An Ecosystem of Rule-based Design Tools and Languages

Micro Workflow and Design Decisions

- Types?
- Functionality?
- Characteristics?
- Dynamic Behavior?

Selection

Composition

Selection Example: "Web of Registries"

Data Exchange Standards

Part Library (PL)

Composition Example: Combinatorial Design Space

Given:
- PL = { pIn, pIn2, pOut, rbs, c1, term, GFP }
- Design Size = 9

> 20 billion combinations (7^9 * 2^9)

Languages and Rule-based Design Tools

Sparrow

- A Library is a set of Biological Parts, Devices, or Systems and their Relationships.
- Specification and Population of Library
  - Manual
  - Import data from File or "Web of Registries"
  - Query and Curate the Library
  - Verify and Describe Systems and Designs

Sparrow Rules

- // MANUAL
  - Promoter pLac
    - .Name(pLac)
    - .Sequence("ATCG")
  - Repressor LacI
    - .Name(pLac)
    - .Sequence("ATCG")

// RELATIONSHIPS

- araC INDUCES pBad
  - pe RIBOSOMAL sigma

// Web of Registries

- import RBS_22300+ from iGEM
- import NORGate from "./nor.eug"

Sparrow (Part) Library

- Querying Parts
  - Type = "Promoter" AND Strength > 5

- Design Description:
  - ORGate: pIn1 AND pIn2

- Curation:
  - IF Sequence MATCHES "ATC" THEN
  - IF RBS BEFORE Promoter THEN

miniEugene

- Declarative Language for Specification of Composition
  - Types of Constraints:
    - Counting, Pairing, Positioning, Interactions, Orientation

miniEugene Input

Design Size: 5
Constraints:

- // EVENT 1
  - pIn1 INDUCES pIn1
  - pIn2 INDUCES pIn2

- // EVENT 2
  - pIn1 DRIVES cRep
  - pIn2 DRIVES cRep

- // EVENT 3
  - cRep REPRESSIONS pOut

- // EVENT 4
  - pOut DRIVES GFP

miniEugene Output

- Device d1:
  - pIn1,pIn2,expRepressor,pOut,reporter); Device d2:
  - pIn1,pIn2,expRepressor,pOut,reporter); cRep

REFERENCES