

GARR-X Progress

Infrastruttura digitale per promuovere ricerca, istruzione e competitività nel Sud

Potenziamento strutturale
Avviso D.D.274
del 15/02/2013



Governo Italiano - Presidenza del Consiglio dei Ministri
Ministro per la Coesione Territoriale



Giovanni Cesaroni GARR

Monitoring della rete GARR

GARRX Progress in training, Catania, 17.06.2015

- GINS

- Statistiche di traffico
- Tool di monitoring

- Come monitorare la rete

- SNMP poll
- SNMP trap
- Latenza
- Temperature
- Looking glass
- LLDP

- «Hands on»

- SNMP Trap con snmptrapd
- SNMP Trap con nodejs
- SNMP Poll esempi
- RRD

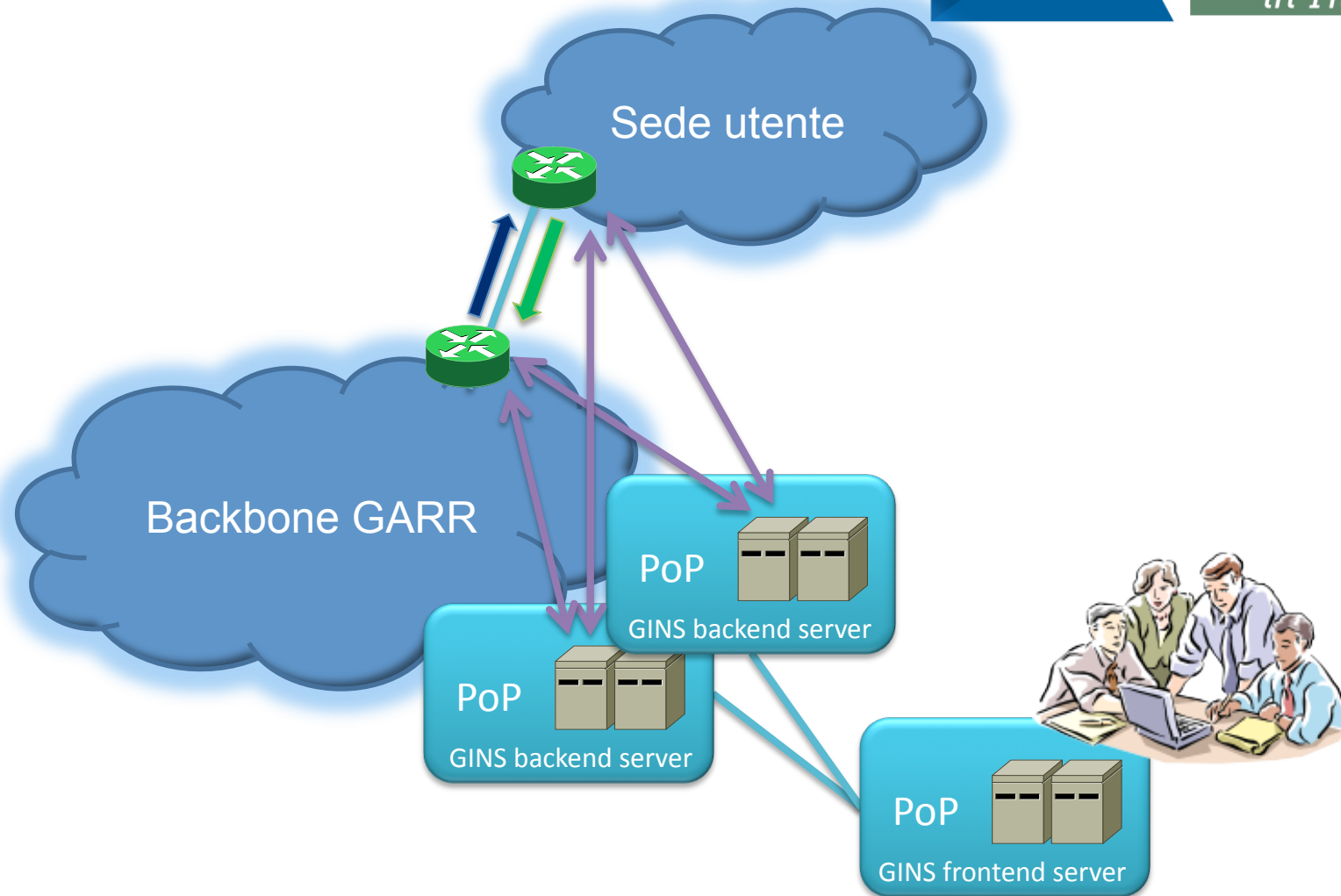
GARR Integrated Networking Suite

<https://gins.garr.it/>

Scopi:

- Monitorare lo stato e le performance della rete
 - Connettività utenti, backbone, servizi ad ogni livello
 - Stato, performance, evoluzione storica
- Permettere al NOC, OPS di gestire «facilmente» le rete
 - TTS, reports, UIs, automatizzazione configurazione tools

Architettura



GINS home page



- Statistiche di traffico
- Weathermap
- Trouble tickets
- Reportistica
- Tools

Ricerca sede

The screenshot displays the GARR Integrated Networking Suite (GINS) interface. The main header includes the GARR logo and navigation tabs: Home, Statistics, Weathermaps, Reports, TTS, and Search. A 'Login' button is located in the top right corner. The left sidebar contains sections for 'Services' (with a 'Search Site' button), 'Weathermap' (with 'Weathermap GARR-X' and 'Weathermap GARR detailed' options), and 'Traffic' (with five sub-sections: 'Traffic by Site', 'Traffic by Link', 'Traffic by PoP layer 3', 'Traffic by PoP layer 2', and 'Traffic by Peering'). The main content area features a 'Search' section with a magnifying glass icon, a 'Filter:' input field containing the text 'catanzaro', and 'Search' and 'Clear' buttons. Below the search input, a list of results is displayed:

- Site: CZIS001002 - IIS Fermi - Catanzaro Lido
- Site: CZTF010008 - ITI Scalfaro - Catanzaro
- Site: UNI-Catanzaro

Interfaccia sede



Statistiche aggregate dei link

Statistiche link

Trouble ticket

Interfaccia sede: trouble tickets


 Show 10 entries Search:

ID	Start	End	Object	Ticket type	Problem type	Problem description	Problem fix	Site name	Site extended name	Key	Competence	Operatore
15780 Close	27/04/2015 17:00	27/04/2015 20:00	PoP Catanzaro-Germaneto	Planned maintenance	Other	Manutenzione programmata sul PoP di Catanzaro. Si prevede possibile assenza di connettività nella fascia oraria indicata.	Manutenzione conclusa.	CZIS001002 - IIS Fermi - Catanzaro Lido	CZIS001002 - IIS E. Fermi - Catanzaro Lido	SGP	Other	Gervasi
15616 Close	25/02/2015 15:04	26/02/2015 08:30	RC-CZ -- RX1-CT1 on rx1.ct1.garr.net	Incident	Fault	Assenza di connettività.	Connettività ripristinata a seguito del ripristino dell'energia elettrica.	CZIS001002 - IIS Fermi - Catanzaro Lido	CZIS001002 - IIS E. Fermi - Catanzaro Lido	SGP	User	Gervasi
15554 Close	02/02/2015 09:13	02/02/2015 10:44	CZIS001002 - IIS Fermi - Catanzaro Lido	Incident	Fault	Assenza di connettività	Ripristinata energia elettrica.	CZIS001002 - IIS Fermi - Catanzaro Lido	CZIS001002 - IIS E. Fermi - Catanzaro Lido	SGP	Supplier	Gervasi

Showing 1 to 3 of 3 entries First Previous 1 Next Last

Oggetto del ticket

Problem/Fix

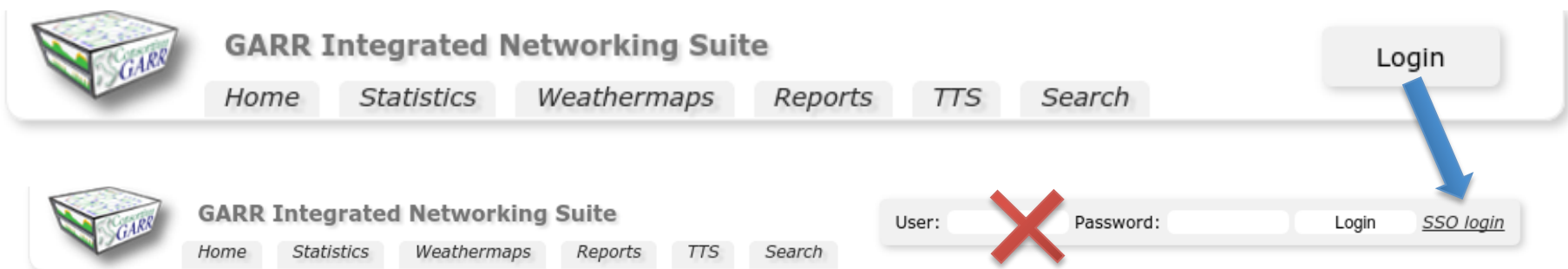
Sede

@NOC

GINS e' un SP federato



Autenticazione



Autorizzazione



Statistiche di traffico



GARR Integrated Networking Suite

[Home](#)[Statistics](#)[Weathermaps](#)[Reports](#)[TTS](#)[Search](#)[Login](#)

GINS Statistics

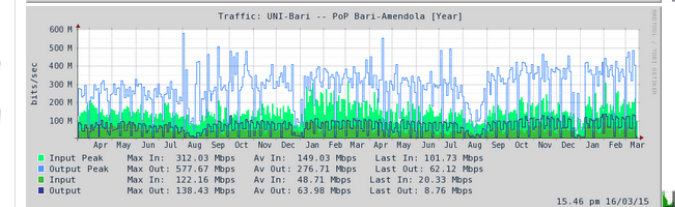
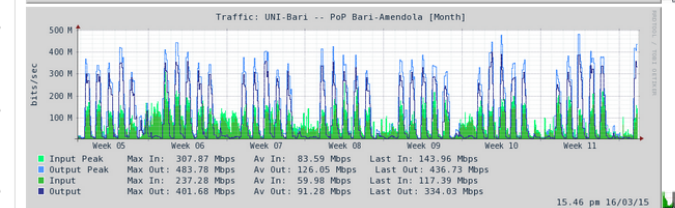
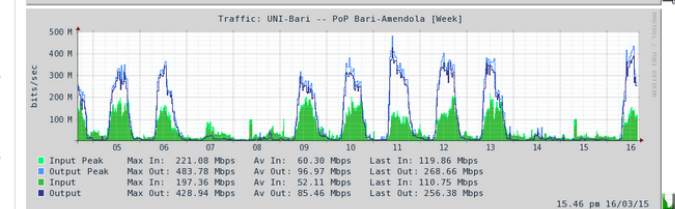
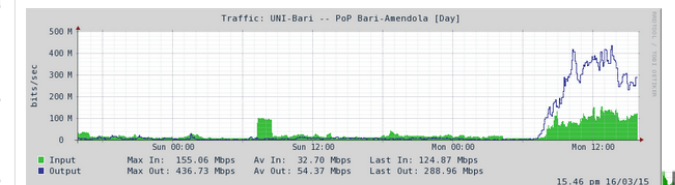
- ➔ Statistiche di traffico dei **link IP** per **utenza**
- ➔ Statistiche di traffico dei **link IP** per **PoP** di attestazione **layer 3**
- ➔ Statistiche di traffico dei **link IP** per **PoP** di attestazione **layer 2**
- ➔ Statistiche di traffico **aggregate** dei link IP per **utenza**
- ➔ Statistiche di traffico dei **Peering**
- ➔ Statistiche di traffico dei **Content services**
- ➔ Statistiche di traffico **IPv6**
- ➔ Statistiche di **temperatura** e **CPU load** apparati

Statistiche di traffico

Time scale: [Day](#) [Week](#) [Month](#) [Year](#) 5 Year Metrics: [IPv6](#) [Latency](#) [Traffic sum](#) Actions: [Set as default](#) [Get this url](#)

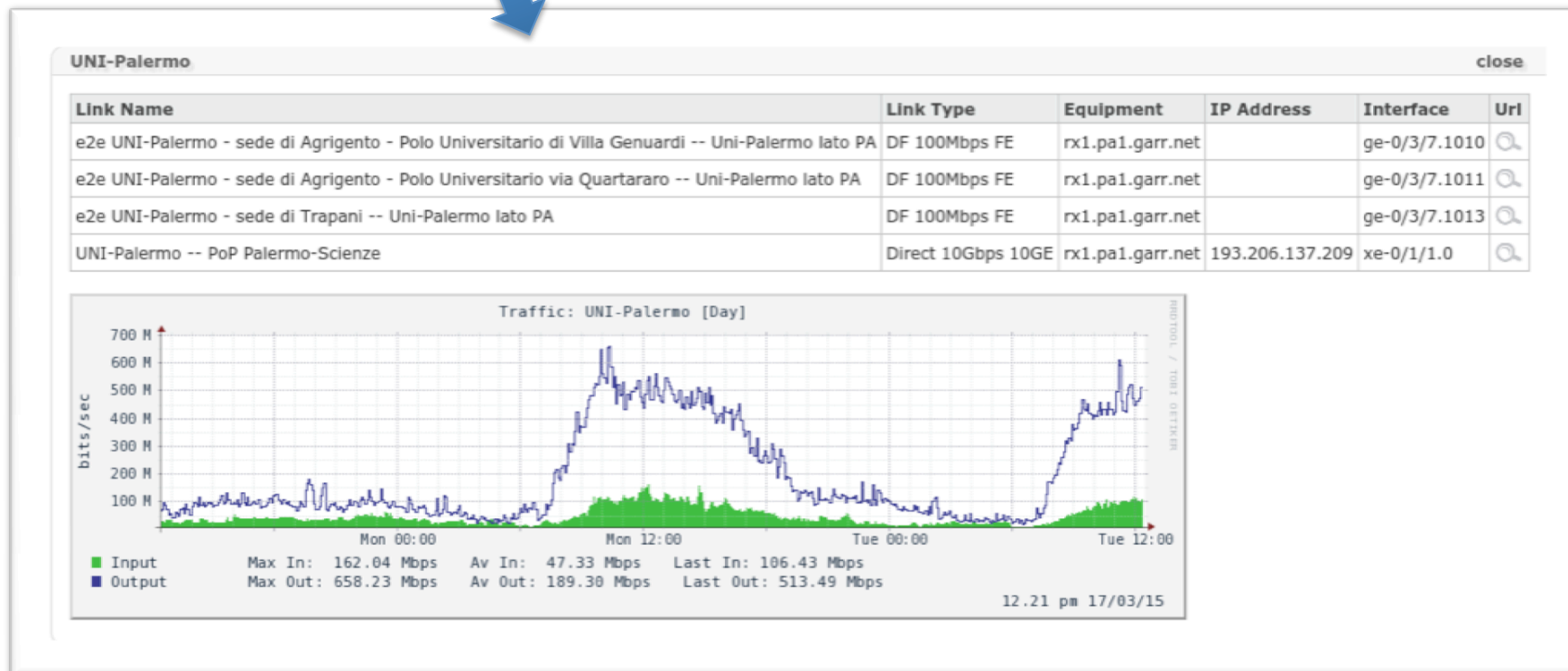
UNI-Bari -- PoP Bari-Amendola

Link Type	Equipment B	Interface B	IPv4 Address	IPv6 Address
Direct 1Gbps GE	rx1.bal.garr.net	ge-11/2/7.0	193.206.137.89	



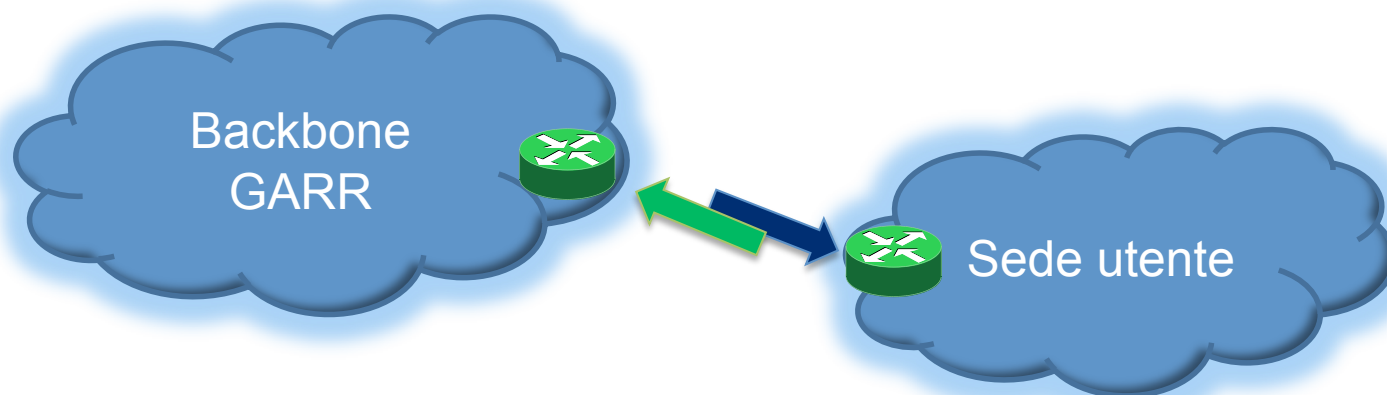
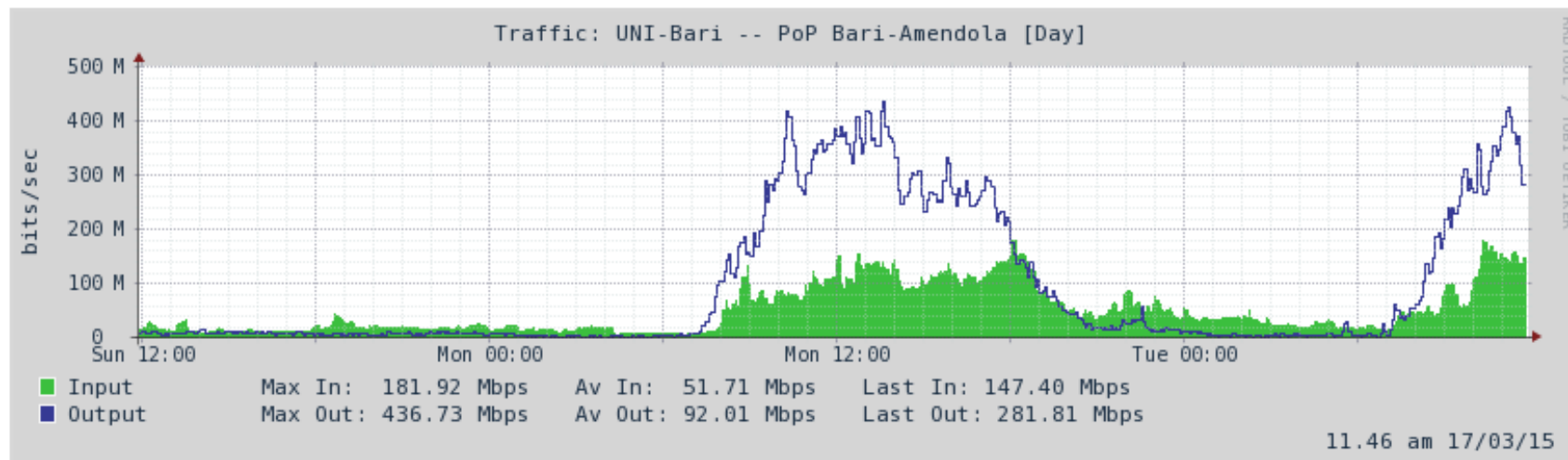
Statistiche di traffico: aggregati

➡ Statistiche di traffico **aggregate** dei link IP per **utenza**



Statistiche di traffico

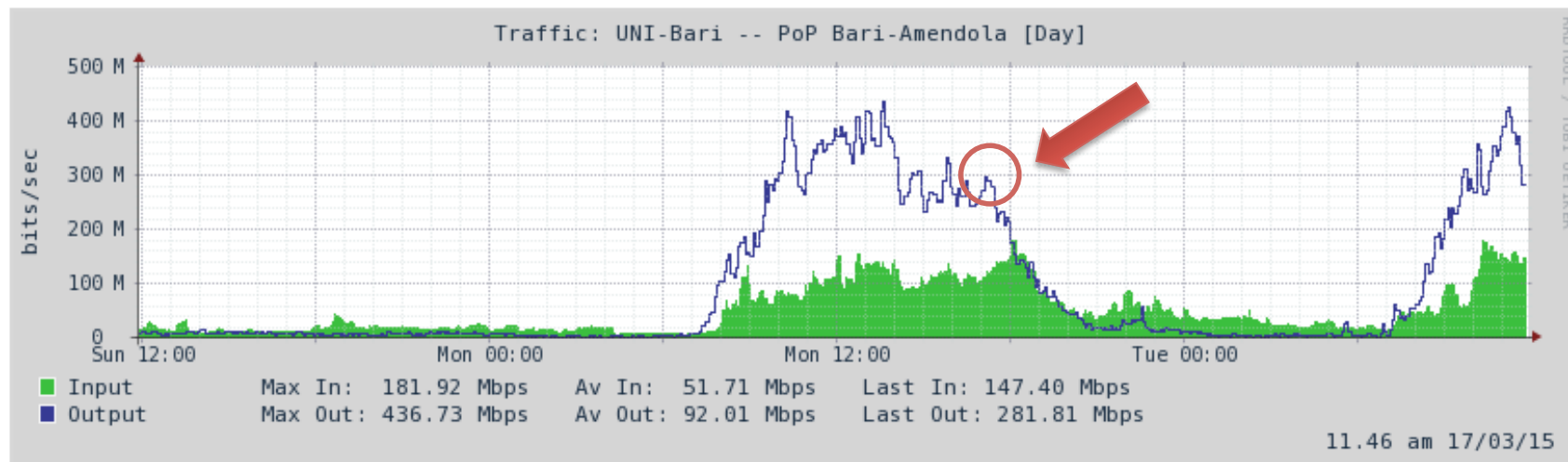
Colori e direzioni del traffico:



Statistiche di traffico

Valori:

- Lettura del contatore incrementale a 64 bit che conta Bytes passati su una porta
- Lettura ogni 5 minuti e computazione del bit rate



Sono veramente 300 Mbps ?
mediamente nei 5 minuti sì,
ma potrebbero anche essere 600 Mbps per 2.5' e 0 per 2.5'

Statistiche di traffico

Lettura del contatore ogni 5 minuti

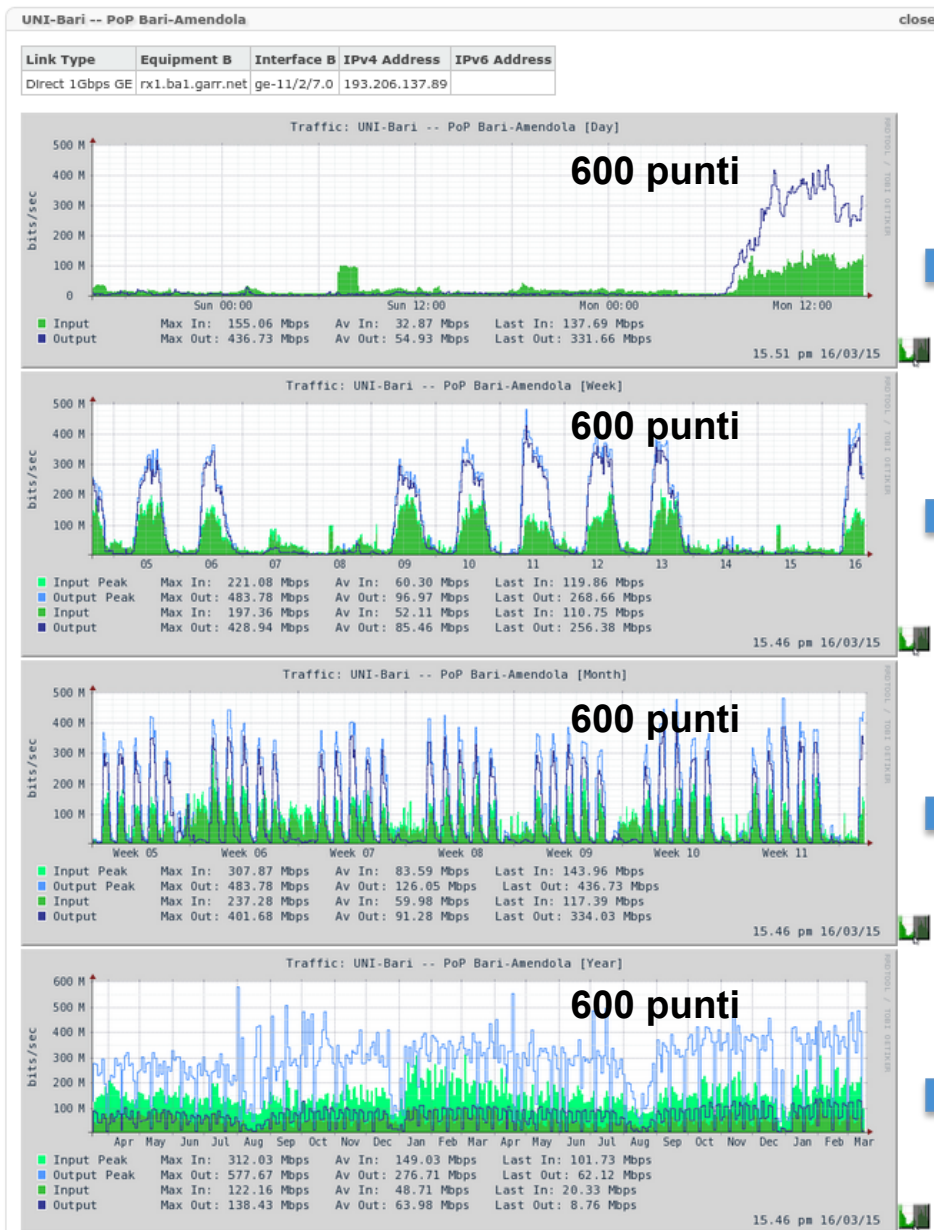
un punto ogni 5 minuti

un punto ogni mezz'ora
media e picco nella mezz'ora

un punto ogni 2 ore
media e picco sulle 2 ore

un punto ogni giorno
media e picco sulle 24 ore

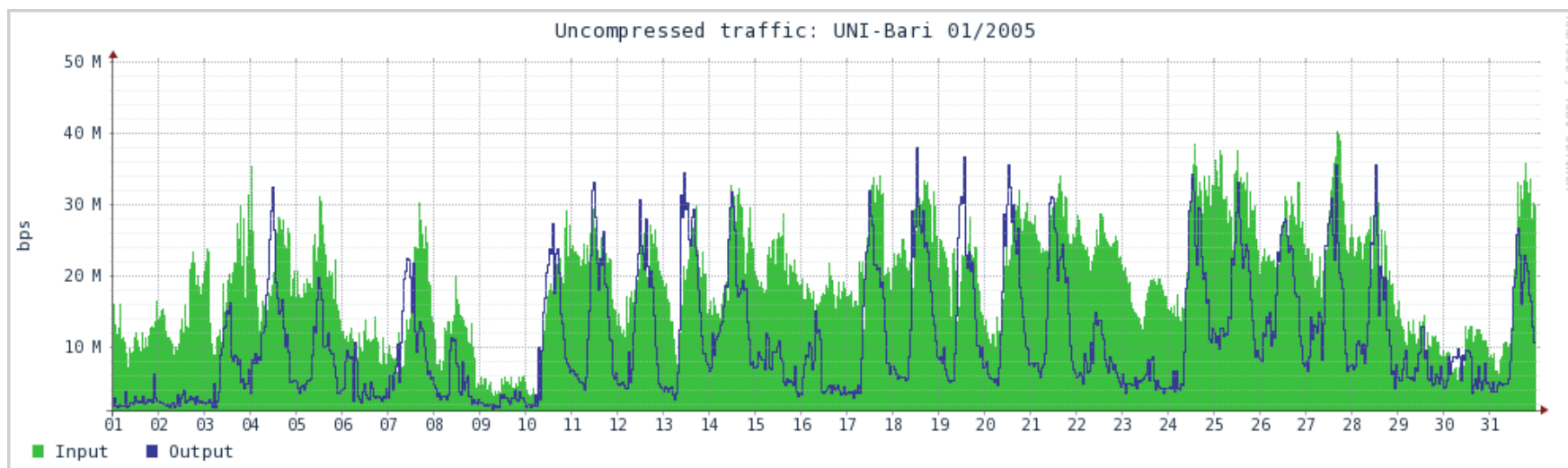
compressione



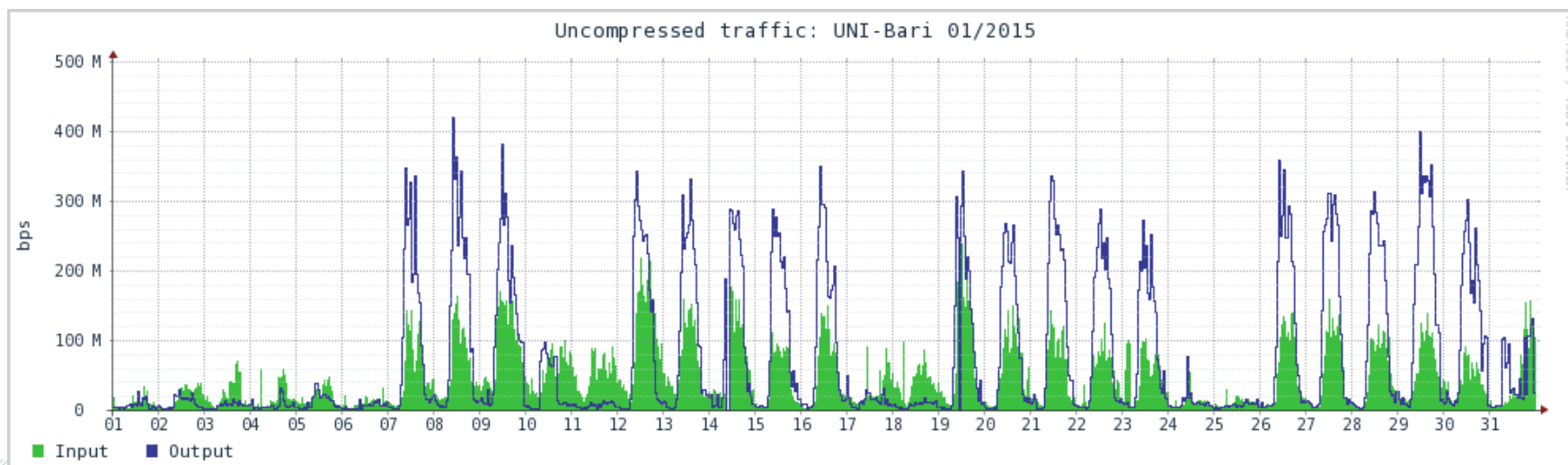
Statistiche non compresse

Reports > Statistiche di traffico non compresse

2005



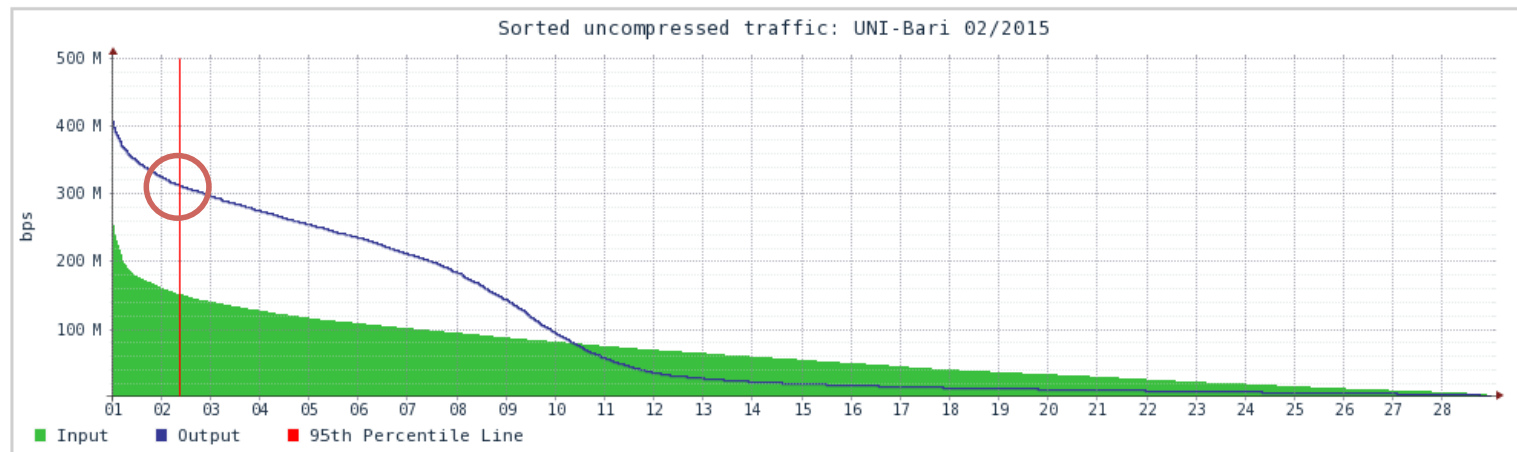
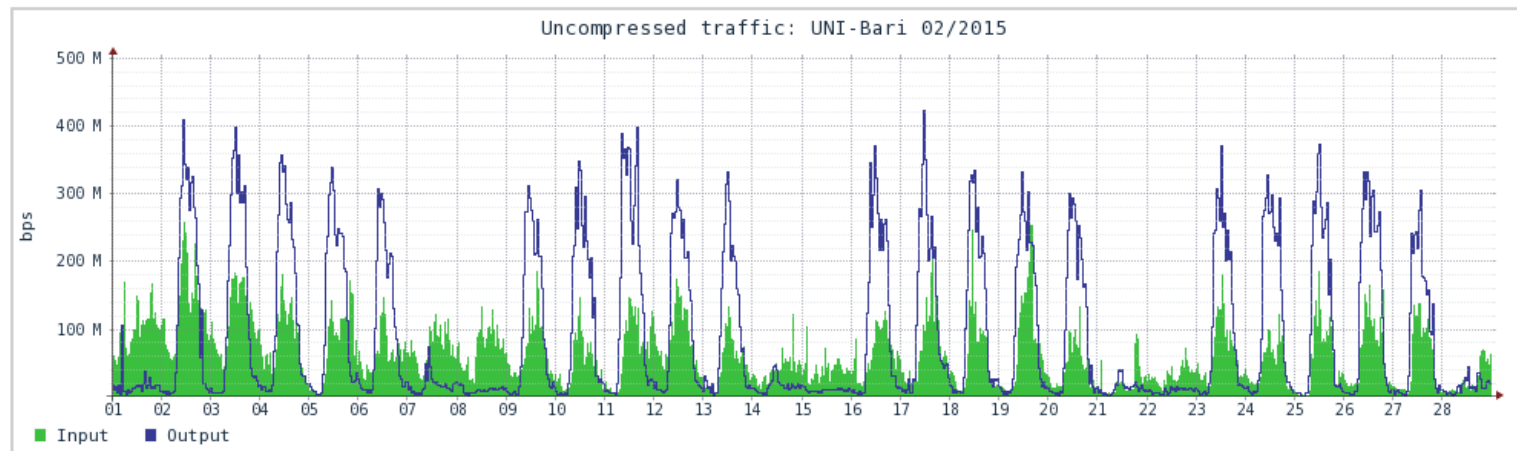
2015



95° percentile

UNI-Bari

Month	Average In (Mbps)	Average Out (Mbps)	Max In (Mbps)	Max Out (Mbps)	Volume In (Tb)	Volume Out (Tb)	95th percentile In (Mbps)	95th percentile Out (Mbps)	95th percentile (Mbps)
02/2015	64.35	89.78	315.06	447.41	155.72	217.25	151.27	313.04	313.04



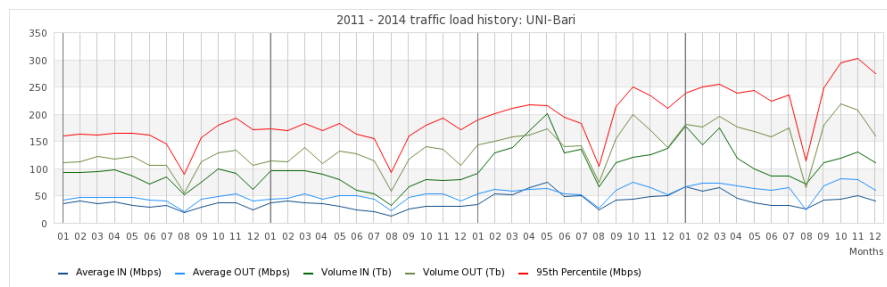
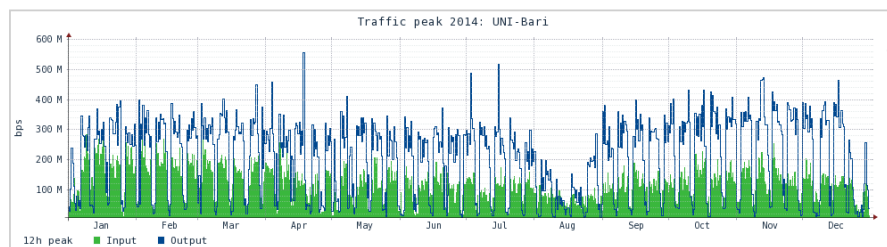
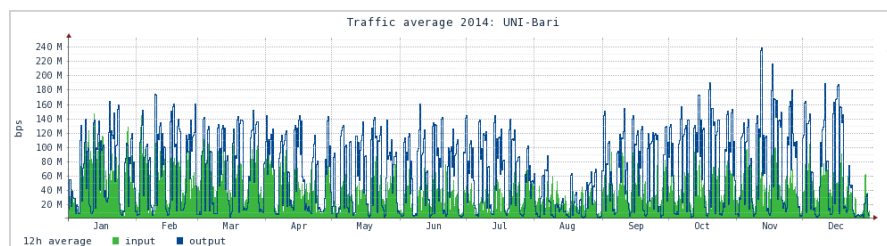
Statistiche non compresse

Reports > Statistiche di traffico non compresse

Uncompressed traffic Statistics:

UNI-Bari								
Month	Average In (Mbps)	Average Out (Mbps)	Max In (Mbps)	Max Out (Mbps)	Volume In (Tb)	Volume Out (Tb)	95th percentile In (Mbps)	95th percentile Out (Mbps)
01	66.74	67.78	309.91	394.81	178.80	181.57	176.41	238.31
02	59.56	72.88	275.26	398.58	144.13	176.36	167.90	249.81
03	65.44	73.22	313.35	449.56	175.07	195.89	157.12	255.27
04	46.03	68.29	256.74	555.07	119.33	177.05	132.39	239.22
05	37.45	63.04	206.96	409.87	100.34	168.89	109.45	243.23
06	33.35	61.29	191.83	371.84	86.45	158.89	97.16	224.21
07	32.40	65.45	173.48	516.78	86.81	175.34	95.18	235.34
08	26.95	24.65	116.22	287.43	72.21	66.04	61.16	114.87
09	42.72	69.43	188.20	397.39	110.75	180.01	110.17	249.25
10	44.77	81.80	228.66	431.37	120.11	219.44	119.34	294.00
11	50.28	80.39	254.02	471.49	130.35	208.42	134.65	303.04
12	41.65	59.95	204.83	462.72	111.58	160.60	109.33	274.41

Year	Average		Maximum		Total volume		Average percentile		
	Average In (Mbps)	Average Out (Mbps)	Max In (Mbps)	Max Out (Mbps)	Volume In (Tb)	Volume Out (Tb)	95th percentile In (Mbps)	95th percentile Out (Mbps)	95th percentile (Mbps)
Year	45.61	65.68	313.35	555.07	1435.93	2068.5	122.52	243.41	243.41



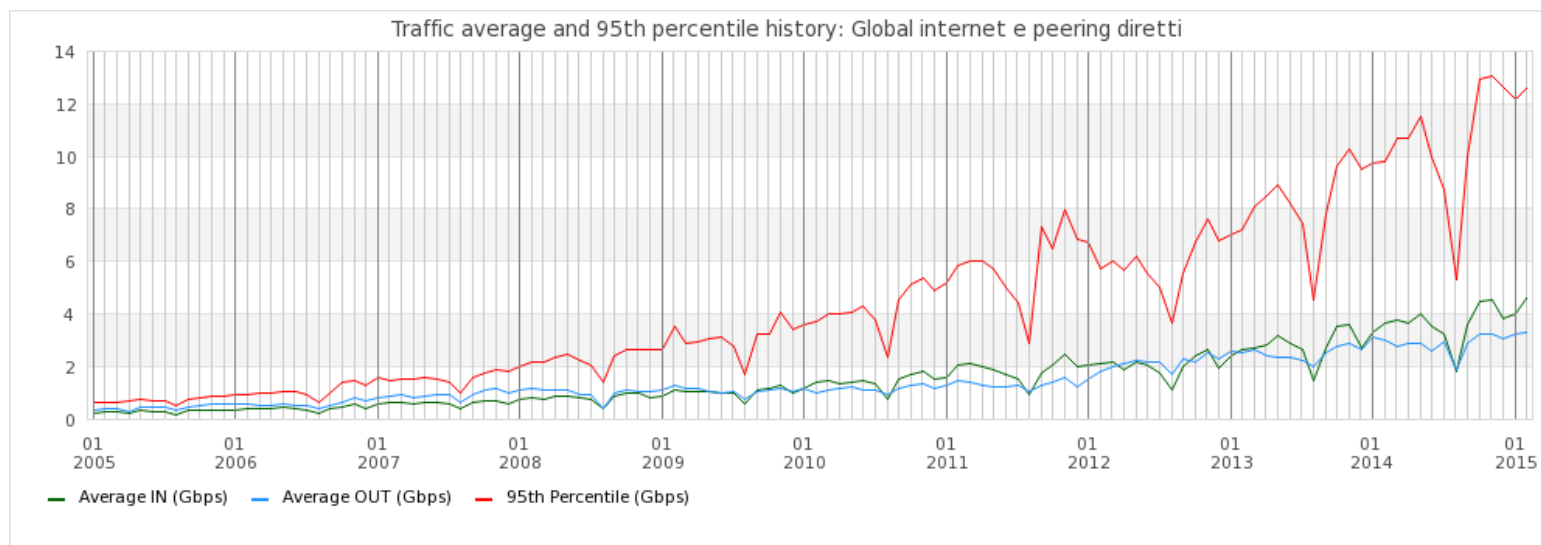
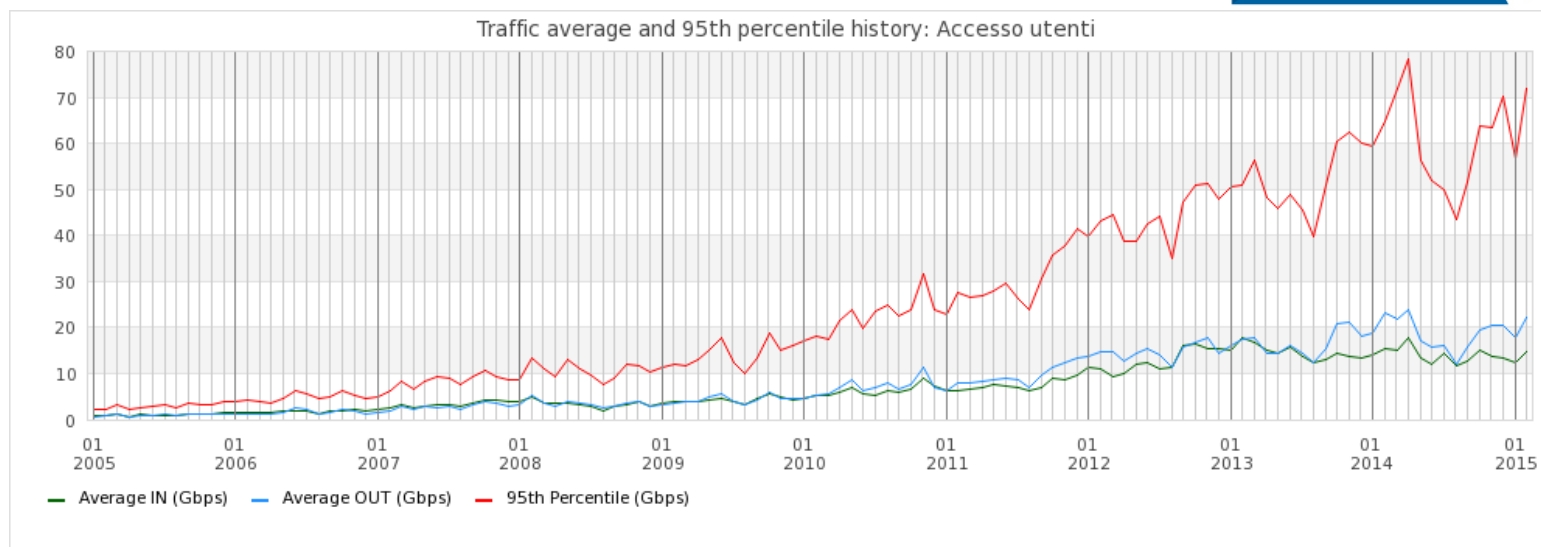
Dati mensili e annuali

Grafico anno, media su 12 ore

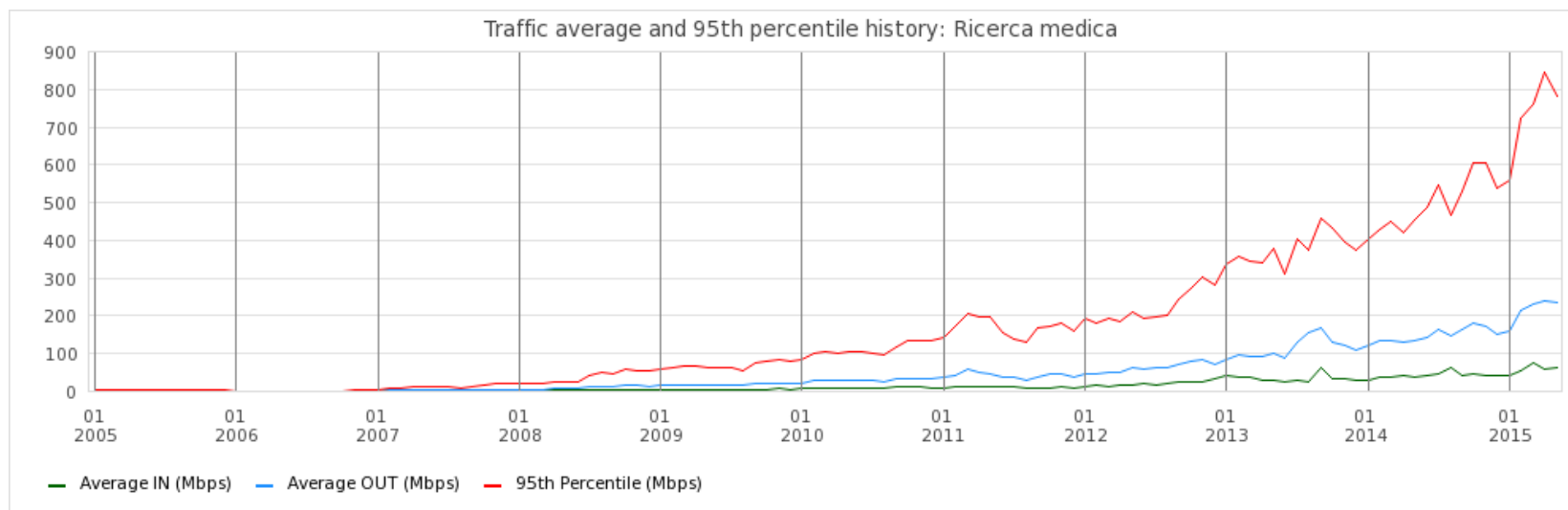
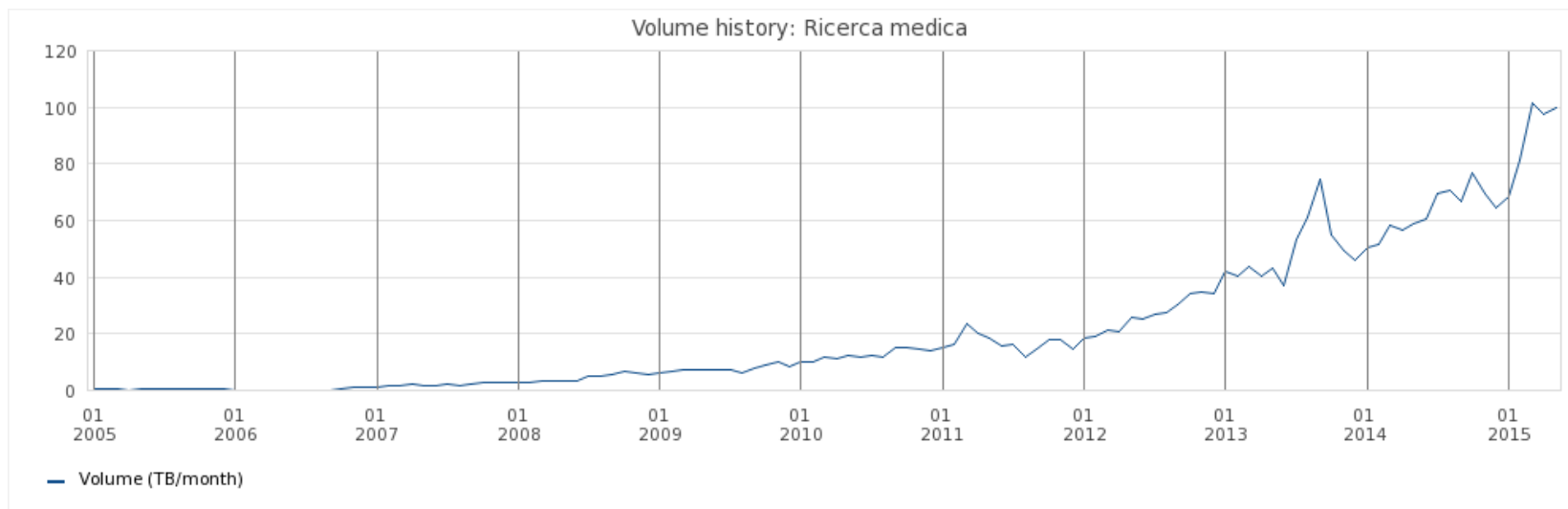
Grafico anno, picchi su 12 ore

Evoluzione mensile su 4 anni

Evoluzione della connettività'



Evoluzione della connettività'



Weathermap



 **GARR Integrated Networking Suite**

[Home](#) [Statistics](#) [Weathermaps](#) [Reports](#) [TTS](#) [Search](#) [Logout](#)

GINs::Weathermaps

PoP Layer 3

- PoP AN
- PoP AQ1
- PoP BA1
- PoP BO1
- PoP BO3
- PoP BR
- PoP CA
- PoP CS
- PoP CT1
- PoP FE
- PoP FI1
- PoP FG
- PoP FRA
- PoP FUC
- PoP GE1
- PoP LE
- PoP ME
- PoP MI1
- PoP MI2
- PoP MI3
- PoP MT
- PoP NA1
- PoP PA1
- PoP PG
- PoP PI1
- PoP PD2
- PoP PD1
- PoP PV
- PoP PZ
- PoP RM1
- PoP RM2
- PoP RM4
- PoP SA
- PoP SS
- PoP TO1
- PoP TN
- PoP TS1
- PoP UR
- PoP VE

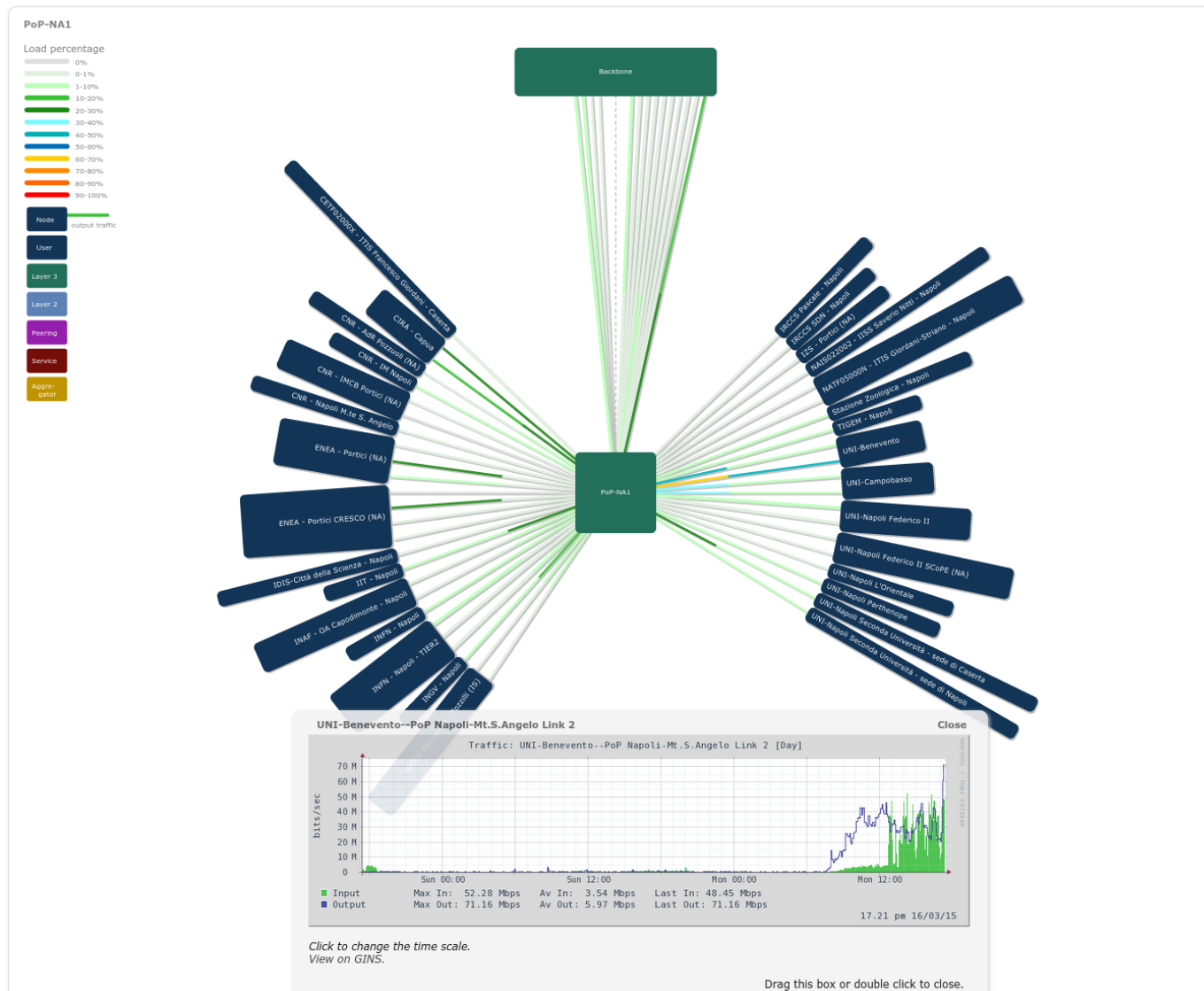
Users Layer 3

- AFAM
- ASI
- BIBLIOTECHE
- CNR
- CONSORZI UNIVERSITARI
- ENEA
- IRCCS
- INFN
- ISTITUTI ZOOPROFILATTICI SPERIMENTALI
- INGV
- INAF
- MIUR: ENTI DI RICERCA
- Istituzioni afferenti al MISE
- MIUR: SEDI
- PEERING INTERNAZIONALI
- PEERING INTERNAZIONALI RICERCA
- PEERING DIRETTI
- PEERING NAZIONALI
- PEERING PRIVATI
- PEERING REGIONALI
- SCUOLE DI ECCELLENZA
- SCUOLE GARR-X Progress
- SCUOLE LEPIDA
- SCUOLE VEICOLATE DA CSP
- SCUOLE VEICOLATE DA Uni-Pisa
- SCUOLE VEICOLATE DA Uni-Cassino
- UNIVERSITA' STATALI
- UNIVERSITA' NON STATALI
- ENTI AFFERENTI AD UNIVERSITA'
- ALTRI ENTI DI RICERCA
- ALTRI ENTI DI RICERCA INTERNAZIONALI

Infrastructures and projects

- Backbone GARRX
- Backbone GARRX detailed
- LHC

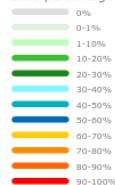
Weathermap: PoP Layer 3



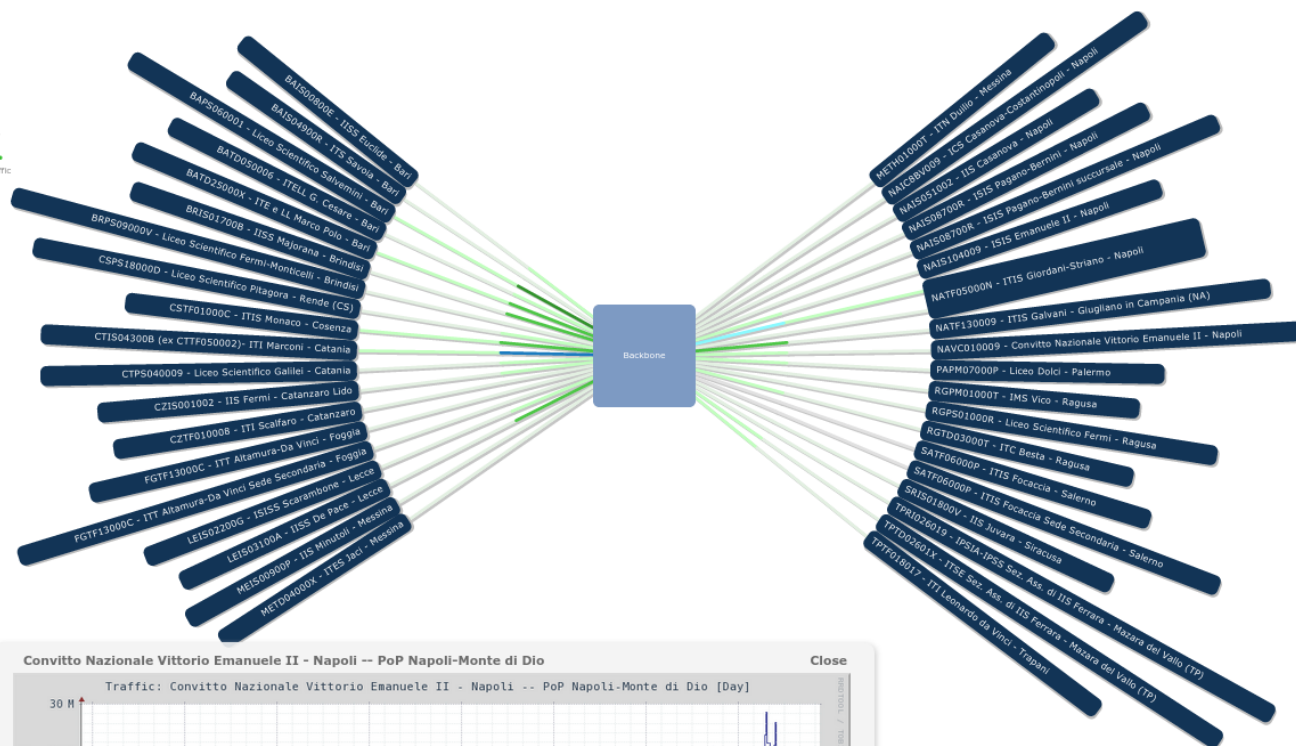
Weathermap: utenti

SCUOLE GARR-X Progress

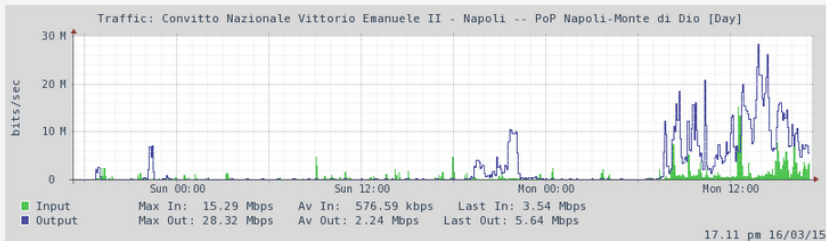
Load percentage



Node
User
Layer 3
Layer 2
Peering
Service
Aggregator



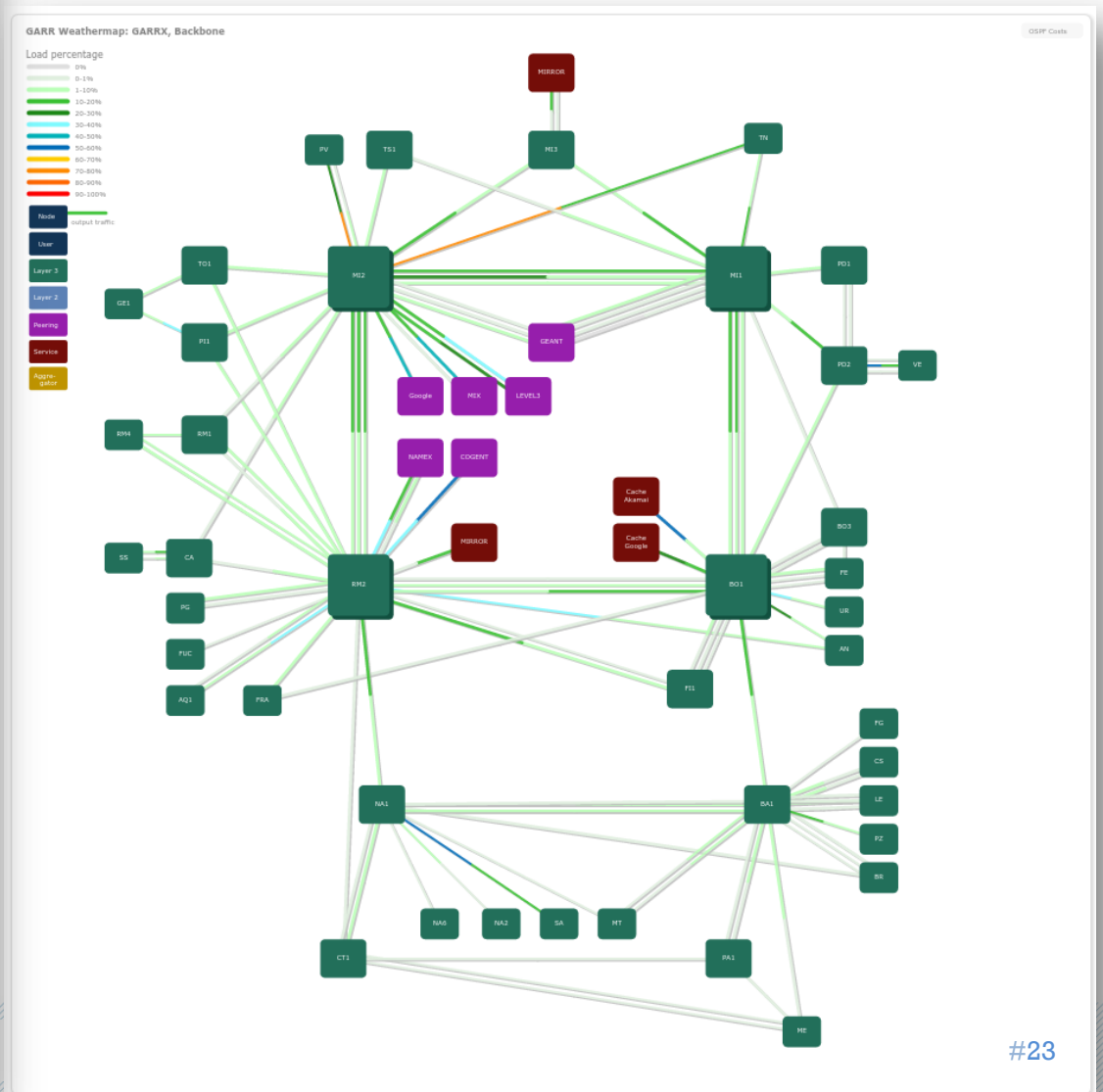
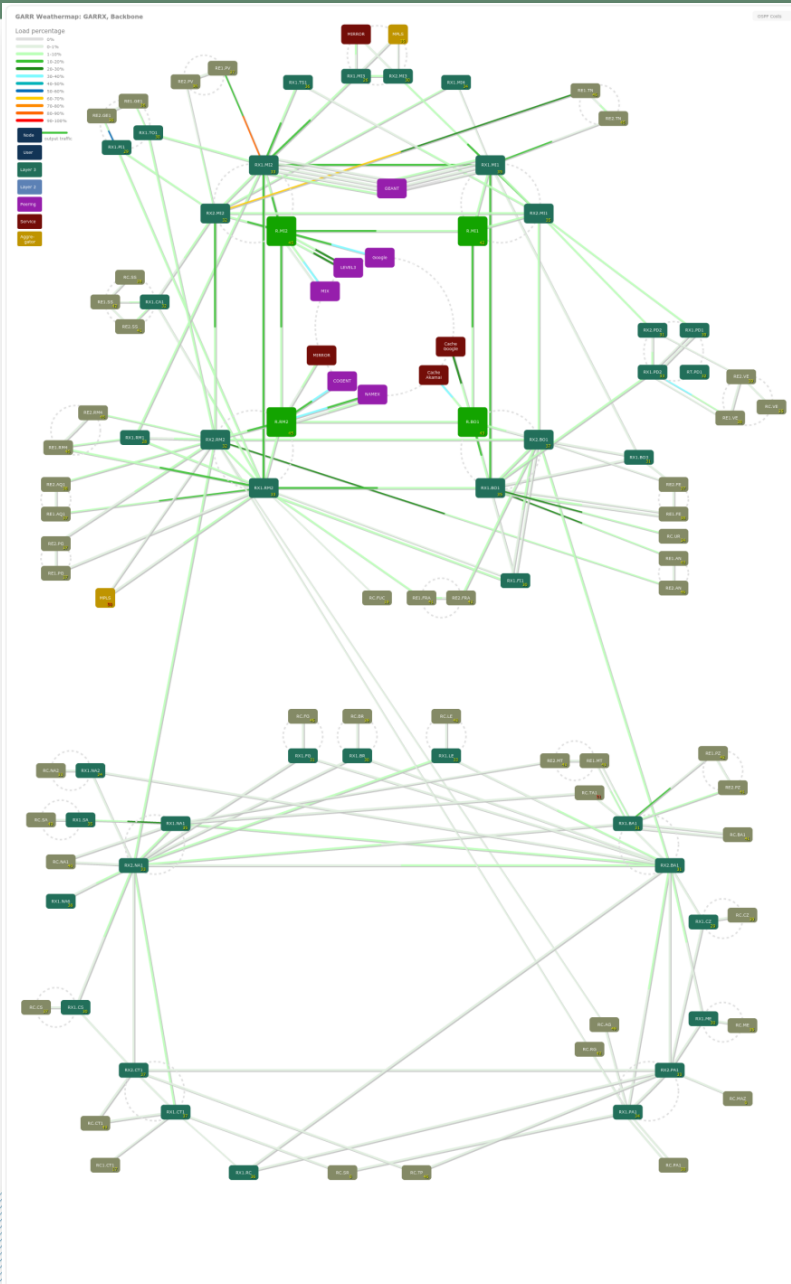
Convitto Nazionale Vittorio Emanuele II - Napoli -- PoP Napoli-Monte di Dio



Click to change the time scale.
View on GINS.

Drag this box or double click to close.

Weathermap: backbone



Statistiche di traffico



GINS

Frontend
Middleware
Backend



Backend

<http://www.zabbix.com/>

The screenshot shows the Zabbix 2.4 website. At the top, it says 'ZABBIX The Enterprise-class Monitoring Solution for Everyone'. Below this is a navigation bar with links: Product, Solutions, Services, Training, Partners, Download, Community, About Us. The main content area features the text 'Built for your needs & requirements' followed by 'Zabbix 2.4' in large red letters. A red 'NEW' badge is next to the version number. To the right, there's a callout bubble saying '50 new features and improvements' above a bar chart. Below the main heading, there are sections for 'Next Webinars' (listing dates and topics in Portuguese, German, and French), 'Upcoming Trainings' (listing dates and locations in Italy, Spain, and Belgium), and 'Contact Sales' (providing worldwide, USA, and Japan phone numbers).

<http://www.cacti.net/>

The screenshot shows the Cacti website. It has a green header with the Cacti logo and navigation links: forums, repository, documentation. The main content area includes 'Latest News' with several entries dated from 2012 to 2014, and a 'Download Cacti' section with a link to the download page. There's also a 'Publications' section mentioning a book by Thomas Urban.

<http://www.opennms.org/>

The screenshot shows the OpenNMS website. It has a dark header with the OpenNMS logo and navigation links: Home, About OpenNMS, Get OpenNMS, Get Support, Get Involved, Get Stuff. The main content area features a large banner with the text 'World's first open source, enterprise grade network management application platform' and a 'Download Now' button. Below this, there are sections for 'See a Live Demo', 'Get the Network to Work® with OpenNMS!', and 'Get OpenNMS', 'Get Support', and 'Get Involved' links.

- Cosa controlliamo:
 - Variazioni di traffico
 - Raggiungibilita' ICMP
 - Stato degli apparati e delle porte
 - Errori sulle interfacce
 - Stato degli LSP MPLS
 - Stato delle VPN L2/L3
 - Sessioni BGP e prefissi
 - Allarmi LACP, IMA
 - Allarmi Chassis specifici
 - Soglie temperature



Tool di monitoring

Actions: [TTS](#) [Show blacklist](#) [Show history](#) Tools: [eMon alarms \[9-91\]](#) [BGP alarms \[52\]](#) [IMA alarms \[0\]](#) [LACP alarms \[12\]](#) [MPLS alarms \[5\]](#) [e2e alarms \[0\]](#)

Alarms

Chassis alarms: ok

Users links

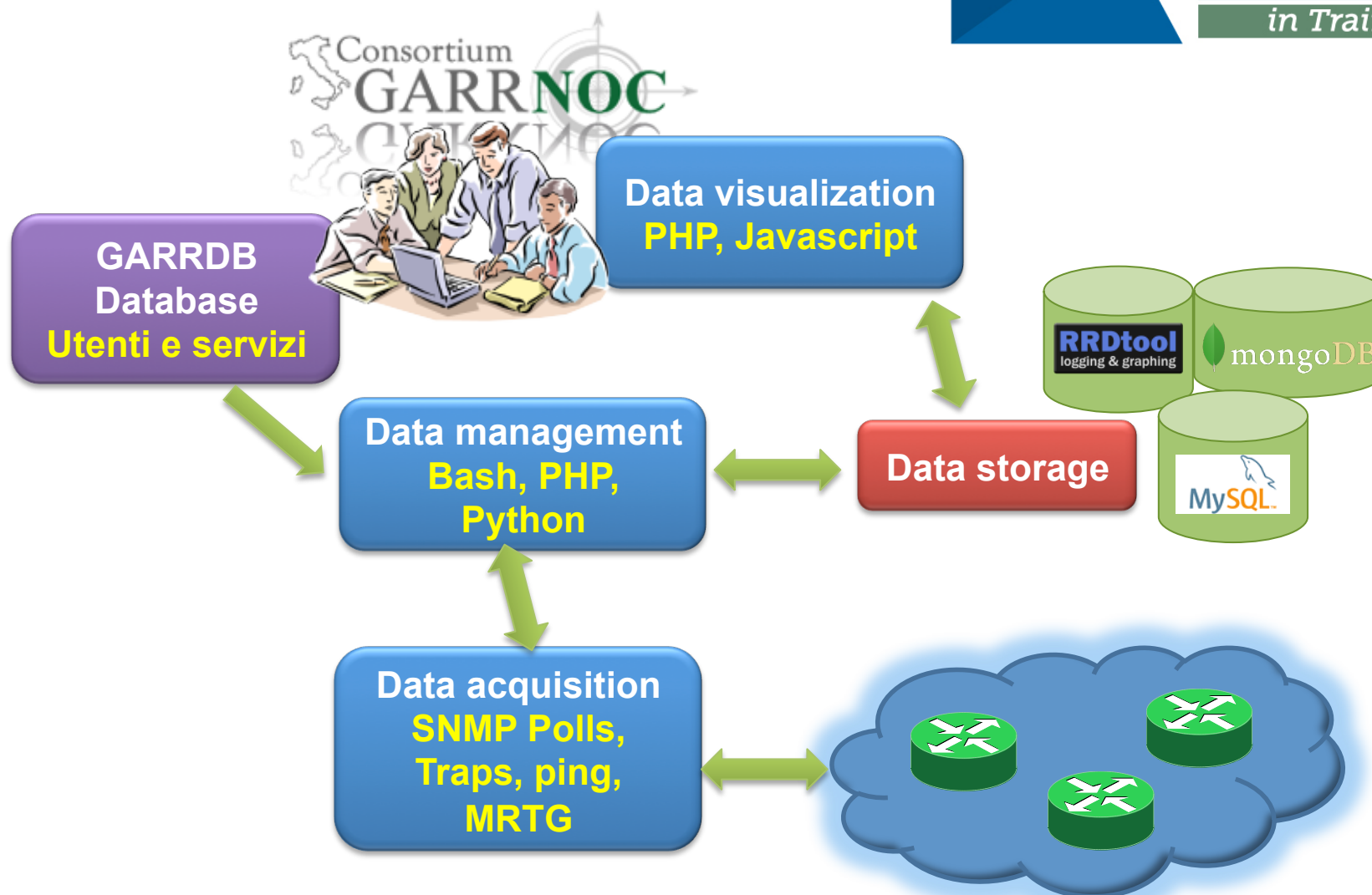
Id	Name	Date	Router interface	IP	I/O	Pg	eM	Tr	St	St	Hi	BL	TBL	TTS
5294	CINECA-PRACE - Casalecchio di Reno (BO) -- PoP Milano-Lancetti	17/03/2015 18:07	rx1.mil.garr.net xe-1/0/0.0	10.31.1.122	1.6 1.83	■	■	■	■	+	+	+	+	New
5504	Liceo Scientifico Vercelli - Asti -- CSP Torino	17/03/2015 14:58	rx1.to1.garr.net xe-0/0/0.117		0 0	■	■	■	■	+	+	+	+	New
4923	Registro ccTLD.it -- PoP Pisa-Torricelli	14/03/2015 23:22	rx1.pi1.garr.net ae7.13	193.206.136.58	185.36 1.07	■	■	■	■	+	+	+	+	15674 bataloni 13/03 14:54 Lorenzo Rossi: disattivato la sessione BGP IPv4 tra l'AS2597 e l'AS137. Stiamo rivedendo tutta la nostra architettura di rete in seguito ad alcuni problemi che abbiamo sperimentato. In questo transitorio vorrei mantenere down il transito IPv4 con l'AS137 al fine di semplificare l'analisi di alcune situazioni. 15674 bataloni 13/03 14:54 Aperto ticket
4972	ITST Fermi - Frascati -- PoP Roma-Tizil	13/03/2015 14:49	rx1.rm2.garr.net ge-2/3/7.640	193.206.131.30	0.27 0.23	■	■	■	■	+	+	+	+	New
3395	e2e FEDERICA GARR-PSNC	10/03/2015 09:37	sw01.mil.it.net.fp7-federica.eu ge-0/0/0.0	194.132.52.86	0 0.19	■	■	■	■	+	+	+	+	15662 dambrosio 10/03 12:23 Problem with one of switches where these FEDERICA lines are terminated, due to power outage.
4193	ENEA - Frascati -- PoP Frascati-Fermi backup	09/03/2015 08:40	re2.fra.garr.net ge-1/1/3.923	193.206.136.194	0.27 0.05	■	■	■	■	+	+	+	+	15656 pellegrini 09/03 08:56 volevo avvisarvi che a breve spegneremo il router di backup della sede ENEA Frascati per permettere l'inserimento e i test di un nuovo firewall. La valutazione durerà qualche giorno, per cui si prevede di riaccendere il router di backup il prossimo mese.
5441	NATO M&S COE - Roma -- PoP Roma-Sapienza backup	17/02/2015 12:00	rx1.rm1.garr.net ge-11/2/9.623	193.206.132.166	0.38 0.2	■	■	■	■	+	+	+	+	15591 dambrosio 17/02 16:14 Contattato APM per richiesta abilitazione ICMP
5644	SSBAR - Roma - Terme di Diocleziano -- PoP Roma-Tizil	27/01/2015 12:07	rx2.rm2.garr.net ge-4/3/2.647	193.204.217.214	0.27 0.09	■	■	■	■	+	+	+	+	15535 dambrosio 27/01 14:57 In attesa dell'installazione del router in sede utente

Legenda:

Id	URI database
In, Out	traffico In Kbps
Stat	verifica stato dell'acquisizione delle statistiche - URI statistiche
Ping	esito del ping
eMon	verifica stato della porta fisica da eMon
Trap	verifica l'arrivo di trap LINK_DOWN nell'ultima ora da TrapMon
Aggr Traf	verifica traffico aggregato dei link - URI statistiche aggregate
Colori esito test:	■ negativo ■ positivo ■ non attivo
BL	manda in blacklist
TBL	manda in blacklist temporaneamente (1 ora)



GINS architettura



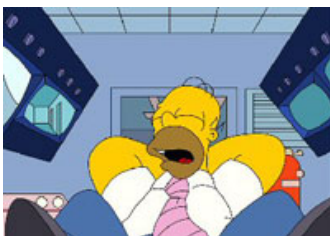
Come monitorare la rete

- Interrogare gli apparati



SNMP poll

- Ascoltare gli eventi generati dagli apparati



SNMP trap

- Misurare le prestazioni



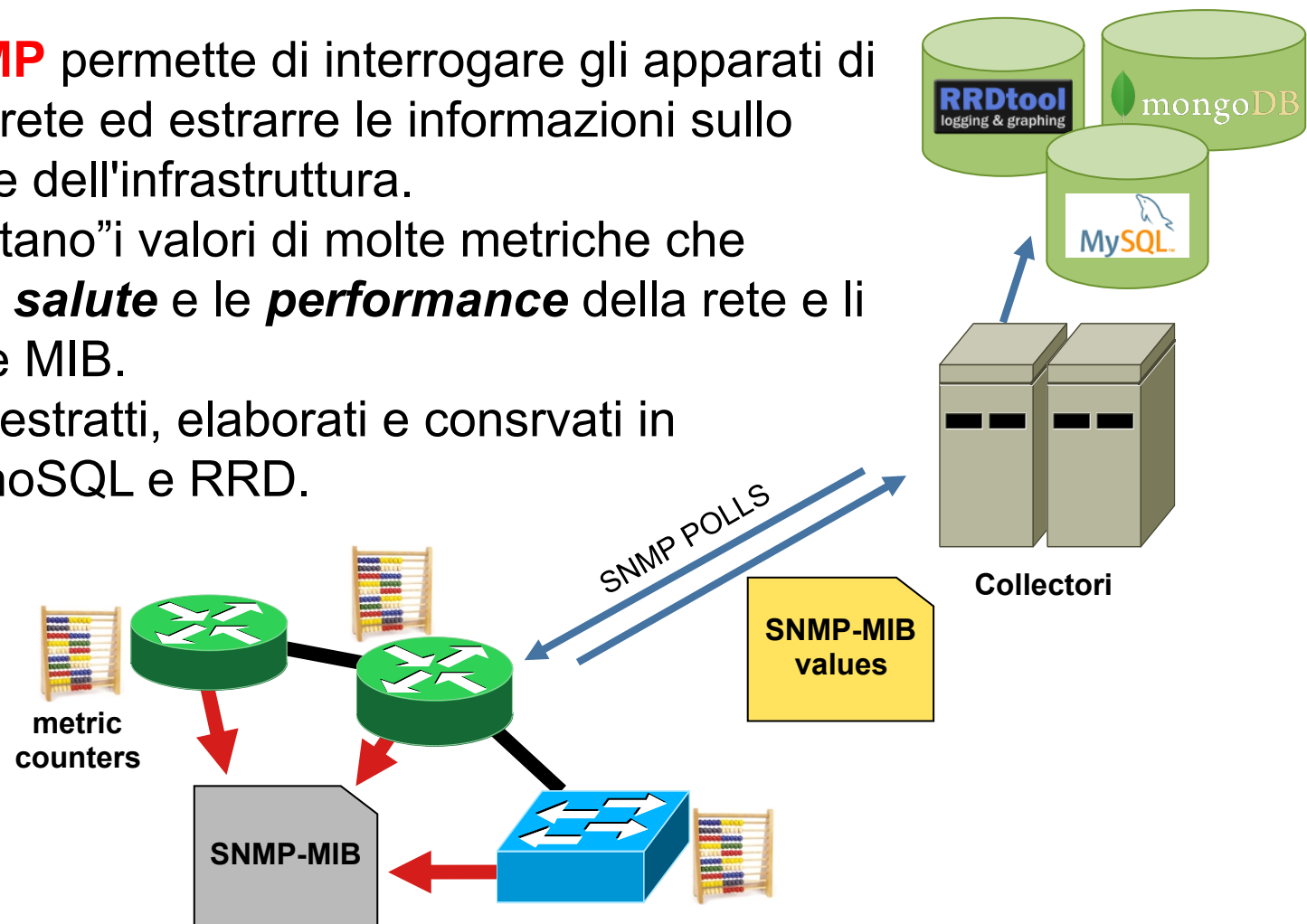
Active measuring

Interrogare la rete: SNMP Poll

Il protocollo **SNMP** permette di interrogare gli apparati di ogni livello della rete ed estrarre le informazioni sullo stato dei servizi e dell'infrastruttura.

Gli apparati “contano” i valori di molte metriche che caratterizzano la **salute** e le **performance** della rete e li conservano nelle MIB.

I valori vengono estratti, elaborati e conservati in database SQL, noSQL e RRD.



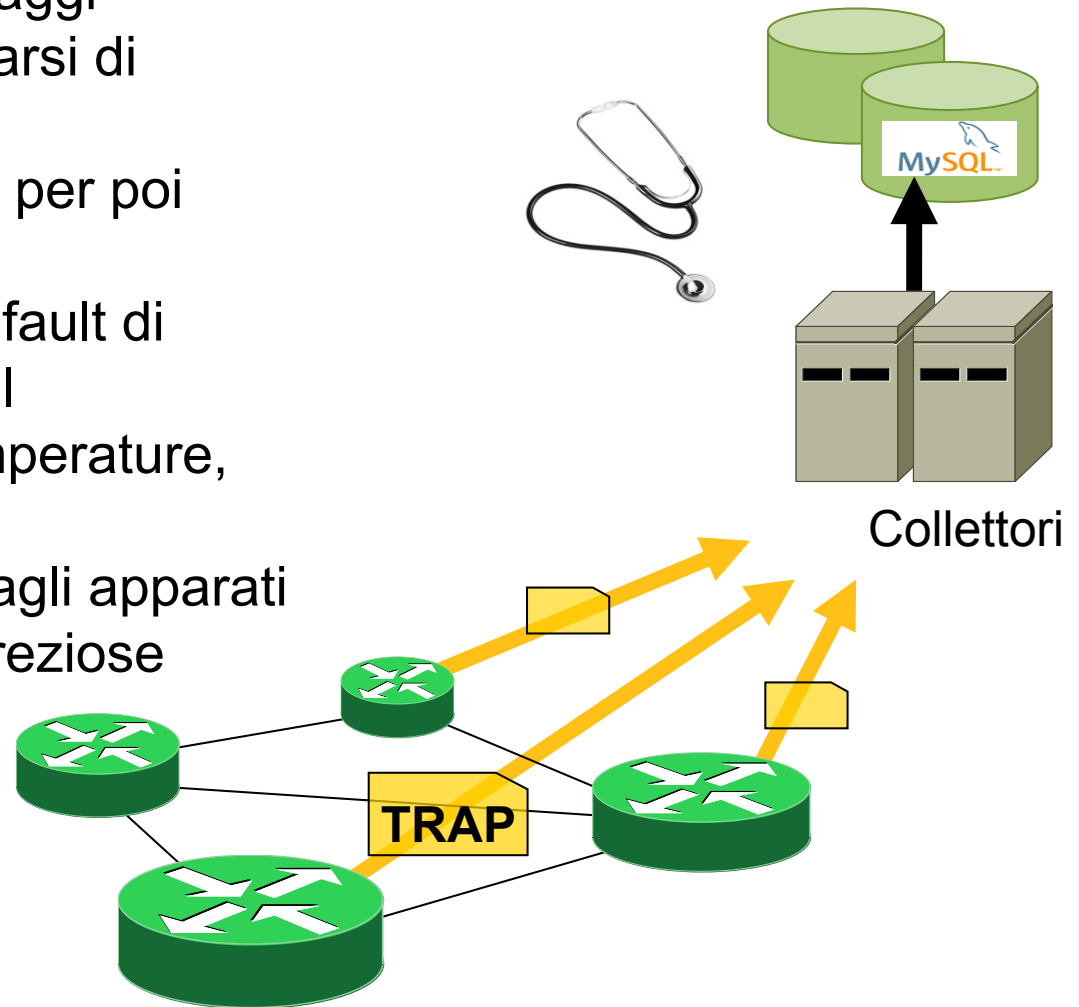
Ascoltare la rete: SNMP Trap

Le **TRAP SNMP** sono dei messaggi generati dagli apparati al verificarsi di **eventi critici**.

Vengono “tradotti” e collezionati per poi essere analizzati.

Gli eventi possono riguardare il fault di apparati o di servizi, ma anche il superamento di soglie (es. Temperature, livelli ottici).

Vengono inviate direttamente dagli apparati di rete, fornendo informazioni preziose quando si presenta un problema in rete, prima che gli altri sistemi se ne accorgano.



Ascoltare la rete: SNMP Trap

- Cosa ascoltare:

- Approccio mirato:
configurare apparati per inviare Trap per eventi specifici
- Approccio aperto e complesso:
inviare tutto, classificare, analizzare

- Come ascoltare:

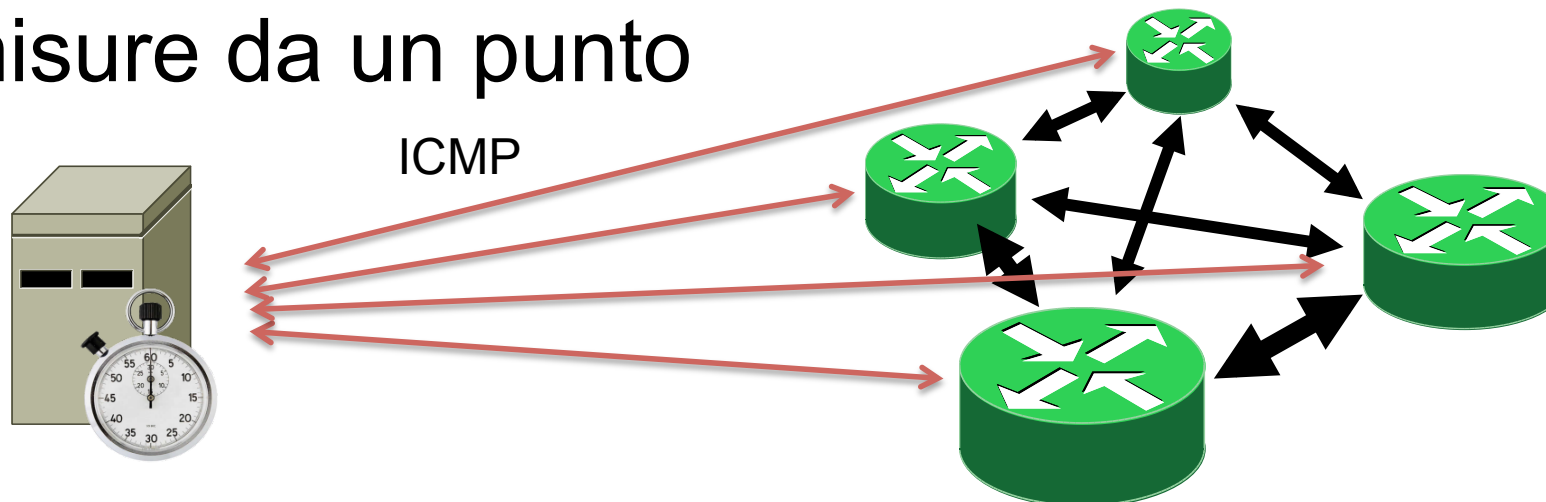
- Snmptrapd
- Event driven tools, esempio nodejs (LAB)

```
trap-group space {  
  categories {  
    authentication;  
    chassis;  
    link;  
    routing;  
    startup;  
  }  
}
```

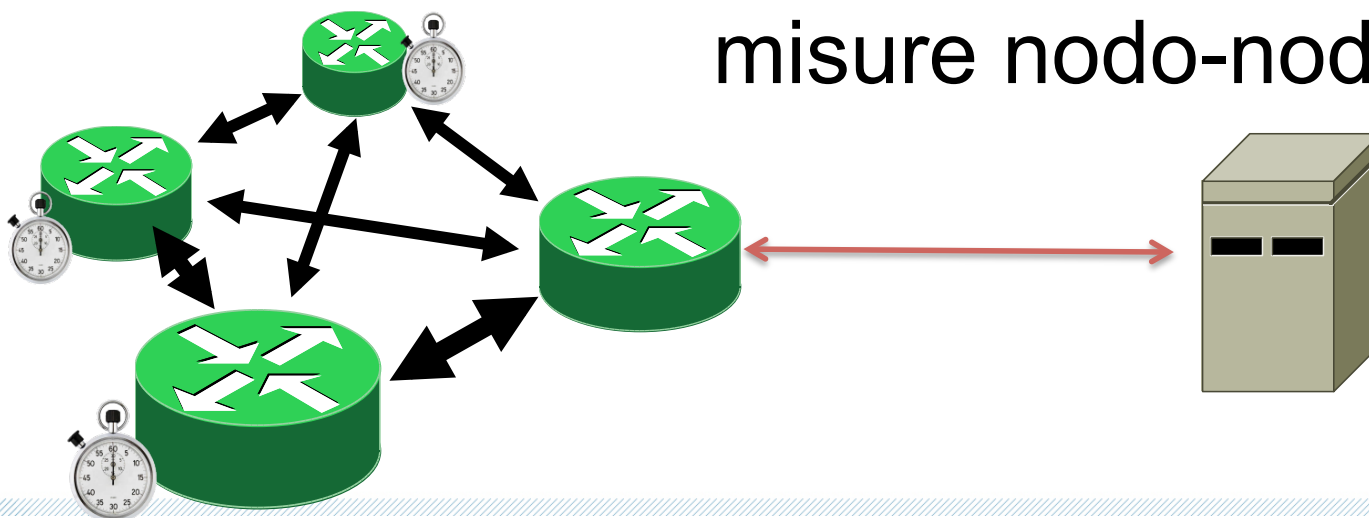


Latency

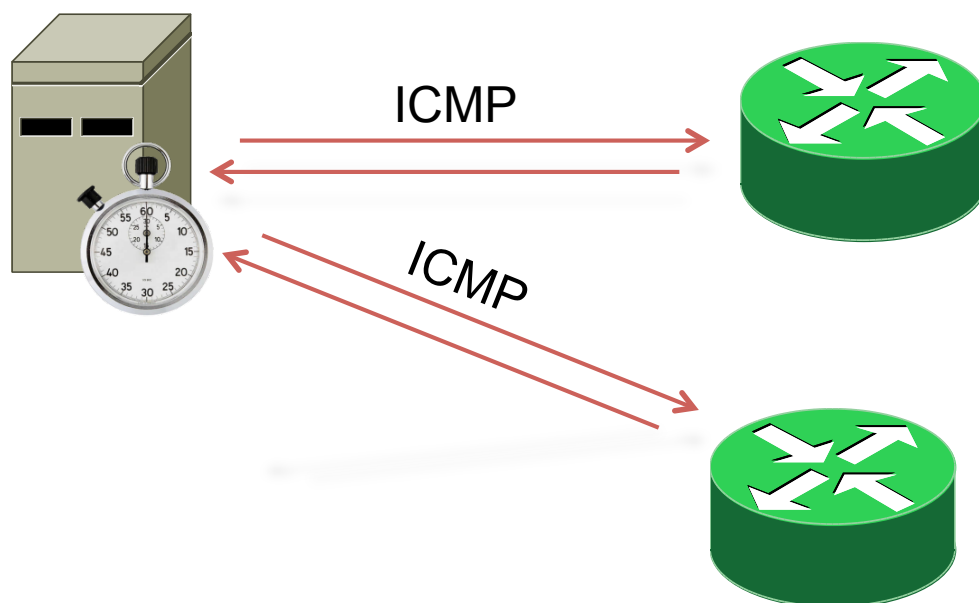
misure da un punto



misure nodo-nodo



- Misura da un punto

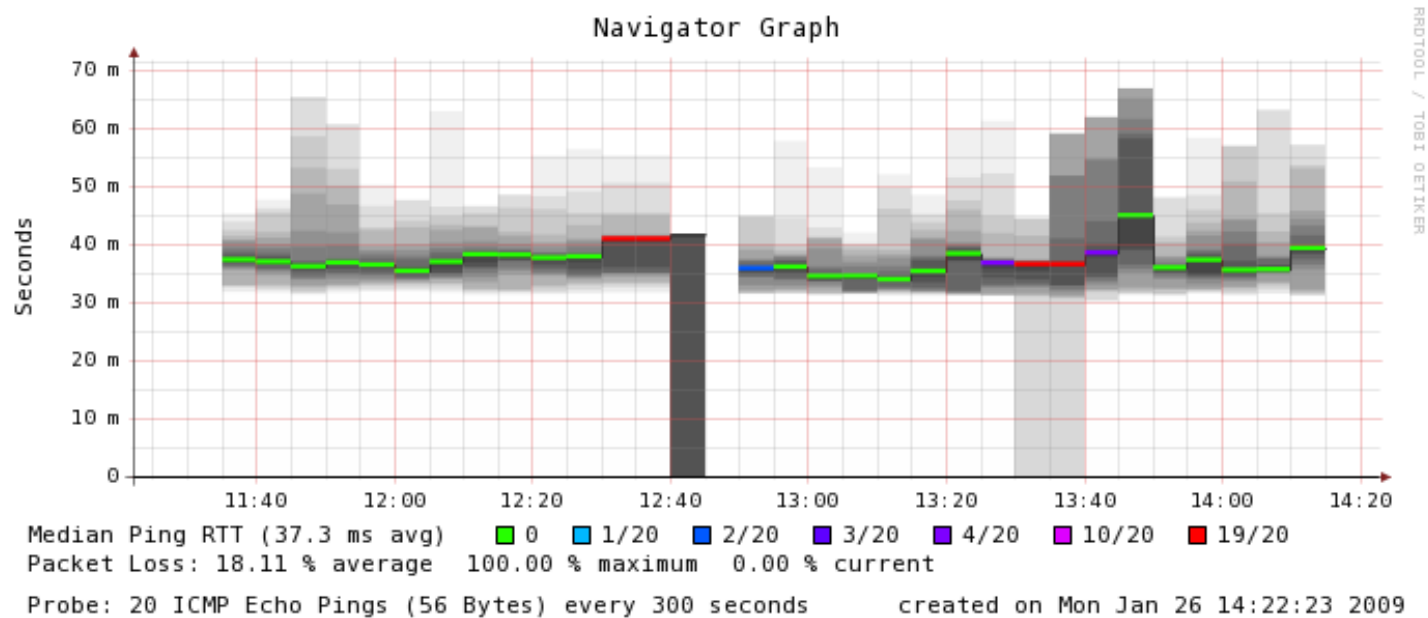


Tool scelto:



<http://oss.oetiker.ch/smokeping/>

Latency



- Round Trip Time fluctuations
- Packet Loss percentage

Latency

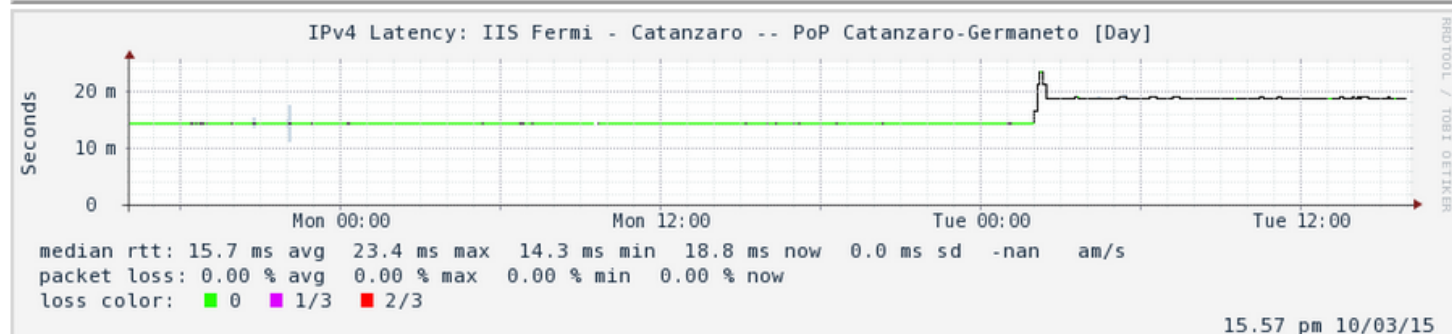
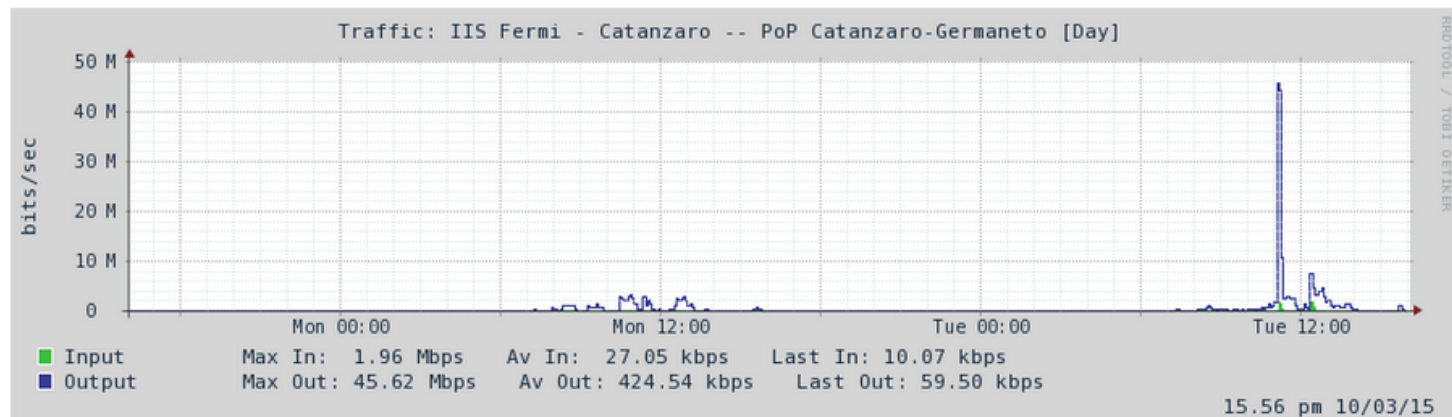
Statistiche di traffico

Time scale: [Day](#) [Week](#) [Month](#) [Year](#) [5 Year](#) Metrics: [IPv6](#) [Latency](#) [Traffic sum](#) Actions: [Set as default](#) [Get this url](#)

IIS Fermi - Catanzaro -- PoP Catanzaro-Germaneto

close

Link Type	Equipment B	Interface B	IPv4 Address	IPv6 Address	Equipment A	Interface A
DF 100Mbps FE	rc.cz.garr.net	Gi0/1	193.204.93.177		rc-cz-ru-isfermi-cz.cz.garr.net	



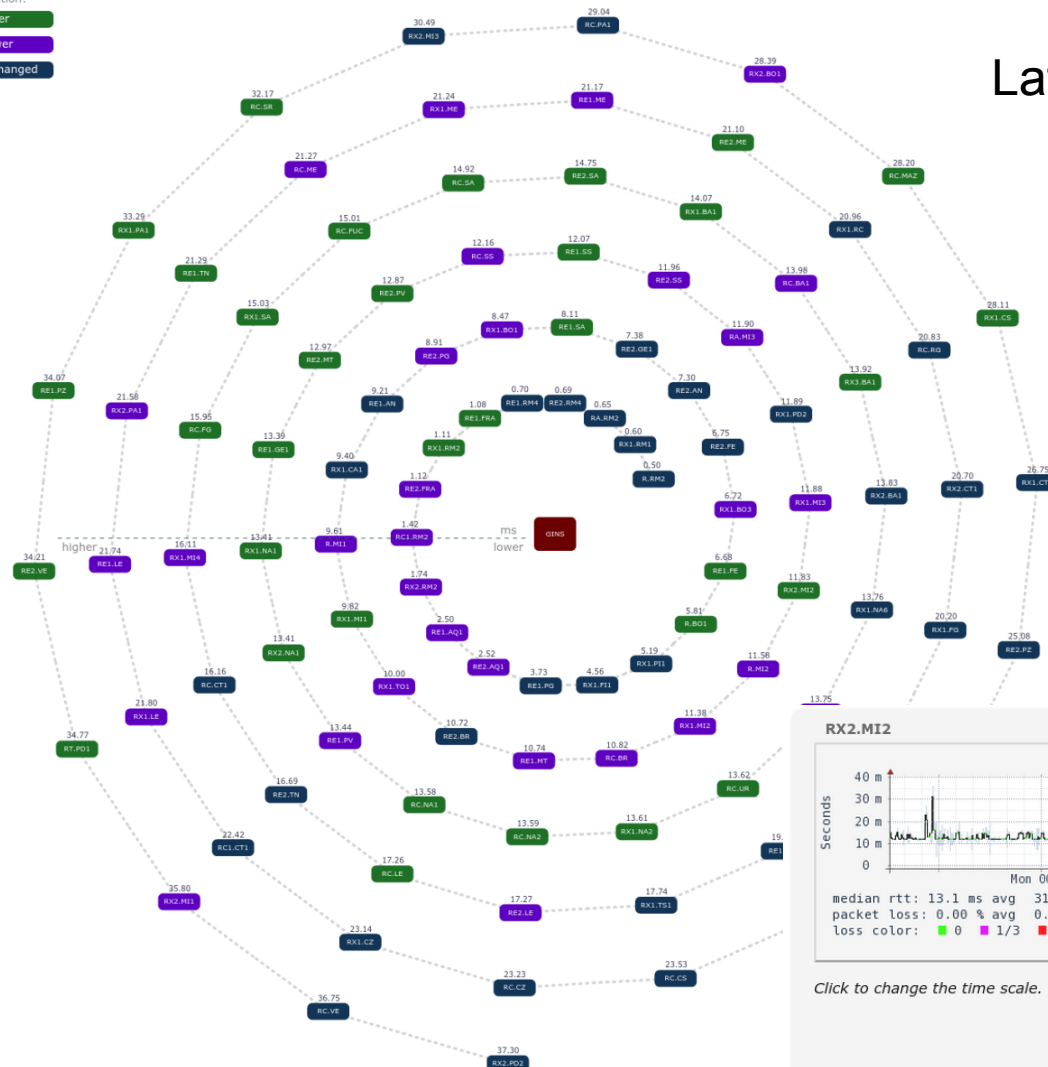
Latency

GARR Weathermap: Backbone latency

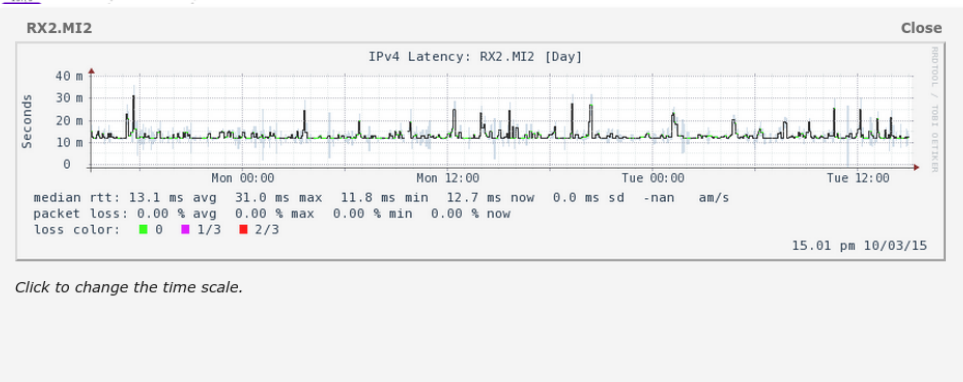
Updated at: 10/03/2015 14:50:01.

Evolution:

faster
slower
unchanged



Latenza della rete vista da GINS

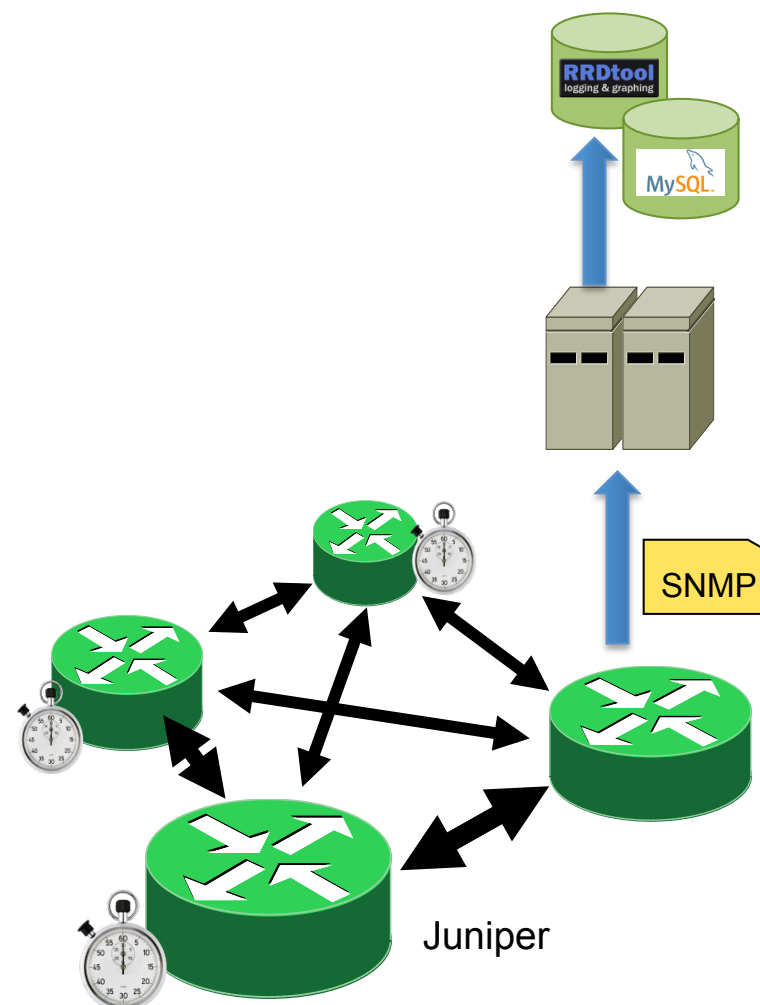


Click to change the time scale.

■ Misura nodo-nodo

I router Juniper sono dotati di un sistema di misura attivo delle performance distribuito, basato sulla tecnologia **RPM** (Real-Time Performance Monitoring).

Permette di misurare la latenza della rete tra due nodi qualsiasi anche a livello applicativo.



Latency

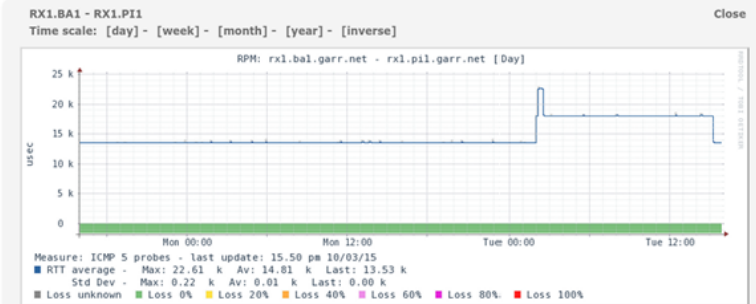
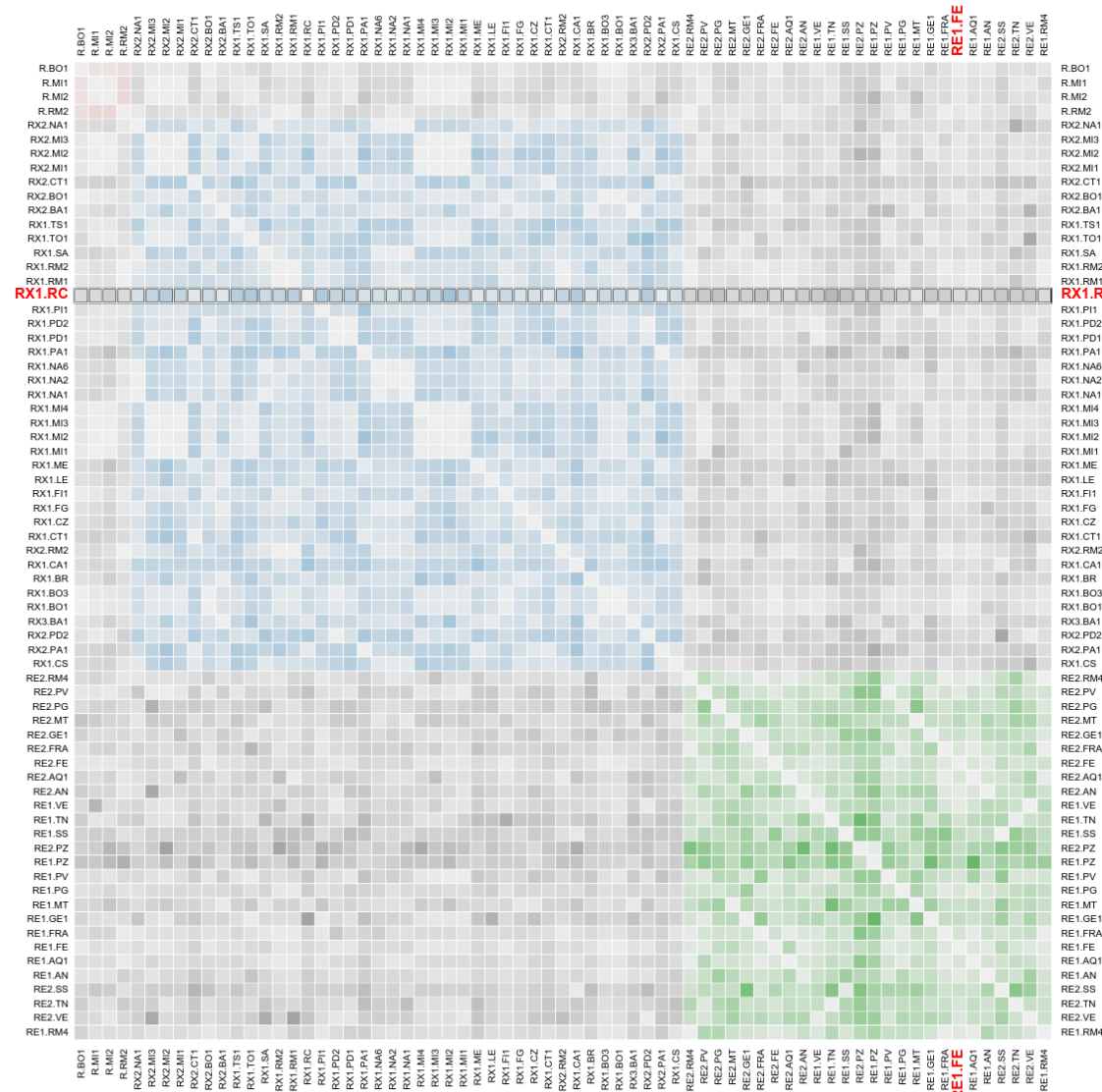
https://gins.garr.it/RPM/rpm_matrix.php



GINS RPM

Backbone RPM matrix (updated at: 15:31 16-06-2015)

Order:



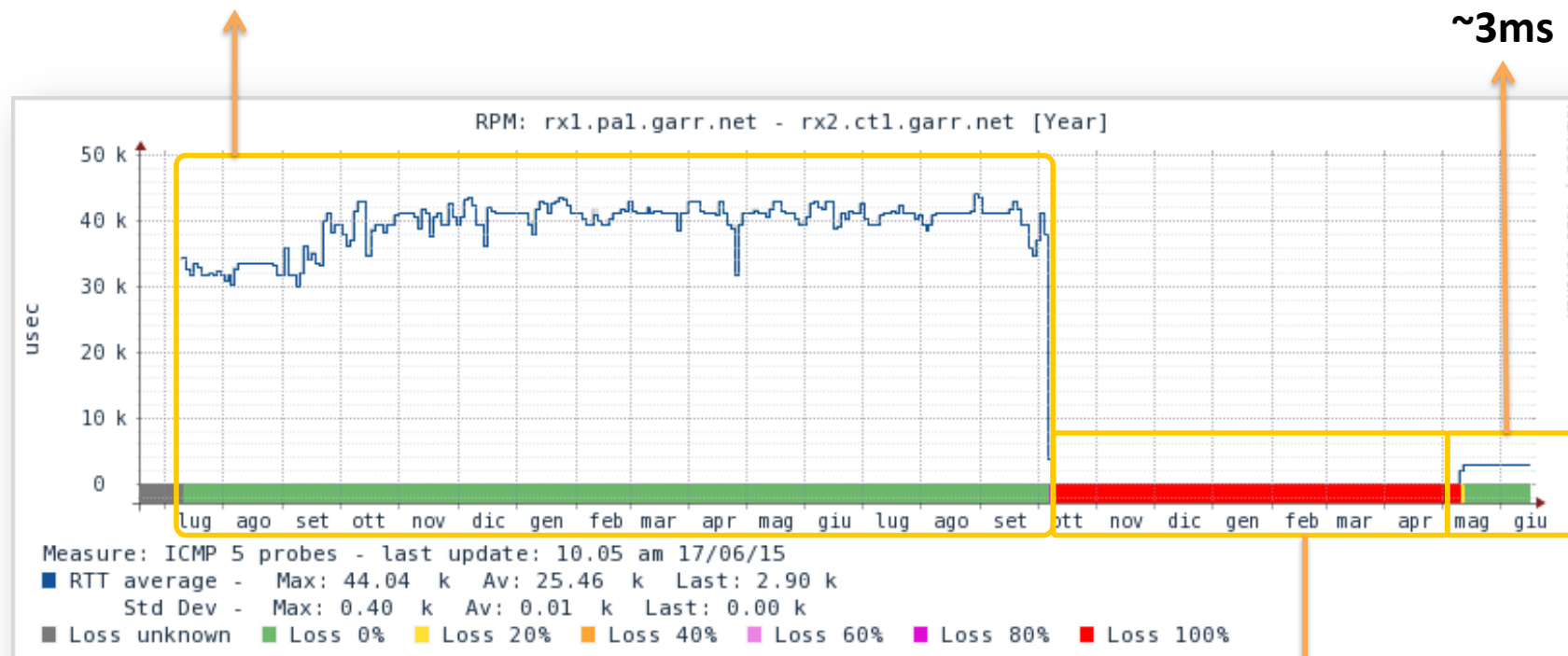
Latency

Latenza Palermo - Catania

Prima di GARRX-Progress

~40ms

Ora
~3ms

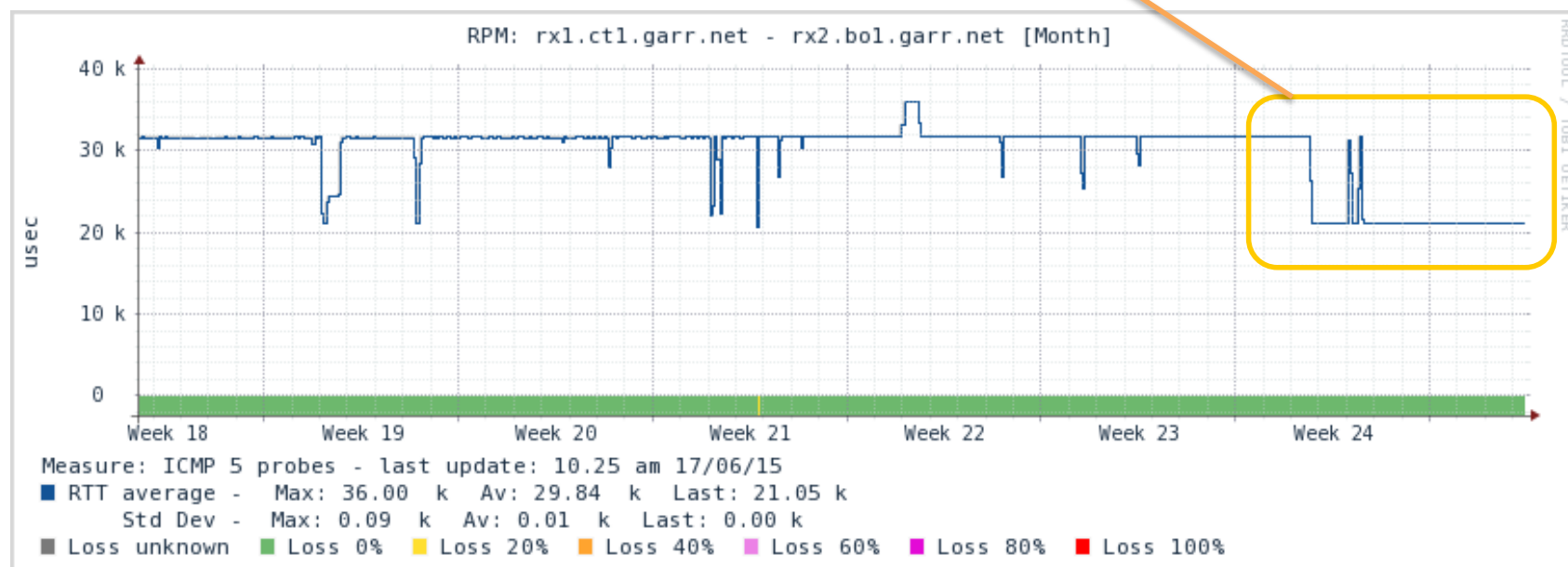


altro circuito

Latency

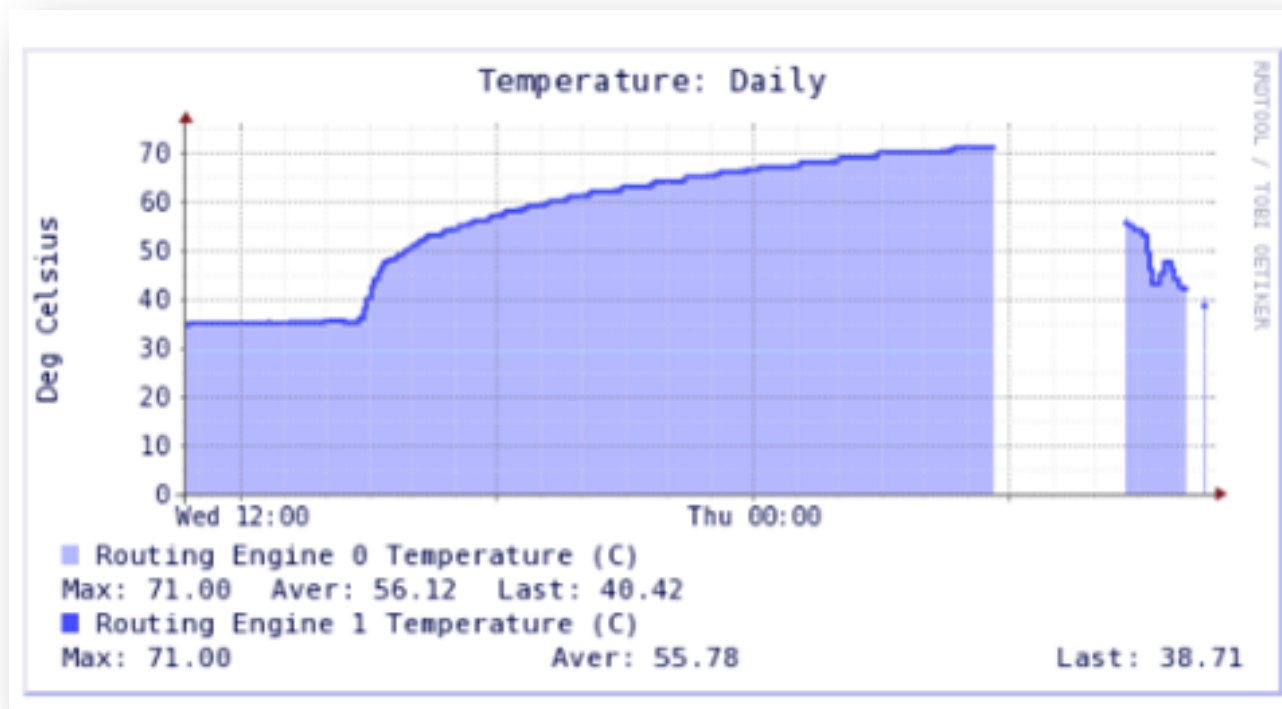
Latenza Catania

Ottimizzazione del trasporto sulla rete ottica



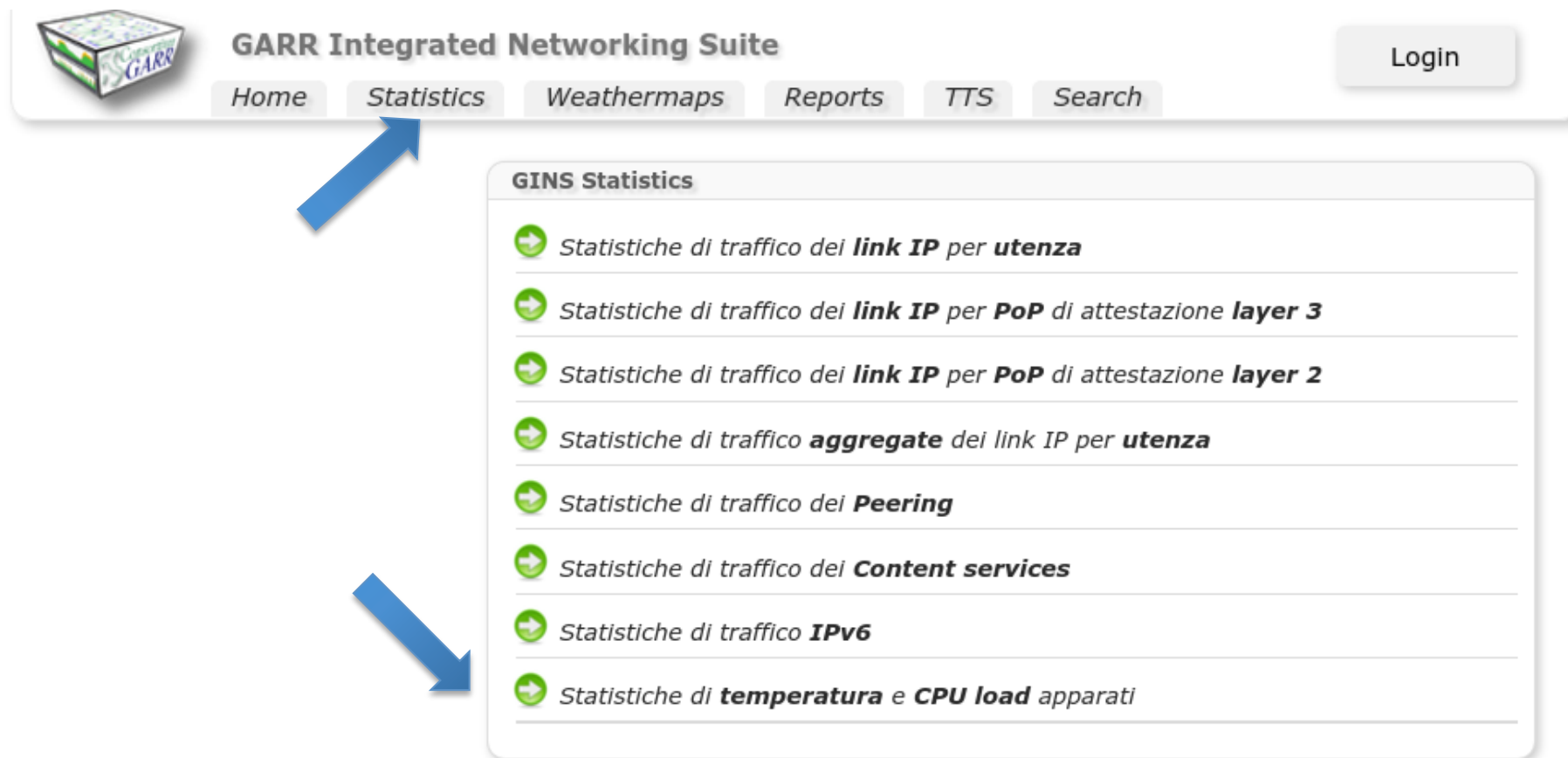
Temperature

Da evitare:



Temperature

Dove trovarle?



GARR Integrated Networking Suite

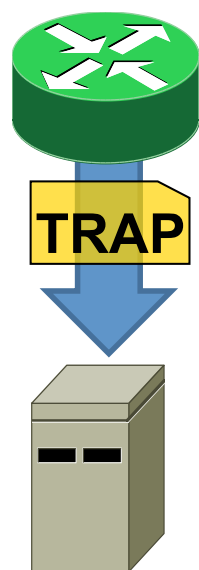
Home Statistics Weathermaps Reports TTS Search Login

GINS Statistics

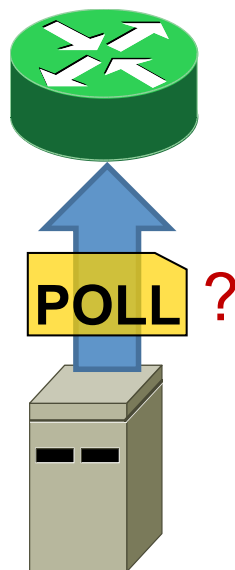
- Statistiche di traffico dei **link IP** per **utenza**
- Statistiche di traffico dei **link IP** per **PoP** di attestazione **layer 3**
- Statistiche di traffico dei **link IP** per **PoP** di attestazione **layer 2**
- Statistiche di traffico **aggregate** dei link IP per **utenza**
- Statistiche di traffico dei **Peering**
- Statistiche di traffico dei **Content services**
- Statistiche di traffico **IPv6**
- Statistiche di **temperatura** e **CPU load** apparati

Temperature

- Un apparato di rete ha tante temperature
- Le MIBs sono proprietarie
- Le soglie di allarme non sono sempre di facile interpretazione



OK, se arriva



> show chassis temperature-thresholds

Item	Fan speed		Yellow alarm		Red alarm	
	Normal	High	Normal	Bad fan	Normal	Bad fan
Chassis default	48	54	65	55	75	65
Routing Engine 0	70	80	95	95	110	110
Routing Engine 1	70	80	95	95	110	110
FPC 0	55	60	75	65	90	80
FPC 1	55	60	75	65	90	80
FPC 2	48	54	70	60	80	70
FPC 3	48	54	70	60	80	70
FPC 4	48	54	70	60	80	70
FPC 5	48	54	70	60	80	70
FEB 0	48	54	70	60	80	72
FEB 1	48	54	70	60	80	72
FEB 2	48	54	70	60	80	72
FEB 3	48	54	70	60	80	72
FEB 4	48	54	70	60	80	72
FEB 5	48	54	70	60	80	72

Temperature

> show chassis temperature-thresholds

Item	Fan speed		Yellow alarm		Red alarm	
	Normal	High	Normal	Bad fan	Normal	Bad fan
Chassis default	48	54	65	55	75	65
Routing Engine 0	70	80	95	95	110	110
Routing Engine 1	70	80	95	95	110	110
FPC 0	55	60	75	65	90	80
FPC 1	55	60	75	65	90	80
FPC 2	48	54	70	60	80	70
FPC 3	48	54	70	60	80	70
FPC 4	48	54	70	60	80	70
FPC 5	48	54	70	60	80	70
FEB 0	48	54	70	60	80	72
FEB 1	48	54	70	60	80	72
FEB 2	48	54	70	60	80	72
FEB 3	48	54	70	60	80	72
FEB 4	48	54	70	60	80	72
FEB 5	48	54	70	60	80	72

La soglia di temperatura a cui viene generato un allarme e' funzione della capacita' di raffreddamento dell'apparato

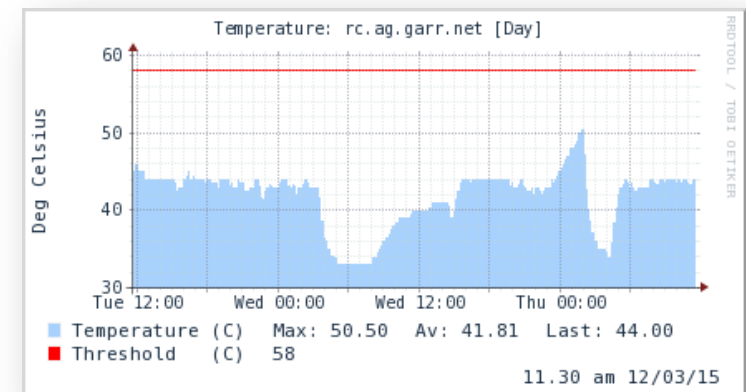
Raffreddamento OK

Raffreddamento ridotto

Temperature

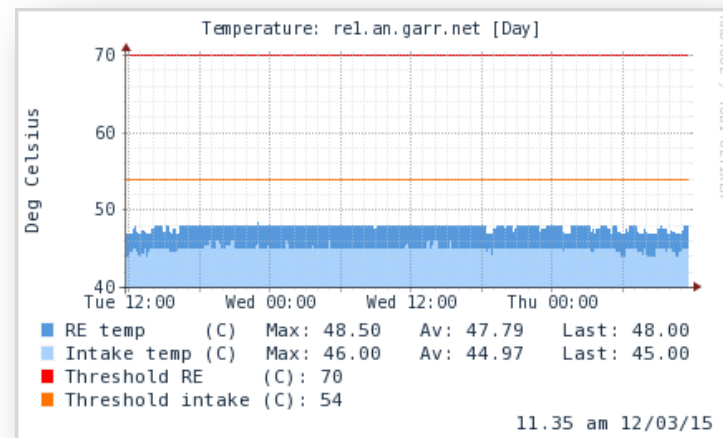
■ Cisco

- temperatura (1.3.6.1.4.1.9.9.13.1.3.1.3.<index>)
CISCO-ENVMON-MIB::ciscoEnvMonTemperatureStatusValue
- soglia (1.3.6.1.4.1.9.9.13.1.3.1.4.<index>)
CISCO-ENVMON-MIB::ciscoEnvMonTemperatureThreshold



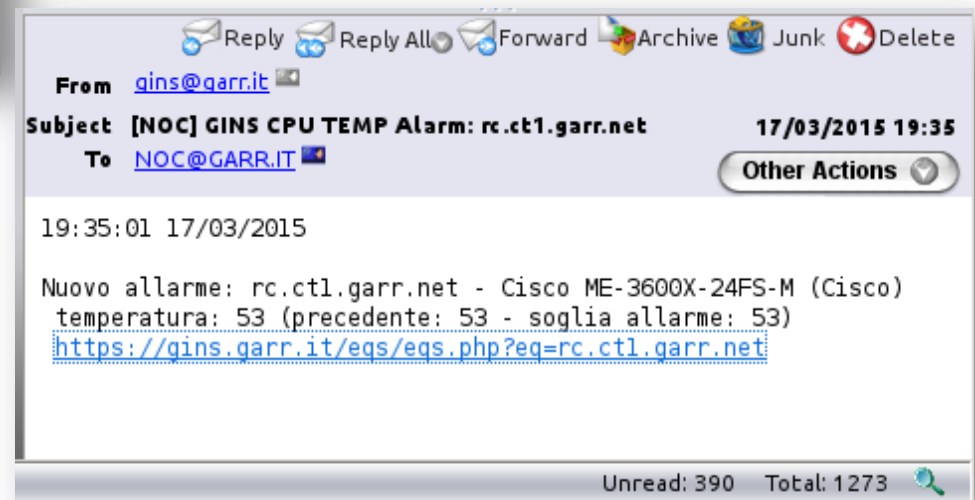
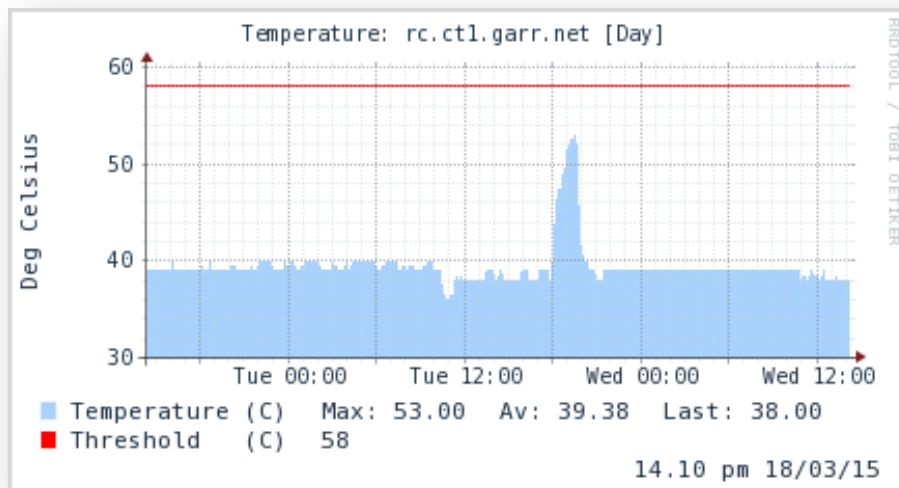
■ Juniper

- temperatura (1.3.6.1.4.1.2636.3.1.13.1.7.<index>)
JUNIPER-MIB::jnxOperatingTemp
 - Allarmi
 - intake > 54
 - RE > 70



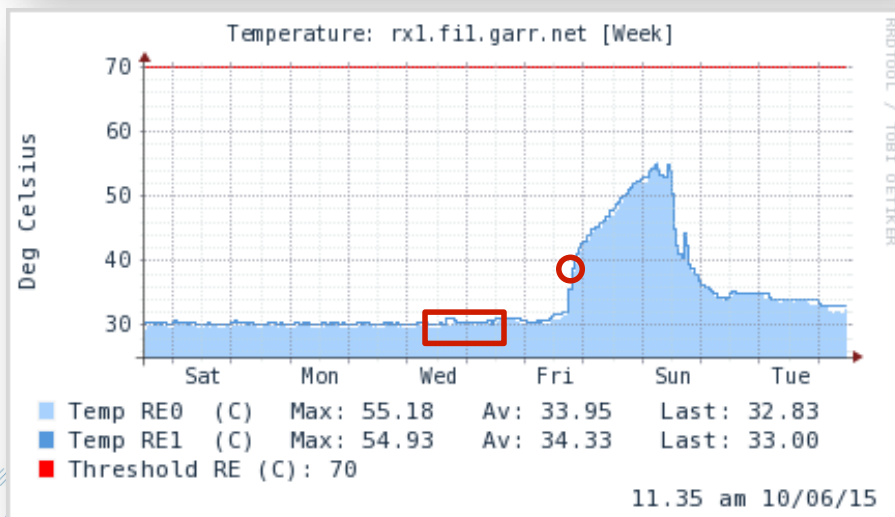
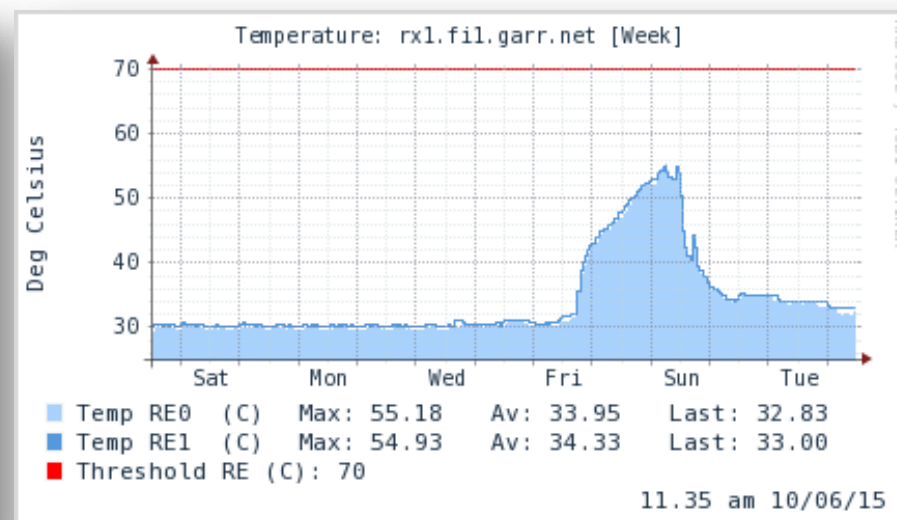
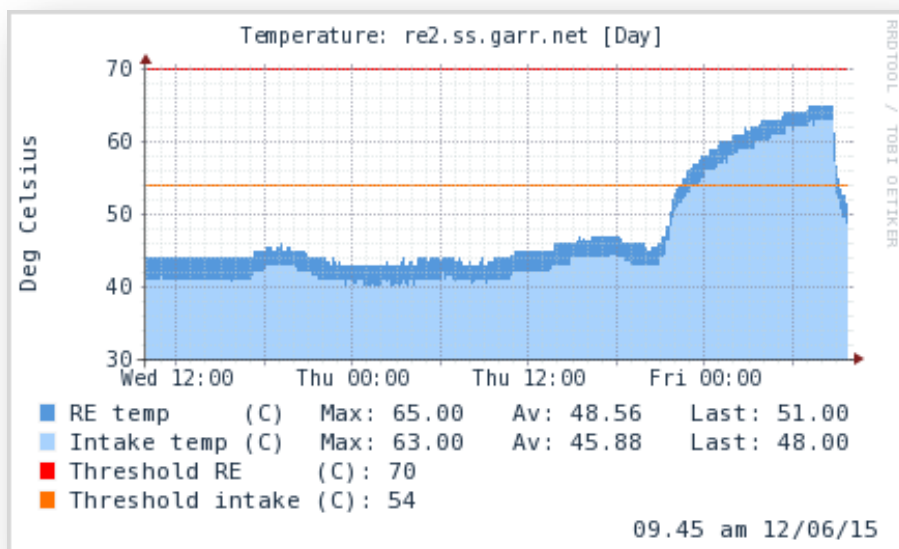
Temperature

Notifica prima del superamento soglia



Temperature

Quando il condizionamento ha problemi



Allarme e notifica se:
la temperatura attuale
>
temperatura media su 24h
delle 24h precedenti al
momento attuale + 8 C

Looking glass

<https://gins.garr.it/LG/>



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[Statistics](#)

[Weathermaps](#)

[Reports](#)

[TTS](#)

[Search](#)

[Tools](#)

[Logout](#)

Looking Glass

Host:

Command:

- ☒ ping ADDRESS
- ☐ traceroute ADDRESS
- ☐ show bgpv4 summary
- ☐ show bgpv6 summary
- ☐ show route ADDRESS[/PREFIX]
- ☐ show bgp neighbor ADDRESS
- ☐ show dampened route
- ☐ show msdp
- ☐ show msdp source-active
- ☐ show multicast sessions
- ☐ show multicast ipv4 route ADDRESS
- ☐ show multicast ipv6 route ADDRESS
- ☐ show pim interface
- ☐ show pim neighbors
- ☐ show multicast forwarding table
- ☐ show multicast rpf ADDRESS
- ☐ show pim Rendez-vous Point
- ☐ show pim join ADDRESS

Argument:

use my address as argument

ping count 5 8.8.8.8

PING 8.8.8.8 (8.8.8.8): 56 data bytes

64 bytes from 8.8.8.8: icmp_seq=0 ttl=57 time=25.220 ms

64 bytes from 8.8.8.8: icmp_seq=1 ttl=57 time=28.073 ms

64 bytes from 8.8.8.8: icmp_seq=2 ttl=57 time=25.561 ms

64 bytes from 8.8.8.8: icmp_seq=3 ttl=57 time=45.936 ms

64 bytes from 8.8.8.8: icmp_seq=4 ttl=57 time=24.629 ms

--- 8.8.8.8 ping statistics ---

5 packets transmitted, 5 packets received, 0% packet loss

round-trip min/avg/max/stddev = 24.629/29.884/45.936/8.112 ms

Looking glass

<https://gins.garr.it/LG/>



GARR Integrated Networking Suite

Home Monitor Statistics Weathermaps Reports TTS Search Tools Logout

Looking Glass

Host:

Command:

- ☐ ping ADDRESS
- ☒ traceroute ADDRESS
- ☐ show bgp v4 summary
- ☐ show bgp v6 summary
- ☐ show route ADDRESS[/PREFIX]
- ☐ show bgp neighbor ADDRESS
- ☐ show dampened route
- ☐ show msdp
- ☐ show msdp source-active
- ☐ show multicast sessions
- ☐ show multicast ipv4 route ADDRESS
- ☐ show multicast ipv6 route ADDRESS
- ☐ show pim interface
- ☐ show pim neighbors
- ☐ show multicast forwarding table
- ☐ show multicast rpf ADDRESS
- ☐ show pim Rendez-vous Point
- ☐ show pim join ADDRESS

Argument:

use my address as argument

traceroute 193.204.93.178

```
1 rx1-mi2-rx1-rm2.rm2.garr.net (90.147.80.61) 35.391 ms 37.779 ms rx1-mi2-rx2-mi2.mi2.garr.net (90.147.80.70) 35.114 ms
  MPLS Label=466290 CoS=0 TTL=1 S=1
2 rx2-mi2-rx2-rm2.rm2.garr.net (90.147.80.65) 26.035 ms rx1-rm2-rx2-rm2.rm2.garr.net (90.147.81.50) 24.969 ms rx2-mi2-rx2-rm2.rm2.garr.net (90.147.80.65) 25.517 ms
  MPLS Label=546321 CoS=0 TTL=1 S=1
3 rx2-rm2-rx2-na1.na1.garr.net (90.147.82.73) 25.092 ms 30.979 ms 25.536 ms
  MPLS Label=342560 CoS=0 TTL=1 S=1
4 rx2-na1-rx2-ba1.ba1.garr.net (90.147.82.78) 25.742 ms 20.751 ms 25.704 ms
  MPLS Label=311360 CoS=0 TTL=1 S=1
5 90.147.82.238 (90.147.82.238) 29.927 ms 25.311 ms 25.670 ms
6 rx1-cz-rc-cz.cz.garr.net (90.147.86.62) 34.067 ms 29.480 ms 29.915 ms
7 rc-cz-ru-isfermi-cz.cz.garr.net (193.204.93.178) 25.295 ms * 26.029 ms
```

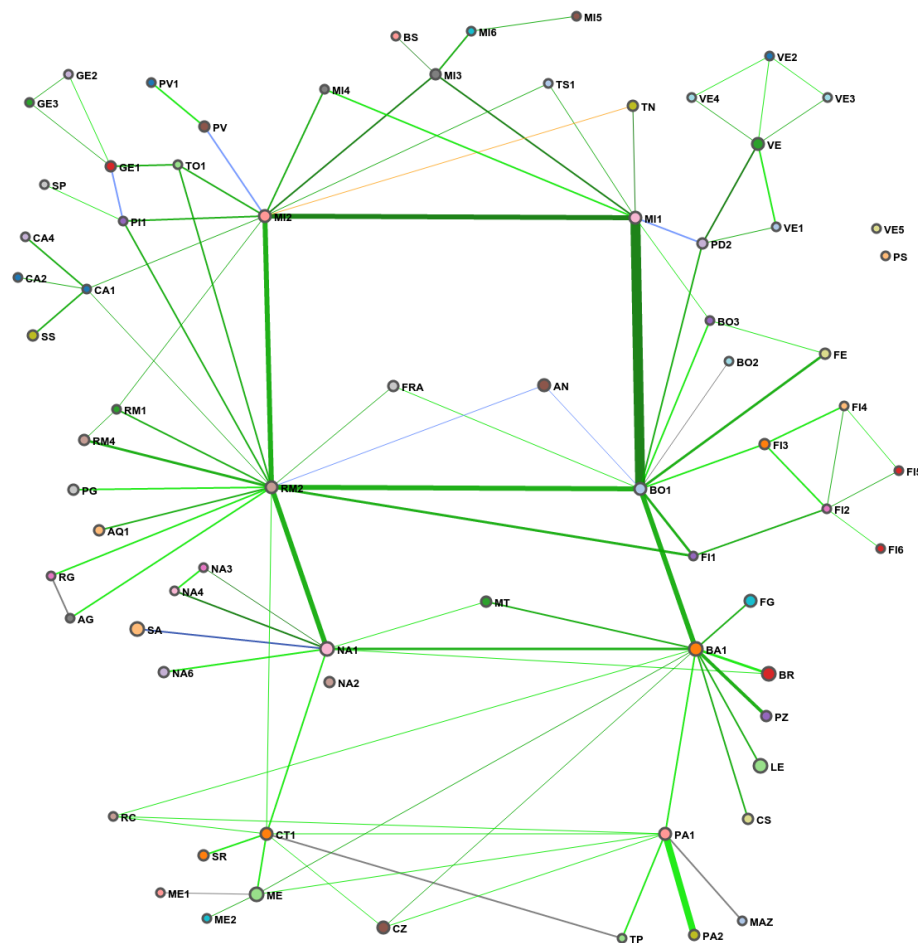

LLDP protocollo amico

The Link Layer Discovery Protocol (LLDP) is a vendor-neutral link layer protocol in the Internet Protocol Suite used by network devices for advertising their identity, capabilities, and neighbors on an IEEE 802 local area network, principally wired Ethernet.

```
> show lldp neighbors
Local Interface Chassis Id      Port info  System Name
ge-0/3/9       00:1e:bd:97:7e:00 GigabitEthernet1/0/25 SWE-LAN.garr.net
ge-2/3/9       00:1e:bd:97:7e:00 GigabitEthernet1/0/27 SWE-LAN.garr.net
ge-0/2/2       1c:aa:07:cb:6e:00 GigabitEthernet0/13 SWE.FG.garr.net
ge-11/2/2      1c:aa:07:cb:6e:00 GigabitEthernet0/15 SWE.FG.garr.net
xe-2/1/1       1c:de:a7:9b:da:9c TenGigabitEthernet0/1 swu1-cnr-adr-ba.ba1.garr.net
ge-0/2/1       8c:b6:4f:ae:d8:80 GigabitEthernet1/0/25 swg.ba1.garr.net
ge-11/3/1      f0:9e:63:8c:80:00 GigabitEthernet0/16 swu-uniba-biotec.ba1.garr.net
ge-11/3/3      f0:9e:63:8c:9a:80 GigabitEthernet0/16 swu-uniba-valenzano.garr.net
ge-11/3/0      f8:c0:01:1b:dd:68 ge-1/0/0    RE1.MT
ge-11/2/6      f8:c0:01:1b:dd:68 ge-1/0/1    RE1.MT
ge-11/3/7      f8:c0:01:1c:05:68 ge-1/0/3    RE1.PZ
ge-0/2/3       f8:c0:01:1c:05:68 ge-1/0/4    RE1.PZ
xe-11/1/1      f8:c0:01:1c:2c:68 xe-0/0/1    RE2.LE
ge-11/3/9      f8:c0:01:1c:32:68 ge-1/0/3    RE2.PZ
```


GARR
PROGRESS
in Training

HOST (info) PORT (info) – PORT (info) HOST (info)

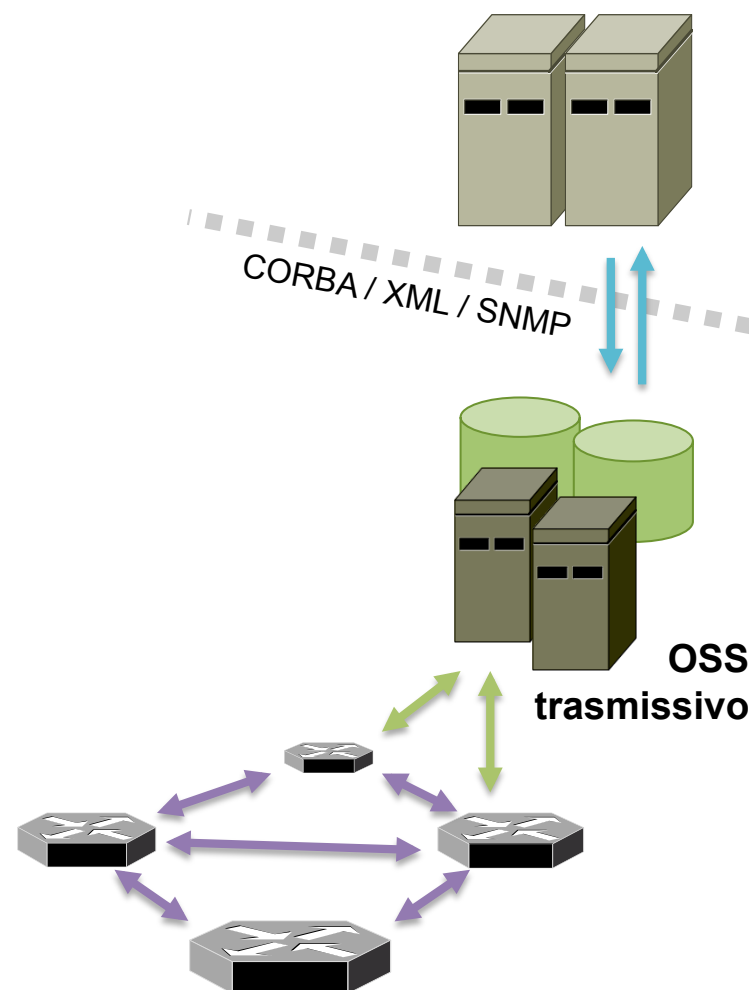


Rete trasmissiva

La gestione e il controllo della rete ottica avviene tramite un sistema hardware e software dedicato, chiamato **OSS** (Operating Support System).

Questo sistema è parte integrante dell'infrastruttura della rete trasmissiva.

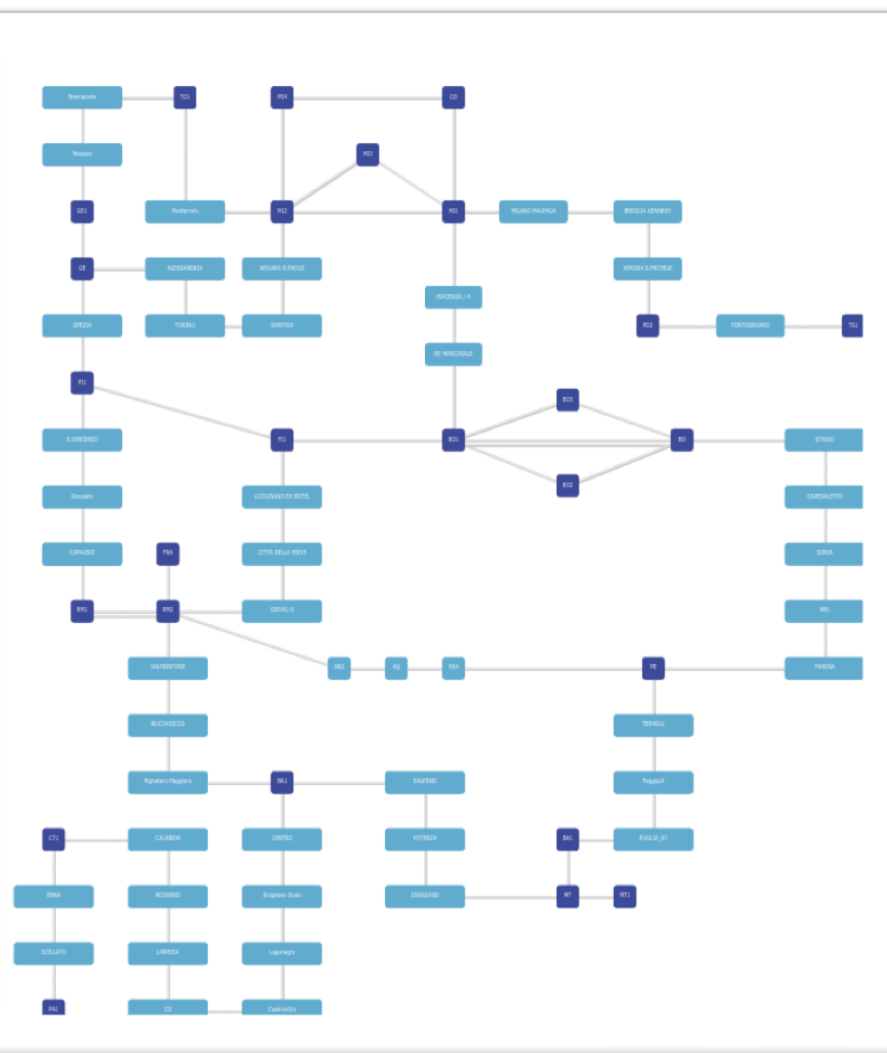
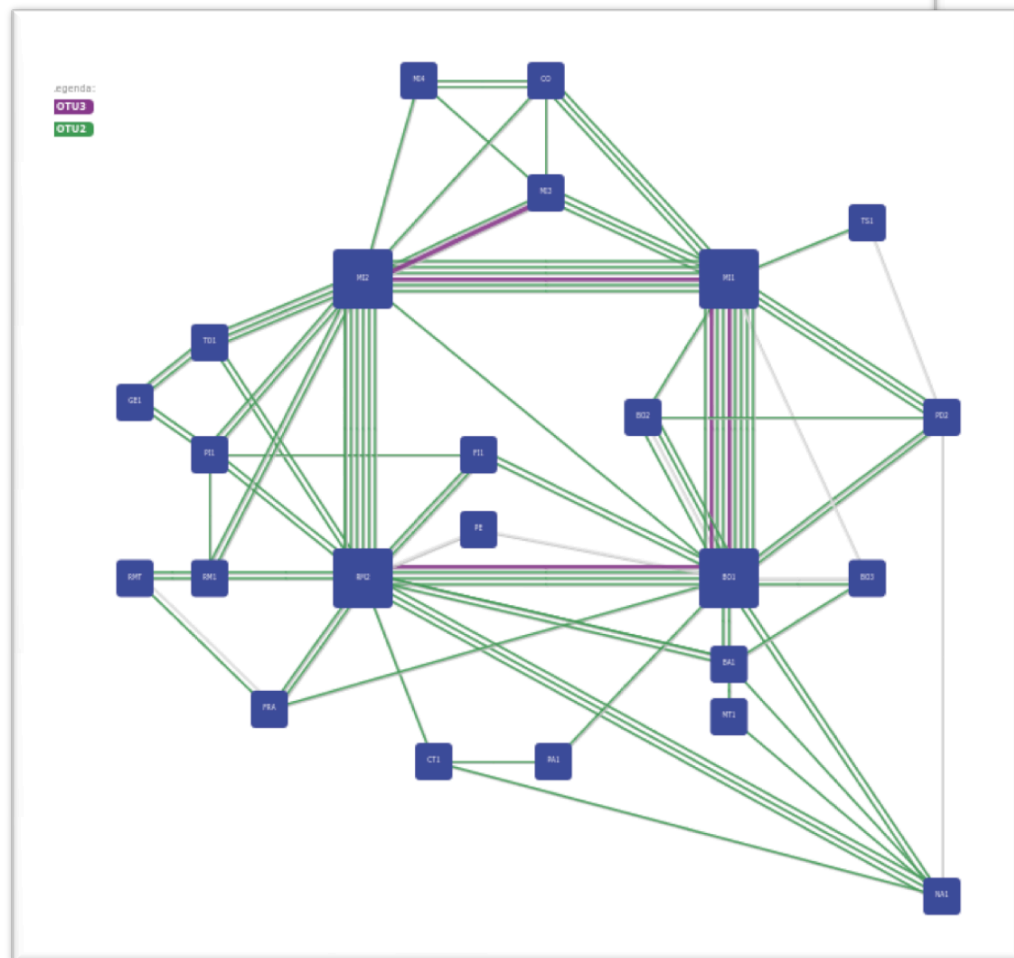
I dati raccolti dall'OSS vengono esportati mediante molteplici interfacce, che permettono l'analisi e la correlazione delle informazioni della rete ottica con i dati relativi agli altri livelli di rete.



Rete Trasmissiva

Fibra

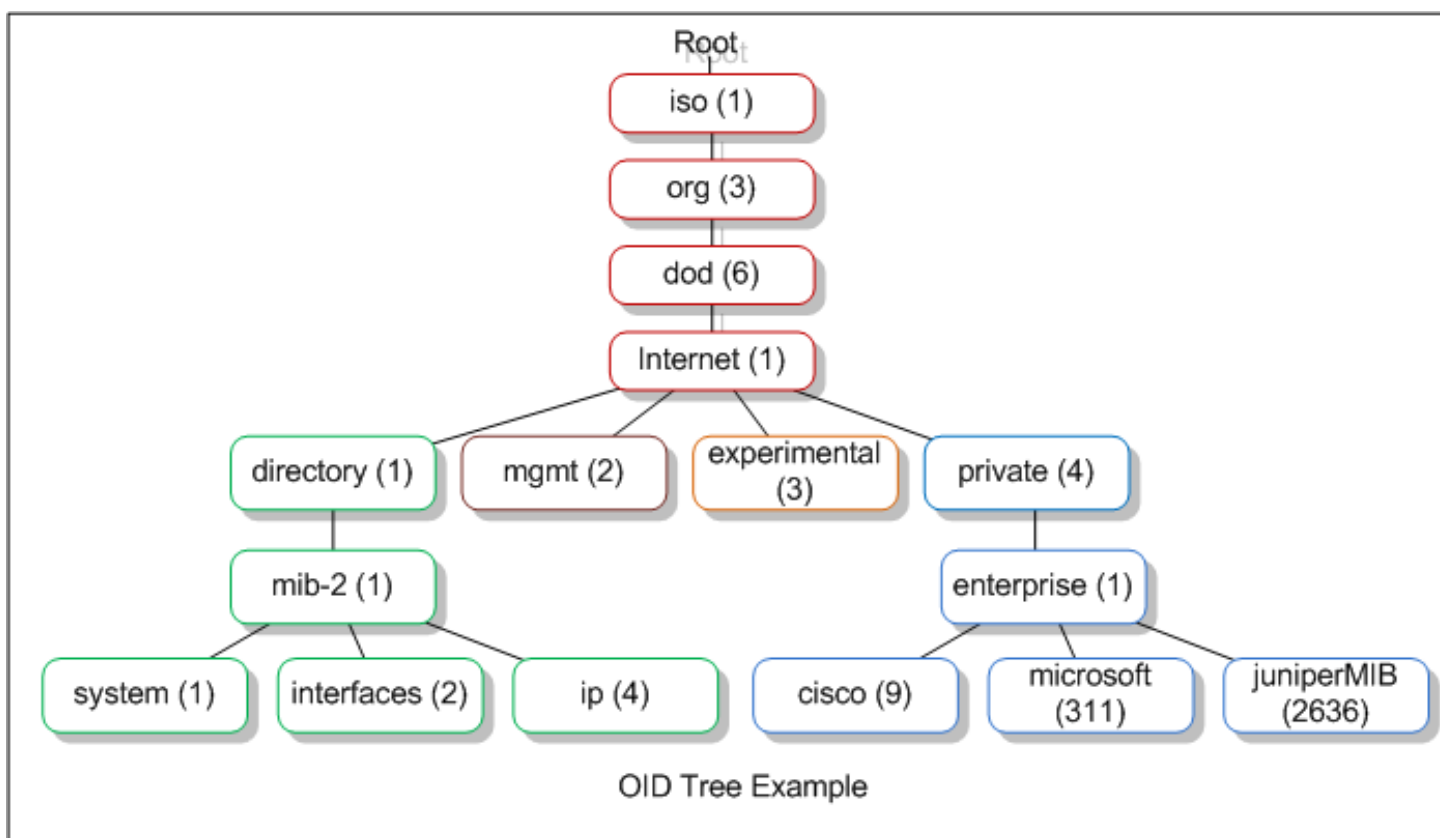
Lambda



Agenda

- MIBs
- SNMP Trap
- SNMP Trap con snmptrapd
- SNMP Trap con nodejs
- SNMP Poll esempi
- RRD

MIB OID



MIB translate

OID: 1.3.6.1.4.1.9.9.187.1.2.4.1.1 ?

```
$ snmptranslate -m ALL -Pu -Ts 1.3.6.1.4.1.9.9.187.1.2.4.1.1
```

```
SNMPv2-SMI::enterprises.9.9.187.1.2.4.1.1
```

mancono i MIB file

MIB download

1.3.6.1.4.1.9.9.187.1.2.4.1.1 ?

tools.cisco.com/Support/SNMP/do/BrowseOID.do?objectInput=1.3.6.1.4.1.9.9.187.1.2.4.1.1

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Tools & Resources

SNMP Object Navigator

TRANSLATE/BROWSE SEARCH DOWNLOAD MIBS MIB SUPPORT - SW

Translate Browse The Object Tree

Translate OID into object name or object name into OID to receive object details

Enter OID or object name: examples - OID: 1.3.6.1.4.1.9.9.27 Object Name: ifIndex

Translate

Object Information

Specific Object Information	
Object	cbgpPeerAcceptedPrefixes
OID	1.3.6.1.4.1.9.9.187.1.2.4.1.1
Type	Counter32
Permission	read-only
Status	current
MIB	CISCO-BGP4-MIB - View Supporting Images
Description	"Number of accepted route prefixes on this connection, which belong to an address family."

OID Tree

You are currently viewing your object with 2 levels of hierarchy above your object.

[iso\(1\)](#) [org\(3\)](#) [dod\(6\)](#) [internet\(1\)](#) [private\(4\)](#) [enterprises\(1\)](#) [cisco\(9\)](#) [ciscoMgmt\(9\)](#) [ciscoBgp4MIB\(187\)](#) [ciscoBgp4MIBObjects\(1\)](#) [cbgpPeer\(2\)](#)

```
-- *****
-- CISCO-BGP4-MIB.my
--
-- June 2001, Ravindra Rathi
--
-- Copyright (c) 2001, 2010 by Cisco Systems, Inc.
-- All rights reserved.
--
-- *****

CISCO-BGP4-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY,
    OBJECT-TYPE,
    NOTIFICATION-TYPE,
    Integer32,
    Unsigned32,
    Gauge32,
    Counter32,
    IpAddress
        FROM SNMPv2-SMI
    MODULE-COMPLIANCE,
    OBJECT-GROUP,
    NOTIFICATION-GROUP
        FROM SNMPv2-CONF
    TruthValue,
    TEXTUAL-CONVENTION
        FROM SNMPv2-TC
    InetAddressType,
    InetAddress,
    InetPortNumber,
    InetAutonomousSystemNumber
        FROM INET-ADDRESS-MIB
    SnmpAdminString
        FROM SNMP-FRAMEWORK-MIB
    bgpPeerEntry,
    bgpPeerRemoteAddr,
    bgpPeerLastError,
    bgpPeerState
        FROM BGP4-MIB
    ciscoMgmt
        FROM CISCO-SMI;

ciscoBgp4MIB MODULE-IDENTITY
    LAST-UPDATED "201009300000Z"
    ORGANIZATION "Cisco Systems, Inc."
    CONTACT-INFO
        "Cisco Systems
        Customer Service

        Postal: 170 W Tasman Drive
        San Jose, CA 95134
        USA

        Tel: +1 800 553-NETS

        E-mail: cs-iprouting-bgp@cisco.com"
```

Save in ~/.snmp/mibs
o nel giusto path

MIB translate



1.3.6.1.4.1.9.9.187.1.2.4.1.1 ?

```
$ snmptranslate -m ALL -Pu -Ts 1.3.6.1.4.1.9.9.187.1.2.4.1.1
```

```
CISCO-BGP4-MIB::cbgpPeerAcceptedPrefixes
```

MIB browser

MIB Browser

The screenshot shows the iReasoning MIB Browser interface. The top menu bar includes File, Edit, Operations, Tools, Bookmarks, and Help. The address bar shows the OID .1.3.6.1.2.1.15.3.1.2. The left pane displays the MIB Tree with the following structure:

- iso.org.dod.internet.mgmt.mib-2.bgp
 - bgpVersion
 - bgpLocalAs
 - bgpPeerTable
 - bgpPeerEntry
 - bgpPeerIdentifier
 - bgpPeerState
 - bgpPeerAdminStatus
 - bgpPeerNegotiatedVersion

The right pane shows the Result Table with the following columns: Name/OID, Value, Type, and IP:Port. The table contains multiple rows of BGP peer state information, all with a value of 'established (6)' and a type of 'Integer'.

Below the MIB Tree, the details for the selected object (bgpPeerState) are shown:

Name	bgpPeerState
OID	.1.3.6.1.2.1.15.3.1.2
MIB	BGP4-MIB
Syntax	INTEGER {idle(1),connect(2),active(3),opensent(4),openconfirm(5),established(6)}
Access	read-only
Status	current
DefVal	
Indexes	bgpPeerRemoteAddr
Descr	The BGP peer connection state.

Ascoltare la rete: SNMP Trap

Struttura della trap:

```
<host> UDP: [<IP src>]:<port>->[<IP dst>]:162 <OID> <value> <OID> <value> ...
```

Trap tradotta:

```
{src: '<ip>',  
  date: Wed May 20 2015 19:19:11 GMT+0200 (CEST),  
  type: 'SNMPv2_Trap(7)',  
  oid: '1.3.6.1.4.1.9.9.91.2.0.1',  
  name: 'CISCO-ENTITY-SENSOR-MIB::entSensorThresholdNotification',  
  vb:  
    [ 'DISMAN-EVENT-MIB::sysUpTimeInstance': '615516684',  
      'SNMPv2-MIB::snmpTrapOID.0': '1.3.6.1.4.1.9.9.91.2.0.1',  
      'CISCO-ENTITY-SENSOR-MIB::entSensorThresholdValue.1058.2': '-70',  
      'CISCO-ENTITY-SENSOR-MIB::entSensorValue.1058': '-63' ] }
```

Tipo di evento

informazioni

```
{ src: '<ip>',  
  date: Wed May 20 2015 19:25:32 GMT+0200 (CEST),  
  type: 'Trap(4)',  
  oid: '1.3.6.1.4.1.318',  
  name: 'SNMPv2-SMI::enterprises.318',  
  vb: [ 'SNMPv2-SMI::enterprises.318.2.3.3.0': 'UPS: Batteries need immediate replacement.' ] }
```

Ascoltare la rete: SNMP Trap

Struttura della trap:

```
<host> UDP: [<IP src>]:<port>->[<IP dst>]:162 <OID> <value> <OID> <value> ...
```

Trap tradotta:

```
{ src: '<ip>',  
  date: Wed May 20 2015 19:29:13 GMT+0200 (CEST),  
  type: 'SNMPv2_Trap(7)',  
  oid: '1.3.6.1.6.3.1.1.5.3',  
  name: 'IF-MIB::linkDown',  
  vb:  
  [ 'DISMAN-EVENT-MIB::sysUpTimeInstance': '112224290',  
    'SNMPv2-MIB::snmpTrapOID.0': '1.3.6.1.6.3.1.1.5.3',  
    'IF-MIB::ifIndex.2': '2',  
    'IF-MIB::ifDescr.2': 'GigabitEthernet0/0',  
    'IF-MIB::ifType.2': '6',  
    'CISCO-SMI::local.2.1.1.20.2': 'Link down' ] }
```


Ascoltare la rete: SNMP Trap

Struttura della trap:

```
<host> UDP: [<IP src>]:<port>->[<IP dst>]:162 <OID> <value> <OID> <value> ...
```

Trap tradotta:

```
{ src: '<ip>',  
  date: Wed May 20 2015 19:29:13 GMT+0200 (CEST),  
  type: 'SNMPv2_Trap(7)',  
  oid: '1.3.6.1.6.3.1.1.5.3',  
  name: 'IF-MIB::linkDown',  
  vb:  
  [ 'DISMAN-EVENT-MIB::sysUpTimeInstance': '112224290',  
    'SNMPv2-MIB::snmpTrapOID.0': '1.3.6.1.6.3.1.1.5.3',  
    'IF-MIB::ifIndex.2': '2',  
    'IF-MIB::ifDescr.2': 'GigabitEthernet0/0',  
    'IF-MIB::ifType.2': '6',  
    'CISCO-SMI::local.2.1.1.20.2': 'Link down' ] }
```

Ascoltare la rete: SNMP Trap

Trap tradotta:

```
Trap from host: <ip> -  
Event: CISCO-ENTITY-SENSOR-MIB::entSensorThresholdNotification -  
Date: Fri Jun 12 2015 10:26:43 GMT+0200 (CEST)  
DISMAN-EVENT-MIB::sysUpTimeInstance: 844717312  
SNMPv2-MIB::snmpTrapOID.0: 1.3.6.1.4.1.9.9.91.2.0.1  
CISCO-ENTITY-SENSOR-MIB::entSensorThresholdValue.1135.4: -30  
CISCO-ENTITY-SENSOR-MIB::entSensorValue.1135: -56
```

Chi e' l'entita' 1135?

```
$ snmpwalk -c public -v2c <ip> .1.3.6.1.2.1.47.1.1.1.1.7.1135  
SNMPv2-SMI::mib-2.47.1.1.1.1.7.1135 = STRING: "Gi0/3 Transmit Power Sensor"
```

(I valori -30 e -56 sono in realta' -3.0 e -5.6)

SNMP TRAP ascoltare con snmptrapd

1- /etc/snmp/snmptrapd.conf

```
disableAuthorization yes  
traphandle default /home/cesaroni/test/my_trap_handler.sh
```

2- /home/cesaroni/test/my_trap_handler.sh

```
#!/bin/bash  
A=`cat /dev/stdin`  
echo $A >> /home/cesaroni/test/trap_log.txt
```

3- lancio snmptrapd

```
$ sudo snmptrapd -d
```

```
$ tail -f trap_log.txt  
<host> UDP: [<IP src>]:<port>->[<my IP>]:162 OID value OID value OID value  
....
```

SNMP TRAP ascoltare con nodejs



Node.js is a platform built on Chrome's JavaScript runtime for easily building fast, scalable network applications. Node.js uses an event-driven, non-blocking I/O model that makes it lightweight and efficient, perfect for data-intensive real-time applications that run across distributed devices.

SNMP TRAP + nodejs

Invio Trap:

```
$ snmptrap -v 2c -c public localhost "" .1.3.6.1.4.1.5000.5000.1 .  
1.3.6.1.4.1.5000.5000.1.1 s "pippo" .1.3.6.1.4.1.5000.5000.1.2 s "pluto"
```

Ricevo Trap:

```
$ sudo nodejs test.js  
{ "name": "snmpjs", "hostname": "pcgarr9", "pid": 26416, "level": 30, "msg": "Bound to  
0.0.0.0:162", "time": "2015-03-11T15:52:40.742Z", "v": 0 }
```

Trap Received Wed Mar 11 2015 16:53:05 GMT+0100 (CET) n: 1

Trap Sender 127.0.0.1

varbind oid: 1.3.6.1.2.1.1.3.0 value: 60677003

varbind oid: 1.3.6.1.6.3.1.1.4.1.0 value: 1.3.6.1.4.1.5000.5000.1

varbind oid: 1.3.6.1.4.1.5000.5000.1.1 value: pippo

varbind oid: 1.3.6.1.4.1.5000.5000.1.2 value: pluto

Hands on: SNMP TRAP + nodejs

Esempio di Trap listener minimale in nodejs

```
var os = require('os');
var snmp = require('snmpjs');
var trapd = snmp.createTrapListener();
var count=0;

trapd.on('trap', function(msg){
  count = count+1;
  var src=msg.src.address;
  var now = new Date();
  console.log("Trap Received " + now + " n: " + count);
  console.log("Trap Sender "+src);
  var vars = snmp.message.serializer(msg)['pdu'].varbinds;
  for(var i in vars){
    console.log('varbind oid: ' + vars[i].oid + ' value: '+ vars[i].string_value);
  }
});
trapd.bind({family: 'udp4', port: 162});
```

Hands on: SNMP TRAP + nodejs



Ma arriveranno tutte? stressiamolo

```
$ for i in {1..10000}; do snmptrap -v 2c -c public localhost:162 "" .1.3.6.1.2.1.25.3.1.2.0&  
done
```

Trap Received Wed Mar 11 2015 17:12:10 GMT+0100 (CET) n: **10000**

Trap Sender 127.0.0.1

varbind oid: 1.3.6.1.2.1.1.3.0 value: 60791459

varbind oid: 1.3.6.1.6.3.1.1.4.1.0 value: 1.3.6.1.2.1.25.3.1.2.0

Hands on: SNMP TRAP + nodejs



In opera

GINS-TrapServer status:

Started at: Tue Jun 16 2015 17:18:47 GMT+0200 (CEST)

Ora sono le 11:58 del Jun 17 2015

Trap counters:

CISCO-ENTITY-SENSOR-MIB::entSensorThresholdNotification: **82502**

IF-MIB::linkDown: **170714**

In circa 20 ore sono state ricevute

82502 trap di sensori fuori soglia

170714 trap di link down

I link down quasi interamente da un singolo Cisco 2900 con una porta malfunzionante

Hands on: SNMP TRAP + nodejs



Quindi?

Cosa fare con l'evento TRAP:

- Fare poco e veloce
- Meccanismi di blacklist pre processing
- Selezione eventi specifici
- Poco storico (no DB)
- No mail

Hands on: SNMP poll esempi



snmpget -v2c -c <community> <router> <Object Identifier OID>

snmpwalk -v2c -c <community> <router> <Object Identifier OID subtree>

Poll response: <OID> = <data type>: <value>

Esempi:

snmpget -v2c -c <community> <router> IP-MIB::ipAdEntIfIndex.192.168.0.1

IP-MIB::ipAdEntIfIndex.192.168.0.1 = INTEGER: 82

snmpget -v2c -c <community> <router> IF-MIB::ifName.82

IF-MIB::ifName.82 = STRING: ge-1/2/0.4

snmpget -v2c -c <community> <router> IF-MIB::ifHighSpeed.82

IF-MIB::ifHighSpeed.82 = Gauge32: 1000

snmpget -v2c -c <community> <router> IF-MIB::ifHCInOctets.82

IF-MIB::ifHCInOctets.82 = Counter64: 262925908632166

Hands on: SNMP poll esempi

Stato di un Peer BGP: 1.3.6.1.2.1.15.3.1.2 (RFC 1269)

```
snmpwalk -v2c -c <comunity> <router> 1.3.6.1.2.1.15.3.1.2 |  
    awk -F '15.3.1.2.' '{print $2}' |  
    awk -F ' = INTEGER: ' '{print $1,$2}'
```

Restituisce la lista di :
<IP address del Peer> <Stato numerico Peer>

"1"=>"Idle"
"2"=>"Connect"
"3"=>"Active"
"4"=>"Opensent"
"5"=>"Openconfirm"
"6"=>"Established"

AS of the Peer BGP:

1.3.6.1.2.1.15.3.1.9 (RFC 1269)

```
snmpwalk -v2c -c <community> <router> 1.3.6.1.2.1.15.3.1.9 |  
    awk -F '15.3.1.9.' '{print $2}' |  
    awk -F ' = INTEGER: ' '{print $1,$2;}'
```

Restituisce la lista di :
<IP address del Peer> <AS del Peer>

Hands on: SNMP poll esempi



Prefissi BGP, MIB proprietarie

CISCO-BGP4-MIB

Accepted prefixes from Peer

1.3.6.1.4.1.9.9.187.1.2.4.1.1.<IP>.1.1 (.1.1 = IPv4 Unicast)

Advertised prefixes to Peer

1.3.6.1.4.1.9.9.187.1.2.4.1.6.<IP>.1.1

BGP4-V2-MIB-JUNIPER

Received prefixes from Peer

1.3.6.1.4.1.2636.5.1.1.2.6.2.1.7.<Peer Index>.1.1

Advertised prefixes to Peer

1.3.6.1.4.1.2636.5.1.1.2.6.2.1.10.<Peer Index>.1.1

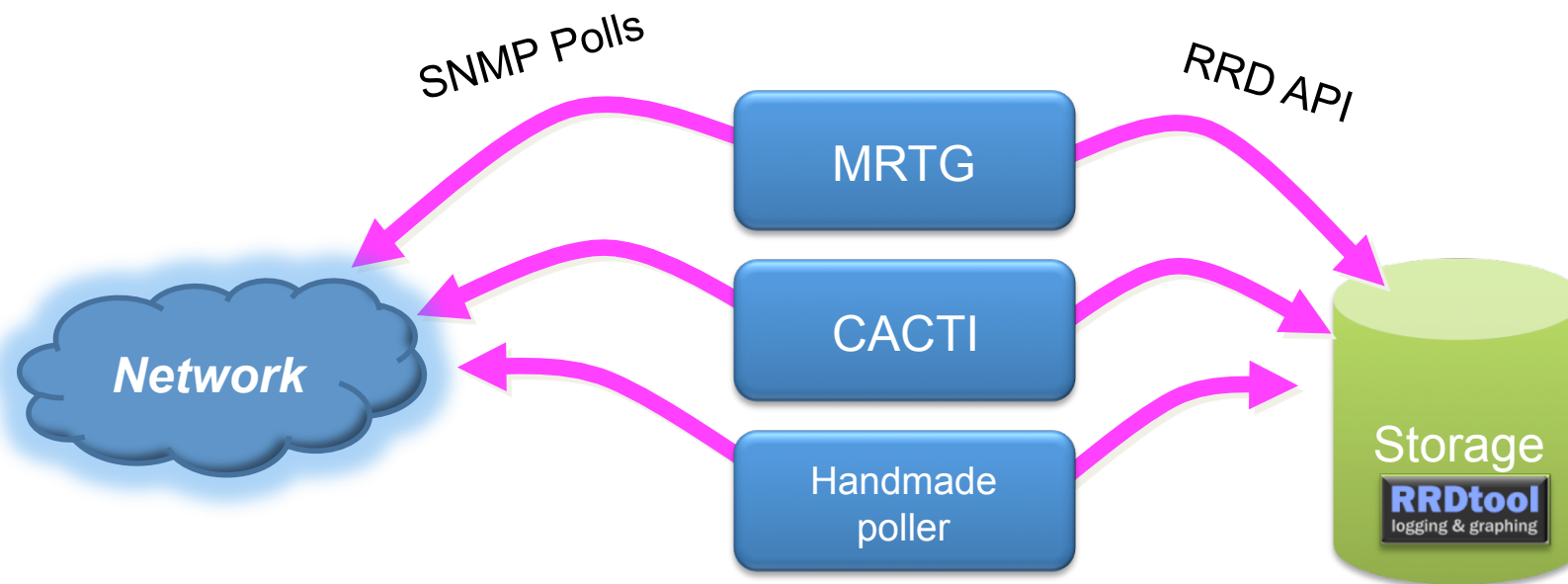
Accepted prefixes from Peer

1.3.6.1.4.1.2636.5.1.1.2.6.2.1.8.<Peer Index>.1.1

Peer Index from:

1.3.6.1.4.1.2636.5.1.1.2.1.1.1.14

Hands on: RRD

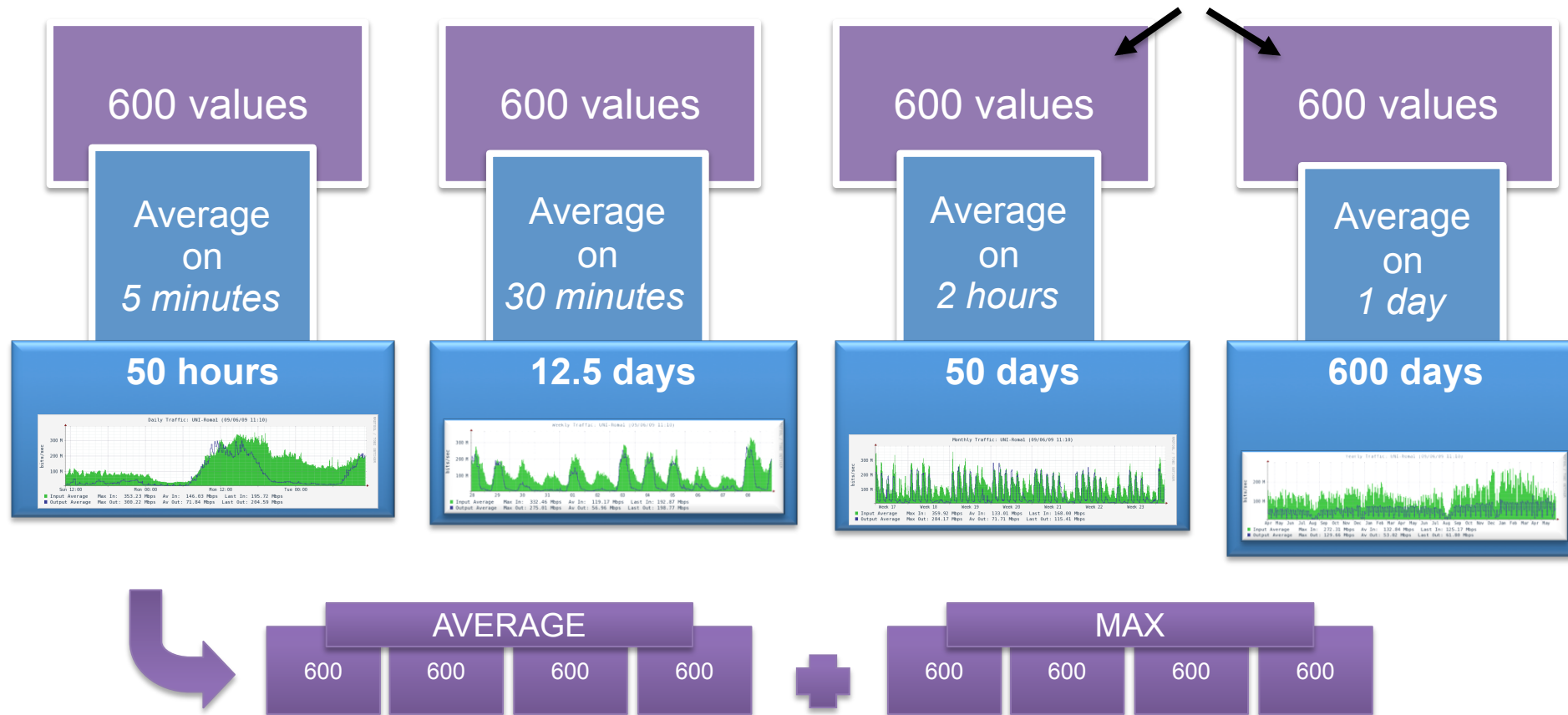


Hands on: RRD

Il file RRD:

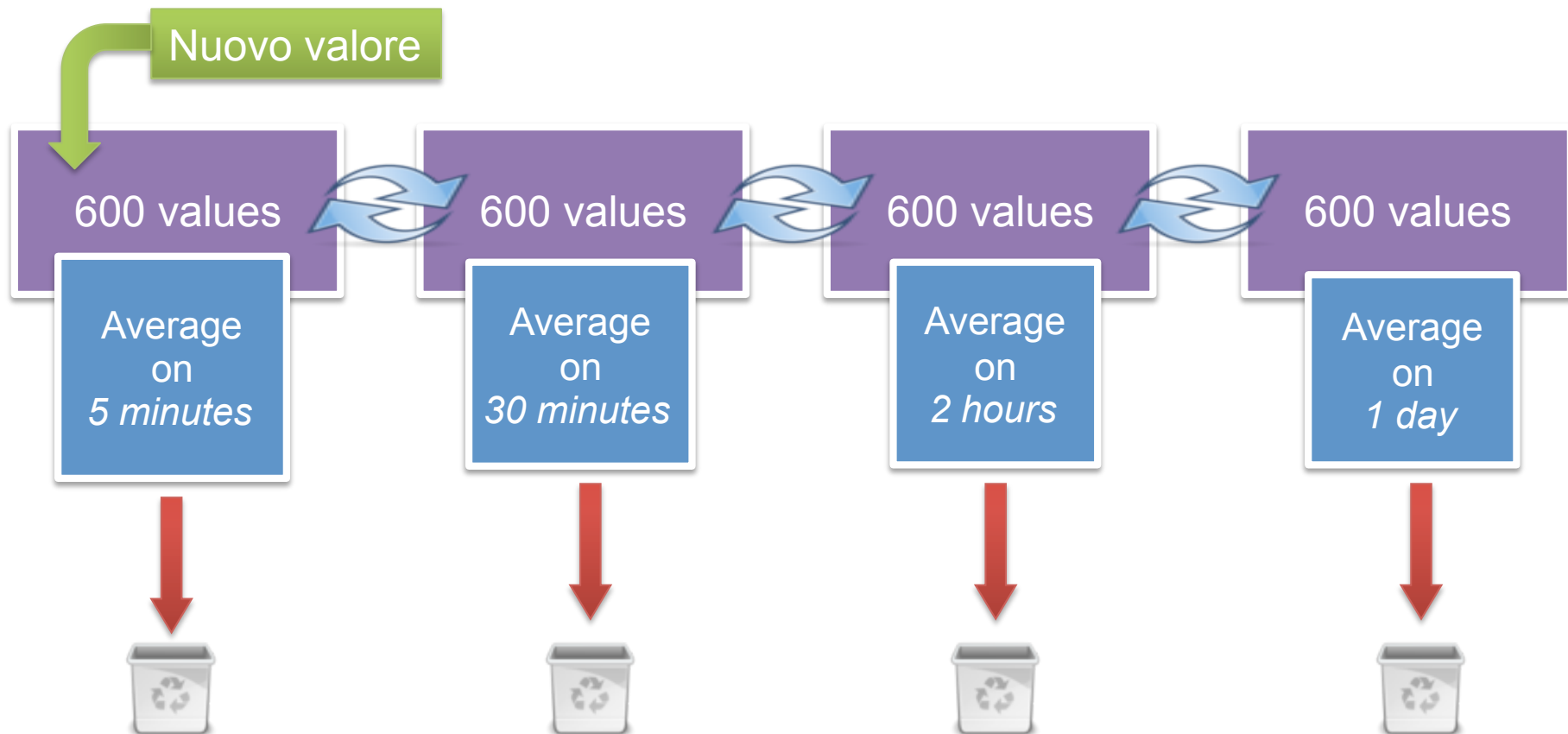
Possibile e tipica struttura temporale di un RRD file creato da MRTG:

Round Robin Archive: RRA



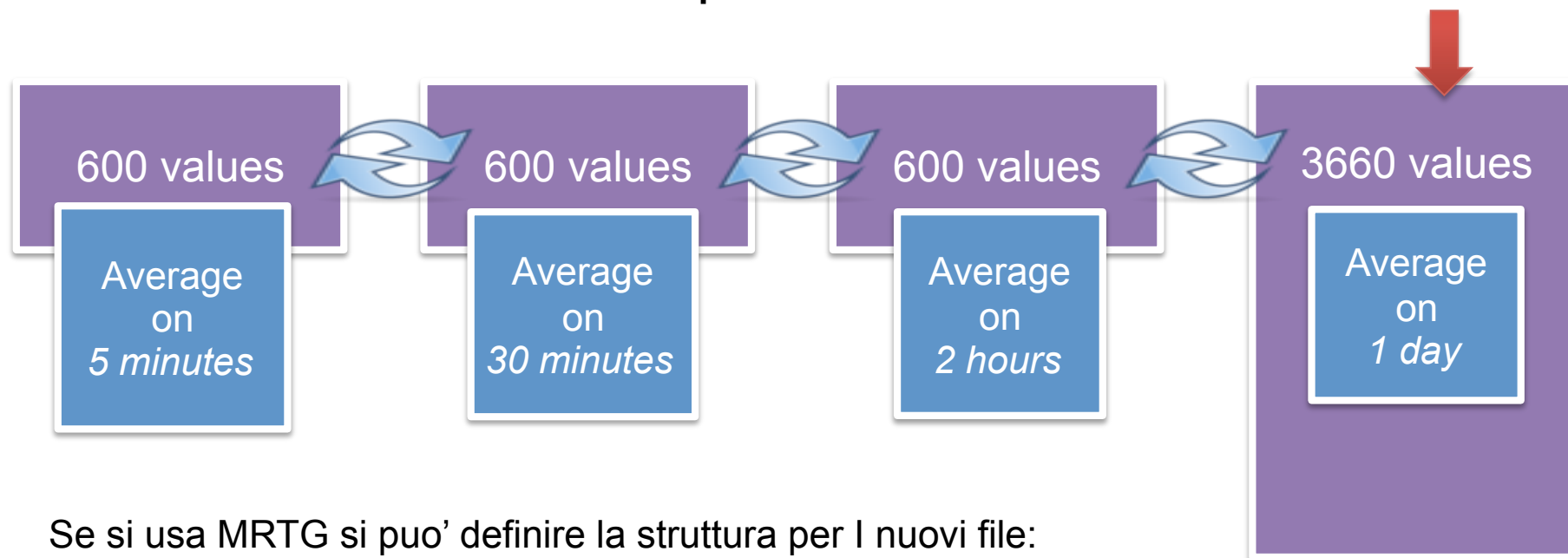
Hands on: RRD

aggiornamento RRD:



Hands on: RRD

Modificare la struttura temporale del RRA a **10** anni



Se si usa MRTG si puo' definire la struttura per I nuovi file:

```
Target[<target>]: /  
<IP>:<community>@<host>:::2  
RRDRowCount1d[<target>]: 3660  
MaxBytes[<target>]: 4000000  
Options[<target>]: bits,growright  
YLegend[<target>]: Bits Per Second  
ShortLegend[<target>]: b/s
```

Hands on: RRD

RRD API:

Info, create, update, fetch, tune, graph, dump, restore, etc.

```
rrdtool info <file.rrd>
```

```
rra[0].cf = "AVERAGE"  
rra[0].rows = 600  
rra[0].pdp_per_row = 1 → 5 m  
rra[1].cf = "AVERAGE"  
rra[1].rows = 600 → 30 m  
rra[1].pdp_per_row = 6  
rra[2].cf = "AVERAGE"  
rra[2].rows = 600 → 2 h  
rra[2].pdp_per_row = 24  
rra[3].cf = "AVERAGE"  
rra[3].rows = 600 → 1 d  
rra[3].pdp_per_row = 288
```

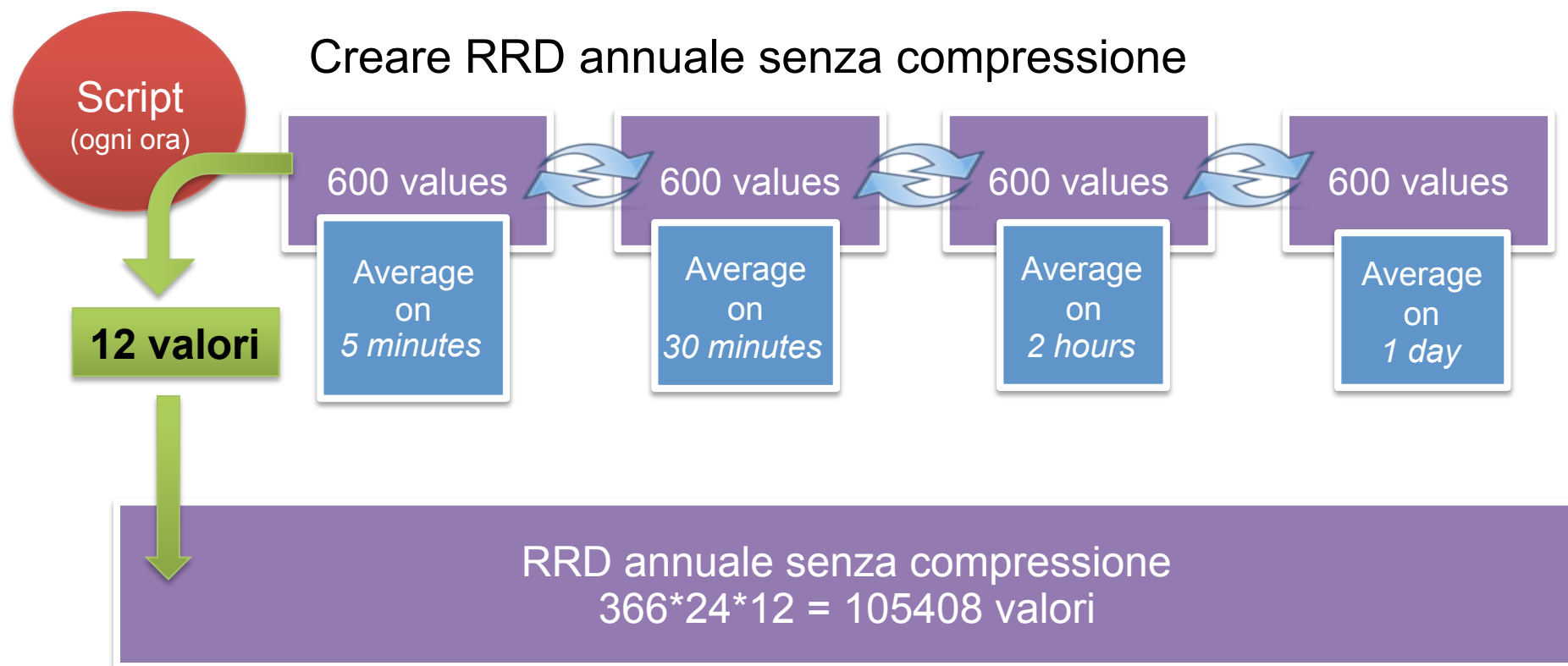
RRR number

```
rrdtool resize <file.rrd> 3 GROW 3060
```

```
rra[0].cf = "AVERAGE"  
rra[0].rows = 600  
rra[0].pdp_per_row = 1  
rra[1].cf = "AVERAGE"  
rra[1].rows = 600  
rra[1].pdp_per_row = 6  
rra[2].cf = "AVERAGE"  
rra[2].rows = 600  
rra[2].pdp_per_row = 24  
rra[3].cf = "AVERAGE"  
rra[3].rows = 3660  
rra[3].pdp_per_row = 288
```

Hands on: RRD

Come evitare di perdere i dati:



Creare RRD annuale senza compressione:

1- creazione RRD un anno :

```
rrdtool create <destinazione.rrd>  
> --start <qualche anno fa> --step 300  
> DS:in:GAUGE:600:U:U DS:out:GAUGE:600:U:U  
> RRA:LAST:0.5:1:105408
```

2- estrazione valori di 1 ora e inserimento:

```
rrdtool fetch <sorgente.rrd> --end now-600s --start now-4200s AVERAGE |  
awk -F ' ' 'BEGIN {x=0;}{x++; if (x>2){ print $1 $2":"$3 } }' |  
xargs rrdtool update <destinazione.rrd>
```

- <https://gins.garr.it>
- sw.dev@garr.it
- info@garr.it
- noc@garr.it
- giovanni.cesaroni@garr.it