

Overview of the HUBzero Platform

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Why Cyberinfrastructure?



Title: Center for Genomic Studies on Mental Disorders (U24)

Request for Applications (RFA) Number: RFA-MH-08-100

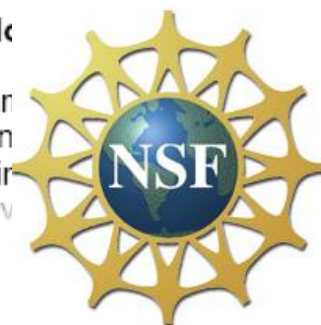
Center will function as a single, national resource. A new critical feature of the Center will be the establishment of a genomic **cyberinfrastructure** that represents the coordinated aggregate of software, hardware and other technologies, as well as human expertise, required to support current and future discoveries in the genetics of mental disorders. This cyberinfrastructure will integrate relevant and often disparate genetic and genomic resources to provide a useful, usable, and enabling framework for human genetic research and gene discovery

2. Educational Opportunities Using **Cyberinfrastructure** and Virtual or Mixed Reality (Explanatory)

Applications of networked computing and communication, sophisticated user input, and dynamic only begun to realize the potential benefit of these new technologies to improve, enhance, and education. Many innovative projects in cyberlearning, virtual environments and laboratories, in visualizations and tutoring systems have required the development of new technology. However

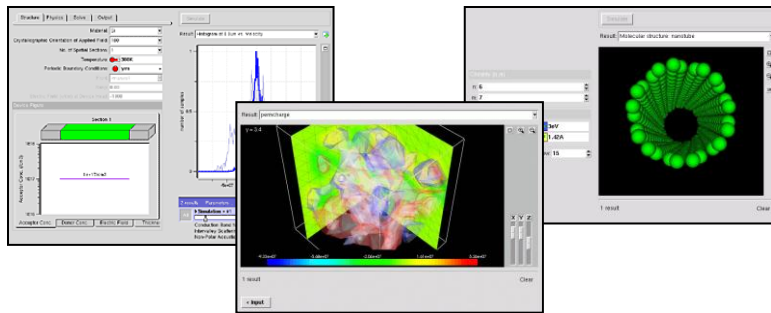
- Supporting the acquisition and development of instrumentation that contributes to, or takes advantage of, existing investments in **cyberinfrastructure**, while avoiding duplication of services already provisioned by NSF investments. Please consult the NSF document, "Cyberinfrastructure

across the United States. It should have known expertise in the targeted program areas of interdisciplinary graduate education and professional development. It is also expected that the lead institution will have known expertise in the IT field, developing and maintaining **cyber-communities** and communication modes, and in addressing the needs of the community the Resource Center is meant to support.

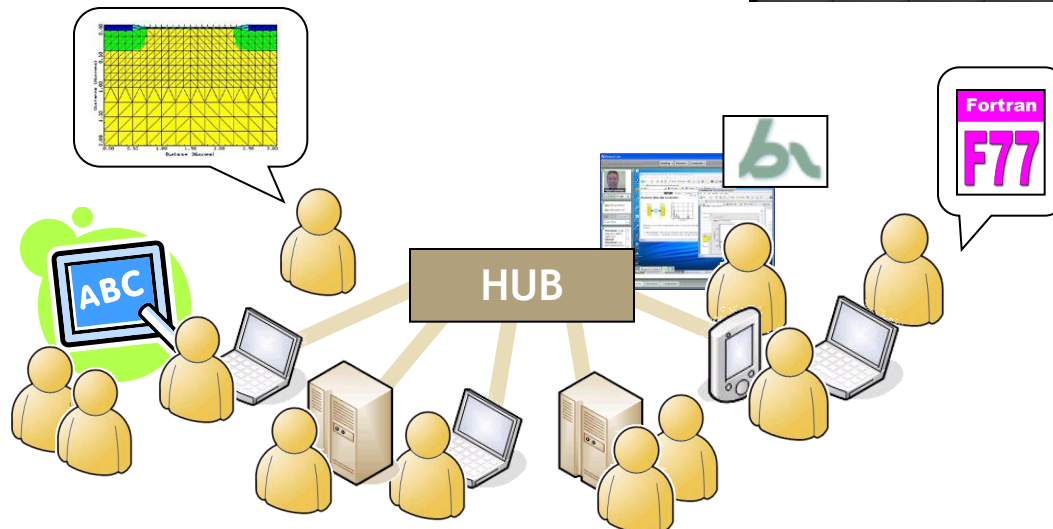


Cyberinfrastructure = HUB

Online simulation...



...and more!



What is a HUB?

The screenshot shows the nanoHUB.org website in a Mozilla Firefox browser window. The browser's address bar displays <http://nanohub.org/>. The website's header includes the nanoHUB.org logo, the tagline "ONLINE SIMULATION AND MORE", and a search bar with "Login" and "Register" buttons. A navigation menu at the top lists: Home, My HUB, Resources, Members, Explore, About, Support, and Help!.

The main content area features a large banner titled "Do you Teach" with a large question mark. Below the banner, it says "Teaching introductory quantum mechanical principles in an electrical engineering or physics curriculum" and "AQME Quantum Mechanics for Engineers". A "Learn more" link is provided.

Below the banner, there are several sections:

- SIMULATE**: A list of simulation categories including RESEARCH, TEACH & LEARN, CONTRIBUTE, and NANO NETWORKS.
- FEATURED TOOL**: A section titled "Crystal Viewer Tool: Visualize different lattices and planes" with a small image of a crystal lattice.
- FEATURED ONLINE PRESENTATION**: A section titled "Ionic Selectivity in Channels: complex biology created by the balance of simple physics: An important class of biological molecules—proteins called ionic channels—conduct ions (like Na⁺, K⁺, Ca²⁺, and Cl⁻) through a narrow ..." with a small image of a protein channel.
- FEATURED PROFILE**: A section titled "Eric Jakobsson: Eric Jakobsson, Ph.D., is a faculty member in the department of Molecular and Integrative Physiology at the University of Illinois at ..." with a small portrait of Eric Jakobsson.
- TOP TAGS**: A list of tags including algorithms, carbon nanotubes, course lecture, devices, education/outreach, material science, molecular electronics, nano/bio, nanobio applications, nano electro-mechanical systems, nanoelectronics, nanomedicine, nanophotonics, nano-transistors, NEGF, quantum transport, research seminar, transistors, tutorial, and uiuc.
- RESOURCES**: A section for additional resources.

Example: nanoHUB.org

Demo: [AVI](#) [MOV](#) [YouTube](#)

nanoHUB.org Usage Statistics

105,000 users worldwide

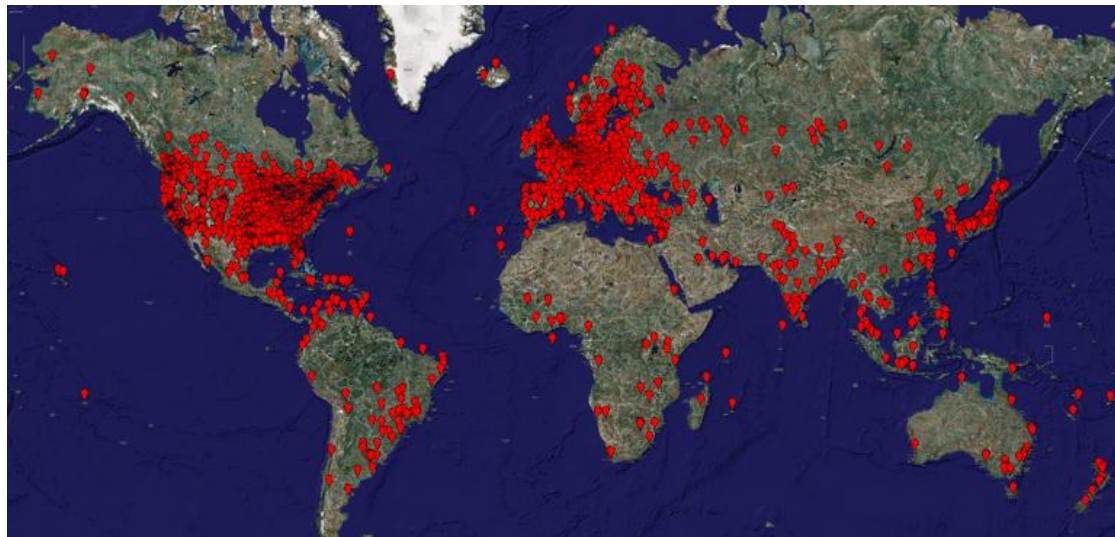
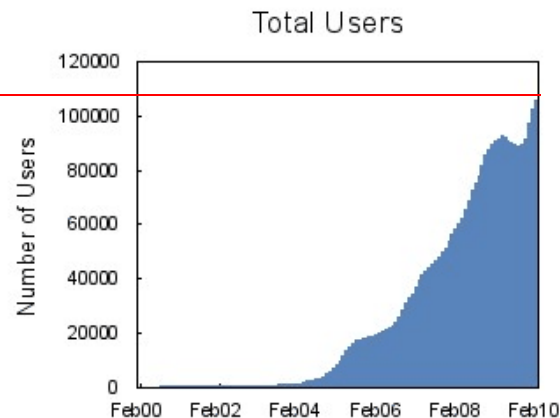
>5,000,000 hits/month

All Top 50 US Engr Schools

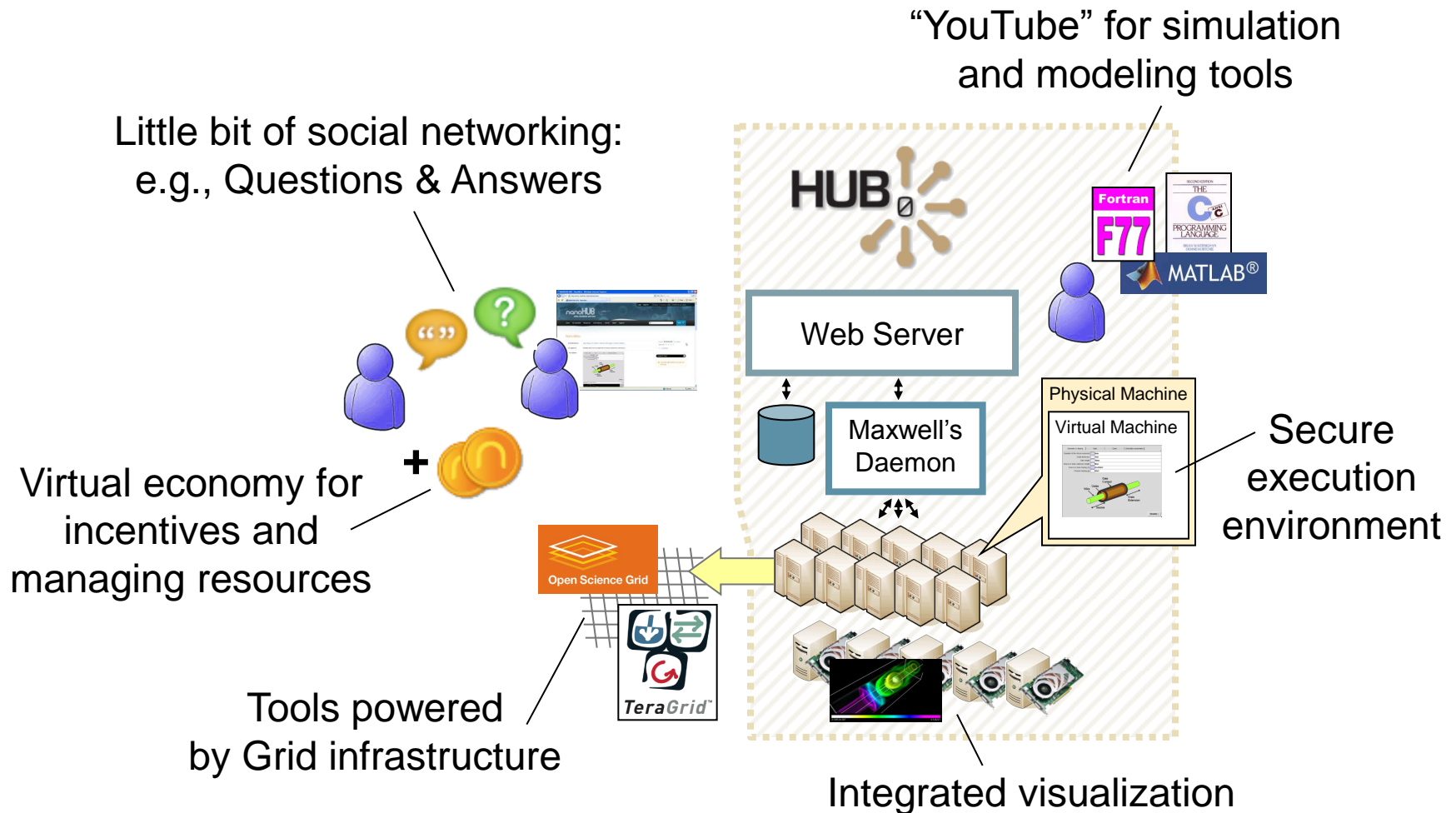
14% of all .edu domains

333 International Ed Institutions

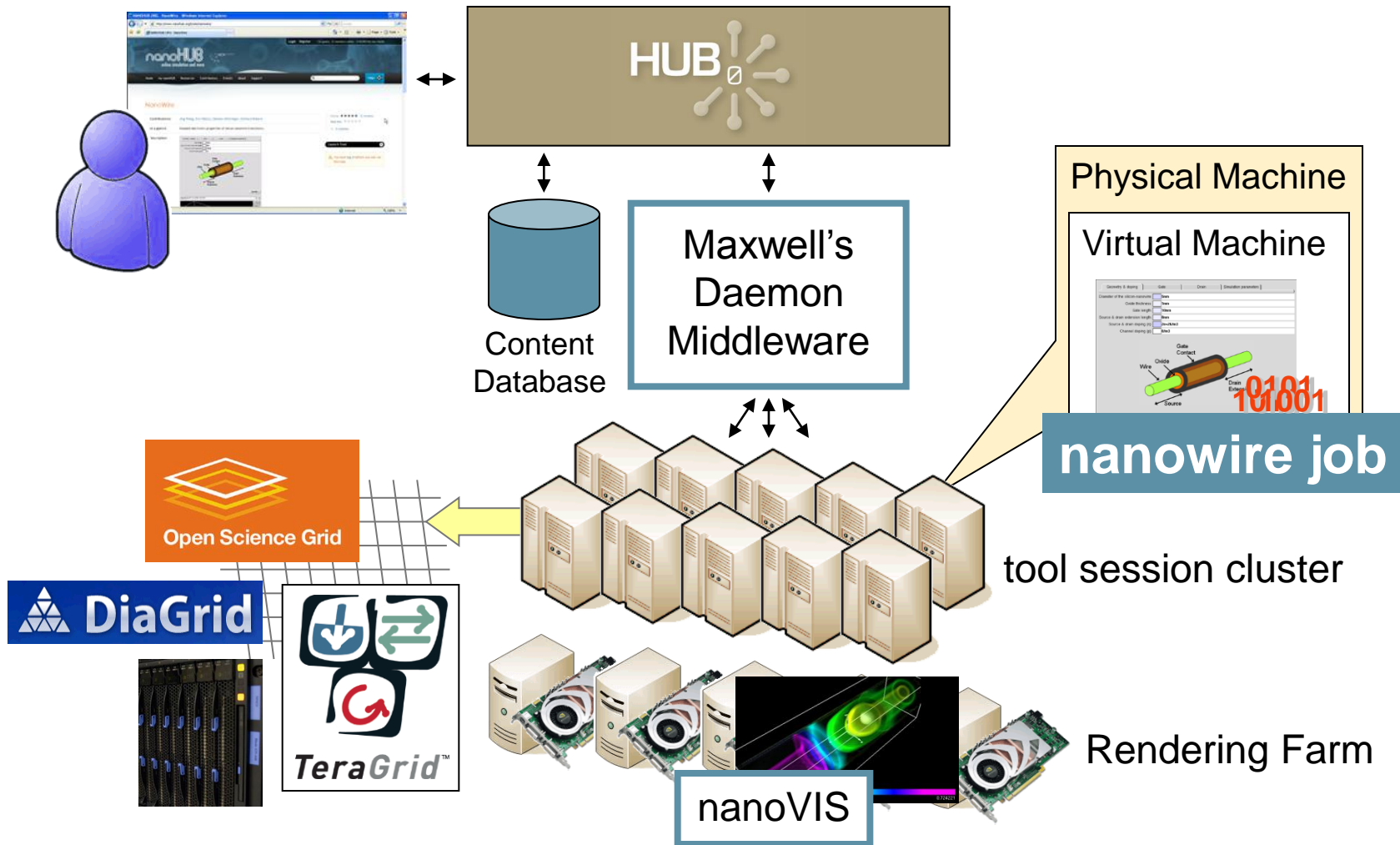
233 US K-12 schools



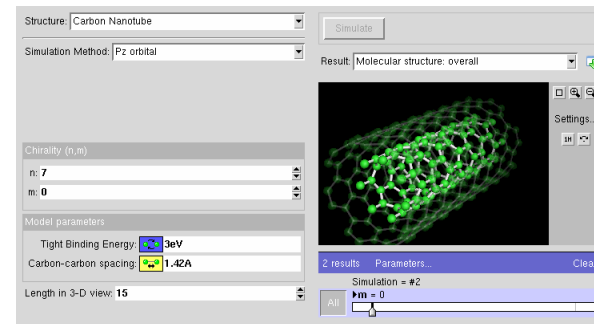
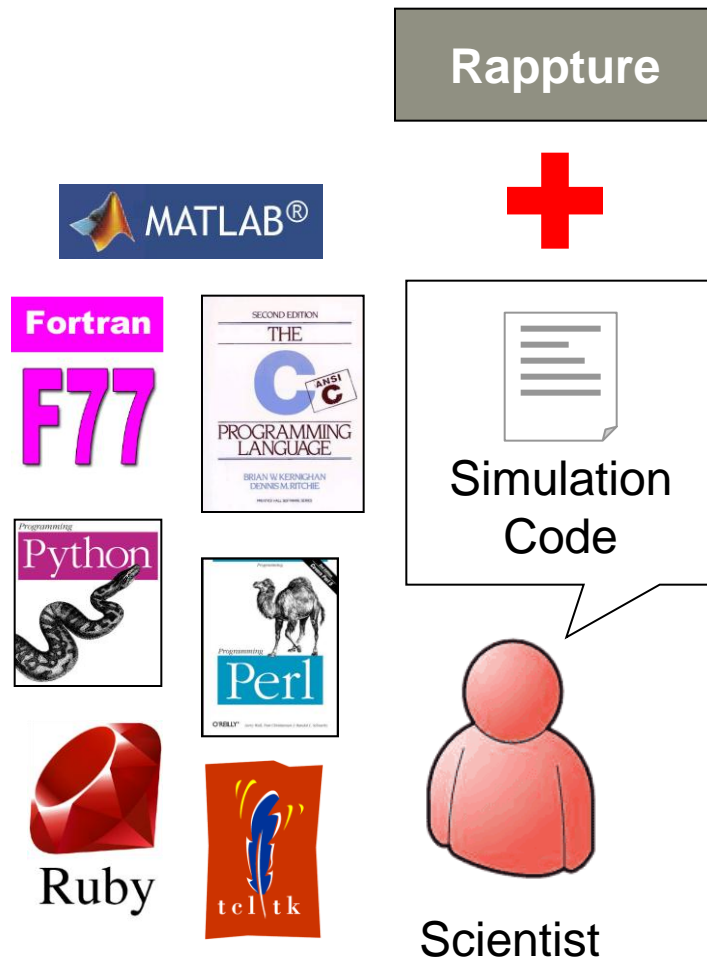
Platform for Scientific Collaboration



Cyberinfrastructure for Running Tools

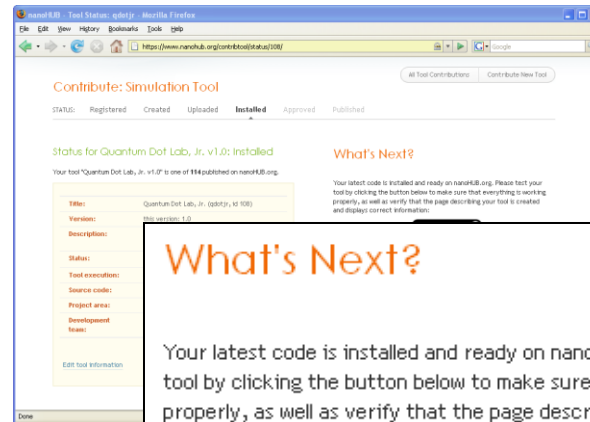
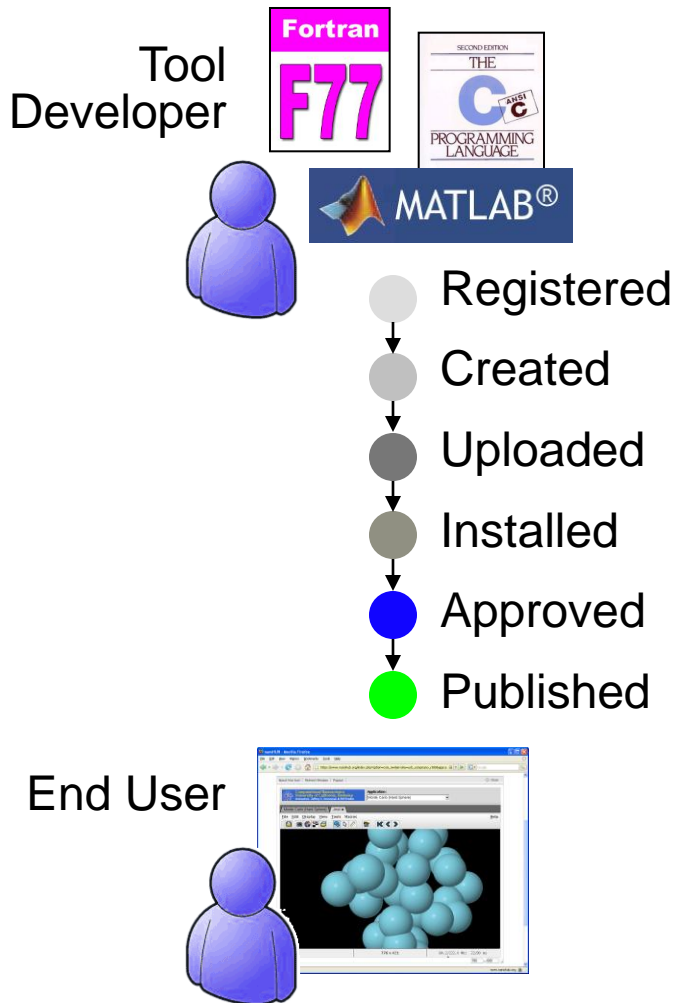


Rappture: Rapid Application Infrastructure



- Works with your favorite programming language
- Open Source
- Online at <http://rappture.org>
- Used by 200 projects and 300 developers

Cyberinfrastructure for Developing Tools



Web-based
Publishing
System

What's Next?

Your latest code is installed and ready on nanoHUB.org. Please test your tool by clicking the button below to make sure that everything is working properly, as well as verify that the page describing your tool is created and displays correct information:

➔ Test your application: **Launch tool**

➔ [Review the page describing your tool](#)

We're waiting for You

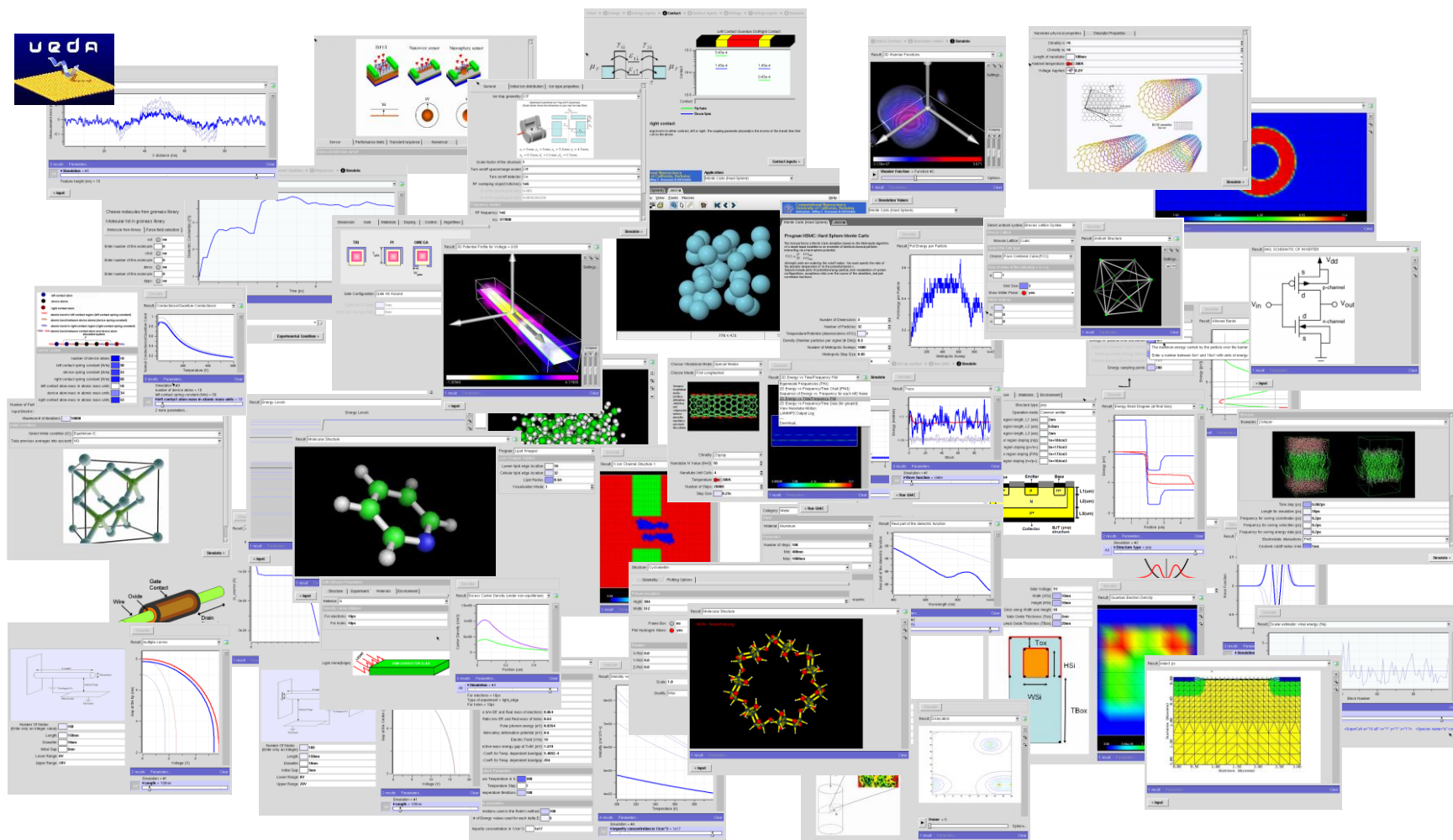
Once you tested your tool and verified that it is working properly, click here to let us know:

➔ [My tool is working properly. I approve it.](#)

Need to make changes? Once you've checked in your latest fixes, click here to let us know:

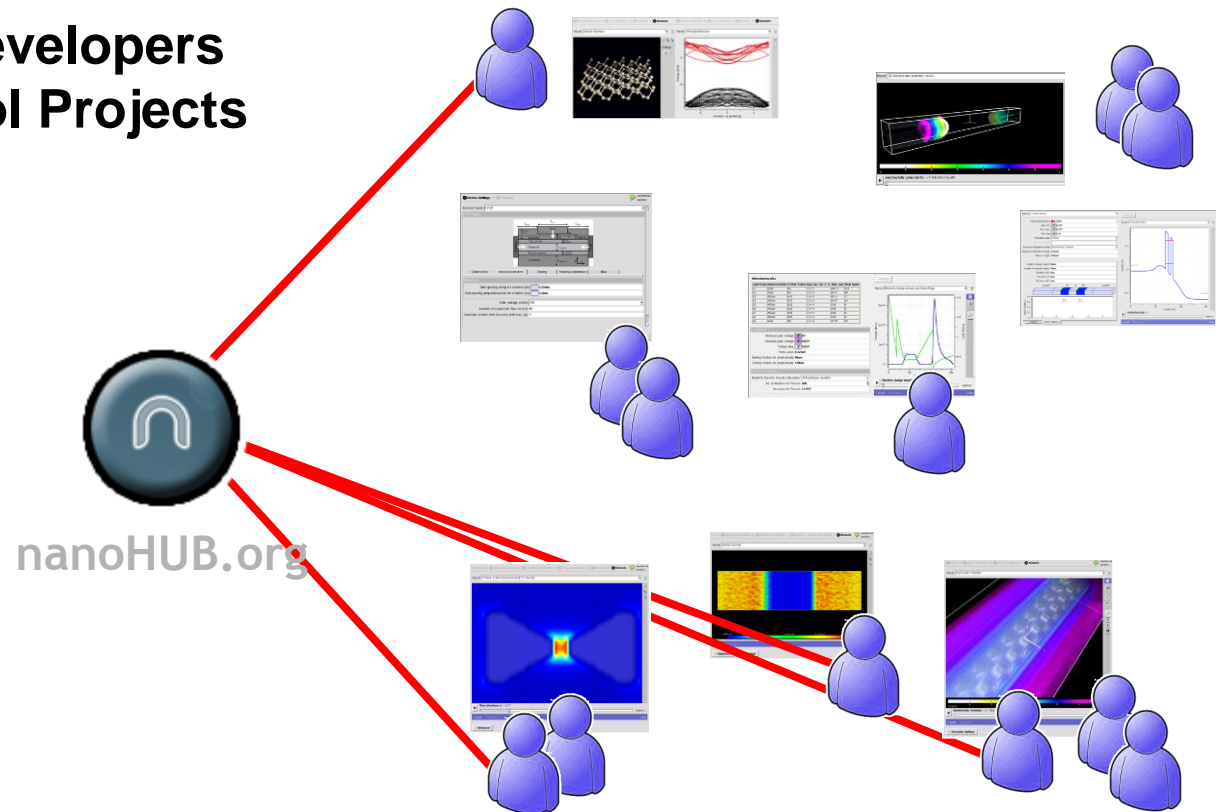
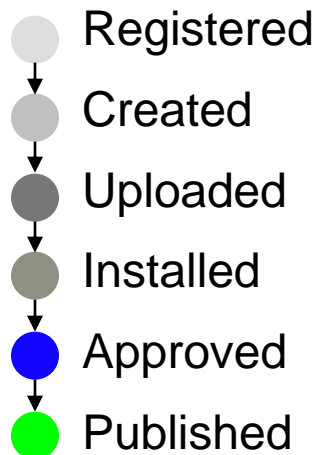
➔ [I've fixed my code. Please install the latest updates.](#)

Hundreds of tools online!



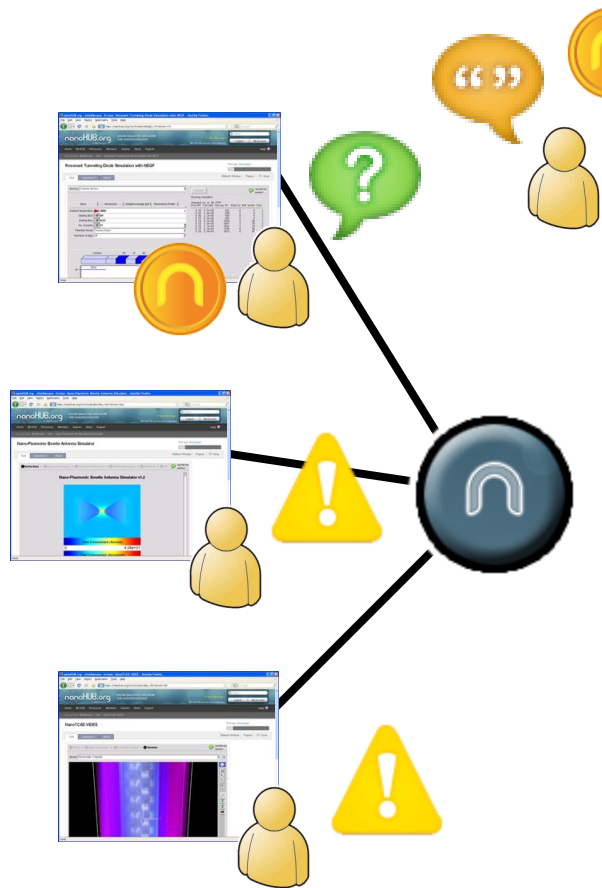
Supporting hundreds of projects

Hundreds of Developers
Hundreds of Tool Projects

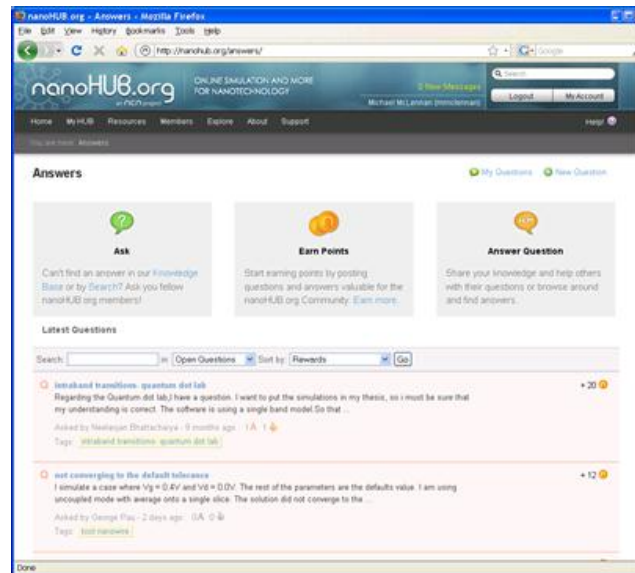


281 Tool Projects
Year of Development >>

Replicate, Support, Sustain



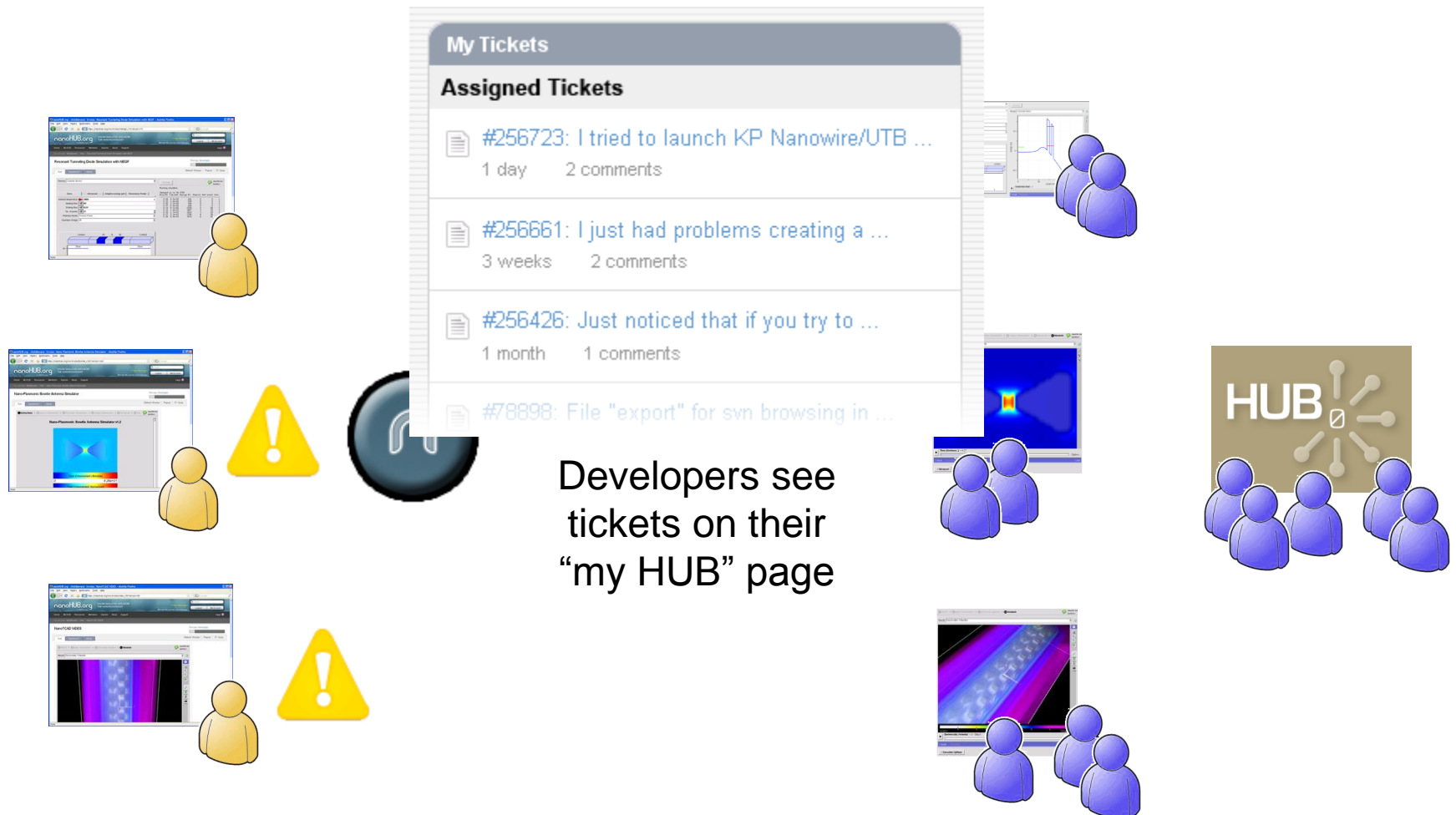
Question & Answer Forum



? ? ?

HUBzero
team

Replicate, Support, Sustain



My Tickets

Assigned Tickets

- #256723: I tried to launch KP Nanowire/UTB ...
1 day 2 comments
- #256661: I just had problems creating a ...
3 weeks 2 comments
- #256426: Just noticed that if you try to ...
1 month 1 comments
- #78898: File "export" for svn browsing in ...

Developers see tickets on their "my HUB" page

Wish Lists

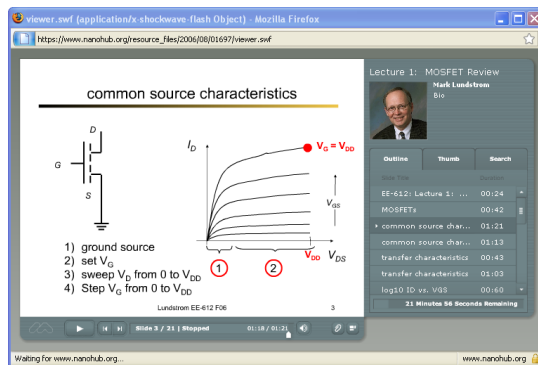
Community can vote
on wishes and
bid points for fulfillment

Supporting Education

ECE 612 Nanoscale Transistors (Fall 2006)

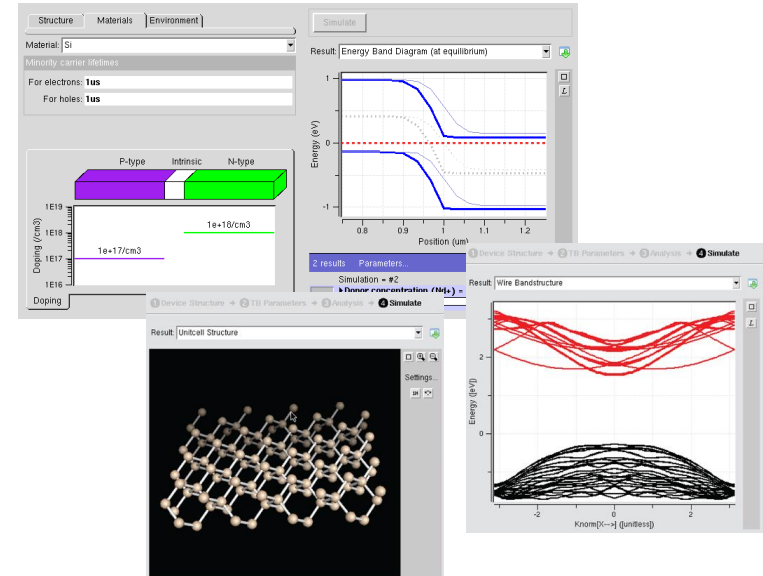
Contributor(s) [Mark Lundstrom](#)
Purdue University, West Lafayette

Abstract Please Note: An [updated version](#) of this course is in production for the physics of advanced transistors



Teaching Materials:

- Complete courses
- Tutorials and Podcasts
- Homework assignments

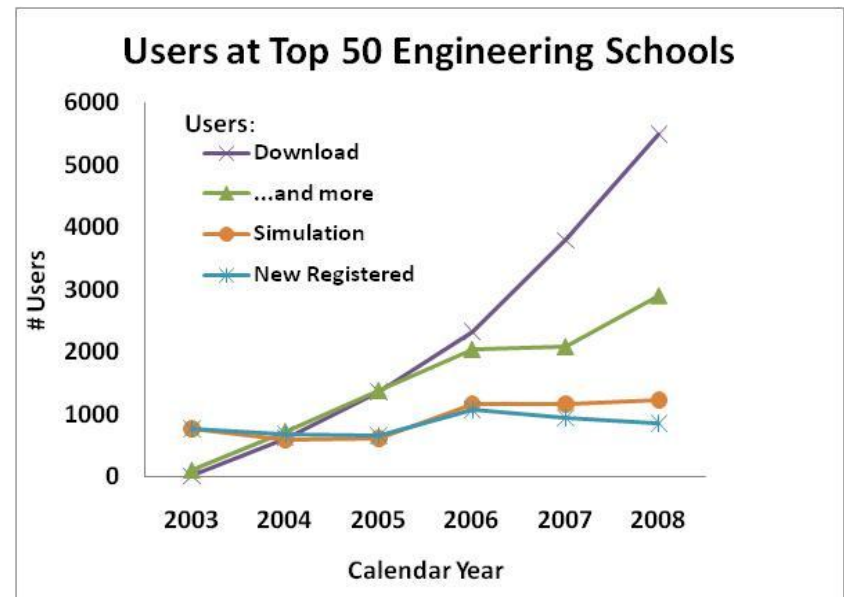
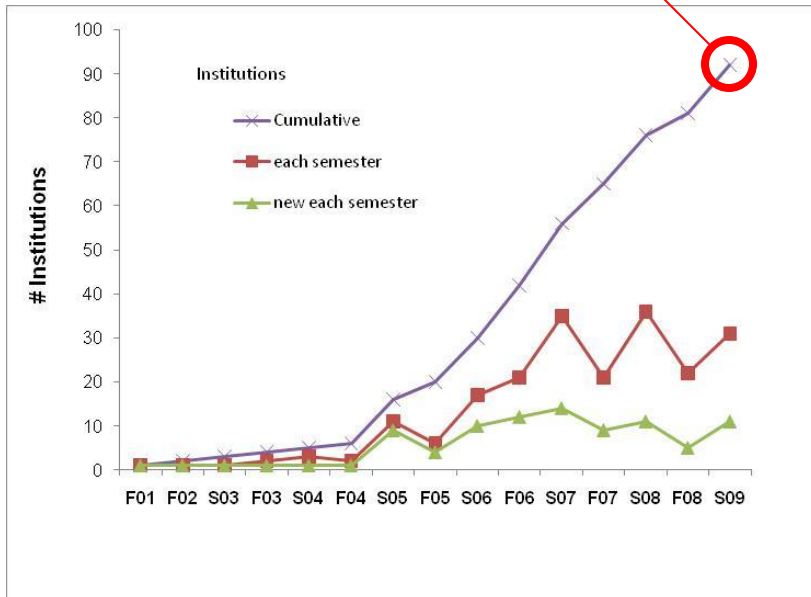


Simulation tools:

- Demonstrations in class
- Homework assignments
- Class projects

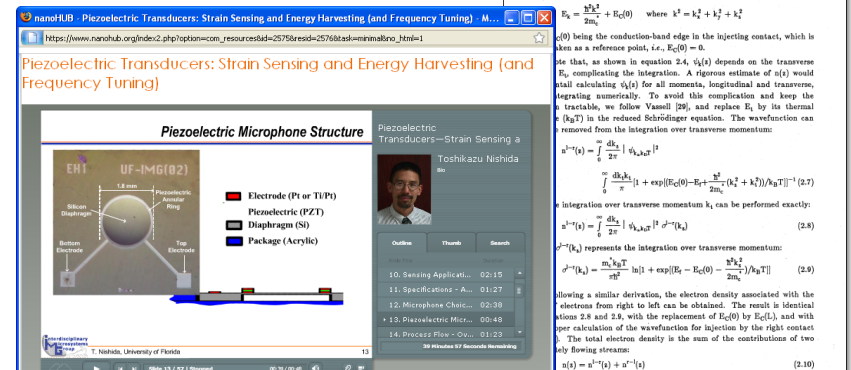
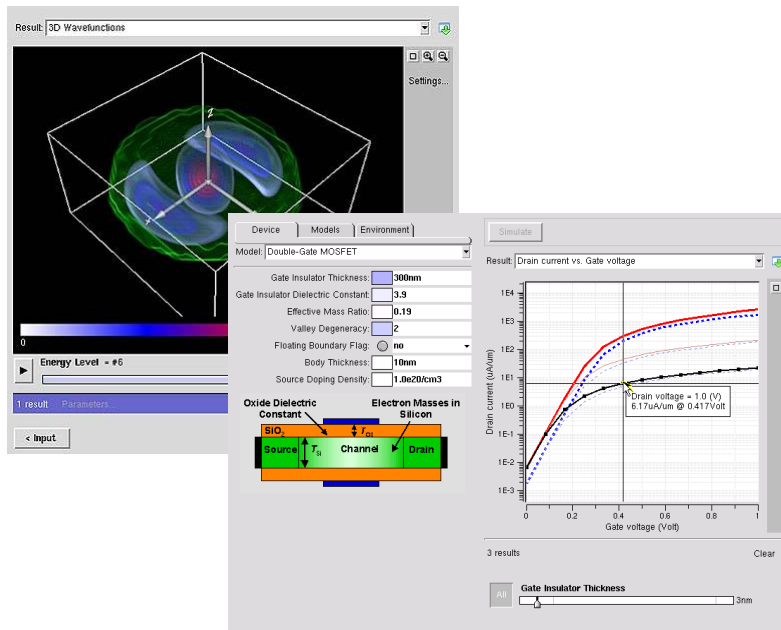
Educational Use Is Growing

**116 classes
at 97 institutions
in 2009**



nanoHUB.org Educational Usage

Supporting Research



- [2] The justification for this value of switching energy in practical present-day circuits can be found e.g. in Mukhopadhyay S, Switching energy in CMOS logic: how far are we from physical limit? Available from <<http://www.nanohub.org/resources/1250//>>.
- [3] Zhirnov VV, Cavin RK, Hutchby JA, Bourjanoﬀ GI. Limits to

Simulation tools:

- Used by theorists
- Used by experimentalists

Tutorials and Seminars:

- Cutting edge research
- Cited in journal articles
- Preprints and tech pubs

More than 500 citations to resources

52% outside
NCN

Scaling the High-Performance
Double-Gate SOI MOSFET down
to 32 nm Technology Node with
SiO/sub2/-based Gate Stacks

Device Physicist
Enrico Sangiorgi
University of Bologna, Italy

Analysis of Scaling Strategies for
Sub-30 nm Double-Gate SOI
N-MOSFETs

Ultra-thin fully-depleted SOI
MOSFETs: Special charge
properties and coupling effects

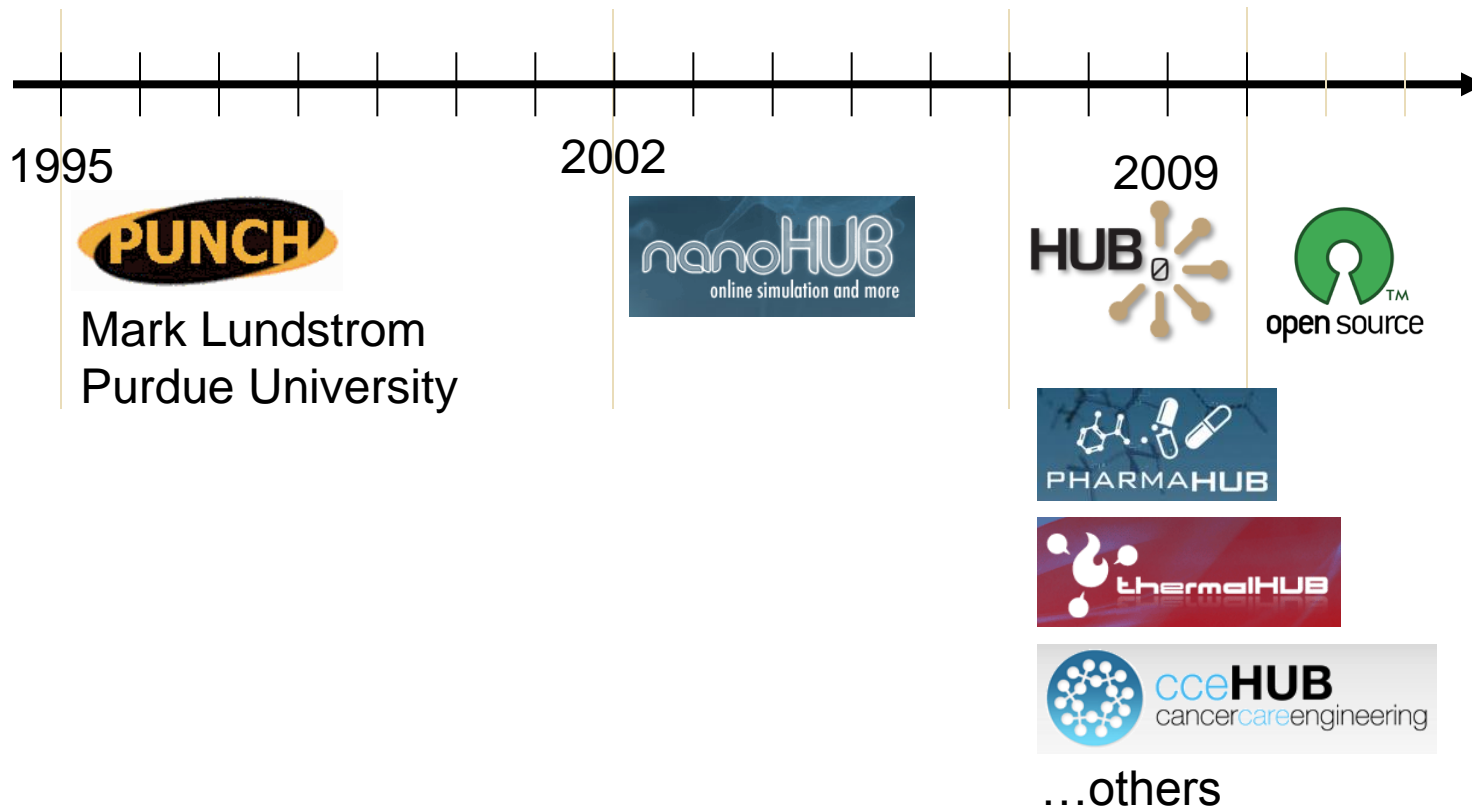
Experimentalist
Akiko Ohata
IMEP Minattec, France

Electrical characteristics related
to silicon film thickness in
advanced FD SOI-MOSFETs

Research	338	79%
Infr./About	26	6%
Education	37	9%
Cyberinfr	68	16%

Leveraging the Platform

~ \$15.5 million of development
NSF Network for Computational Nanotechnology



Hubs 'R Us



- Feb 2007: 1 hub
- Feb 2008: 5 hubs
- Feb 2009: 8 hubs
- Feb 2010: 21 hubs

Each hub has its own funding stream



HUBzero: an organization with Recharge Center

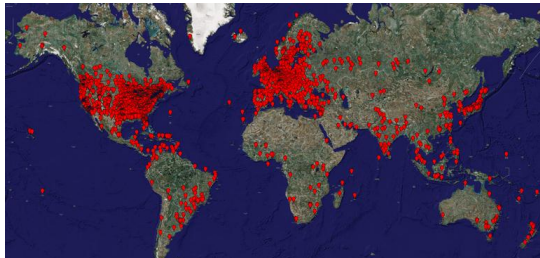
HUBzero Consortium



- Four founding members
- Ongoing development of HUBzero core
- Documentation: <http://hubzero.org/documentation>
- Dissemination and support, yearly conference

Cyberinfrastructure is changing...

Sharing of information

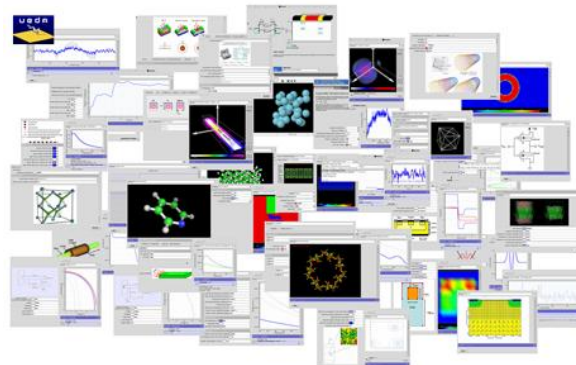


<http://hubzero.org>

Practice of science

[2] The justification for this value of present-day circuits can be found e. energy in CMOS logic: how far are from <<http://www.nanohub.org/re>

[3] Zhirnov VV, Cavin RK, Hutchb



Pace of model development