



## Network Monitoring

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NEPAL

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## Welcome! Network Management Workshop

#### Network Monitoring Concepts, Tools And Deployment Procedures

#### APRICOT 2005 18-25 February 2005, Kyoto, Japan

## Assumptions & Objectives

#### Assumptions

- Know basic networking concept and fundamentals.
- Linux literate, knowledge of basic linux commands.
- Interest to learn.

#### **Objectives**

- Understand general concepts of Network Monitoring.
- Ability to configure Nagios, Apan, RRDtool, Nagios-statd, Snmp.
- Daily administration and maintainence.

## Agenda

- Why Network Monitoring
- Various Network Monitoring Tools
- Why Nagios
- Live presentation of network monitoring application Nagios with apan and rrdtool on pre-configured Nagios server
- Nagios, Apan, rrdtool installation procedure
- Step by step procedure to configure Nagios with apan, rrdtool, snmp, nagios-statd
- All students are requested to act together with presentation

## Why Monitoring

- With large numbers of machines it is hard to keep track of whats going on without good monitoring tool
- To know the problems before manager ask you to do and before customer calls
- To keep network always sound and healthy
- Fault detection for networks, gateways and critical servers
- To notify an administrator of problems on time
- Documentation and visualization of the network
- Benefits of centralized administration
- Is must on networking environment

## Monitoring But How?

- With the help of system builtin commands i.e ping, traceroute, tcpdump, nmap, netstat etc.
- With some other commercial tools i.e network inspector
- With the help of open source or community contributed application i.e nagios, apan, mrtg, which we always prefer

# What open source application available

- Nagios
- Angel Network Monitor
- Auto Status
- HiWAyS
- MARS
- Node Watch
- More on freshmeat.net

## Why Nagios?

- Open source
- Very scaleable, Manageable, Secure and more
- Best documentation available
- Good log and database system
- Nice, informative and attractive web interface
- Very flexiable
- Emails automatically sent if condition changes
- Verious notification options (Email, epager, mobilephone)

## Why Nagios

- Avoidance of "Too many red flashing lights"
  - "Just the facts" only want root cause failures to be reported, not cascade of every downstram failure.
  - also includes avoiding unnecessary checks
  - e.g. HTTP responding, therefore no need to ping
  - e.g. power outage, doesn't ping, so don't bother trying anything else
  - Services are running fine no need to do host-checkalive



- Individual node status

http://nagios.org

- Is it up?
- What is its load?
- What is the memory and swap usage?
- NFS and network load?
- Are the partitions full?
- Are applications and services running properly?
- How about ping latency?
- Amalgamated node status
  - Same info, but across groups of nodes

## Nagios Feature

- Nagios (formerly Netsaint)
  - host and service monitor designed to inform you of network problems before your clients, end-users or managers do
  - Designed to run under the Linux operating system, but works fine under most \*NIX variants
  - Monitoring daemon runs intermittent checks on hosts and services
  - uses external "plugins" which return status information to Nagios
  - when problems are encountered, the daemon can send notifications out to administrative contacts in a variety of different ways (email, instant message, SMS, etc.)
  - current status information, historical logs, and reports can all be accessed via a web browser
  - Nagios® is licensed under the terms of the GNU General Public License Version 2 as published by the Free Software Foundation

#### Feature contd.

- Monitoring of network services (SMTP, POP3, HTTP, NNTP, PING, etc.)
- Monitoring of host resources (CPU load, disk and mem usage, etc.)
- Monitoring of environment / temperature
- Simple plugin design that allows users to easily develop their own host and service checks
- Ability to define network host hierarchy, allowing detection of and distinction between hosts that are down and those that are unreachable
- Contact notifications when service or host problems occur and get resolved (via email, pager, or other user-defined method)
- Optional escalation of host and service notifications to different contact groups
- Support for implementing redundant and distributed monitoring servers
- Retention of host and service status across program restarts
- Ability to acknowledge problems via the web interface
- Web interface for viewing current network status, notification and problem history, log file, etc
- Simple authorization scheme that allows you restrict what users can see and do from the web interface



Web Client At NOC

#### Nagios Status Detail screen



#### Tactical Overview Of Nagios

	https://thuldai.mos.com	n.np/nagios/cgi-bin/tac	.cgi			
			?	# Passive Checks:	0	<u> </u>
Network Outages				Network Heal	th	
1 Outages				Host Health:		
1 Blocking Gatages				Service Healt	th:	
Hosts						
14 Down	0 Unreachable	156 Up	0 Pending			
14 Unhundled Problems						
Services						
		17 Critical			2 Warning	0 22 Unknown Ol
E Unbund Unbundled Problem Hosts	ied Problems					
Monitoring Features						
Flap Detection	Notifications	Event Handlers	Active Checks	Passive Checks		
All Services Enabled  II. Services  Flapping  All Hosts Enabled  Hosts Flapping	All Hosts Enabled	All Services Enabled All Hosts Enabled	All Services Enabled All Hosts Enabled	All Services Enabled		
		2003				6

#### Service Detail of Nagios

![](_page_15_Figure_1.jpeg)

Host 🚹	Service 1	Status 1	Last Check 个	Duration 1	Attempt 🛧	Status Information
ACTIONAID	Ping	<mark>Ж</mark> Е <mark>ок</mark>	02-01-2004 09:53:07	0d 12h 20m 9s	1/3	PING OK - Packet loss = 0%, RTA = 2 ms
AFP	Ping	XE <mark>ок</mark>	02-01-2004 09:55:38	0d 13h 40m 29s	1/3	PING OK - Packet loss = 0%, RTA = 1 ms
AGNIPAGE	🔁 Ping 💭	<b>@__Е</b>	02-01-2004 09:55:27	0d 0h 0m 59s	1/3	PING OK - Packet loss = 0%, RTA = 1 ms
BRTSCHOOL	e Ping	<mark>Ж</mark> Е <mark>ок</mark>	02-01-2004 09:54:06	d 18h 7m 39s	1/3	PING OK - Packet loss = 0%, RTA = 8 ms
Ban-cat	Ping	<mark>Ж</mark> Е <mark>ок</mark>	02-01-2004 09:56:11	0d 22h 44m 39s	1/3	PING OK - Packet loss = 0%, RTA = 1 ms
🔟 🖂 💁 门 Tra	nsferring data fro	n thuldai.mos.com	np			
📥 😔 🎯	S	8	Cu	rrent S 🗐 [roo	t@dhr	Sun Feb 01, 9:26 PM

![](_page_16_Picture_0.jpeg)

i ×

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Y	Curren	it Servi	ice S	tatus - Mozil	a		
Eile	e <u>E</u> dit	View	<u>G</u> o	<u>B</u> ookmarks	Tools	Window	Help

Kanasa			02-01-2004 10.21.36 30 220 460 348	1/3	ANNIF OK. USI-CPU.1, Sys-CPU.1,
	FIP	би	02-01-2004 10:23:48 3d 22h 46m 38s	1/3	FTP OK - 0.007 second response time port 21 [220 kailash.mos.com.np FTF server ready.]
	Free-Mem	югу 🖉 ОК	02-01-2004 10:22:15 3d 22h 48m 34s	1/3	SNMP OK: Ram-Free:3100,
	HTTP	бк	02-01-2004 10:22:59 3d 22h 46m 38s	1/3	HTTP ok: HTTP/1.1 200 OK - 0.021 second response time
	Load	減 🔁 ок	02-01-2004 10:25:17 3d 22h 48m 34s	1/3	SNMP OK: 1MIN-Load:0.08, 5MIN-Load:0.05, 15MIN-Load:0.00,
	Ping	💓 🔁 ок	02-01-2004 10:25:07 0d 5h 7m 33s	1/3	PING OK - Packet loss = 0%, RTA = 0 ms
	disk usag	• 🚿 🔁 ок	02-01-2004 10:22:51 3d 22h 48m 34s	1/3	Disk utilization: All disks OK
Karnali	Ping	<mark>Ж</mark> Е <mark>ок</mark>	02-01-2004 10:25:58 0d 17h 48m 53s	1/3	PING OK - Packet loss = 0%, RTA = 1 ms
Kopila	- Epu-usage	а 💥 🔁 ок	02-01-2004 10:24:07 3d 22h 48m 34s	1/3	SNMP OK: usr-cpu:0, sys-cpu:1,
	Free-Mem	югу 🗶 ОК	02-01-2004 10:22:51 3d 22h 46m 38s	1/3	SNMP OK: Ram-Free:3808,
	Load	ок	02-01-2004 10:22:18 3d 22h 48m 34s	1/3	SNMP OK: 1MIN-Load:0.18, 5MIN-Load:0.19, 15MIN-Load:0.18,
	POP	💥 <mark>ок</mark>	02-01-2004 10:23:07 3d 22h 46m 38s	1/3	POP OK - 0.028 second response time port 110 [+OK <8832.1075610415@kopila.mos.com
	Ping	<mark>Ж</mark> Е <mark>ок</mark>	02-01-2004 10:25:58 3d 15h 7m 15s	1/3	PING OK - Packet loss = 0%, RTA = 1 ms
Koshi	🧠 Ping	<mark>Ж</mark> Е <mark>ок</mark>	02-01-2004 10:22:37 1d 13h 37m 43s	1/3	PING OK - Packet loss = 0%, RTA = 9 ms
			TH		
	Done				

![](_page_17_Figure_0.jpeg)

#### Status Overview from nagios

![](_page_18_Figure_1.jpeg)

#### Status Summery Based On Hostgroup

🔇 🔘 🕼 🛇 https://thuldai.mos.com.np/nagios/cgi-bin/status.cgi?hostgroup=all&style=summary 🛛 🔍						
Status Summary For All I Groups	Host	-10				
Host Group	Host Status Totals	Service Status Totals				
Access Servers@KTM (AS@KTM)	11 UP	11 OK				
All Brouters @KTM (Brouters@KTM)	7 <u>.0P</u>	7 <u>0K</u>				
All Routers @MIX Customers w/ Radio Link (Brouters@MIXR)	<u>I UP</u>	<u>1.0K</u>				
All Brouters @Xprewway Customers w/ Radio Link (Brouters@XpresswayR)	19 UP T DOWN	19 OK I CRITICAL				
All Brouters @Xprewway Customers w/ Radio Link (Cnet Clients@XpresswayR)	<u>6 UP</u> 4 DOWN	<u>5 OK</u> 5 CRITICAL				
All Cnets @KTM (Cnets@KTM)	2 UP 1 DOWN	<u>2.0K</u> I CRITICAL				
All Co-located Servers (Co-locators)	2.UP	2.0K				
Ipricot DVB @DMG (DVB@DMG)	1 UP	<u>I OK</u>				
All Email-alert-only Boxes (E-boxes)	I UP	<u>I OK</u>				
All Livingston Portmasters @Kathmandu (Portmasters@KTM)	10 UP	10 OK				
All Livingston Portmasters @MC-POPs (Portmasters@POPs)	<u>I UP</u>	1 WARNING				
All Routers @Baneshor (Routers@BAN)	I UP	<u>I OK</u>				
All Routers @Durbar Marg-KTM (Routers@DMG)	<u>3 UP</u>	3.OK				
All Routers @Kantipath-KTM (Routers@KP)	2 UP	2.0K				
All Routers @Lazimpat (Routers@LAZ)	2.UP	2.0K				
All Routers @POPs w/ Lease Link (Routers@POPsL)	4 UP	4 <u>OK</u>	-			

#### Host Trends or Status History

![](_page_20_Figure_1.jpeg)

## Histogram Of Host

![](_page_21_Figure_1.jpeg)

http://www.naglos.org

#### Day of the Month

#### Event Logs

![](_page_22_Picture_1.jpeg)

[02-01-2004 12:14:28] HOST NOTIFICATION: Amod; WORLDBANK-R; DOWN; host-notify-by-epager; PING CRITICAL - Packet loss = 100% [02-01-2004 12:14:28] HOST NOTIFICATION: DeepakA; WORLDBANK-R: DOWN: host-notify-by-epager: PING CRITICAL - Packet loss = 100% [02-01-2004 12:14:28] HOST NOTIFICATION: Krishna; WORLDBANK-R: DOWN; host-notify-by-epager; PING CRITICAL - Packet loss = 100% [02-01-2004 12:14:27] HOST NOTIFICATION: NirajS; WORLDBANK-R; DOWN; host-notify-by-email; PING CRITICAL - Packet loss = 100% [02-01-2004 12:14:27] HOST NOTIFICATION: Prabhu; WORLDBANK-R:DOWN:host-notify-by-epager:PING CRITICAL - Packet loss = 100% [02-01-2004 12:14:27] HOST NOTIFICATION: Ravin; WORLDBANK-R; DOWN; host-notify-by-email; PING CRITICAL - Packet loss = 100% [02-01-2004 12:14:27] HOST NOTIFICATION: Ravin:WORLDBANK-R;DOWN:host-notify-by-epager;PING CRITICAL - Packet loss = 100% [02-01-2004 12:14:27] HOST NOTIFICATION: Upendra; WORLDBANK-R; DOWN; host-notify-by-email; PING CRITICAL - Packet loss = 100% [02-01-2004 12:12:16] SERVICE ALERT: SDC:Ping:WARNING;HARD:1:PING WARNING - Packet loss = 60%, RTA = 23.73 ms [02-01-2004 12:12:16] HOST ALERT: SDC:DOWN:HARD:1:PING CRITICAL - Packet loss = 100% [02-01-2004 12:11:09] SERVICE ALERT: Htd-vsat:Ping; WARNING: HARD: 3:PING WARNING - Packet loss = 40%, RTA = 674.22 ms [02-01-2004 12:10:26] SERVICE ALERT: Htd-lease; Ping; WARNING; HARD; 3: PING WARNING - Packet loss = 40%, RTA = 385.85 ms [02-01-2004 12:08:58] SERVICE FLAPPING ALERT: WORLDBANK-R:Ping:STOPPED; Service appears to have stopped flapping (3.8% change < 5.0%)</p> threshold) [02-01-2004 12:08:49] HOST NOTIFICATION: Gyanu; Htd-lease; UP; host-notify-by-email; PING OK - Packet loss = 30%, RTA = 357.24 ms [02-01-2004 12:08:48] HOST NOTIFICATION: Ishwar;Htd-lease;UP;host-notify-by-email;PING OK - Packet loss = 30%, RTA = 357.24 ms [02-01-2004 12:08:48] HOST NOTIFICATION: Kedar:Htd-lease;UP;host-notify-by-epager;PING OK - Packet loss = 30%, RTA = 357.24 ms [2] [02-01-2004 12:08:48] HOST NOTIFICATION: MSurya; Htd-lease; UP; host-notify-by-email: PING OK - Packet loss = 30%, RTA = 357.24 ms

#### Who are Notified?

Contact Notifications		All Contacts			ontacts	Notification detail level for all contac		
st Updated: Sun Fe gios® - <u>www.nagio</u> gged in as <i>dhruba</i>	b-1-12:07:: <u>ss.org</u>	59 NPT 2004	Arel	est tive S	Log F Naviga un Feb 1 0 NPT 2 to Presen	7ile ntion 00:00:00 004 nt	All notifications Older Entries First:	Update
				File: /u	sr/local/na	gios/var/nagios.log		
Host	Service	Туре	Time		Contact	Notification Comma	nd Information	
WORLDBANK-R	N/A	HOST DOWN	02-01-2004	11:13:12	Amod	host-notify-by-email	PING CRITICAL - Packet loss = 100%	
WORLDBANK-R	N/A	HOST DOWN	02-01-2004	11:13:12	Amod	host-notify-by-epager	PING CRITICAL - Packet loss = 100%	
WORLDBANK-R	N/A	HOST DOWN	02-01-2004	11:13:11	DeepakA	host-notify-by-epager	PING CRITICAL - Packet loss = 100%	
WORLDBANK-R	N/A	HOST DOWN	02-01-2004	11:13:11	Krishna	host-notify-by-epager	PING CRITICAL - Packet loss = 100%	
WORLDBANK-R	N/A	HOST DOWN	02-01-2004	11:13:11	NirajS	host-notify-by-email	PING CRITICAL - Packet loss = 100%	
WORLDBANK-R	N/A	HOST DOWN	02-01-2004	11:13:11	Prabhu	host-notify-by-epager	PING CRITICAL - Packet loss = 100%	
WORLDBANK-R	N/A	HOST DOWN	02-01-2004	11:13:11	Ravin	host-notify-by-email	PING CRITICAL - Packet loss = 100%	
WORLDBANK-R	N/A	HOST DOWN	02-01-2004	11:13:10	Ravin	host-notify-by-epager	PING CRITICAL - Packet loss = 100%	
WORLDBANK-R	N/A	HOST DOWN	02-01-2004	11:13:08	Upendra	host-notify-by-email	PING CRITICAL - Packet loss = 100%	
Laz-enet	N/A	HOST DOWN	02-01-2004	11:07:49	Amod	host-notify-by-email	PING CRITICAL - Packet loss = 100%	
Laz-enet	N/A	HOST DOWN	02-01-2004	11:07:49	Amod	host-notify-by-epager	PING CRITICAL - Packet loss = 100%	-
Laz-cnet	N/A	HOST DOWN	02-01-2004	11:07:49	DeepakA	host-notify-by-epager	PING CRITICAL - Packet loss = 100%	
Laz-cnet	N/A	HOST DOWN	02-01-2004	11:07:49	Krishna	host-notify-by-epager	PING CRITICAL - Packet loss = 100%	
Laz-cnet	N/A	HOST DOWN	02-01-2004	11:07:49	Prabhu	host-notify-by-epager	PING CRITICAL - Packet loss = 100%	
Laz-enet	N/A	HOST DOWN	02-01-2004	11:07:48	Ravin	host-notify-by-email	PING CRITICAL - Packet loss = 100%	
Laz-cnet	N/A	HOST DOWN	02-01-2004	11:07:48	Ravin	host-notify-by-epager	PING CRITICAL - Packet loss = 100%	
· · · · · · · · · · · · · · · · · · ·	N/A	HOST DOWN	02-01-2004	11:07:48	Upendra	host-notify-by-email	PING CRITICAL - Packet loss = 100%	
Laz-enet		and the second second second		and the second second	and the second second second	And the second sec		

#### Notification Email Sample

From: nagios@thuldai.mos.com.np

To: "ishwars@mos.com.np" <ishwars@mos.com.np>

Subject: Host DOWN alert for WORLDBANK-L!

Date: 05/02/04 11:09

\*\*\*\*\* Nagios \*\*\*\*\*

Notification Type: PROBLEM

Host: WORLDBANK-L

State: DOWN

Address: 202.52.239.70

Info: PING CRITICAL - Packet loss = 100%

Date/Time: Thu Feb 5 11:06:38 NPT 2004

#### APAN

![](_page_25_Picture_1.jpeg)

Apan.sourceforge.net

- Is used to collect result from Nagios plugins and stores it in RRD-files
- APAN-Advance Performance Addon for Nagios
- Can be used to view graphs of data in Nagios web-interface
- It creats graphs on the fly
- A wonderful stuff

## What is RRD-tool?

- Is a tool to create round robin database file
- Is not a linear database which keeps appending to the table when new data is arrived
- Size of an rrdtool database is determied at the time of creation
- RRDtool database is a kind of perimeter of a circle, when new data reaches the starting point it overwrite the existing data.
- It is both frontend and backend tool
- But we use it as a backend tool, our front end is APAN

## RRDtoo

![](_page_27_Picture_1.jpeg)

#### www.rrdtool.com

- 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

## Define Data Sources (Inputs)

- DS:speed:COUNTER:600:U:U
- DS:fuel:GAUGE:600:U:U
  - DS = Data Source
  - speed, fuel = "variable" names
  - COUNTER, GAUGE = variable type
  - 600 = heart beat UNKNOWN returned for interval if nothing received after this amount of time
  - U:U = limits on minimum and maximum variable values (U means unknown and any value is permitted)

## Define Archives (Outputs)

- RRA:AVERAGE:0.5:1:24
- RRA:AVERAGE:0.5:6:10
  - RRA = Round Robin Archive
  - AVERAGE = consolidation function
  - 0.5 = up to 50% of consolidated points may be UNKNOWN
  - 1:24 = this RRA keeps each sample (average over one 5 minute primary sample), 24 times (which is 2 hours worth)
  - 6:10 = one RRA keeps an average over every six 5 minute primary samples (30 minutes), 10 times (which is 5 hours worth)
- Clear as mud!
  - all depends on original step size which defaults to 5 minutes

#### RRDtool Database Format

![](_page_30_Figure_1.jpeg)

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

![](_page_31_Figure_0.jpeg)

#### Disk Usage

![](_page_32_Figure_1.jpeg)

#### Free Memory

![](_page_33_Figure_1.jpeg)

https://thuldai.mos.com.np/

![](_page_34_Figure_1.jpeg)

#### Server load detail of particular host

![](_page_35_Figure_1.jpeg)

## Nagios-statd

- Nagios-statd is the daemon program that listens for connection from clients
- It forks off a new daemon for each incoming connection.
- The forked daemon executes a series of typical UNIX command and return output to the client
- It is installed on the host to be monitered
- It is designed to be integrated with the nagios monitoring tool

## Nagios-stat

- Nagios-stat is the client that connects to the nagios-statd server
- It then sends the daemon which check it want to run, parse the data, prints a result and then exits appropriately
- It is installed on nagios server at usr/local/nagios/libexec/nagios-stat as plugin
- Both nagios-statd and nagios-stat programs together comprise a systems monitoring tool for various platform

## Snmp

- A request-reply protocol run on udp port161
- Operate between management-station and an agent
- Nagios server is mainly a management-station and monitored nodes are agent
- Snmp agent need to be installed and running on to monitor snmp based services through nagios.
- Required packages are: net-snmp and net-snmp-utils

## Snmp How?

- Management Information base (MIB) is a database which contain various information about system i.e. Memory, cpu-usage, routing table information, inerfaces statistics etc.
- Or it is a set of managed object
- We need access to managed objects, but how?
- With the help of "OID" object identifier
- OID is a series of integer that represent the hierarchical value of mib managed strings

#### Internet Management Model

![](_page_40_Figure_1.jpeg)

Managed Device

Managed Device

Managed Device

## Snmp manager utilities

- Net-snmp-utils rpm contains required utilities i.e. Snmpwalk, snmpget etc
- .1.3.6.1.4.1.2021.10.1.3.1 is a oid to get 1 munite
- average load of linux box
- Snmpget -c <community name> <ip or hostname> oid
- Snmpget -c public 192.168.10.1 .1.3.6.1.4.1.2021.10.1.3.1
- Snmpwalk -v1 192.168.10.1 -c public (to test weather snmp agent is running or not on remote node)
- Some important oids are available at our server name is "Imp linux oids"

## How to enable snmp agent on cisco router

my-router# configure terminal

- Create access-list so that only specific host can query my-router(config)# access-list 99 permit 202.52.255.25
   my-router(config)# snmp-server community IacH25 RO 99
   my-router(config)# end
- RO is for read Only
- 99 is access-list applied

## How to run snmp agent on linux

- # rpm -qa | grep snmp
- net-snmp and net-snmp-utils need to be installed
- #cp /etc/snmp/snmpd.conf /etc/snmp/snmpd.conf.bkup
- # vi /etc/snmp/snmpd.conf
- d shift+G
- rocommunity public 202.52.255.225
- For more options check /etc/snmp/snmpd.conf.bkup
- For interactive configuration run following command
- # snmpconf -g basic\_setup
- #/sbin/chkconfig -level 235 snmpd on
- #/sbin/service snmpd start

#### Some Imp OIDs

- To get cpu stuff:
  - a) Load:

1 minute Load: .1.3.6.1.4.1.2021.10.1.3.1 5 minute Load: .1.3.6.1.4.1.2021.10.1.3.2 15 minute Load: .1.3.6.1.4.1.2021.10.1.3.3 b) CPU: percentage of user CPU time: .1.3.6.1.4.1.2021.11.9.0 raw user cpu time: .1.3.6.1.4.1.2021.11.50.0 percentages of system CPU time: .1.3.6.1.4.1.2021.11.10.0 raw system cpu time: .1.3.6.1.4.1.2021.11.52.0 percentages of idle CPU time: .1.3.6.1.4.1.2021.11.11.0 raw idle cpu time: .1.3.6.1.4.1.2021.11.53.0 raw nice cpu time: .1.3.6.1.4.1.2021.11.51.0

#### Some Imp OIDs

• To get memory stuff:

Total Swap Size:	.1.3.6.1.4.1.2021.4.3.0
Available Swap Space:	.1.3.6.1.4.1.2021.4.4.0
Total RAM in machine:	.1.3.6.1.4.1.2021.4.5.0
Total RAM used:	.1.3.6.1.4.1.2021.4.6.0
Total RAM Free:	.1.3.6.1.4.1.2021.4.11.0
Total RAM Shared:	.1.3.6.1.4.1.2021.4.13.0
Total RAM Buffered:	.1.3.6.1.4.1.2021.4.14.0
Total Cached Memory:	.1.3.6.1.4.1.2021.4.15.0

• To get incoming and outgoing octects on interface

interfaces.ifTable.ifEntry.ifInOctets.2 .1.3.6.1.2.1.2.2.1.10.2 interfaces.ifTable.ifEntry.ifOutOctets.2 .1.3.6.1.2.1.2.2.1.16.2

![](_page_46_Picture_0.jpeg)

## Web Sites

- http://nagios.org
- http://apan.sourceforge.net
- http://www.rrdtool.com
- http://www.snmp.com
- http://net-snmp.sourceforge.net

Questions?