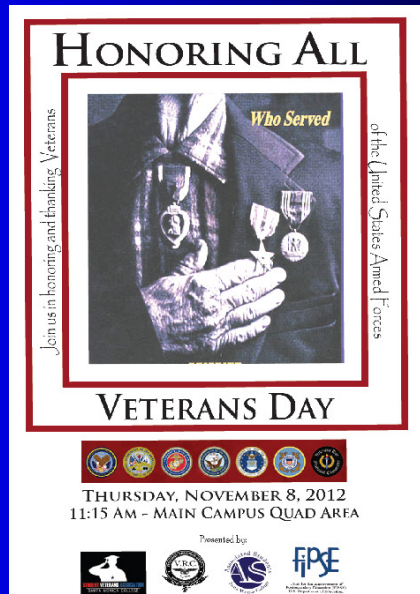# Hard at Work on Vacation

CIPAIR* project
summer 2012
Jet Propulsion Laboratory

*Curriculum Improvements Partnership Award
for the Integration of Research

November 8, 2012

JPL 2012

Concurrently today …

JPL 2012

Summer with the rocket boys

- what's it like to sojourn at JPL?
    - better than the beach
- what was my project about, in particular?
    - building a network testbed

Nov. 15, 1936
Arroyo Seco, JPL

Rudolph Schott, Apollo Smith, Frank
Malina, Ed Forman and Jack Parsons

JPL 2012

What's in it for…

- JPL
    - temporary talent infusion
    - qualified source of potential employees
    - diffusion of research into society
- faculty fellows   (you!)
    - new people, fresh ideas, personal growth
    - ivory tower therapy
        - stop teaching, pause and do something else
          "Those who can do, those who can't teach"
                    (I didn't say it!!)
        - strengthen yourself professionally
          reinforce/expand/diversify your expertise

        "A change will do you good."

JPL 2012

Paradoxical juxtaposition at JPL

- scientific heroics
- but no heros
  - JPL scientists are regular guys
  - they worry about their work like you do yours
  - they don't always succeed, try again
  - their extraordinary, intergalactic acrobatics come not automatically, but through ordinary intelligently calculated strategy and effort

JPL 2012

At JPL, what kinds of people are you with?

- focused skill
- measured rigor
- quiet determination
- patient purpose
- humble realism
- uncomplacent perseverence

HAVE U HERD?

GEEK IZ THA NEW COOL

nerds, in the finest sense of the word!
geekdom, respectable & vindicated

GEEK IS
The New Sexy

Propitious timing, my good fortune

sputnik
Chicago 1957

Apollo 11
Boston 1969

CURIOSITY KNOWS NO BOUNDS

PLANETFEST
planetary.org

The Planetary Society is proud to host
Curiosity Lands on Mars
A Planetfest 2012 Event
August 5, 2012 • Pasadena Civic Auditorium
Thank you to our sponsor

JPL
Jet Propulsion Laboratory
California Institute of Technology

8:30 p.m.   Welcome
9:00 p.m.   JPL Programming
10:30 p.m.   Curiosity Landing
11:00 p.m.   Commentary
12:00 midnight End

Mars Science Laboratory
Pasadena 2012
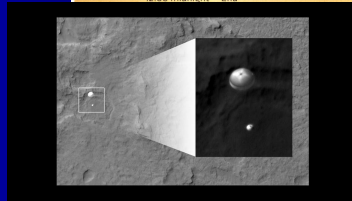
JPL 2012

Pasadena Civic Auditorium
MSL landing 8/5/12 10:31pm

JPL 2012

What kinds of projects are there?

- last year's SMC faculty projects
  - advanced fuel cell catalysts (Cooley)
  - computer assisted image recognition (Gallogly)
  - detecting /modeling "invisible" deformation of earth's surface from space (Grippo)
  - radar mapping of the Martian subsurface (Paik)

What kinds of projects are there?

- my "runners up" those considered that I didn't do
  - multi-level security (differential identity-based authorization)
  - autonomous information units (credentials bound to distributed data)
  - delay tolerant network protocols (talk to nodes farther than China)

What kinds of projects are there?

- other projects I encountered
  - Cassini (Saturn explorer)
  - CubeSats
  - elliptic curve cryptography

Science Candyland !

What was our project?

"Building an Emulab Testbed
and Interfacing it with the
National Cyber Range Testbed"

jointly with SMC student Arleena Faith

What was our project?

- subjects: 2 network testbed technologies
  - Emulab (University of Utah)
  - National Cyber Range (DARPA)
- tasks
  - contruct an Emulab testbed
  - translate between network description languages of the two testbeds

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What is a testbed?

A collection of computers that can be automatically wired together on demand, in *ad hoc* subsets, to produce arbitrary-topology networks for experimentation.

DETER testbed
Marina del Rey

Emulab testbed
Utah

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Background
how I got into this mess

- by using DETER at USC and SMC from 2008
- I design student lab experiments
- currently used in all my SMC classes

- but *using* and *building* are two different things

What is NCR? – a testbed

"Replicating the complexity of thousands of globally interconnected network systems is a challenge faced by researchers developing tools to protect our nation against the growing threat of cyber attacks. Sophisticated attacks as well as adaptive malware have the ability to devastate defense and commercial networks...."

"Under the National Cyber Range (NCR) program, DARPA has developed the architecture and software tools for a secure, self-contained testing capability to rapidly emulate large-scale complex networks that match the depth and diversity of real-world networks."

http://www.darpa.mil/Our_Work/STO/Programs/National_Cyber_Range_%28NCR%29.aspx

- "scale model of the Internet"
- thousands of nodes
- Orlando, FL

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What is Emulab? – a testbed

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Where else are Emulabs running?

USC/ISI
University of Kentucky
Taiwan Info. Security Center
…and elsewhere

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Task 1: construct an Emulab at JPL
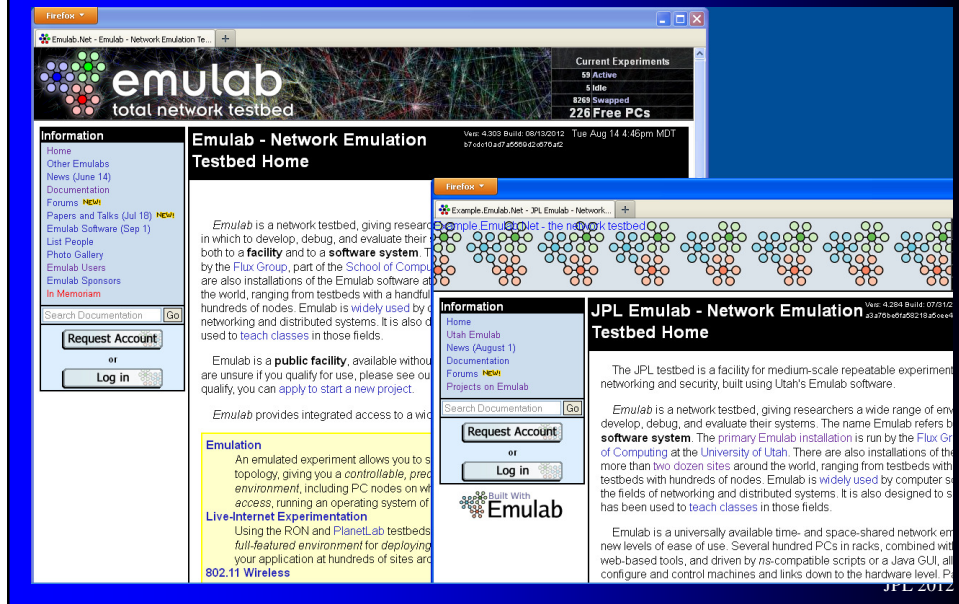
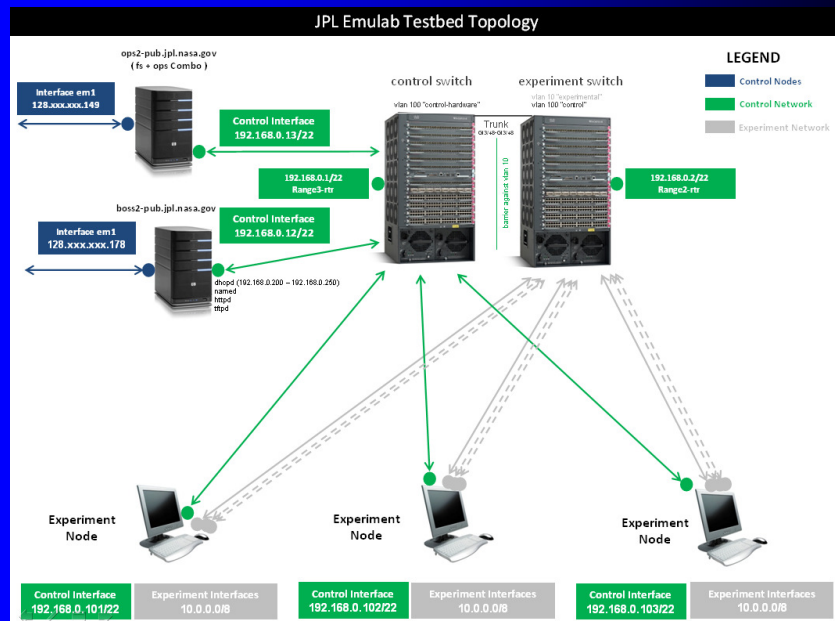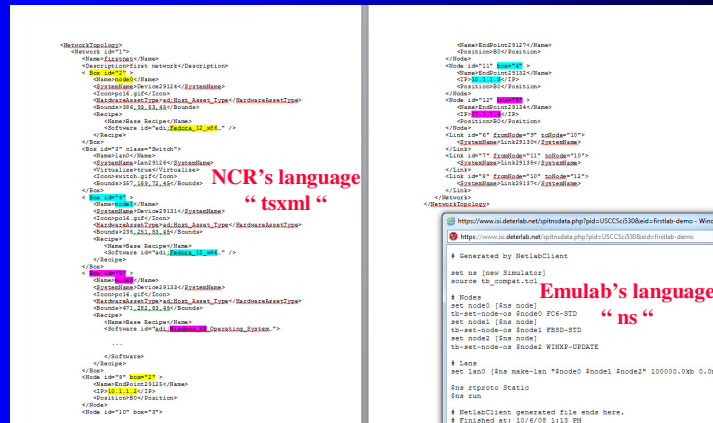# The Emulab we built at JPL

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JPL Emulab architecture

How do you get a testbed to give you a network?

… just ask

How do you ask?

Give the testbed a scripted description of the network you want, in it's language

NCR's language "tsxml"

Emulab's language "ns"

- it will requisition the components and physically configure them
- you will access them remotely

Task 2: translate NCR > Emulab

Emulab's language "ns"

NCR's language "tsxml"

Translator program was written by our student Arleena Faith

Was it a success? – disappointments

- it was hard, and we made lots of mistakes
- it took too long
  - up and running just 1 week before the end
- it was too small
  - seven nodes, not DETER's hundreds or NCR's thousands
- it was not taken to production use
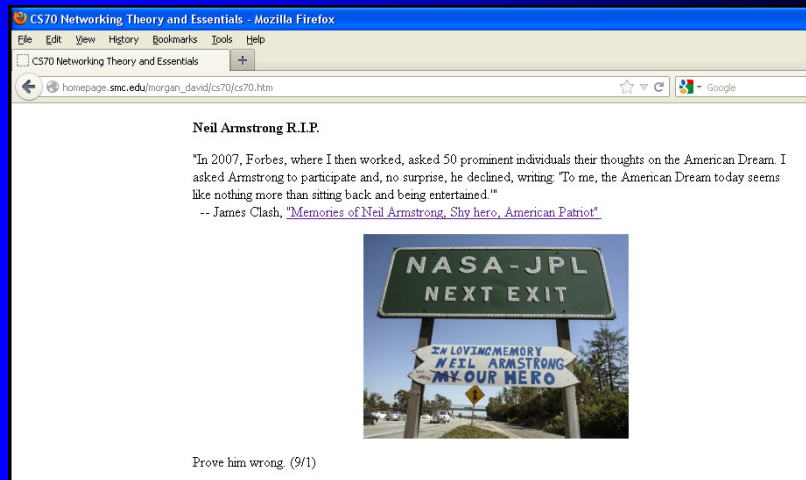 - no cross-platform NCR-Emulab test yet

Was it a success? – achievements

- we handled the mistakes
  - learned from them   (that's what they're for)
  - fixed them
  - documented them
- the testbed works
- it has been elaborated since August
  - in hands of Simon Woo, my JPL mentor and USC colleague

JPL CIPAIR – give it a shot

Neil Armstrong R.I.P.

"In 2007, Forbes, where I then worked, asked 50 prominent individuals their thoughts on the American Dream. I asked Armstrong to participate and, no surprise, he declined, writing: 'To me, the American Dream today seems like nothing more than sitting back and being entertained.'"
  -- James Clash, "Memories of Neil Armstrong, Shy hero, American Patriot"

Prove him wrong. (9/1)

please consider the opportunity for 2013

JPL 2012

Resources

- www.jpl.nasa.gov
- homepage.smc.edu/morgan_david
     (these slides)

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