A Science Gateway with Global Usage and Impact

nanoHUB.org

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Activities on http://nanoHUB.org in 172 countries

- New Registrations
- Simulation Users
- Tutorial / Lecture Users

Over 13,000 / 280,000 Users Annually
Mythbusting
Scientific Knowledge Transfer with nanoHUB.org
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Over 13,000 / 280,000 Users Annually
Documenting with Real Data
Research <=> Education, Collaborative, Global Impact

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Over 13,000 / 280,000 Users Annually

Interactive lectures we have been a MOOC

Simulation Users
Total Users

Over 13,000 / 280,000 Users Annually
Nanotechnology
Extensive Facilities
Nano Models

Carbon Nanotubes

Quantum Dots

Artificial Atoms

Carbon Nanotubes
Imagine Breaking Barriers

Easy use
No Install
Any Browser
Most research codes are written by one user for one user?
Structure
{
    Material
    {
        name = GaAs
        tag = substrate
        crystal_structure = simplecubic
        atoms = (GaAs)
        Lattice:a_lattice = 0.565
        regions = (1)
        Bands:TB:s:param_set = nanohub
        Bands:TB:s:nanohub:E_S_GaAs = 12.1307935176
        Bands:TB:s:nanohub:V_S_S_Sigma_GaAs_H = -20
        Bands:TB:s:nanohub:passivation_potential = 125
    }
    Domain
    {
        name = structure1
        type = pseudomorphic
        base_material = substrate
        dimension = (18.0,19.0,9.0)
        periodic = (false, false, false)
        crystal_direction1 = (1,0,0)
        crystal_direction2 = (0,1,0)
        crystal_direction3 = (0,0,1)
        space_orientation_dir1 = (1,0,0)
        space_orientation_dir2 = (0,1,0)
        regions = (1)
        geometry_description = simple_shapes
    }
}
User Hostile

Why is this so hard?

Most research codes are written by one user for one user?

Structure

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Bands:TB:s:nanohub:passivation_potential = 125

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Why is this so hard?

Accessible (no installation)

Most research codes are written by one user
Development Friendly

User Friendly

HUBzero

Rappture
It has been very hard!

Accessible (no installation)

Developer Friendly

User Friendly

Emerged Myths

HUBzero

Rappture
Emerged Myths

User Friendly
Cannot use research codes for education
Must write own code to do research
Experimentalists cannot use research codes

Accessible (no installation)
NO End-to-end Science Cloud Possible

Developer Friendly
Building User Interfaces too Difficult
Must rewrite code for web deployment
There is no incentive to share codes
Importance of a good GUI

Same behavior across all similar converted tools

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Balancing Usability and Capability

nanoHUB

iPhone / iPad

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Emerged Myths

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Usual Science Gateway Process

- 175 tools / 4 years: => $82M
- $500k/tool
- NO new research!
- Not validated by researcher (disowned)
- Researcher has much better version
- Code rewrite takes 2-3 years

Many Proposals read alike
Usual Science Gateway Process

- 175 tools / 4 years: => $88M
- $500k/tool

Customers / Users
- Scale back expectations
- Not research codes
- Toy applications
- Not deep research
- Maybe for education?

Generating a Bad Reputation

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nanoHUB Process

- 175 tools / 4 years without $88M
- Eliminate bottlenecks
  - No Middleman
  - No Rewrite
  - Retain ownership
- Rapid Deployment: 2-3 years → 1-2 weeks
- Rappture toolkit
- HUBzero Ecosystem

nanoHUB is different

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nanoHUB can prove it

380+ Developers
NOT PAID by NCN

Continual Engagement

Product Innovation
Products
Suppliers
Developer Collaboration Network

Each dot is a Developer suppliers
Links are tools product

Supplier Network

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Building User Interfaces too Difficult
Must rewrite code for web deployment
There is no incentive to share codes

Myths Busted:
- User Interfaces too Difficult
- Rewriting Code for web deployment
- There is no incentive to share codes

Products:
- 270+ Interactive Tools
- 380+ Developers (mostly volunteers)

Suppliers:
- Rappture
- HUBzero

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Must write own code to do research

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NO End-to-end Science Cloud Possible

Emerged Myths

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http://nanoHUB.org
in 172 countries

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Customers

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NanoHUB.org usage 2012-02-03 00:00:00

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Formal Education vs. Research

Myth Busted:
Proof of use in EDUCATION!
Knowledge Transfer out of Research
19,435 students,
1,003 courses,
185 institutions

Voluntary / Viral Use

July 1, 2009

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Time to First Adoption

Typical textbook update: 3.8 years

Time Between Tool Publications and First Use in Classroom
Rapid Adoption of Research

**Time-To-Market**

Median adoption time:

174 days (5.7 months)

Typical textbook update:

3.8 years

Time Between Tool Publications and First Use in Classroom

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User Behavior Analysis

=> Is Research Possible?

- single tool, single use / homework
- single tool, sustained, intense
- multiple tools, sustained, periodic
- multiple tools, small class
- research, self-study

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Myth Busted

Proof of use in RESEARCH!
Over 2,220 authors, 77% non NCN
Proof of voluntary use by OTHERS

Thursday, October 10, 13
Myth Busted: Proof of use in Experimental Work! Not just computational theory!

Barrier Broken

7% of papers by Industry Authors
**h-index: Research Quality Indicator**

**Is it good research?**

- **Year 2013**
  - 1,076 nanoHUB citations
  - >12,236 secondary citations
  - h-index: 51

- **Year 2009**
  - 575 nanoHUB citations
  - >3,200 secondary citations
  - h-index: 27

**Faculty member**
- 3 years after PhD
- 6

**Academy of Engineering Members**
- 37
- 54
- 27
- 50

- Thursday, October 10, 13
Usage Patterns

=> Tool Qualification

Educational Use

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Literature Citations

=> Tool Qualification

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Education and Research are coupled!

235 tools!
Emerged Myths

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Customers
Suppliers
Market
Think about a new class of Users! => End Users in Application Sciences

User Friendly
Think about YOUR grad students and their incentives!

Accessible (no installation)
Free and no special access privileges

Developer Friendly

Big Data Challenges
Customers
Market
Suppliers

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