

# Introducing the Rappture Toolkit

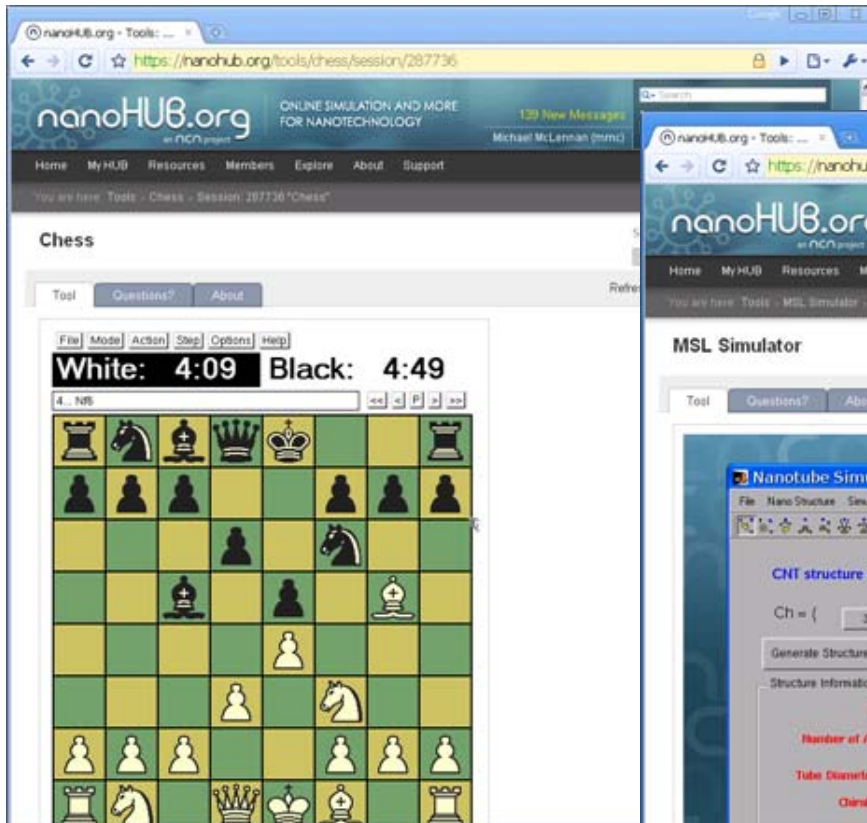
```

<?xml version="1.0"?>
<run>
  <tool>
    <title>Graphing Calculator</title>
    <about>Press Simulate to view results.</about>
    <command>python $tool/graph.py $driver</command>
  </tool>
  <input>
    <string id="formula">
      <about>
        <label>Formula</label>
        <html><math>2x + 1/3\sin(x)</math></html>
      </about>
      <math>2x + 1/3\sin(x)</math>
    </string>
    <number id="min">
      <about> <label>From x</label> </about>
      <value>0</value>
    </number>
    <number id="max">
      <about> <label>To x</label> </about>
      <default>1</default>
    </number>
  </input>
  <output>
    <curve id="result">
      <about> <label>Formula: Y vs X</label> </about>
    </curve>
  </output>
</run>

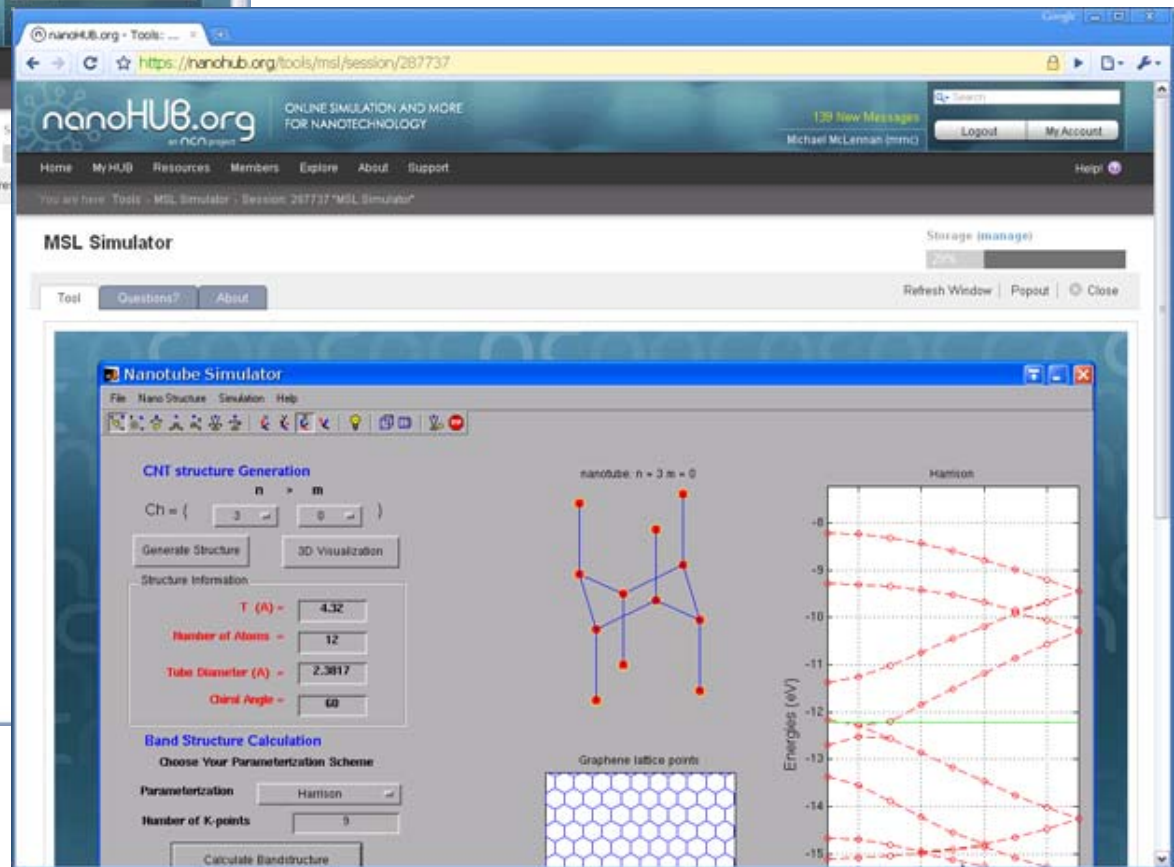
```

**Michael McLennan**  
 Software Architect  
 HUBzero™ Platform for Scientific Collaboration

# Publish ANY X11/Linux Tool



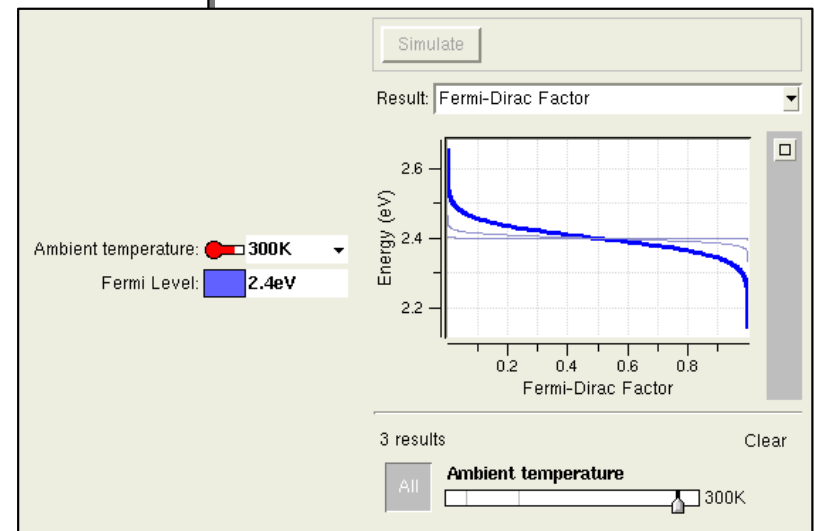
GNU Chess



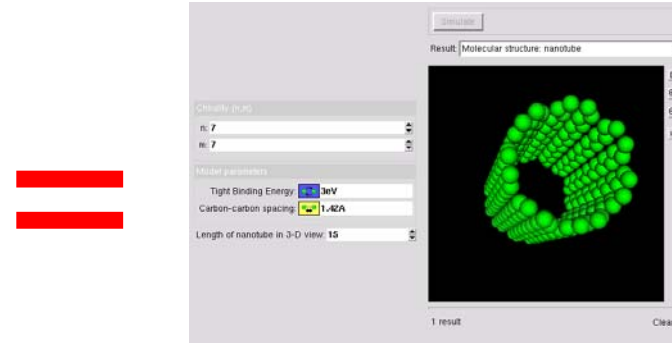
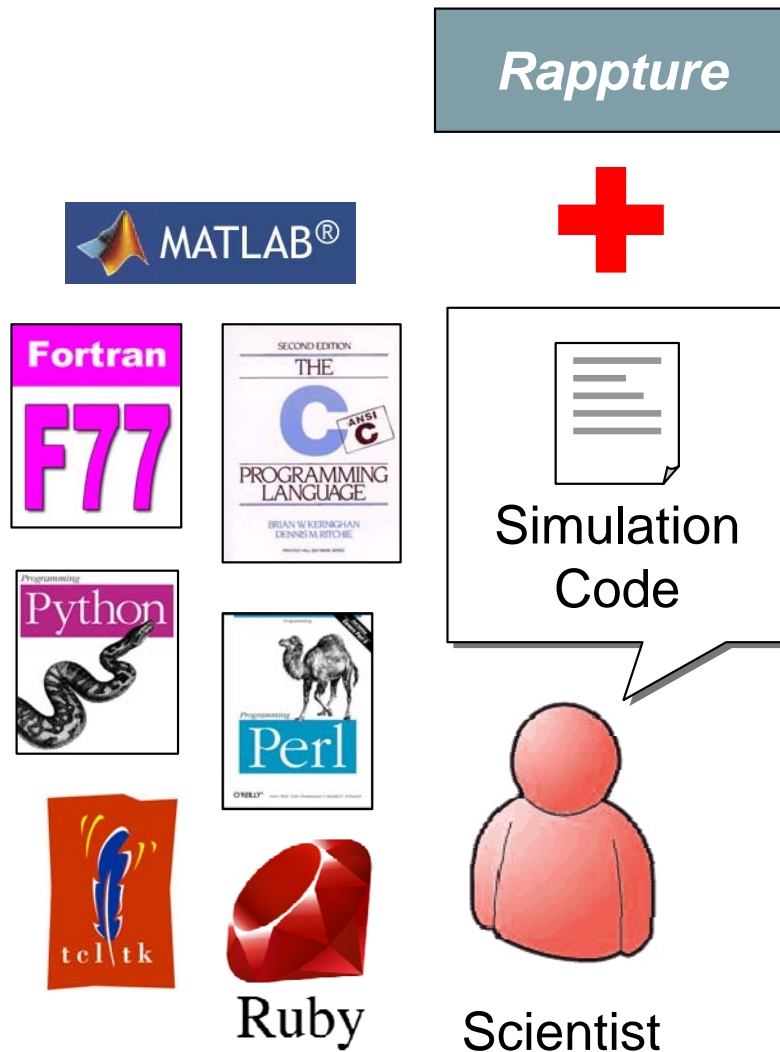
MATLAB Program

# What if you have a C/C++ or Fortran program?

```
#include <stdio.h>
#include <math.h>
int main(int argc, char *argv[]) {
    double T, Ef, E, dE, kT, Emin, Emax, f;
    printf("Enter the Fermi energy in eV: \n");
    scanf("%lg", &Ef);
    printf("Enter the Temperature in K: \n");
    scanf("%lg", &T);
    kT = 8.61734e-5 * T;
    Emin = Ef - 10*kT;
    Emax = Ef + 10*kT;
    E = Emin;
    dE = 0.005*(Emax-Emin);
    while (E < Emax) {
        f = 1.0/(1.0 + exp((E - Ef)/kT));
        printf("%f %f\n", f, E);
        E = E + dE;
    }
    return 0;
}
```



# The Rappture Toolkit



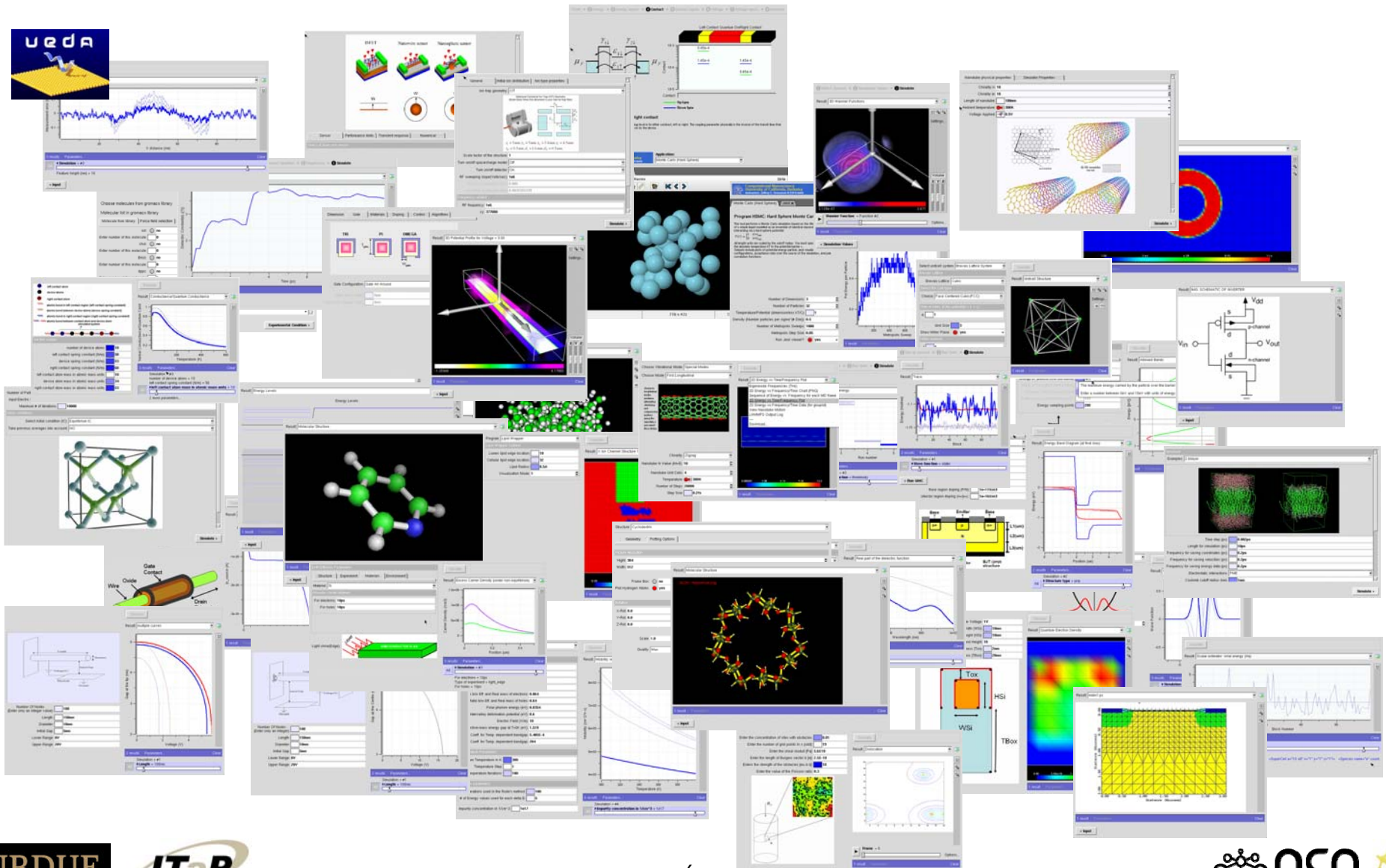
- Rapid Application Infrastructure
- Released in May 2005
- Open Source ([rappture.org](http://rappture.org))
- Create standard desktop apps
- Works with your favorite programming language

# Create tools like this

Demo at <http://hubzero.org/tour> >>

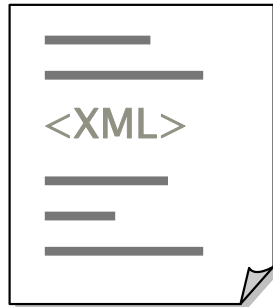


# Used to Create/Deploy Hundreds of Tools

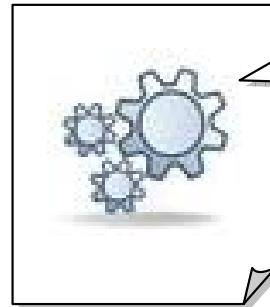


# How does it work?

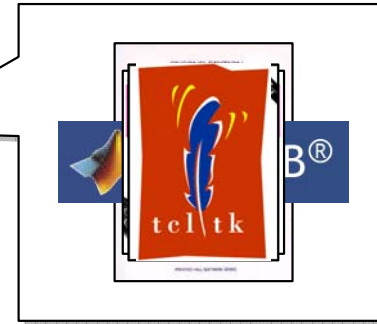
description of tool,  
including inputs  
and outputs



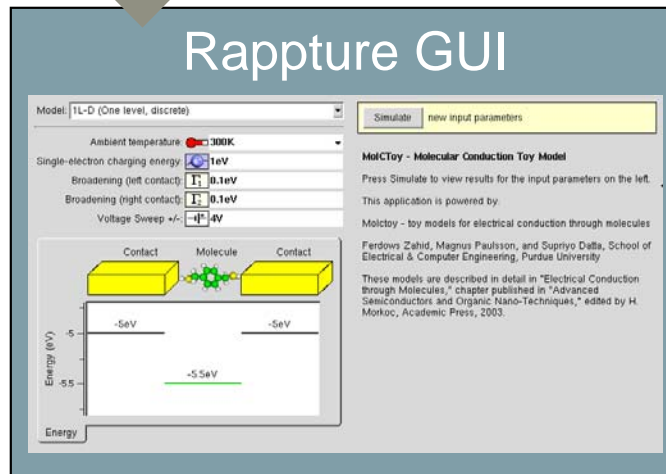
tool.xml



executable

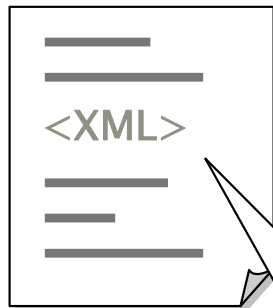


Produces the  
user interface  
*automatically!*



# Focus on tool.xml

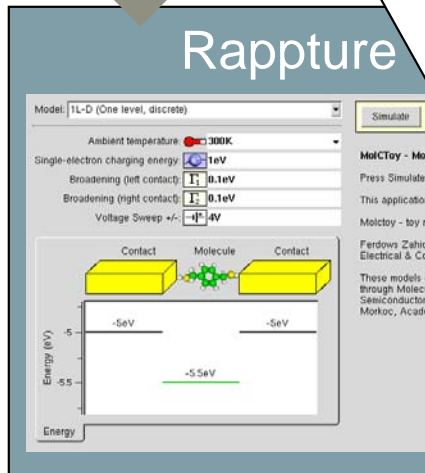
description of tool,  
including inputs  
and outputs



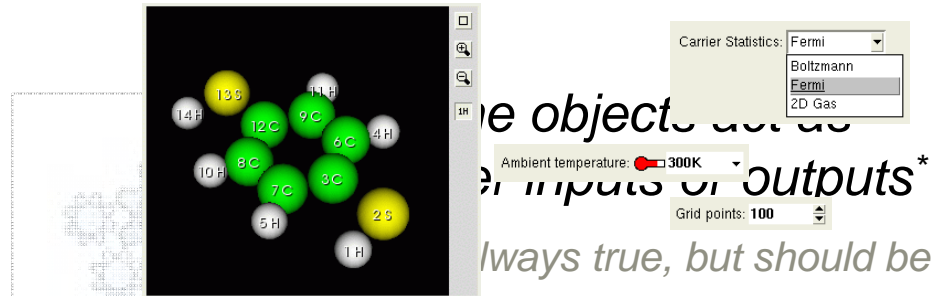
tool.xml



Rappture



Produces the  
user interface  
*automatically!*



```

<?xml version="1.0"?>
<run>
  <tool >
    <about>This is my tool.</about>
    ...
  </tool >
  <i nput>
    [Red Box]
  </i nput>
  <output>
    [Green Box]
  </output>
</run>
  
```



# Tour the zoo

rappture\_xml\_elements - Rappture - Trac - Mozilla Firefox

Getting Started Latest Headlines

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### Zoo of Inputs/Outputs

Welcome to the zoo of Rappture elements! This page shows the various snippets of XML code needed to create a Rappture tool.xml file.

#### Overall Structure

Each tool is described by a tool.xml file, which has the following structure:

```
<?xml version="1.0"?>
<root>
  <tool>
    <title>Name of the tool</title>
    <about>Description and credits</about>
    <command>
      @tool/path/to/executable @driver
    </command>
    <limits>
      <runtime>900</runtime>
      <filesize>1000000</filesize>
    </limits>
    <layout>xxx</layout>
    <control>xxx</control>
    <analyser>xxx</analyser>
    <reportJobFailures>1</reportJobFailures>
  </tool>
  <input>
    ..see Element Index below...
  </input>
  <output>
    ..see Element Index below...
  </output>
</root>
```

The <tool> section describes the underlying compute engine and includes the command needed to run it. This can be any Unix-style command line. The @tool keyword gets replaced with the name of the directory containing the tool.xml file. The

Carrier Statistics: Fermi

Boltzmann

Fermi

2D Gas

Ambient temperature: 300K


Grid points: 100

## Zoo of Examples

- Complete catalog of data objects online
- See screen shots
- Copy xml code

# Similar structure

All objects have an <about> section with <label> and <description>



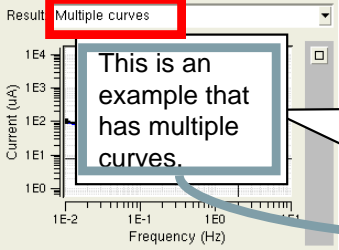
Ambient temperature: 300K

This is the temperature in the environment around the device.

```

<number id="temperature">
  <about>
    <label>Ambient temperature</label>
    <description>This is the temperature in the
environment around the device.</description>
  </about>
  ...
</number>

```



Multiple curves

This is an example that has multiple curves.


```

<curve id="multiple">
  <about>
    <label>Multiple curves</label>
    <description>This is an example that has
multiple curves.</description>
  </about>
  ...
</curve>

```

<number>

### Real number with optional units

Voltage Sweep +/-:  4V

Optional base-64 (mime) encoded GIF image for icon

Optional color is used if min/max values are set

```

<number id="vsweep">
  <about>
    <label>Voltage Sweep +/-</label>
    <description>This determines the voltage sweep used to obtain results from the model.</description>
    <icon>
ROI GODI hGgASAKEBAAAAAP//////////////////yH+FUNyZWF0ZWQgd2I 0a
CBUaGUgROI NUAAh+QQBCgAB
ACwAAAAAGgASAAACLoyPqcvtdD8CRj 8VZrYw8h/tRn2eA4Ei aosa1q
ttC1EmW81qrtbYvdG8DCodE
RQEA0w==
    </icon>
  </about>
  <units>V</units>
  <min>0V</min>
  <max>10V</max>
  <color>purple</color>
  <default>4V</default>
</number>


```

Optional system of units

Constrain input values

Start with this by default

&lt;number&gt;

*Real number with optional units*Ambient temperature:  300K ▾

Temperature gauge  
appears if units are  
for temperature

Presets create a  
little drop-down menu  
of common choices

```
<number id="temperature">
  <about>
    <label>Ambient temperature</label>
    <description>This is the temperature in the
environment around the device.</description>
  </about>
  <units>K</units>
  <min>50K</min>
  <max>1000K</max>
  <default>300K</default>
  <preset>
    <value>300K</value>
    <label>300K (room temperature)</label>
  </preset>
  <preset>
    <value>77K</value>
    <label>77K (liquid nitrogen)</label>
  </preset>
</number>
```



# <integer>

*Like a <number>, but accepts only integer values*

Grid points: **100**



Buttons to adjust  
value up/down

```

<i n t e g e r  i d = " p o i n t s " >
  <a b o u t >
    <l a b e l > G r i d  p o i n t s </l a b e l >
    <d e s c r i p t i o n > N u m b e r  o f  n o d e s  u s e d  i n  t h e
s i m u l a t i o n  m e s h . </d e s c r i p t i o n >
  </a b o u t >
  < m i n > 1 0 </m i n >
  < m a x > 1 0 0 0 </m a x >
  < d e f a u l t > 1 0 0 </d e f a u l t >
</i n t e g e r >

```

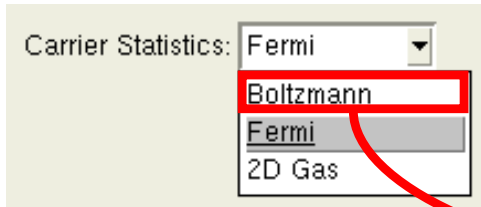
Constrain input values  
 Start with this by default

## &lt;boolean&gt;

*Simple on/off value*Impact Ionization Model:  yes

```
<boolean id="ii model ">
  <about>
    <label>Impact Ionization Model </label>
    <description>Used to enable/disable the effects
of impact ionization on the mobility
model. </description>
  </about>
  <default>yes</default> ——— Start with this by default
</boolean>
```

*Set of mutually exclusive options*



```

<choice id="stats">
  <about>
    <label>Carrier Statistics</label>
    <description>Determines the model...</description>
  </about>

  <option>
    <about>
      <label>Boltzmann</label>
      <description>From the Boltzmann transport
equation</description>
    </about>
    <value>bte</value> ——— Optional. If specified, then
report this value when this
option is selected

    ...

    <default>Boltzmann</default> ——— This by default
</choice>
  
```

*Quick line of text, or even a whole file! Binary files too.*

Title:

```
<string id="title">
  <about>
    <label>Title</label>
    <description>Title for all plots.</description>
  </about>
  <default>untitled</default>
</string>
```

Input:

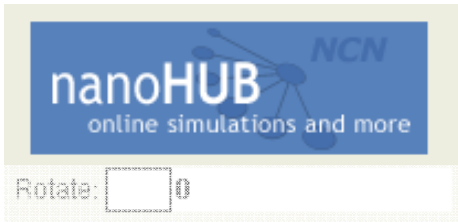
EXAMPLE: .print ac vm(11) mag(i(vcc))

```
<string id="ideck">
  <about>
    <label>Input</label>
    <description>This is the control file for the program.</description>
    <hints>EXAMPLE: .print ac vm(11)</hints>
  </about>
  <size>40x10</size>
  <default>Enter your SPICE commands here.</default>
</string>
```

width x height  
in characters



&lt;image&gt;

*Data for image processing*

```
<i image>  
  <current>ROI G0DI htAA8APcAAFeBu///0VurKW829Ld7YSj Q1  
8Y+rOrHE31aAus3Y6VJ5sEpysEdvrXeVwl V+uVB6tVZ/uEhwrl V/u  
tkZol 5yy0092q0dqmVV+t053tEI xr0Vml EVnl U92ql R8tFN7sk12s  
...  
  </current>  
</i image>
```

GIF, JPEG, or PNG in base-64 format

Can use as a decoration on the input side, but there are better ways to do that now.

# Better User Interfaces

**Temperature gauge**

Ambient temperature:  300K

Fermi Level:  2.4eV

**Validation of inputs  
Units conversion**

**Zoom in/out**

**Adjust knob to  
compare simulations**

Simulate

Result: Fermi-Dirac Factor

Energy (eV)

Fermi-Dirac Factor

3 results Clear

All Ambient temperature  300K

# More Information

<http://rappture.org>

- [What is Rappture?](#)
- [Getting Started](#)
- [Documentation](#)
- [Downloads](#)

Examples:

</apps/rappture/current/examples>

In your workspace, type:

`/apps/rappture/copy_rappture_examples`

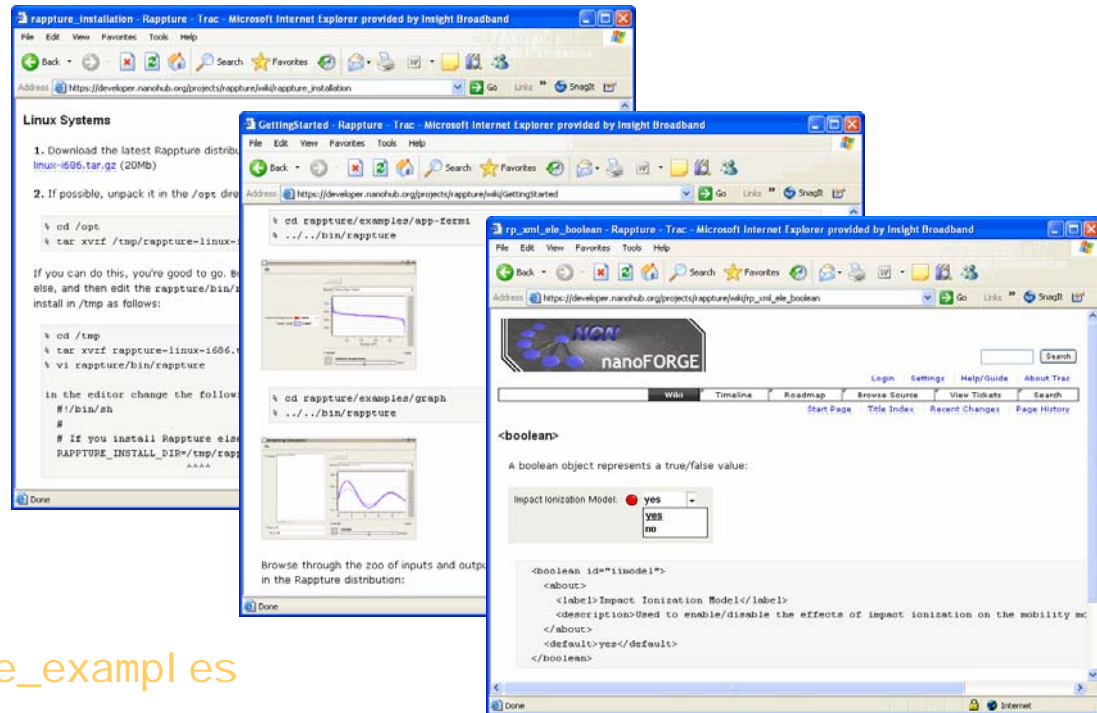
`cd rappture_examples`

`ls`

Mailing list:

Post: [rappture@lists.nanohub.org](mailto:rappture@lists.nanohub.org)

Subscribe: [rappture-request@lists.nanohub.org](mailto:rappture-request@lists.nanohub.org) with subject `subscribe`



## Exercise #2: Create a Rapture Interface

Write the tool.xml file to create this tool:

Ambient Temperature:

Number of Grid Points:

Comments:

**Assignment #2: Simple Interface**

This is the solution for Assignment #2 in the Rapture Tutorial for HUBhub 2010. For more details about the Rapture toolkit, visit <http://rappture.org>.

Michael McLennan  
Purdue University

See [https://rappture.org/wiki/rappture\\_xml\\_elements](https://rappture.org/wiki/rappture_xml_elements)