Infrastructure, Data Services, and Visualization

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Data Services and Visualization Objectives

- Enable scientists and engineers to see and understand the results of large, complex computational simulations and provide unprecedented confidence in these results.
- Develop enabling technologies, including scalable platforms, middleware, networks, I/O and visualization.

Outline

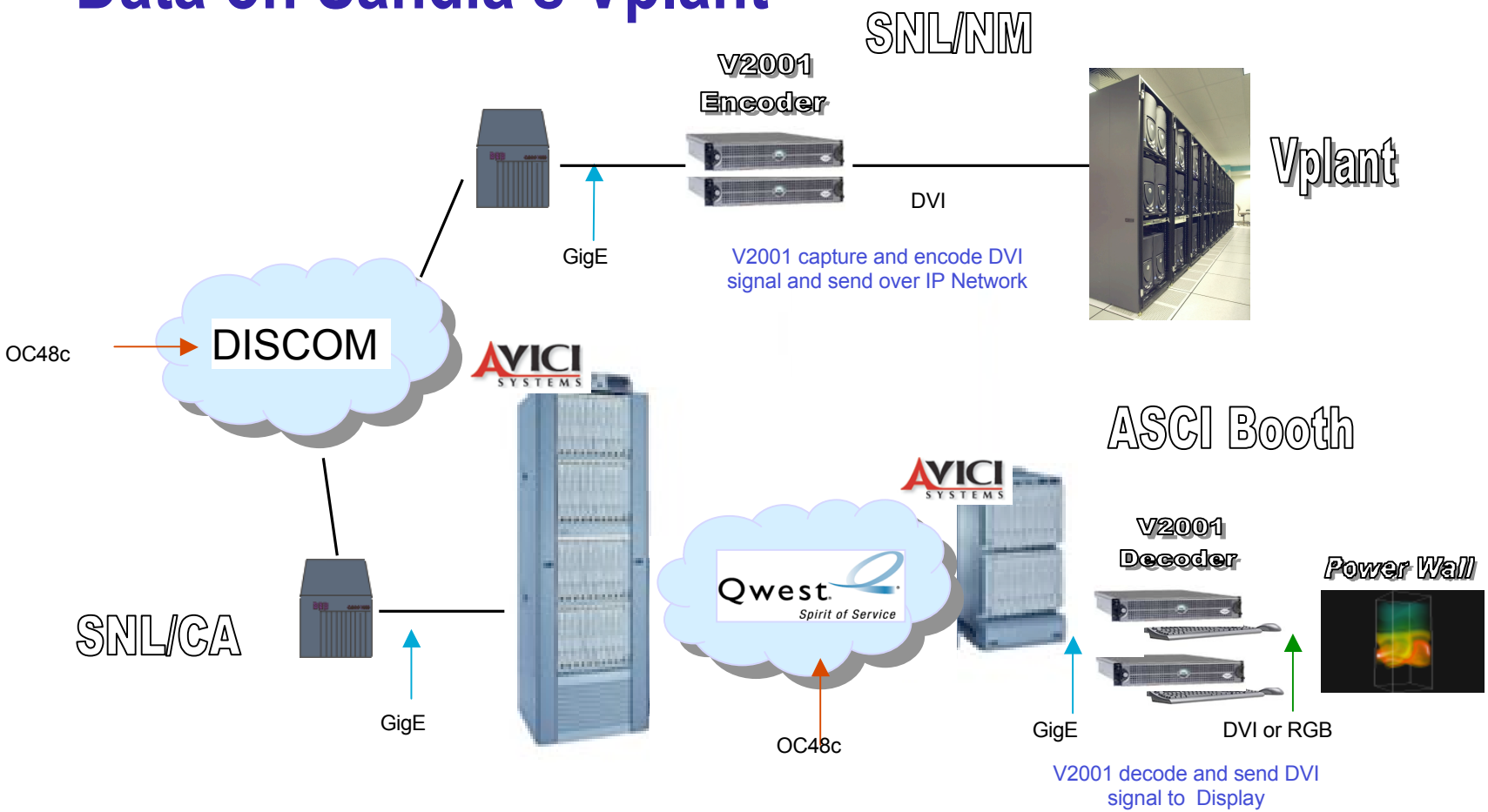
The demonstration

- Interactive Remote Visualization – 1:30 PM on 11/19/02
- Visualization with remote storage – 11:30 AM on 11/20/02

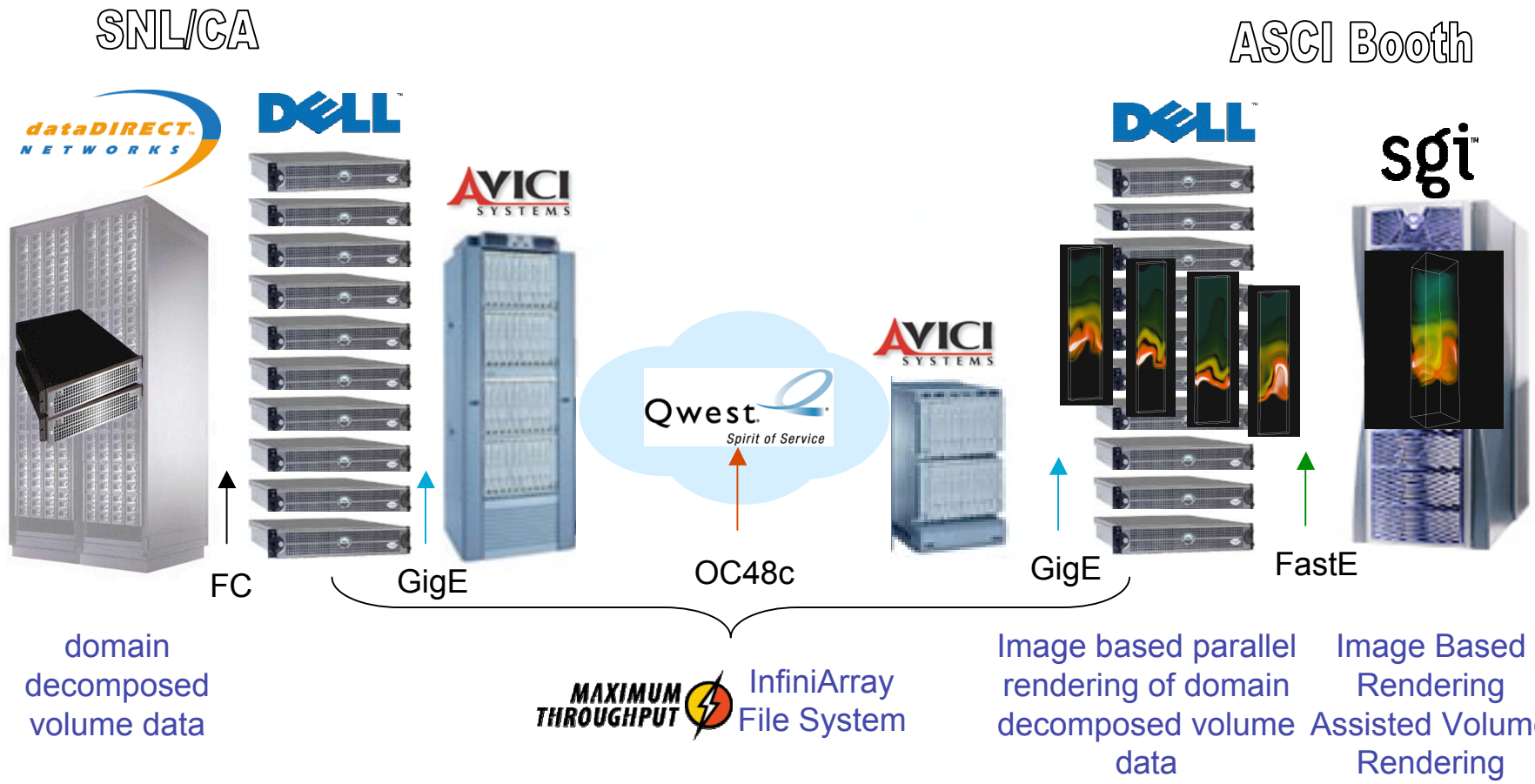
The enabling technologies

- Network
- Platform
- Storage
- File system
- Visualization

Interactive Remote Visualization of Terascale Data on Sandia's Vplant



LBL's Visapult Demonstration



Qwest's Transcontinental Fiber-Optic Link

- Qwest contributes OC48c bandwidth from Sunnyvale CA to SCinet in Baltimore MD, shared between Sandia/CA and LBL

Avici's Terascale Switch Router

- Avici TSR at SNL/CA and SSR at ASCI Booth connect transcontinental SONET to local Gigabit Ethernet networks
  - Internal fabric is 3-D torus network – Non-blocking and scalable to 5.6 Tbps aggregate bandwidth
    - POS OC48c and Gigabit Ethernet modules used
    - POS OC192C and OC12c modules also available
    - ASIC based, wire speed Forwarding
  - Fabric implements credit-based flow-control – Zero packet-drop
  - Modules support hardware based QoS and MPLS

Dell's Data Clusters

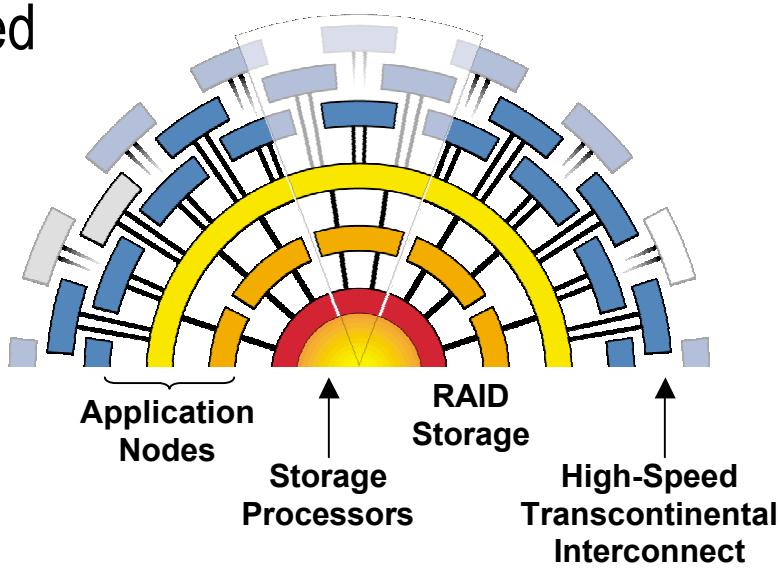
- One cluster at SNL/CA, one at ASCI Booth
- Each cluster has 10 Dell PE 2650 servers:
  - Dual 2.4 GHz Intel Xeon Processors
  - 512 KB L2 Cache
  - 2 GB 400 MHz DDR memory
  - Dual on board Gigabit Ethernet (Copper)
  - Intel and Syskonnect Gigabit Ethernet (Optical)
  - Qlogic 2340 – 2Gbps Fibre Channel HBA on separate PCI-X bus
  - Redhat Linux 7.3

DataDirect's Fibre-Channel RAID Storage

- Attached to Dell Data Cluster in SNL/CA
- S2A6000 Silicon Storage Appliance by DataDirect Networks
  - 5 Terabytes capacity
  - 8 ports connected directly to 8 servers
  - 95 Megabytes/second sustained bandwidth per port
  - 600 Megabyte/second aggregate bandwidth
  - No performance penalty in writes versus reads

Maximum Throughput's InfinARRAY File System

- High-performance, scalable, distributed cluster file system
  - Single Global Namespace
  - Achieved 0.8 Gbyte/sec in initial tests at Sandia
- Transcontinental WAN capability developed for this show
  - 10 Storage Servers in CA
  - 10 Application Nodes (clients) in MD
  - Dynamic TCP window adjustment
  - Adjustable block I/O parameters



MAXIMUM THROUGHPUT

SGI's Graphics Engines

- One SGI Onyx 3000 in ASCI Booth, each with
  - 16 MIPS R14000 600 MHz CPUs
  - 4 InfiniteReality family graphics pipes.
  - RAID subsystem

Industry Partners

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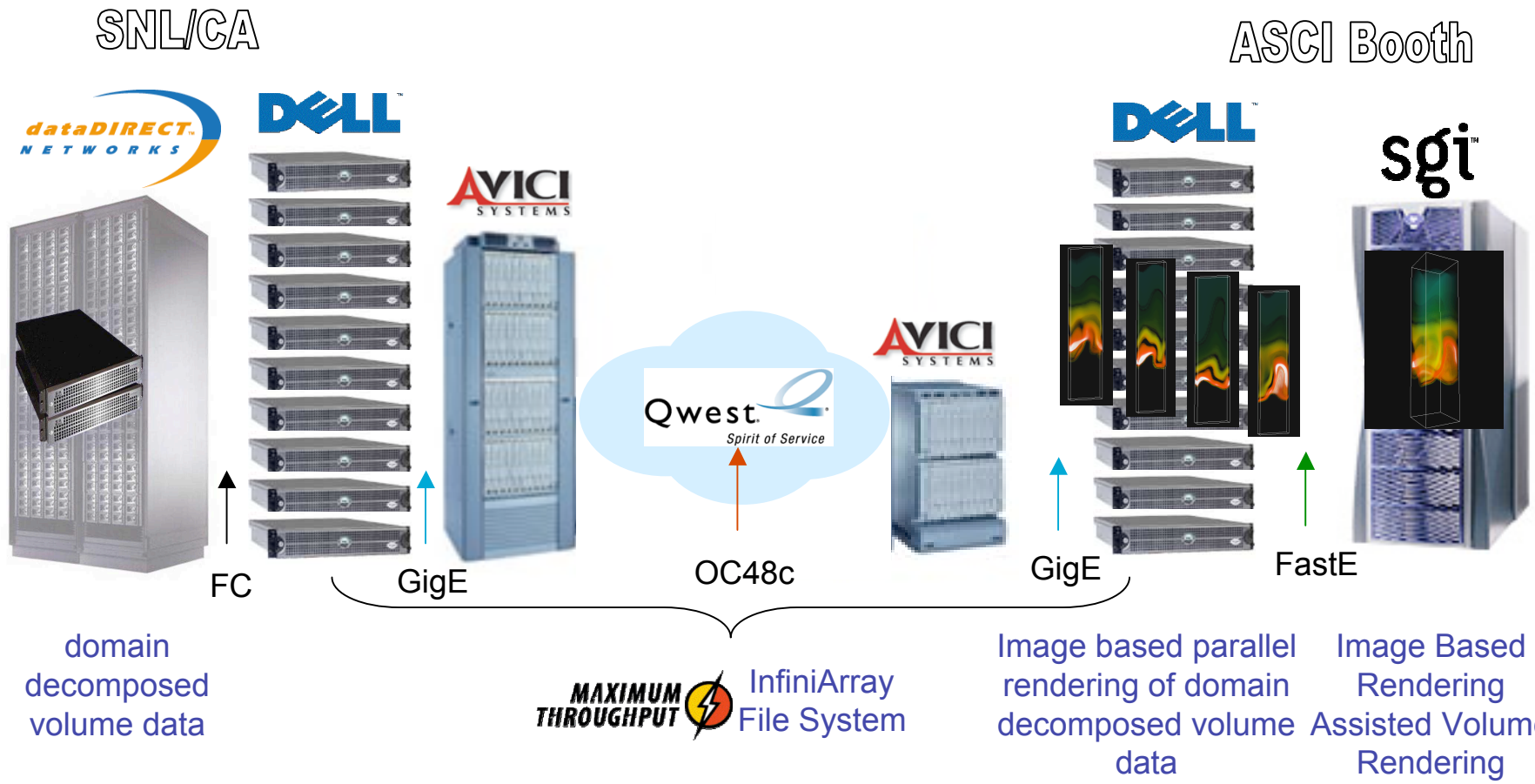
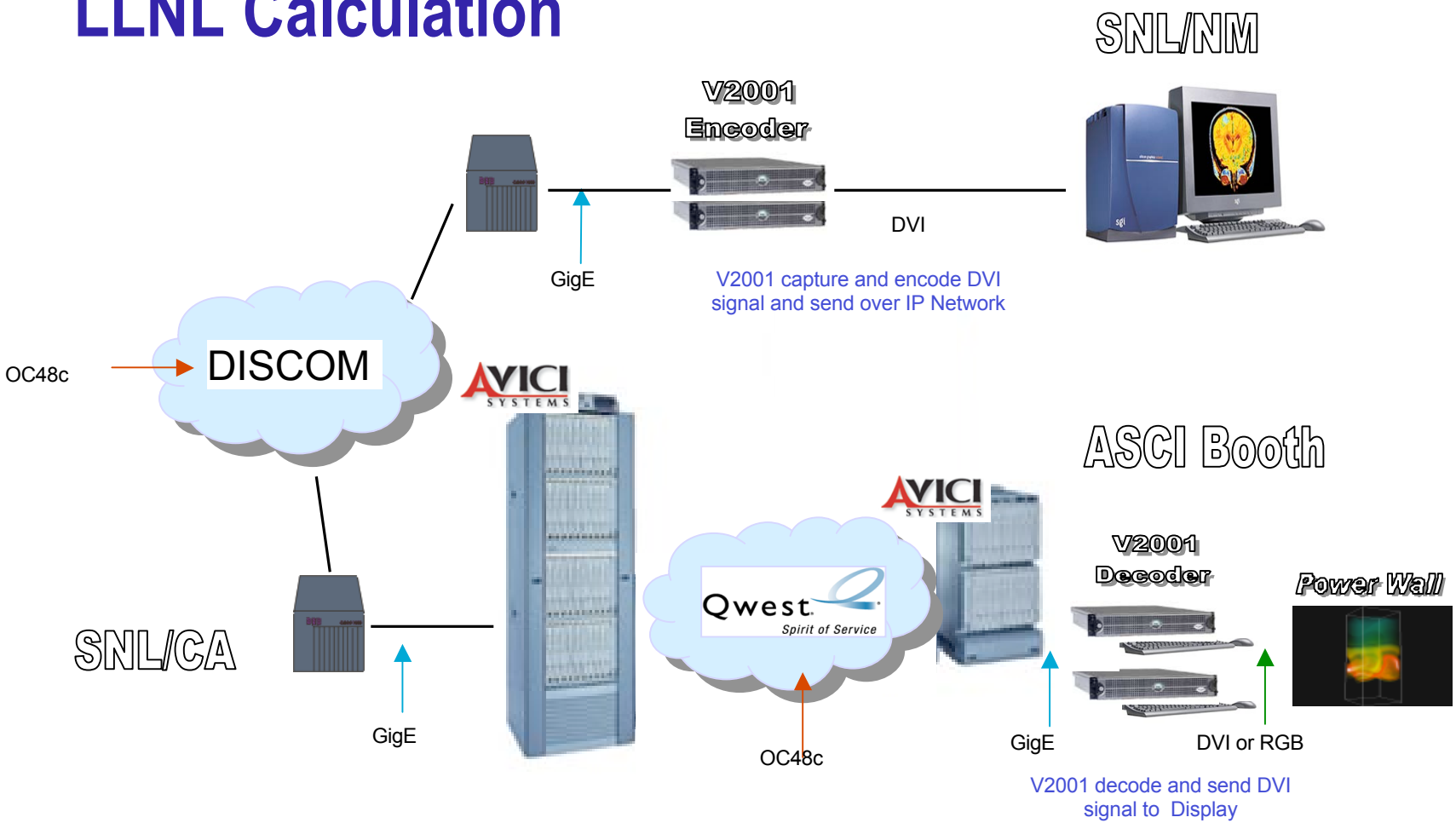
LBL's Visapult Demonstration



LBL's Visapult

- Visapult is an application and framework for remote and distributed, high performance direct volume rendering
  - The Visapult *back end* is a distributed memory application that performs data loading and partial rendering in parallel
  - The viewer uses the *Image Based Rendering Accelerated Volume Rendering* (IBRAVR) technique to achieve interactive frame rates even with extremely large datasets

Visualization of Simulation Results form an LLNL Calculation



The LLNL Visualization

- Liam Krauss