Graphing and Trending in Nagios

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v0.6
Agenda

• What is the problem?
• What should a trending system do?
• What are the parts?
• What options are available?
• What issues need to be considered?
Background

- Small Nagios installations with 40-80 hosts and 500-2000 services
- Small businesses with 10-20 servers and 20-40 workstations
- Continuous build environments with 30+ virtual machines
- Power, water, septic, and weather monitoring on an island in Maine
- Databases and ticketing system for pop singer

Nagios Experience

- Design optimization and supply chain optimization

Day Job

- Budget: low
- Costs: time is not free
- Training: ok for expert to setup, not ok for expert to operate
- Hack Factor: rather high

Introduction • Problem • Requirements • Components • Options • Issues • Summary
What are the options?

- **nagiosgraph**
  1.4.4 2011-01-16
  http://nagiosgraph.sourceforge.net/

- **nagiosgrapher**
  1.7.1 2008-12-18

- **n2rrd/rrd2graph**
  1.4.4 2011-08-16
  http://n2rrd-wiki.diglinks.com/display/n2rrd/Addon

- **pnp4nagios**
  0.6.15 2011-09-14
  http://pnp4nagios.sourceforge.net/

- **cacti**
  0.8.7g 2010-07-09
  http://www.cacti.net/

- **mrtg**
  2.17.1 2011-02-18
  http://oss.oetiker.ch/mrtg/
What is the problem?

- Nagios indicates current status
- Nagios Core trending consists only of states and notifications
- Nagios Core does not provide performance trending
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What is the problem?

- Nagios indicates current status
- Nagios Core trending consists only of states and notifications
- Nagios Core does not provide performance trending
Why is this a problem?

• How do you figure out which notifications matter?
• How do you know what the thresholds should be?
• What is happening between notifications?
• What caused the known disasters?
• How to predict the unanticipated disasters?
Show me some examples...

- Why do the temperature alarms go off each day? UPS temperature monitoring
- How close do we come to exceeding thresholds? Software license use
- How can we understand dynamic environments? Cross-platform distributed build/test environment
Temperature Cycles

This exception tipped us off

Introduction • Problem • Requirements • Components • Options • Issues • Summary
What is happening when we are not being notified?

Introduction • Problem • Requirements • Components • Options • Issues • Summary
Changing Thresholds

Track the changes to the requirements, not just the changes to the data.
Dynamic Targets

![Graph showing data trends over time]

- Bytes Received: Max 1.84M, Avg 308.35k, Min 5.65k, Cur 18.6k
- Bytes Transmitted: Max 2.81M, Avg 268.98k, Min 7.19k, Cur 56.14k

**Wednesday, 28 September 2011**
Dynamic Targets

What is the source of the traffic spike in this interval?

Introduction • Problem • Requirements • Components • Options • Issues • Summary
Dynamic Targets

Introduction • **Problem** • Requirements • Components • Options • Issues • Summary

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**vm15** is active here

**vm16** is active here
Dynamic Targets

Introduction • Problem • Requirements • Components • Options • Issues • Summary
Trending is not just drawing graphs

• Catch problems before they become disasters
• Provide context for discovering patterns
• Data correlation and comparison
So what should a performance trending system do?

Display thresholds as well as performance data
So what should a performance trending system do?

Display all services for a specified host
So what should a performance trending system do?

Display all hosts that have a specified service

Introduction • Problem • Requirements
So what should a performance trending system do?

Display arbitrary groups of host/service data
So what should a performance trending system do?

Provide interactive queries as well as canned reports
So what should a performance trending system do?

- Display thresholds as well as performance data
- Display all services for a specified host
- Display all hosts with a specified service
- Display arbitrary groups of host/service data
- Provide interactive queries as well as canned reports
- Compare data from any host/service with any other host/service
- Compare data from any two periods of time
- Provide export of data for analysis

- Easy to use
- Easy on the eyes
- Easy to configure
Graphing and Trending in Nagios

- Data Collection
- Data Storage
- Data Display

Introduction • Problem • Requirements • Components • Options • Issues • Summary
Data Collection

- **How to do it in Nagios?**
  - Immediate
  - Batch
  - Shared library
  - External process

Introduction • Problem • Requirements • **Components** • Options • Issues • Summary
**Data Collection**

- **Nagios**
  - commands.cfg
  - perfdata.log

- **map**
  - `commands.cfg`
  - `insert.pl`

- **perfdelta.log**
  - 1317218378: mailq: mailq reports queue is empty; unsent=0;5;20;0
  - 1317218379: http01: ups-temp: OK - Internal Temperature: 36.9 C, temp=36.9;45;48
  - 1317218379: power3: ups-temp: OK - Internal Temperature: 42.7 C, temp=42.7;45;48

**commands.cfg**

```
process_performance_data=1
service_perfdata_file=/var/nagios/perfdata.log
service_perfdata_file_template=$LASTSERVICECHECK$||$HOSTNAME$||$SERVICEDESC$||$SERVICEOUTPUT$||$SERVICEPERFDATA$
service_perfdata_file_mode=a
service_perfdata_file_processing_interval=30
service_perfdata_file_processing_command=process-service-perfdata
```

**map**

```plaintext
# Service type: ping
# output: PING OK - Packet loss = 0%, RTA = 0.00 ms
/output: PING.*?\d+%.+?([.-]\d+\\sms/ and push @s, ['pingloss', ['losspct', GAUGE, $1]]
and push @s, ['pingrta', ['rta', GAUGE, $2/1000]];
```
Data Collection

- How to do it in Nagios?
  - Immediate
  - Batch
  - Shared library
  - External process

- Issues
  - Performance data
  - Plugin output
  - Data from plugins or data from Nagios itself
  - Sampling interval
  - Sampling precision
  - Is Nagios the best tool for data collection?

Introduction • Problem • Requirements • Components • Options • Issues • Summary
Data Storage

- How to do it?
  - Round-Robin Database (rrdtool)
  - SQL Database (mySQL)
  - JavaDB
Data Storage

Introduction • Problem • Requirements • Components • Options • Issues • Summary

**Components**

- perfdata.log
- commands.cfg
- insert.pl

**RRD files**

```
ls -l /var/nagiosgraph/rrd/*
```

```
/var/nagiosgraph/rrd/www:
total 72
-rw-rw-r-- 1 nagios nagios 24120 2011-09-28 10:00 http___http.rrd
-rw-rw-r-- 1 nagios nagios 24120 2011-09-28 10:00 http___http.rrd_max
-rw-rw-r-- 1 nagios nagios 24120 2011-09-28 10:00 http___http.rrd_min
```

**rrdtool update**

```
rrdtool update
```

```
DS:inOctets:COUNTER:120:0:4294967296
RRA:AVERAGE:.5:1:43200
RRA:AVERAGE:.5:5:105120
RRA:AVERAGE:.5:10:105120
```

**rrdtool dump servicedesc___ds.rrd**

```
<?xml version="1.0" encoding="utf-8"?>
<!DOCTYPE rrd SYSTEM "http://oss.oetiker.ch/rrdtool/rrdtool.dtd">
<!-- Round Robin Database Dump -->
<rrd>
  <version>0003</version>
  <step>300</step> <!-- Seconds -->
  <lastupdate>1317218410</lastupdate> <!-- 2011-09-28 10:00:10 EDT -->
  ...
</rrd>
```
Data Storage

- **How to do it?**
  - Round-Robin Database (`rrdtool`)
  - SQL Database (`mySQL`)
  - JavaDB

- **Issues**
  - Schema definition
  - Storage space limitations
  - Storage space pruning
  - Redundancy
  - Backups
Data Display

• How to do it?
  - CGI (PERL+rrdtool)
  - PHP (PHP+PERL+rrdtool)
  - JavaScript
  - Google Charts

Introduction • Problem • Requirements • Components • Options • Issues • Summary
Data Display

Introduction • Problem • Requirements • Components • Options • Issues • Summary
Data Display

- How to do it?
  - CGI (PERL+rrdtool)
  - PHP (PHP+PERL+rrdtool)
  - JavaScript
  - Google Charts

- Issues
  - Today, yesterday, last week, last month, last year
  - Single host/service/source
  - Combinations of hosts/services/sources
  - Canned reports
  - Interactive queries
What are the options?

- **Nagios**
  - commands.cfg
  - perfdata.log
  - RRD files

- **nagiosgraph**
  - 1.4.4 2011-01-16

- **nagiosgrapher**
  - 1.7.1 2008-12-18

- **n2rrd/rrd2graph**
  - 1.4.4 2011-08-16
  - [http://n2rrd-wiki.diglinks.com/display/n2rrd/AddOn](http://n2rrd-wiki.diglinks.com/display/n2rrd/AddOn)

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Introducion • Problem • Requirements • **Components** • Options • Issues • Summary
cacti

- Standalone system
- Data collection and/or display
- Browsing
- Querying
- Zoom
mrtg

- Standalone system designed for SNMP
- Data collection and/or display

Introduction • Problem • Requirements • Components • Options • Issues • Summary
n2rrd and rrd2graph

- Data collection (n2rrd)
- Data display (rrd2graph)
- Template-based RRA
- Template-based graphs
- All services per host
- Arbitrary grouping
- Interactive selection of data
- Zoom (in new context)
- Export graphs as PDF, PNG, EPS, SVG
- rrdtool, PERL
pnp4nagios

- Data collection and display
- Template-based graphs
- All services per host
- Arbitrary grouping
- Arbitrary time interval
- Zoom (in new context)
- Mouseover thumbnail graphs
- Export data as CSV
- Export graphs as PDF, PNG
- rrdtool, C, PHP, PERL, jQuery

**Options**

**Introduction** • **Problem** • **Requirements** • **Components** • **Options** • **Issues** • **Summary**
nagiosgraph

- Data collection and display
- Parameter-based RRA
- Parameter-based graphing
- All services per host
- All hosts per service
- Arbitrary grouping
- Arbitrary time interval
- Zoom (in place)
- Interactive selection of data
- Mouseover thumbnail graphs
- Export data as CSV, XML
- rrdtool, PERL, JavaScript

Introduction • Problem • Requirements • Components • Options • Issues • Summary

Wednesday, 28 September 2011
Issues

- Is Nagios the right tool for collecting performance data?
- Which add-on/system should I use?
- Performance data versus plugin output
- Seeing both the forest and the trees
- How much data to collect? How much to save?
- Getting the RRA parameters right
- Dealing with rigid schemas
- What format to save the data? (mysql, rrdtool)
- Automatic provisioning/discovery/configuration
- Transient hosts/services
- Data freshness
Is Nagios the right tool?

- Nagios checks have access to performance data, so why not?
- No need to install additional software
- Confounding of state and performance data
- Does Nagios collect data often enough?
- What happens to the data when Nagios cannot collect it?
Which system(s) should I use?

**Nagios**

- Collection: **nagiosgraph**
- Storage: **rrdtool**
- Glue: **nagiosgraph**
- Display: **nagiosgraph**

- Collection: **pnp4nagios**
- Storage: **rrdtool**
- Glue: **pnp4nagios**
- Display: **pnp4nagios**

**Nagios**

- Collection: **cacti**
- Storage: **rrdtool**
- Glue: **cacti**
- Display: **cacti**

**N2RRD**

- Collection: **Nagios**
- Storage: **rrdtool**
- Glue: **n2rrd**
- Display: **cacti**

Introduction • Problem • Requirements • Components • Options • Issues • Summary

Wednesday, 28 September 2011
## Which add-on(s) should I use?

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<th>rrd2graph</th>
<th>pnp4nagios</th>
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<th>cacti</th>
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</tr>
</tbody>
</table>

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**Introduction** • **Problem** • **Requirements** • **Components** • **Options** • **Issues** • **Summary**

Wednesday, 28 September 2011
Performance Data

name = value[units];[warn];[crit];[min];[max]

where units is one of:

- unitless
- s,us,ms time
- % percentage
- B,KB,MB,GB,TB,PB bytes
- c counter

Beware of the bug in Nagios 3.3.1!
How to see the forest and the trees?

You never know what you'll need until long after you can save it.

Introduction • Problem • Requirements • Components • Options • Issues • Summary
How to see the forest and the trees?

You never know what you'll need until long after you can save it.
How to see the forest and the trees?

- You never know what you’ll need until long after you can save it
How to see the forest and the trees?

• You never know what you’ll need until long after you can save it

• With rrdtool, the further back you go, the more you lose
How to see the forest and the trees?

- You never know what you’ll need until long after you can save it
- With rrdtool, the further back you go, the more you lose

Archaeology
How much to collect and save?

• Collect the source data, not the derivative data
• Collect everything - you can stop collecting later
• Collect often - let profiling dictate when to collect less often
• Save everything - you can throw it away later
• Using RRD ensures that your system scales by host/service, not time
Getting the RRA parameters right

DS:NAME:TYPE:HEARTBEAT:MIN:MAX
RRA:CONSOLIDATION_METHOD:XFF:PDPs:CDPs

DS:inOctets:COUNTER:120:0:4294967296
RRA:AVERAGE:.5:1:43200
RRA:AVERAGE:.5:5:105120
RRA:AVERAGE:.5:10:105120

XFF: x files factor
PDP: primary data point
CDP: consolidated data point

Building a Monitoring Infrastructure with Nagios, David Josephson, 2007
Rigid Schemas

- Put one data source in each RRD file, plus associated thresholds
- Use consistent service names
- Use service description based on plugin, not platform
- Keep the specifics of the schema in the glue layer
- Schemas are not just an issue with rrdtool
So where are we?

There are a few free tools, and a few more not-so-free tools
So where are we?

There are a few free tools, and a few more not-so-free tools

All of the existing tools suck...
So where are we?

There are a few free tools, and a few more not-so-free tools

All of the existing tools suck...

but at least one of them is probably good enough...
So where are we?

There are a few free tools, and a few more not-so-free tools

All of the existing tools suck...

but at least one of them is probably good enough...

and many of them continue to progress.
nagiosgraph: then and now

Introduction • Problem • Requirements • Components • Options • Issues • Summary

Wednesday, 28 September 2011
nagiosgraph: history and status

- first release was 2004 - Soren Dossing
- release 0.1 (2004-08-04) was 16KB (compressed)
- release 1.4.4 (2011-01-16) was 158KB (compressed)
- 18 project members, 2 current (Alan Brennar, Matthew Wall)
- typically 70-100 downloads per day (20 on weekends)
- packages for deb and rpm added Jan 2011
- 1259 unit tests providing 78.5% code coverage
- 155KB perl code, 44KB javascript/css, 276KB unit test code
nagiosgraph: What next?

- Arbitrary combinations of data sources
- Interactive manipulation of data sources
- Management of stale data
- Export of data
- Template-based RRAs and graphs
- Better multi-byte character support
- More unit tests and code coverage
The tr/end//

Circonius Dashboard Prototype

Cacti Screenshot

nagiosgraph Screenshot

Introduction • Problem • Requirements • Components • Options • Issues • Summary
References

• http://lancet.mit.edu/mwall/projects/nagios

• http://nagiosgraph.sourceforge.net

• http://www.scribd.com/doc/58991647
  Building a Monitoring Infrastructure with Nagios
  David Josephson 2007

• https://labs.omniti.com/labs/reconnoiter