Assume a Supercomputer (and a bunch of other stuff)
Earthcube & Other Origins

Achieving the EarthCube goal of an “integrated system to access, analyze and share information that is used by the entire geosciences community” will require transformative advances in approaches to data collection, integration, analysis, and curation.

Success depends on identifying productive solutions from inside and outside the community while building on decades of effort in developing the existing community cyberinfrastructure.
Cyberinfrastructure is the coordinated aggregate of software, hardware and other technologies, as well as human expertise, required to support current and future discoveries in science and engineering.

The challenge of Cyberinfrastructure is to integrate relevant and often disparate resources to provide a useful, usable, and enabling framework for research and discovery characterized by broad access and “end-to-end” coordination.

Assume a can opener

From Wikipedia, the free encyclopedia

"Assume a can opener" is a catchphrase used to mock economists and other professionals who base their conclusions on unrealistic or unlikely assumptions.

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2 Meaning
3 Examples of usage
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Origin

It derives from a joke which dates to at least 1970 and possibly originated with British economists.\(^1\) The first book mentioning it is likely Economics as a Science (1970) by Kenneth E. Boulding.\(^2\)

There is a story that has been going around about a physicist, a chemist, and an economist who were stranded on a desert island with no implements and a can of food. The physicist and the chemist each devised an ingenious mechanism for getting the can open; the economist merely said, "Assume we have a can opener!"

The phrase was popularized in a 1981 book and has become sufficiently well known that many writers on economic topics use it as a catchphrase without further explanation.\(^3\)\(^4\)

Meaning

The phrase "takes aim at how economists use assumptions to simplify — and sometimes oversimplify — the problems they face.\(^5\) It may be used to express the writer's disdain for "the propensity of modern economic theory for unjustified and oversimplified assumptions.\(^6\)"
Globaly!

For further information regarding the international programs of Internet2, visit http://internet2.edu/international or contact Heather Boyles, International Relations Director, international@internet2.edu.

A listing of networks reachable via the Internet2 Network is found on the back of this page.
And Locally!

- **2014**
  - **UW Campus 40G MPLS Network**
  - **Typical campus user**
  - **Campus Researcher**
  - **Nx10G/40G to campus research labs**

- **High Speed Research Network (HSRN)**
  - **Pacific Rim R&E Networks**
  - **Pacific Wave**
  - **Northern Wave**
  - **Internet**
  - **US R&E Networks**

- **Hyak, lolo, PerfSonar, Co-located Research Equipment Nx10G/40G/100G**

- **NSF CC-NIE funding supports 10G/40G/100G interconnect components in the green devices.**
The Networking “Business” Model
Or, how successful efforts are funded

> *Partner* with researchers with leading needs

> Design a solution that satisfies their needs

> Apply for funding

> Let everyone else come along *FOR FREE*
An assumed Supercomputer
Or, what we learned from Hyak

> Transfers from Outside to *Central HPC*

> Transfers from Campus to *Central HPC*

> Transfers from Outside to Campus
SIZE isn’t the only important dimension

- Leadership Class
  - 100s of Teraflops
  - Large-scale campus/commercial resources, supercomputers
- Teraflop Class
  - 10s of Teraflops
  - Centre Supercomputers
- Mid-range parallel processors and networked workstations
  - 1s of Teraflops
  - Medium-scale campus/commercial cluster
- High performance workstations
  - 10s of Gigaflops
  - Small-scale desktop
Not a Can Opener, supercomputer
But which supercomputer?

> “It’s not about the cycles, it’s the data that matters”
Assumes magic?

> “Take the CPU to the data”
Origin’s in MapReduce & Hadoop, irrelevant today
Assumes a single-purpose system
Assumes each researcher has one

> “CLOUD!
Assumes one “cloud”
Assumes you can pay for it
Assumes it does what you want
“CLOUD!” Is Always Cheaper!!!! errrrr, just kidding

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<tr>
<th>% Usage</th>
<th>Hyak</th>
<th>AWS On-Demand</th>
<th>AWS 1-year Reservation</th>
<th>AWS 3-year Reservation</th>
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<td>7.17</td>
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</table>
“CLOUD!” Is Always Cheaper!!!! errrrrr, just kidding, in a plot
But what about XSEDE?

Top 10 Users - Hyak vs XSEDE - 2014

- Hyak: 18,298,792
- XSEDE: 7,259,042
Distributed *Supercomputing* Doesn’t Work
EFFECTIVE throughput still poor
**CLOUDY** storage still slow

[Image of a table and diagram]
The Use Cases

> **Prep for Petascale**  **P4P**
  Campus<->Hyak<->Outside
  Immediate, on-demand access
  Traditional queue useful for testing at larger scales

> **Speed of Science**  **SoS**
  Campus<->Hyak<->Outside
  Immediate, on-demand access
  Traditional queue useful for parameter sweeps, etc.

> **Big Data Pipelines**  **Catchy Abbreviation Pending**
  Campus<->Hyak
  Immediate, on-demand access
  Traditional queue useful exploration
The Campus Condo Cluster

Overview of Compute

CPU Total: 10396
Hosts up: 851
Hosts down: 2

Avg Load (15, 5, 1m): 77%, 77%, 78%
Localtime: 2015-07-24 14:22

Cluster Load Percentages
- 100+ (10.99%)
- 75-100 (92.17%)
- 50-75 (3.06%)
- 25-50 (3.25%)
- 0-25 (21.52%)
- down (0.23%)

Compute Cluster Load last week

Compute Cluster CPU last week

Compute Cluster Memory last week

Compute Cluster Network last week
Is a collection of **Personal Supercomputers**
With a traditional supercomputer
FOR FREE

Hyak Elastic Usage

- TOTAL
- Std
- Backfill
- Interactive
- GPU

Months
Supporting DIVERSE Workloads

Hyak Core-Hours Used in Standard Queues by job core-count & runtime

% of Std. Queue Core-Hours

Core Count

Runtime in Hours

Core Count

8 16 32 64 128 256 512 1024 2048

8 16 32 64 128 256 512 1024 2048
Partnering with Anchor Tenants Works for STORAGE Too!

Users vs Bytes
UW Libraries Data Repository Survey Results

<table>
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<tr>
<th></th>
<th>KB</th>
<th>MB</th>
<th>GB</th>
<th>TB</th>
<th>PB</th>
<th>&gt;PB</th>
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<tr>
<td>% Respondents</td>
<td>5.10%</td>
<td>28.23%</td>
<td>45.92%</td>
<td>18.37%</td>
<td>1.36%</td>
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<td>0.00%</td>
<td>0.00%</td>
<td>0.16%</td>
<td>11.75%</td>
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Files vs Bytes

It’s the same story everywhere
Conclusions

Which supercomputer?

> Leadership-class systems are important, of course

> Distributed computing (e.g. BOINC) also!

> But CAMPUS CONDOS fill an important and growing gap

> And the networks we’re building already ASSUME Campus Condos (or similar)!
Conclusions

Don’t assume your cyberinfrastructure!

> **Fill the gap** with a Campus Condo Cluster

> **And Storage** – DTN, archives, and working disk

> **Partner** with your biggest users – it works

> And provide assistance to the *Long Tail* – it won’t grow by itself
Assume a Supercomputer (and a bunch of other stuff)

THANKS!

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