An Introduction to Monitoring with Nagios

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References

- `www.nagios.org`: official distribution (core, plugins and documentation)
- `www.nagiosexchange.org`: lots of complementary plugins

W. Barth.
Nagios, System and Network Monitoring.
Open Source Press GmbH, first edition, 2006.
ISBN: 1-59327-070-4.

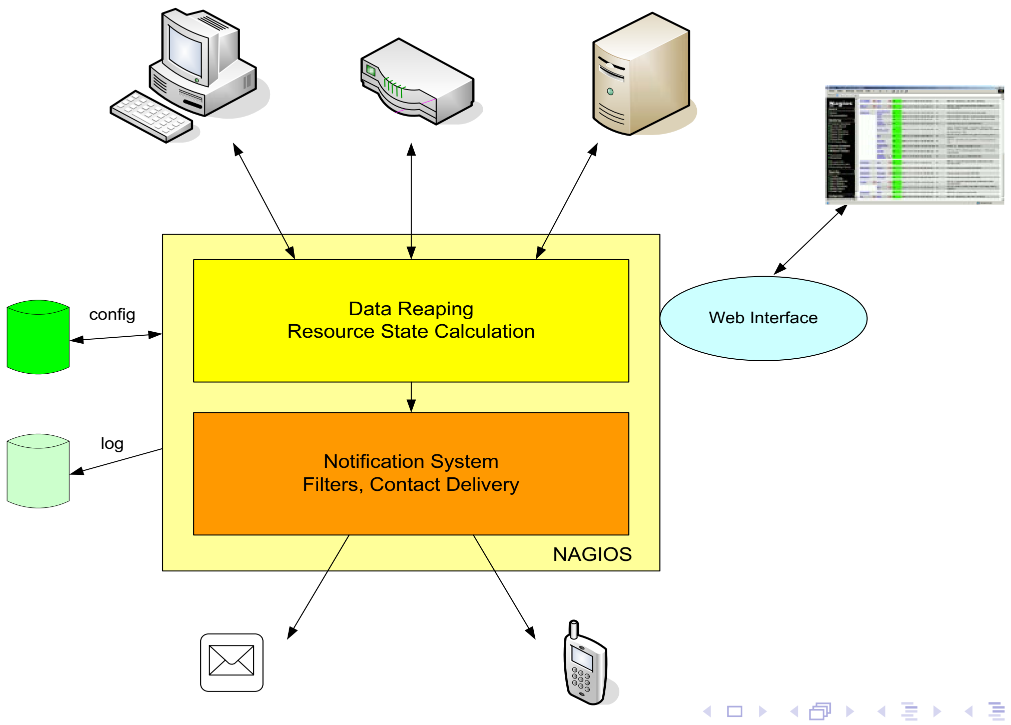
What is Nagios? What is Nagios useful for?

- A widely-used monitoring tool for trouble-shooting
  - Simple and open source
  - Network, system, service levels
- With a sophisticated (?) notification system to inform administrators when something goes wrong
- Nagios provides support to administrator(s) for detecting problems **before** users (including the boss!)
  - Mail server failure
  - Hard drive overload
  - Network outage

Key concepts

- Colored area concept
  - Green/Yellow/Red (Ok/Warning/Critical)
- No performance analysis or display (*a priori*)
- Checks using **external** commands (plugins)
- Various possibilities for **remote** checks
- Possibility for **passive checks** (from managed resources)
- Web interface + notifications

Functional architecture



Architecture at run-time

- Data reaping + notification system= *nagios processes*
  - Can be run as a service (`rcX.d`, soft runlevel)
- Web interface
  - External web server (Apache)
  - Bunch of cgi scripts (part of Nagios)
- Configuration
  - Simple text files
  - Or a postgres database
- Logs (local files)
- Named pipe (unix domain socket) to enable nagios to **receive** commands (from cgi, passive asynchronous events)

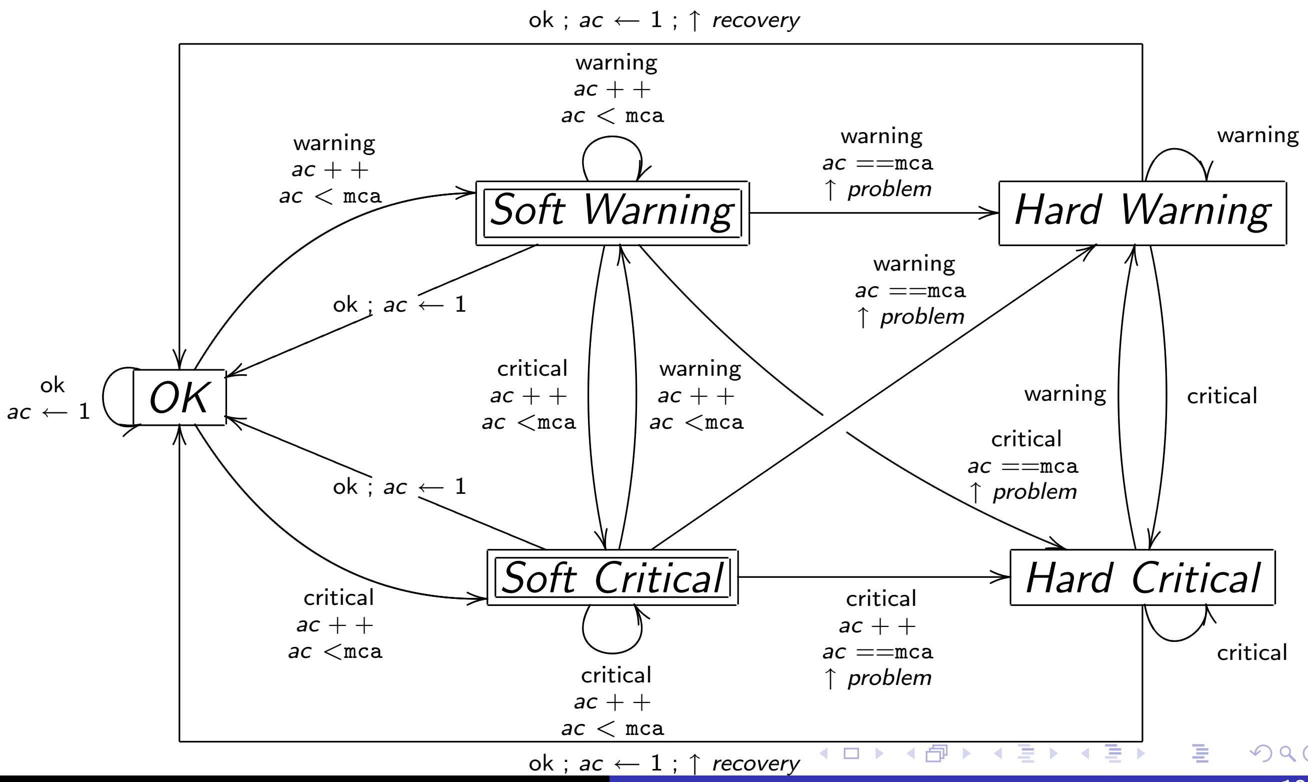
Service, service check

- Service
  - Service delivered by a software
  - Percentage of free space on a partition
  - Bandwith usage on a network interface ...
- Service check
  - Provides state information on a service
  - Returns a value: OK, WARNING, CRITICAL (exit status 0, 1, 2), UNKNOWN (exit status 3, due to time out or plugin runtime trouble) to reflect the Nagios view about this service
  - Can be local (OS calls) or remote (ICMP, NRPE, SNMP ...)
  - Is implemented by a plugin (external command/script)

Service states

- Service states are the mirror of what nagios observes
- States: OK, WARNING, CRITICAL, UNKNOWN
- Transitions from one state to another one based on results provided by checks
- Critical and warning states are shadowed by related *soft* states
  - A service goes first to a *soft* state
  - Attempt count mecanism to reach a definitive *hard* state
- User notification can only occur when *hard* states are reached

Service state diagram


ok ; $ac \leftarrow 1$; ↑ *recovery*
warning $ac++$ $ac <$ mca
warning $ac++$ $ac <$ mca
Soft Warning
warning $ac ==$mca ↑ *problem*
Hard Warning
warning
ok ; $ac \leftarrow 1$
warning $ac ==$mca ↑ *problem*
ok $ac \leftarrow 1$
OK
critical $ac++$ $ac <$mca
warning $ac++$ $ac <$mca
warning
critical
critical $ac ==$mca ↑ *problem*
ok ; $ac \leftarrow 1$
Soft Critical
Hard Critical
critical $ac++$ $ac <$mca
critical $ac++$ $ac ==$mca ↑ *problem*
critical $ac++$ $ac <$ mca
critical
ok ; $ac \leftarrow 1$; ↑ *recovery*

Service state diagram legend

- $\boxed{HS}$ hard state, using **normal_check_interval** between 2 checks
- $\boxed{\boxed{S}}$ soft state, using **retry_check_interval** between 2 checks
- $\xrightarrow{\text{RS}}$ transition triggered by a check with a return status of RS$\in$ { ok, warning, critical }
- $\xrightarrow{ac{+}{+}}$ *Attempt Count* is incremented when transition is triggered

Service state diagram legend (ctd)

- $\xrightarrow{ac<mca}$ transition is triggered if *Attempt Count* is smaller than the service configuration attribute: **max_check_attempts**
- $\xrightarrow{ac==mca}$ transition is triggered if *Attempt Count* is equal to the service configuration attribute: **max_check_attempts**
- $\xrightarrow{ac\leftarrow 1}$ *Attempt Count* is set to 1 then the transition is triggered
- $\xrightarrow{\uparrow notification}$ a user notification $\in$ { problem, recovery } is generated when this transition is triggered

Nagios configuration

- Object-oriented representation
  - A nagios object describes a specific unit: a service, an host, a contact, a contactgroup ... with attributes and values
  - kind of inheritance mechanisms, dependencies amongst objets
- Set of configuration files
  - Main file: nagios.cfg (ref. to other cfg. files)
  - 1 file per object type: services.cfg, hosts.cfg, contacts.cfg, checkcommands.cfg, misccommands.cfg, timeperiods.cfg ...
- Requires an *a priori* knowledge
- Configuration can also stand into a database

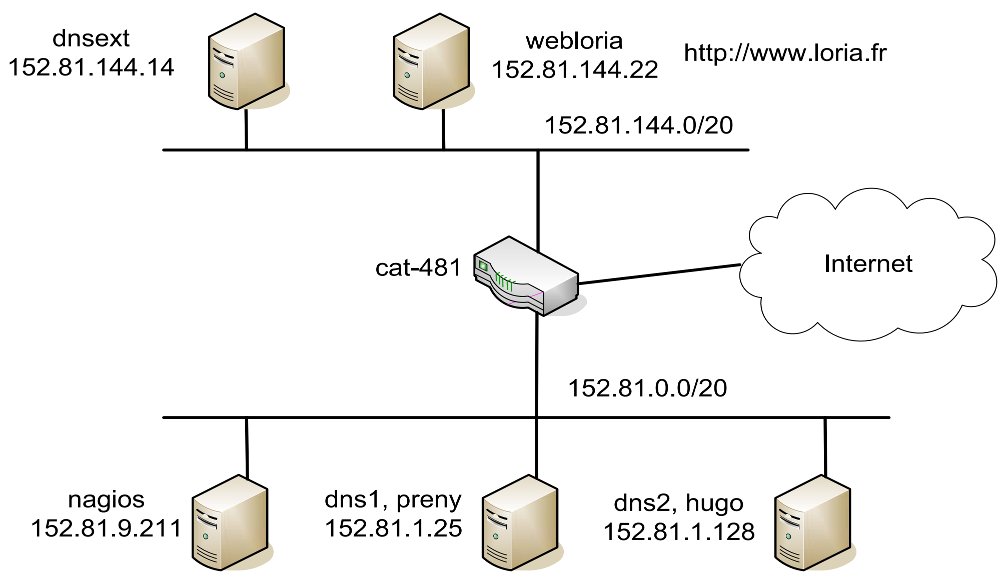
Host

- A service **have** to be linked to an *host*
- Only *UP* and *DOWN* states
- User notification (problem, recovery)
- Same external checks than services
  - UP = (WARNING or OK), DOWN = CRITICAL
  - Typically: ICMP-based checks
- No active checks if related services are **OK**
- Host group (cosmetic ...)

Other Nagios elements

- contact, contactgroup: to specify who to notify, how to notify and when to notify
  - Used in host and service definitions
- command: to execute check plugins or to send user notifications
  - Links Nagios attributes found in definitions (ex: host name) to plugin parameters
  - Already provided for most common plugins (see `checkcommands.cfg` file)
  - Basic wrapping to send emails (`misccommands.cfg` file)

Example scenario



Host definition (example)

hosts.cfg

```
define host {
    host_name                   webloria
    alias                       webloria linux machine
    address                     152.81.144.22
    check_command               check-host-alive
    max_check_attempts          3
    check_period                24x7
    notification_interval       180    # 3 hours
    notification_period         24x7
    notification_options        d,r,f,u
   # down,recovery ,flapping ,unreachable
    contact_groups              administrators
    }
```

Service definition (example 1)

services.cfg

```
define service{
    host_name                   webloria
    service_description         http service
    check_command               check_http
    max_check_attempts          3
    normal_check_interval       5
    retry_check_interval        1
    check_period                24x7
    notification_interval       180
    notification_period         24x7
    notification_options        w,c,r,f,u
   # warning,critical ,recovery ,flapping ,unreachable
    contact_groups              administrators
}
```

Command definitions (example 1)

checkcommands.cfg

```
define command{
 command_name     check-host-alive
 command_line     $USER1$/check_icmp -H $HOSTADDRESS$
 }

define command{
 command_name     check_http
 command_line     $USER1$/check_http -H $HOSTADDRESS$
 }
```

Service definition (example 2)

services.cfg

```
define service{
    host_name                   dnsext
    service_description         dns service
    check_command          check_name_for_given_dns
                           !www.loria.fr!152.81.144.22
    max_check_attempts          3
    normal_check_interval       5
    retry_check_interval        1
    check_period                24x7
    notification_interval       180
    notification_period         24x7
    notification_options        w,c,r,f,u
    contact_groups              administrators
}
```

Command definition (example 2)

checkcommands.cfg

```
define command{
 command_name check_name_for_given_dns
 command_line $USER1$/check_dns -H $ARG1$ -a $ARG2$
              -s $HOSTADDRESS$
              # $ARG1$: fully qualified name
              # $ARG2$: IP address
 }
```

Contact definition (example)

contacts.cfg

```
define contact{
   contact_name                        andrey
   alias                               laurent andrey
   service_notification_period         24x7
   host_notification_period            24x7
   service_notification_options        w,u,c,r
   host_notification_options           d,r
   service_notification_commands       notify-by-email
   host_notification_commands          host-notify-by-email
   email                               andrey@loria.fr
   }
```

Contactgroup definition (example)

contacts.cfg

```
define contactgroup{
  contactgroup_name        administrators
  alias                    group of administrators
  members                  andrey
  }
```

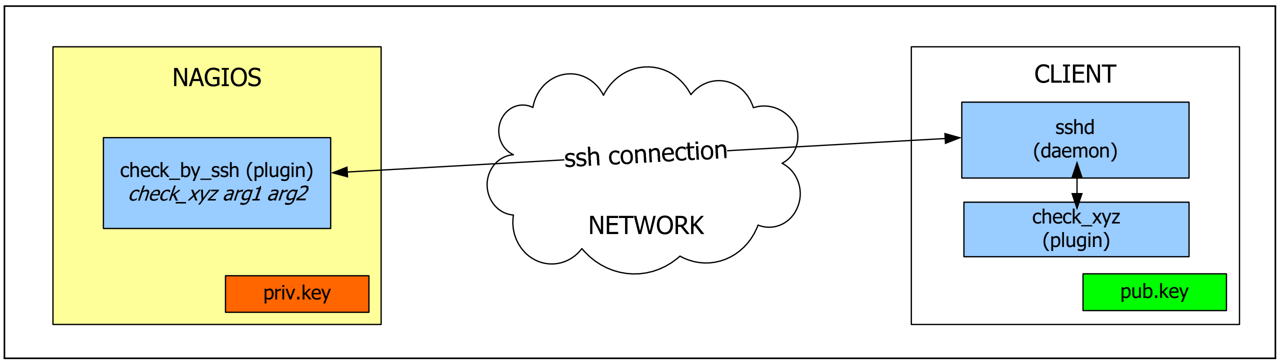
Local checks

- Getting information about your **local** system
- Plugins based on system commands (such as ps, df, uptime)
- `check_disk -w 30% -c 15% -p /var`
- `check_load -w 2.0,1.0,0.5 -c 4.0,2.0,1.0`
- `check_procs -w 150 -c 250 --metric=PROCS`

Direct network checks

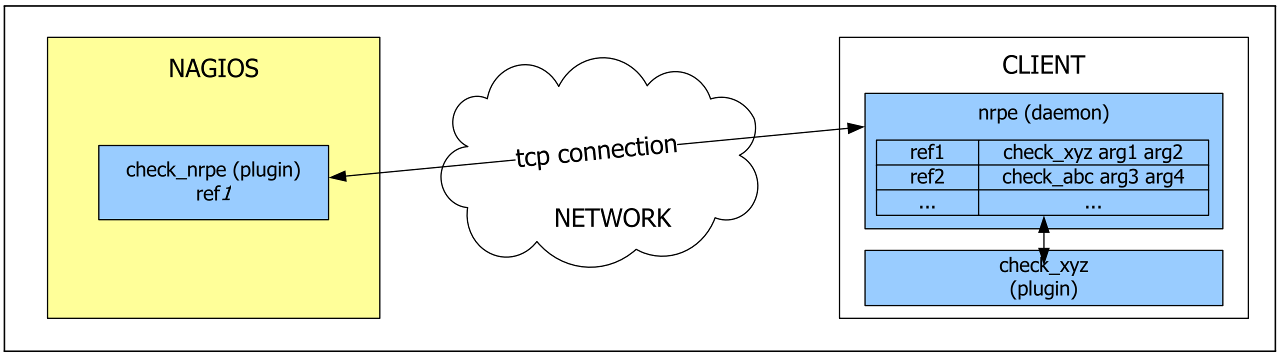
- Checking network services of remote hosts
- Plugins based on **network** protocols
- Directly executed from the Nagios machine
- `check_icmp -H 1.14.1.2 -w 100.0,20% -c 200.0,40%`
- `check_tcp -H boston.loria.fr -p 7000`
- `check_ftp -H ftp.inria.fr -p 21 -e 220`
- `check_http -H http://www.esial.uhp-nancy.fr`
- `check_smtp, check_imap, check_pop`

Checks using SSH (Secure Shell)



- Nagios executes the `check_by_ssh` plugin
- To run a plugin deployed on the remote machine
- Based on asymetric keys to log without typing a password

Checks using NRPE (Nagios Remote Plugin Executor)



- Nagios executes the `check_nrpe` plugin
- To interact with a dedicated daemon called `nrpe`
- Based on pre-configured plugin invocations

Other remote checks

- Checks using SNMP
  - Collecting management information from SNMP agents
  - `check_snmp` plugin ⇔ net-snmp `snmpget`
  - SNMP reply + warning and critical limits ⇒ service state
- Checks using NSCA (Nagios Service Check Acceptor)
  - Passive method where checks are initiated by the resources themselves (close to SNMP traps)
  - A NSCA daemon waits for incoming check results (on the Nagios machine), while the `send_nsca` program (on the remote machines) sends messages containing check results

Making configuration more simple

- Monitoring the same service on several hosts
  - setting the **host_name** attribute of the service as a comma separated list of host names
  - or setting an **hostgroup_name** attribute for the service
- Defining template-based objects
  - Notion of inheritance
  - Factorizing many low-interest attributes
  - **register** attribute to define a template
  - **use** attribute to inherite from a template

Service and hostgroup (example)

```
define hostgroup{
    hostgroup_name    dns_hosts
    alias             hosts supporting DNS
    members           dns1,dns2 ,dnsext
    }

define service{
    hostgroup_name              dns_hosts
    service_description         dns service
    check_command               check_name_for_given_dns
                                !www.loria.fr!152.81.144.22
    max_check_attempts          3
    normal_check_interval       5
    retry_check_interval        1
    check_period                24x7
    notification_interval       180
    notification_period         24x7
    notification_options        w,c,r,f,u
    contact_groups              administrators
    }
```

Specifying dependencies

- Remainder: service critical state ⇒ host check
- How does Nagios make a difference between:
  - case 1: **webloria** is really *down*
  - case 2: **webloria** is *unreachable* due to the network?
- Solution: defining dependency relationships amongst objects (**parents** attribute)
  - If an host is detected as **down**, the parent is checked
  - If the parent is **OK**, the initial host is really declared *down*
  - If not, the host is declared *unreachable*
- Ex: **cat-481** router defined as a parent of **webloria**

Conclusions

- Open source monitoring solution
- Based on simple concepts: checks, states, notifications
- Easily extensible and integrable
- No discovery mechanism
- Experience it during lab exercises!
  - Monitoring hosts and their services
  - Developing and testing our own plugin
  - Experimenting state transitions and notifications