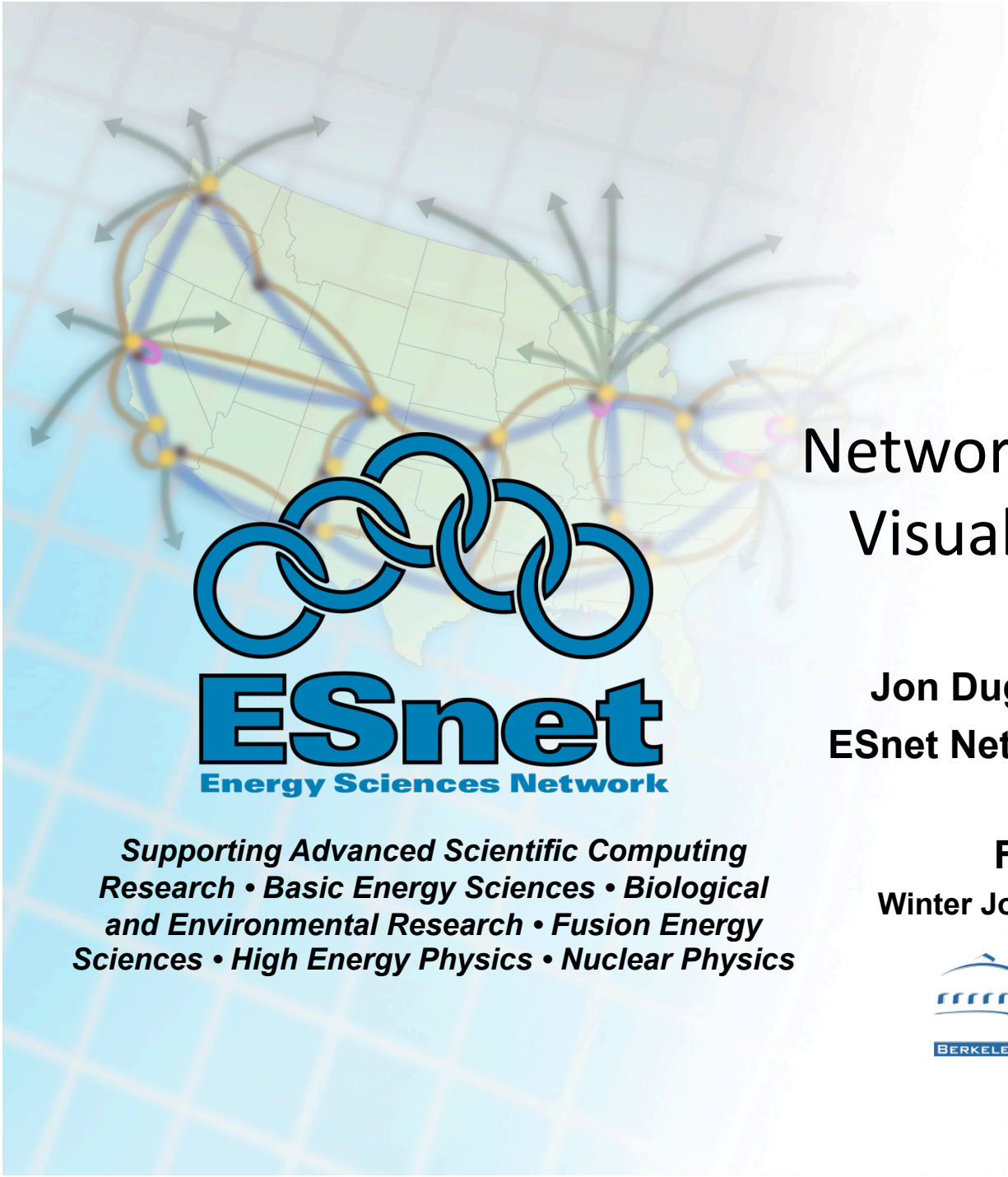


ESnet
Energy Sciences Network

Supporting Advanced Scientific Computing Research • Basic Energy Sciences • Biological and Environmental Research • Fusion Energy Sciences • High Energy Physics • Nuclear Physics

Network Monitoring and Visualization at ESnet

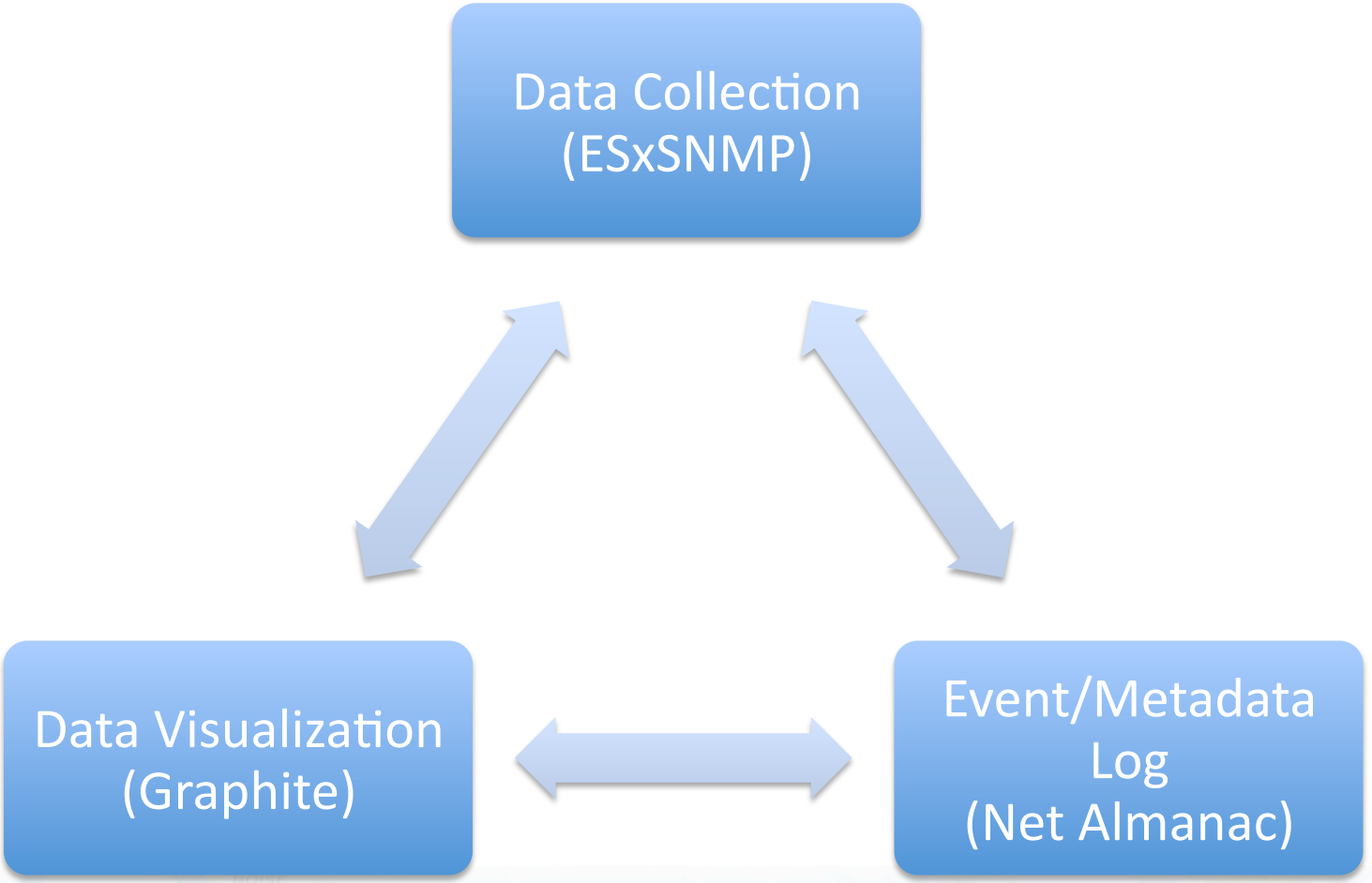
Jon Dugan, Network Engineer
ESnet Network Engineering Group

February 3, 2010
Winter Joint Techs, Salt Lake City, UT

Berkeley Lab

U.S. Department of Energy
Office of Science

Overview


Data Collection
(ESxSNMP)
Data Visualization
(Graphite)
Event/Metadata
Log
(Net Almanac)

ESxSNMP: Goals

- Automate everything possible
- Provide summaries but don't lose raw data
  - Disk is cheap
  - It can be useful to take a hard look at the past
- Flexibility and scalability
- Minimize up front assumptions
- Protect data collection from DoS by users
- Make data easy to access and manipulate

ESxSNMP: Polling

- Interface metadata
  - Automatically detects new interfaces
  - Automatically detects interface changes
  - Historical log of interface info
- Automatic addition of new devices
  - Detects new entries in our RANCID database
- Allow arbitrary transformations at poll time
  - Stored by ifDescr rather than ifIndex
    - ifHCInOctets.fxp0 vs ifHCinOctets.1
    - Sidesteps problem of ifIndex renumbering
  - Store firewall counters by name
  - Custom transformations via simple Python class
- High Performance
  - 7000 interfaces every 30 seconds
  - Storing the metrics is limiting factor

ESxSNMP: Metrics Storage

- TSDB
  - RRD summarizes data
  - Optimized for retrieval by timestamp
  - Allows for multilevel storage
  - Similar interface to RRD, but fewer surprises
  - Distinct library

- Can be distributed
  - Disk I/O can be an issue
    - SSD
    - RAM disk
  - Allow many requests to be serviced
  - The design accounts for this, current deployment does not

ESxSNMP: Metrics Retrieval

- Allow easy, consistent access to data
  - Data will be used in unanticipated ways
  - Language neutral
- Technical details
  - RESTful interface
  - URL hierarchy: eg, `core-rtr-1/interface/xe-0_0_0/in`
  - HTTP transport using HTTP semantics
  - Data returned in JSON format

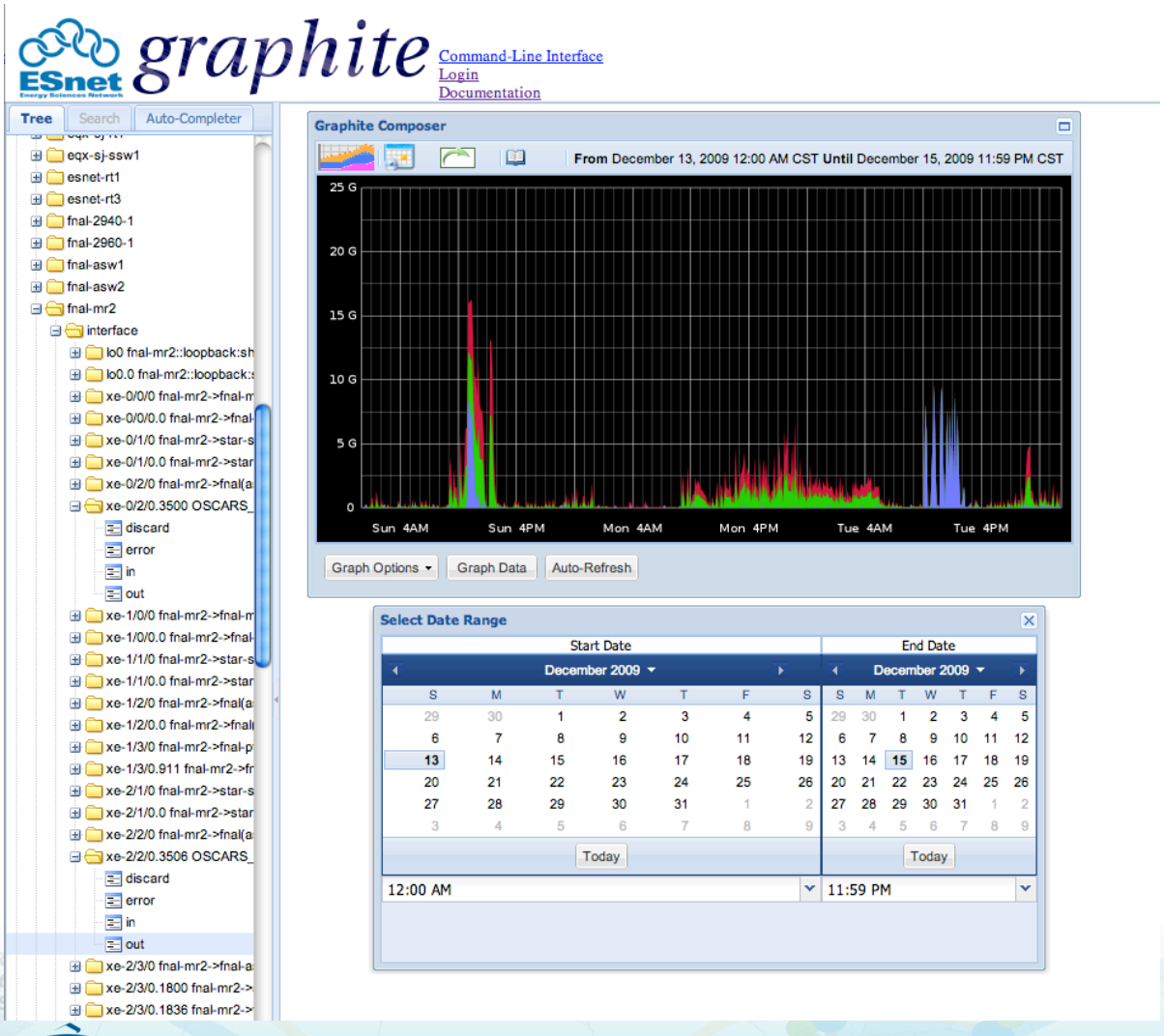
ESxSNMP: Tested platforms

- Standard MIB polling
  - Juniper
  - Cisco
  - Foundry
  - Force10
- Custom MIB polling
  - Juniper: firewall and class of service
  - Cisco: CPU utilization

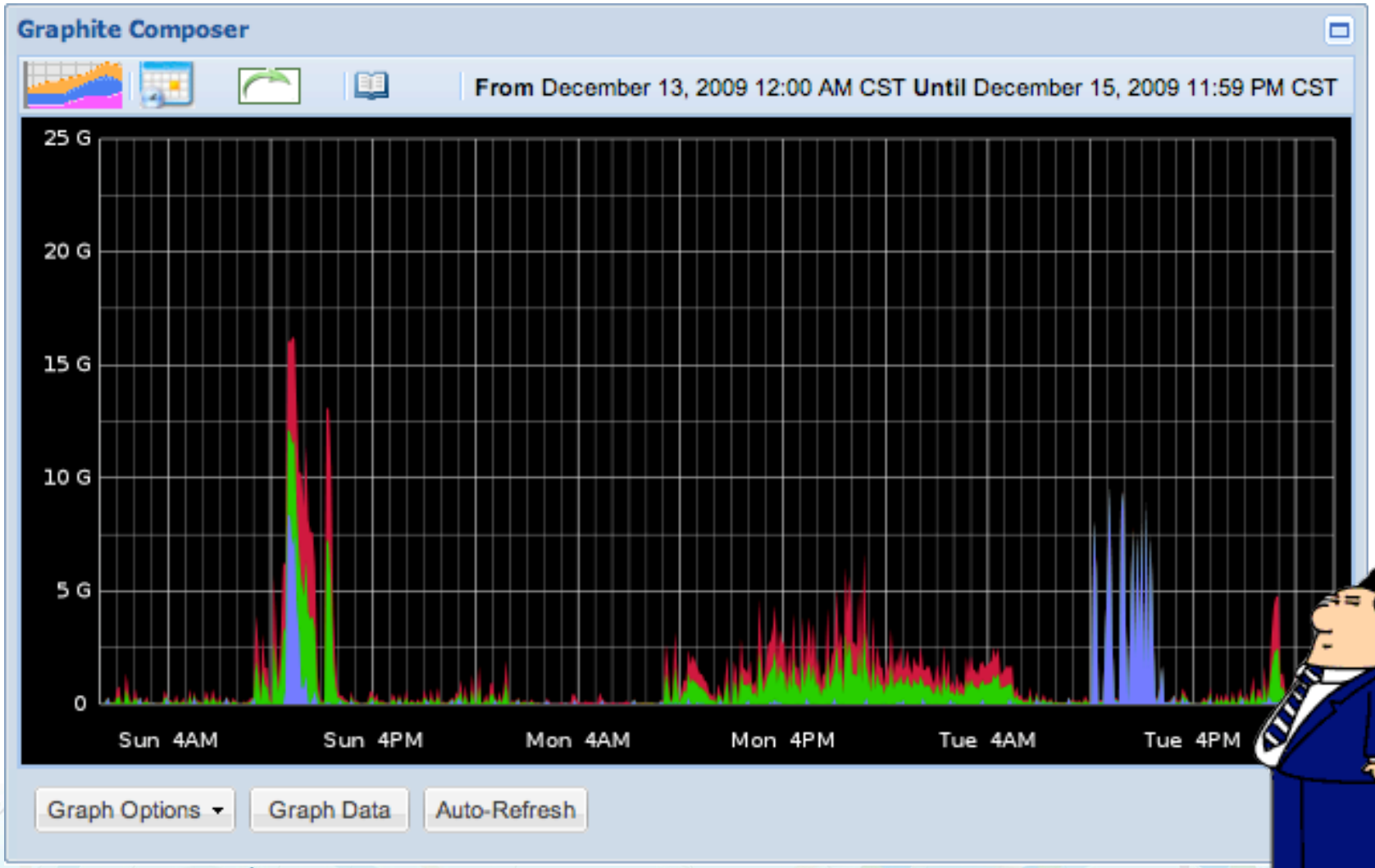
Graphite: Data visualization

- Developed by Orbitz to visualize internal performance data
- Clean design allowed easy integration
- Flexible
- Bookmarkable
- Fast

Graphite: Screenshot



What's that, right there?

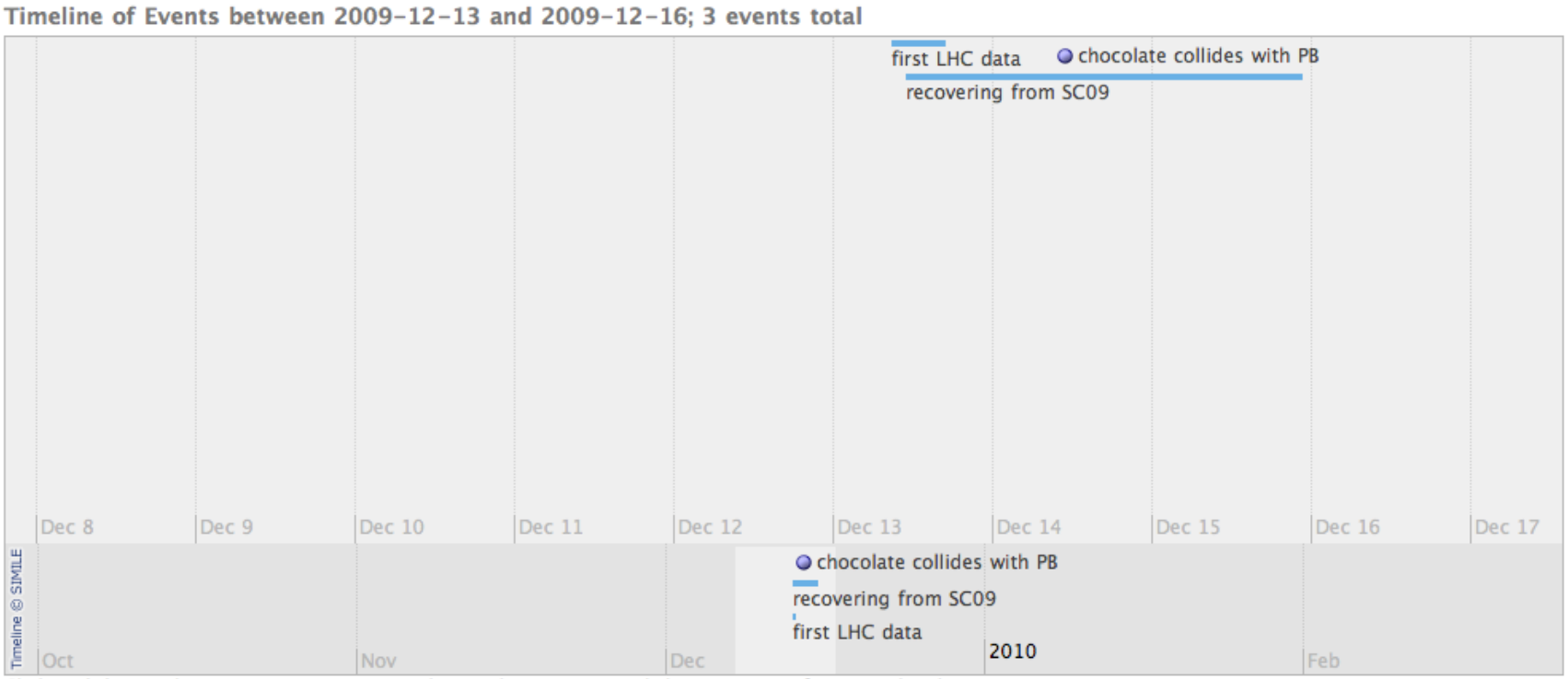


Net Almanac

"Why is there a traffic spike on this graph?"

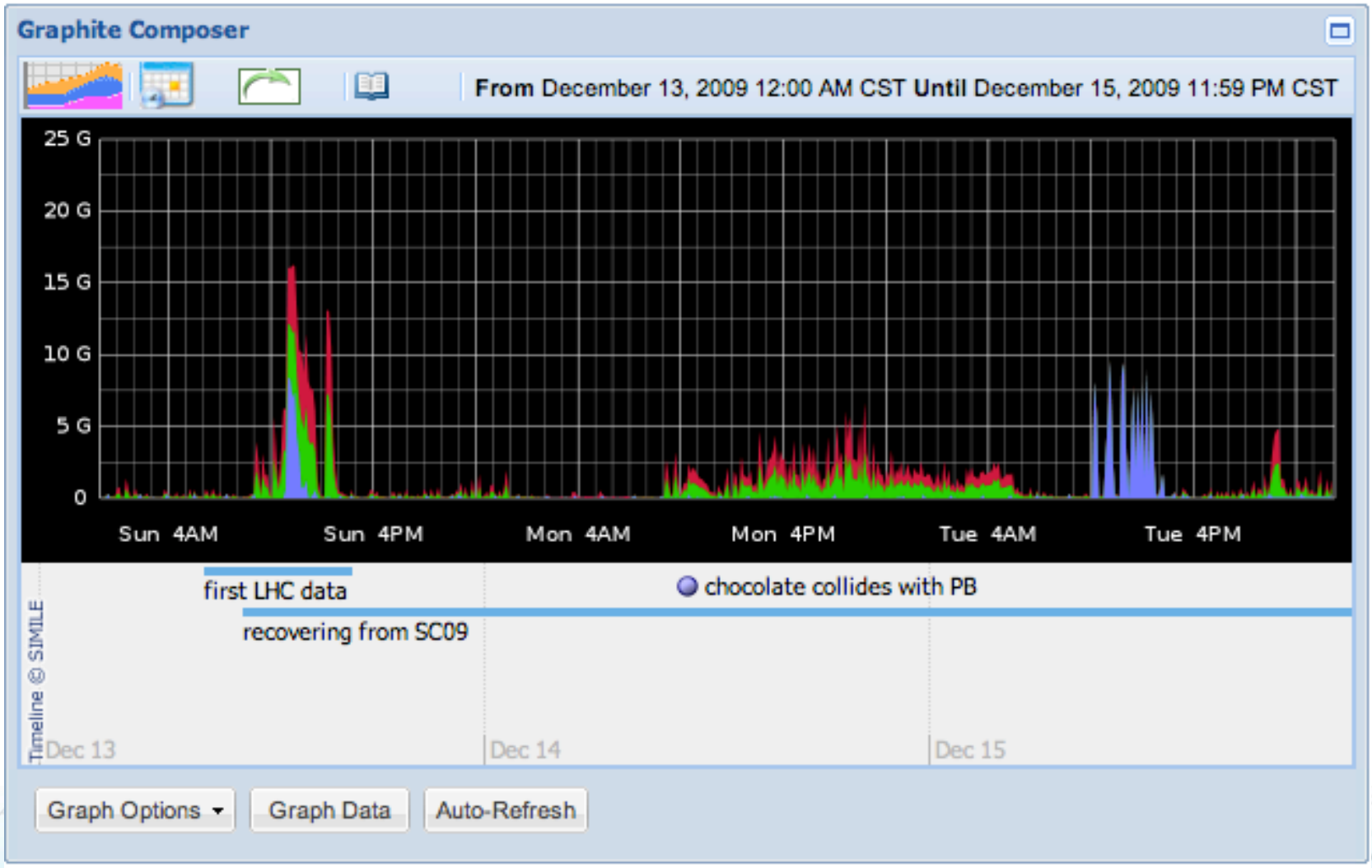
- Long term memory for events
  - conferences, data trials, etc
  - outages, maintenance
  - interface up/down
  - configuration changes
- Human interface
- Machine interfaces: REST/JSON

Net Almanac: Example



Click and drag with your mouse to navigate the timeline. You may click on an event for more detail.
All times are in Pacific Standard Time.

You got your chocolate in my PB!



Free your data

- The web has made a lot of data human accessible
- Needs to be more machine accessible without sacrificing usability
- Stop reinventing the wheel
- HTTP and JSON/XML ubiquitous
- RESTful Services

RESTful Integration Successes

- Graphite
  - Consumes data from ESxSNMP
  - Consumes data from Net Almanac
  - Provides data as plots, CSV, or JSON
- Net Almanac
  - Consumes data from syslog, outage calendar
  - Provides data as JSON
- ESnet Weathermap
  - Consumes data from ESxSNMP
  - Java / Python living together
  - http://weathermap.es.net/
- Traceroute visualizer
  - Consumes Graphite plots
  - Consumes perfSONAR topology infomrmation

perfSONAR Integration

- ESxSNMP and Graphite used at SC09
  - Primary SNMP polling for SCinet
  - Used to judge Bandwidth Challenge
- Implement a bridge between ESxSNMP and perfSONAR in about 45 minutes
  - Perl and Python living together
- Native perfSONAR interface on the way
  - Python perfSONAR library in development

RESTful Services: Examples

- Possible future services
  - Outage Notifications
  - Contact Information (NOCs, etc)
  - Read twitter feeds
  - perfSONAR?
  - OSCARS
  - Access to other report data (monthly stats)

Lessons Learned

- Don’t reinvent the wheel
- Sometimes you need a different kind of wheel
- Simplicity requires effort
- Everything is a struggle
- Programmers are optimists (sort of)
- Simple, language neutral APIs easily accommodate unexpected use cases

Links and whatnot

- Services
  - http://stats1.es.net/graphite/
  - http://weathermap.es.net/
- Code
  - http://code.google.com/p/esxsnmp/
  - http://code.google.com/p/tsdb/
  - http://code.google.com/p/net-almanac/
  - http://code.google.com/p/esnet-weathermap/
  - http://graphite.wikidot.com/
- REST
  - http://www.infoq.com/articles/rest-introduction
  - http://tomayko.com/writings/rest-to-my-wife
- Me
  - Jon Dugan <jdugan@es.net>

Extra Slides

RESTful Services

- Representational State Transfer
  - Fielding's PhD Thesis
  - Provides an "architectural style"

- Common Usage
  - Exposed resources
  - Multiple representations
    - Human: HTML/CSS/PNG, etc
    - JSON
    - XML