Monitoring with “Non-Obvious” Nagios

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Notes PDF at http://www.syonex.com/notes/

Contents

Overview

- Nagios is well-established and widely used
  - Over a million known servers running 3.X
- We’re going to look at some of the non-obvious bits
- And ways to extend Nagios
- We’ll assume a basic knowledge of Nagios and what it does
- This is a three hour course sliced to 1:45

Notes:

- I’m assuming you’ve already chosen Nagios for your environment
  - Or you’re very careful when making decisions and don’t want to rush into anything
- Or at least I hope what we’re covering is non-obvious and/or non-trivial
- The server count is from Ethan Galstad’s talk at Ohio LinuxFest 2010 — servers that check for available updates.
- I sure hope the network and my laptop are both happy . . .
- So, if the slides are not completely consistent, I hope you’ll be understanding

Viewpoints and Religion

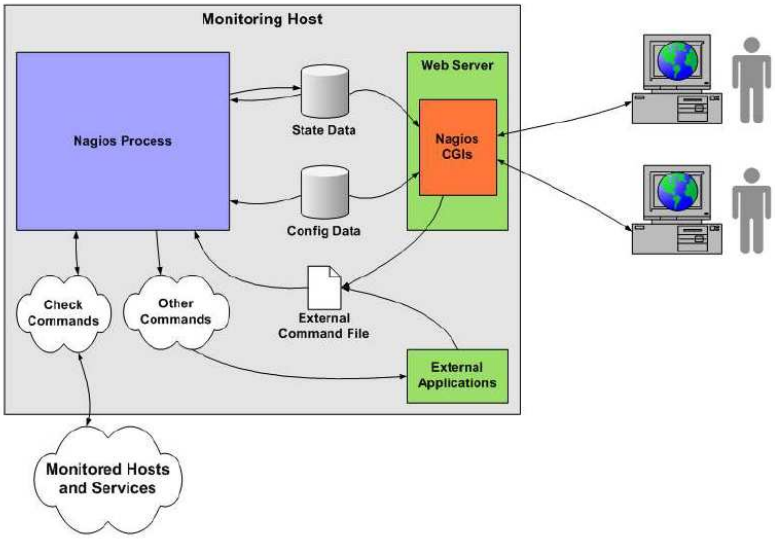
- Monitoring is Exceptions, Trending, History
- UNIX philosophy: Effective tools, not kitchen sink
  - Choose the best tool(s) for the job
- SNMP is Your Friend
  - Use it whenever you can
- Solve any problem in computer science with another level of indirection

Nagios Basics

Nagios Basics

- You likely already know everything I normally say here
- But:
  - Well over a million installations
  - Discrete components
  - Well-defined interfaces
  - Great documentation
- And:
  - Nagios core just schedules and executes
  - It’s just an engine

Nagios Overview



Stolen from Ethan Galstad

Notes:

- Shamefully stolen from Ethan Galstad’s FOSDEM 2005 presentation http://www.nagios.org/fosdem2005

Building Nagios

- The typical build process, with a few tweaks
- Lots (and lots) of configure options . . .
- Is `--enable-embedded-perl` a good idea?
- Likely want `--enable-event-broker`
- Don’t forget `make install-commandmode`
  - Creates the external command file (named pipe)
- Setup Apache with the example conf entries

Notes:

- Quickstart Installation Guides
  http://nagios.sourceforge.net/docs/3_0/quickstart.html
- Embedding a Perl interpreter just seems not quite right to me
  - But see the documentation for pros and cons:
    http://nagios.sourceforge.net/docs/3_0/embeddedperl.html
- `make install-webconf` might do the Apache config for you
- `make install-init` may set up your boot script
- `make fullinstall` may do it all for you
- I use the FreeBSD port . . .
- Most people likely just install the “standard packages”

Not Running Nagios?

- Who watches the watcher?
- In the past, the `cgi.cfg` setting nagios_check_command checked that nagios is running
- Not any more!
- If the `status.dat` file is left around, and nagios is dead, nothing notices
  - As far as I can see . . .
  - CGIs are happy with a days old `status.dat`
- Run `check_file_age` from cron?

Notes:

- At least up to version 3.4.1
- In practice, I’ve never seen this happen, but it’s good to be paranoid
- I don’t know how best to solve this
- I think it should be addressed in the CGIs at least
- Or perhaps cfengine, puppet, etc. will fix

Configuration Basics

- Arbitrary probes, flexible parameters. macro substitution
- Time-variable behaviours to cover work-day vs off-hours issues
- Template based, inheritable, grouping, etc.
- Consistent and well-documented
- Some tools try to provide a web interface to the configs
- Three required files:
  - `nagios.cfg` — overall configuration, refers to other files
  - `resource.cfg` — global variables and database access
  - `cgi.cfg` — controls web interface behaviour and access

Notes:

- Some people say: “it should be in a database”
- I like text files that I can manipulate or generate
- Version 3 cleans up a bunch of configuration “issues” and makes things much better
  - Not that things were bad before, but they are even better now

Nagios Plugins

Nagios Plugins

- All Nagios host and service checks are performed by external “plugins”
  - Hand wave away any question about plugins run with embedded Perl interpreter
- A separate nagiosplug development team
  - Standard syntax and output
  - Consistent coding standards and processing
- The nagiosplug distribution has helpers for your own plugins
  - Such as Nagios::Plugin for Perl

Notes:

- http://nagiosplugins.org/
- Version 1.4 February 3, 2005; 1.4.15 July 27, 2010

Theory of Plugins

- A plugin command will be invoked by Nagios as required, with arguments as specified in the command definition that was used
- Standard options include
  - who to check: `--hostname=` or `-H`
  - where to check: `--ipaddress=` or `-I`
  - the port to check: `--port=` or `-P`
  - critical error level: `--critical=` or `-c`
  - warning level: `--warning=` or `-w`
  - provide usage help: `--help` or `-h`
- Critical and warning levels are in units that make sense for the plugin being used

Notes:

- The “ROADMAP” file in the current nagiosplug source provides additional information

Theory of Plugins (cont’d)

- Plugins return an informative message, and an exit code
  - Limited to about 350 characters of message (pre-V3)
  - The message is displayed in the web status interface
- Exit codes indicate current state
  - 0 OK
  - 1 WARNING
  - 2 CRITICAL
  - 3 UNKNOWN
- Nagios reacts based on exit code
  - Invokes notifications, exception handlers
- Optional “performance data” is for statistics collection

Notes:

- Version 3 allows long (4,000 character), multi-line output from plugins
  - I think first line goes in web display
  - All output available via macros
- Plugins may also return “performance data” by appending an or-bar (“|”) and “key=value” information to the message
- Performance data can be processed via appropriate settings in the nagios.cfg file
  - So you can stuff your plugin results into a database, or a graph, etc.

Plugin Extra-Opts

- C plugins can consult a run-time config file

  `check_whatever --extra-opts=[section][@file]`

- Config file is “ini” style

  ```
  [section]
  key=value
  ```

- File defaults to `plugins.ini` or `nagios-plugins.ini`
- Searched for in `$NAGIOS_CONFIG_PATH` or various `/etc` dirs
- Configure with `--enable-extra-opts`

Notes:

- http://nagiosplugins.org/extra-opts hmm - wish there was per-host option
- I don’t think you can do per-hostaddress settings within the file itself
  - Though you could have different sections named for a macro used on the command line
- Extra-opts capability was added in 1.4.12
- Early on I didn’t find documentation on how to find the file, so I looked at the code — fixed now
- The code to file the config file seems a little convoluted
- Ethan Galstad pointed out that this is handy for hiding userids and passwords and other secrets from the `ps` command

Plugin Development

- It’s very easy to write your own plugins
  - A shell script that checks a file or process and returns an exit code is dead easy
- Wrappers around existing data
  - Another level of indirection . . .
- For Perl: Nagios::Plugin module
- Performance/speed can be an issue as you monitor more services
- Try it yourself!

Notes:

- Nagios::Plugin comes with the nagios plugins distribution
  - Configure with `--enable-perl-modules`
- Nagios Plugin API: http://nagios.sourceforge.net/docs/3_0/pluginapi.html
- I tried it myself: snagtools plugins collection www.syonex.com/resources/software.html

Existing Plugins

- There are many, many plugins already available
- Typically divide into local and remote checks
  - Local checks something on the Nagios server
  - Remote checks use SNMP or connect to a remote service port to check status
- Mechanisms for executing “local” plugins on remote machines
  - e.g `check_by_ssh`, NRPE
  - Religion: I check remote machine state via SNMP

Notes:

- More on NRPE later
- That may be my religion, but some times I am a heretic
- See exchange.nagios.org
  - Lots of tools and plugins there
  - Pointers to various places
- We’ll discuss plugin efficiency and overhead later

More on Configuration

Configuration Details

- Recall: Text files, 3 core files plus object definitions
- Recall: Read and digested when Nagios starts
- Recall: Can be a little complicated at first glance
  - Likely only because there are so many possibilities
  - But consistent and well documented
- Let’s look at it in some more depth

Notes:

- Version 3 allows pre-digesting configs before startup
  - Speeds startup time in large environments

Required Files

- `nagios.cfg` `resource.cfg` and `cgi.cfg`
  - `nagios.cfg` location is specified on `nagios` command line
  - `resource.cfg` location is set in `nagios.cfg`
  - `nagios.cfg` location is set in `cgi.cfg`
  - `cgi.cfg` location is compiled into the CGIs
- Syntax for these: `variable = value`
- Variables are case-sensitive

nagios.cfg Settings

- Worth a particular mention is check_result_reaper_frequency
- It tells Nagios how often (in seconds) to gather results from service checks
  - Default setting is every 10 seconds
- Child processes (service check plugins) hang around until they are “reaped”
- If you’re doing a non-trivial number of service checks, setting this lower will (typically)
  - Reduce the number of processes waiting, taking up space
  - Lower the local load average numbers, sometimes

Notes:

- In version 2, check_result_reaper_frequency was called service_reaper_frequency
- Load average depends on how processes blocked on I/O are counted on your particular system
  - I think

Object Configuration

- nagios.cfg specifies the locations of “object configuration files”
  - With the cfg_file and cfg_dir variables
  - Which can be repeated to refer to multiple files and directories
  - cfg_dir directories are recursive
- Hosts, services, contacts, etc. are defined in template-based definitions in those files
- Template inheritance provides a reasonably effective mechanism

Notes:

- cfg_dir recursion was added in version 2

Object Configuration (cont’d)

- Object definitions look like

```
define type {
    directive  value
    directive  value
    ...
}
```

- Definitions include a “type_name” directive and value
- Templates include a “name” directive and value, and the directive “register” with a value of “0”
- To inherit from a template, a definition includes a “use” directive with a template name as the value

Notes:

- Directive names are case-sensitive
- Comments with # in column 1 or semi-colon anywhere
- Newer documentation uses “directive” and “variable” interchangeably
- It sounds a little more complicated than it really is
- You can also inherit from a “registered” object, such as some other host or service
  - e.g. host1 is fully defined, host2 is “just like host1”
- See “Object Inheritance” in the docs
  http://nagios.sourceforge.net/docs/3_0/objectinheritance.html

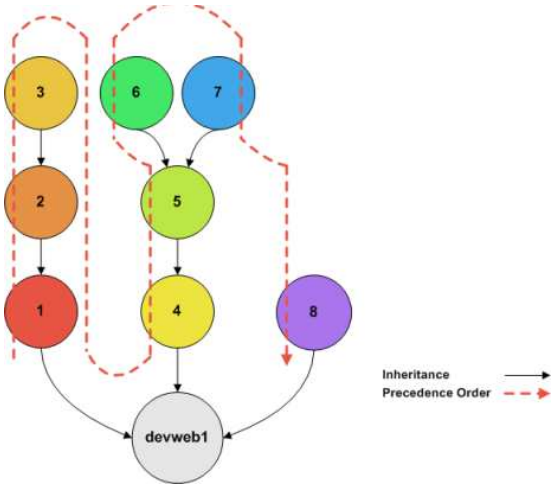
Object Templates

- The “use” directive causes a definition to inherit the directives declared in a template definition
- You can only have one “use” directive in a given template
  - Its location in the template is irrelevant, anything local to the template overrides anything inherited from a “use” directive
- Value for “use” directive is comma-separated list
  - You can have a “tree” of definition inheritance from a common root
  - Or multiple roots
- Reasonably powerful . . .

Notes:

- Version 3 added multiple template inheritance
  - In earlier versions you could inherit from only one template
  - Though you could have a template “chain”
- I think template inheritance must take the form of an acyclic directed graph.
  - There — my math degree proves useful once again

Object Template Inheritance



- Host devweb1 definition contains `use 1, 4, 8`
- First template (1 in this case) has highest priority

Notes:

- Stolen from Nagios 3 documentation
- Multiple inheritance sources were added in version 3
- Very handy with multiple locations, variable overrides, etc.

Directives and Values

- Each object type has pre-defined directive names
  - Generally consistent across different object types
- Append to an inherited value: `directive +value`
- Delete inherited value: `directive null`

Notes:

- Appending with + is called additive inheritence
- No subtractive inheritence i.e. can’t remove an item from a list unless you re-set the list

Custom Directives

- Custom directives start with underscore
  - And are case IN-sensitive
  - e.g. _snmp_community, etc.
- Use in host, service and contact definitions
- Refer to as macros or environment variables
  - e.g. _bloop in a host definition becomes
    - macro $_HOSTBLOOP$
    - environment variable NAGIOS_ _HOSTBLOOP

Notes:

- The documentation calls these custom *variables*, not directives
- Note that the macros and environment variables are uppercase
- And similarly for SERVICE and CONTACT custom variables
- I don’t know if you can use custom directives in other objects, or how you would refer to them
- More on macros and environment variables later

Implied Inheritance

- Nagios will sometimes assume a value from a related object
- Service objects will inherit
  - contact_groups, notification_interval, notification_period

  from the associated host
- Hostescalations and serviceescalations will similarly inherit as well
  - Except notification_period becomes escalation_period

Notes:

- Which is convenient and makes sense, and saves keeping the same information consistent in multiple places

Object Types

- There are quite a few different object types that can be defined
- host, hostdependency, hostescalation
- hostgroup
- contact, contactgroup
- service, servicegroup, servicedependency, serviceescalation
- hostextinfo, serviceextinfo
- timeperiod
- command

Notes:

- I think “quite a few” equals 14
- More or less self explanatory
- The “extinfo” types provide “extended” information for hosts and services for the web interface
- hostgroupescalation removed in 2.x — you can now use hostgroup_name in hostescalation definitions
- 2.x added servicegroup primarily for CGI display purposes
- Servicegroup can be referred to by servicedependency and serviceescalation definitions
- hostextinfo and serviceextinfo are now deprecated
  - All directives are now part of host and service definitions

Object Definitions

- Object definitions have many possible directives
  - You’ll default many, and inherit many from master templates
- The directives are fairly consistent across different object types
- The sample configuration files are well-documented
- The samples used to be in different files by object type
  - Not necessary to split them up that way
  - Many find that a “cfg_dir” full of .cfg files is very convenient
- Order is unimportant — multiple files are treated the same as a single file

Notes:

- You should read/review the sample config files
- cfg_dir is recursive as of 2.x
  - Which is handy

Timeperiod Definitions

- Timeperiods are used to define when to do service checks, and when notifications can be sent

```
define timeperiod{
  timeperiod_name  nonwork
  alias            Time to be Not Working
  sunday           00:00-24:00
  monday           00:00-09:00,18:00-24:00
}
```

- Most object types have a “type_name” directive, which is used by other objects to refer to the object being defined, and for some display purposes
- “alias” defines a more verbose description of the object

Notes:

- Apparently we work 24 hours a day from Tuesday to Saturday
- Most object types also have an “alias” directive
- http://nagios.sourceforge.net/docs/3_0/timeperiods.html

Timeperiod Definitions (cont’d)

- Version 3 added lots of timeperiod features
  - Dates and date ranges, day of month
  - Offset weekday e.g. 3rd Monday of a month or all months
  - And more!
- Exclude one timeperiod from another with the exclude directive
- Very powerful, handy for scheduling or recurring windows, holidays, vacations, etc.
- Non-weekday definitions are called “exceptions”
  - Which seems confusing to me

Notes:

- Lots and lots of examples at http://nagios.sourceforge.net/docs/3_0/objectdefinitions.html#timeperiod
- I think you can do just about anything
  - Including making it completely incomprehensible

Command Definitions

- All service and host checks are performed by commands defined in command definitions

```
define command{
  command_name  check_tcp
  command_line  $USER1$/check_tcp
      -H $HOSTADDRESS$ -p $ARG1$
}
```

- Note the use of variable substitution to pass parameters to the actual command
- A service definition that is checking for the gopher port to be listening would use

```
check_command  check_tcp!70
```


Notes:

- I wrapped the command_line to fit, but you can’t do that in a real definition
- There are a number of macros defined based on the values of directives in definition types
  - We’ll touch on macros later
- `$HOSTADDRESS$` is set from the “address” directive in the appropriate host definition
- Command line quoting is sometimes challenging, so try to avoid special characters in your arguments
- Do you remember gopher?

contact Definitions

- A contact is a person that may be notified, or who has access to the web interface
- host_notification_period and service_notification_period take a timeperiod_name
- host_notification_options are d,u,r,f,s,n for down, unreachable, recovery (up), flapping start/stop, scheduled downtime start/stop, or none
- service_notification_options are w,u,c,r,f,s,n for warning, unknown, critical, etc.
- The email, pager, host_notification_commands, and service_notification_commands directives are “obvious”

Notes:

- I think by now you probably understand the definition syntax
- Notification periods define when you can notify the person
- I’ve left out the contact_name and alias directives
- Notification options are comma-separated lists of code letters
- You might not want to include unreachable by default
  - If a key router, switch or firewall goes down, you’ll get a lot of noise
  - As long as you’ve properly defined host parent/child relationships

contactgroup Definitions

- Think of a contactgroup as a work team that is responsible for some hosts and/or services
  - It provides a level of indirection or abstraction in the configuration of areas of responsibility
- You might also define a “managers” contactgroup to be used in escalations
- The members directive is a comma separated list of contact_names of people in this group

Notes:

- Recall that all problems in computer science can be solved by another level of indirection

host Definitions

- A host definition specifies a host or device which provides “services”
- A host has both a host_name and an address
  - address can be an IP address or FQDN
  - An IP address avoids alerts if DNS fails, but is harder to maintain
- The check_command is used to see if a host is up
  - Typically a “ping” test of some form
  - Only used if service checks fail
- parents — a list of routers, gateways between here and there

Notes:

- Remember to define the check_command (somewhere!) otherwise your host checks will show as “pending”
  - Depending on firewalls, sometimes pings won’t work and I use `check_ssh` as the check_command
- The “parents” directive lets you describe your network topology, so that if a network link goes down, you’ll get notified about the link, not that all the unreachable hosts are down
- An unreachable host can cause a “route verification” to take place
  - If I was a marketer, I would say “root cause analysis” here

Groups for Hosts

- Hosts are included in hostgroups via
  - The hostgroups directive in the host definition
  - The members directive in hostgroup definitions
- contact_groups directive is per-host, not per-hostgroup
  - Consistent with use in service definitions
  - Need to be a contact for all hosts in a hostgroup to have access to the hostgroup

Notes:

- Contact groups used to be defined for a hostgroup
- I think this means that hostgroups and servicegroups are more or less equivalent
  - Just different names for grouping things you want to group

hostgroup Definitions

- A hostgroup defines an administrative grouping of hosts
- Used to organize output in the web interface, and to determine access restrictions
  - You can only access those hosts/services that you are responsible for
- members lists the hosts that are members
- hostgroup_members includes other hostgroups in this one

Notes:

- Can have multiple members directives for convenience
  - I think
- Contacts used to be attached to hosts only by the old contact_groups directive in hostgroups

service Definitions

- In Nagios terms, a “service” could be an aspect of a running system, like disk capacity, or memory utilization
  - A “service” needn’t be offered externally to a device
- Nagios tests services based on
  - max_check_attempts — how many times to check a service before concluding it is actually down
  - normal_check_interval — how many “time units” to wait between regular service checks
  - retry_check_interval – how many “time units” to wait before checking a service that is not “OK”
- contact_groups — who to complain to in case of a problem

Notes:

- See the documentation on “Service Check Scheduling” at http://nagios.sourceforge.net/docs/2_0/checkscheduling.html
  - Nagios works hard to be efficient and effective at doing checks
  - Not yet written/updated for Nagios 3.x

Service check_command Directives

- Each service definition must include a check_command directive
- You can refer to a defined command
  - Arguments can be provided, separated by !
- For example

```
check_command    check_ntserv!w3svc
```

- Open question: where should you quote special characters?

Notes:

- You used to be able to provide a “raw” command to be executed, surrounded by double quotes
  - But I don’t think you can anymore
  - Not often used — you’re better off to use the indirection provided by command definitions

Notification Configuration

- Host and service definitions also define when notifications should be sent using the following directives
  - notification_interval — number of “time units” (default: minutes) before re-notifying of a problem
  - notification_period — the timeperiod during which notifications may be sent
  - notification_options — hosts: d,u,r,f,s,n; services: w,u,c,r,f,s
  - notifications_enabled — 1 for yes, 0 for no
- The contact_group for the hostgroup or service is notified, using the rules for the individual contacts in group

Notes:

- “Time units” are in terms of the “interval_length” defined in the nagios.cfg file
  - Which defaults to 60 seconds
  - So the number given in an object definition for an “interval” is usually the number of minutes
- Hosts: down, unreachable, recovery (up), flapping start/stop, scheduled downtime start/stop, none
- Services: warning, unknown, critical, recovered, flapping start/stop, scheduled downtime start/stop, none
- See the detailed rules in “Notifications”, at http://nagios.sourceforge.net/docs/3_0/notifications.html

Notes and Links

- You can define
  - notes notes_url action_url

  for
  - host hostgroup service servicegroup

  objects
- Show up in reasonable places in the web interface
- Allow you to link to documentation or other things you can do to the host

Notes:

- These are relatively recent - late version 2, or version 3?
- Or perhaps they were always in the hostextinfo and serviceextinfo objects which I never used?

Dependency Definitions

- The hostdependency and servicedependency definitions allow you to define relationships between hosts and services
- For example, you could declare that your WWW service depends on your SQL service
  - If SQL is down, don’t bother checking WWW, because we already know it will fail
- Or your web host may depend on your nfs-server host
  - Similar but different from a host’s “parents”
  - parents defines network topology

Notes:

- Leave dependent_host_name and dependent_hostgroup_name empty (or null) for “same host”
- See “Host and Service Dependencies” at http://nagios.sourceforge.net/docs/3_0/dependencies.html
- More on dependencies later

Escalation Definitions

- If something is broken, you may want/need to “escalate” the problem if it’s not resolved quickly
- Define these if so: hostescalation hostgroupescalation serviceescalation
- first_notification and last_notification — which notifications to escalate
- notification_interval — how often to send them
- contact_groups — who to send them to
  - Remember to include the “lower level” contactgroups
  - Or use additive inheritance (with a + sign)

Notes:

- Notifications and escalations provide a very flexible mechanism
- For example, you could set up different contactgroups and contacts for the same people, but with different ways to contact them, so that you could
  - first email problems reports to the contacts
  - then page them
  - then send SMS messages to their phones
  - then call their home phone numbers
  - and so on
- See “Notification Escalations” at http://nagios.sourceforge.net/docs/2_0/escalations.html
- hostgroupescalation removed in 2.x — you can now use hostgroup_name in hostescalation definitions

Definition Shortcuts

- General rule: anywhere you can list a host_name or hostgroup_name you can
  - use a comma-separated list of hosts/groups
  - exclude with !
  - use a wildcard host_name of “∗”, meaning “all hosts”

  to have it apply (or not) to multiple hosts
- e.g. A service definition for the HTTP service might include
  `hostgroup_name webservers`
  to cause the service to be defined for all hosts in the webservers hostgroup
- This can save a lot of repetition in your configs

Notes:

- e.g. For a service, dependency, or escalation
- Note that this is a “general rule” and won’t necessarily apply in every possible instance
- In `nagios.cfg` set `use_regexp_matching=1`
- See “Time-Saving Tricks For Object Definitions” at http://nagios.sourceforge.net/docs/3_0/objecttricks.html

Nagios Macros

- Nagios defines a number of macros for use in commands
  - Some implicitly from definition directives, etc.
  - Some explicitly, in the `resource.cfg` file
- These macros can be substituted into host and service check commands, notifications, event handlers, etc.
  - Different macros are available at different times
- An effective way of passing variable data outside of the Nagios core

Notes:

- See “Understanding Macros and How They Work” at
  http://nagios.sourceforge.net/docs/3_0/macros.html
  http://nagios.sourceforge.net/docs/3_0/macrolist.html
  for all the details
- Including a handy reference table of what’s available when, and what all the macros mean

More on Macros

- Lots of macros — all sorts of variant information is available
- Most are added to environment e.g. `NAGIOS_SERVICESTATE`
  - Including any custom variables
- “On-Demand Macros” allow you to refer to values from other config settings e.g.
  `$SERVICESTATEID:novellserver:DS Database$`
- “On-Demand Group Macros” get you a comma-separated list of all values in a host, service or contact group e.g.
  `$HOSTSTATEID:hg1:,$`

Notes:

- Can disable environment variables by setting the `enable_environment_macros` variable to 0
  - Avoids a bunch of overhead, or so they say
  - But it removes a bunch of information that can be useful for plugins and other commands
- On-demand macros are not added to the environment
- Environment variables, on-demand macros and more added in version 2
- Even more macros added in version 3

Theory and Practice

Theory of Operation

- Documentation contains “Theory of Operation” information
- It covers many of the details of how things actually work
  - Status and reachability of network hosts
  - Determination of network outages
  - Service check scheduling, service state
  - Notifications, timeperiods
  - Plugins
- You should at least review this information, as it will help you understand both what is happening, and what is possible

Notes:

- Used to be a separate section, now at the end of “The Basics”
- And review the “Advanced Topics” section as well
- And all the rest of the documentation while you’re at it

State of the Network

- Current state of a service or host: two things
  - Status: OK, Warning, Up, Down, etc.
  - State: Soft, Hard, Unreachable
- Soft state: a check failed, but still have retries to do
  - Logged, and event handler run
- Hard state: When we’re sure
  - Notification logic invoked

Notes:

- I was tempted to try a pun related to the state of the network address, but I held back
- State Types: http://nagios.sourceforge.net/docs/3_0/statetypes.html
- That document doesn’t mention “unreachable” as a state, but I think it likely is an actual state

Stalking and Volatility

- If enabled, stalking logs any changes in plugin output
  - Even with no state change
  - e.g. RAID check was “1 disk dead” and is now “2 disks dead”
  - Logged for later review/analysis
- Volatile services
  - Something that resets to OK after each check
  - Need attention every time there is a problem
  - Notification and event handler happen once per failure
  - e.g. Alert on a port scan

Notes:

- Most people likely won’t want to use stalking
- Enabled on host and service definitions
- http://nagios.sourceforge.net/docs/3_0/stalking.html
- I’m thinking you could likely get the same result as volatility by setting only 1 check, no recovery notifications
  - But I could be wrong
- http://nagios.sourceforge.net/docs/3_0/volatileservices.html

Topology Matters

- Parents directive in host definitions defines topology
- Parents are typically routers, firewalls, switches, etc.
  - i.e. How the packets get there from here
- Can have multiple parents with redundant network paths
- Notification_option “u” sends on UNREACHABLE state
- Buzzphrase: root cause analysis

Notes:

- Unless your network is tiny, flat or otherwise trivial
- Used in drawing network maps in a sensible way
- Parents in a comma-separated list of all parent hosts
- See the docs: “Determining Status and Reachability of Network Hosts” http://nagios.sourceforge.net/docs/3_0/networkreachability.html

Depending on Others

- Host and service dependencies define operational requirements
  - e.g. Web server can’t work unless file server is working
- `execution_failure_criteria` and `notification_failure_criteria` determine what we do if something we depend on fails, e.g.
  - if file server down, don’t execute web check
  - and don’t notify me about web problem
- Set `inherits_parent` to inherit dependencies in definitions

Notes:

- Failure criteria are o (OK), w (warning), u (up), c (critical), p (pending), n (none)
- I think `inherits_parent` is perhaps misnamed – parents are topological, dependencies are different
- http://nagios.sourceforge.net/docs/3_0/dependencies.html

Cached Checks

- Can cache and re-use host or service check results
- Used only for “On-Demand Checks”
  - Checking that host is up if a service fails
  - Checking topological reachability
  - For “predictive dependency checks”
- i.e. Checking for “collateral damage”
- Lower overhead, good results
  - You should enable and tune the cache

Notes:

- “Predictive dependency checks” – in a network outage, schedule more topological checks earlier, since we’re likely to need that information
- http://nagios.sourceforge.net/docs/3_0/cachedchecks.html
- Don’t blame me for the “cached checks” pun, because in Canada “cached cheques” makes no sense at all

Event Handlers

- In a perfect world, nothing would ever go wrong
  - In a semi-perfect world, problems would fix themselves
- Event handlers are one of Nagios’ ways of moving closer to perfection
- An event handler is a command that is run in response to a state change
  - Canonical example: restart httpd if WWW service fails
  - Open a trouble ticket on failure?
- Complications: runs as the nagios user, on the nagios server
- Global and specific host and service event handlers

Notes:

- And incidentally, in a perfect world, tutorial notes would never contain any typos
- A state change is (simplistically speaking) a failure or a recovery
  - I’m ignoring “hard” vs “soft” states here
- As documented, sudo and ssh can be useful in event handling commands for elevating permissions and access to remote services
  - And recall that SSH key files can allow only specific commands
  - I restart a Windows IIS service from Nagios via a script and ssh
- Host and service definitions can use the event_handler directive
- Event handlers can (and should) be passed all sorts of state and check attempt information

External Commands

- The Nagios server maintains a named pipe in the file system for accepting various commands from other processes
- External commands are used most often by the web interface to record information and modify Nagios’ behaviour
  - But you can do lots of things from shell scripts . . .
- Some of the available functionality
  - Add/delete host or service comments
  - Schedule downtime, enable/disable notifications
  - Reschedule host or service checks
  - Submit passive service check results
  - Restart or stop the Nagios server

Notes:

- Written to the named pipe as a single line, with multiple fields
  - Syntax is timestamp, command, then ;-separated arguments
- e.g. to get Nagios to restart, write this:
  `[1041175870] RESTART_PROGRAM;1041175870`
- Documented (of course) at
  http://nagios.sourceforge.net/docs/3_0/extcommands.html
- Exhaustive list of 157 available commands, with examples, at
  http://www.nagios.org/developerinfo/externalcommands/

Passive Service Checks

- Nagios can accept service check results from other programs
  - Since Nagios did not initiate the check, these are called “passive service checks”
- These are useful for
  - Asyncronous events (SNMP traps, say)
  - Results from other existing programs
  - Results from remote or secured systems
- You’ll recall that the NSCA addon uses these

Notes:

- Submitted through the external command interface

Distributed Monitoring

- Nagios supports distributed monitoring of a certain style
- Remote Nagios servers are essentially probe engines, submitting their results to a central server with passive service check results
- The configuration on the remote servers is a subset of the central configuration
- The central server is configured to notice if the passive results stop coming from the remote server

Distributed Monitoring (cont’d)

- This seems like a fair amount of duplication of effort to me, but it gets you all the status on one central console
- I tend to set up independent Nagios servers
  - And use my check_nagios_status plugin to “screen-scrape” the remote web interface
  - Providing a central summary and click-through to the remote server
- Tools like DNX can spread the load
  - But still retain one Nagios host doing the scheduling
- Your mileage may vary

Notes:

- More on DNX on page 97
- My simple-minded mb_divert (page 98) distributes some checks
- The “central aggregation” approach is used by a number of more recent tools, such as Nagios Fusion, Thruk (page 104), MNTOS (page 104), and Multisite (page 104)

Adaptive Monitoring

- Can change things during runtime via external commands
  - e.g. schedule changes, or from an exception handler
- Can change
  - Check commands and arguments
  - Check interval, max attempts, timeperiod
  - Event handler commands and arguments
- Likely just for very specific uses or situations

Notes:

- An previous audience member gave an example of an active/passive cluster that is behind a hardware load balancer
  - Checking the hosts directly
  - Need to move the checks if the service fails over
  - No service address that moves between the hosts
- Added in version 2
- http://nagios.sourceforge.net/docs/3_0/adaptive.html

Obsession

- OCSP: Obsessive Compulsive Service Processor
- OCHP: Obsessive Compulsive Host Processor
- Commands that may be executed after every service or host check
- Allows you to pass results to external applications
  - e.g. Used to submit distributed monitoring results with send_nsca
- Efficient? Commonly Used? Scalable?

NEB – Nagios Event Broker

- Allows you to add code to the Nagios core
- Dynamically loaded module
- Has access to internal Nagios events and data
- Limited documentation — helloworld.c in source
- Starting to be used for interesting things
  - Logging to database
  - DNX – check distribution

Notes:

- USENIX ;login: articles on NEB Modules by David Josephsen in October and December 2008
  http://www.usenix.org/publications/login/2008-10/index.html
  http://www.usenix.org/publications/login/2008-12/index.html

Getting Larger

Scaling Up

- Nagios can handle a lot without much effort
- As you get larger, advanced features are more important
  - Use parent/child and host/service dependencies
  - More efficient for humans and machines
- You will need to be more rigorous in your configuration
  - Consistency, completeness, tuning
- Version 3 adds scalability and tuning features

Check Execution

- A check is typically fork(), fork(), exec()
- Theory is that running the plugins uses lots of resources
- Distribute plugin execution for more capacity
  - Distributed monitoring, multiple servers, DNX, etc.
- Perhaps embedded perl is a practical tool?
  - Pros and cons – not all Perl will embed nicely
  - Force/avoid ePN: `# nagios: +epn`
  - In first 10 lines of Perl script . . .

Notes:

- ePN is “embedded Perl Nagios”
- Explicit - if first 10 lines of a script contain
  - # nagios: +epn
  - # nagios: -epn
- Implicit use of ePN via configuration options
- Embedded perl overview and pros and cons at http://nagios.sourceforge.net/docs/3_0/embeddedperl.html

More on Timeperiods

- Timeperiods can be quite specific
- Use and exclude of timeperiods are very flexible
  - e.g. define “holidays” and exclude from “workhours”
- Can describe on-call schedules, maintenance windows, etc.
- Avoid check overhead when you don’t care
- Not quite as useful for the one-person shop . . .

Notes:

- All the cool timeperiod stuff was added in version 3
- “Time Periods”
  http://nagios.sourceforge.net/docs/3_0/timeperiods.html
- “On-Call Rotations”
  http://nagios.sourceforge.net/docs/3_0/oncallrotation.html

Large Installation Tweaks

- `use_large_installation_tweaks` option
- No summary macros in the environment to avoid overhead
  - e.g. TOTALHOSTSUP, etc.
- Lazy, but more efficient memory freeing in children
- Checks are single, not double, fork()

Notes:

- “Large Installation Tweaks”
  http://nagios.sourceforge.net/docs/3_0/largeinstalltweaks.html

Tuning for Performance

- Lots of tunable configuration parameters
- Keep performance graphs of Nagios
  - MRTG, nagiostats, etc.
- Disable environment macros
- Use passive checks if you can
  - Not my favorite idea . . .
- Avoid interpreted plugins, or offload checks
- Use Fast Startup Options – pre-cache configs

Notes:

- Lots of good information in the documentation
- “Tuning Nagios For Maximum Performance”
  http://nagios.sourceforge.net/docs/3_0/tuning.html
- “Graphing Performance Info With MRTG”
  http://nagios.sourceforge.net/docs/3_0/mrtggraphs.html
- “Fast Startup Options”
  http://nagios.sourceforge.net/docs/3_0/faststatup.html

Tips and Tricks

Tips and Tricks

- Use the parent/child topology
  - Pre Nagios 3, host checks are not parallelized
  - Host checks of a down segment can block all other checks
- Be consistent and use templates and groups
  - Make it easy to add another similar host
  - Make it easy to add a service to a group of hosts
- Smarter plugins make life (configuration) easier

Hostgroups Are Your Friends

- Hostgroups are really handy for grouping checks
- Use the +groupname syntax e.g.
  `hostgroups +webservers,dbservers`
  which makes it easy to add on checks as you include templates
- With multiple Nagios servers use
  `allow_empty_hostgroup_assignment=1`
  - You can define machine types as common hostgroups
  - Even if you don’t have every type on every Nagios server

Organize Your Config Files

- Put files in different directories
- One host per config file
- Generate configs from other information you already have
  - Or use a script to generate from a list
- Take advantage of your naming convention
  - Wildcards in host names based on FQDNs

Separate Your Problem Space

- Multiple locations? Use multiple servers!
  - Distributed monitoring
  - Or separate systems, aggregated or summarized centrally
- Can you delegate to different internal groups?
  - One system for networks, one for servers, . . .
  - Scales software, and your time

Another Level of Indirection

- Wrap your plugins in smarter scripts
  - How about a master checker that knows all and checks everything on a host?
- Have your plugins determine what’s “normal” or not
  - So you don’t have to pre-set thresholds, etc.

Custom Object Variables for Limits

- Define a custom variable, use it in a check command
- In a global host template, set defaults
- Use other templates to set defaults for locations, hostgroups
- Set per-host values in host definition

Host template or host:

```
_LOADWARN       5,3,2
_LOADCRIT       7,5,4
```

Command definition:

```
command_line $USER1$/check_load
  --warning=$_HOSTLOADWARN$
  --critical=$_HOSTLOADCRIT$
```


Notes:

- Useful with multiple inheritence:

```
define host {
name busymachines
_LOADWARN 10,6,4
_LOADCRIT 15,10,6
register 0
}
define host {
use busymachines,generic
...
}
```

- Silly me, I only twigged to this after using Nagios 3.x for a long time, when I was trying to solve a particular problem

Abusing Nagios

Contact Convolution

- Note that people to contacts need not be one to one
- Sometimes you want to be paged, sometimes mailed, sometimes not
- Consider three contact groups:
  - sysadmin, sysadmin-email, sysadmin-page
- Contactgroup directives include contactgroup_members
- Define generic contact templates with notification commands
- Define per-person contact templaces with details
- Define 3 contacts for each, use-ing the templates, in the contactgroups

Notes:

- If this isn’t clear, please let me know, and I’ll send a sample file

Cheap (Check) Tricks

- Check for an open localhost TCP port (e.g. 3366)
  tcp.tcpConnTable.tcpConnEntry.tcpConnState
  .127.0.0.1.3366.0.0.0.0.0
  = listen(2)
  - Which may not work on Windows . . .
- I put together a `check_allstorage` plugin
  - Don’t need to set limits in nagios config
  - Gets list of filesystems from device, cache in /tmp dir
  - Estimates thresholds based on current usage
- And `check_netapp_df` for NetApp volumes

Notes:

- I needed to check that the PureMessage Milters were actually running and listening locally on remote mail servers
- I find check_allstorage very handy, we used nagmin, which I found a little cumbersome
  - I can tweak the automatic thresholds by editing the /tmp file
- http://www.syonex.com/resources/

Getting There from Here

- I try to avoid the standard tools to run remote plugins
  - Like NRPE, `check_by_ssh`, etc.
- My `check_snmpexec` does an SNMP query to run plugin remotely
  - Net-SNMP `snmpd` exec functionality
- I check Windows services with `check_winsvc`
  - Uses `snmptable` to get `enterprises.lanmanager .lanmgr-2.server.svSvcTable`
  - And looks for the desired services in the output

Notes:

- Fits nicely with my SNMP religion

Web Server Abuse

- There’s lots of different transports
- Got a visible web server that can run PHP or CGI?
- Set up a “hidden” web page to run your check
  - Use Auth or allow/deny rules to limit access
  - Use check_http to look for a regular expression
  - Get remote status over port 80

Notes:

- We do a few variants on this to get status and state out of our public web servers

Put Yourself in Someone Else’s Shoes

- Sometimes you don’t “own” a remote network
  - Central networking group
  - Service provider
- My theory: a tiny utility server solves many problems
  - NRPE, SSH, plugins
- My idea: MonBOX
  - Coming soon . . .
- Consider this a gratuitous plug

Ghost Hosts

- We had a bunch of SMTP servers, and seven locations
- We had DNS names like smtp.location.company.com
  - Which are DNS A records with multiple addresses
  - So they can be sendmail “smart hosts”
- How do we know that the smtp names still work?
- Define a “virtual” host called `smtp-servers` with address 127.0.0.1
- And a bunch of `check_smtp` service checks for the various names

Notes:

- At former employer

Service as a Host

- We had an outsourced help desk
  - They watched nagios, but only cared about “down” hosts
- How did we get them to notice a down link between up routers?
- Made up a hostname “link-tor-det” and the host check is check_hops
- So the link down looks like a host down

Nonsense with Negate

- The negate plugin inverts the result of a plugin
- No webserver (or telnet, or . . .) allowed:

```
negate check_http -H hostname
```

- File doesn’t exist:

```
negate check_file_age -H hostname
```

- Another level of indirection . . .

Hey! Wake Up!

- At FreshBooks, we have “hack offs”
- I have a remote control power bar
- I bought at 12 volt revolving light at the auto supply
- A few scripts watch the status file
  - Look for unhandled problems
- Can be used with a klaxon horn as well . . .
- I now have this hooked into my Asterisk box at home . . .

Remember . . .

- Anything you care about can be monitored
- It does not need to be a “service”
- Or even something on a computer or network device
- Simple shell plugins are powerful

Nagios Addons

Visualizing Nagios Data

- There are manu visualization tools for Nagios
- Graphing, mapping, business processes, . . .
- I’m not covering any of those today

Nagios Addons

- The “downloads” section of the Nagios web site includes references to a number of “addons” for Nagios
  - Providing interesting additional functionality
- The extras are now listed on nagiosexchange.org
- Have a browse, and you’ll get some interesting ideas
- A few addons, in particular, are worth special mention

Notes:

- See my “Tools You Need” notes for more addon mentions
- http://www.nagios.org/download/addons/
- http://exchange.nagios.org/

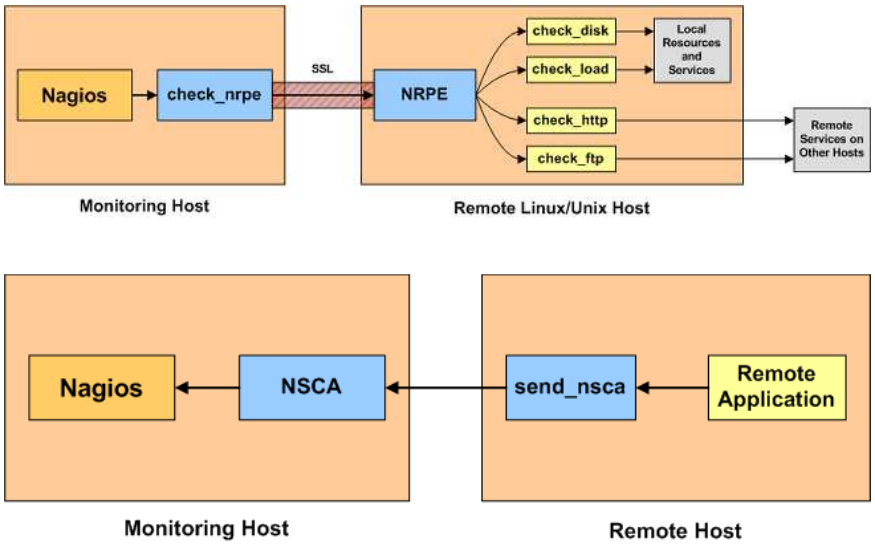
NRPE and NSCA

- These addons were written to address the need to do remote service checks of various types
- NRPE – Nagios Remote Plugin Executor
  - A client “check_nrpe” and server “nrpe” pair
  - Lets a Nagios server connect to a remote daemon, which will run plugins on the remote machine, and return the results
  - Moderate security features
- For Windows: try nrpe_nt
  - A re-implementation for Windows servers

Notes:

- Both NRPE and NSCA were written by Ethan Galstad (the Nagios author), so you can sort of consider them as just outside the Nagios core
- Despite my religion, I will sometimes admit that not all problems can be solved with SNMP
  - But don’t attempt to quote me on that!
- Was going to be split out at http://sourceforge.net/projects/nrpe
- nrpe_nt for Windows at http://www.miwi-dv.com/nrpent/
- Plugins for Windows NRPE: search for “Windows NRPE” at http://exchange.nagios.org/

NRPE and NSCA Illustrated



Notes:

- I stole these from http://www.nagios.org/images/addons/nrpe/nrpe.png and http://www.nagios.org/images/addons/nsca/nsca.png

NRPE and NSCA (cont’d)

- NRPE uses `popen()` which means a shell is involved on the remote host
  - Leads to problems with special characters and quoting
- NSCA – Nagios Service Check Acceptor
  - A client “send_nsca” and server “nsca” pair
  - Lets a remote system run a local check and submit a “passive service result” to the Nagios server
  - Can also be used to set up distributed monitoring, with service results aggregated on a central server

Notes:

- My slightly modified NRPE avoids some problems and tries to make some things easier
- http://www.syonex.com/resources/software.html

NRDP — Nagios Remote Data Processor

- Designed to replace NSCA
- Standard ports and protocols — HTTP(S) and XML
- Can be used for other purposes as well
  - Send data, status or commands to a server
  - Let server do something with it

Notes:

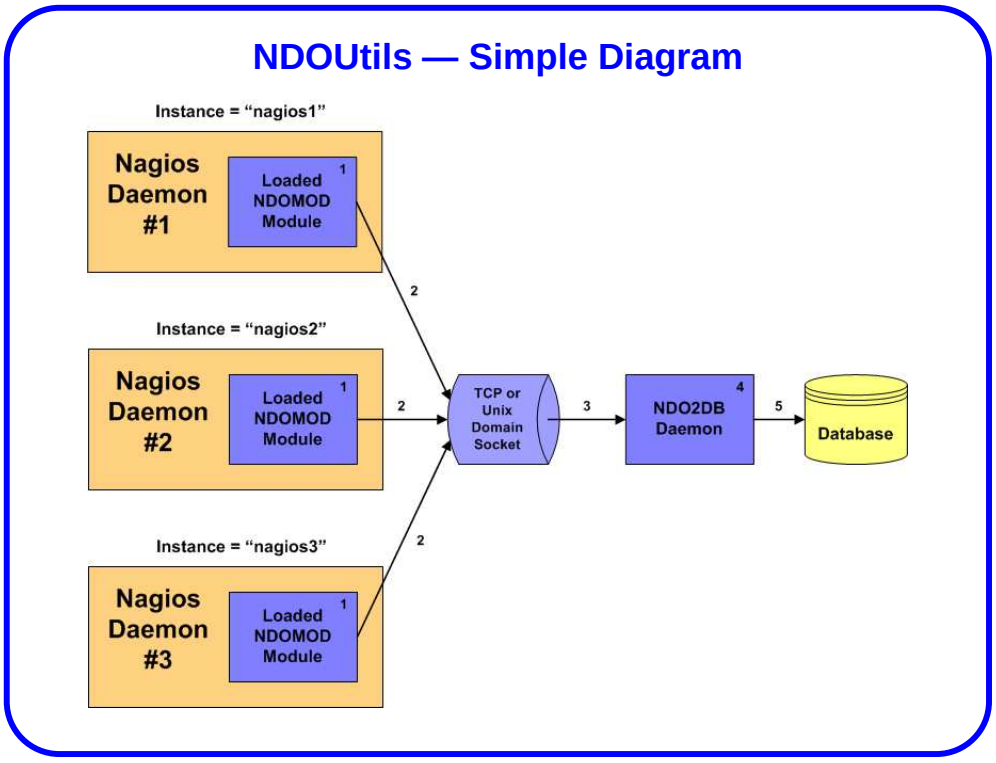
- http://exchange.nagios.org/directory/Addons/Passive-Checks/NRDP–2D-Nagios-Remote-Data-Processor/details

NDOUtils — Status and Events to DB

- Nagios Data Output Utilities
- Event broker and intermediate programs to stuff status and event data into a database
  - So you can crunch the details later
  - Into pretty reports and graphs
- Real time (via pipe) or periodic (via files)
- Can import old logs
- Still alpha/beta, and still “experimental”
- “likely play a central role in the new Nagios web interface”

Notes:

- Also by Ethan Galstad, so just outside the nagios code
- Currently MySQL only, but PostgreSQL will likely be added at some point
  - Or so the README says
  - I think the icinga equivalent may have PostgreSQL support now



Notes:

- Stolen from http://www.nagios.org/images/addons/ndoutils/ndoutils.png

NDOUtils – building

- On FreeBSD, I had to do:

```
% env CPPFLAGS=-I/usr/local/include
% LDFLAGS=-L/usr/local/lib
./configure
--with-mysql-inc=/usr/local/include
--with-mysql-lib=/usr/local/lib/mysql
```

- If I added `--with-pgsql-lib` it failed to find mysql
- But it wouldn’t compile . . .
  - No -I on gcc commands

DNX – Distributed Nagios Executor

- NEB module, intercepts check commands before execution
- Passes work off to a “worker node”
- Bypasses external command pipe/file
- Workers register with the server
  - Can come and go as they please (or die)
- Assumption: no worker is preferred
  - i.e. doesn’t address local vs remote

Notes:

- http://dnx.sourceforge.net/
- From the LDS Church
  - They do $> 10,000$ checks every 5 minutes
  - And expect “sharp increases” in requirements

mbdivert - Divert Checks Elsewhere

- mbdivert – plugin wrapper
- Sends plugin checks elsewhere based on hostname/IP/regex
- Uses check_nrpe or check_by_ssh or . . .
- “Seamless” intergration into existing Nagios configs
- Makes use of a slightly enhanced NRPE
- Geographic, administrative or per-network diversion/distribution

Notes:

- This is one of my little projects
- Available soon: www.syonex.com/resources/software.html
- Ask me about the MonBOX remote monitoring appliance . . .

Nagios Business Process Addons

- “Roll Up” host/service checks to represent “business processes”
- Adds new entries in web menu
- Sort of a process summary view
- Seems like a useful abstraction
- http://nagiosbp.sourceforge.net/

Merlin or Module for Effortless Redundancy and Loadbalancing In Nagios

- Effort to make distributed Nagios easy
  - Alternative to NSCA
- Load balancing, redundancy, distributed
- Status database
- Still in development, if I understand correctly

Notes:

- From the good folks at op5.com, who have Nagios-based products.
- Requires Nagios 3.2.4, which is not yet available
  - Or so the README in the git repository says
- http://www.op5.org/community/projects/merlin
- Merlin 0.9.0 released November 2010

V-Shell — Alternative Front End for Nagios

- Standard web interface is thought to be “long in the tooth”
- Alternative web interface to Nagios Core
  - From the Nagios Enterprises team
- PHP, CSS, valid XHTML
- Basic, functional rather than web 2.0 whizbang
- Work in progress

Notes:

- V-Shell released in early October 2010
- List of notable themes and web interfaces at http://www.nagios.org/download/frontends
- Nagios V-Shell is referenced there and on http://exchange.nagios.org

NINJA or Nagios Is Now Just Awesome

- Attempt to develop an alternative Nagios GUI
- PHP, scalability, better searching and filtering
- Multi-language, templates/skins
- Relies on Merlin
- Used in op5’s monitoring product

Notes:

- Also from the good folks at op5.com.
- http://www.op5.org/community/projects/ninja
- Ninja 1.1.0 released November 2010

Naglite2 — Simple Status Screen

- At FreshBooks we use Naglite2 for a status screen
- Quick summary of currently un-ack’d problems
- Handy for NOC status wall screens
- By Laurie Denness, at Last.fm
- http://laurie.denness.net/blog/2010/03/naglite2-finally-released/
- http://github.com/lozzd/Naglite2

Multiple Nagios Aggregators

- MNTOS — Multi Nagios Tactical Overview System
  - Simple summary of multiple Tactical Overview pages
- Thruk Monitoring Webinterface
  - Aggregates multiple backends
  - Uses MKLivestatus for communication and commands
- Multisite — aggregator, multiple views
  - Same author(s) as MKLivestatus

Notes:

- MNTOS from http://www.sorkmos.com/index.php?page=mntos
- http://www.thruk.org/index.php
- Thruk supports Nagios and “similar” tools
- MKLivestatus NEB module from http://mathias-kettner.de/checkmk_livestatus.html
- Multisite from http://mathias-kettner.de/checkmk_multisite.html

Wrap Up

And Finally!

- Feel free to contact me directly if you have any unanswered questions, either now, or later: jsellens@syonex.com
- Questions? Comments?
- Thank you for attending!

Notes:

- Thank you very much for taking this tutorial, and I hope that it was (and will be) informative and useful for you.
- I would be very interested in your feedback, positive or negative, and suggestions for additional things to include in future versions of this tutorial, on the comment form, here at the conference, or later by email.