# Lessons Learned When Building a Greenfield HPC Ecosystem

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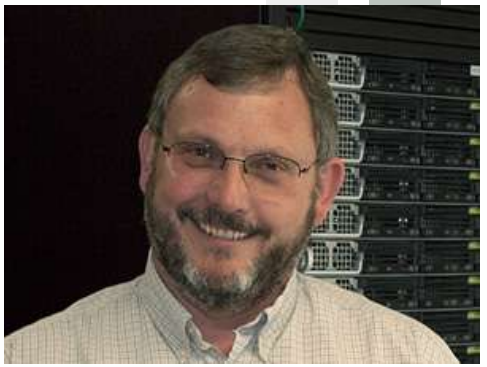
# Terminology

- High Performance Computing
- Greenfield- In contrast to brownfield

# About iCER / HPCC

- ‘Cyber-Enabled’
- 300+ nodes (500+ soon)
- > 1 PB storage
- High speed networks, GPUs, Xeon Phi accelerators, Large memory
- Software!
- People!



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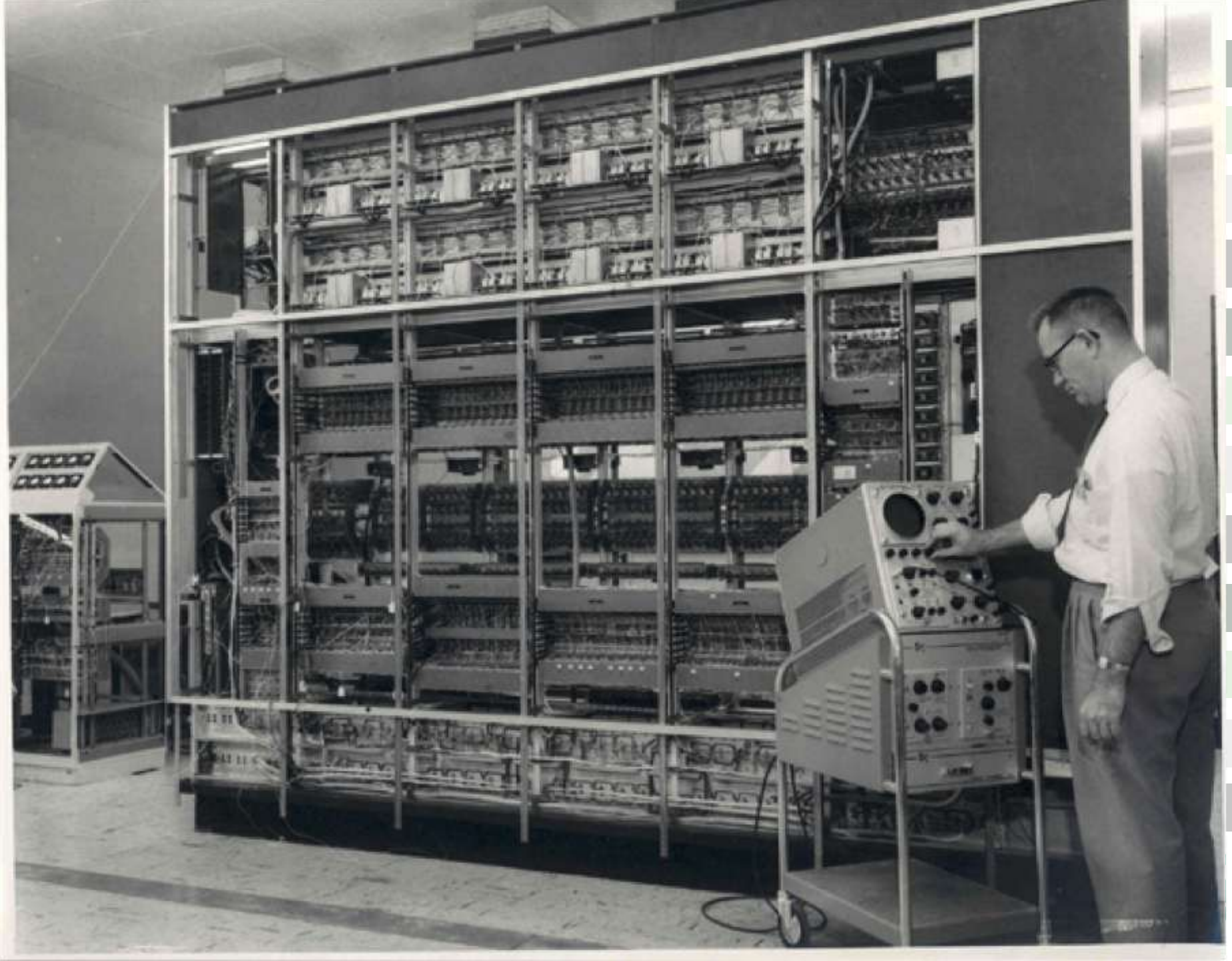
# There's more than FLOPS?

It's an ecosystem:

- Users!
- Compute
- Storage
- Physical Infrastructure
- Management Tools
- Policies
- Education
- Community



# Startup

- Big SMP system from a Famous Name
  - RFP benchmarks looked great!
- Actual workloads…
- Didn't have adequate I/O bandwidth

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- Storage
- Physical Infrastructure
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# Storage

- Fast Storage
  - Lustre; 350 TB, 9 GB/s
- Safe Storage
  - ZFS
  - Data Integrity, Snapshots, Replication
  - Fast-ish
  - First TB free
  - $175/TB/year- competitive with offline cloud storage!

# Configuration Management

- Never manage your systems by hand
- Can manage appliances/devices
  - NetApps
  - Junipers
  - VMWare
- Puppet – GIT environments are cool

# Availability

- HPC is not HA*
  - but that doesn't mean you can't avoid disruptive pain points
  - Outages can be disruptive
  - Build redundancy based on budget and tolerance for disruption

# Cluster Management

- Hardware Management
  - IPMI
  - Firmware Updates and configuration!
  - Lock-in

# Security

- Reflect resource's goals
- Environment
- Trusts matter

# Use Outside Resources

- Organization and Community, resources
- Don’t reinvent the wheel
- Gitlab!
- http://gitlab.msu.edu

# Communication

- No one reads bulk email
- Few people read personal email
- Social Media?
- Ticketing / Issue Tracking is *critical*

# Physical Concerns

- Lots of power, small space
- Whole Room vs. Spot
- Containment
  - Easy to prototype!
- Long term?

# CyberInfrastructure days

- October 24-25
- Open to the MSU community to learn and collaborate about MSU, national CI resources
- http://tech.msu.edu/CI-Days

# New Compute Cluster

- 2x Intel Xeon Ivy Bridge E5-2670v2 (2.5 GHz, 20 cores total)
- 500 GB HDD
- FDR (56 gigabit) network

| Type | Mem (GB) | Accelerators | Total Performance (GigaFLOPS) | Cost |
|---|---|---|---|---|
| Base | 64 | | 400 | $3,805 |
| Big Mem | 256 | | 400 | $5,339 |
| Bigger Mem | 512 | | 400 | ~$12,000 |
| GPU | 128 | 2x NVIDIA K20 | 2400 | $7,900 |
| Phi | 128 | 2x Phi 5110p | 2400 | $9,043 |

# Conclusion

Questions?

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