

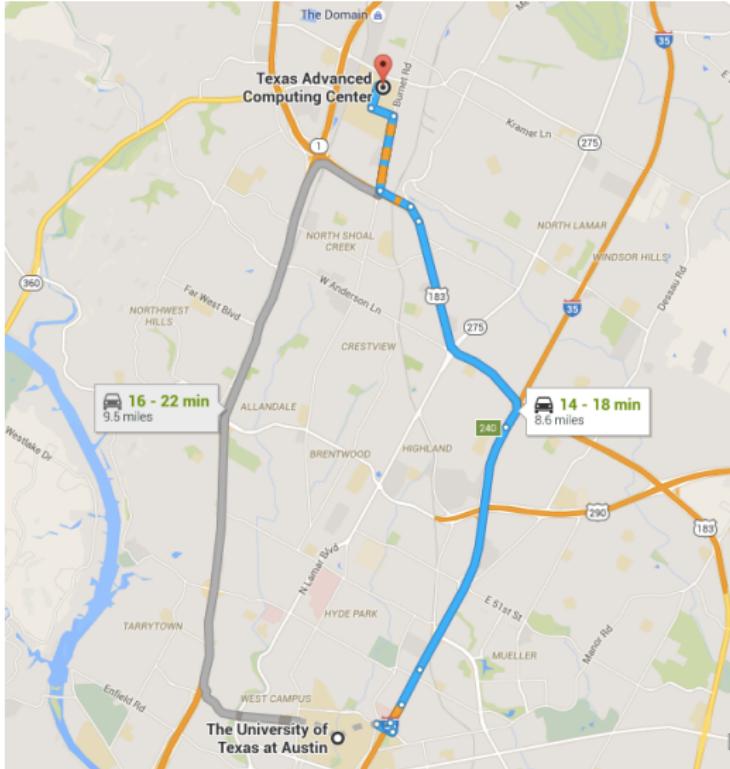
# Overview of TACC

Fall 2023

last formatted: February 6, 2024

Your instructors work at the  
Texas Advanced Computing Center

# So where is TACC?



# How do you get to TACC?



# Pickle Campus

Formerly Balcones Research Center,  
location of some of the best wildflowers in Austin.



# James Jarrell ‘Jake’ Pickle

- 1913–2005, congressman  
1963–1995
- US Navy during WW II
- important role in Civil Rights Act and Social Security reform



# TACC

- Started in 2001 with 10-ish people, now 160
- UT has had computing centers before; in 2001 TACC became independent unit: falls under VP for research.
- First major supercomputer in 2008: Ranger (top500 ranking: #7).
- Currently: Frontera, #21 in the world (highest ranking #5), and largest academic computer in the world; and Stampede2, #56 in the world (highest ranking #12).
- Other rankings: Stampede1: #6,

# TACC now

- 160-ish people, divided into Systems, High Performance Computing, Computational Biology, Big Data, Machine learning, Visualization, Outreach (and more) groups.
- A dozen machines-big-enough-to-have-a-name
- 1000 projects, 200 public data collections
- 30 web portals with 35k users
- new 10MWatt data center
- second new building in 10 years

# Our new building



# Supercomputers come and go

TACC has operated some of the leading supercomputers in the country / the world since 2008,

Want to guess how much a computer costs?

```
/poll "Cost of a supercomputer?" "Under $1M" "$1M--10M" "$10M--100M" "$100M--1B"
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How long it stays operational?

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/poll "Supercomputer lifetime?" "2 yrs" "5 yrs" "12 yrs"
```

# Frontera

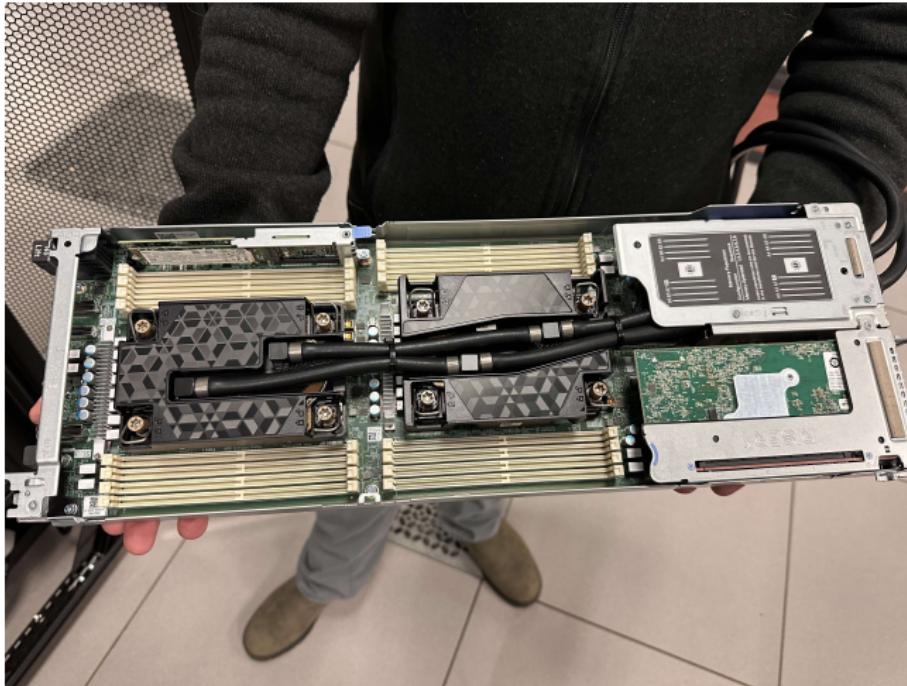
- Our currently most powerful machine, operational as of Right Now.
- Rough cost: \$60M for hardware, and similar for personnel.
- 91 racks with 8008 nodes; each node two 28-core Intel Cascade Lake processors.
- 60Pbyte of storage, of which 3Pbyte flash.
- Two GPU subclusters

# Frontera compute racks; front view



rightmost rack is open: note the water cooling cables

# Water-cooled node



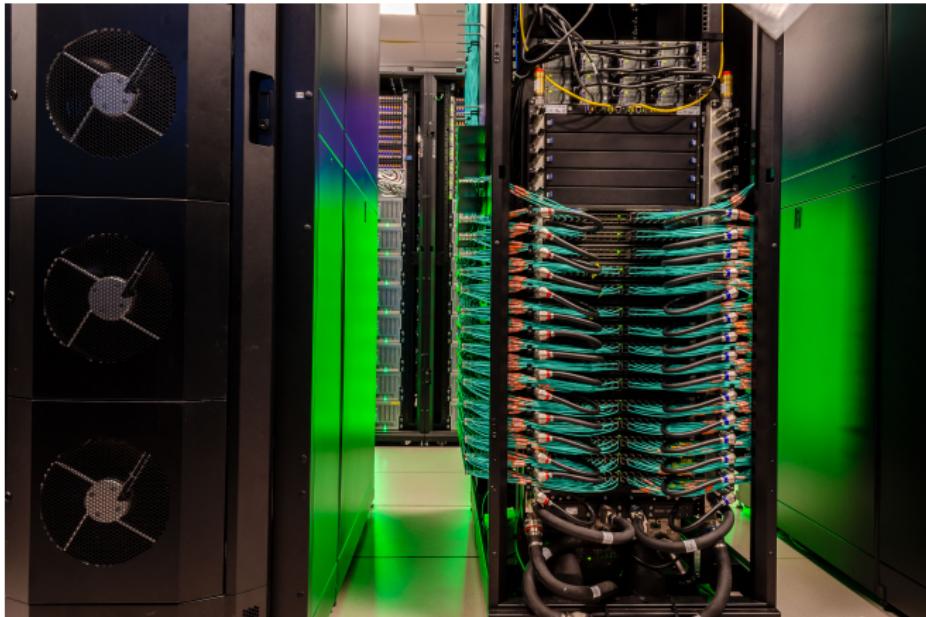
(actually a Sapphire Rapids node)

# Frontera compute racks; rear view



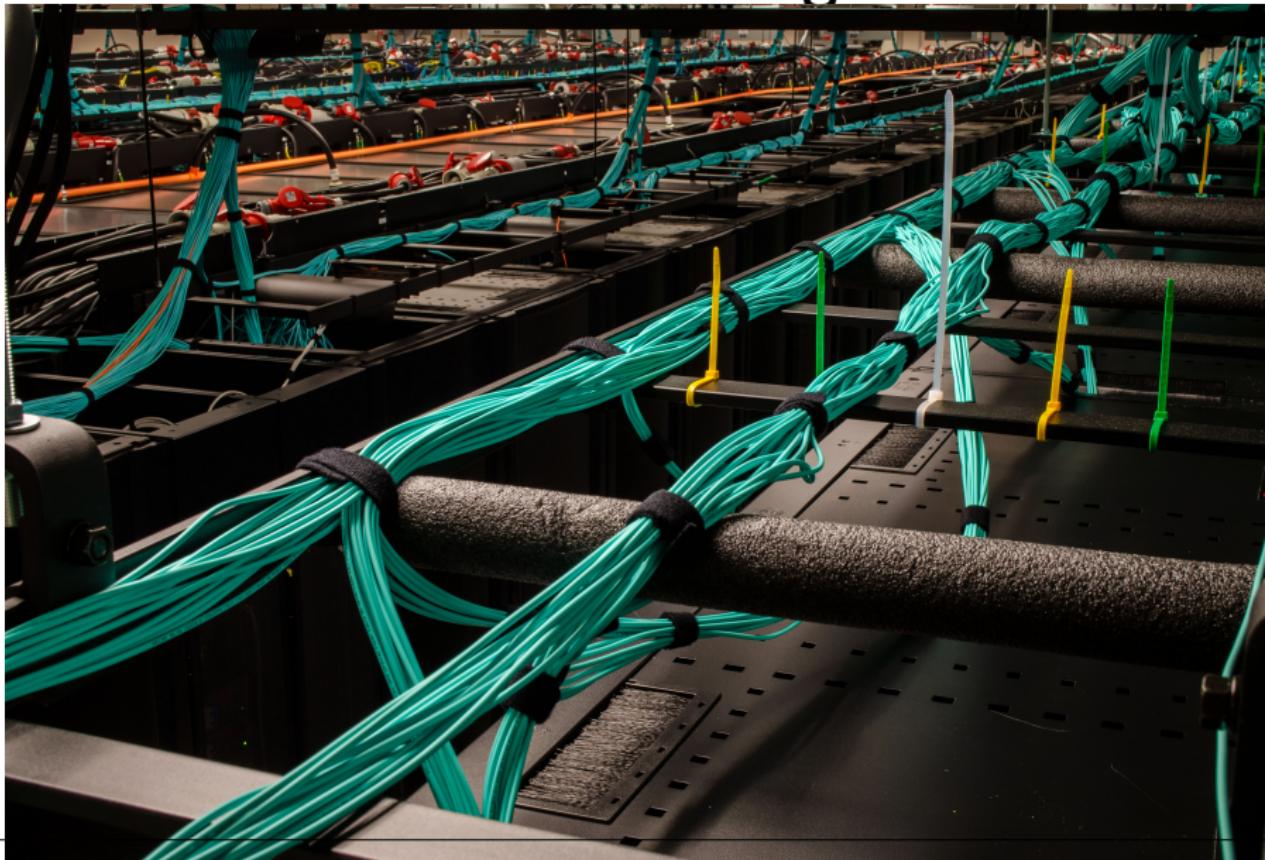
racks are approx 9ft tall; note blue network cables

# Frontera network switch

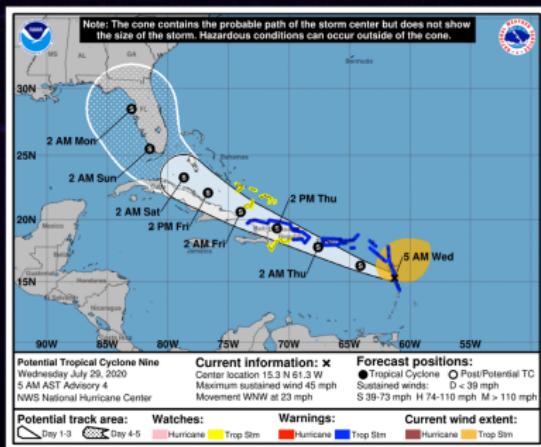
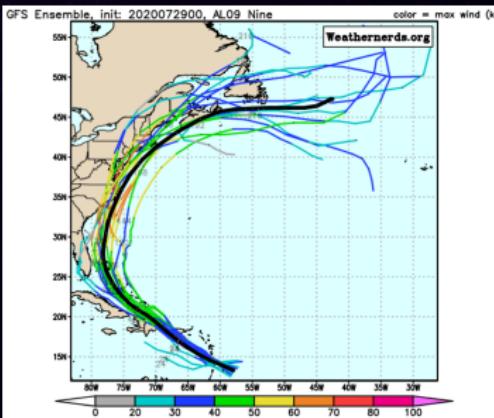


multiple network switches

# Overhead cabling

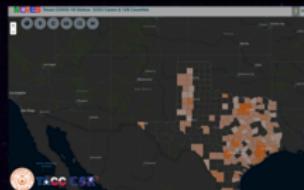


# WHAT IS FRONTERA IS DOING THIS WEEK IS THIS. . .

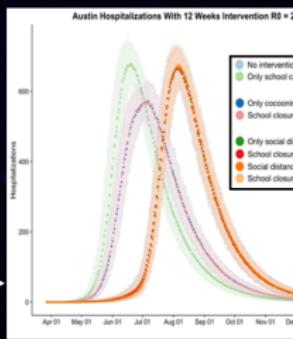
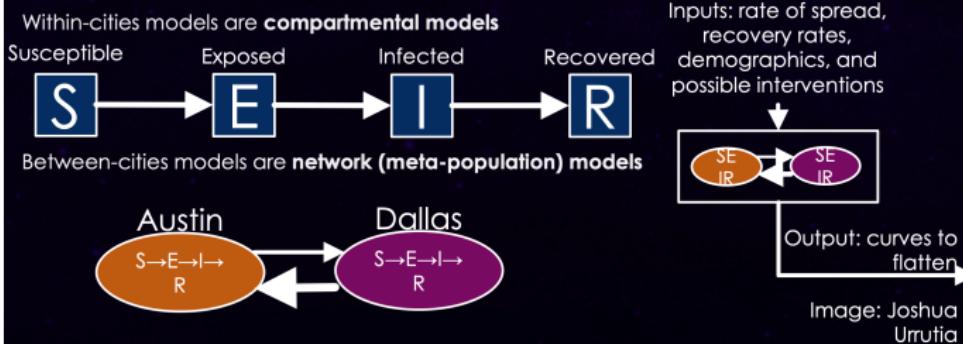


# COVID - EPIDEMIOLOGY

- ▶ Dr. Lauren Meyers, UT-Austin -- Epidemiology guiding Austin and Texas shelter-in-place orders
- ▶ County-by-county outbreak predictions covered on front page of New York Times, April 5<sup>th</sup>.



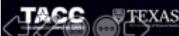
Emergency Responder  
courtesy Gordon W



# FIELDS OF SCIENCE

- ▶ From last allocation request

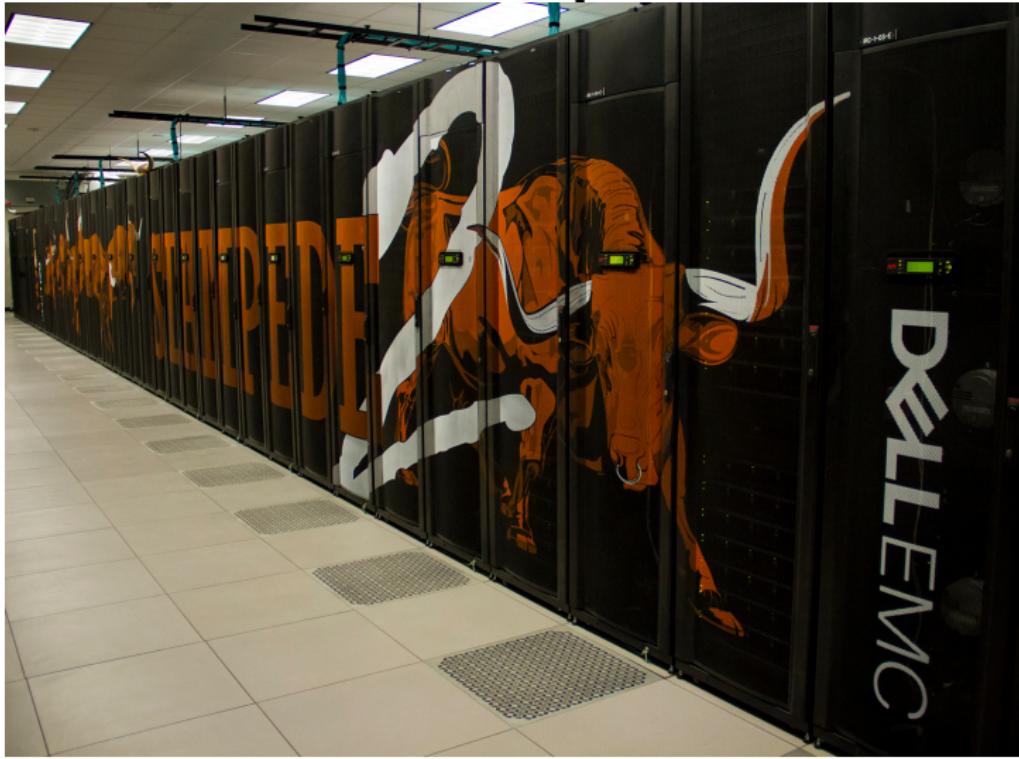
Extragalactic Astronomy and Cosmology	Materials Research	Nuclear Physics	Gravitational Physics	Astronomy and Sciences
Fluid, Particulate, and Hydraulic Systems	Biophysics	Chemistry	Molecular Biosciences	Condensed Matter Physics
		Physics	Solar Terrestrial Research	Stellar Astronomy and... Atmospheric Chemist...
		Elementary Particle Physics	Geophysics	Mathematical... Applied Materials... Atmospheric...
				Computational... Interfacial,... Physical...



# Stampede2

- Second biggest machine: cost \$30M
- 4000 nodes with Intel 'Knights Landing' Xeon phi; 1700 nodes with two Intel Skylake server processors; 200 nodes Intel Icelake
- 75 miles of cabling, up to 4.5Mwatt power
- TACC's machines are popular and reliable:  
Stampede1 was used by 5000 users, up 98% of the time, 8 million jobs over its lifetime.

# Stampede2



# Actually, stampede3



Stampede 2 is in the process of being turned off.

Stampede 3 is being opened up.

# Cabling coming down

Cables go from each, over the racks,  
coming down to the switches



# Lonestar5

Our late and not-all-that-lamented Cray



# Lonestar6

Our first AMD in a long time  
liquid-immersion cooled



('space coffin': before we wrapped it)

# Lonestar6

With beautiful artwork:



# Frontera-rtx

Single precision GPUs.



Note: the machine hangs in a bath of HEB-\$1/bottle-mineral oil  
(ok, slightly better than that)

# Oil



# Hikari

Solar powered



No longer with us, but: ...

# Solar panels

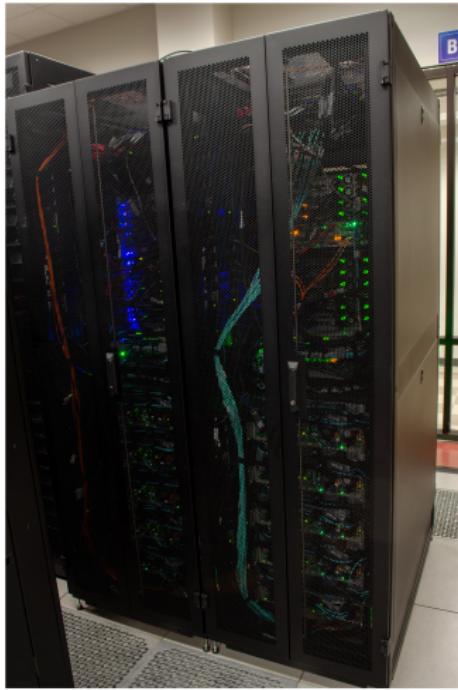


# Big data

- Stockyard: 7Pbyte spinning disc (shared between all clusters)
- Ranch: 100Pbyte of tape
- Corral3: 40Pbyte
- Rustler: hadoop cluster (up for refresh)

# Stockyard

Mass storage



# Corral

Large spinning disc



# Clouds

- Rodeo: mostly internal use
- Chameleon: cloud research
- Jetstream: for educational use

# Visualization lab (POB)

Our graphics people can help you understand your results (and sell your research) through high quality visualization.



# Small display in the TACC building



# We're very hands-on



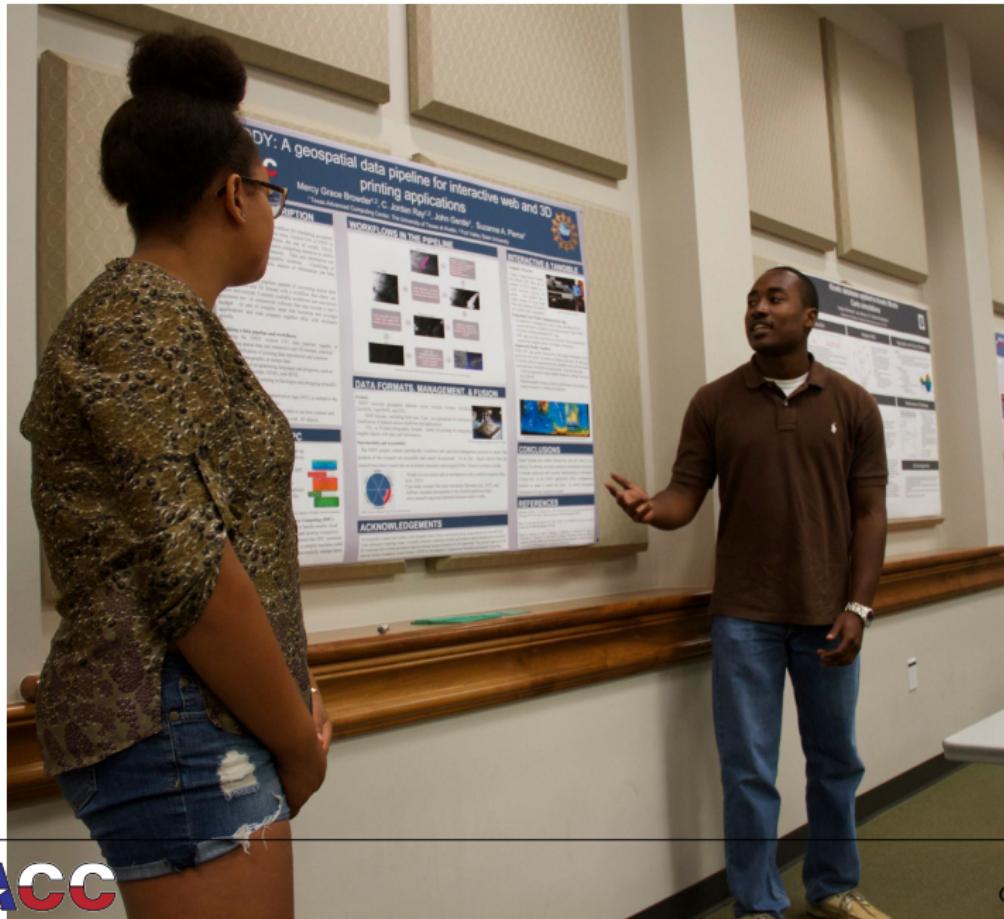
# We're very hands-on



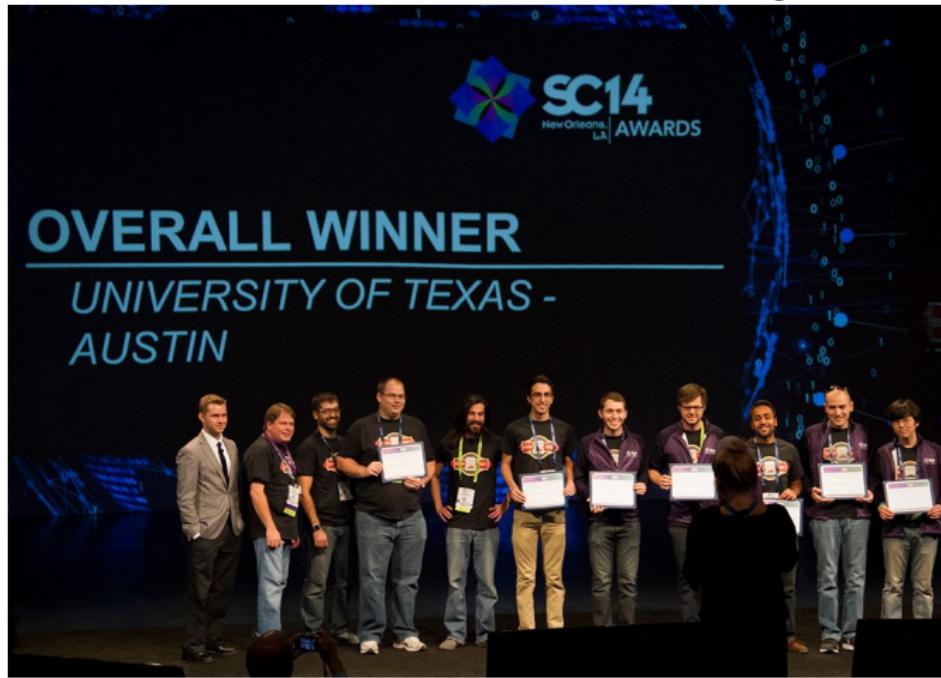
# We're very hands-on



# Student activities: REU



# Student cluster competition



# Outreach: Code at TACC



# We share



# We keep growing

Horizon in, we hope, FY25:



Artist Rendering of Switch Data Centers at Dusk

# Bridging Frontera and Horizon: Vista

# Credits

Most pictures: Jorge Salazar, TACC media group