Serviços de Rede 1 –

Lesson 9 - Practices

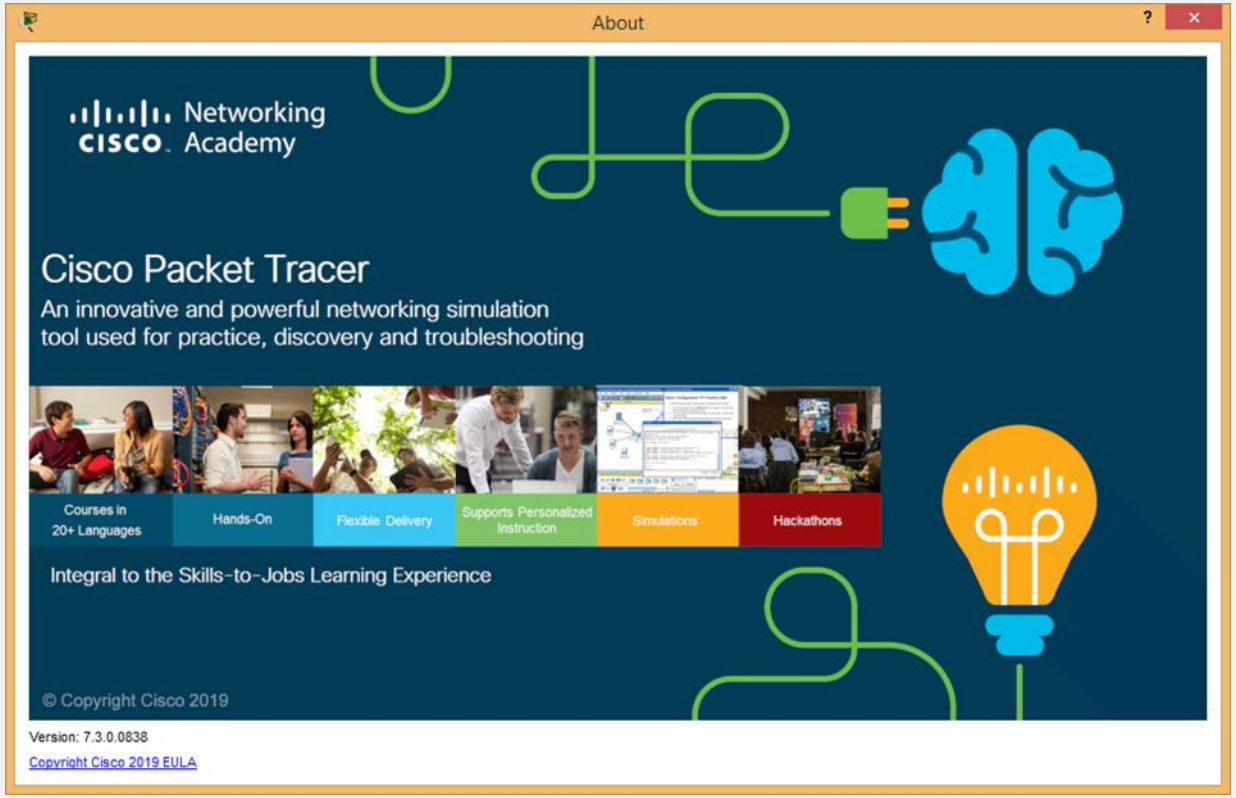
2019-2020

Instituto Politécnico de Coimbra

Departamento de Engenharia Informática

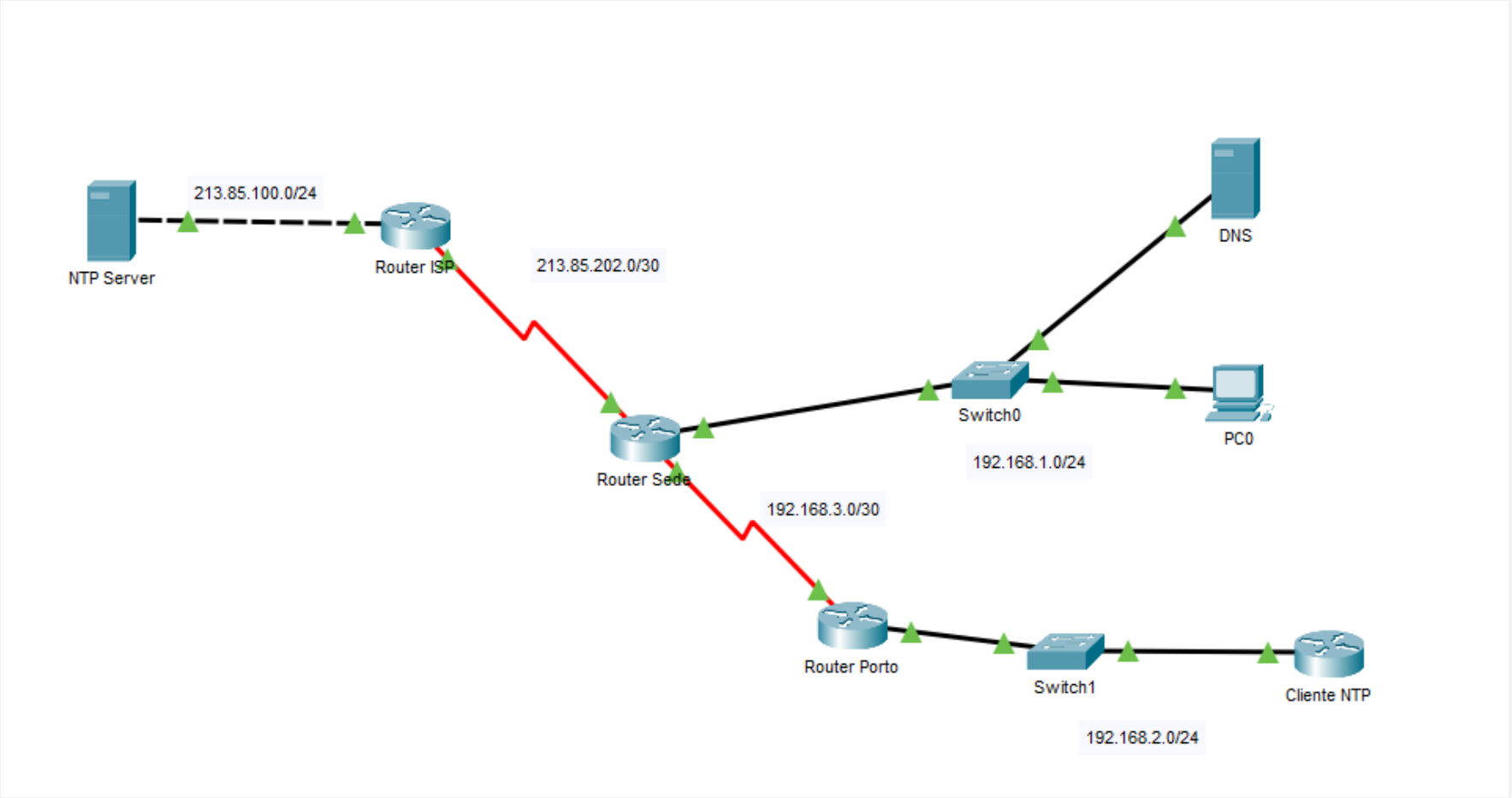
Pre-Requisites -Exercise 1

- You have installed the Cisco Packet Tracer version 7.3.0



Exercise 1 - NTP in Cisco environment

Exercise 1


213.85.100.0/24
NTP Server
Router ISP
213.85.202.0/30
DNS
Switch0
PC0
192.168.1.0/24
Router Sede
192.168.3.0/30
Router Porto
Switch1
Cliente NTP
192.168.2.0/24

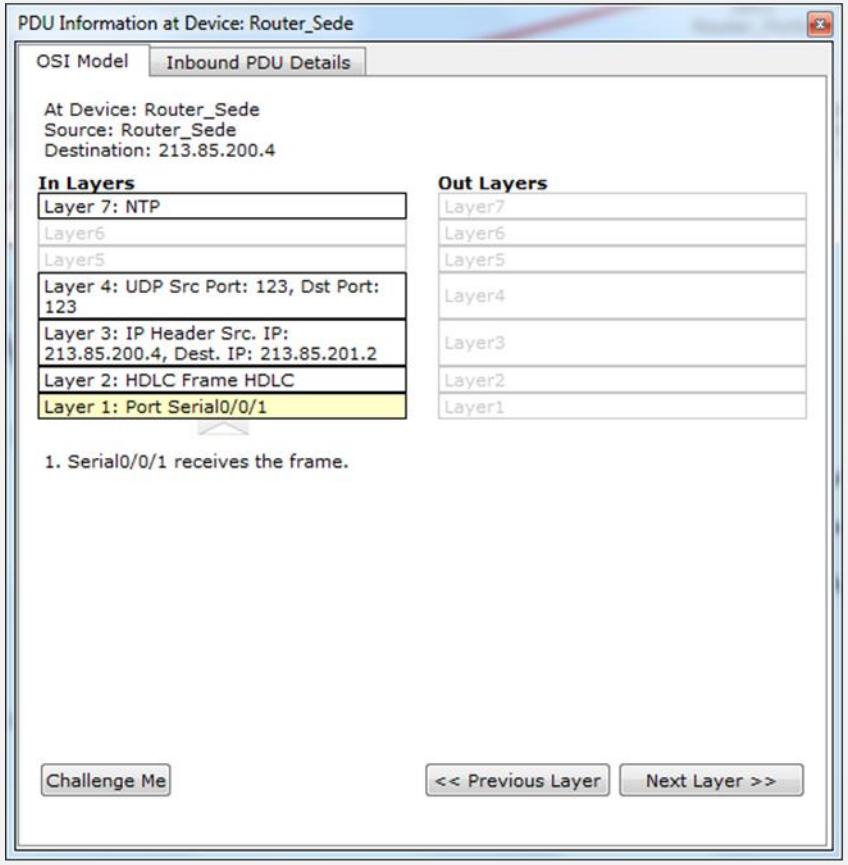
Exercise 1

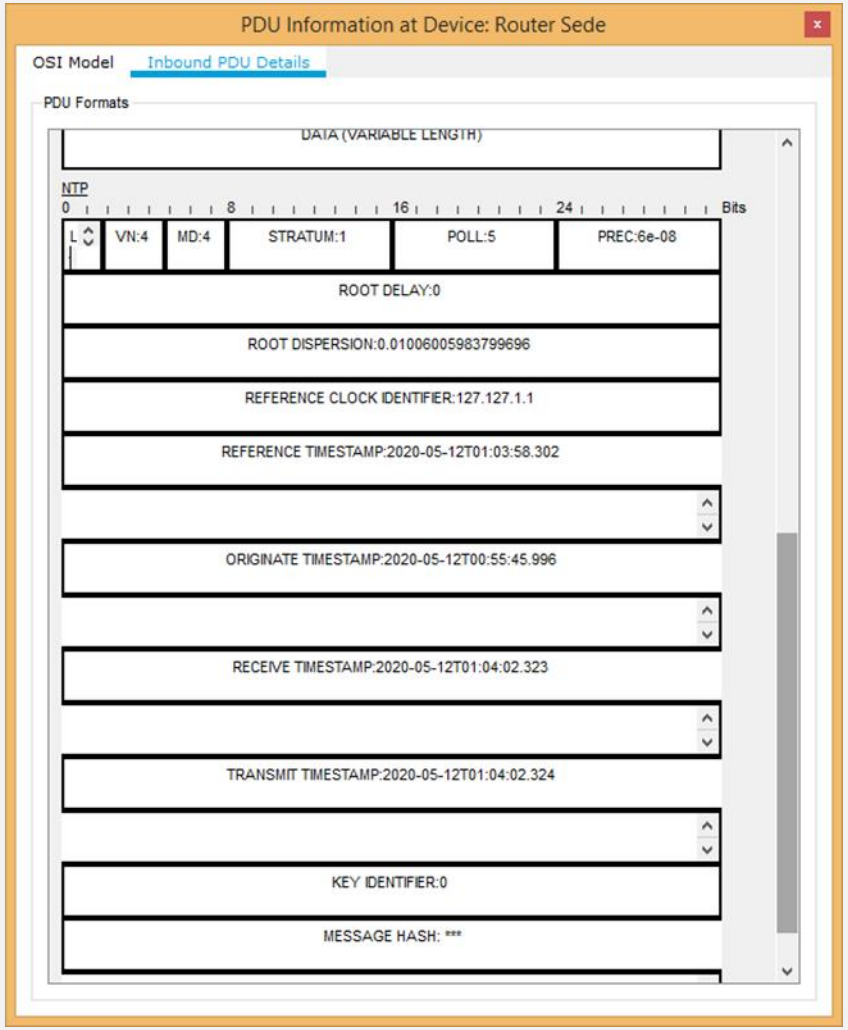
- Make the topology indicated in the previous image.
- Put IP of the different equipment in a fixed way but according to the networks indicated in the image.
- Ensure that all devices have connectivity to the NTP server (NTP_Server) that is on your ISP's network.

Exercise 1

- See the time and date on the headquarters router. It must be little right ;-)
- On the NTP Server, turn off all services except NTP. Configure the NTP service on this server.
- Configure your home router to synchronize with the NTP server.
- Force the calendar update.
- Make a simulation to do an analysis of the information packets that are exchanged between the router and the server.

Exercise 1


PDU Information at Device: Router_Sede
OSI Model
Inbound PDU Details
At Device: Router_Sede
Source: Router_Sede
Destination: 213.85.200.4
In Layers
Out Layers
Layer 7: NTP
Layer6
Layer5
Layer 4: UDP Src Port: 123, Dst Port: 123
Layer 3: IP Header Src. IP: 213.85.200.4, Dest. IP: 213.85.201.2
Layer 2: HDLC Frame HDLC
Layer 1: Port Serial0/0/1
Layer7
Layer6
Layer5
Layer4
Layer3
Layer2
Layer1
1. Serial0/0/1 receives the frame.
Challenge Me
<< Previous Layer
Next Layer >>

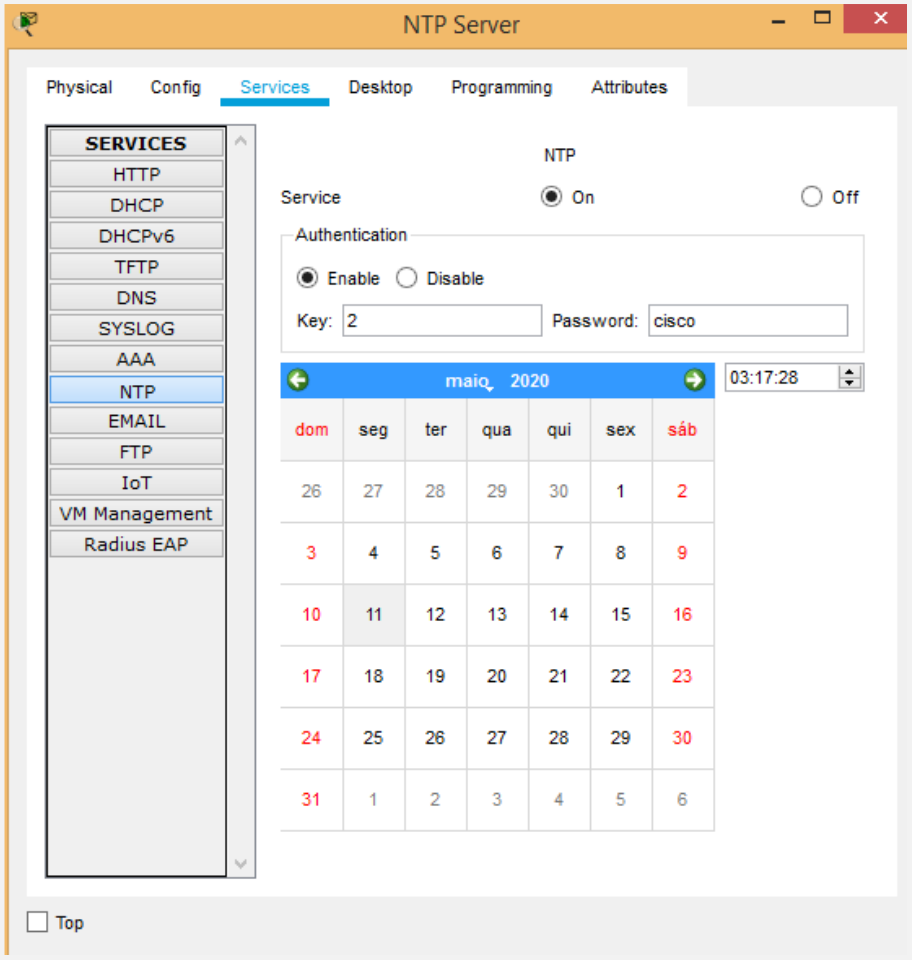

PDU Information at Device: Router Sede
OSI Model
Inbound PDU Details
PDU Formats
DATA (VARIABLE LENGTH)
NTP
0
8
16
24
Bits
L
VN:4
MD:4
STRATUM:1
POLL:5
PREC:6e-08
ROOT DELAY:0
ROOT DISPERSION:0.01006005983799696
REFERENCE CLOCK IDENTIFIER:127.127.1.1
REFERENCE TIMESTAMP:2020-05-12T01:03:58.302
ORIGINATE TIMESTAMP:2020-05-12T00:55:45.996
RECEIVE TIMESTAMP:2020-05-12T01:04:02.323
TRANSMIT TIMESTAMP:2020-05-12T01:04:02.324
KEY IDENTIFIER:0
MESSAGE HASH: ***

Exercise 1

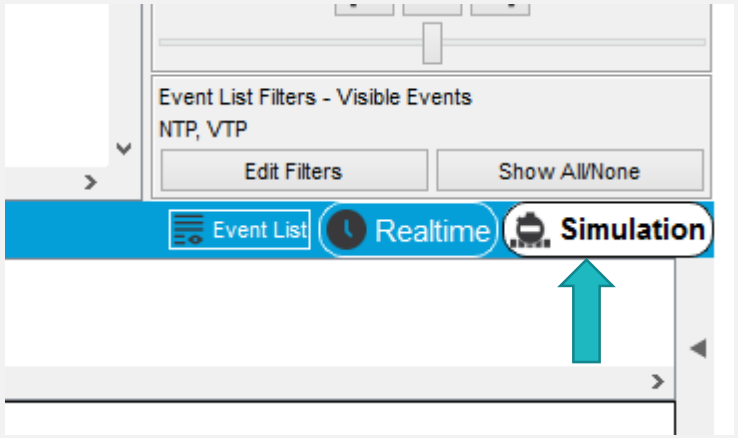
- Switch to real time mode and see the time on the router. Already right?
- Configure the other routers to update on the NTP server.
- Configure the headquarters router as the Stratum of the layer immediately after the Server.
- Configure the other routers to update themselves at the headquarters router.

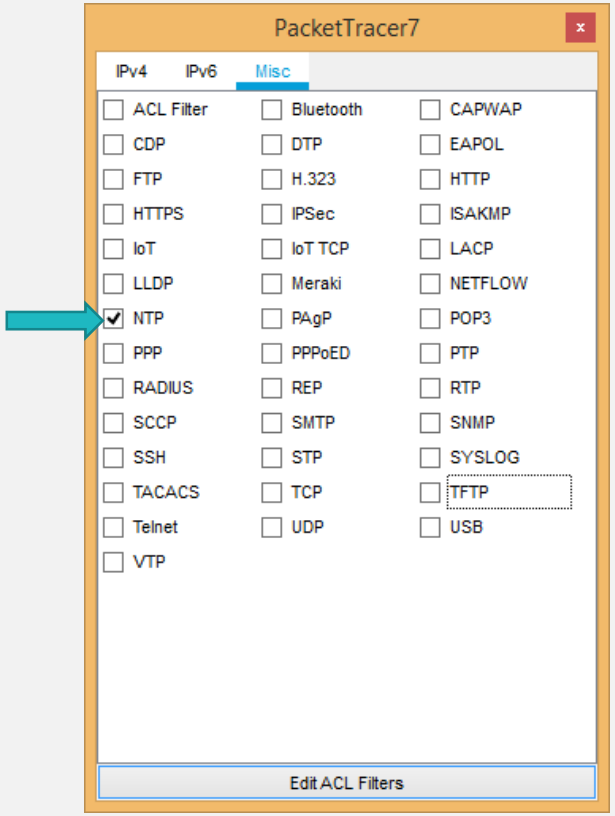
How To

Configure the NTP service



Simulation


Event List Filters - Visible Events
NTP, VTP
Edit Filters
Show All/None
Event List
Realtime
Simulation


PacketTracer7
IPv4
IPv6
Misc
ACL Filter
Bluetooth
CAPWAP
CDP
DTP
EAPOL
FTP
H.323
HTTP
HTTPS
IPSec
ISAKMP
IoT
IoT TCP
LACP
LLDP
Meraki
NETFLOW
NTP
PAgP
POP3
PPP
PPPoED
PTP
RADIUS
REP
RTP
SCCP
SMTP
SNMP
SSH
STP
SYSLOG
TACACS
TCP
TFTP
Telnet
UDP
USB
VTP
Edit ACL Filters

Cisco Configuration

- To see a router's time, run the “show clock” command:

```
R_Sede#sh clock
*0:30:59.27 UTC Mon Mar 1 1993
R_Sede#
```

- NTP is active on all default interfaces

[no] ntp enable **Example:** `switch(config)# ntp enable`	Enables or disables the NTP protocol on the entire device. NTP is enabled by default.

- NTP server definition

ntp server {*ip-address* | *ipv6-address* | *dns-name*} [**prefer**] [**use-vrf** *vrf-name*] **Example:** `switch(config)# ntp server 192.0.2.10`	Forms an association with a server. Optionally configures the NTP server to communicate over the specified VRF. The *vrf-name* can be any case-sensitive alphanumeric string up to 64 characters. Optionally use the **pefer** keyword to make this the preferred NTP server for the device.

Cisco Configuration

- We can enforce restrictions using access-lists

Command	Purpose
`ntp access-group {query-only | serve-only | serve | peer} access-list-number`	Creates an access group and applies a basic IP access list to it.

- Impose that the system is an authoritative server (master)

`[no] ntp master [stratum]`
 	
Example:
`switch(config)# ntp master`
	Configures the device as an authoritative NTP server.
	
	You can specify a different stratum level from which NTP clients get their time synchronized. The range is from 1 to 15.

- Calendar update

Command	Purpose
`ntp update-calendar`	Configures NTP to update the calendar.

Cisco Configuration

- Define associations

ntp peer {*ip-address* | *ipv6-address* | *dns-name*} [**prefer**] [**use-vrf** *vrf-name*] switch(config)# ntp peer 2001:0db8::4101	Forms an association with a peer. You can specify multiple peer associations. Optionally configures the NTP peer to communicate over the specified VRF. Optionally use the **pefer** keyword to make this the preferred NTP peer for the device. The *vrf-name* can be any case-sensitive alphanumeric string up to 64 characters.

- Broadcast Ads

Command	Purpose
ntp broadcast [version number]	Sends NTP broadcast packets.
ntp broadcast client	Receives NTP broadcast packets.
ntp broadcastdelay *microseconds*	Adjusts estimated delay.

Cisco Configuration

- Monitoring

Command	Purpose
`show calendar`	Displays the current system calendar time.
`show clock [detail]`	Displays the current system clock time.
`show ntp associations [detail]`	Shows the status of NTP associations.
`show ntp status`	Shows the status of NTP.
`show sntp`	Displays information about SNTP (Cisco 1003, Cisco 1004, Cisco 1005, Cisco 1600, Cisco 1720, or Cisco 1750 only).

Exercise 2 - NTP in Windows environment

Exercise

- Download and install The Meinberg NTP on the Windows 2012 server.
- At installation you must:
  - Choose the default NTP servers for Portugal.
  - Create a user to manage this service.
- Make sure your program is installed and the W32 time service is disabled.
- View the properties of the NTP service you just installed.

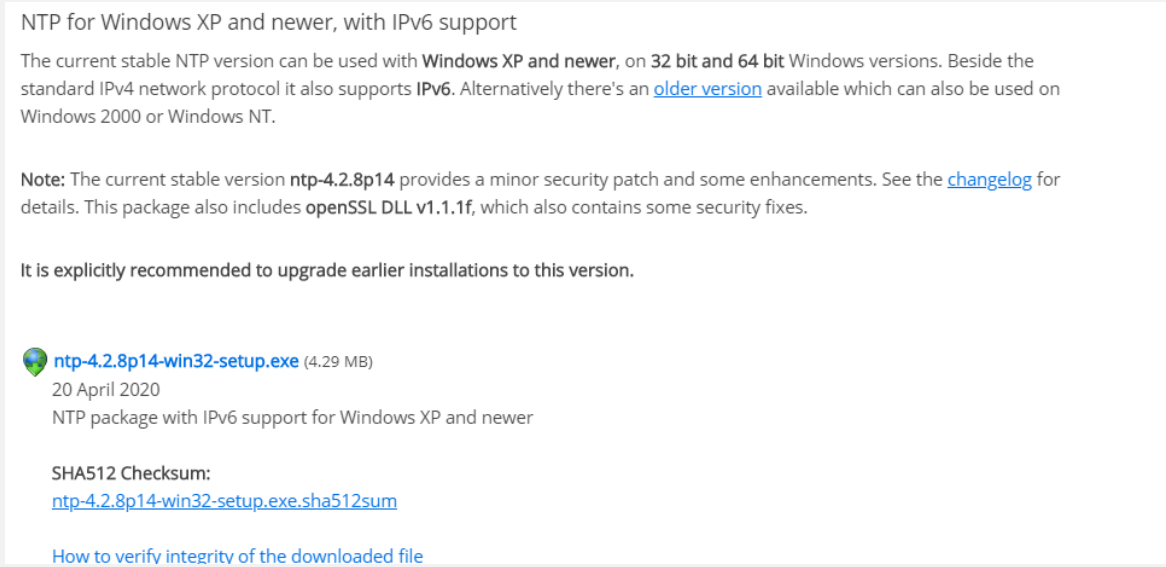
Exercise

- Identify who your NTP server's system peer is and which other servers participate in the time calculation. Identify the stratum of these servers. Analyze the other parameters.
- Identify which version of NTP is running and which stratum is on your server and the current time it has.

How To

The Meinberg NTP

- Windows has, by default, a simplified implementation of NTP (w32time) that has many limitations. It is therefore recommended to use a specialized program to manage this network service.
- The “The Meinberg NTP” that is used on most NTP servers was developed by David Mills, the creator of the first RFC of this protocol.
- You can download it at https://www.meinbergglobal.com/english/sw/ntp.htm


NTP for Windows XP and newer, with IPv6 support

The current stable NTP version can be used with **Windows XP and newer**, on **32 bit and 64 bit** Windows versions. Beside the standard IPv4 network protocol it also supports **IPv6**. Alternatively there's an older version available which can also be used on Windows 2000 or Windows NT.

Note: The current stable version **ntp-4.2.8p14** provides a minor security patch and some enhancements. See the changelog for details. This package also includes **openSSL DLL v1.1.1f**, which also contains some security fixes.

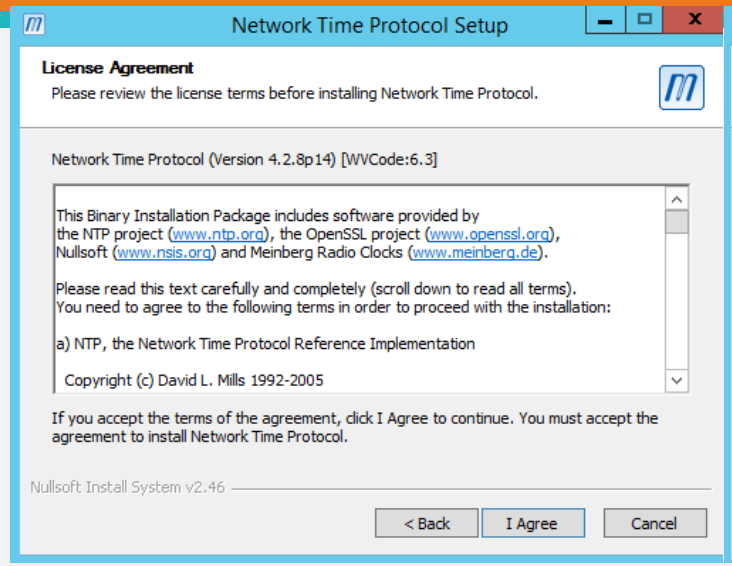
It is explicitly recommended to upgrade earlier installations to this version.

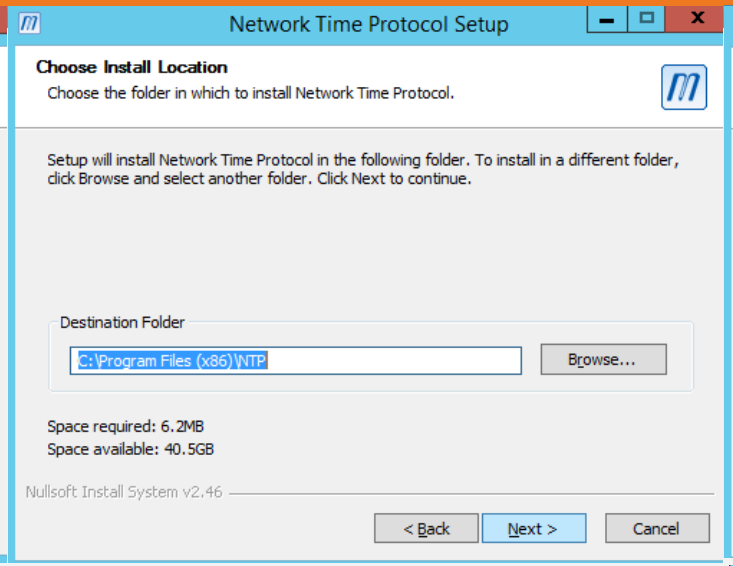
ntp-4.2.8p14-win32-setup.exe (4.29 MB)
20 April 2020
NTP package with IPv6 support for Windows XP and newer

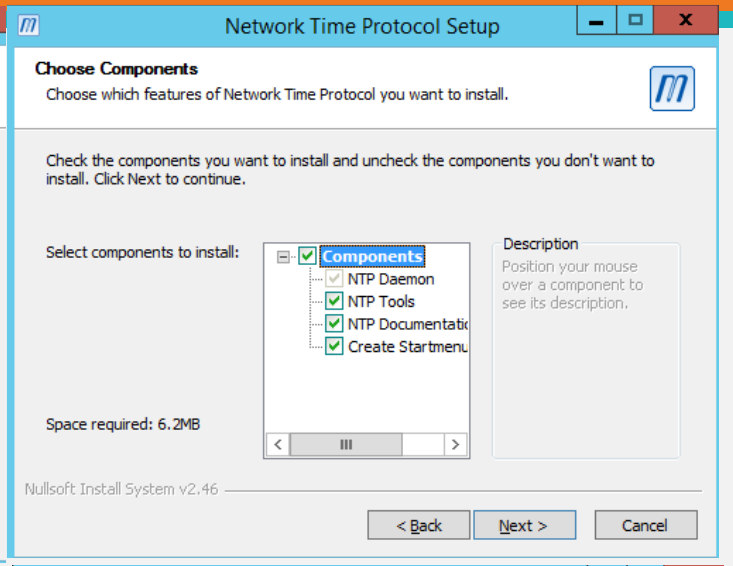
SHA512 Checksum:
ntp-4.2.8p14-win32-setup.exe.sha512sum

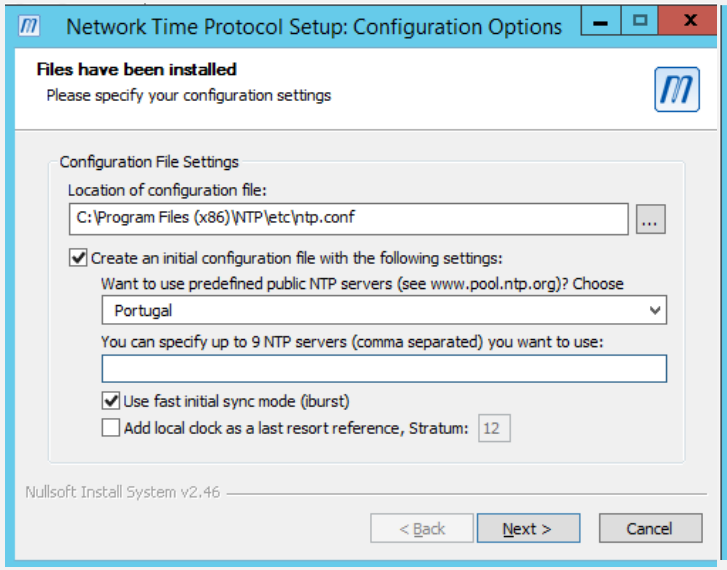
How to verify integrity of the downloaded file

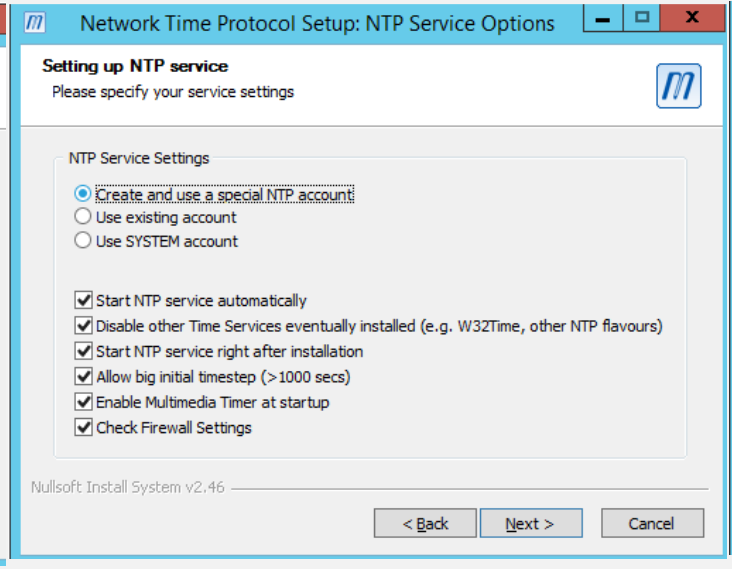
The Meinberg NTP

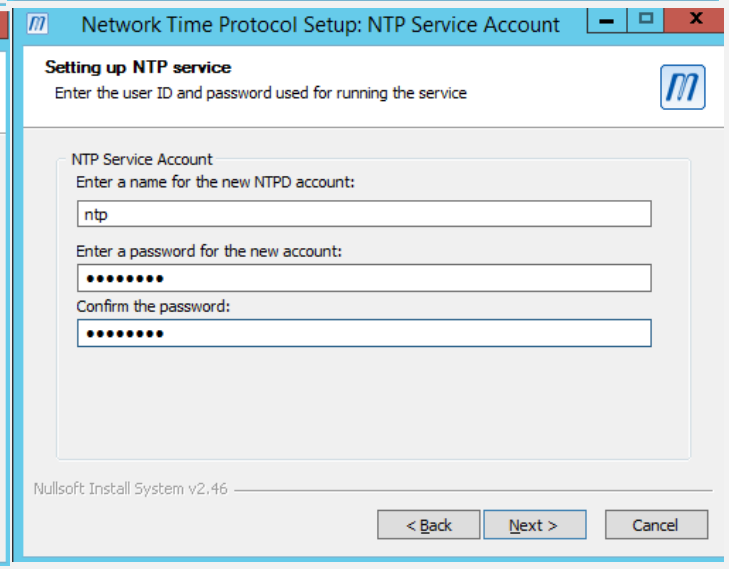




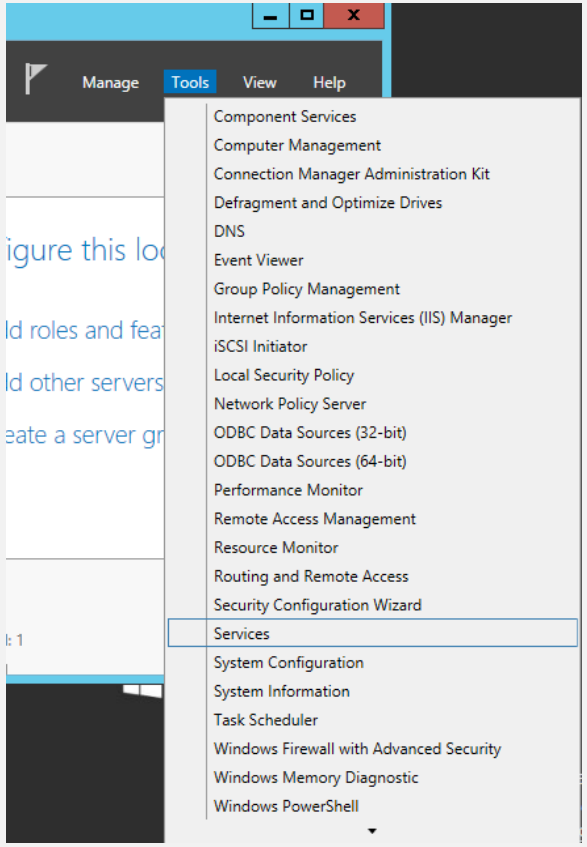


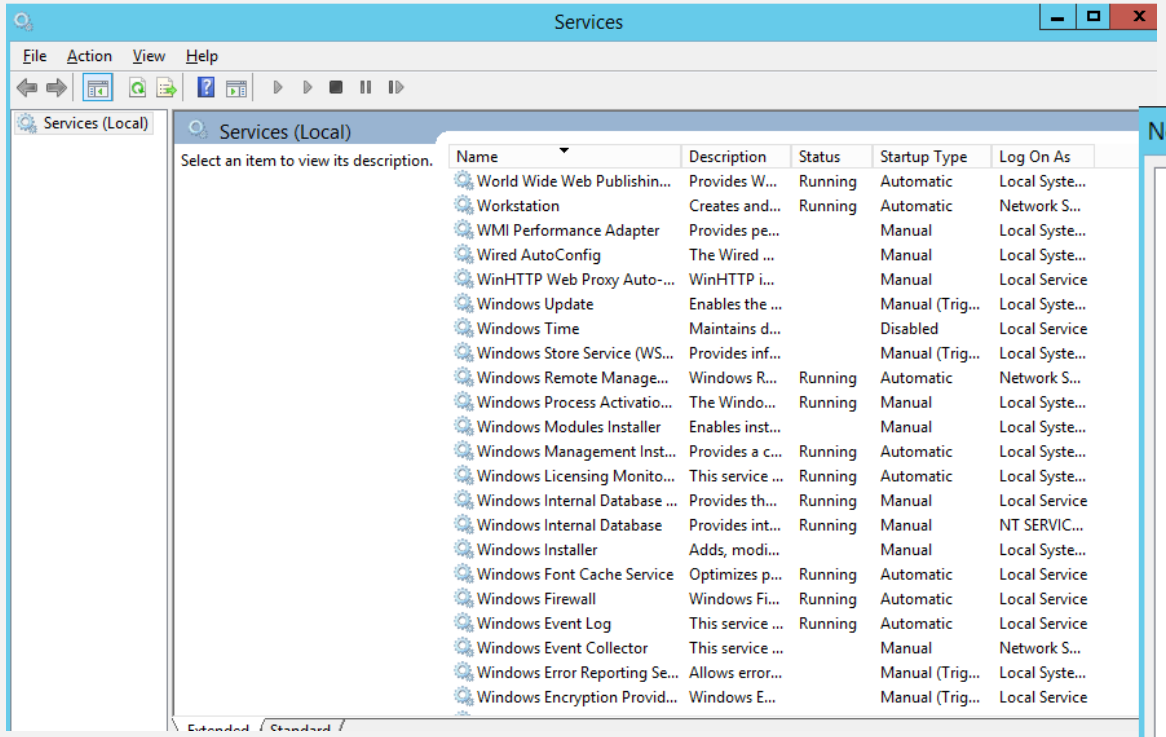


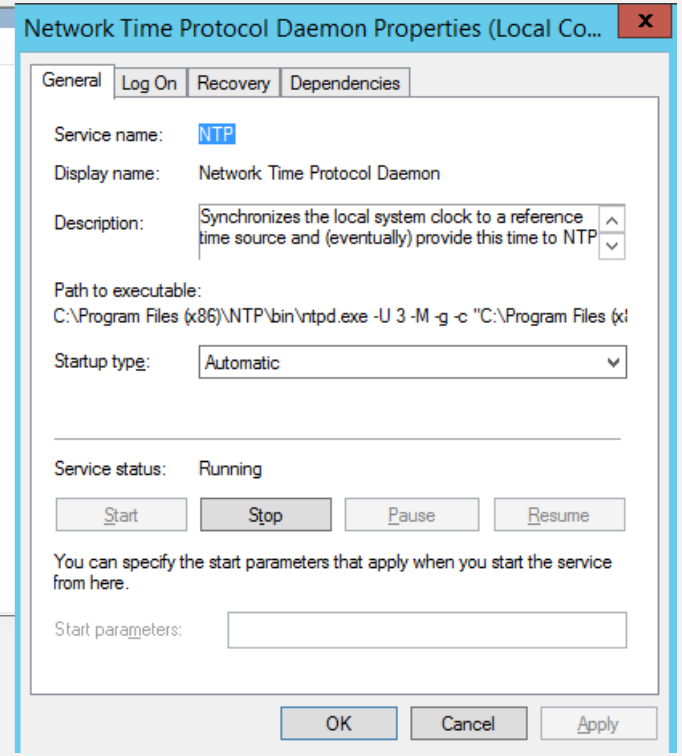




View services on a server





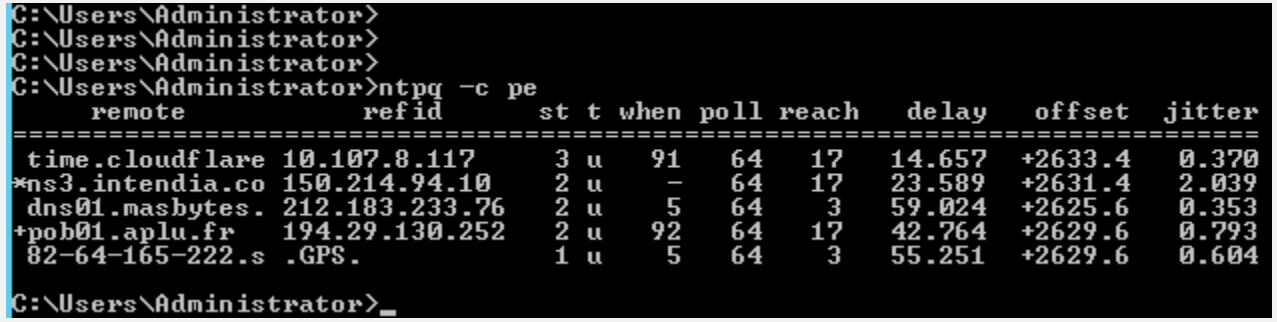


The Meinberg NTP

- NTP has some tools that allow you to monitor its functioning. The most important is "ntpq".

ntpq -c pe

- The * means that this server was chosen as a system peer, that is, the main reference in system synchronization. The + means that the server (s) are also used, but with a lower weight, to get the right time.
- You can also observe the offset, the offset, delay, or delay, and the jitter, or variation, all in milliseconds.



- If the answer is “ntpq: read: Connection refused” it is a sign that your NTP server is not working.

The Meinberg NTP

Column	Meaning
remote	Time source name or IP
refid	System pair to which the remote time server is synchronized
st	The Stratum of the Time Source
when	How many seconds have passed since the last consultation with that time source
poll	How many in how many seconds is this source consulted
reach	An 8-bit register represented in octal form that rotates to the left, which shows the result of the last 8 queries to the time source: 377 = 11,111,111 means that all queries were successful; other numbers indicate failures, for example 375 = 11,111,101, indicates that the penultimate consultation failed
delay	Delayed, or round trip time, in milliseconds, from packages to that source of time
offset	Displacement, or how much the local clock must be advanced or delayed, in milliseconds, to be equal to that of the time source
jitter	The variation, in milliseconds, between the different displacement measures for that time source

The Meinberg NTP

- While the previous command presents the variables related to each association, that is, each time source, this one presents the (global) variables of your server.

ntpq -c rl

```
C:\Users\Administrator>ntpq -c rl
associd=0 status=c613 leap_alarm, sync_ntp, 1 event, spike_detect,
version="ntpd 4.2.8p14@1.3728-o Apr 16 16:01:49 (UTC+02:00) 2020  (1)",
processor="x86", system="Windows", leap=11, stratum=4, precision=-21,
rootdelay=54.975, rootdisp=2811.742, refid=162.159.200.123,
reftime=e2653907.06cb174d  Tue, May 12 2020 16:02:31.026,
clock=e2653926.2ad61dbd  Tue, May 12 2020 16:03:02.167, peer=1684, tc=6,
mintc=3, offset=+0.000000, frequency=+500.000, sys_jitter=2.932775,
clk_jitter=0.000, clk_wander=0.000
```

- That allows you to see additional information about your server.

The Meinberg NTP - Monitorização do Servidor

Variable	Meaning
version	Ntp version
stratum	Local server stratum
precision	Precision indicated with the exponent of a base number 2
rootdelay	Delay or round-trip time of packages to Stratum 0, in milliseconds
rootdisp	Maximum error of the offset measurement in relation to layer 0, in milliseconds
refid	The system pair, or main reference
offset	Displacement, how much the local clock has to be advanced or delayed to arrive at the right time (time equal to stratum 0)
frequency	Local clock frequency error, relative to stratum 0 frequency, in parts per million (PPM)

Exercise 3 - NTP in Windows environment - Management Console

Exercise

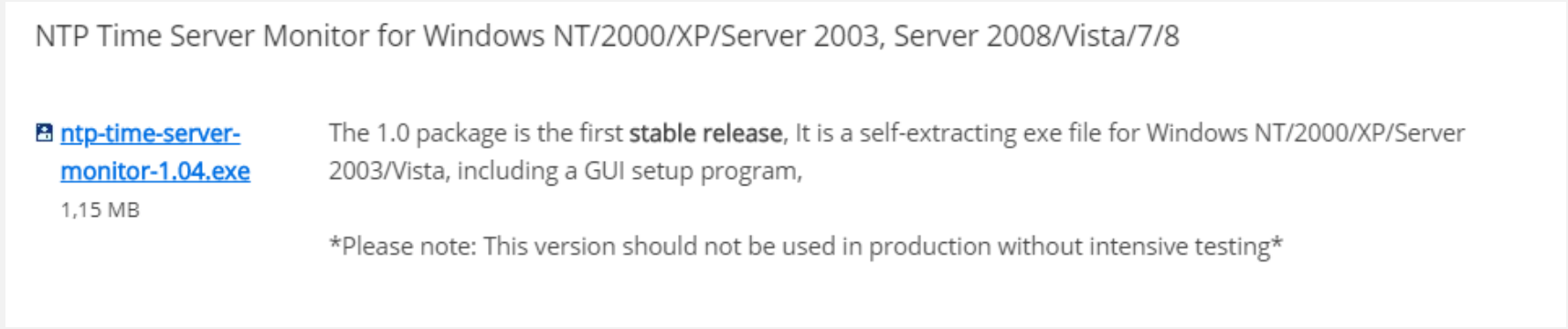
- Download and install the NTP Time Server Monitor program on the Windows 2012 server.
- Make a Restart to your NTP service in the management console.
- Identify who your NTP server's system peer is and which other servers participate in the time calculation. Identify the stratum of these servers. Analyze the other parameters.
- Generate statistics from your server.
- Place the ntp02.oal.ul.pt and ntp04.oal.ul.pt servers as the only NTP servers that your server will use to set the time. See what is now the system peer and what are the other servers that participate in calculating the time.
- Now add the server 0.es.pool.ntp.org. See what is now the system peer and what are the other servers that participate in calculating the time.
- On the Windows 10 client, place the NTP server as your server.
- On the client, force the update. See what happens.

How To

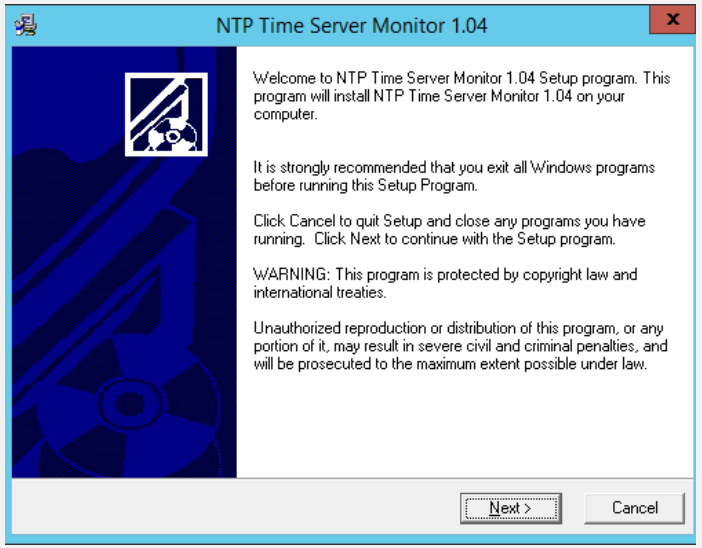
NTP Time Server Monitor

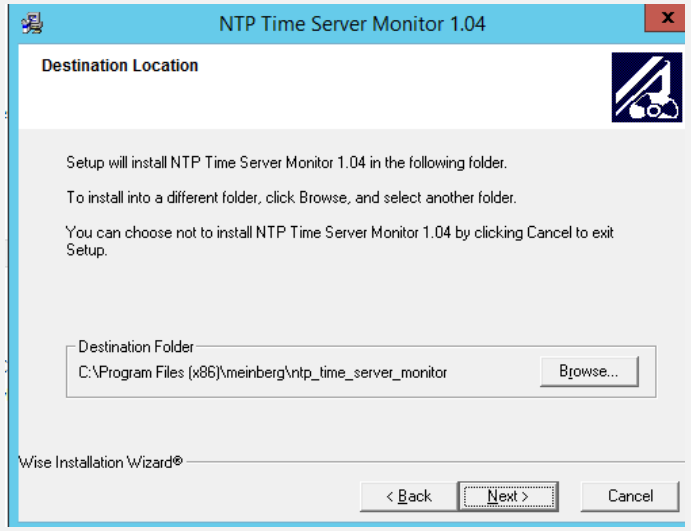
- There is a graphical tool that facilitates the management of the NTP server.
- As you can see, you do not need to have this tool installed to have the service running and perform its functions, but it facilitates its management.
- This tool is the NTP Time Server Monitor and can be downloaded at:

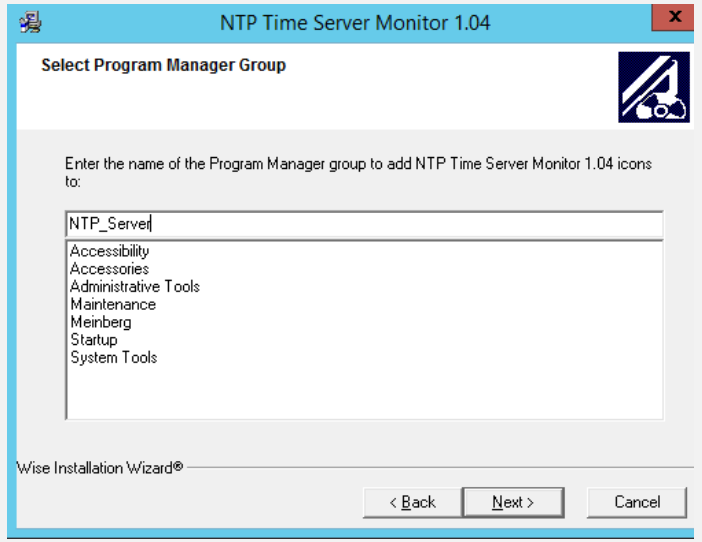
https://www.meinbergglobal.com/english/sw/ntp-server-monitor.htm



NTP Time Server Monitor - Instalação

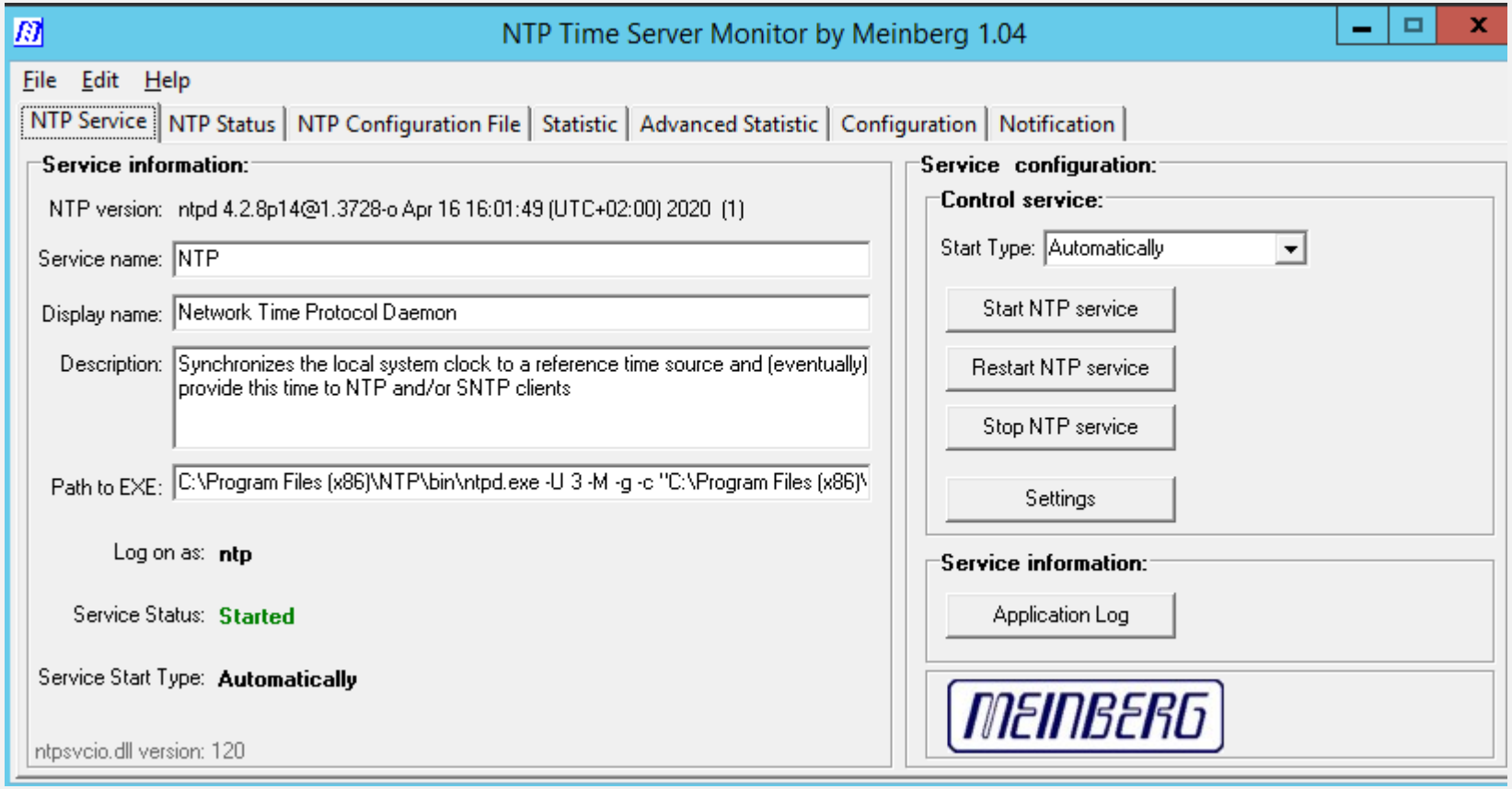






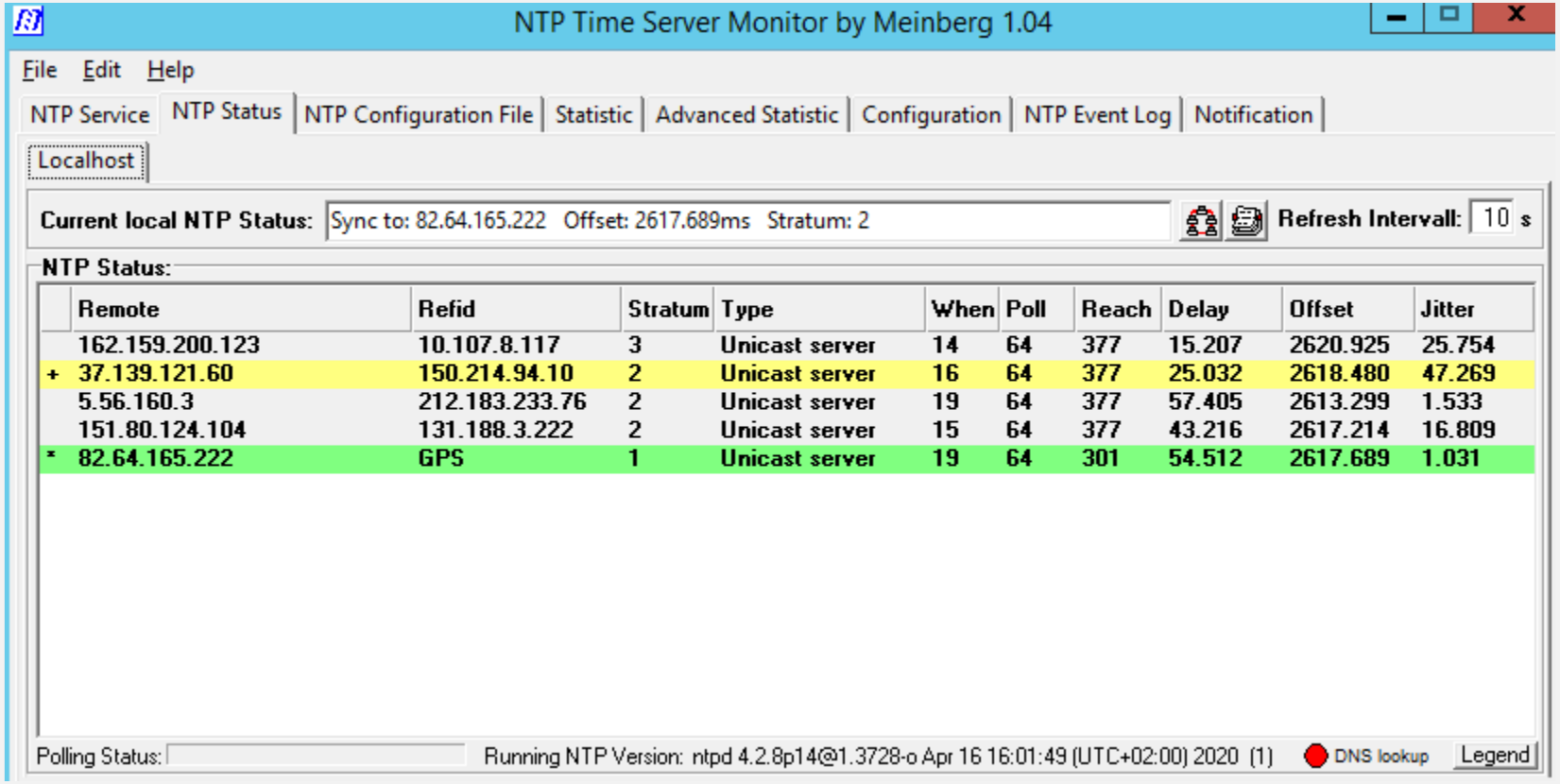
NTP Time Server Monitor - Operação

- Allows you to manage the NTP service



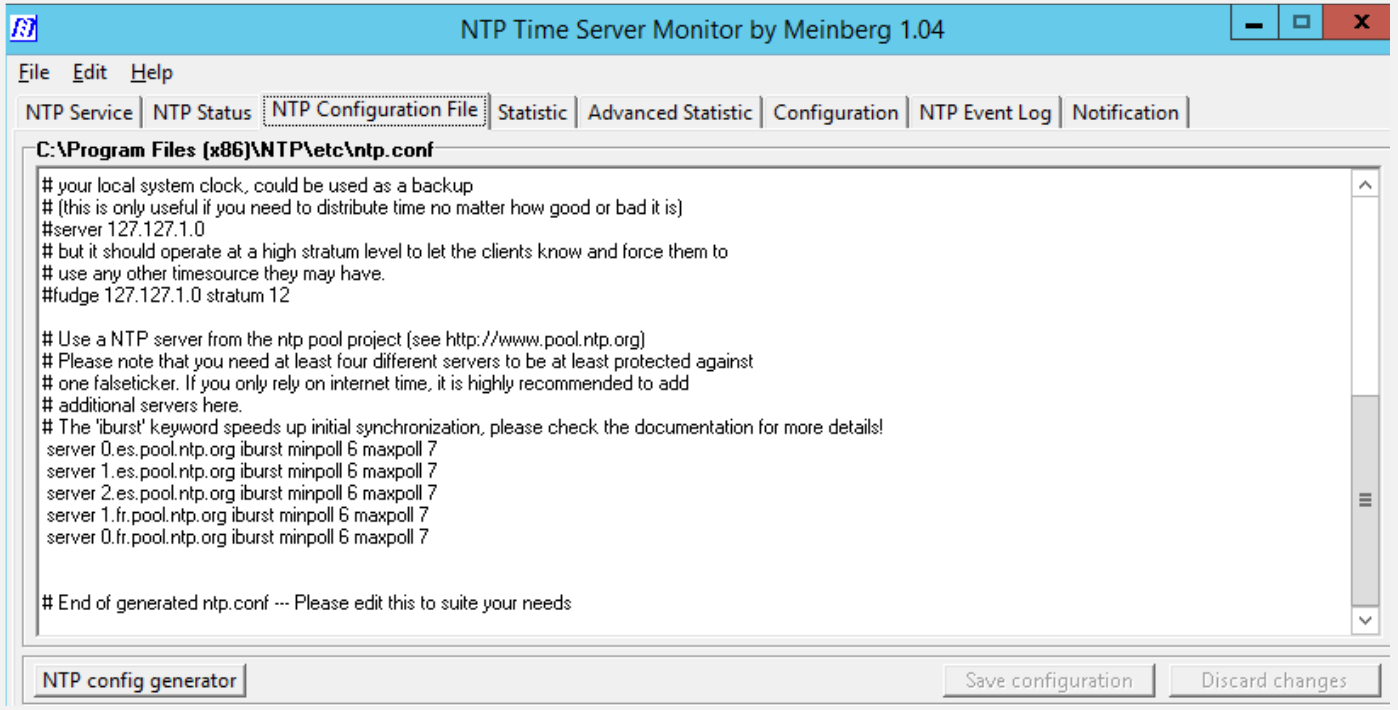
NTP Time Server Monitor

- View the status of the servers you are using to set the time:



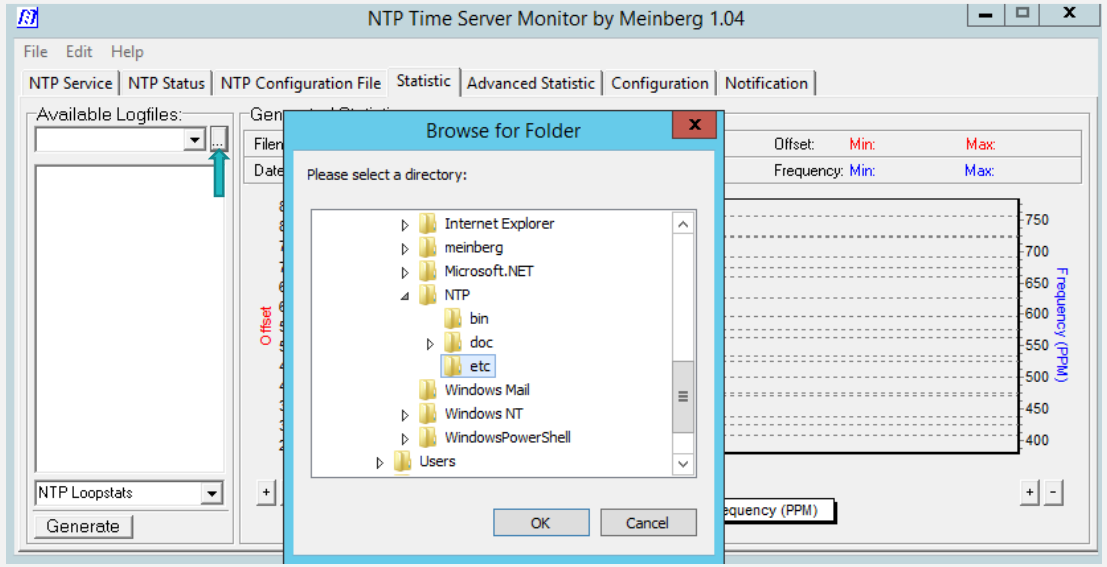
NTP Time Server Monitor

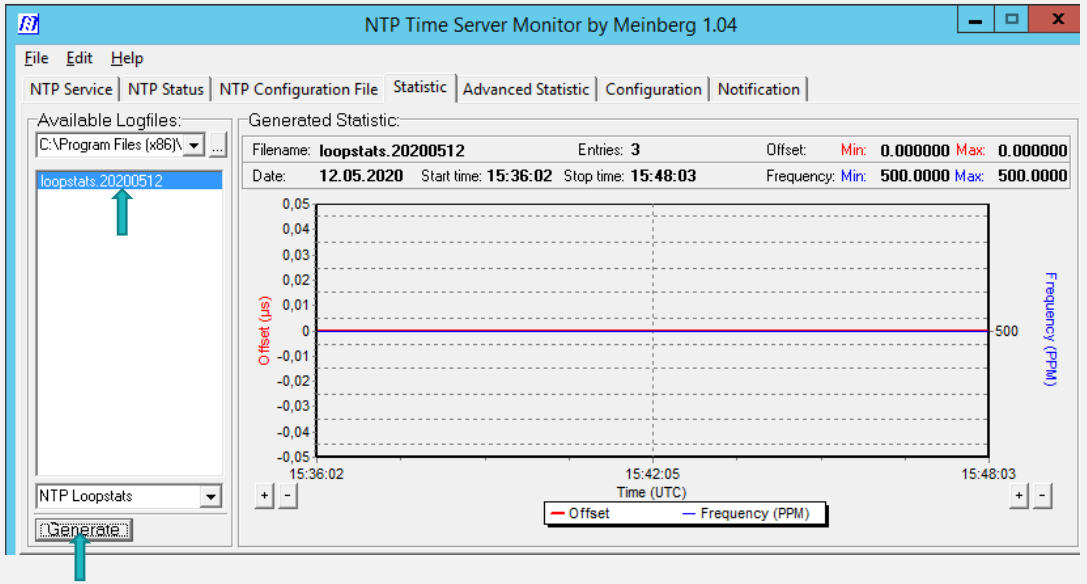
- Allows you to view and edit the service configuration file.
- For the changes to take effect, the service must be restarted.



NTP Time Server Monitor

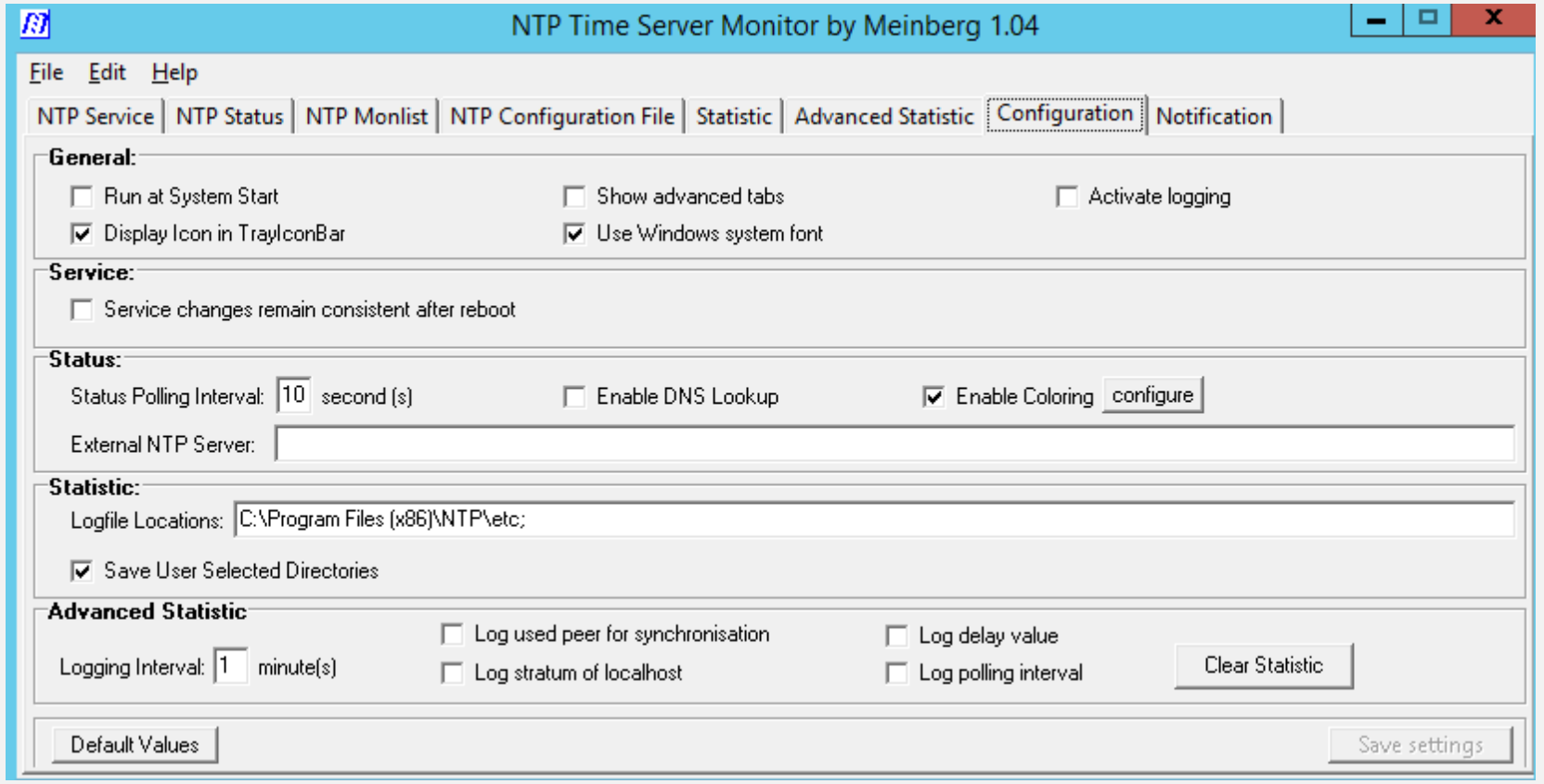
- Allows you to see your server's statistics. You initially have to select where the LogFiles are and which one to use for the statistics. LogFiles are usually in… \ ntp \ etc





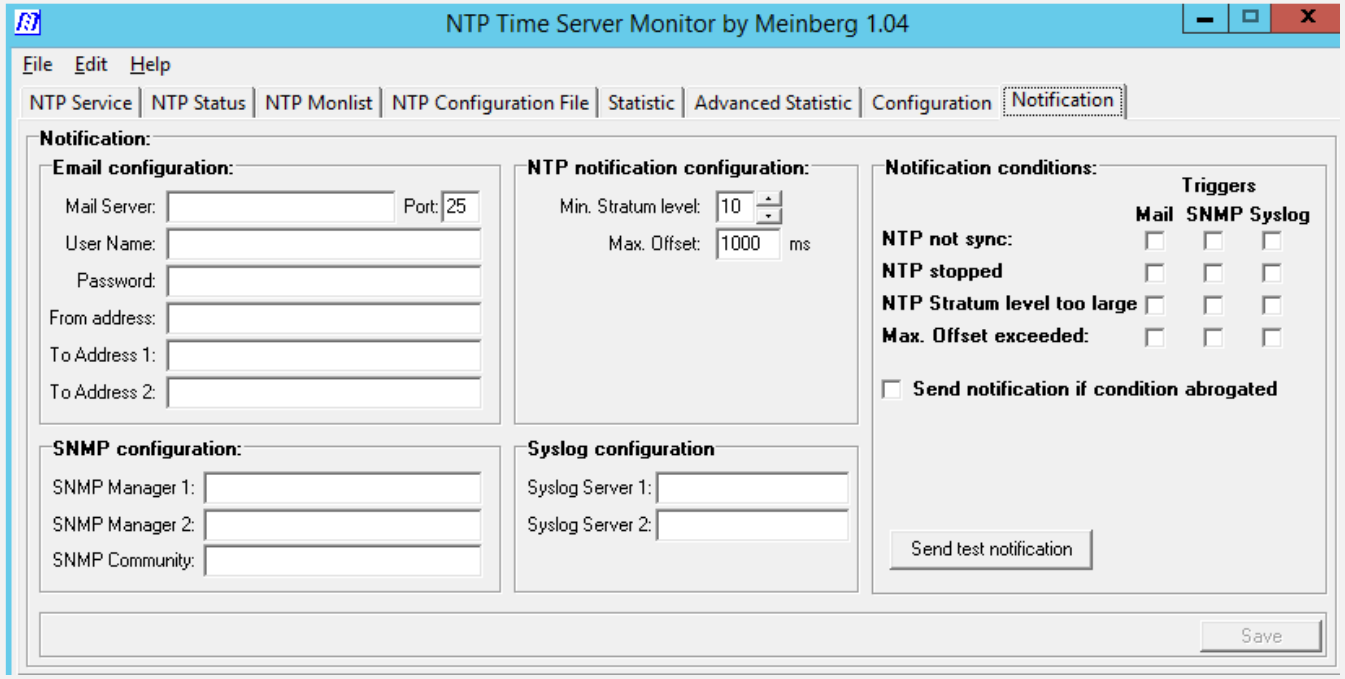
NTP Time Server Monitor

- Allows you to configure your system

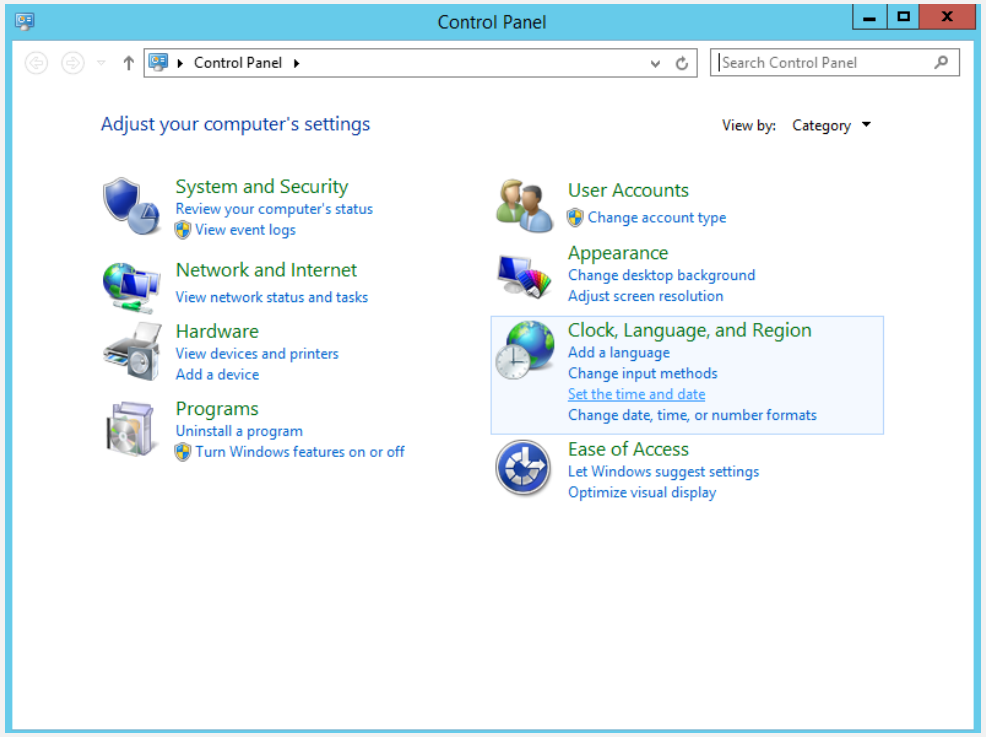


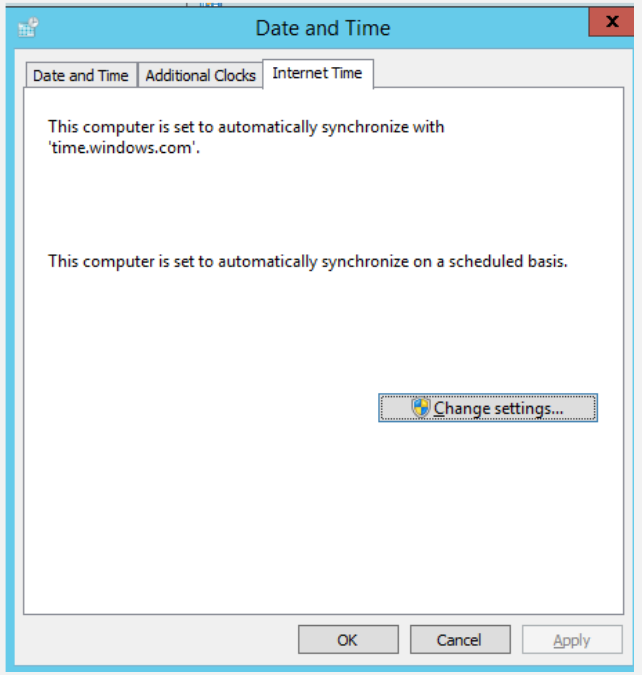
NTP Time Server Monitor

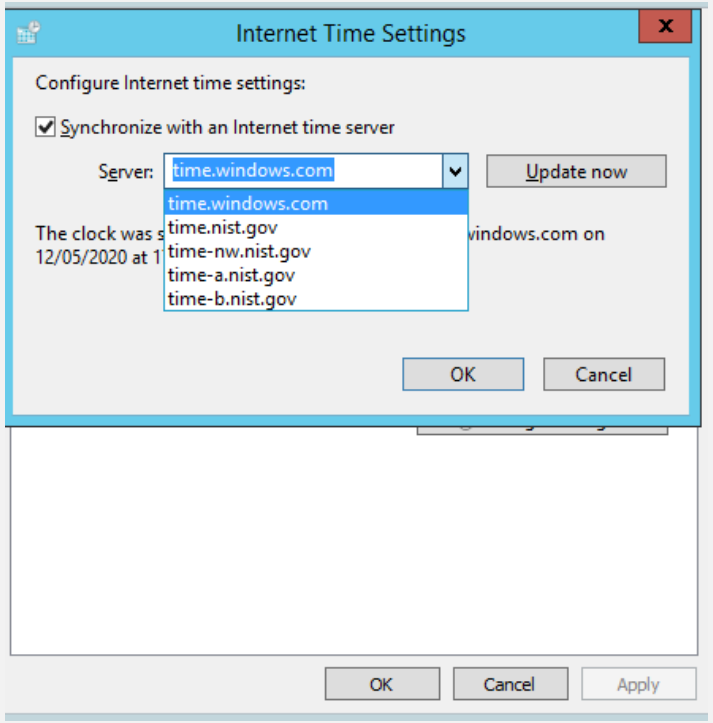
- Manage notifications, SNMP and syslog configuration.



Changing the NTP server on a client







Dúvidas

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