NeuroML is a standardised XML based language for computational neuroscience

Version 1.x allowed specification of:
- Detailed neuronal morphologies
- Ion channels
- Synapses
- 3D network structure

Version 2 features:
- Greater range of models
- Easier to extend using LEMS

[NeuroML]

Where is NeuroML used?

Simulators

NEURON
GENESIS
MOOSE
Brian

Initiatives

OpenWorm
Open Source Brain

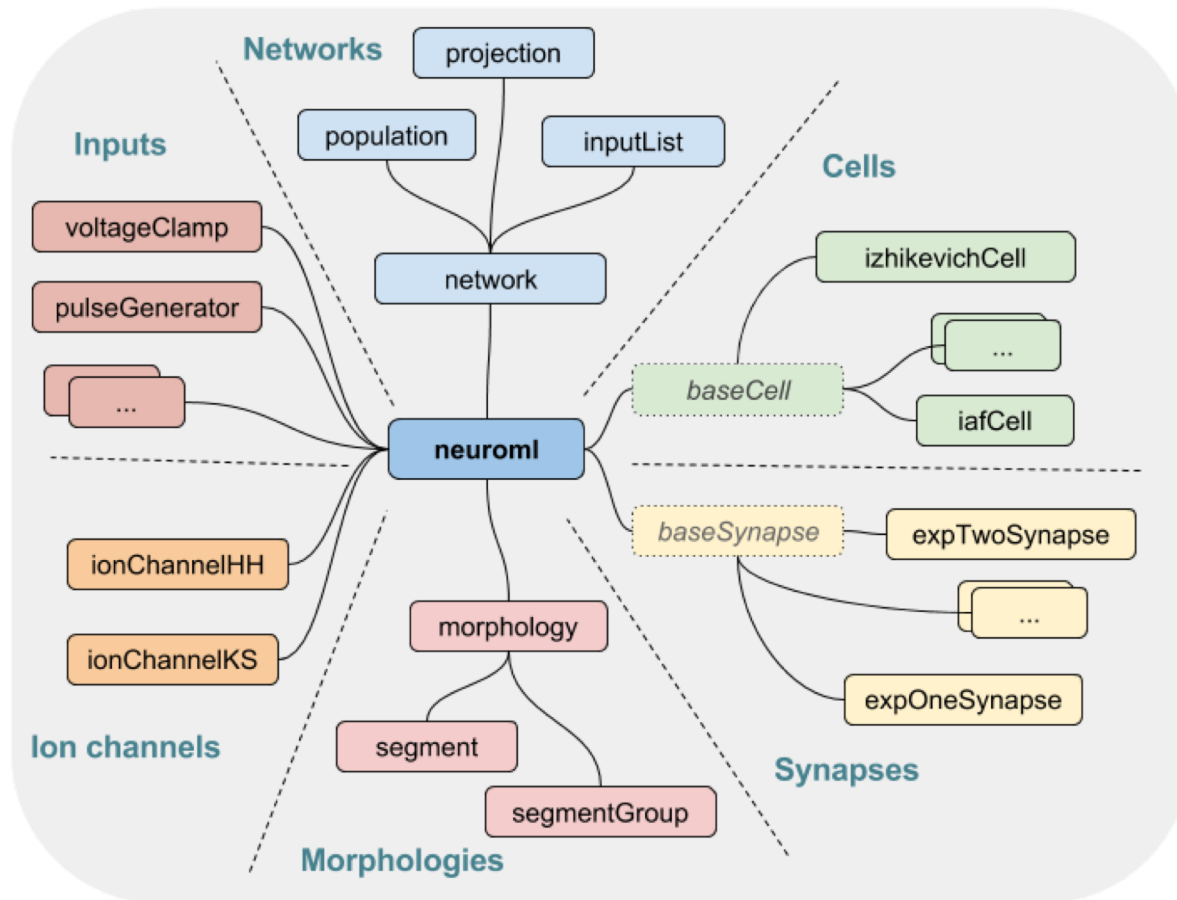**Interoperability**

PyNN
neuroConstruct

Morphological analysis/ generation

Cx3D
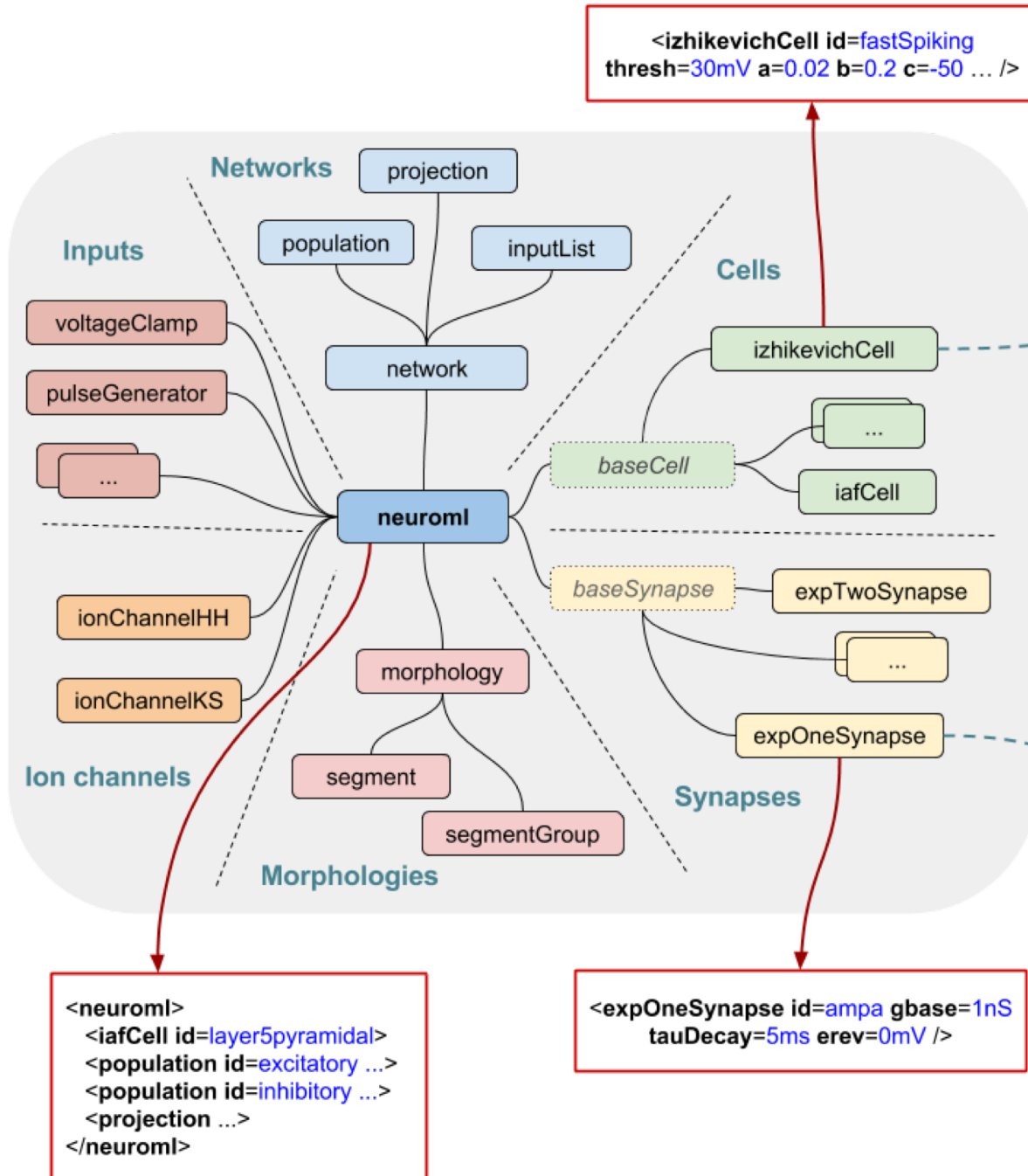TREES Toolbox
NeuGen

Databases

Channelpedia
BBP NMC
NeuroMorpho
Allen Institute
Cell Types DB

Scope of NeuroML 2: Ion channels, synapses, cells, networks...

NeuroML 2 files set parameters…

…LEMS files define the dynamics


```
<izhikevichCell id=fastSpiking
thresh=30mV a=0.02 b=0.2 c=-50 … />
```

Networks
- projection
- population
- inputList
- network

Inputs
- voltageClamp
- pulseGenerator
- …

neuroml

Ion channels
- ionChannelHH
- ionChannelKS

Morphologies
- morphology
- segment
- segmentGroup

Cells
- izhikevichCell
- *baseCell*
  - …
  - iafCell

Synapses
- *baseSynapse*
  - expTwoSynapse
  - …
  - expOneSynapse

```
<neuroml>
  <iafCell id=layer5pyramidal>
  <population id=excitatory ...>
  <population id=inhibitory ...>
  <projection ...>
</neuroml>
```

```
<expOneSynapse id=ampa gbase=1nS
tauDecay=5ms erev=0mV />
```

Standard NeuroML 2 ComponentType definitions

Cells.xml

ComponentType: **izhikevichCell**
Parameters: **thresh, a, b, c, d, …**

Dynamics
  StateVariables: **v, U**
  TimeDerivatives:
    d**v**/dt = 0.04***v**^2 + 5***v** + 140.0 - **U**
    d**U**/dt = **a** * (**b*****v** - **U**)
  OnConditions:
    v > **thresh** =>
      v = **c**
      U = **U** + **d**

Synapses.xml

ComponentType: **expOneSynapse**
Parameters: **gbase, tauDecay, erev**

Dynamics
  StateVariables: **g**
  TimeDerivatives:
    d**g**/dt = -**g** / **tauDecay**
  DerivedVariables:
    i = **g** * (**erev** - **v**)
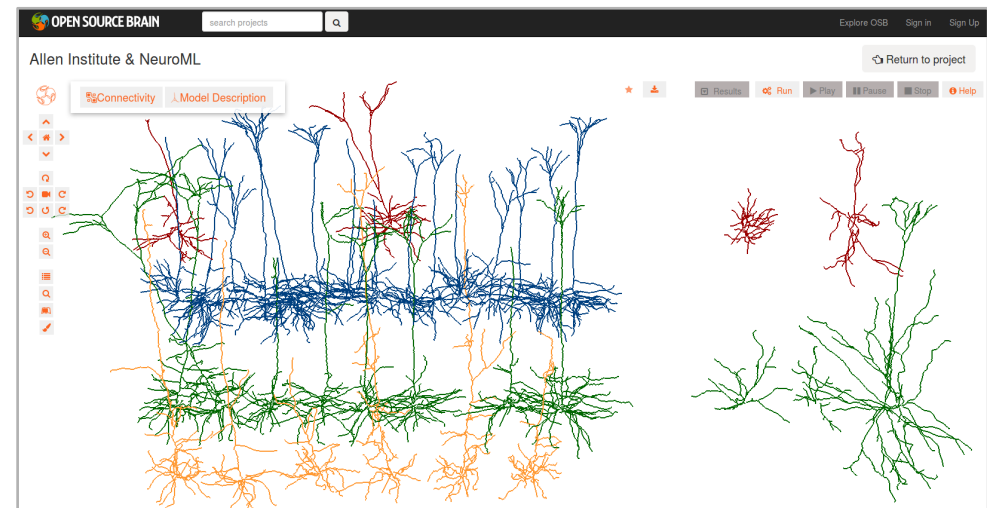 OnEvents:
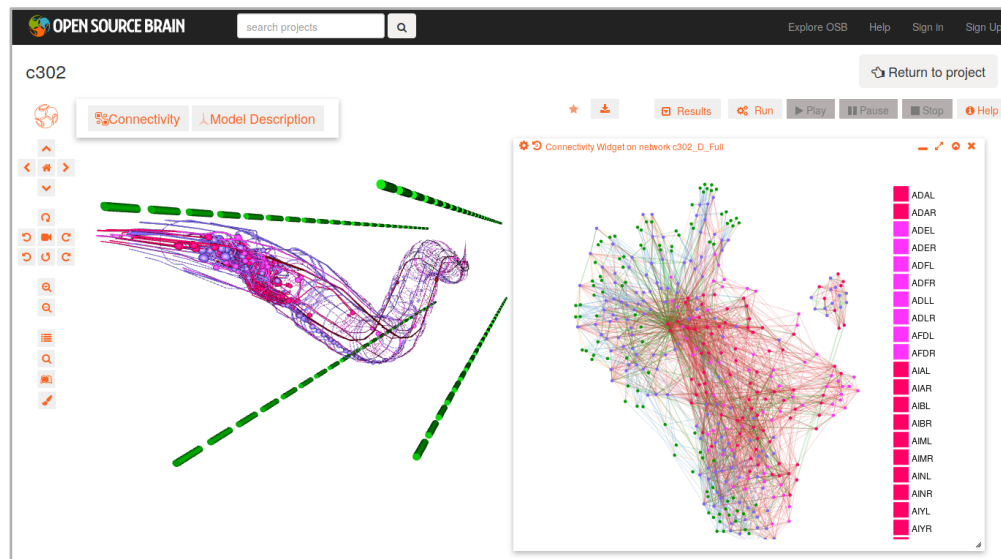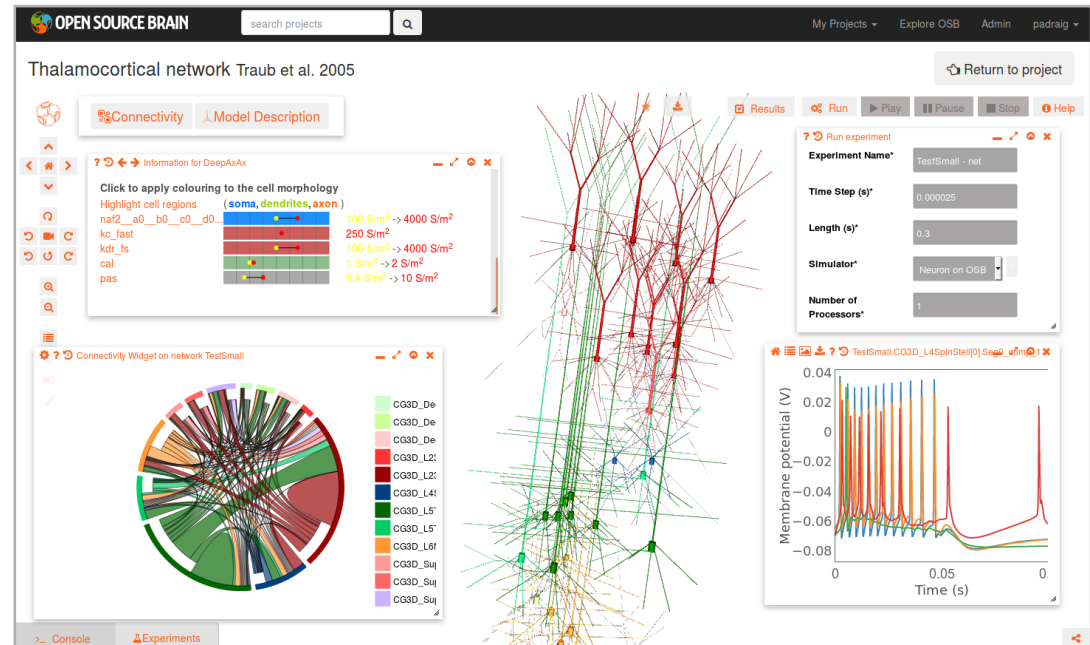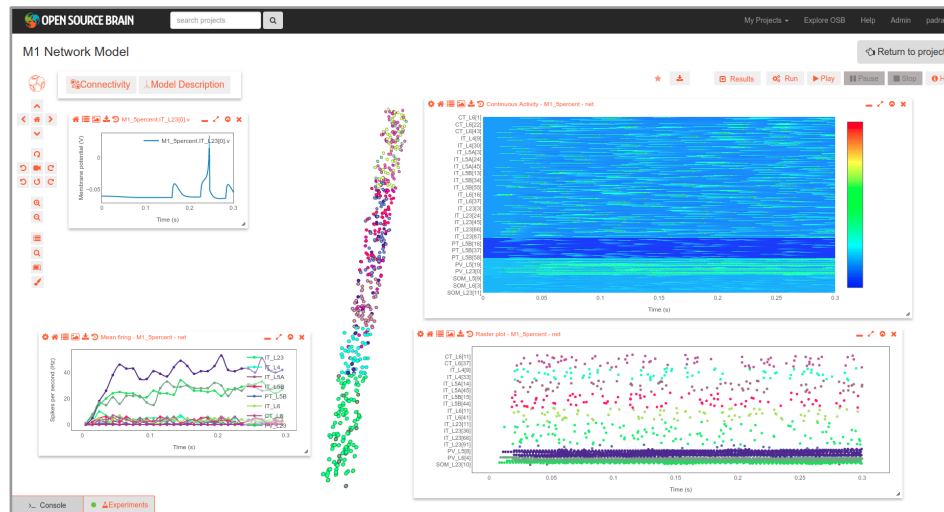   **g** = **g** + **gbase**

Networks.xml   Inputs.xml   …   …

Where can I find (and visualize/analyze/simulate) NeuroML 2 models?

Try *http://www.opensourcebrain.org*!

OPEN SOURCE BRAIN