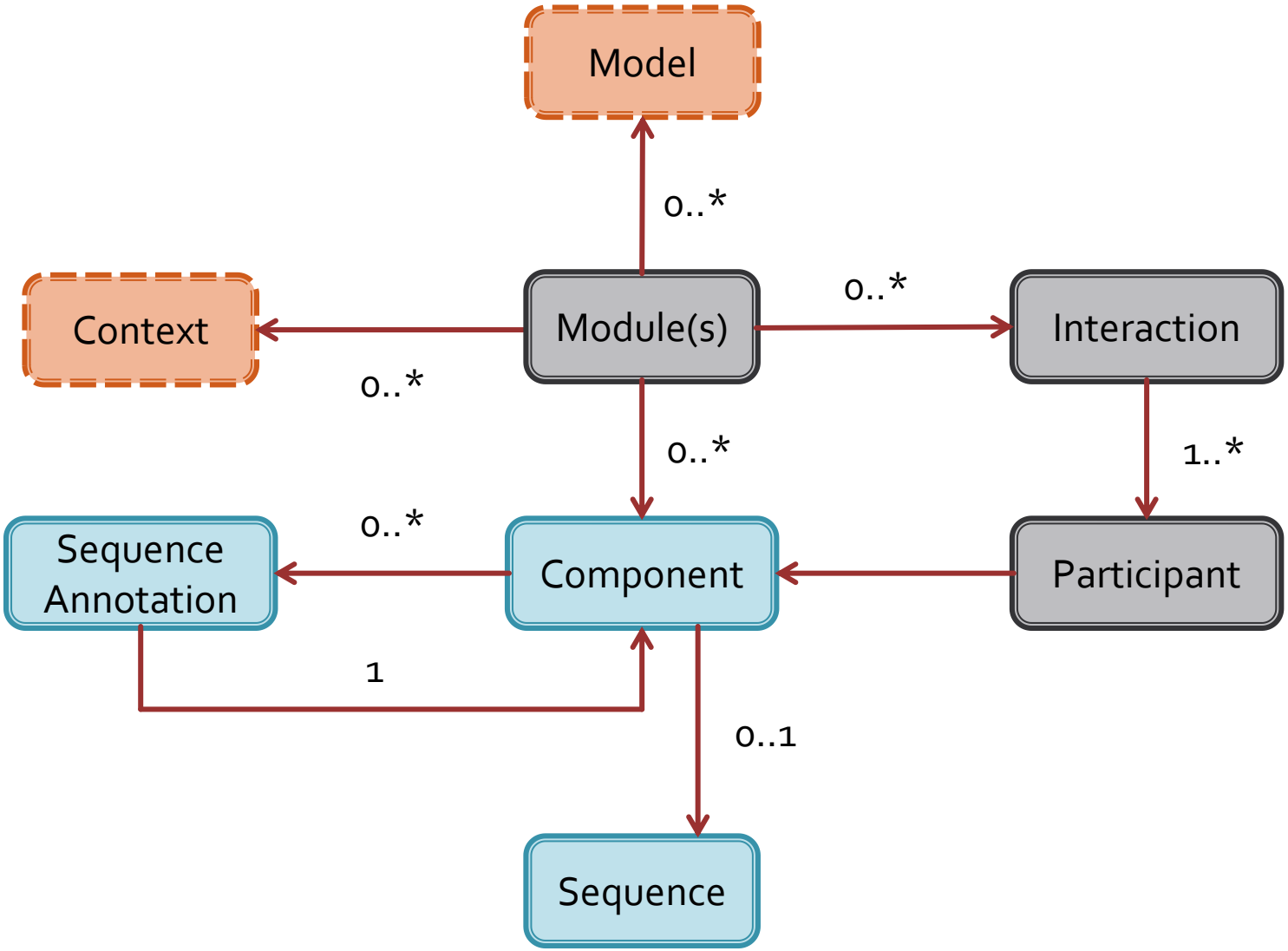
JBEI Respository



Synthetic Biology Open Language (SBOL) – 1.1

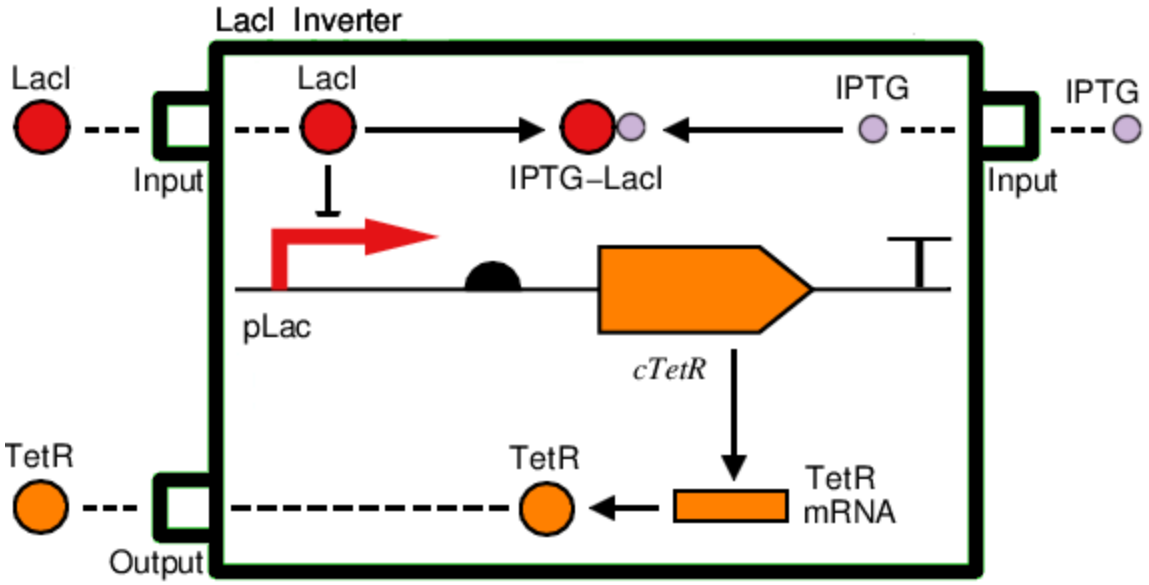


Synthetic Biology Open Language (SBOL) – 2.0

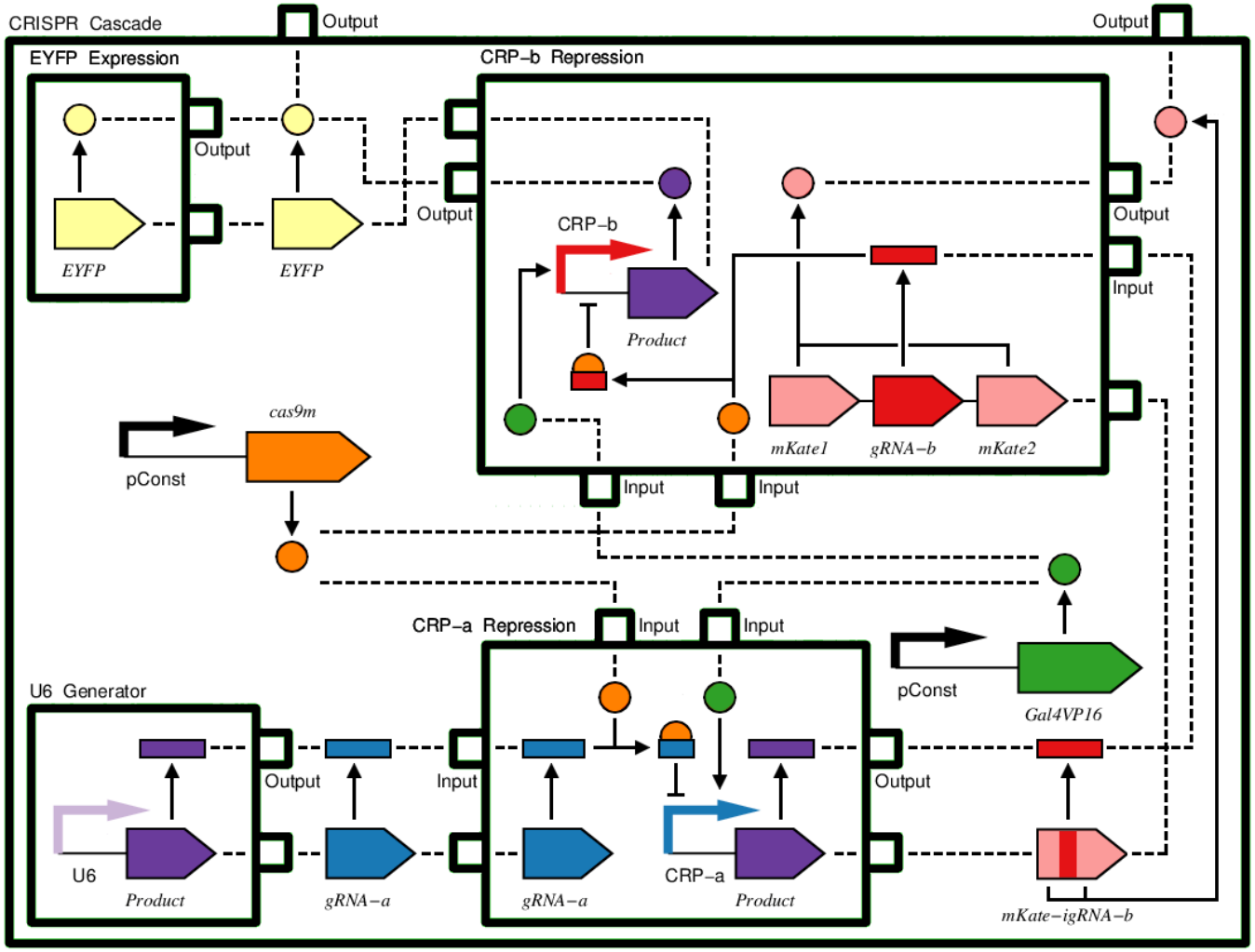


Use Case

IPTG	LacI	TetR (Out)
0	0	1
0	1	0
1	0	1
1	1	1



Use Case: More Complex Example



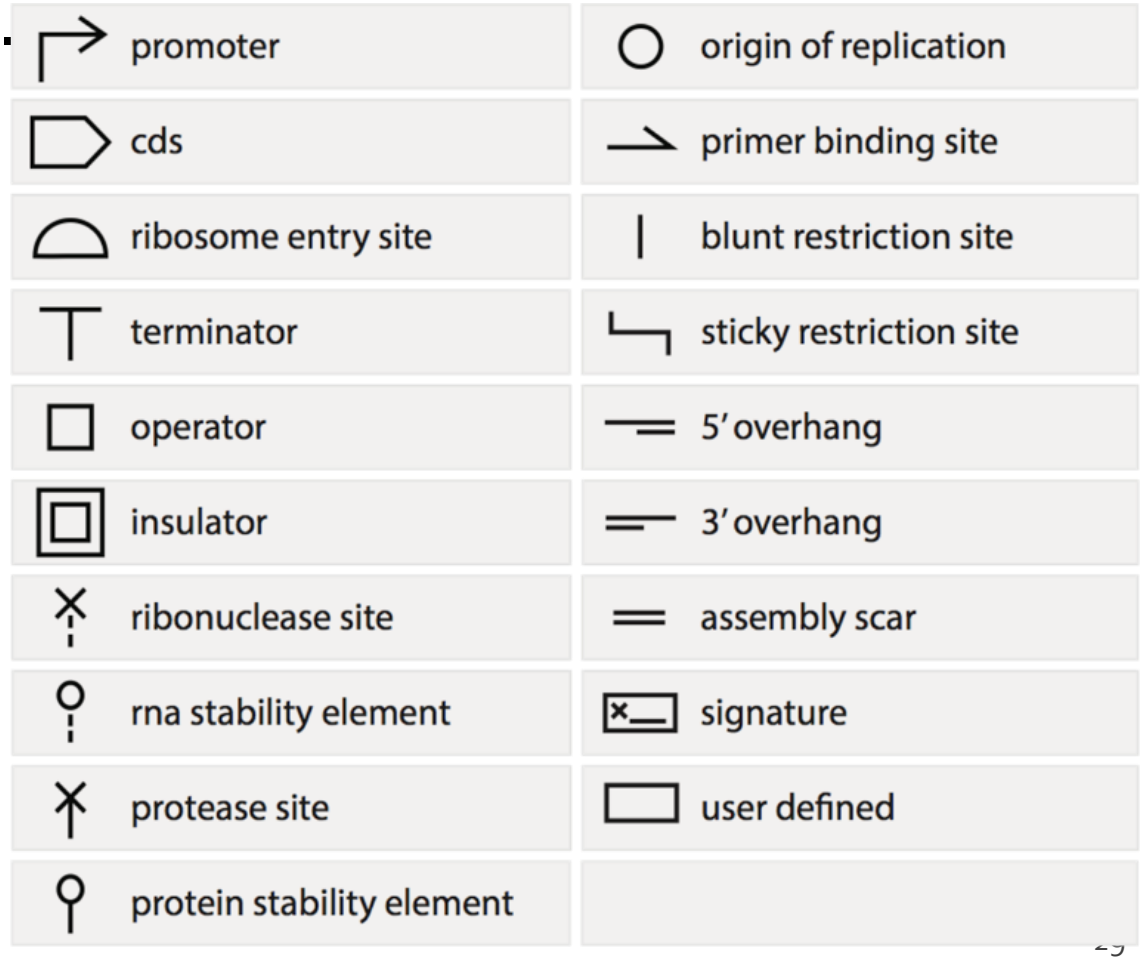
Current Status of 2.0

- Spec has been roughed out, most issues resolved
  - Will be discussed on Wednesday breakout
- Support libraries are being updated with test implements planned at Utah, Washington and Newcastle.
  - Will be discussed on Wednesday breakout
- Exploits SBML for representing computational models
- SBOL Visual also being updated for 2.,0

SBOL Visual (SBOLv) – Agreed in 2013

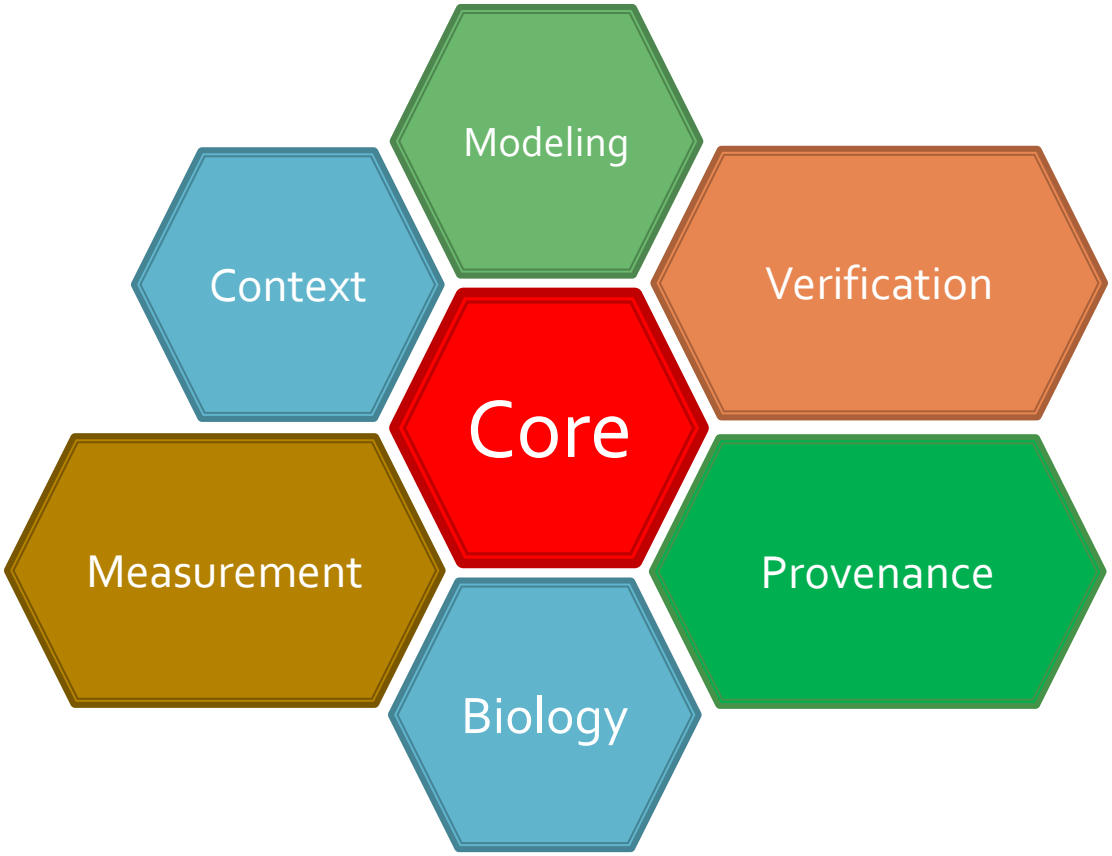
Originally developed at the Berkeley BIOFAB (Endy, Jacqueline Quinn et al).

A means to annotate DNA



Software and Standards Development:

SBOL is too big to be developed by one group



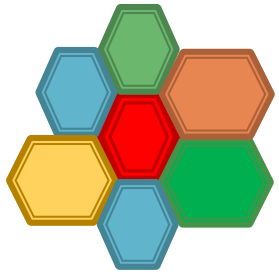
Software and Standards Development:

SBOL is too big to be developed by one group.

Supporting software libraries and the exchange formats have to easily extensible.

The burden on tool developers must be minimized.

We must engage with the engineers who make stuff.

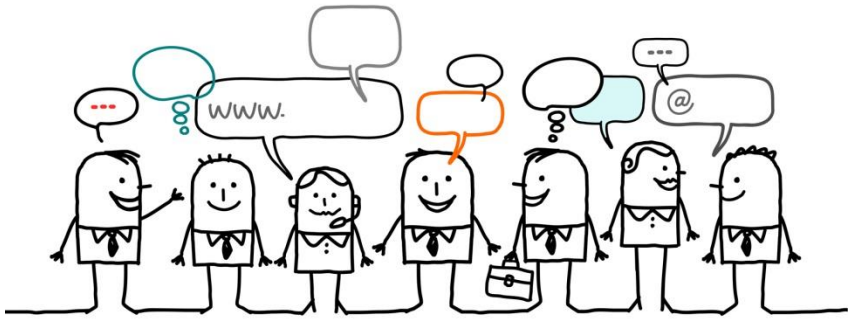


Future Efforts

- Test Suite
- Bringing more experimentalists into the conversation
- Explore use of SBGN/BioPAX

SBOL Breakout Sessions

- Tuesday: Breakouts Tuesday afternoon
- Wednesday: Main Session in the morning
- Wednesday: Breakouts in the afternoon
- Friday: Breakouts afternoon



Acknowledgements

Current Editors:

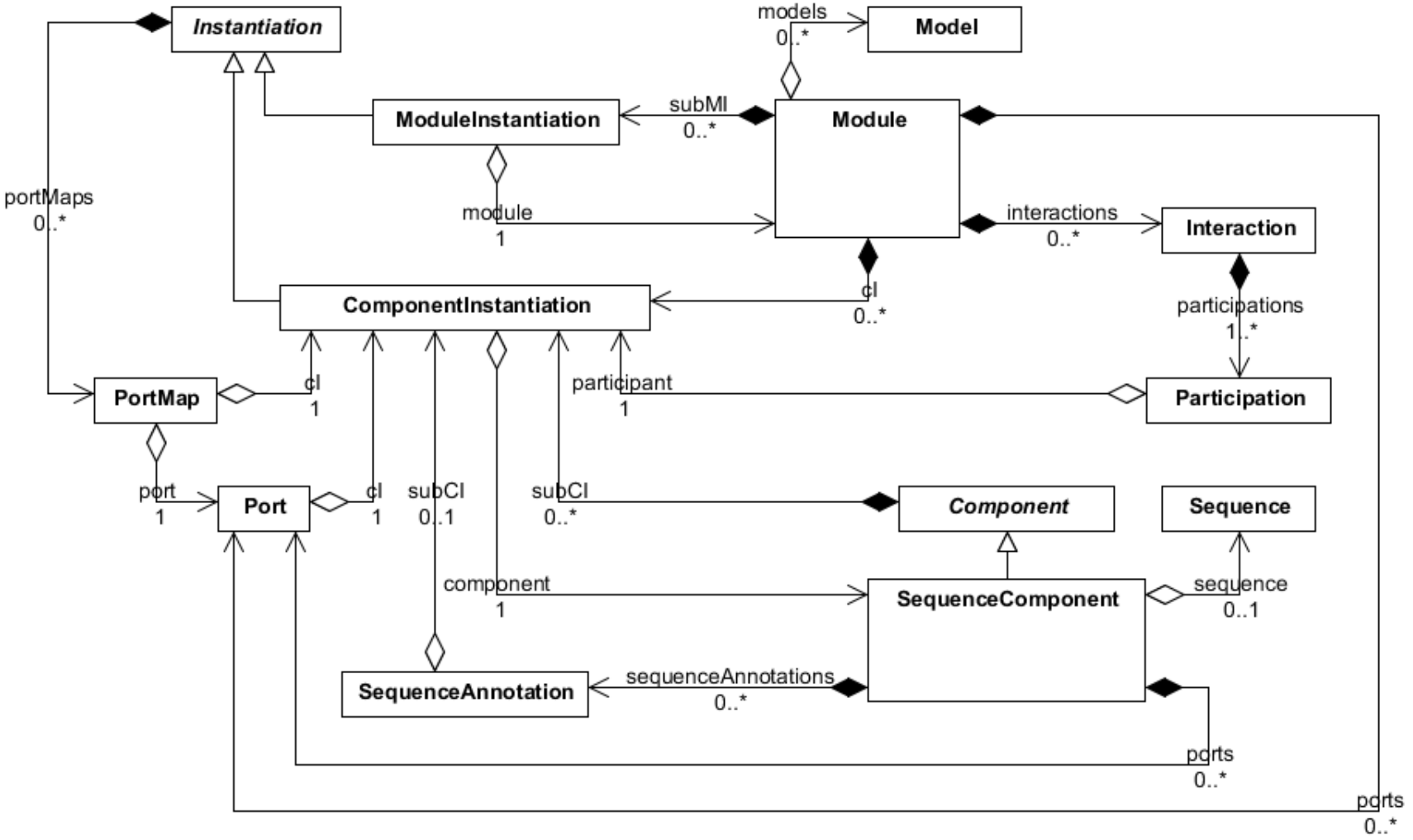
Bryan Bartley, University of Washington
Kevin Clancy, Life Technologies
Goksel Misirli, Newcastle University
Jacqueline Quinn, Google
Nicholas Roehner, University of Utah

Past Editors:

Michal Galdzicki, University of Washington
Ernst Oberortner, Boston University
Matthew Pocock, Newcastle University
Cesar Rodriguez, Autodesk
Mandy Wilson, Virginia Bioinformatics Institute

The SBOL Community

SBOL 2.0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