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Cyberscience: Computational Science and the Rise of the Fourth Paradigm

 Electric8sheep, Flickr

Honors 352, Class #0.0

August E. (Gus) Evrard, PhD

Fall 2010

University of Michigan

What is Cyberscience?

Answer #1: A business intelligence (BI) company founded in 1977.
(Top rank in google search for term `cyberscience' .)

Cyberscience Corporation

Cyberscience CORPORATION

Founded in 1977, Cyberscience Corporation is one of the world's leading business intelligence solution providers, with operations in North America, Europe, and Australasia. Cyberscience develops and markets Cyberquery, which is the result of thirty years' experience delivering business intelligence excellence. Cyberscience supports a worldwide user base, including Fortune 500 companies in all industries, with thousands of users served through direct relationships and value-added reselling partnerships. A financially sound and independent company, Cyberscience has consistently achieved profitability while continuing to invest in ongoing research and development to extend the range, facilities, and features of its solutions.

Value Proposition

Cyberquery offers Red Hat Enterprise Linux users a single, integrated business intelligence platform for delivering everything from end user querying to executive dashboards, with one of the lowest TCOs in the BI industry.

Cyberscience offers a unique BI proposition to the Red Hat user community. Our flagship product, Cyberquery, is a fully integrated BI solution with more than 30 years of development at its core. Cyberquery offers an extremely intuitive report creation environment, the power to deliver even the most complex production reporting, and impressive speed via its server-side engine and native database APIs. Accessing multiple dissimilar databases in a single query and delivering the results through its automated, browser-based deployment architecture, Cyberquery offers the most compelling BI proposition for Red Hat users.

 Cyberscience website screenshot from www.cyberscience.com/about.html.

What is Cyberscience?

Answer #2: Something to which Penn State has dedicated a Research Institute.

 Penn State website screenshot from http://www.ics.psu.edu/about/index.html.

What is Cyberscience?

from PSU Institute for CyberScience, Strategic Plan, FY2009-FY2013 (http://www.ics.psu.edu/about/ICSStratPlan.pdf)

"Cyberscience is a fast-growing mode of discovery which enhances traditional theory and experiment by providing a unique virtual laboratory to investigate complex problems that are otherwise impossible or impractical to address. Among such problems are: genomic/ molecular basis of disease; the socio-economic impacts of a digital society; the origins of the universe; designing smart structures and nanoscale tailored materials; and developing systems for clean energy or real-time responses to threats. The intellectual strength of cyberscience is its universality as the emerging "science of discovery." All research domains benefit from it, but none is solely defined by it.

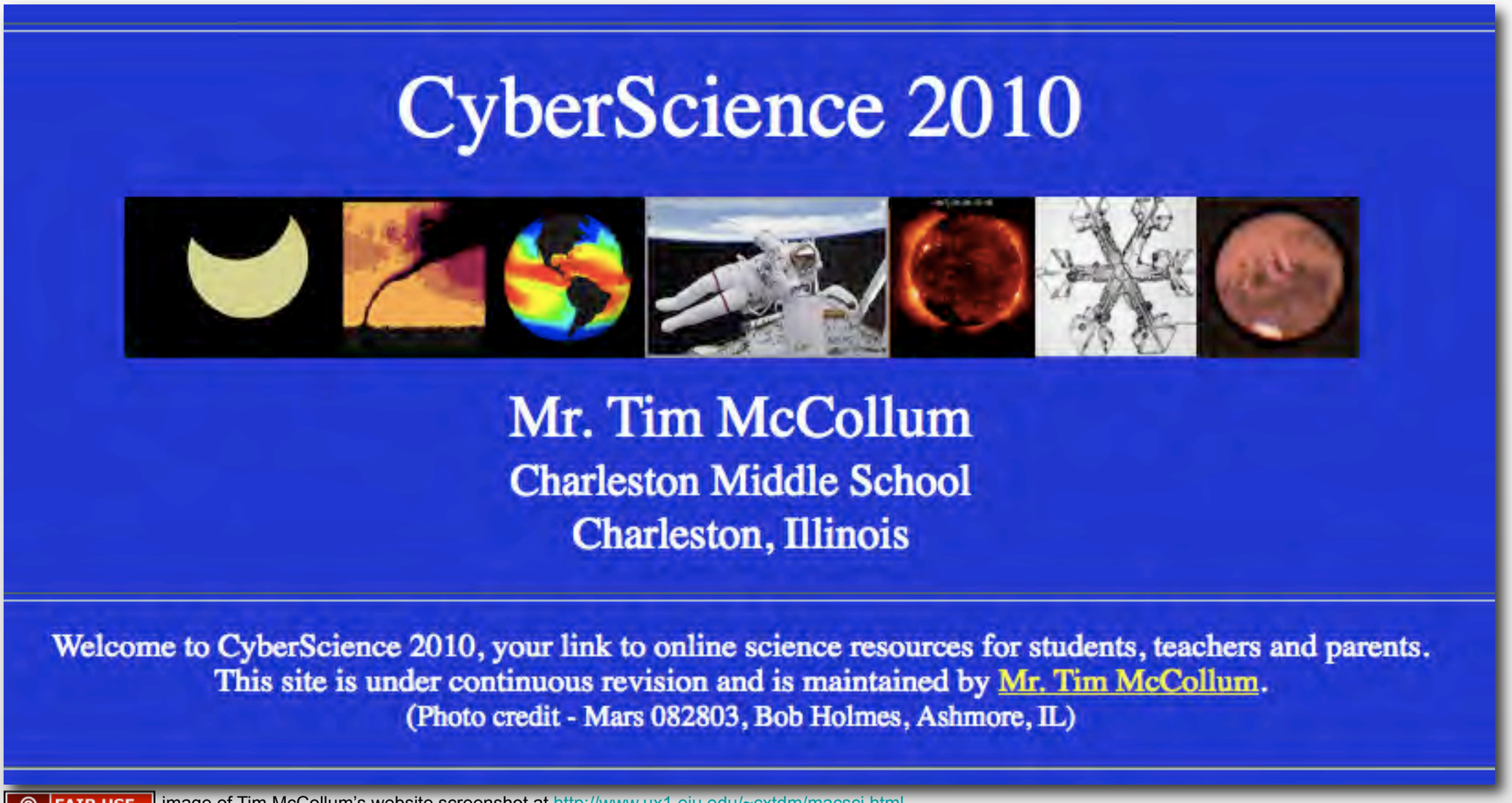
...

The process of discovery through computing involves multiple interacting layers of specialization, methodology and infrastructure. At the highest level, scientists determine domain-specific problems and methodology (often derived from theory and experiment) – these are typically called applications. Next, the methods are represented computationally as an algorithm, which is an abstract yet well-defined entity that can be analyzed and optimized for scalability, accuracy, and quality of solution. Algorithms are implemented as software, which are finally executed on computing hardware (including processors and data storage), to complete a virtual experiment. A single investigator or a small group of two or three investigators can certainly engage in all facets of this process. However, discovery through computing at the frontiers of knowledge is best performed in a cyberscience ecosystem, where larger groups of scholars can work collaboratively across the four layers. More importantly, grand challenges of science and society demand compute- and data-intensive advances that cut across all four layers, representing major advances in multiple method and domain areas. This in turn demands that collaboration be built upon a sustainable and extensible cyberinfrastructure, which integrates the hardware, software, algorithm, and application layers.

Cyberscience is thus a grand multidisciplinary enterprise encompassing an eclectic array of methodological sciences (computing and information science, applied mathematics, statistics, operations research, etc.) and serving as the means for discovery in issue-driven research (energy, life, materials, social sciences, etc.)."

What is Cyberscience?

Answer #3: The website of a super-duper middle school teacher in Illinois.



What is Cyberscience?

Answer #4: A cool way to name an internet security training program.

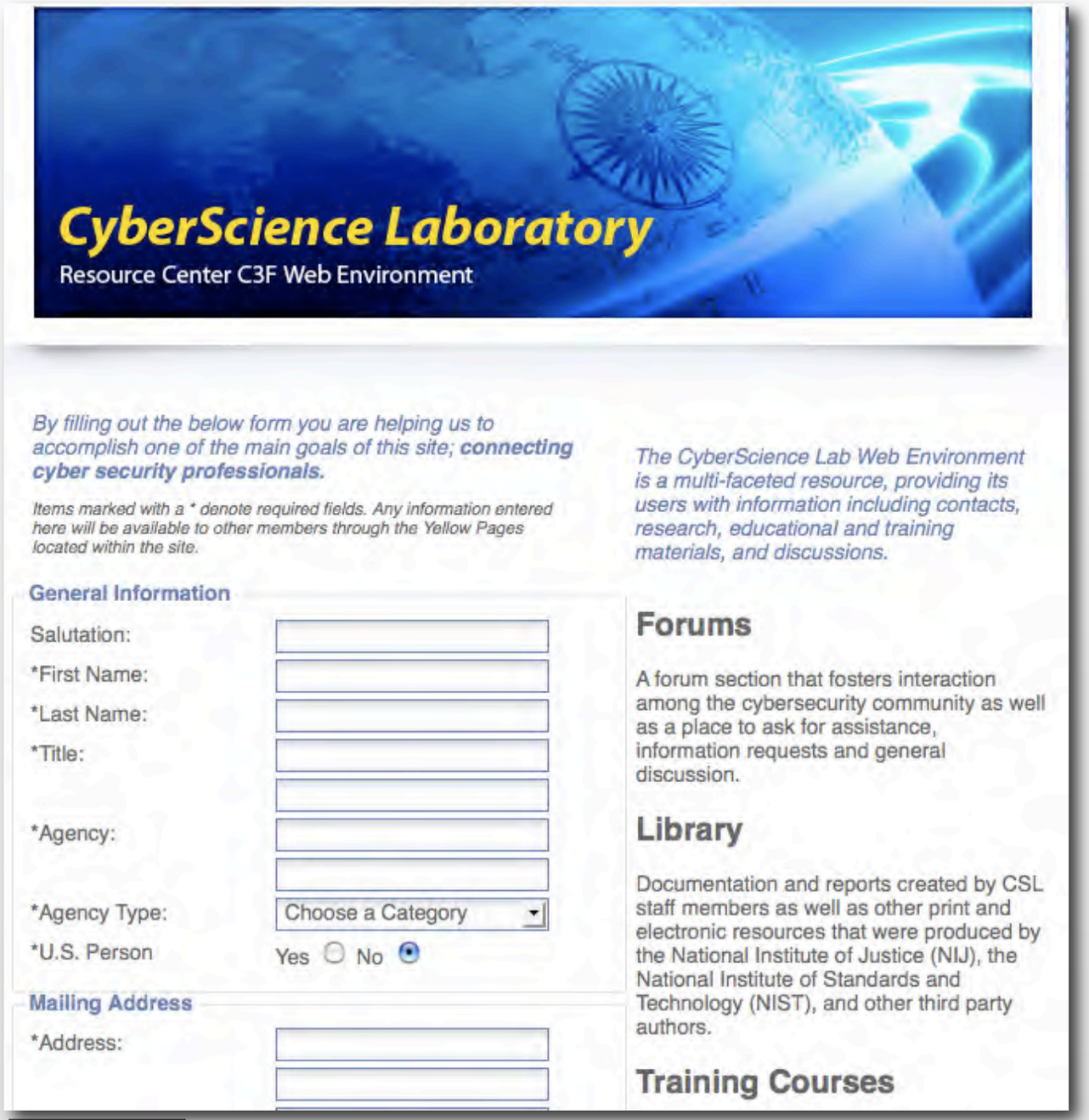


 Image of screenshot from Cyberscience Laboratory website at www.cybersciencelab.com.

What is Cyberscience?

Answer that matters: Cyberscience is for us to discover over the course of the term!

What will we do?

- ***read***
  - diverse sources, focused by collection of essays, *Fourth Paradigm*
  - technical, social, historical perspectives

- ***research***
  - investigate underlying technologies, scientific applications, and research support models of cyberscientists @UM and other institutions

- ***experience***
  - get your hands dirty with a few lab exercises

- ***synthesize***
  - via in-class discussion, group work, office hour visits, blog comments, etc.

- ***report***
  - present group project proposals, updates and final findings in class

- ***publish***
  - blog posts and comments, groups project reports

digital resources for this class

* CTools site: announcements, calendar, assignments, notes from class presentations, ...

    + linked from CTools are:

* google site: group project development (~wiki), potential public face of the course (open to umich.edu members of google apps for education suite)

* blogger site: for short writing assignments, synthesis, open to public?

First Exercise

Write short definitions of these two terms, bearing in mind the context of cyberscience.

enterprise

infrastructure

For Thursday

- do reading for week 1 (see syllabus)
- bring your laptop for a quick reading quiz
- *recruit a few more students for this class?*

Additional Source Information

for more information see: http://open.umich.edu/wiki/CitationPolicy

Slide 3, Image 1 (left): United States Federal Government
Slide 3, Image 2 (right): electric8sheep, “Earth Simulator,” Flickr, http://www.flickr.com/photos/28285401@N05/431915484/, CC: BY 2.0, http://creativecommons.org/licenses/by/2.0/deed.en

Slide 4: Please see original image of Cyberscience website screenshot at www.cyberscience.com/about.html.

Slide 5: Please see original image of Penn State website screenshot at http://www.ics.psu.edu/about/index.html.

Slide 6: Please see original quote from PSU ICS website at http://www.ics.psu.edu/about/ICSStratPlan.pdf.

Slide 7: Please see original image of Tim McCollum’s website screenshot at http://www.ux1.eiu.edu/~cxtdm/macsci.html.

Slide 8: Please see original image of screenshot from Cyberscience Laboratory website at www.cybersciencelab.com.

Slide 14: A. E. Evrard, University of Michigan