BETTER THAN REMOVING YOUR APPENDIX WITH A SPORK: DEVELOPING FACULTY RESEARCH PARTNERSHIPS

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PURDUE UNIVERSITY

PURDUE'S IT MISSION

Implement novel business models for the acquisition of computational infrastructure to support research

2007 at PURDUE: BEFORE CLUSTER PROGRAM

- Faculty purchase computers in a variety of platforms from multiple vendors
- Research computers housed in closets, offices, labs and other spaces
- Grad students support computers rather than focus on research
- Inefficient utility usage
- Wasted idle time cycles
- Redundant infrastructures for scattered sites

2008: STEELE
A New, Collaborative Model

- IT negotiates “bulk” research computer purchase
- Existing central IT budget funds investment
- Researchers buy nodes as needed/access other, idle nodes as available
- Infrastructure/support provided centrally at no cost to researchers
- Money-back guarantee

“I’d rather remove my appendix with a spork than let you people run my research computers.”

2008: STEELE
Results

- 12 early adopters increase to over 60 faculty
- 1,294 nodes purchased in 4 rounds
  - $600 savings per node (40%)
  - Collective institutional savings more than $750K
- Ranking: 104 in Top 500; 3 in Big Ten
- No one acted on money-back guarantee

“IT completely took care of the purchasing, the negotiation with vendors, the installation. They completely maintain the cluster so my graduate students can be doing what they, and I, want them to be doing, which is research.”

— Ashlie Martini
associate professor of mechanical engineering,
University of California Merced

“In a time when you really need it, you can get what you paid for and possibly more, when available. And when you don’t need it, you share with others so they can benefit from the community investment.”

— Gerhard Klimeck
professor of electrical and computer engineering
and Reilly Director of the Center for Predictive Materials and Devices
(c-PRIMED) and the Network for Computational Nanotechnology (NCN)

SIX COMMUNITY CLUSTERS

STEELE

$27.02 PER GFLOP

7,216 cores

Installed May 2008

Retired Nov. 2013

COATES

$21.84 PER GFLOP

8,032 cores

Installed July 2009

Retired Sept. 2014

ROSSMANN

$16.58 PER GFLOP

11,088 cores

Installed Sept. 2010

17 departments

37 faculty

HANSEN

$13.28 PER GFLOP

9,120 cores

Installed Sept. 2011

13 departments

26 faculty

CARTER

$10.52 PER GFLOP

10,368 cores

Installed April 2012

26 departments

60 faculty

#282 on June 2014 Top 500

CONTE

$2.86 PER GFLOP

9,280 Xeon cores
(69,600 Xeon Phi cores)

Installed August 2013

20 departments

51 faculty (as of Aug. 2014)

#39 on June 2014 Top 500

2013: CONTE

- Intel/HP offer next generation chips with Phi accelerators
- Max speed 943.38 teraflops
- Peak performance 1.342 petaflops
- 580 nodes
- 78,880 processing cores (the most in a Purdue cluster to date)
- Ranked 28th in TOP500 (June 2013 rankings)

"We've been running things on the Conte cluster that would have taken months to run in a day. It's been a huge enabling technology for us."

— Charles Bouman

Showalter Professor of Electrical and Computer Engineering and Biomedical Engineering and co-director of the Purdue Magnetic Resonance Imaging (MRI) Facility

"For some of the tasks that we're looking at, just running on single cores we estimated that my students would need a decade to graduate to run all their simulations. That's why we're very eager and dedicated users of high-performance computing clusters like Conte."

— Peter Bermel

assistant professor of electrical and computer engineering

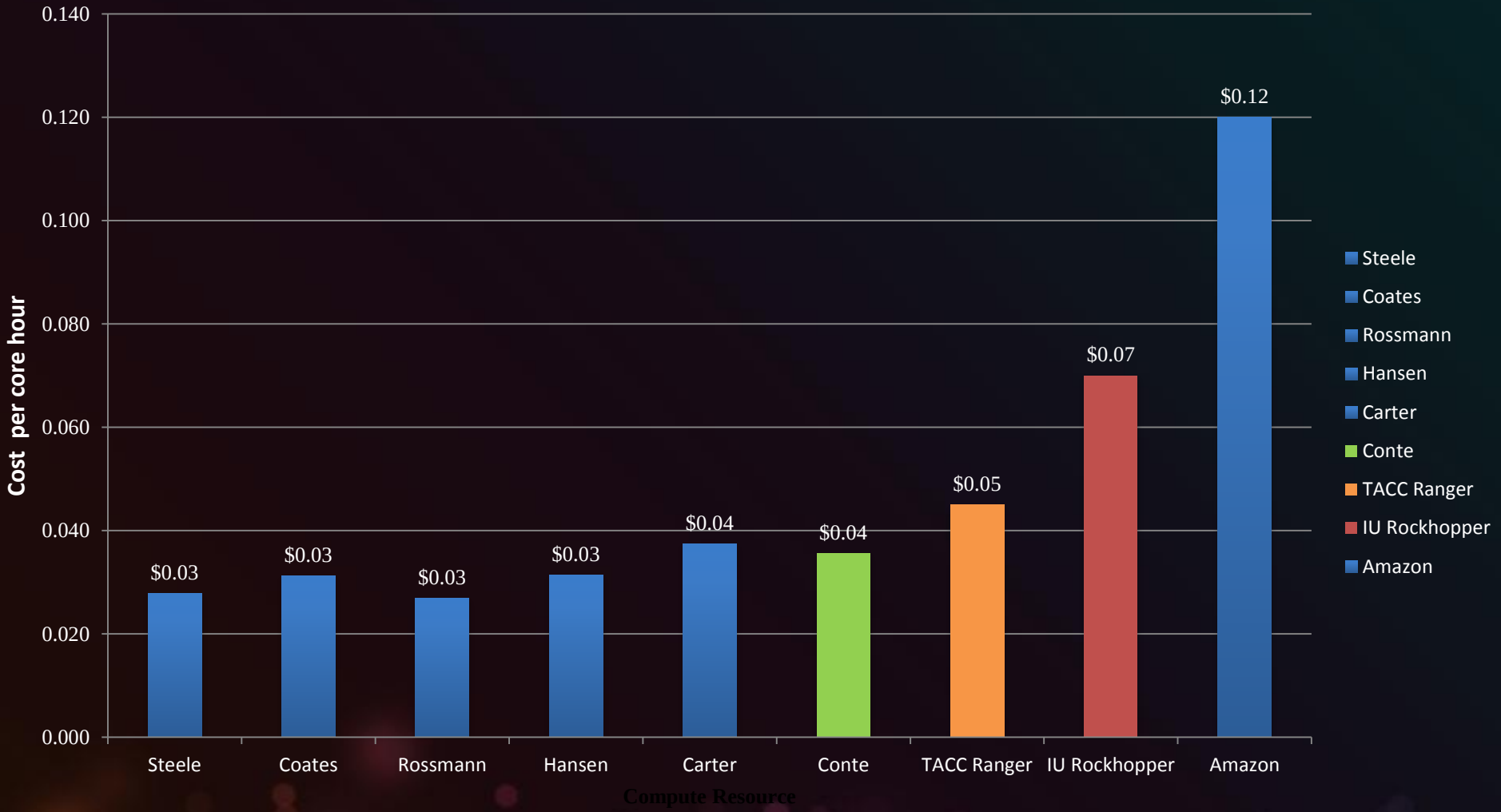
NUMBER OF PRINCIPAL INVESTIGATORS

TOP TEN CAMPUS SUPERCOMPUTERS IN THE NATION

June 2014 Top 500

U.S. CAMPUS RANKING	UNIVERSITY	NAME	WORLD RANKING
1	PURDUE	CONTE	39
2	RENSSELAER POLYTECHNIC INSTITUTE	AMOS	43
3	INDIANA UNIVERSITY	BIG RED II	62
4	CLEMSON UNIVERSITY	PALMETTO 2	66
5	USC	HPCC	71
6	TEXAS A & M	NEUMANN	110
7	TEXAS A & M	ADA	121
8	MISSISSIPI STATE	SHADOW	185
9	UNIVERSITY OF ROCHESTER	BLUEGENE/Q	276
10	PURDUE	CARTER	282

NORMALIZED PER CORE-HOUR COST



OUR ACADEMIC PARTNERS

By Department	Cores
Physics	9,832
Electrical and Computer Eng.	9,816
Mechanical Engineering	7,008
Aeronautics and Astronautics	5,048
Earth & Atmospheric Sciences	3,632
Chemistry	1,936
Materials Engineering	1,504
Chemical Engineering	1,144
Biological Sciences	1,104
Med. Chem./Molecular Pharm.	1,104
Mathematics	720
Biomedical Engineering	640
Statistics	520
Civil Engineering	448
Nuclear Engineering	432
Ag. and Biological Engineering	416

By Department	Cores
Industrial and Physical Pharmacy	384
Commercial Partners	304
Computer Science	280
College of Agriculture	256
Agronomy	240
Forestry and Natural Resources	64
Computer and Information Tech.	48
Health Sciences	48
Industrial Engineering	48
Brian Lamb School of Comm.	40
Animal Sciences	32
Computer Graphics Technology	32
Horticulture/Landscape Arch.	32
Management	24
Agricultural Economics	16
Entomology	16

MANAGEMENT, NOT MAGIC

- Develop relationship with Sponsored Programs
- Cultivate the early adopters
- Respect your project managers
- Establish operational credibility in central IT
  - Do it—take the risk
  - Do it well
- Flex the business model
- Don’t ask for money

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