

ncn
nanohub.org

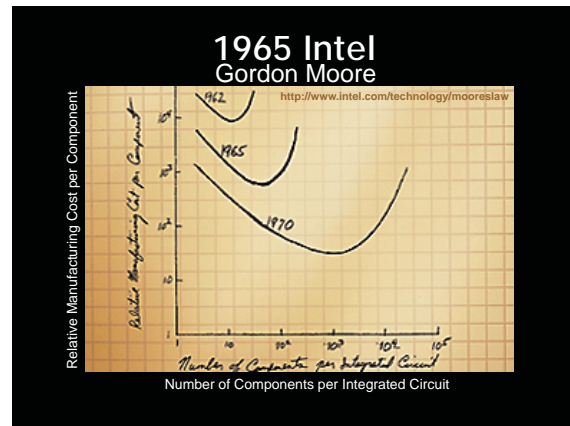
Network for Computational Nanotechnology (NCN)
Purdue, Norfolk State, Northwestern, MIT, Molecular Foundry, UC Berkeley, Univ. of Illinois, UTEP

HUBzero:
Future Sociology and Cybertechnology
that empowers over 137,000 Annual Users in
Research, Education, and Industry Today




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Gerhard Klimeck



1972 Berkeley SPICE
Simulation **P**rogram with **I**ntegrated **C**ircuit **E**mphasis.

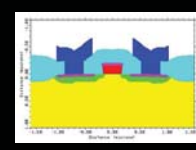


from: Larry Nagel, BCTM '96

- Started as a class project
- Developed as a teaching tool
- Quality control: pass Pederson
- Dissemination:
 - ▶ Public domain code
 - ▶ Pederson carried tapes along
 - ▶ Students took it along to industry and academia

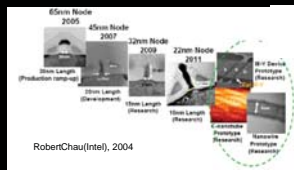
<http://www.cse.berkeley.edu>

1973/4 Stanford
Stanford **U**niversity **P**rocess **M**odeling




- Stanford wanted to mimic Berkeley success
- Combine various existing models
- Dissemination:
 - ▶ Public domain code
 - ▶ Community workshops
 - ▶ Students took it along to industry and academia

2010 Intel



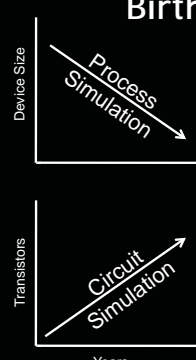
RobertChau@Intel, 2004

Device Size:
Tens of nanometers
Stanford SUPREM

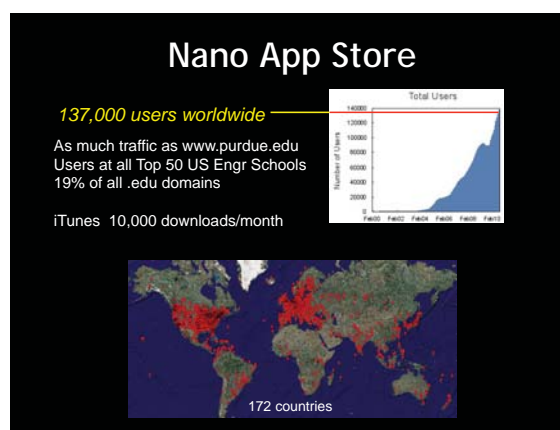
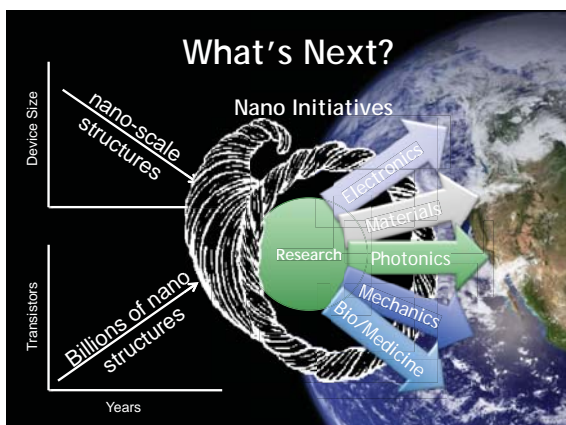


Device Integration:
>2 Billion
Berkeley SPICE

Birth of an Industry



Intel Capitalization:
\$85B
Total Industry:
\$280B



Sociology

How do Users Behave?

- Questions:
 - How many students in the class?
 - Which tools?
 - Intensity of use
 - Sustained use
 - Percentage of service: Education vs. Research use
- Some Statistics
 - 8,600 users ran 345,000 simulations last 12 month
 - 116 classes / 97 institutions in 09/10
 - Info Obtained from self-registration, manual follow-up
 - 575 citations in the literature
 - Info obtained from Google Scholar and manual analysis

Sociology

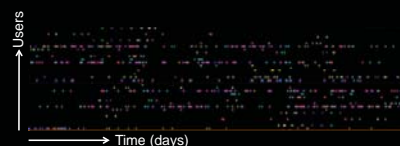
How do Users Behave?

- Questions:
 - How many students in the class?
 - Which tools?
 - Intensity of use
 - Sustained use
 - Percentage of service: Education vs. Research use
- Can we get answers? Automatically?
 - => Improve Services
 - Better tool classification
 - Customize web page for users, customize learning experience
 - Computational resource provisioning
- Broaden user base

The Matrix



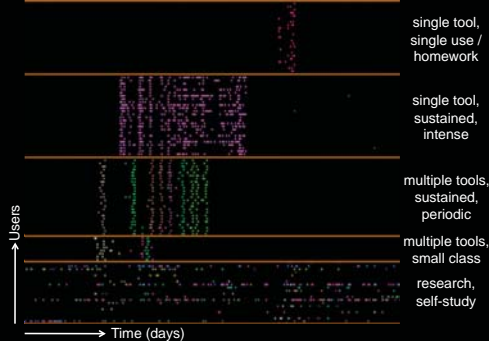
The nanoHUB Matrix



Each dot represents simulation activity on a particular day
The color of the dot indicates a particular tool

We will look backwards into history
for each user in the past 12 months
And plot ALL their activities

The nanoHUB Matrix Formal Education vs. Research



single tool,
single use /
homework

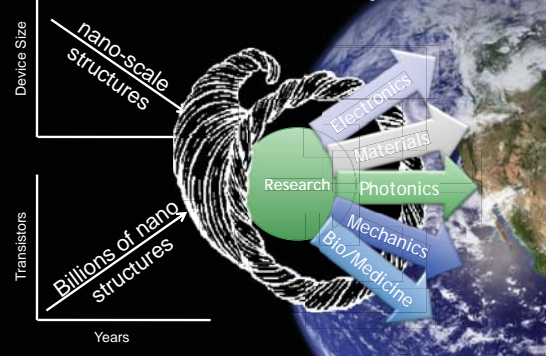
single tool,
sustained,
intense

multiple tools,
sustained,
periodic

multiple tools,
small class

research,
self-study

Workforce Development



Driving Economic and Workforce Development with nanoHUB.org

Bruce Barker, J.D.
President
Chippewa Valley Technical College



NSF Site Visit
April 2010

Chippewa Valley Technical College • Business Education • www.cvtc.edu

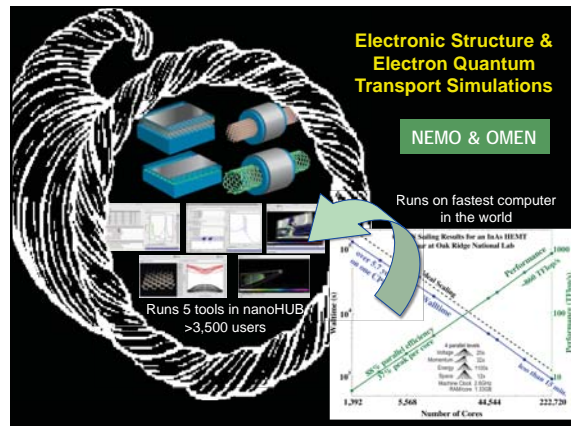
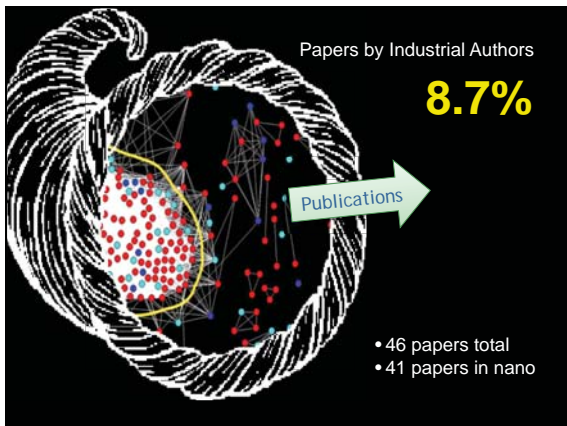
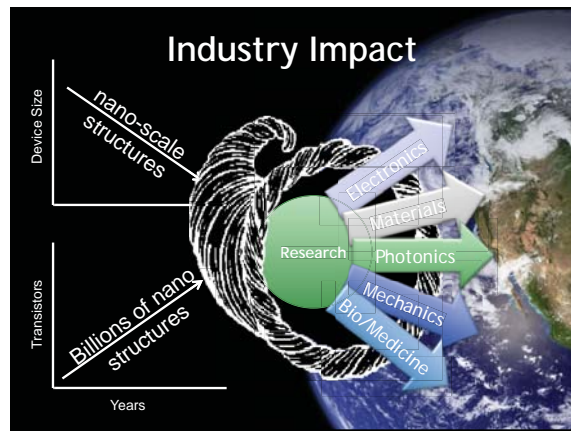
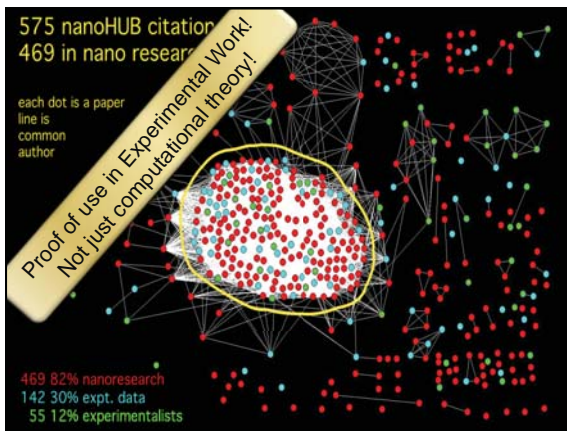
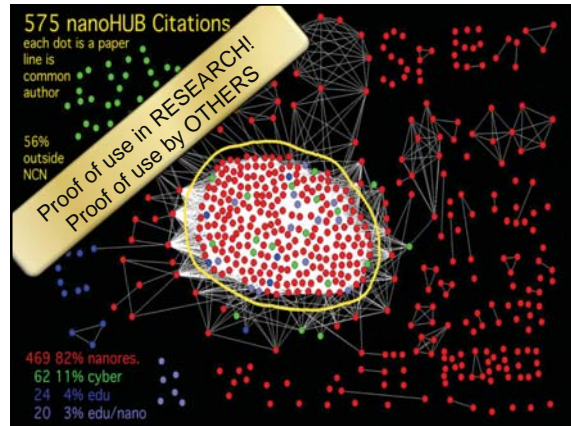
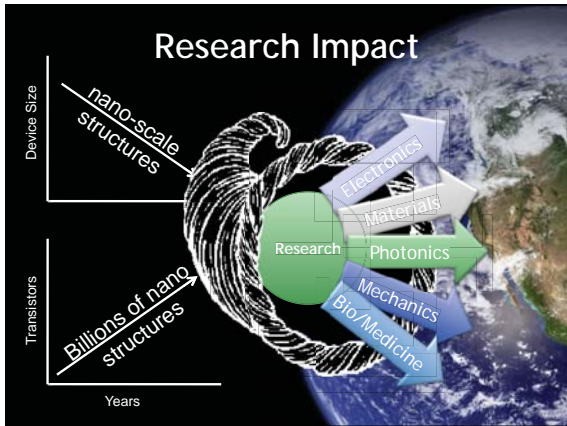
nanoHUB Impact

- nanoHUB lowers the cost of education
 - It allows access to resources that can't be easily duplicated
- nanoHUB enables a well-developed workforce to generate economic opportunity
- nanoHUB connects non-traditional students to a wider academic world by engaging national expertise at the local level



NSF Site Visit
April 2010

Chippewa Valley Technical College • Neillsville Campus • www.cvtc.edu



OMEN

Electronics

intel

Mark Stettler, PhD.
Mgr. TCAD, Oregon

Dmitri Nikonov, PhD.
Mgr. Strategic Research, CA

Texas Instruments => Patent

Dr. R. Chris Bowen
Texas Instruments

I used the tool in a mode ... far away from the original intent of the simulator. ... The insight that "nanoFET Lab" provided was convincing enough for me to begin more detailed simulations at Texas Instruments and to ultimately develop a patent application.

nanoFET Lab

Simulation Runs Web Visits

3 AFM Manufacturers:

- Training / Virtual Instrument
- Research

Mechanics

I have been using VEDA ...
... found it to be extremely useful. ...
... enabled us to make better choices in designing new probes.
... used VEDA as a check on other calculations

Roger Proksch
Asylum Research

New Partnership

Virtual AFM

Mechanics

Materials

Fund tool development

Molecular Dynamics (virtual surfaces)

VEDA (Virtual AFM)

nanoHUB / HUBzero Technology

Device Size

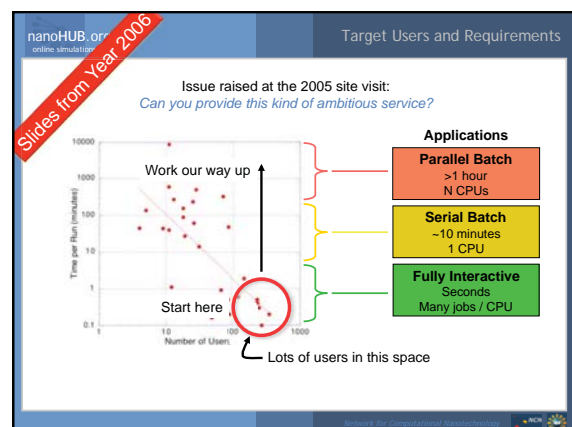
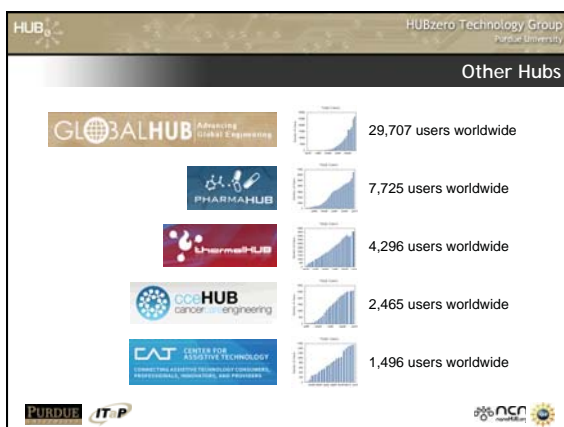
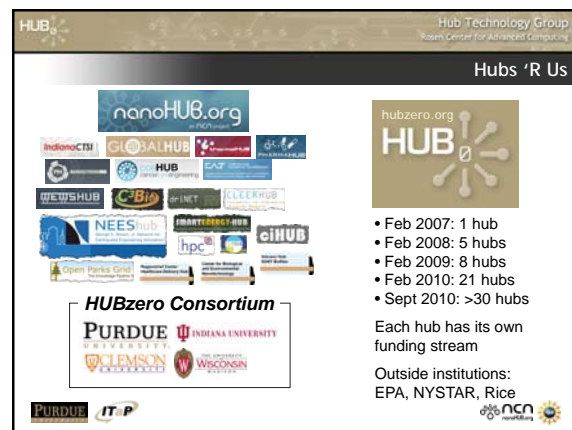
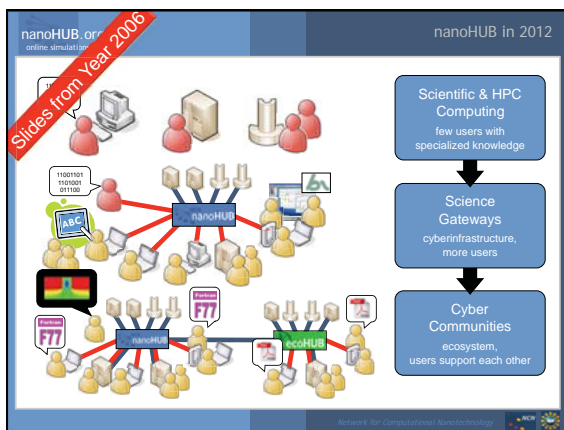
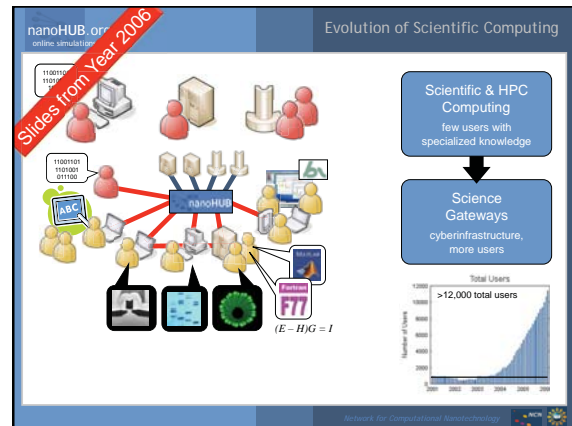
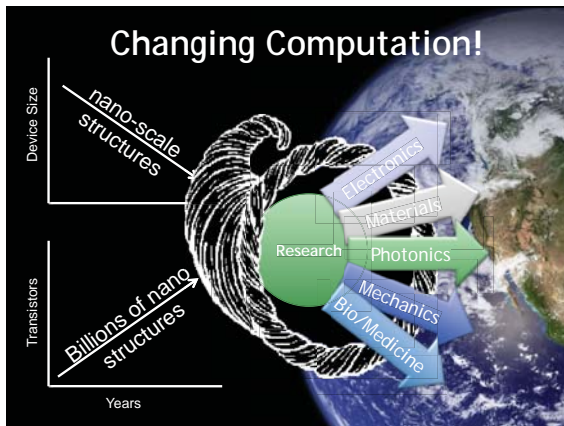
Transistors

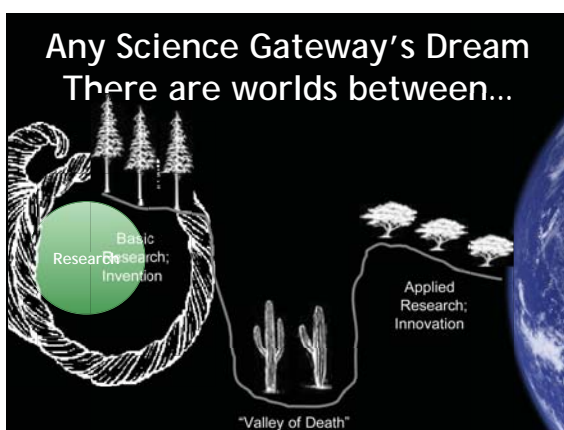
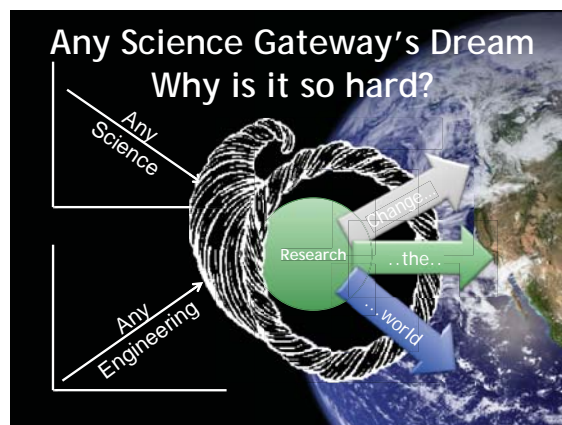
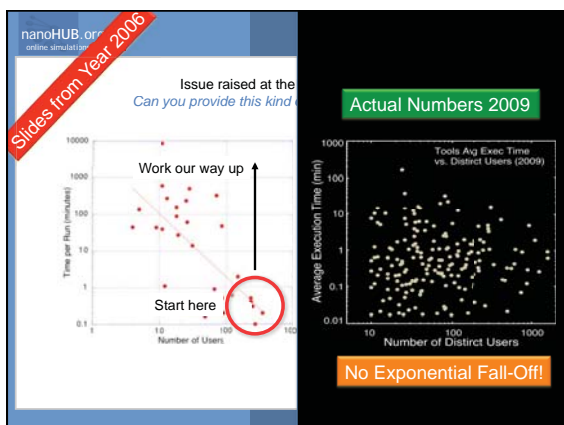
Years

Research Electronics Materials Photonics Mechanics Bio/Medicine

Web-enabling Tools

Vendor Scientist Web Developer





6 Criteria for Successful Science Gateways

1: Outstanding Science "Stuff the world wants"

Leveraged Research
\$5.1M

Basic Research; Invention

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2: Commitment to Dissemination "faculty that want to give it away"

46 faculty

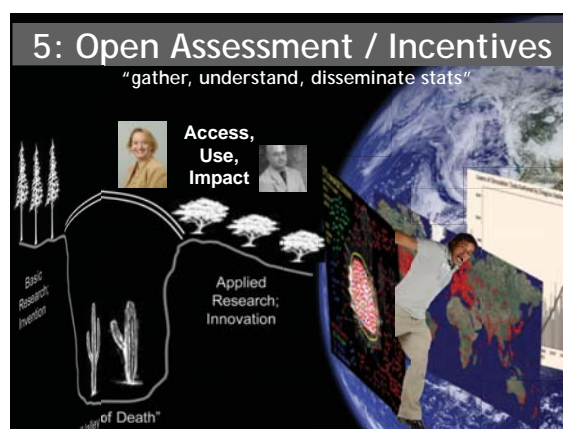
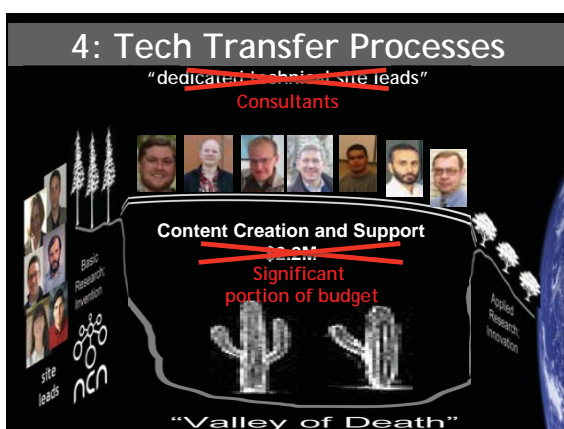
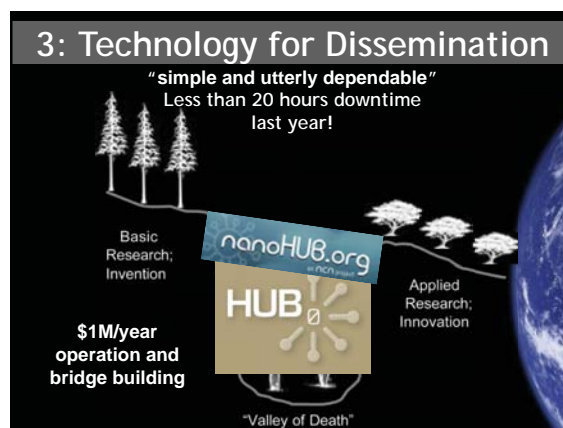
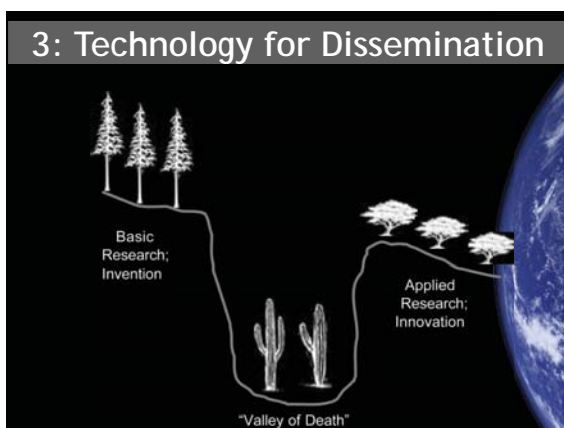
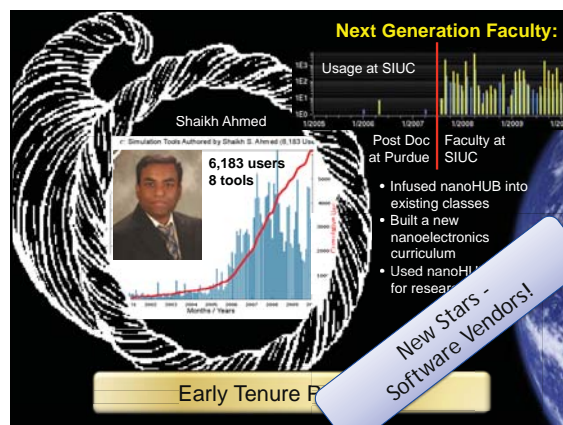
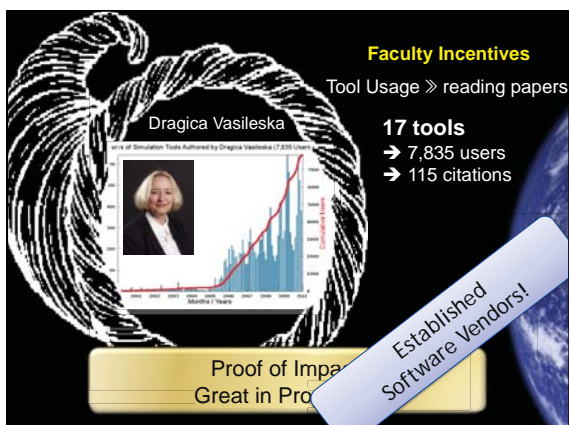
+ 6 site leads

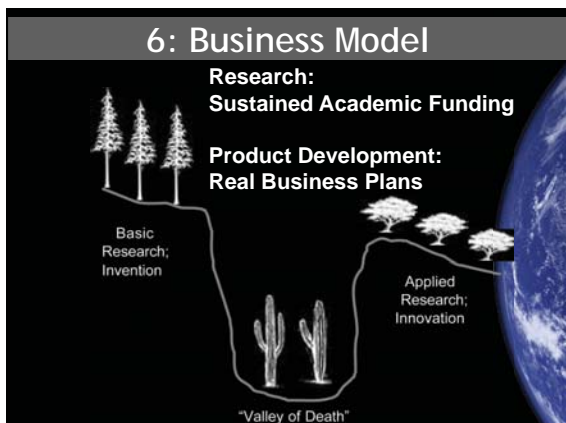
106 grad students

Software Vendors!

Basic Research; Invention

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Key Insights

- 6 criteria for success!
 - Need "consultants" to support / refine tools
- Usability is critical
 - Simplified user interfaces for reduced problems
 - Integrated visualization
 - Easy answers to "What If ?" questions
 - Remote installation – runs in browser

HUBzero Summary

- Support >30 HUBs
- Deploy any linux-based software - any language
- Support and deployment infrastructure
- 24/7 operations <30 hours downtime / year
- Access to HPC resources as needed - transparently to the end user
- HUBzero consortium

HUBzero Consortium

PURDUE INDIANA UNIVERSITY
Clemson University Wisconsin

An Apps Store for SME

Early Success is Possible

WE NEED:

- Few companies with real needs of design improvement - NOT radically new designs
- Ways to constrain general tools to simplified user interfaces
- Software vendors willing to play
- Acceptable open source codes

Long Term Success Possible:
Training, Persistent Use, and Improved Tools
HPC for automatic Design Synthesis