Spectacles, Eugene, and Kepler
Managing Synthetic Biology Device Development
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Teams are making MORE parts!

Berkeley iGEM 2009 Wetlab made over 800 parts this summer!!!
Clotho Infrastructure

Tool-to-tool Interaction

Tool-to-database Interaction

Reconfigurable Data Model
Reconfigurable Data Model

Template Files

Code Gen

Core Keywords

Extension Keywords

Datum

XML

Datum

XML

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Core Keywords

Extension Keywords

Datum

XML

Datum

XML

DB

Hibernate

Relational Databases

Clotho Data Core

Data API

Sequence View

Clotho Tool Core

Algorithm Manager
Design Flow Example

Abstract design → Device Specification → Physical Assembly

BBa_I13521
BBa_I763007
BBa_J3901
BBa_J5526
Design Flow Example

Abstract design

Clotho Core API

Device Specification

Revamped Clotho Core and Data Model

Physical Assembly

Eugene

Spectacles

Kepler
Choose a part
Modify name, sequence, or implementation
Map to physical part in database
Export to Eugene
Realize an abstract design from Spectacles:

- **<part declarations>**: Specify instances of physical parts
- **<rule declarations>**: Specify rules on how parts can interact with each other on devices
- **<device declarations>**: Construct devices while enforcing rules
- **<function calls on devices>**: Perform functions on devices

**Diagram Description**

- **Database Of Parts**
  - **XML**
    - **XML To Eugene Header Tool**
      - **Eugene Header Files**
- **Eugene Compiler**
  - **XML**
    - **Tool X**
Eugene Demo

Created using Wink
Physical Assembly

Clotho

Files for robot

Human Instructions
Assembly Graph

Stage 1

Stage 2

Stage 3

R0040 B0034 E1010 B0010 B0012

R0051 B0034 E1010 B0010 B0012

R0011 B0034 E1010 B0010 B0012

R0010 B0034 E1010 B0010 B0012

J3901 R0010

B0034 E1010

B0010 B0012

B0010

B0010 B0012

B0034 E1010 B0010 B0012

J3901 R0010 B0034 E1010 B0010 B0012

J3901 R0010 B0034 E1010 B0010 B0012

J3901 R0010 B0034 E1010 B0010 B0012

R0051 B0034 E1010 B0010 B0012

R0011 B0034 E1010 B0010 B0012

R0010 B0034 E1010 B0010 B0012

R0040 B0034 E1010 B0010 B0012
Stage 1 Processing

Stage 1

Stock Plate
1. Dilution file for robot
2. Reaction file for robot
3. File with human-readable instructions

Dilution Plate

Reaction Plate

Assignments to wells

Buffer pre-filled

+Digestion Mix
+Ligation Mix
Kepler

Workflow design environment

- Visual
- Extensible

Director: controls the execution of actors

Actor: a process step in the workflow
Abstract device development, device specification, and physical assembly are key activities in Synthetic Biology.

Developed Spectacles, Eugene, and Kepler based software tools on top of a revamped Clotho framework.

Demonstrated the usefulness of these tools as a continued effort toward a complete design flow for Synthetic Biological Systems.

Collaborated with other institutions
  - Stanford, U Minnesota, SynBERC
For more info be sure to stop by our poster and get a demo!

Also be sure to check out:

- [http://sourceforge.net/projects/keplerclotho/](http://sourceforge.net/projects/keplerclotho/)