

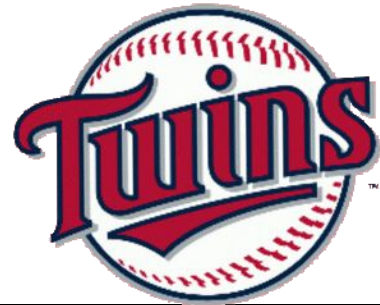
David on Campus: Building a Campus Computing Center

Carl Lundstedt & Derek Weitzel

~~Baseball~~
My type of basketball is
about how to create space,
how to maneuver, how to
get your shot off

~~Hakeem Olajuwon~~

~~David R Swanson (?)~~



Setting the Stage: 1999, When Beige and Blue Ruled the World

Dave returned to Nebraska from Naval Research Lab

PCs rule the desktop

IBM, DEC, SGI rule the data center

Beowulf project is a mere 5 years old, Linux
not yet 10 years old

RCF starts with a single SGI machine and two students

RCF came to a crossroads – How do they move forward?

HOMESTEAD



Origin 2000

32 cores

8 GB of ram

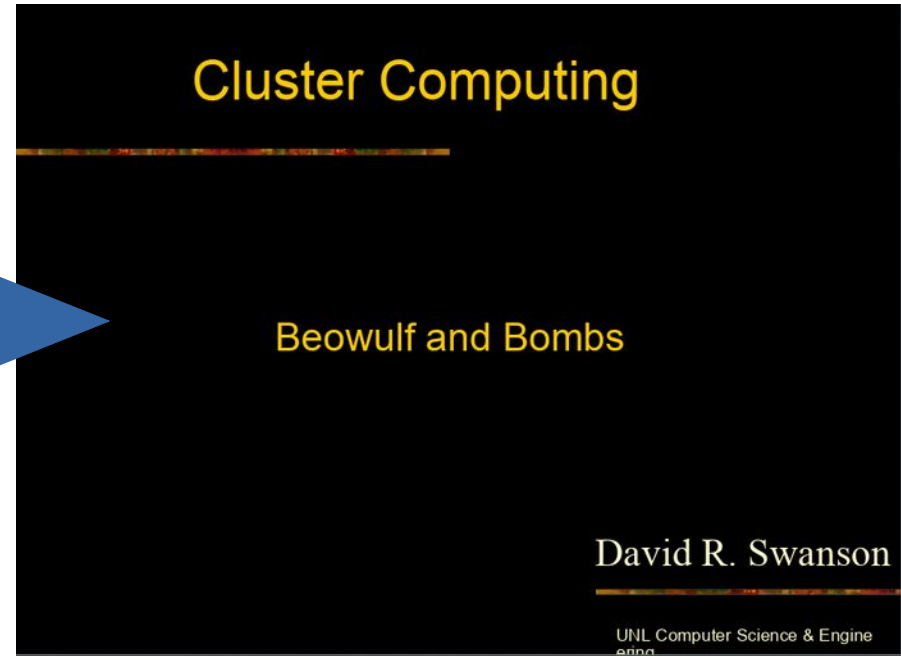
300 GB of disk




Decision time: the Dave method



- **Gather information**
 - Ask the experts
 - Ask your users
 - **Ask your staff**
- **Make a Decision**
- **Make your case**
 - To users
 - To the staff
 - To management
- **Incorporate new info & iterate**
- **Trust your staff (but verify)**



The Conundrum: More SGI or Beowulf?

SGI: Pro	SGI: Con
THE Industry standard	
Plug and play	
Enjoyed the Support of UNL management	
64 bit out of box	

Beowulf: Pro	Beowulf: Con
	Unproven
	Labor intensive
	No institutional experience
	Push back from UNL

Presenting BUGEATER!

A Beowulf testbed

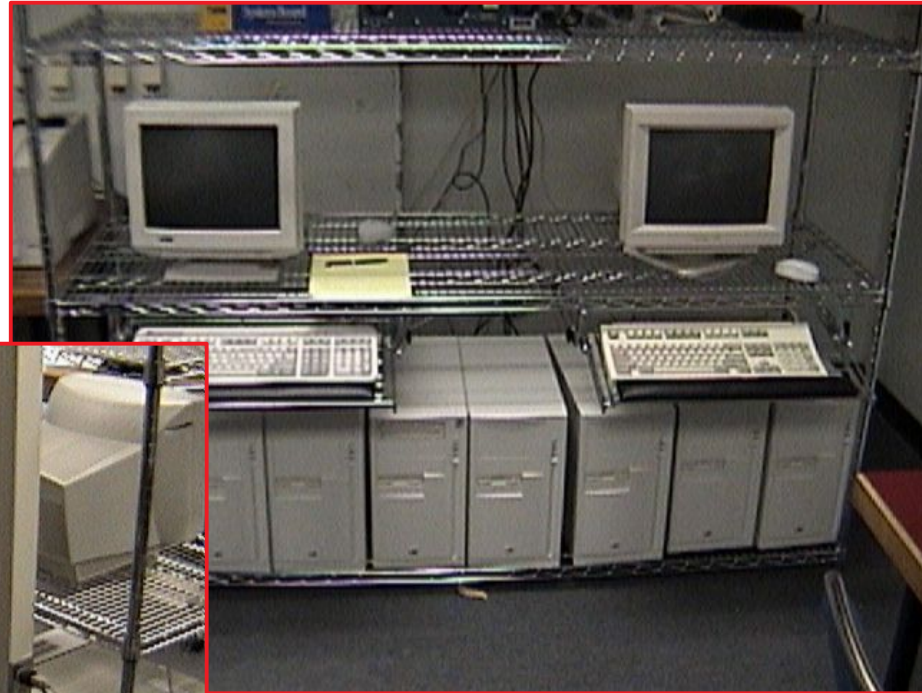
Dual PIII 800MHz

512 MB RAM

20 GB HDD

RedHat LINUX

Fast Ethernet



PrairieFire: DECISION MADE!

PrairieFire debuts on the SC TOP 500 and was once a top 10 performing cluster.

First Beowulf cluster to utilized 128 Nodes.

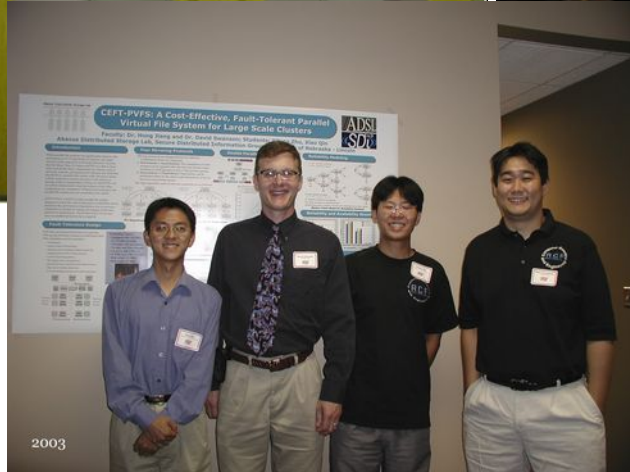
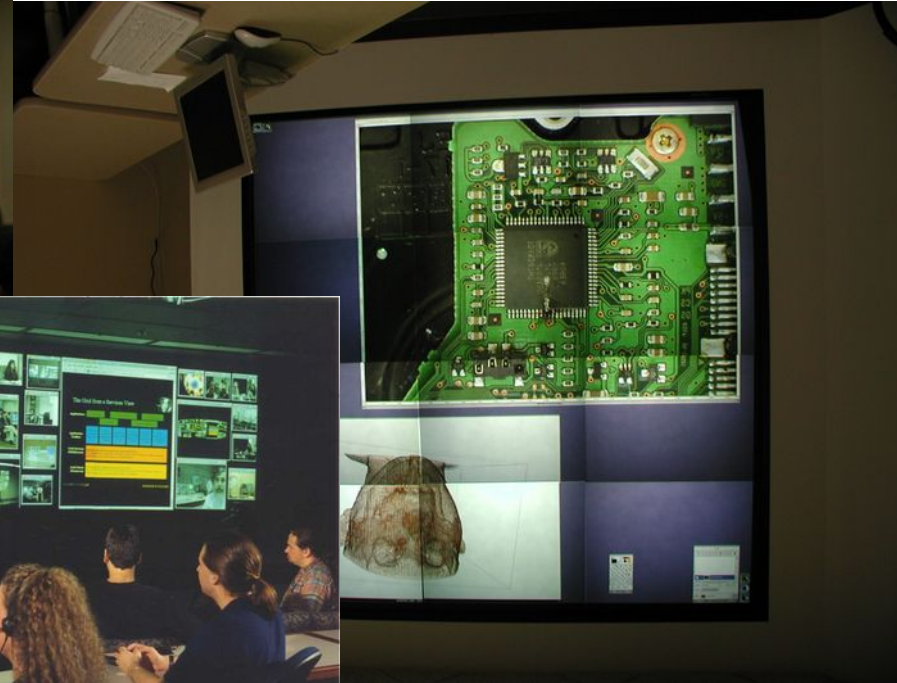
Vindicated Dave's choice

Local news takes notice of big things happening

<video Clip>



RCF and the Miller and Paine Days



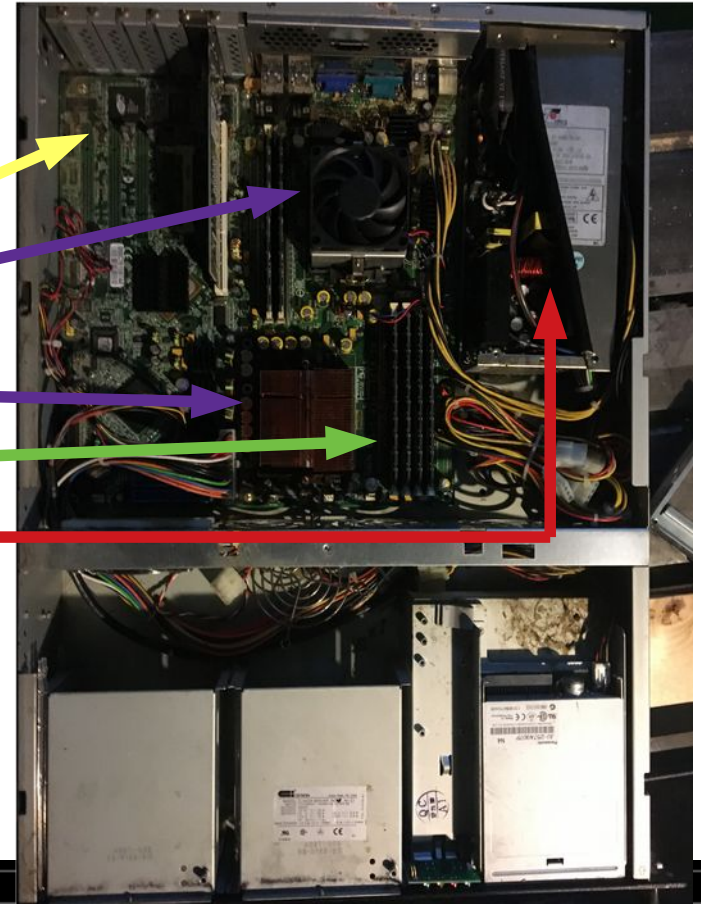
PrairieFire: 32-bit (MP) → 64-bit (Opterons) The Upgrade

How does someone upgrade a cluster?
How do you move from 32-bit to 64-bit?
How do you keep it affordable?

Ask you staff if they'd like to rebuild each machine
of course!

New Processors which means
New Motherboard which means
New Ram which all requires
New Power Supply

This did lead to one of Dave's rare marketing misteps.



2004: Enter the Dragon(s)

Physics hires TWO new faculty in the area of HEP, Ken Bloom and Aaron Dominguez

Ken and Aaron meet Dave in Iowa at a computing conference and discuss the possibility of building a CMS computing facility at UNL

Ken, Aaron and Dave write a proposal and Dave is listed as PI. It's the only T2 proposal without a physicist as PI.

In Nov 2005 CMS comes to the RCF facility for a site visit. They were very impressed with Dave's operation. UNL is awarded the task of hosting a USCMS Tier-2.



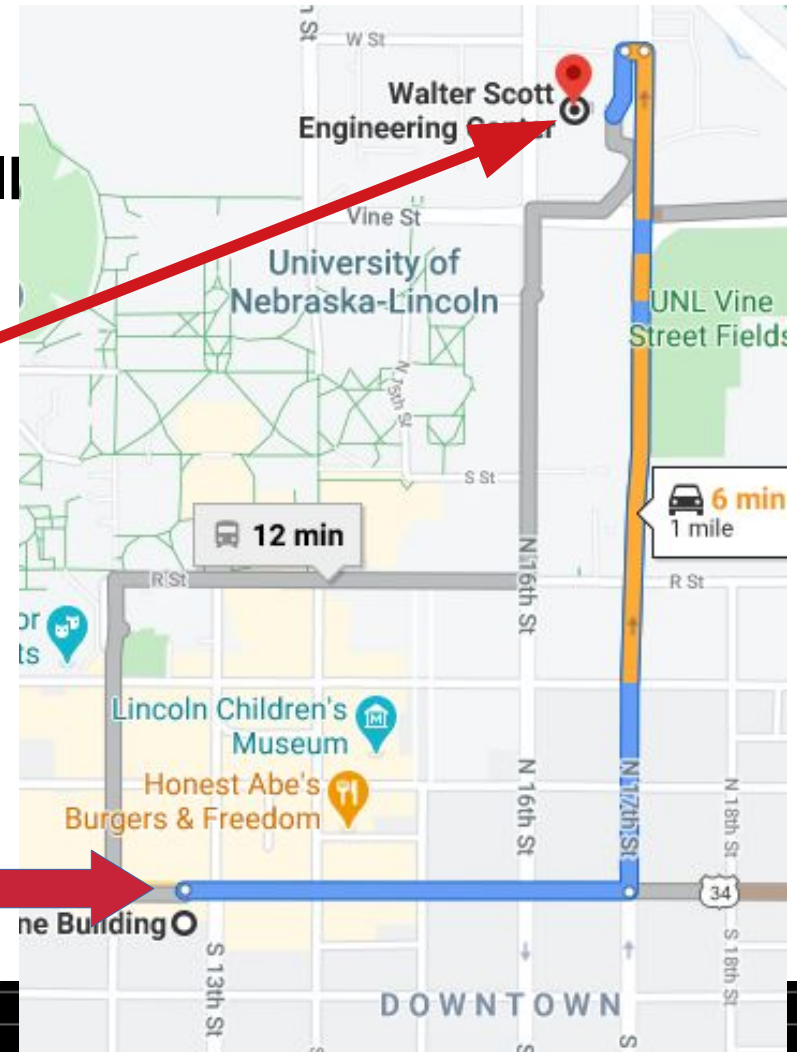
2006: Go Big Red!

256 core of AMD processors, 40TB of bulk storage and 1Gbps uplink to the world

Housed a mile from the RCF offices



RCF's Home



Movin' On Up...to the South Side (of the Stadium)



Meanwhile, in Omaha...

Peter Kiewit Institute



From left, Victor Perez and Barbara Carlson of Panasas Inc. present a check to Dick Holland, lead donor to the Holland Computing Center, Walter Scott Jr. and University of Nebraska President J.B. Milliken to initiate "The Panasas Scholarship Fund in Memory of Mary Holland."

Holland Computing Center Opens to global audience

Center (GISC), within walking distance of The Peter Kiewit Institute (PKI), "will definitely" put *Firefly* to good use. "A lot of modeling there has typically been outsourced," he said. "Going forward, there won't be any reason to look outside. It's right here."

The Holland Computing Center is named for Richard and Mary Holland, the principal donors. The name *Firefly* indicates that the nodes and machines in a super-computing cluster have distinct features but work together to converse with the whole, much the same as the rhythmic bursts of light from fireflies allow them to communicate with and within a larger group.

Attendees received a brief glimpse of *Firefly*'s hardware and capability from David Pratt, Ph.D., chief scientist, fellow and vice president for technol-



“They may be giving me Omaha...”



RCF then became the Holland Computing Center (HCC)

Sandhills, Tusker, Rhino and Cranes...

RCF/HCC continued to provide general computing resources to NU even as we expanded staff and extended to the other campuses

Resource Name	Claim to Fame	Debut Year	Retired Year
Merritt (Lincoln)	512 GB RAM	2007	2013
Sandhills (Lincoln)	Community Cluster	2011	~2016
Tusker (Omaha)	98 Node	2012	~2017**
Crane (Omaha)		2013	**
Attic (Lincoln)	1PB LT Storage	2014	**
Anvil (Omaha)	OpenStack	2015	**
Crane-OPA (Omaha)	Omni-path nodes	2016	**
/common (Omaha)	1PB universal userstorage	2017	**
Crane-GPU (Omaha)	GPU nodes	2019	**

Rhino – A U-haul and a Plan

Created in June 2019 using old Tusker and Sandhills nodes

Located in Walter Scott Engineering building: Use it while we can



Working philosophy

- Use what we buy
 - Depreciation is immediate
 - Leasing is still more expensive (for now)
- Share what we aren't using
 - Share opportunistically – retain local ownership
 - Consume opportunistically – there is more to gain!
 - Collaborators, not just consumers
 - Greater good vs. squandered opportunity

2019's CPU Usage by Departments

Department	CPU Hours: Total
1 [UNL] Chemistry	32,350,065
2 [UNL] Mechanical and Materials Engineering	19,091,323
3 [UNL] Arts and Sciences	16,295,027
4 [UNL] Physics and Astronomy	16,068,962
5 [UNL] Chemical and Biomolecular Engineering	14,247,323
6 [UNL] Center for Biotechnology	11,136,059
7 [UNL] Computer Science and Engineering	3,974,968
8 [UNMC] Pharmaceutical Science	3,065,034
9 [UNO] Physics	1,781,838
10 [UNL] Educational Psychology	1,695,276

Outreach and Training



 software carpentry

PIVOT

<https://hcc.unl.edu/past-events>



The Staff of 2019

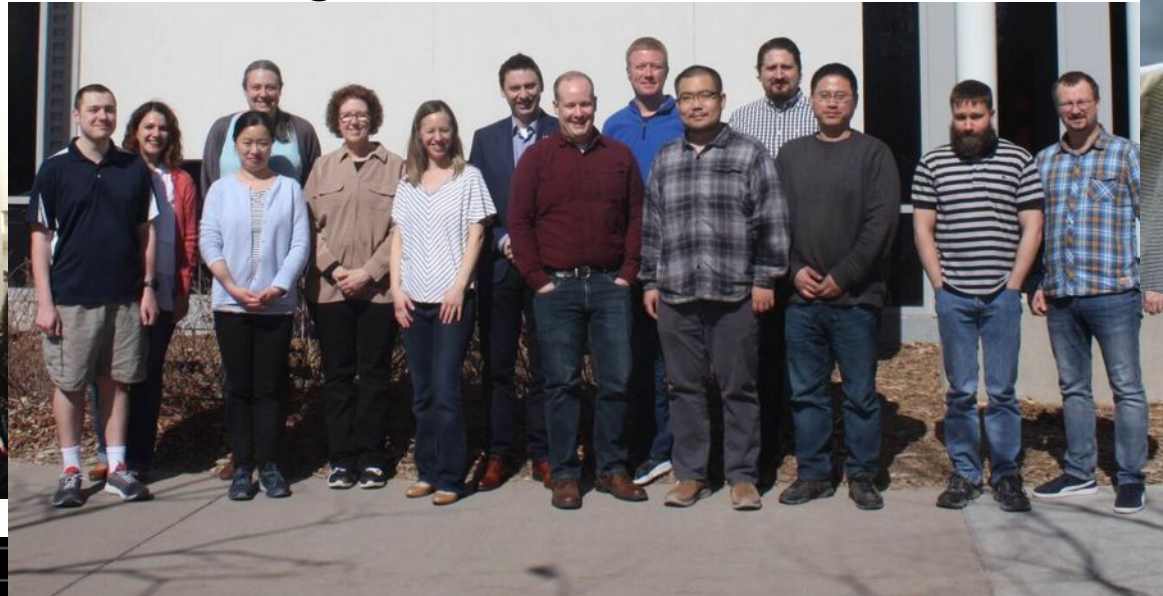
7 System Administrators

6 Application Specialists

2 Full time research personnel

Former students and staff have gone on to:

Apple
Google
Aspen
Argonne



20 years ago Dave was wiring together unremarkable beige boxes and making them do things no one box could do alone. Even though Garhan and I had had to forbid him from touching any stray keyboards in the machine room after one of his well meaning key presses deleted 7 Terabytes of data, Dave remained a master cluster builder.

He no longer worked with beige boxes, rather; he worked with geniuses, misfits, wild-eyed undergraduates and cynical system administrators. Dave connected us all together and allowed us to do things none of us could do alone. In the vocabulary of our profession I would say Dave was our kernel, our network fabric, our proxy server.

In layman's terms David Swanson was our heart and our soul.

We were incredibly blessed to have Dave as our director, our mentor, our colleague and our friend.