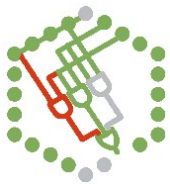
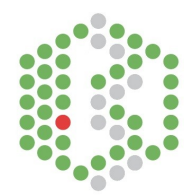


The logo for SBML-Qual features a central arrangement of text and a background of abstract network-like structures. The text 'SBML-Qual' is prominently displayed in the center. Below it, the words 'Development, Validation' are written in a smaller font. The background consists of a circular pattern of light green dots, with several interconnected lines in shades of green, red, and grey forming a complex, web-like structure behind the text.

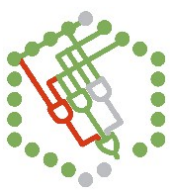
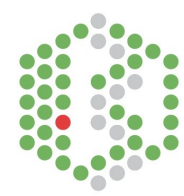
SBML-Qual

Development, Validation



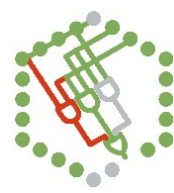
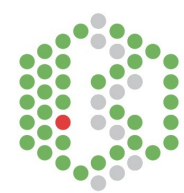
History

- Original draft dates back from 2008
- (I Joined July 2011)
- Still a *draft* proposal, still under discussion
- Validation: RelaxNG schema
- Java: jSBML support

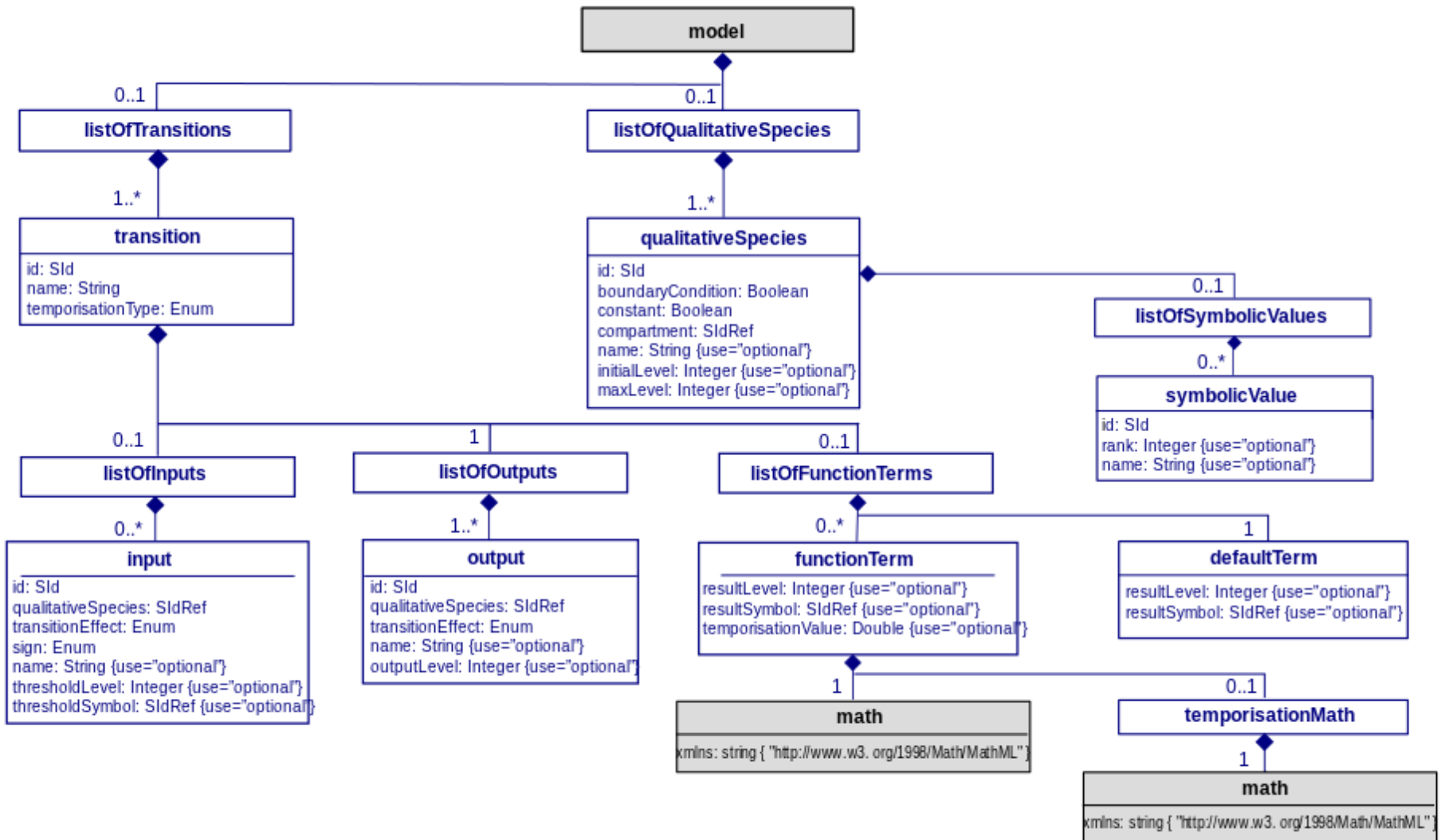


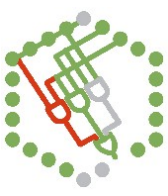
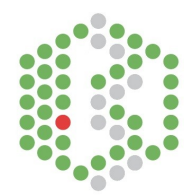
Tool Support

- Support under development for:
 - CellNOpt (jSBML),
 - GinSIM (indep.),
 - The Cell Collective (jSBML),
 - KeggTranslator (jSBML),
 - ...



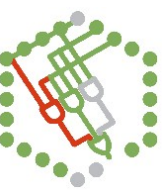
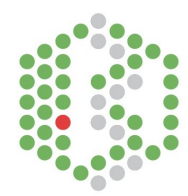
UML Diagram





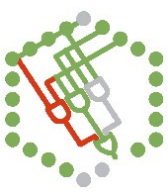
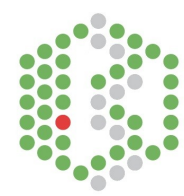
Recent changes

- *sign* attribute added on input (possible values: positive, negative, unknown, dual)
- Cardinality: most lists are now optional (Exception: listOfOutputs)
- An empty list is still useful for annotations.



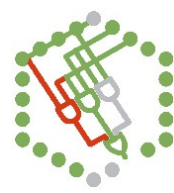
Recent changes

- You can have 0 inputs
- A transition with 0 inputs allow for initial assignments



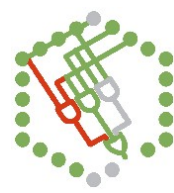
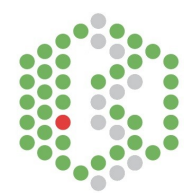
Validation

- *RelaxNG* - a schema definition that is more understandable than the common XML Schema



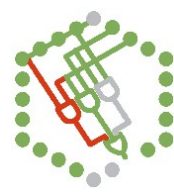
Validation

```
16
17 - <define name="model.datatype" combine="interleave">
18 -   <interleave>
19 -     <optional>
20 -       <element name="qual:listOfTransitions">
21 -         <ref name="listOfTransitions.datatype"/>
22 -       </element>
23 -     </optional>
24 -     <optional>
25 -       <element name="qual:listOfQualitativeSpecies">
26 -         <ref name="listOfQualitativeSpecies.datatype"/>
27 -       </element>
28 -     </optional>
29 -   </interleave>
30 </define>
31
```

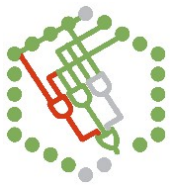
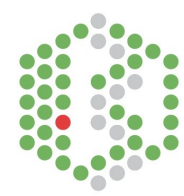
Validation

```
42
43 - <define name="transition.datatype" combine="interleave">
44 -   <interleave>
45 -     <ref name="SBase.datatype"/>
46 -     <optional>
47 -       <attribute name="qual:id">
48 -         <ref name="SId.simpleType"/>
49 -       </attribute>
50 -     </optional>
51 -     <optional>
52 -       <attribute name="qual:name">
53 -         <data type="string"/>
54 -       </attribute>
55 -     </optional>
56 -     <optional>
57 -       <attribute name="qual:temporisationType">
58 -         <ref name="temporisationType.simpleType"/>
59 -       </attribute>
60 -     </optional>
61 -     <optional>
62 -       <element name="qual:listOfInputs">
63 -         <ref name="listOfInputs.datatype"/>
64 -       </element>
65 -     </optional>
66 -     <element name="qual:listOfOutputs">
67 -       <ref name="listOfOutputs.datatype"/>
68 -     </element>
69 -     <optional>
70 -       <element name="qual:listOfFunctionTerms">
71 -         <ref name="listOfFunctionTerms.datatype"/>
72 -       </element>
73 -     </optional>
74 -   </interleave>
75 </define>
76
```



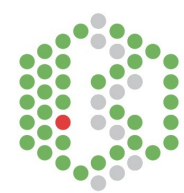
Validation

```
76
77 - <define name="temporisationType.simpleType">
78 -   <choice>
79     <value type="string">timer</value>
80     <value type="string">priority</value>
81     <value type="string">sustain</value>
82     <value type="string">proportion</value>
83     <value type="string">rate</value>
84   </choice>
85 </define>
86
87 - <define name="sign.simpleType">
88 -   <choice>
89     <value type="string">positive</value>
90     <value type="string">negative</value>
91     <value type="string">unknown</value>
92     <value type="string">dual</value>
93   </choice>
94 </define>
95
```

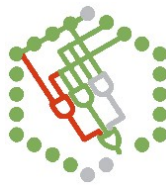


Install & Run Validator

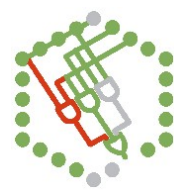
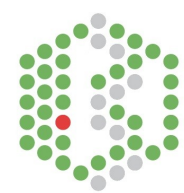
1. Download the jing validator from <http://jing-trang.googlecode.com/files/jing-20091111.zip>
 2. Checkout the RNG Schema from subversion: `svn co http://sbml.svn.sourceforge.net/svnroot/sbml schema`
 3. Uncomment the line relating to sbml-qual from sbml.rng
 4. `java -jar jing-20091111/bin/jing.jar -I schema/sbml.rng <path/to/your/sbml/file>`
- Tip: configure a text-editor like e.g. SciTE to run this command automatically.



Validation



```
sbml-quali.rng - ScITE
File Edit Search View Tools Options Language Buffers Help
toy1.sbml sbml-quali.rng
1 <?xml version="1.0" encoding="UTF-8"?>
2
3 <grammar xmlns="http://relaxng.org/ns/structure/1.0"
4 datatypeLibrary="http://www.w3.org/2001/XMLSchema-datatypes"
5 xmlns:quali="http://sbml.org/Community/Wiki/SBML_Level_3_Proposals/Qualit
6
7 <define name="sbml.datatype" combine="interleave">
8 <attribute name="quali:required" >
9 <data type="boolean"/>
10 </attribute>
11 </define>
12
13 <!-- modelDefinition extends model -->
14
15 <define name="model.datatype" combine="interleave">
16 <interleave>
17 <optional>
18 <element name="quali:listOfQualitativeSpecies">
19 <ref name="listOfQualitativeSpecies.datatype"/>
20 </element>
21 </optional>
22 <optional>
23 <element name="quali:listOfTransitions">
24 <ref name="listOfTransitions.datatype"/>
25 </element>
26 </optional>
27 </interleave>
28 </define>
>jing -i sbml-RelaxNG/sbml.rng
"toy1.sbml"
>Exit code: 0
|i=1 co=1 INS (LF)
```



Validation

RelaxNG
Schema

```
1 <?xml version="1.0" encoding="UTF-8"?>
2
3 <grammar xmlns="http://relaxng.org/ns/structure/1.0"
4 datatypeLibrary="http://www.w3.org/2001/XMLSchema-datatypes"
5 xmlns:quali="http://sbml.org/Community/Wiki/SBML_Level_3_Proposals/Qualit
6
7 <define name="sbml.datatype" combine="interleave">
8 <attribute name="quali:required" >
9 <data type="boolean"/>
10 </attribute>
11 </define>
12
13 <!-- modelDefinition extends model -->
14
15 <define name="model.datatype" combine="interleave">
16 <interleave>
17 <optional>
18 <element name="quali:listOfQualitativeSpecies">
19 <ref name="listOfQualitativeSpecies.datatype"/>
20 </element>
21 </optional>
22 <optional>
23 <element name="quali:listOfTransitions">
24 <ref name="listOfTransitions.datatype"/>
25 </element>
26 </optional>
27 </interleave>
28 </define>
```

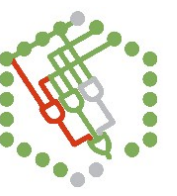
```
>jing -i sbml-RelaxNG/sbml.rng
"toy1.sbml"
>Exit code: 0
```

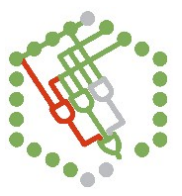
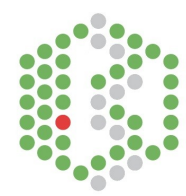
Toy model
validates

ji=1 co=1 INS (LF)



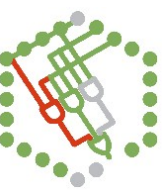
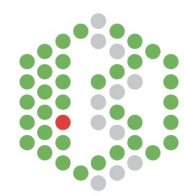
Validation demo





Where to find examples

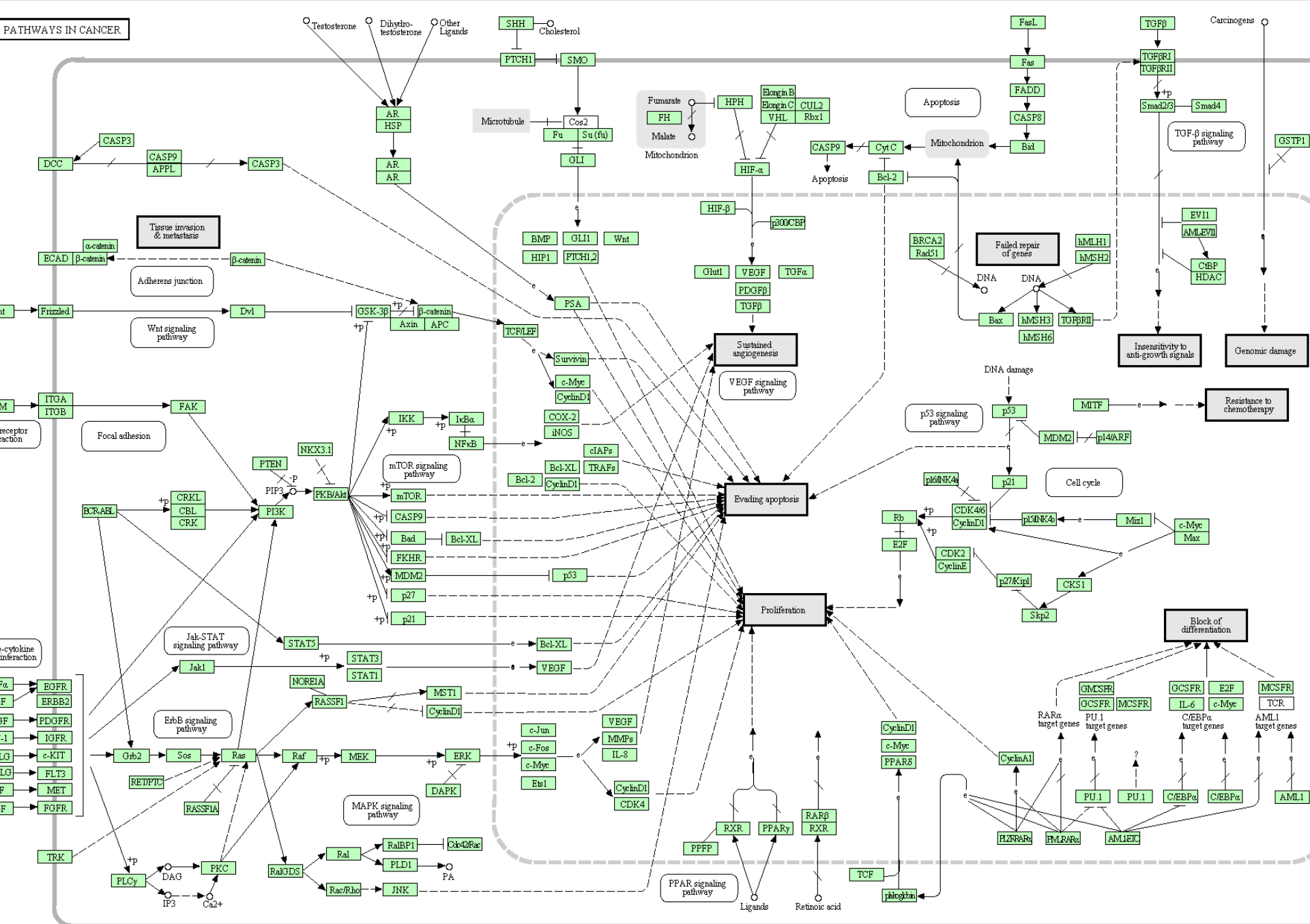
- No good public source for examples yet
 - <https://path2models.googlecode.com/svn/trunk/Sb>
- Export from GinSIM (next version)
- Export from Cell Collective
- Export from CellNOpt (unreleased)
- Path2Models project, will be on BioModels database eventually



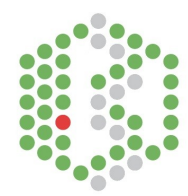
Path2Models

- Project involving EBI, Manchester, Tuebingen
- KEGG Pathways
- Both SBML and SBML-Qual generated
- Great test-case for SBML-Qual

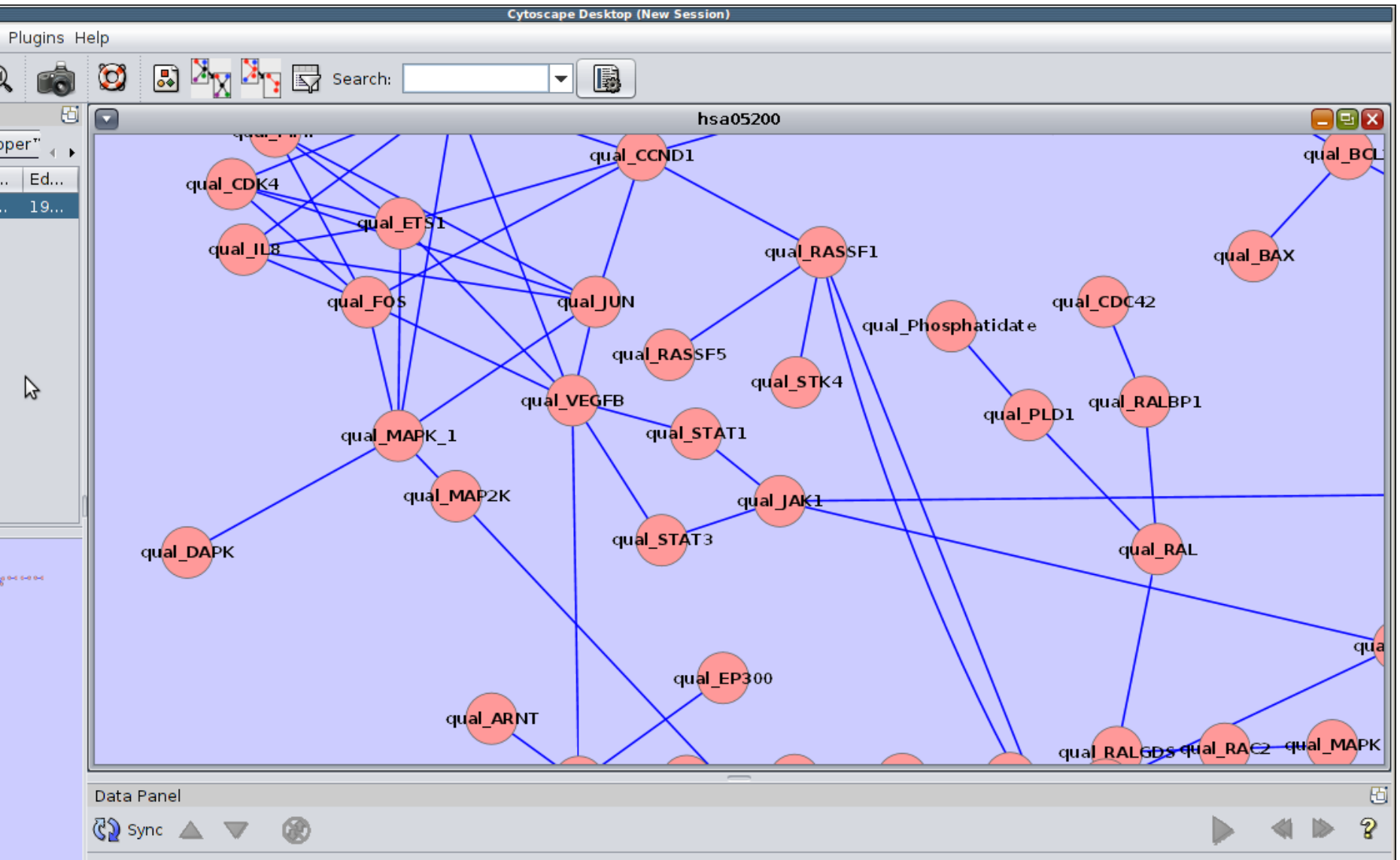
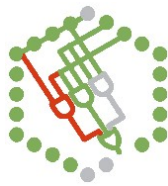
PATHWAYS IN CANCER

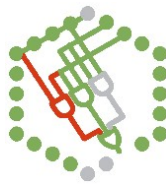
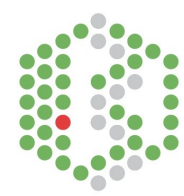


- Colorectal cancer
- Pancreatic cancer
- Glioma
- Thyroid cancer
- Acute myeloid leukemia
- Chronic myeloid leukemia
- Basal cell carcinoma
- Melanoma
- Renal cell carcinoma
- Bladder cancer
- Prostate cancer
- Endometrial cancer
- Small cell lung cancer
- Non-small cell lung cancer

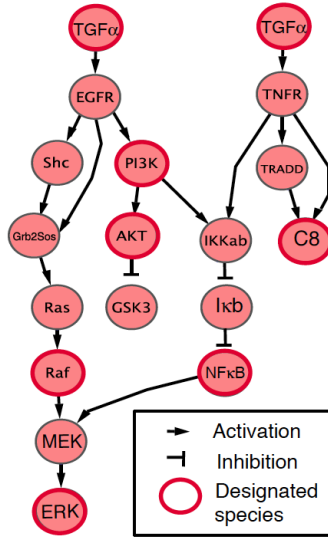


Path2Models



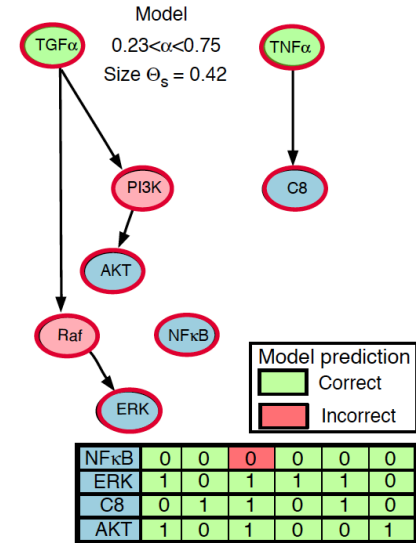


CellNOpt



Designated species	Data					
Stimuli						
TGF α	+	-	+	+	+	+
TNF	-	+	+	-	+	-
Inhibitors						
PI3K	-	-	-	+	+	-
Raf	-	-	-	-	-	+
Readouts						
NF κ B	0	0	1	0	0	0
ERK	1	0	1	1	1	0
C8	0	1	1	0	1	0
AKT	1	0	1	0	0	1

Saez-Rodriguez et al. 2009



1. Begin with prior knowledge

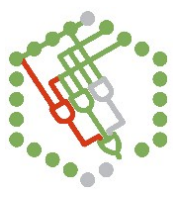
2. A logic network is created and expanded to include all possible connections

3. This network is then trained to the available data

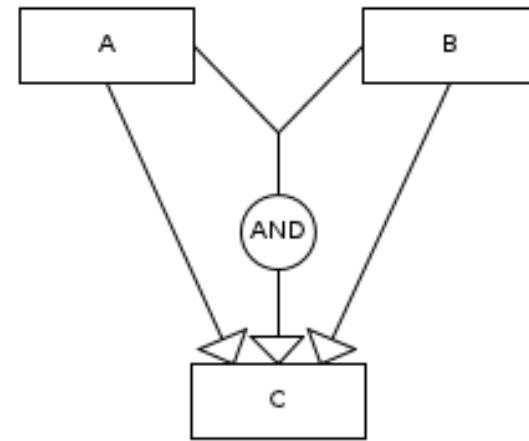
4. Result: A family of models that best explains the data

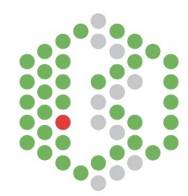


CellNOpt internals

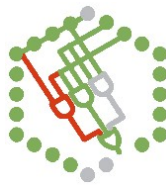


A	1	C
B	1	C
A	1	and1
B	1	and1
and1	1	C





CellNOpt and SBML-Qual



- Currently implemented Qual2SIF & SIF2Qual converters
- CellNOpt is R-based
- Direct implementation in CellNOpt -> waiting for LibSBML support