Center for Experimental Research in Computer Systems

Technologies for Large-scale Clouds

OpenCirrus Meeting – Sept. 2010

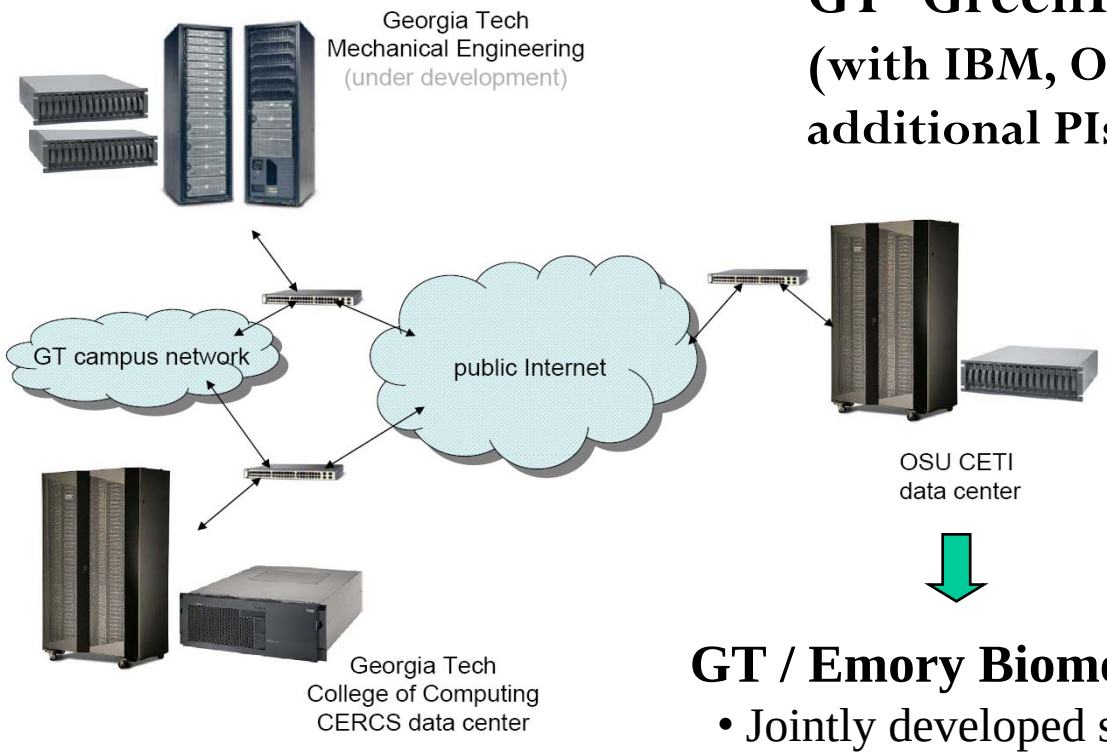
Georgia Institute of Technology

Karsten Schwan

Ada Gavrilovska, Greg Eisenhauer, Chad Huneycutt, Matt Wolf

IUCRCERCS NSF Industry University Co-operative Research Center

Clouds@GT - Overview



GT `GreenIT' Private Cloud
(with IBM, OSISoft, HP, VMWare, additional PIs in ECE and ME)

OpenCirrus
(with HP, Intel, Yahoo)
Hadoop/Fawn
HDFS
Large-scale Management

GT / Emory Biomedical Research Cloud
- Jointly developed system/middleware stack
- Joint hardware, networking investments

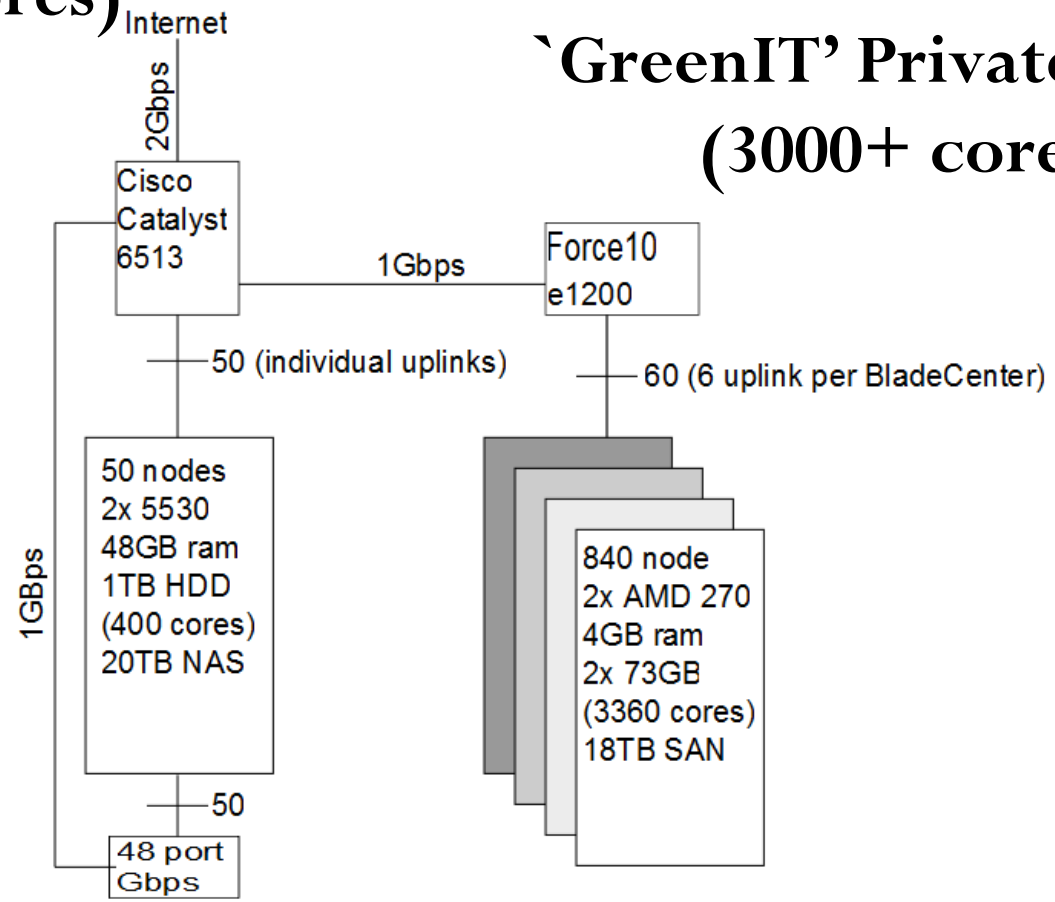
Cloud@home (with Motorola, Intel)

Service Delivery (e.g., Educational Services) (joint with Ohio State)

GT OpenCirrus Clusters

`NextGen' Servers
(=> 1000 cores)

`GreenIT' Private Cloud
(3000+ cores)

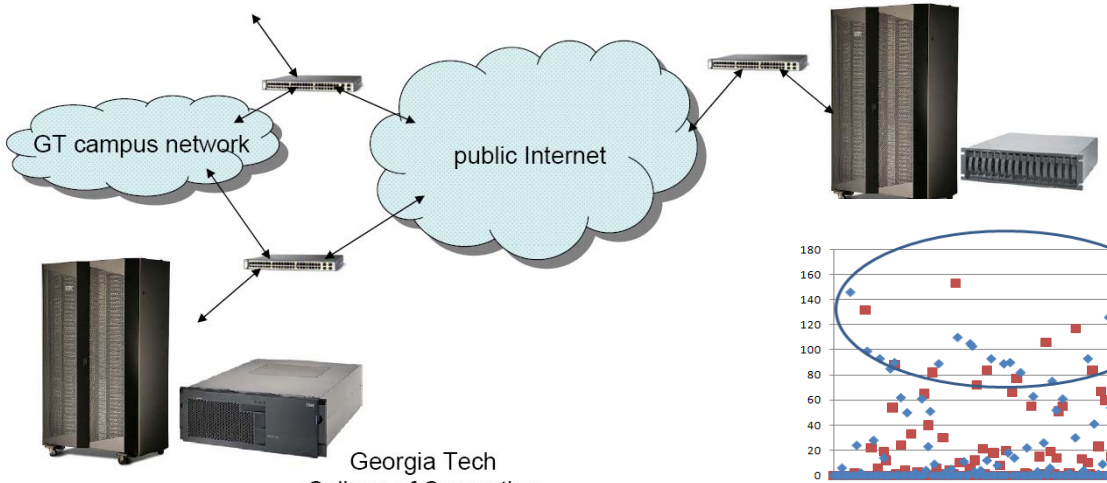


Measurement Repository

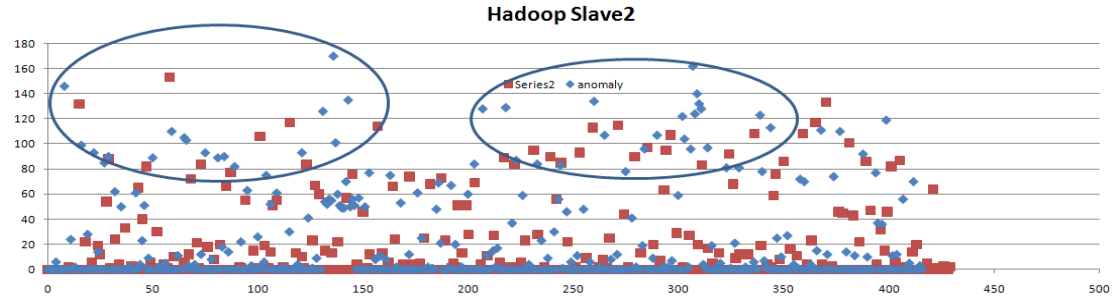
Cloud Management

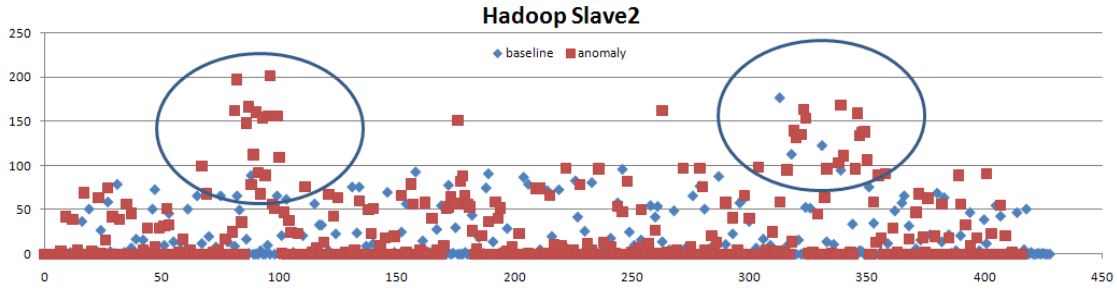
Monalytics /Behavior Detection – with HP, VMWare
Bare Metal and Auto-**Provisioning** – with Intel
Cloud Provisioning – with VMWare
Asymmetric Platforms – with Intel/Microsoft

Georgia Tech
Mechanical Engineering
(under development)



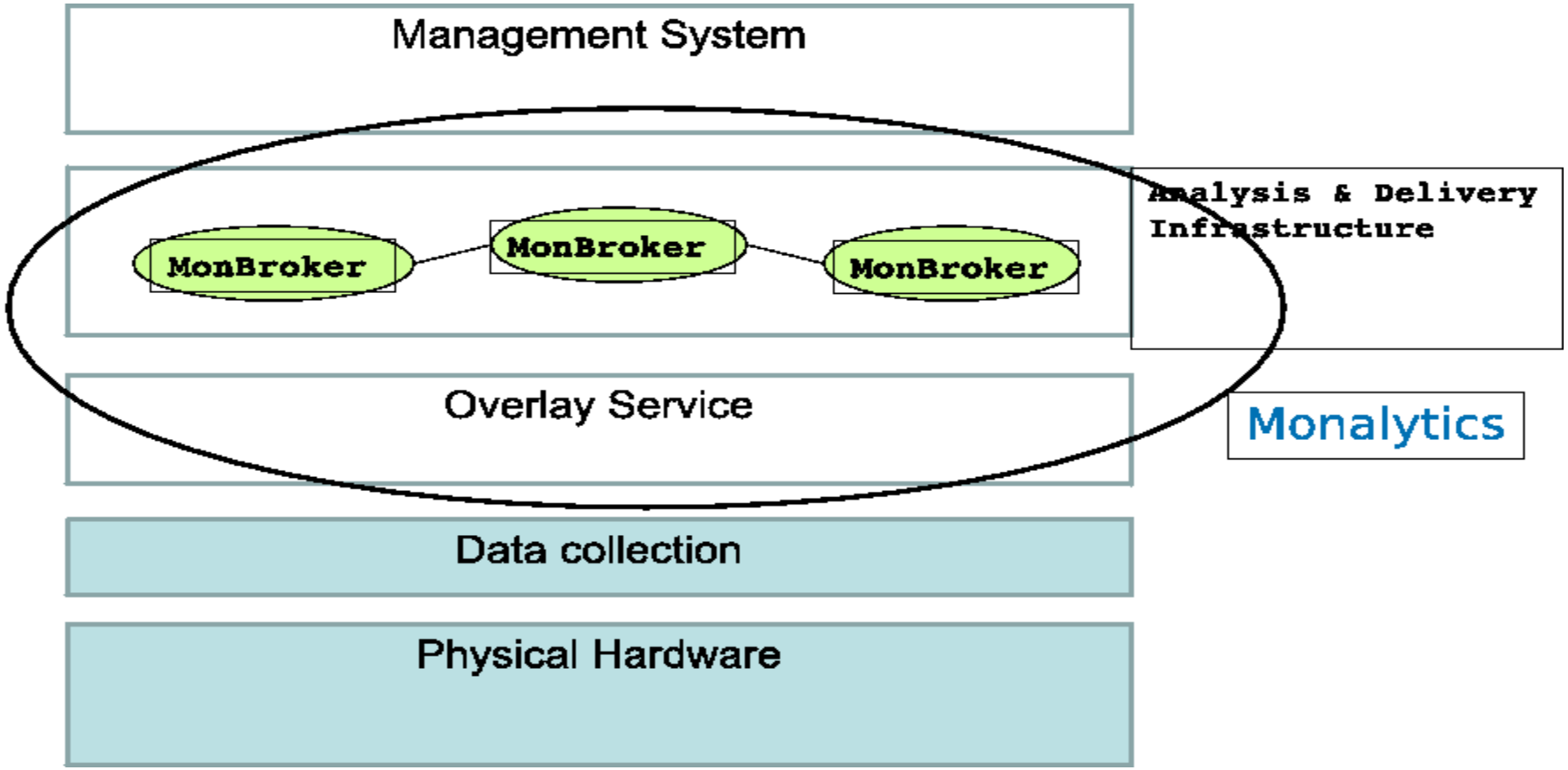
Georgia Tech
College of Computing
CERCS data center





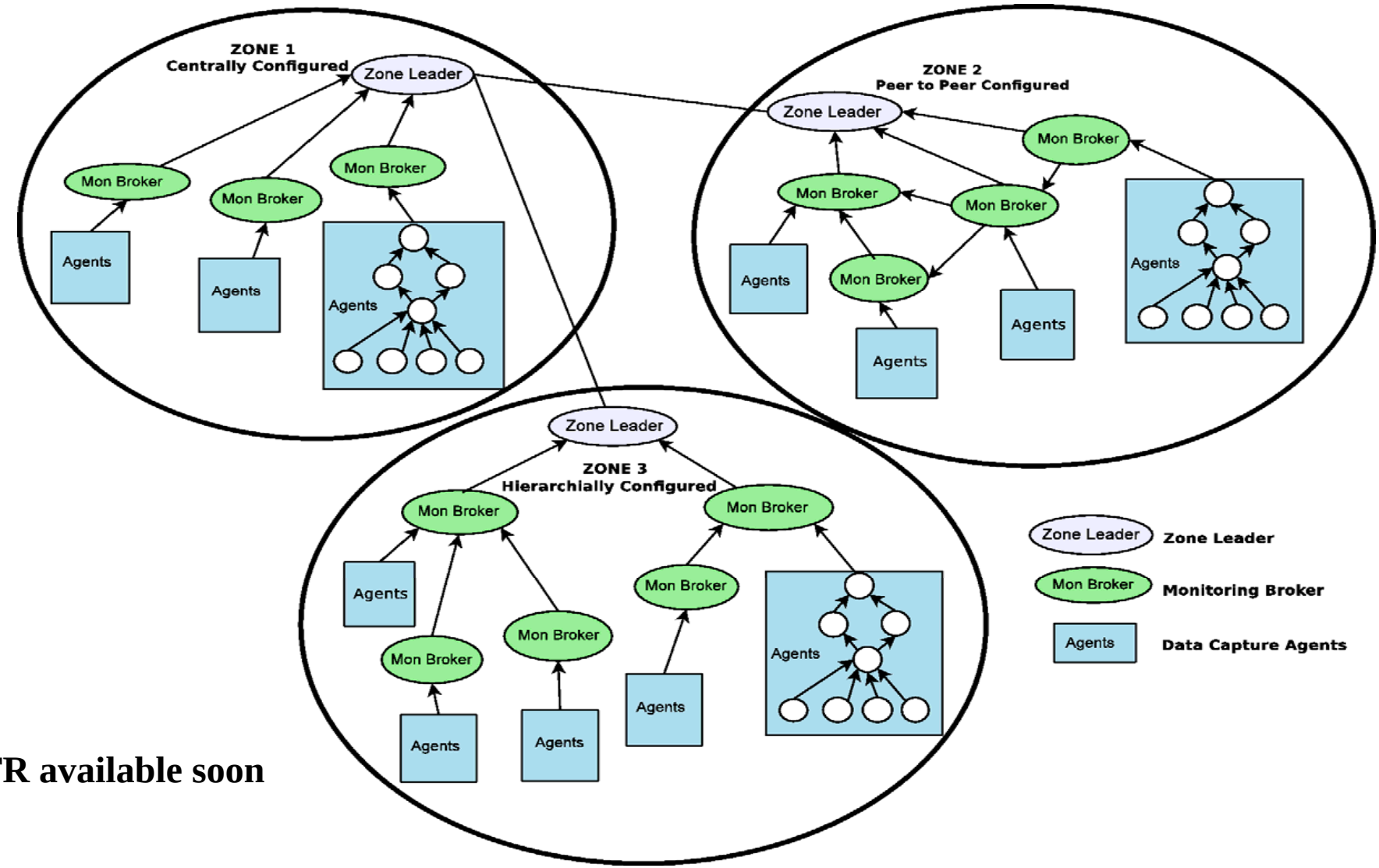
Enterprise applications and systems – with CMU/Yahoo/…
Cloud@home – with Motorola

Cloud Management
Monalytics Architecture – Logical View



1. Chengwei Wang, Vanish Talwar, Karsten Schwan, Parthasarathy Ranganathan, "Online Detection of Utility Cloud Anomalies Using Metric Distributions", NOMS, 2010.
2. Renuka Apte, Liting Hu, Karsten Schwan, Arpan Ghosh,, "LWT: Look Who's Talking", HotCloud, 2010
3. **Monalytics –** Mahendra Kutare, Greg Eisenhauer, Chengwei Wang, Karsten Schwan, Vanish Talwar, 2010 International Conference on Autonomic Computing (ICAC)

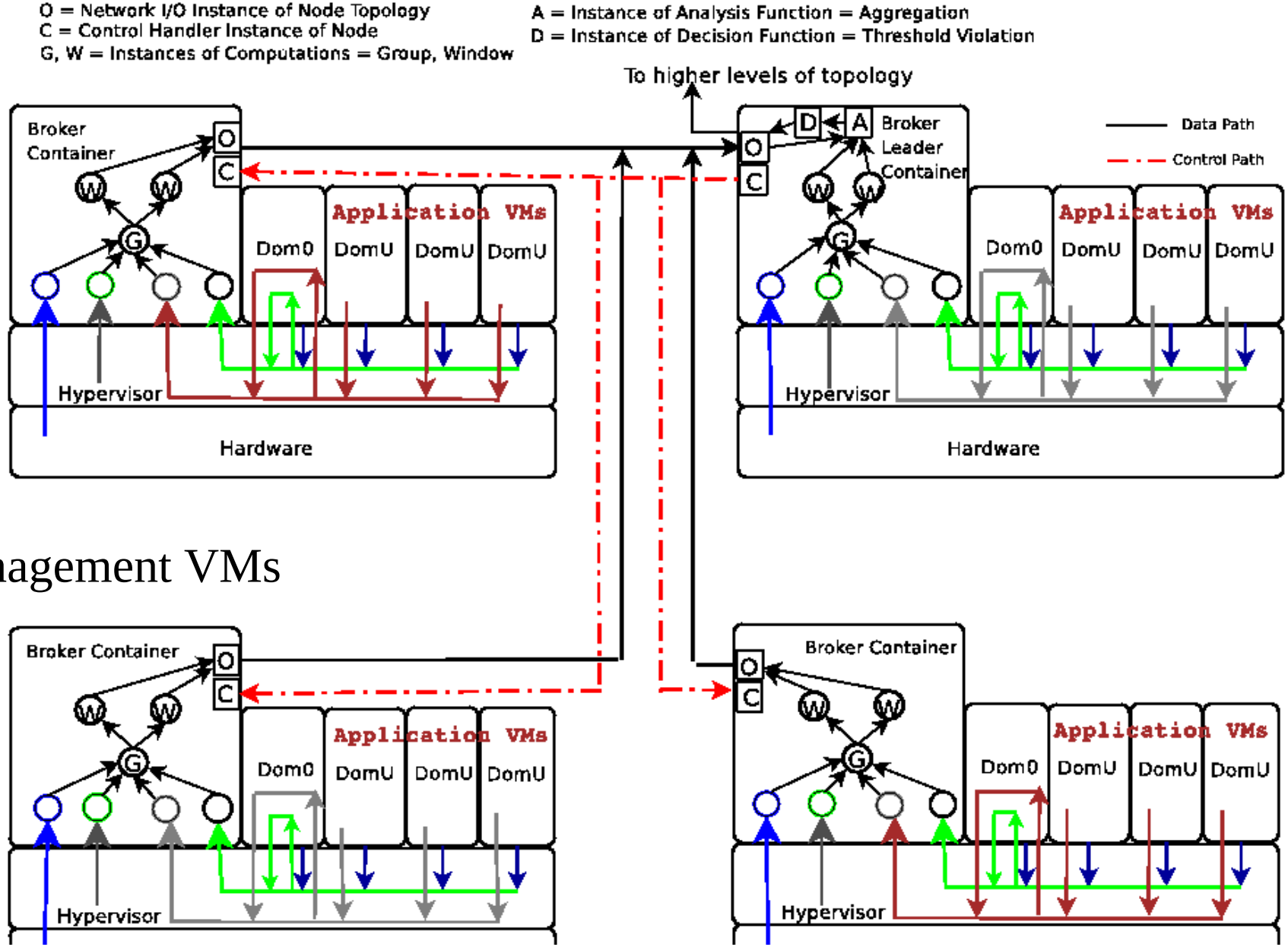
Monalytics Architecture – Topologies



TR available soon

Dynamic Computational Communication Graphs

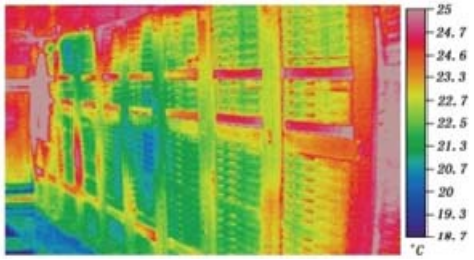
Monalytics - Implementation



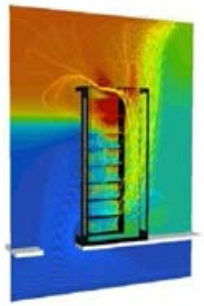
The 'GreenIT' Initiative

Managing the Power Stack

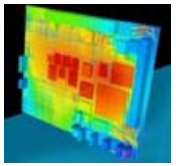
Datacenter and Beyond: Cooling, Resource Management, Power Delivery, Configuration Management (OIT, ME, SCS)



Rack: Thermal & Air Flow Analysis, Resource Management, Cooling (ME, SCS), Heterogenerous and Asymmetric Computing

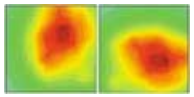


Board Level: Virtual power, VM Scheduling (ME, SCS, ECE); Socket-level Asymmetries



Chip/Package: Power Delivery, Thread Migration (ECE, SCS), 'Islands of Cores (SCC)'

Circuit Level: DVFS, cCock Gating, Power States (ECE)



Zoni

Tashi Monalytics

Conf. Mgt.

Behavior Detection

Applications/HDFS

Cloud@Home

- Increasing capabilities of mobile platforms & diversity of applications
  - multifunction devices
  - distributed games, social networking apps, sensor-based “smart” applications…
- Using virtualization enable infrastructure for next generation apps
  - storage, migration, access…
- Develop virtualization methods suitable for target platforms
  - energy-efficiency, interface & protocol heterogeneity, RT requirements…

Cloud Research - Summary

Cloud Management: GT-HP-VMWare-ORNL – Managing exascale systems (building on earlier work with IBM, addt'l interactions with Yahoo and Microsoft)

- vManage => Monalytics: scalable management for utility clouds
- CloudSense: automated behavior understanding
- Using OpenCirrus, Hadoop, HDFS; considering performance/power tradeoffs
- Hierarchical resource management in vCloud (with VMWare)

The 'GreenIT' Initiative

Entertainment Clouds (Cloud@home): Motorola, Intel

- Exploring new cloud services and functionality
- Exploiting highly heterogeneous platforms