

# Network Monitoring & Management Using Cacti

Network Startup Resource Center  
[www.nsrc.org](http://www.nsrc.org)



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# Introduction

## Network Monitoring Tools

- Availability
- Reliability
- Performance

*Cacti monitors the **performance** and usage of devices.*

# Introduction

**Cacti:** Uses RRDtool, PHP and stores data in MySQL. It supports the use of SNMP and graphics with RRDtool.



*“Cacti is a complete frontend to RRDTool, it stores all of the necessary information to create graphs and populate them with data in a MySQL database. The frontend is completely PHP driven. Along with being able to maintain Graphs, Data Sources, and Round Robin Archives in a database, cacti handles the data gathering. There is also SNMP support for those used to creating traffic graphs with MRTG.”*

# Introduction

- A tool to monitor, store and present network and system/server statistics
- Designed around RRDTool with a special emphasis on the graphical interface
- Almost all of Cacti's functionality can be configured via the Web.
- You can find Cacti here:  
<http://www.cacti.net/>



# Getting RRDtool

Round Robin Database for time series data storage

Command line based

From the author of MRTG

Made to be faster and more flexible

Includes CGI and Graphing tools, plus APIs

Solves the Historical Trends and Simple Interface problems as well as storage issues



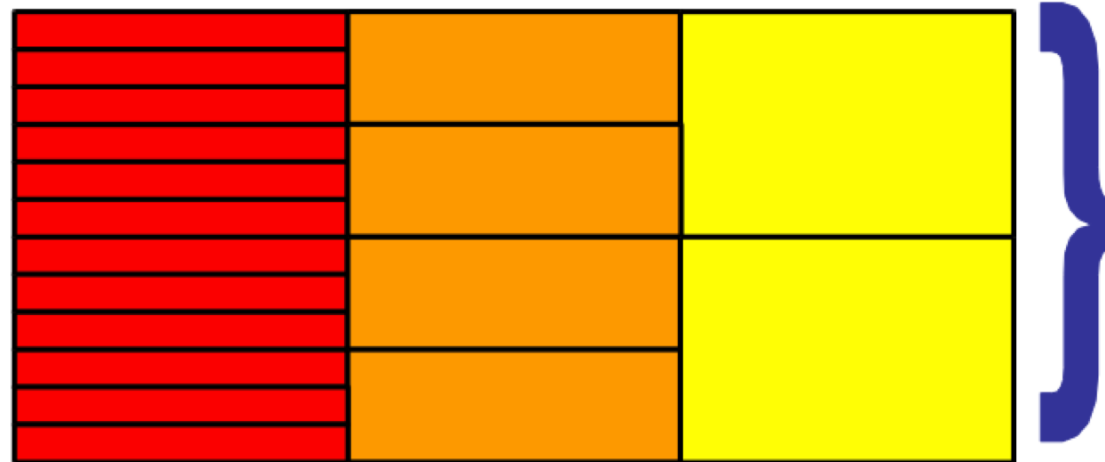
Find RRDtool here: <http://oss.oetiker.ch/rrdtool/>

# RRDtool Database Format

Recent data stored once  
every 5 minutes for the past 2  
hours (1:24)

Old data averaged to one  
entry per day for the last 365  
days (288:365)

--step  
300  
(5 minute  
input step  
size)



RRA  
1:24

RRA  
6:10

RRA  
288:365

RRD  
File

Medium length data averaged to one  
entry per half hour for the last 5 hours  
(6:10)

# General Description

- 1.Cacti is written as a group of PHP scripts.
- 2.The key script is “poller.php”, which runs every 5 minutes (by default). It resides in /usr/share/cacti/site.
- 3.To work poller.php needs to be in /etc/cron.d/cacti like this:

```
MAILTO=root
```

```
*/5 * * * * www-data php /usr/share/cacti/site/poller.php >/dev/null 2>/var/log/cacti/poller-error.log
```

- 4.Cacti uses RRDtool to create graphs for each device and data that is collected about that device. You can adjust all of this from within the Cacti web interface.
- 5.The RRD files are located in /var/lib/cacti/rra when cacti is installed from packages.

# Advantages

## **You can measure Availability, Load, Errors and more all with history.**

- Cacti can display your router and switch interfaces and their traffic, including all error traffic as well.
- Cacti can measure drive capacity, CPU load (network h/w and servers) and much more. It can react to conditions and send notifications based on specified ranges.

## **Graphics**

- Allows you to use all the functionality of rrdgraph to define graphics and automate how they are displayed.
- Allows you to organize information in hierarchical tree structures.

## **Data Sources**

- Permits you to utilize all the functions of rrdcreate and rrdupdate including defining several sources of information for each RRD file.

# Advantages (continued)

## Data Collection

- Supports SNMP including the use of *php-snmp* or *net-snmp*
- Update data sources via SNMP or define scripts to capture required data
- *cactid* implements SNMP routines in C with multi-threading

## Templates

- Create templates to reuse graphics definitions, data and device sources

## Cacti Plugin Architecture

- Extends Cacti functionality. Many, many plugins are available. Part of the default Cacti installation in Ubuntu version 12 and above.

## User Management

- Manage users locally or via LDAP
- Assign granular levels of authorization by user or groups of users.

# Disadvantages

- Configuring Interfaces via the web interface is tedious
- Use provided command-line scripts instead
- Upgrading versions difficult if installed from source.

## Advice:

For continuous use or large installations it is likely that you will be using scripts and tools to automate the configuration of Cacti.

# Steps to Add and Monitor Devices

## PART II

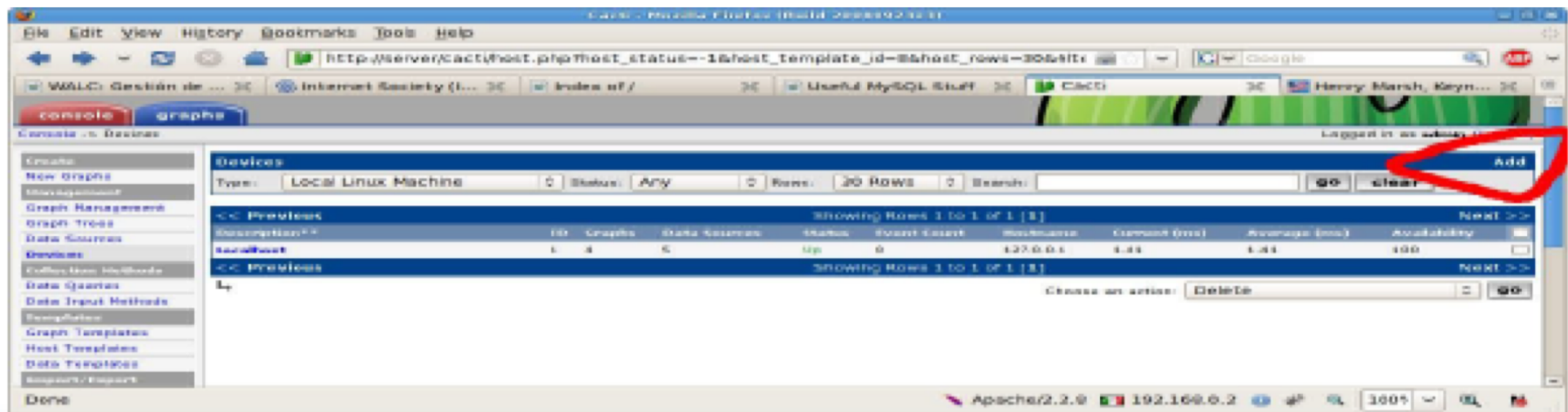
Before we install Cacti we demonstrate how to use the interface to add and monitor some devices...

# Adding a Device via the Web Interface

## Management -> Devices -> Add

Specify device attributes

–We'll add an entry for our gateway router, [gw.ws.nsrc.org](http://gw.ws.nsrc.org)\*



*\*Actual device name may be different.*



# Add Devices (2)

**Devices [edit: Gateway Router]**

**General Host Options**

**Description**  
Give this host a meaningful description. Gateway Router

**Hostname**  
Fully qualified hostname or IP address for this device. gw.ws.nsrc.org

**Host Template**  
Choose what type of host, host template this is. The host template will govern what kinds of data should be gathered from this type of host. Cisco Router

**Disable Host**  
Check this box to disable all checks for this host. ☐ Disable Host

**Availability/Reachability Options**

**Downed Device Detection**  
The method Cacti will use to determine if a host is available for polling.  
*NOTE: It is recommended that, at a minimum, SNMP always be selected.* Ping and SNMP

**Ping Method**  
The type of ping packet to send.  
*NOTE: ICMP on Linux/UNIX requires root privileges.* UDP Ping

**Ping Port**  
TCP or UDP port to attempt connection. 23

**Ping Timeout Value**  
The timeout value to use for host ICMP and UDP pinging. This host SNMP timeout value applies for SNMP pings. 400

**Ping Retry Count**  
After an initial failure, the number of ping retries Cacti will attempt before failing. 1

**SNMP Options**

**SNMP Version**  
Choose the SNMP version for this device. Version 2

**SNMP Community**  
SNMP read community for this device. NetManage

**SNMP Port**  
Enter the UDP port number to use for SNMP (default is 161). 161

**SNMP Timeout**  
The maximum number of milliseconds Cacti will wait for an SNMP response (does not work with php-snmp support). 500

**Maximum OID's Per Get Request**  
Specified the number of OID's that can be obtained in a single SNMP Get request. 10

**Additional Options**

**Notes**  
Enter notes to this host.

cancel create

Menu changes after you select SNMP version below!

# Add Devices (3)

- Host Template: *ucd/net SNMP Host* is recommended for servers to include disk definitions.
- Choose SNMP version 2 for this workshop.
- For “Downed Device Detection” we recommend either using *Ping and SNMP*, or just *Ping*.
- Use “NetManage” for the “SNMP Community” string.

SNMP access is a security issue:

- Version 2 is not encrypted
- Watch out for globally readable “public” communities
- Be careful about who can access r/w communities.
- Replace “xxxxxxx” with your local public r/o string

# Add Devices (4)

For a router you may see *a lot* of potential network interfaces that are detected by SNMP.

Associated Data Queries			
Data Query Name	Debugging	Re-Index Method	Status
1) Karlnet - Wireless Bridge Statistics	(Verbose Query)	Uptime Goes Backwards	Success [0 Items, 0 Rows]
2) SNMP - Interface Statistics	(Verbose Query)	Uptime Goes Backwards	Success [59 Items, 7 Rows]
Add Data Query: Networkware - Get Available Volumes		Re-Index Method: Uptime Goes Backwards	add
			cancel save

Your decision is to create graphs for all of these or not. Generally the answer is, “Yes” – Why?

# Create Graphics

- Chose the “Create graphs for this host”
- Under Graph Templates generally check the top box that chooses *all* the available graphs to be displayed.
- Press Create.
- You can change the default colors, but the predefined definitions generally work well.

# Create Graphics (2)

**Save Successful.**

## Gateway Router (gw.ws.nsrc.org)

### SNMP Information

System: Cisco IOS Software, 1841 Software (C1841-ADVIPSERVICESK9-M), Version  
www.cisco.com/techsupport Copyright (c) 1986-2006 by Cisco Systems,  
Inc. Compiled Tue 28-Feb-06 21:03 by alnguyen  
Uptime: 24881862 (2 days, 21 hours, 6 minutes)  
Hostname: sanog17-2.learn.ac.lk  
Location:  
Contact:

- \* Create Graphs for this Host
- \* Data Source List
- \* Graph List

### Ping Results

UDP Ping Success (1.19 ms)

## Devices [edit: Gateway Router]

### General Host Options

#### Description

Give this host a meaningful description.

Gateway Router

#### Hostname

Fully qualified hostname or IP address for this device.

gw.ws.nsrc.org

#### Host Template

Choose what type of host, host template this is. The host template will govern what kinds of data should be gathered from this type of host.

Cisco Router

# Create Graphics (3)

## New Graphs for [ bdr1.campus6 (bdr1.campus6.ws.nsrc.org) Cisco Router ]

Host:

bdr1.campus6 (bdr1.campus6.ws.nsrc.org)

Graph Types:

All

[\\*Edit this Host](#)  
[\\*Create New Host](#)

### Graph Templates

Graph Template Name

Create: Cisco - CPU Usage

Create: (Select a graph type to create)

### Data Query [SNMP - Interface Statistics]

Showing All Items

Index	Status	Description	Name (IF-MIB)	Alias (IF-MIB)	Type	Speed	High Speed	Hardware Address	IP Address	
1	Up	FastEthernet0/0	Fa0/0	Description Change for FastEthernet0/0 for Tenshi	ethernetCsmacd(6)	100000000	100	CA:18:35:97:00:08	100.68.0.22	
2	Up	FastEthernet0/1	Fa0/1	CAMPUS CORE	ethernetCsmacd(6)	100000000	100	CA:18:35:97:00:06	100.68.6.1	
3	Up	Null0	Nu0		other(1)	4294967295	10000			
4	Up	Loopback0	Lo0	Loopback	softwareLoopback(24)	4294967295	8000		100.68.6.241	
5	Up	Loopback5	Lo5	testing loopback	softwareLoopback(24)	4294967295	8000			



Select a graph type.

- In/Out Bits
- ☒ In/Out Bits (64-bit Counters)
- In/Out Bits with 95th Percentile
- In/Out Bits with Total Bandwidth
- In/Out Bytes
- In/Out Bytes (64-bit Counters)
- In/Out Bytes with Total Bandwidth
- In/Out Errors/Discarded Packets
- In/Out Non-Unicast Packets
- In/Out Unicast Packets

Use 64-bit counters for Gigabit+ devices

# Create Graphics (4)

The screenshot shows a web application interface for creating graphics. At the top, there are tabs for 'console' and 'graphs'. Below the tabs, a breadcrumb trail reads 'Console -> Create New Graphs -> Create Graphs from Data Query'. The user is logged in as 'admin' with a 'Logout' link. A sidebar on the left contains a menu with items like 'Create', 'New Graphs', 'Management', 'Graph Management', 'Graph Trees', 'Data Sources', 'Devices', 'Collection Methods', 'Data Queries', 'Data Input Methods', 'Templates', 'Graph Templates', 'Host Templates', 'Data Templates', 'Import/Export', 'Import Templates', 'Export Templates', 'Configuration', 'Settings', 'Utilities', 'System Utilities', 'User Management', and 'Logout User'. A green cactus icon is at the bottom of the sidebar. The main area displays three templates for creating graphs from data queries. Each template has a title, a 'Graph Items' field, and a 'Legend Color' field. The first template is 'Create Graph from Linux - Memory Usage' with a legend color of '4668E4'. The second is 'Create Graph from Unix - Load Average' with a legend color of 'F51D30'. The third is 'Create Graph from Unix - Logged in Users' with a legend color of '4668E4'. Below these, there is a section for 'Create 1 Graph from Unix - Get Mounted Partitions' with a 'cancel' and 'create' button.

console graphs

Console -> Create New Graphs -> Create Graphs from Data Query

Logged in as admin (Logout)

Create

New Graphs

Management

Graph Management

Graph Trees

Data Sources

Devices

Collection Methods

Data Queries

Data Input Methods

Templates

Graph Templates

Host Templates

Data Templates

Import/Export

Import Templates

Export Templates

Configuration

Settings

Utilities

System Utilities

User Management

Logout User

Create Graph from 'Linux - Memory Usage'

Create Graph from 'Unix - Load Average'

Create Graph from 'Unix - Logged in Users'

Graph Items [Template: Unix - Logged in Users]

Legend Color

The color to use for the legend.

4668E4

Create Graph from 'Unix - Processes'

Graph Items [Template: Unix - Processes]

Legend Color

The color to use for the legend.

F51D30

Create 1 Graph from 'Unix - Get Mounted Partitions'

cancel create

You'll see this screen later when you are creating graphics for hosts vs. routers

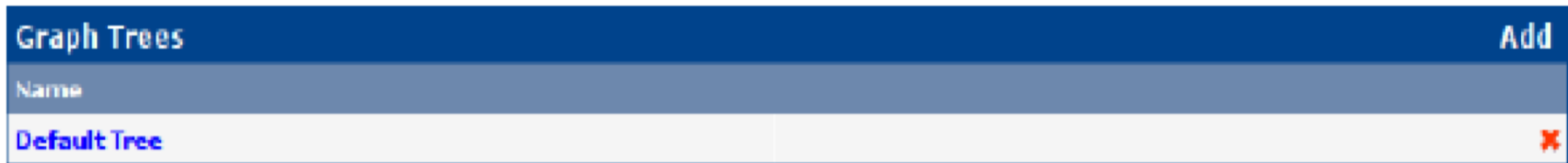
# View the Graphics

- Place the new device in its proper location in your tree hierarchy.
- Building your display hierarchy is your decision. Try drawing this out on paper first.
- Under Management → Graph Trees select the Default Tree hierarchy (or, create one of your own).



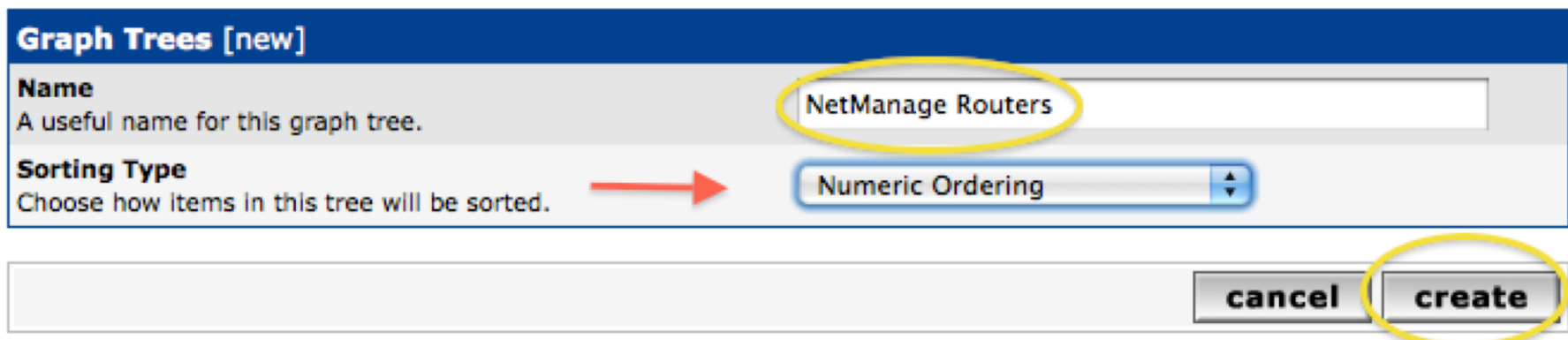
# Graphics Tree

First, press “Add” if you want a new graphing tree:



The screenshot shows a window titled "Graph Trees" with a blue header bar. In the top right corner of the header is an "Add" button. Below the header is a table with a single row. The first column is labeled "Name" and contains the text "Default Tree". The second column is empty. A red "X" icon is visible in the bottom right corner of the table area.

Second, name your tree, choose the sorting order (the author likes Natural Sorting and press “create”:



The screenshot shows a dialog box titled "Graph Trees [new]". It has two main sections. The first section is labeled "Name" and has a description "A useful name for this graph tree." Below this is a text input field containing the text "NetManage Routers". The second section is labeled "Sorting Type" and has a description "Choose how items in this tree will be sorted." Below this is a dropdown menu currently showing "Numeric Ordering". A red arrow points to the dropdown menu. At the bottom right of the dialog are two buttons: "cancel" and "create". The "create" button is circled in yellow.

# Graphics Tree

Third, add devices to your new tree:

**Save Successful.**

**Graph Trees [edit: NetManage Routers]**

**Name**  
A useful name for this graph tree.

**Sorting Type**  
Choose how items in this tree will be sorted.

**Tree Items** **Add**

Item	Value
No Graph Tree Items	

Once you click “Add” you can add “Headers” (separators), graphs or hosts. Now we'll add Hosts to our newly created graph tree:

**Tree Items**

**Parent Item**  
Choose the parent for this header/graph.

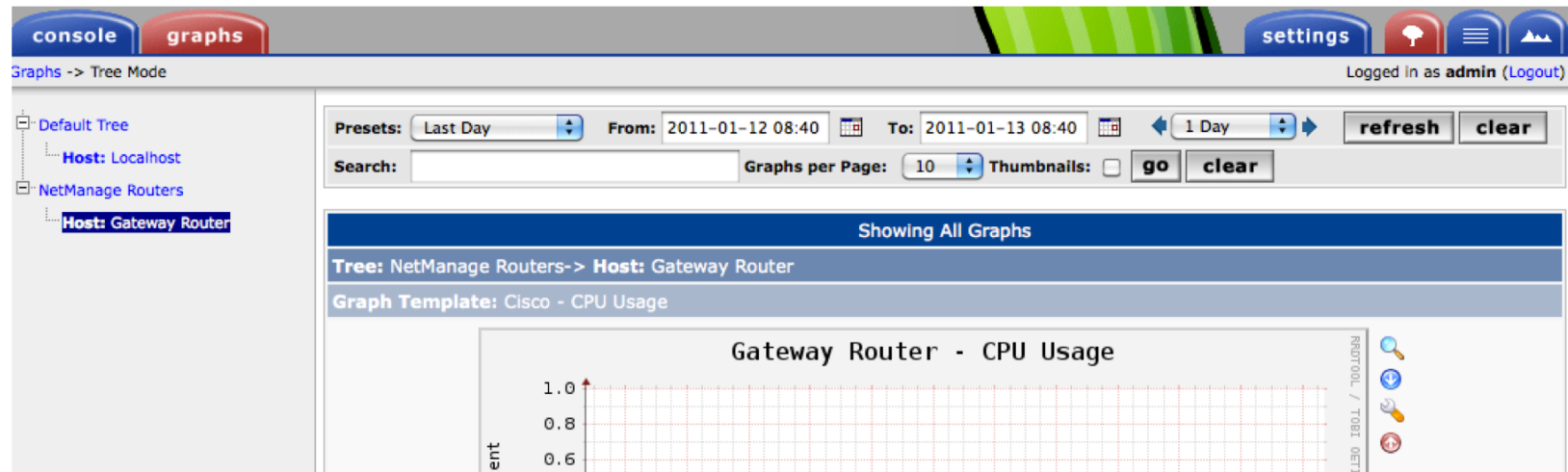
**Tree Item Type**  
Choose what type of tree item this is.

**Tree Item Value**

**Host**  
Choose a host here to add it to the tree.

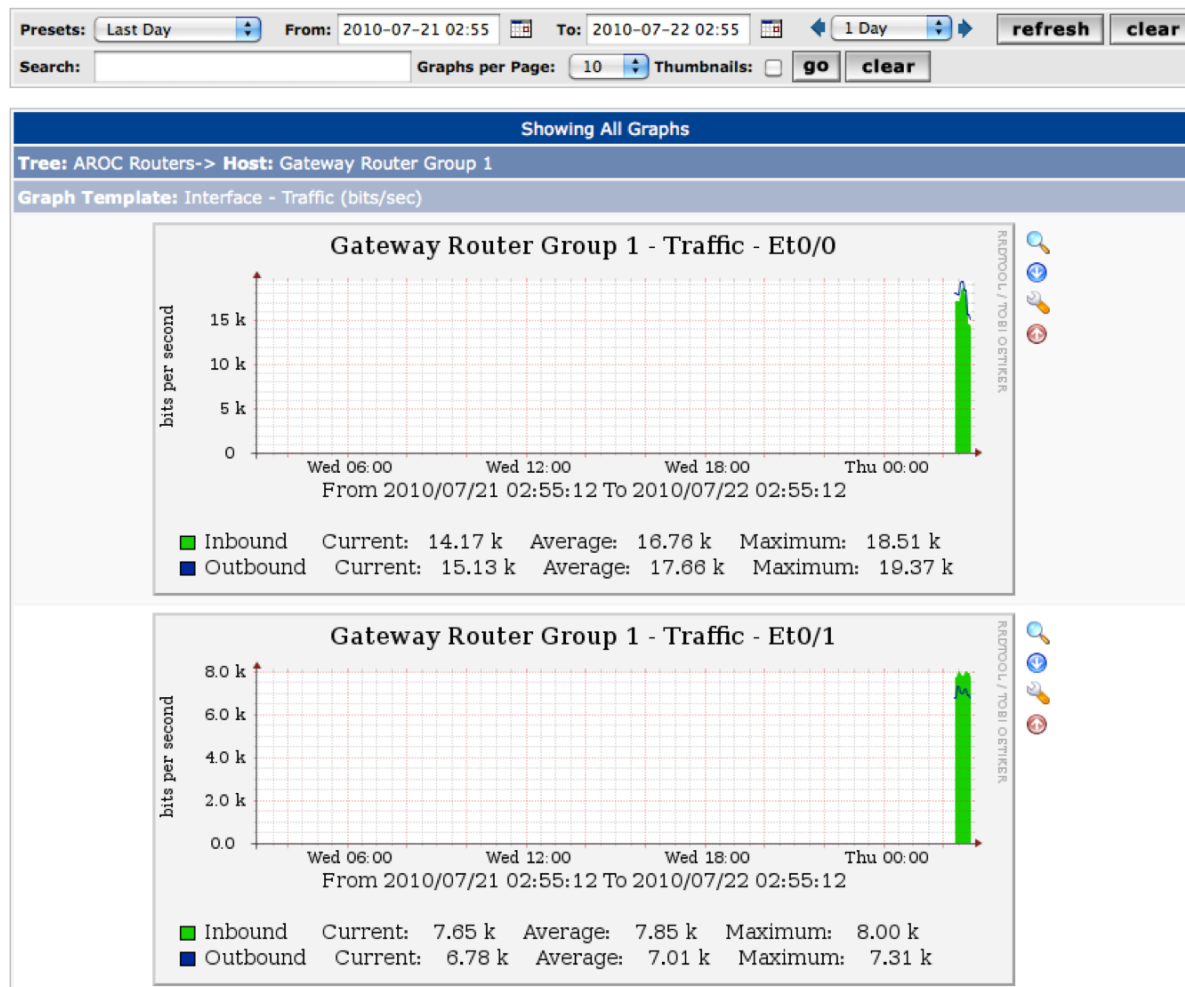
**Graph Grouping Style**  
Choose how graphs are grouped when drawn for this particular host on the tree.

# Graphics Tree with Two Devices

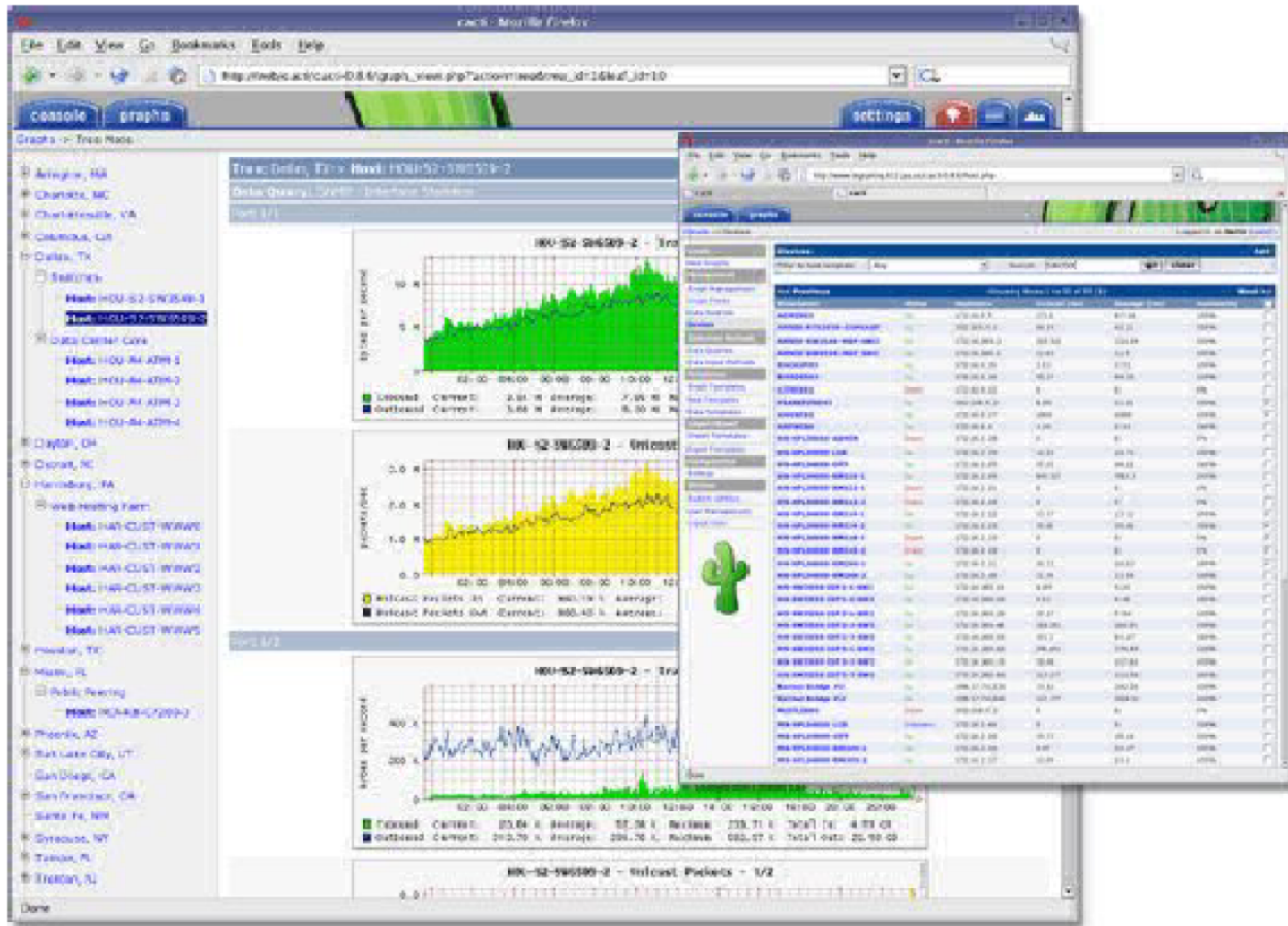


- Our graphics tree *just* after the first two devices were added.
- So far, graphics are empty – the first data can take up to 5 minutes to display.
- Cacti graphs are stored on disk and updated using RRDTool via the poller.php script, which, by default, is run every five minutes using `cron`.

# Initial Graphs



# See Trends Over Time



# Next Steps

- There are a number of popular Cacti plugins, such as:
  - Settings
  - thold
  - PHP Weathermap
- A good place to start is <http://cactiusers.net/> and Google.
- To send email to RT from Cacti via rt-mailgate you can use the Cacti “settings” plugin:

<http://docs.cacti.net/plugin:settings>

- Automate device and graph creation using available command-line scripts in `/usr/share/cacti/cli`, such as:

- `-add_devices.php`
- `-add_graphs.php`
- `-add_tree.php`

# Conclusions

- Cacti is very flexible due to its use of templates.
- Once you understand the concepts behind RRDTool, then how Cacti works should be (more or less) intuitive.
- The visualization hierarchy of devices helps to organize and locate new devices quickly.
- It is not easy to do a rediscover of devices.
- To add lots of devices requires automation. Software such as Netdot, Netdisco, IPPlan, TIPP can help – as well as local scripts that update the Cacti back-end MySQL database directly.

# References

- Cacti Web Site:  
<http://www.cacti.net/>
- Plugin Documentation  
<http://docs.cacti.net/plugins>
- Cacti Discussion Group:  
<http://forums.cacti.net/>
- Cacti Users – Plugin Architecture Home  
<http://cactiusers.org/>



# **Cacti Installation and Configuration**

## **Workshop Labs**