The Changing Landscape of Supercomputing Architectures, Applications, and Interfaces

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Context

• History
  – **Brief** history of supercomputing
  – TACC ecosystem: exemplar for the evolving supercomputing center

• The Present
  – Linux cluster entrenched
  – Microprocessors, accelerators, and such
  – Memory, I/O, networks...
  – Diverse applications!
A Brief History of Supercomputing

1929: Term invented (for IBM tabulator)
1940s: Computers invented
1956: "Preliminary" supercomputers
1964: CDC 6600 – first supercomputer
1970s, 1980s: Cray PVPs
1990s: Massively parallel processors
2000s: Clusters
2010s: Petascale, GPUs
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web  Big Data  mobile  cloud
TACC Ecosystem

**Stampede**
- HPC Jobs
- 6400+ Nodes
- 10 PFlops
- 14+ PB Storage

**Maverick**
- Vis & Analysis
- Interactive Access
- 132 K40 GPUs

**Lonestar**
- HTC Jobs
- 1800+ Nodes
- 22000+ Cores
- 146 GB/node

**Corral**
- Data Collections
- 6 PB Storage
- Databases
- IRODS

**Vis Lab**
- Immersive Vis
- Collaborative Touch Screen
- 3D

**Ranch**
- Tape Archive
- 160 PB Tape
- 1TB Access Cache

**Wrangler**
- Data Intensive Computations
- 10 PB Storage
- High IOPS

**Rodeo**
- Cloud Services
- User VMs
- XXX VCores
- XXX PB

**Stockyard**
- Shared Workspace
- 20 PB Storage
- 1 TB per user
- Project Workspace

**Corral**
- Data Collections
- 6 PB Storage
- Databases
- IRODS
Segments - Systems Share

Application Area - Systems Share

Industry

“Not specified”
Topics

• Recent Evolution of Large systems
  – Driven by scaling in face of system imbalances
  – Driven by power (cost to operate)
  – Driven by expanding applications space, especially in data intensive applications

• Data: It’s not just for breakfast any more
  – The data deluge is here to stay, and the rate is much faster than Moore’s Law

• Cloud Computing
  – It’s Not Grid Computing
  – It’s Not in Opposition to HPC

• Mobile: it’s the new web!
  – But does it have a place in science/research?
So Our Challenges Are...

• Grow systems larger to do new problems (duh)
• Build more, diverse systems to support expanding applications space
  – More data intensive applications means researchers from more domains (and new subdomains in old domains)
    • Even social sciences, arts & humanities, etc.
• Make it all work
  – Reliably: must deal with fault tolerance
  – Together: Network bandwidth/shared data access and I/O, etc.
• Make it all more usable
  – Community apps
  – Cloud/web services/mobile
Recommendations

• Systems evaluations even more important
  – More choices of processors, configurations, etc.

• System diversity necessary for university research
  – HPC, HTC, data, vis, global file storage, etc.

• Helping users analyze data even more important
  – Analysis comes first for data driven applications

• Don’t dismiss ‘the cloud’—embrace it
  – Seriously. You’re already using it every single day.
Final Thoughts

- Thank you for your time, and for putting up with my ‘vision’ of supercomputing 😊
- Texas A&M is a remarkable research institution, with growing engineering and with proximity to Houston/petro/medical
- This new IBM deal is exciting—build on it!
- Questions? Always feel free to email me: jay@vizias.com