

Affiliated Institutions



NOAA-Cooperative Remote Sensing
Science and Technology Center

NOAA|CREST



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Geospatial Technologies and Environmental CyberInfrastructure (GeoTECI) Lab

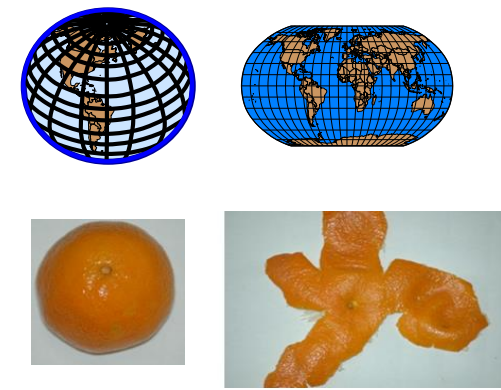
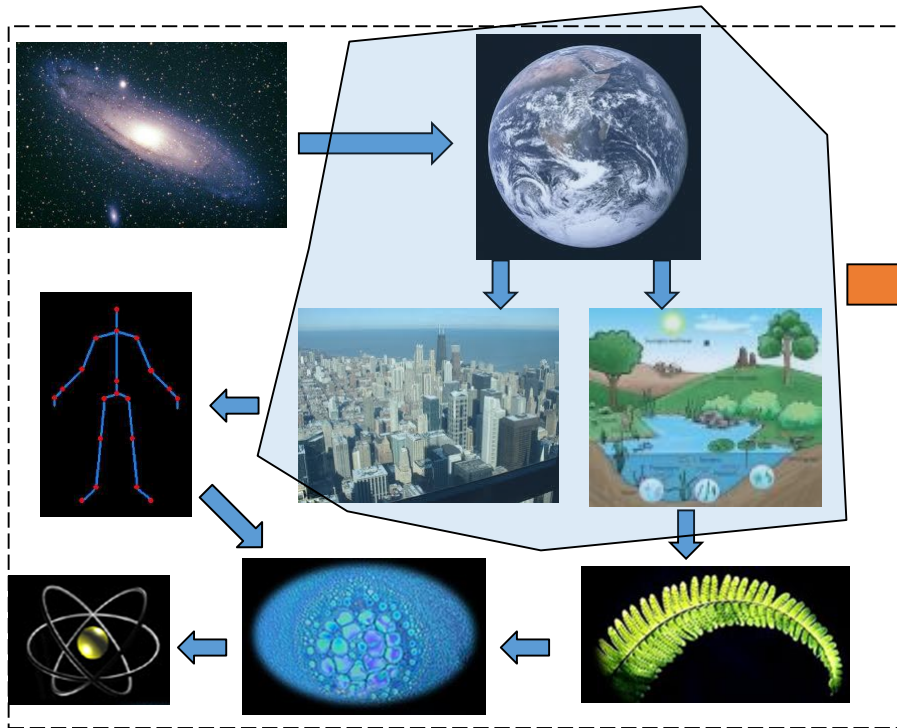
Dr. Jianting Zhang

Department of Computer Science
The City College of New York

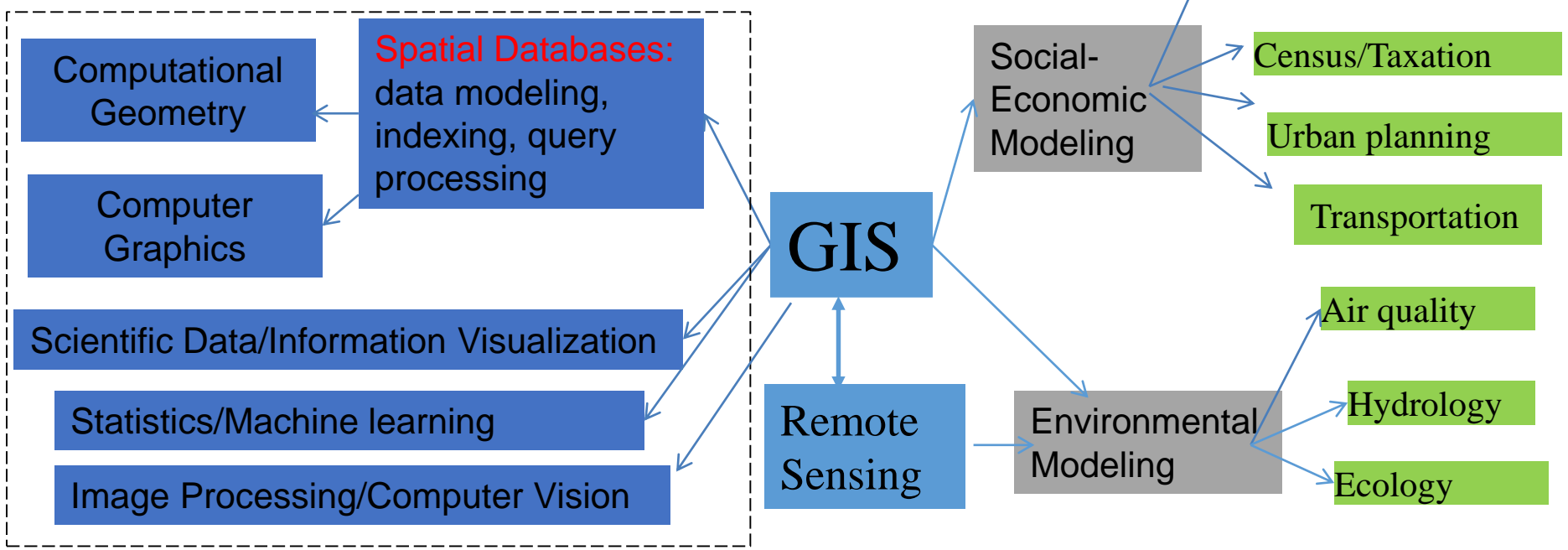
<http://www-cs.ccny.cuny.edu/~jzhang/>

Collaborating Institutions





Geographical Information System





NOAA-Cooperative Remote Sensing Science and Technology Center

NOAA/CREST



U.S. DEPARTMENT OF ENERGY

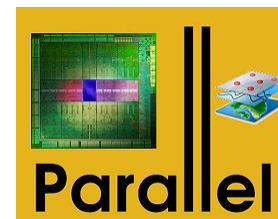
Office of Science



Climate Change Science Institute AT OAK RIDGE NATIONAL LABORATORY



National Science Foundation WHERE DISCOVERIES BEGIN



UC DAVIS UNIVERSITY OF CALIFORNIA

The US Long Term Ecological Research Network



The University of New Mexico



NCAR is sponsored by the National Science Foundation



LREIS

Geography GIS Applications Remote Sensing



NANJING UNIVERSITY

Ecological Informatics



Environmental sciences



Computer Science • Spatial Databases • Data Mining

the university of OKLAHOMA

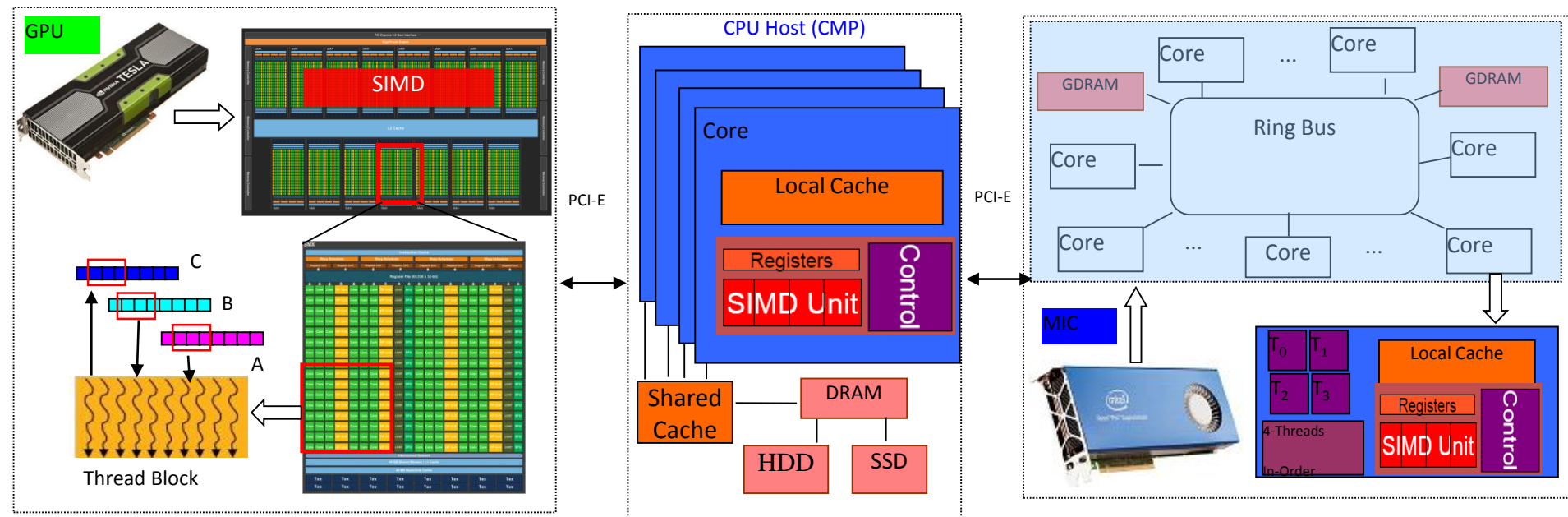
Computer Science

Big Geospatial Data Challenges

- **Event** Locations, trajectories and O-D data
 - E.g., Taxi trip records (GPS traces or O-D locations)
 - **0.5 million** in NYC (medallion taxi cab only) and **1.2 million** in Beijing **per day**
 - From O-D locations to trajectories to frequent patterns
- **Satellite**: e.g., from GOES to GOES-R (2015/2016) [\$11B]
 - http://www.goes-r.gov/downloads/GOES-R-Tri-10-06-09_v7.pdf
 - **Spectral (3X)*spatial (4X)* temporal (5X)=60X**
 - $2\text{km} \times 2\text{km} \times 5\text{min} \times 16\text{bands} \rightarrow (360 \times 60) \times (180 \times 60) \times (12 \times 24) \times 16 \sim \mathbf{1+ trillion pixels per day}$
 - **Derived thematic data products (vector)**
 - <http://www.goes-r.gov/products/baseline.html>
 - <http://www.goes-r.gov/products/option2.html>
- **Species** distributions
 - E.g. **400+ million** occurrence records (GBIF)
 - E.g. **717,057** polygons and 78,929,697 vertices for **4148** birds distribution data (NatureServe)



Cloud computing+MapReduce+Hadoop



16 Intel Sandy Bridge CPU cores+ 128GB RAM + 8TB disk + GTX TITAN + Xeon Phi 3120A ~ \$9,994



ASCI Red: 1997 First 1 Teraflops (sustained) system with 9298 Intel Pentium II Xeon processors (in 72 Cabinets)

Location	Sandia National Laboratories, United States
Power	850 kW
Operating system	Cougaar / Linux
Space	1,600 sq ft (150 m ²) ^[3]
Memory	1212 gigabytes
Speed	1.3 teraflops (peak) ^[1]
Ranking	TOP500: 1, June 2000 ^[4]



- Feb. 2013
- 7.1 billion transistors (551mm²)
- 2,688 processors
- 4.5 TFLOPS SP and 1.3 TFLOPS DP
- Max bandwidth 288.4 GB/s
- PCI-E peripheral device
- 250 W (17.98 GFLOPS/W -SP)
- Suggested retail price: \$999

What can we do today using a device that is more powerful than ASCI Red 16 years ago?

GeoTECI@CCNY

Award Abstract #1302423

III: Medium: Collaborative Research: Spatial Data and Trajectory Data Management on GPUs

\$449,845/4yr (08/01/2013-07/31/2017)

• HIGHEST-DB

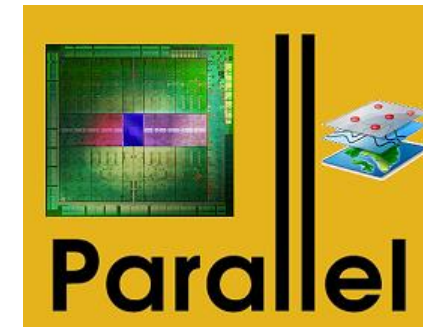
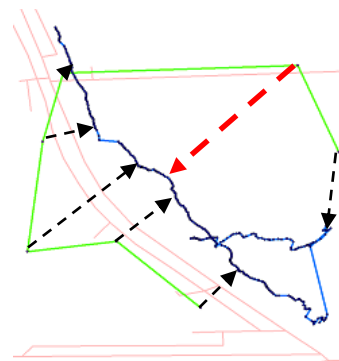
- High-performance Graphics units based Engine for Spatial-Temporal data
- Spatial and Spatiotemporal indexing, query processing and optimization

• Trajectory data management on GPUs

- Segmentation/simplification/compression/Aggregation/Warehousing
- Map matching with road networks
- Data mining (moving cluster, convoy, swarm...)

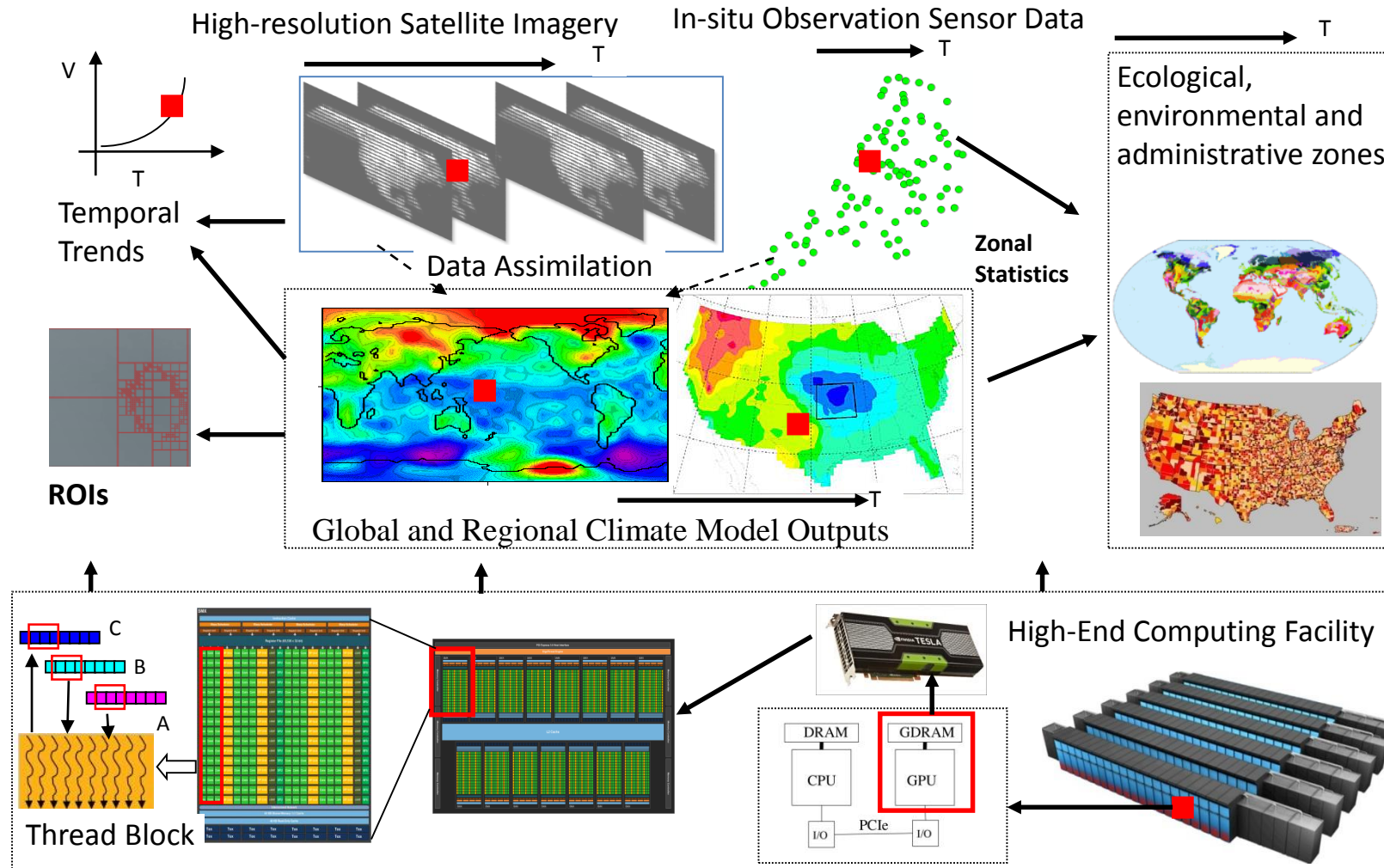


... when yellow cabs, green cabs and MTA buses meet with multi-core CPUs, GPUs and MICs in NYC ...



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... when GOES-R satellites, extratropical cyclones and hummingbirds meet with TITAN ...



...building a highly-configurable experimental computing environment for innovative BigData technologies...

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