Calit2's Program in Nano-science, Nano-engineering, and Nano-medicine

Invited Talk

Review of Nano-cancer project

April 11, 2006

Dr. Larry Smarr

Director, California Institute for Telecommunications and Information Technologies

Harry E. Gruber Professor,

Dept. of Computer Science and Engineering

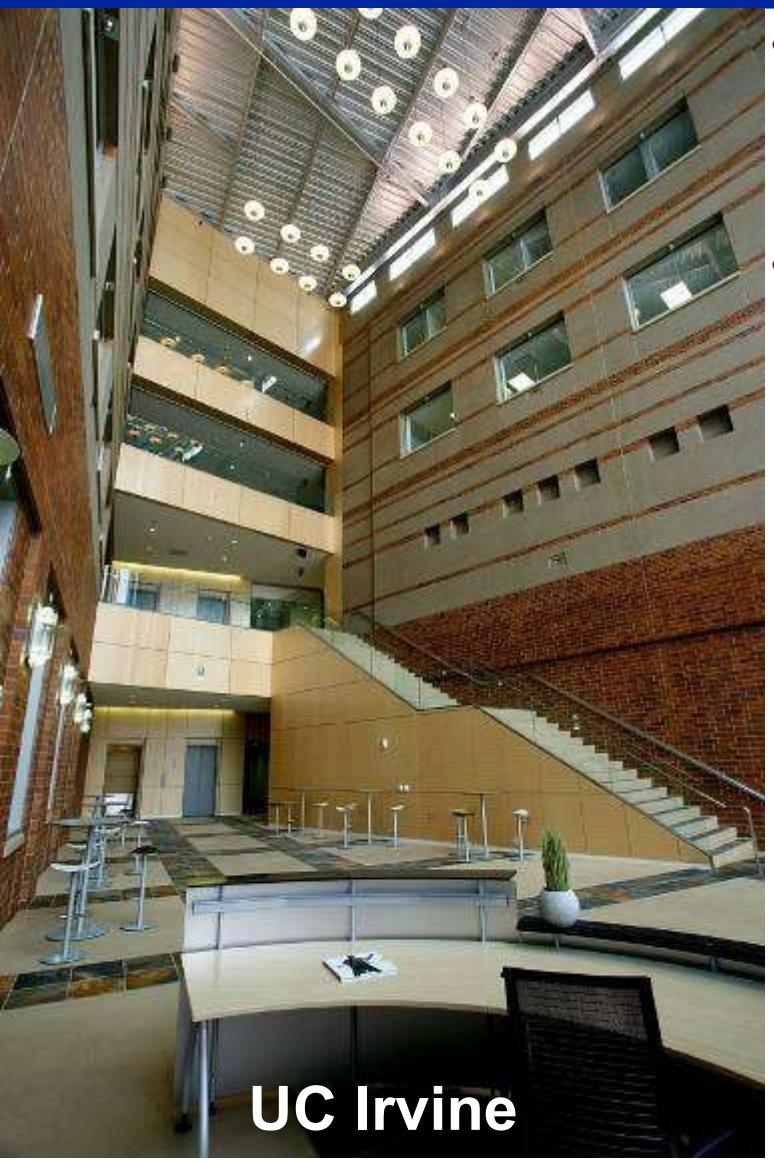
Jacobs School of Engineering, UCSD

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Two New Calit2 Buildings Will Provide Major New Laboratories to Their Campuses



- **New Laboratory Facilities**
  - Nanotech, BioMEMS, Chips, Radio, Photonics, Grid, Data, Applications
  - Virtual Reality, Digital Cinema, HDTV,
- **Over 1000 Researchers in Two Buildings**
  - Linked via Dedicated Optical Networks
  - International Conferences and Testbeds

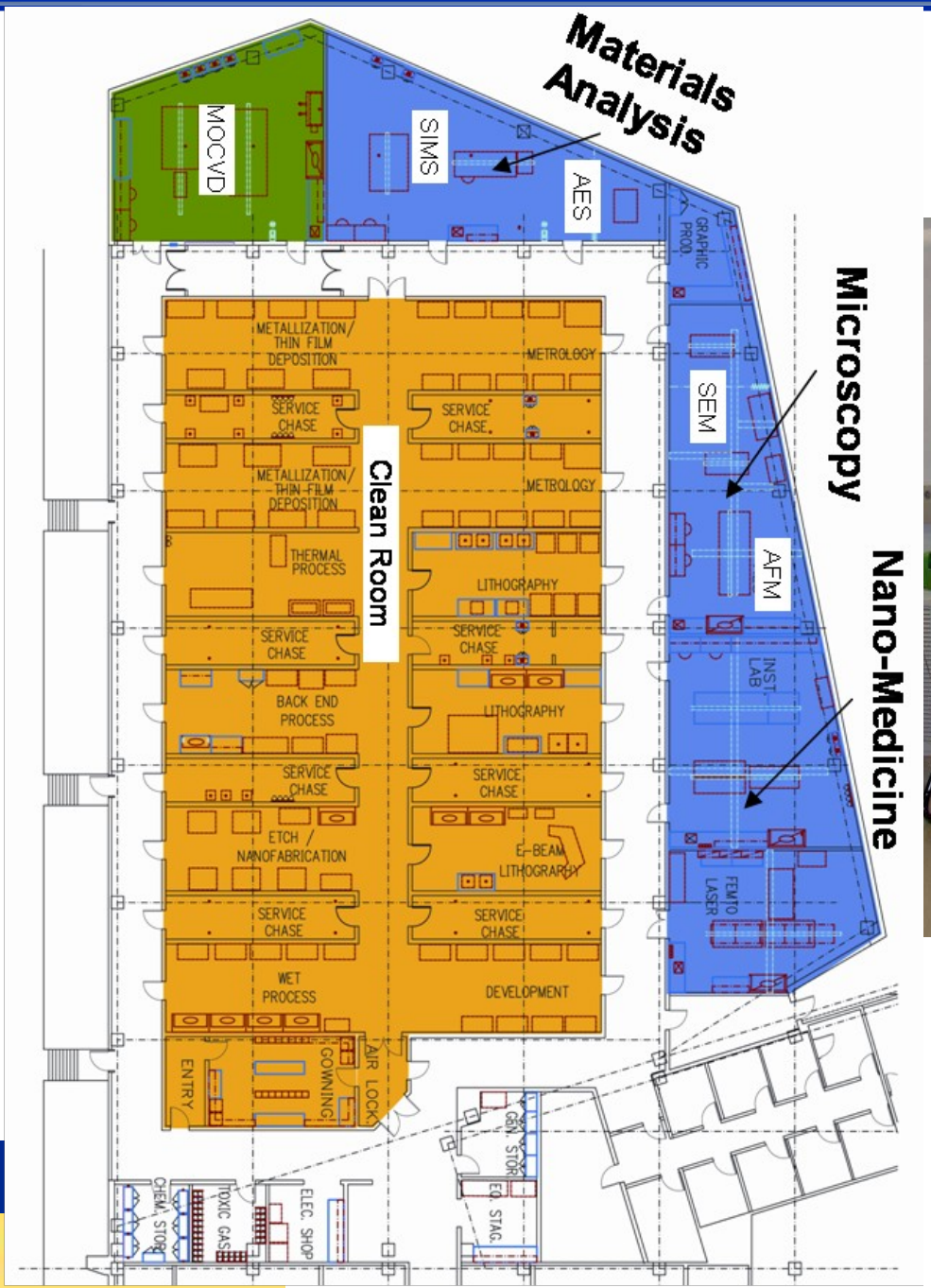
Richard C. Atkinson Hall Dedication Oct. 28, 2005



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www.calit2.net

Calit2 Materials and Devices Laboratory: "Nano3" – Science, Engineering, Medicine



10,000 sq. feet State-of-the-Art Materials and Devices Laboratory



Source: Bernd Fruhberger, Calit2

The First Shared Clean Room Facilities on the UCSD Campus

- **Nanoscale Fabrication:**
  - e-Beam Lithography
  - Optical Lithography
  - Advanced Dry Etching
  - Thin-Film Deposition
  - Wet Chemical Processing
  - Thermal Processing
  - Metrology
  - Back-end Packaging
- **Materials Characterization:**
  - Scanning Probe Microscopy
  - Scanning Electron Microscopy
  - UHV Surface Analysis
  - Diffraction
  - Optical Characterization

- **Nanomedicine:**
  - Facilitating Combined Nano/Micro Fabrication
  - Chemical Synthesis
  - Biochemical Coating



Campus Recharge Facility – Operated by Professional Staff
Limited Operation – April 2006
Fully Functional – September 2006

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Calit2 Nanomedicine Lab Facilities

- **Current Facilities:**
  - Controlled Atmosphere Glove Boxes for Array Coating
  - Nanoparticle Ultrasonicator
  - High Sheer Vortex Emulsifier
  - Laminar Flow Hood
  - Standard Biochemical Tools
- **Planned Facilities:**
  - Preparative HPLC
  - Dip Pen Lithography or Similar Device
  - Fluorescence Microscope Or NSOM
  - Inkjet Printer or Stamp Printer
  - Confocal Laser Cytometer

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Source: Bernd Fruhberger, Calit2

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NanoMedicine Lab: Current Projects

- **Synthesis of:**
  - Multishell Albumin and Liposomal Motherships for Delivering Nanosized Therapeutic and Imaging Agents
  - Albumin Shells For Delivery Of Anti-cancer Viruses Targeting Sentinel Lymph Nodes In Breast Cancer
- **Fabrication of:**
  - Cancer Cell Array Detector for Breast Cancer Surgical Margin Detection
  - Arrays for Single Cell Combined Genotyping and Phenotyping In CLL Cells
  - Arrays for Detection of Multiple Secretants from Single Cells
  - Peptide Arrays for the Detection of Cancer Antibodies

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Source: Bernd Fruhberger, Calit2

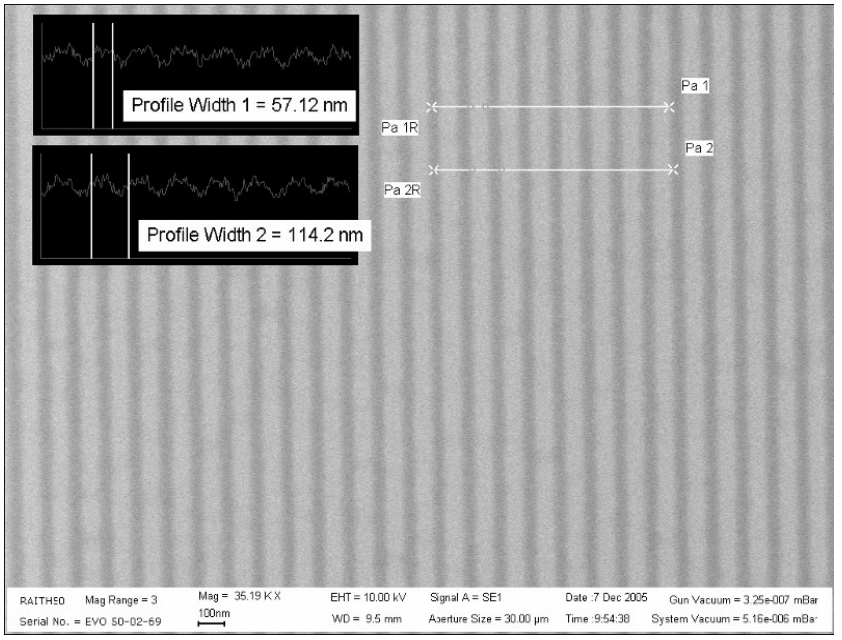
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NanoMedicine Lab – Interface with Cleanrooms

Example: Nanolithography



Raith50 E-beam Writing System
In operation (March 2006)



Nanodimensional grid in PMMA resist

e-beam Nanolithography is Used for Rapid Prototyping of Antibody Arrays to Optimize Size, Shape, and Spacing of the Antibody Coated Gold or TiO_2 Dots

Source: Bernd Fruhberger, Calit2

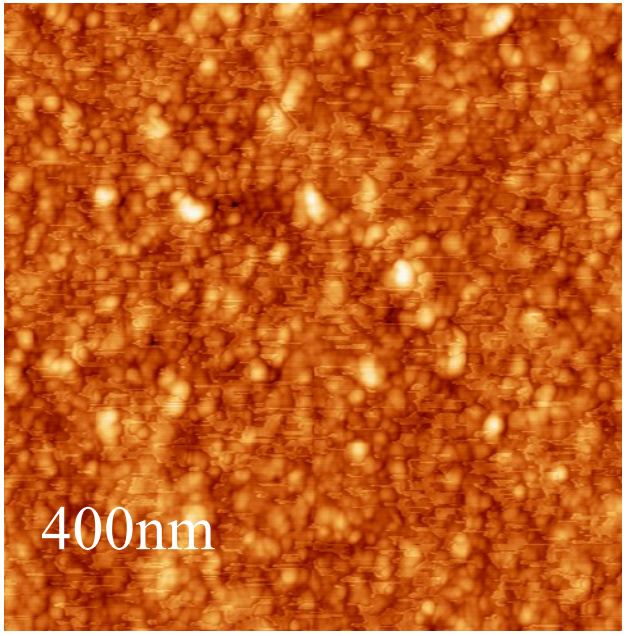
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NanoMedicine Lab – Interface with Materials Characterization Labs

Example: Scanning Probe Microscopy



MultiMode Scanning Probe Microscope w/Nanoscope IV Controller
In operation (March 2006)



Atomic Force Microscopy image of organometallic thin film (Cu-Phthalocyanine)

- Atomic Force Microscopy (AFM), Scanning Tunnel Microscopy (STM), Magnetic Force Microscopy (MFM), Surface Potential
- The Scanning Probe Microscope is Used for Topographical Characterization of Biochemical Coatings at the Nanoscale

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Source: Bernd Fruhberger, Calit2

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Adapting High Resolution Displays with Live Instrument Feeds to Cancer Research



Calit2 OptIPuter Project

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evl electronic visualization laboratory

Source: David Lee, NCMIR, UCSD

NCMIR NATIONAL CENTER for MICROSCOPY and IMAGING RESEARCH at San Diego, an NIH supported resource center

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CAMERA: Community Cyberinfrastructure for Advanced Marine Microbial Ecology Research and Analysis

National LambdaRail
Direct Connect
Computation and Storage Complex

Funded by: Gordon and Betty Moore Foundation

Joint Partnership of:

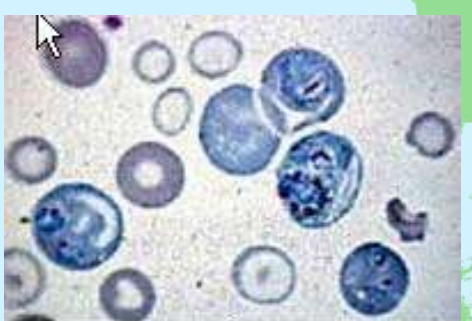
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Announced January 17, 2006

PI Larry Smarr

Marine Genome Sequencing Project
Measuring the Genetic Diversity of Ocean Microbes





Canada
United States
Mexico
Puerto Rico
Honduras
Costa Rica
Panama
Galapagos Islands
x 10 samples
French Polynesia
Vanuatu
Fiji
Tonga
Cook Islands
New Caledonia
x 17 samples
Australia
Cocos-Keeling Is.
Tanzania/ Zanzibar
x 7 samples
Seychelles
Madagascar
South Africa
x 8 samples
Analyzed
Sampled, but not Analyzed

CAMERA will include
All Sorcerer II Metagenomic Data

MARINE MICROBIOLOGY INITIATIVE

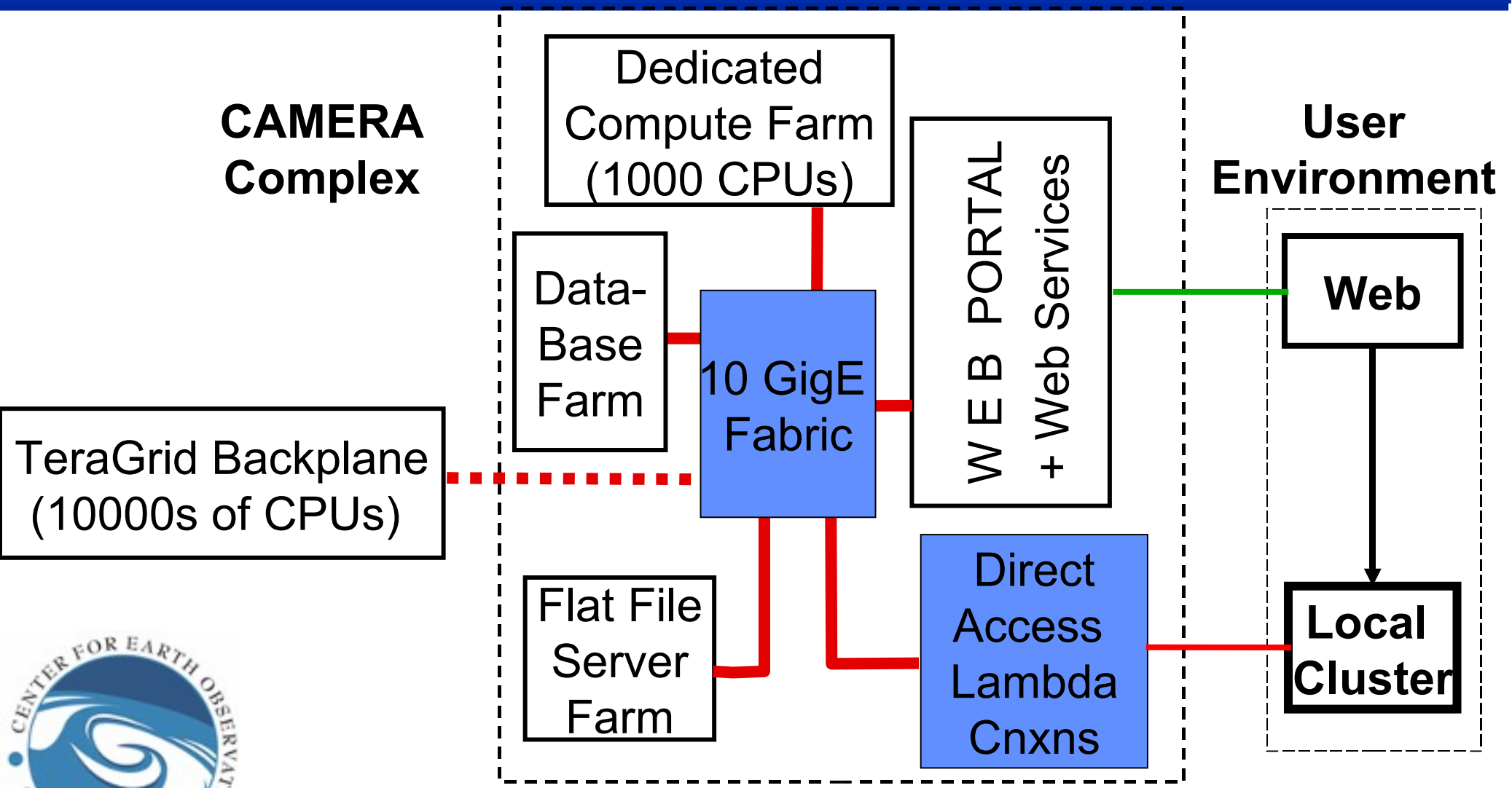
Gordon and Betty MOORE FOUNDATION

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J. Craig Venter INSTITUTE

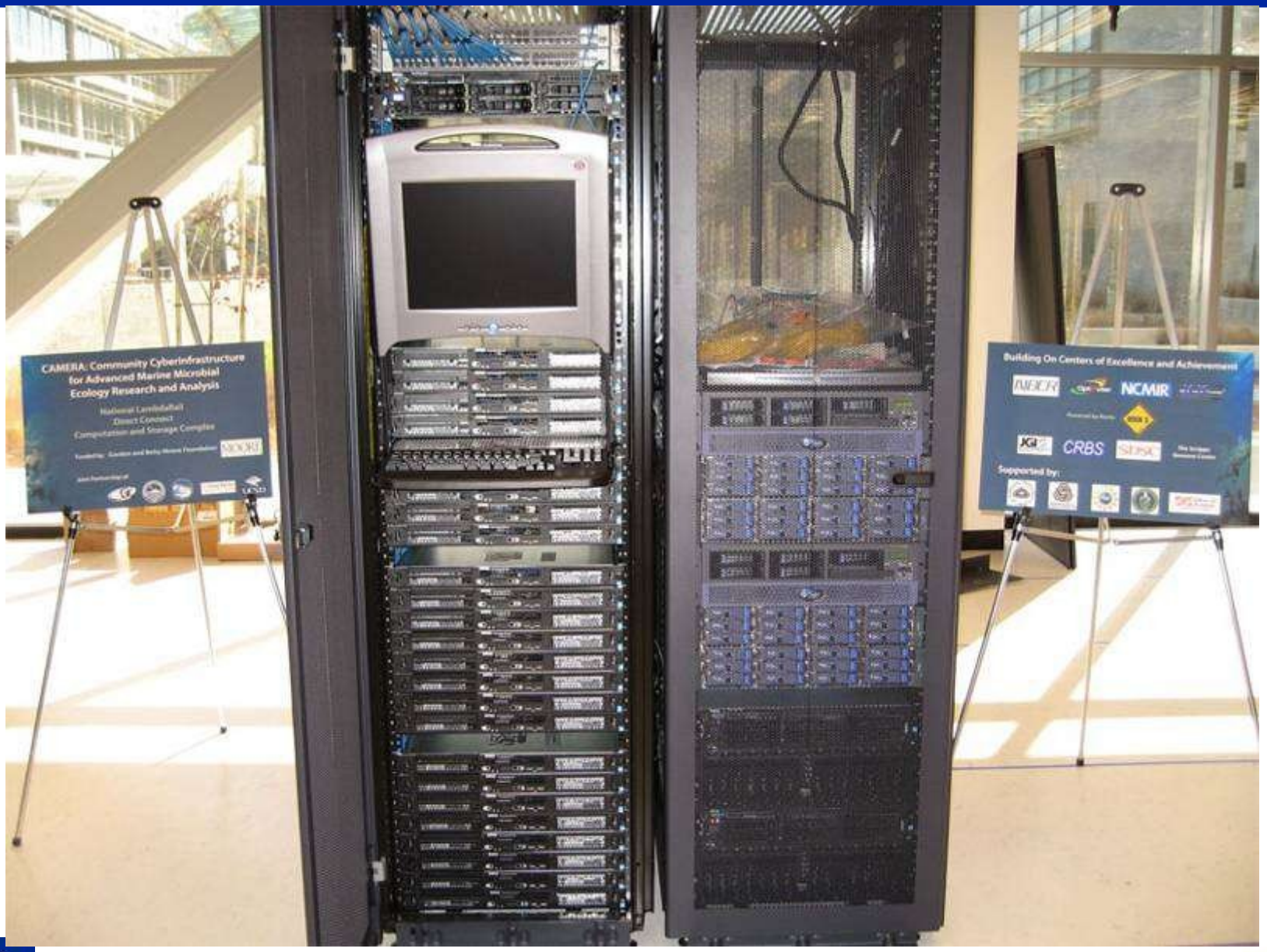
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Calit2's Direct Access Core Architecture Will Create Next Generation Metagenomics Server



Source: Phil Papadopoulos, SDSC, Calit2

First Implementation of the CAMERA Complex



Compute

Database & Storage

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