

Serviços de Rede 1 – **Lesson 9 - Practices**

2019-2020

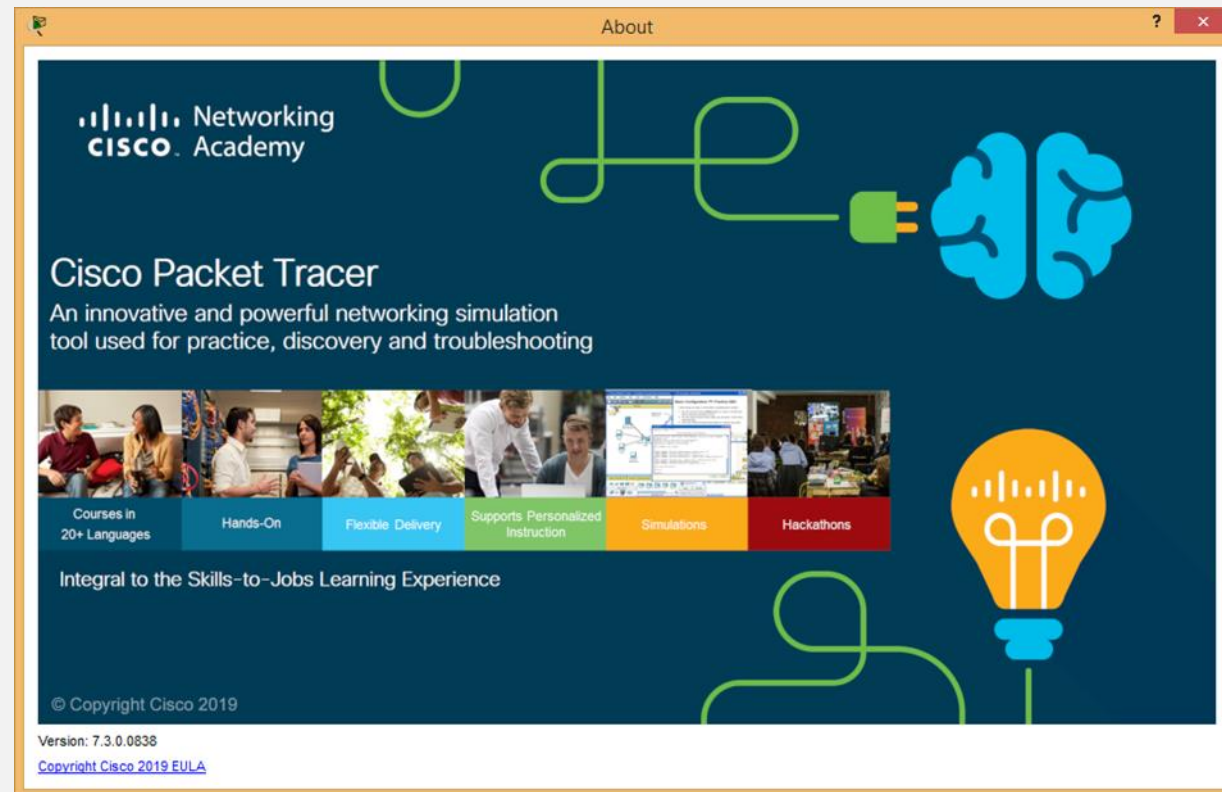
Instituto Politécnico de Coimbra

Departamento de Engenharia Informática



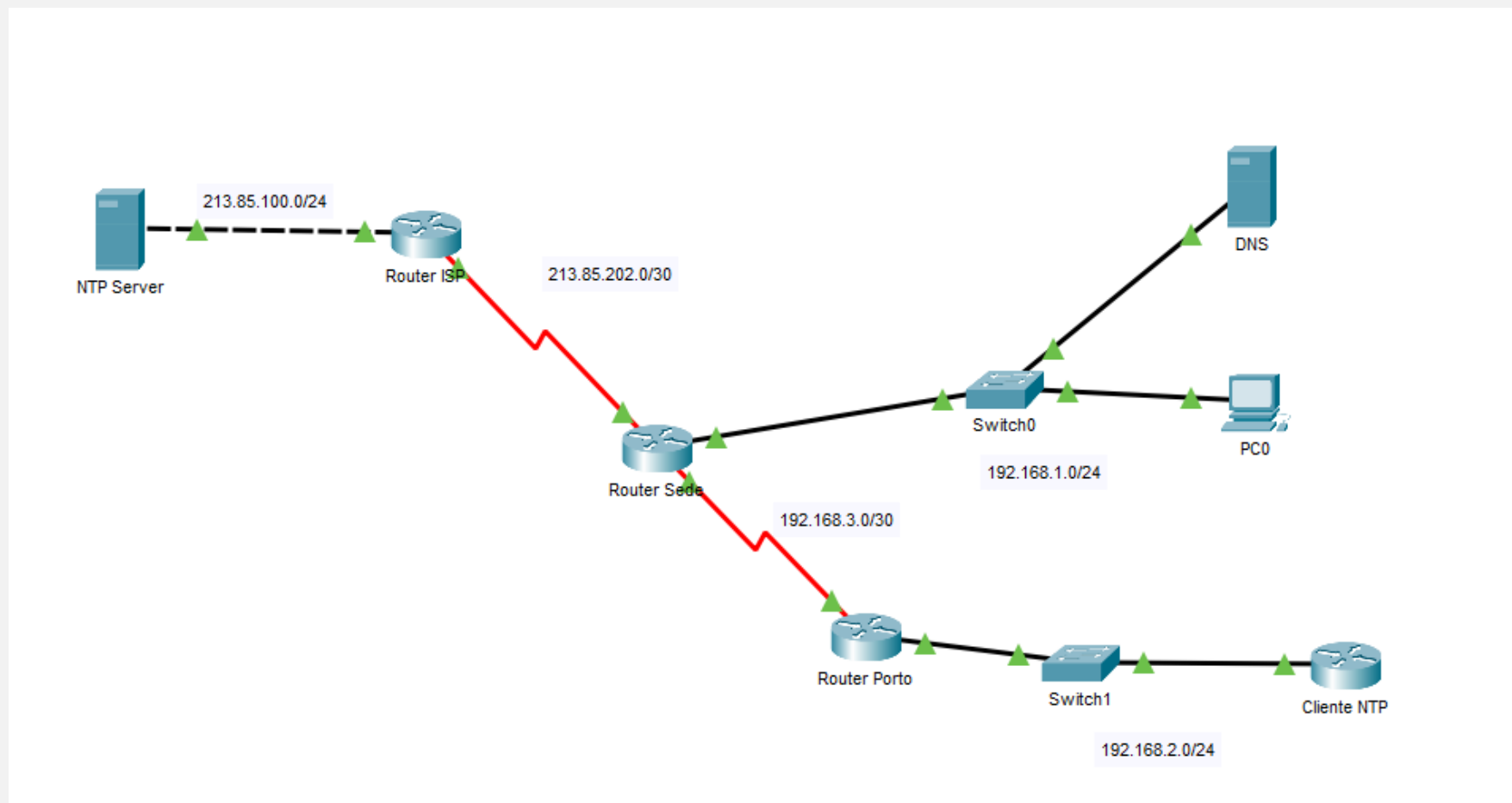
Pre-Requisites -Exercise 1

- You have installed the Cisco Packet Tracer version 7.3.0



Exercise 1 - NTP in Cisco environment

Exercise 1



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	Layer7
Layer6	Layer6
Layer5	Layer5
Layer 4: UDP Src Port: 123, Dst Port: 123	Layer4
Layer 3: IP Header Src. IP: 213.85.200.4, Dest. IP: 213.85.201.2	Layer3
Layer 2: HDLC Frame HDLC	Layer2
Layer 1: Port Serial0/0/1	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

Field	Value
LN	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

NTP Server

Physical Config **Services** Desktop Programming Attributes

SERVICES

- HTTP
- DHCP
- DHCPv6
- TFTP
- DNS
- SYSLOG
- AAA
- NTP**
- EMAIL
- FTP
- IoT
- VM Management
- Radius EAP

NTP

Service ☒ On ☐ Off

Authentication

☒ Enable ☐ Disable

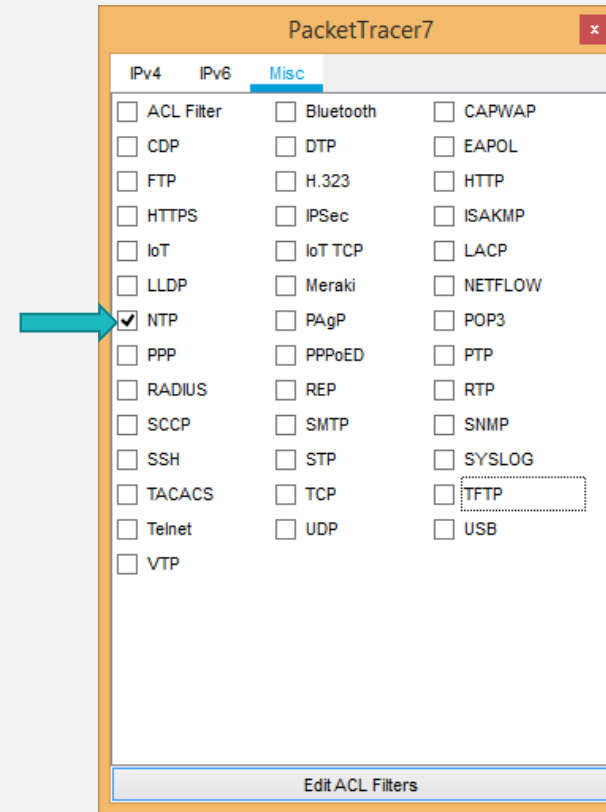
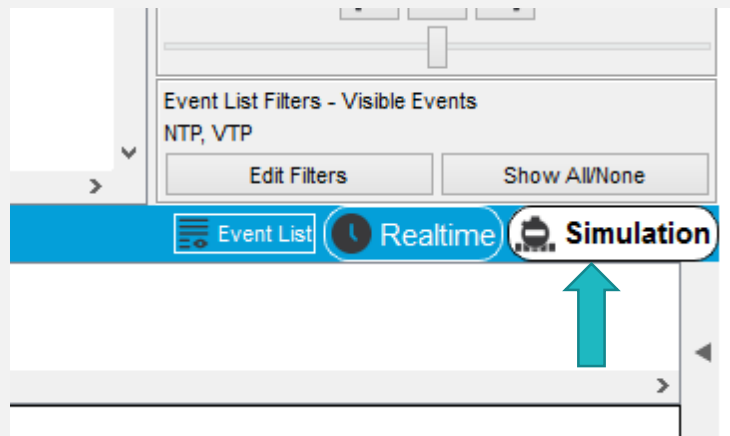
Key: 2 Password: cisco

mai 0, 2020 03:17:28

dom	seg	ter	qua	qui	sex	sáb
26	27	28	29	30	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	1	2	3	4	5	6

☐ Top

Simulation



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 **prefer** keyword to make this the preferred NTP server for the device.

Cisco Configuration

- We can enforce restrictions using access-lists

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

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

<code>[no] ntp master [stratum]</code>	Configures the device as an authoritative NTP server.
Example: <code>switch(config)# ntp master</code>	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
<code>ntp update-calendar</code>	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 **prefer** 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 <i>microseconds</i>	Adjusts estimated delay.

Cisco Configuration

- Monitoring

Command	Purpose
<code>show calendar</code>	Displays the current system calendar time.
<code>show clock [detail]</code>	Displays the current system clock time.
<code>show ntp associations [detail]</code>	Shows the status of NTP associations.
<code>show ntp status</code>	Shows the status of NTP.
<code>show sntp</code>	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

Network Time Protocol Setup

License Agreement

Please review the license terms before installing Network Time Protocol.

Network Time Protocol (Version 4.2.8p14) [WVCode:6.3]

This Binary Installation Package includes software provided by the NTP project (www.ntp.org), the OpenSSL project (www.openssl.org), Nullsoft (www.nullsoft.org) and Meinberg Radio Clocks (www.meinberg.de).

Please read this text carefully and completely (scroll down to read all terms). You need to agree to the following terms in order to proceed with the installation:

a) NTP, the Network Time Protocol Reference Implementation

Copyright (c) David L. Mills 1992-2005

If you accept the terms of the agreement, click I Agree to continue. You must accept the agreement to install Network Time Protocol.

Nullsoft Install System v2.46

< Back I Agree Cancel

Network Time Protocol Setup

Choose Install Location

Choose the folder in which to install Network Time Protocol.

Setup will install Network Time Protocol in the following folder. To install in a different folder, click Browse and select another folder. Click Next to continue.

Destination Folder

C:\Program Files (x86)\NTP

Browse...

Space required: 6.2MB

Space available: 40.5GB

Nullsoft Install System v2.46

< Back Next > Cancel

Network Time Protocol Setup

Choose Components

Choose which features of Network Time Protocol you want to install.

Check the components you want to install and uncheck the components you don't want to install. Click Next to continue.

Select components to install:

Components

☒ NTP Daemon

☒ NTP Tools

☒ NTP Documentation

☒ Create Startmenu

Description

Position your mouse over a component to see its description.

Space required: 6.2MB

Nullsoft Install System v2.46

< Back Next > Cancel

Network Time Protocol Setup: Configuration Options

Files have been installed

Please specify your configuration settings

Configuration File Settings

Location of configuration file:

C:\Program Files (x86)\NTP\etc\ntp.conf

...

☒ Create an initial configuration file with the following settings:

Want to use predefined public NTP servers (see www.pool.ntp.org)? Choose

Portugal

You can specify up to 9 NTP servers (comma separated) you want to use:

☒ Use fast initial sync mode (iburst)

☐ Add local clock as a last resort reference, Stratum: 12

Nullsoft Install System v2.46

< Back Next > Cancel

Network Time Protocol Setup: NTP Service Options

Setting up NTP service

Please specify your service settings

NTP Service Settings

☒ Create and use a special NTP account

☐ Use existing account

☐ Use SYSTEM account

☒ Start NTP service automatically

☒ Disable other Time Services eventually installed (e.g. W32Time, other NTP flavours)

☒ Start NTP service right after installation

☒ Allow big initial timestep (>1000 secs)

☒ Enable Multimedia Timer at startup

☒ Check Firewall Settings

Nullsoft Install System v2.46

< Back Next > Cancel

Network Time Protocol Setup: NTP Service Account

Setting up NTP service

Enter the user ID and password used for running the service

NTP Service Account

Enter a name for the new NTPD account:

ntp

Enter a password for the new account:

.....

Confirm the password:

.....

Nullsoft Install System v2.46

< Back Next > Cancel

View services on a server

The image shows a Windows Server environment with three overlapping windows. On the left is the 'Tools' menu of the Server Manager console, with 'Services' selected. In the center is the 'Services (Local)' console window, displaying a list of system services. On the right is the 'Network Time Protocol Daemon Properties (Local Co...)' dialog box, showing the 'General' tab with service details.

Services (Local) Console Window

Name	Description	Status	Startup Type	Log On As
World Wide Web Publishin...	Provides W...	Running	Automatic	Local Syste...
Workstation	Creates and...	Running	Automatic	Network S...
WMI Performance Adapter	Provides pe...		Manual	Local Syste...
Wired AutoConfig	The Wired ...		Manual	Local Syste...
WinHTTP Web Proxy Auto...	WinHTTP i...		Manual	Local Service
Windows Update	Enables the ...		Manual (Trig...	Local Syste...
Windows Time	Maintains d...		Disabled	Local Service
Windows Store Service (WS...	Provides inf...		Manual (Trig...	Local Syste...
Windows Remote Manage...	Windows R...	Running	Automatic	Network S...
Windows Process Activatio...	The Windo...	Running	Manual	Local Syste...
Windows Modules Installer	Enables inst...		Manual	Local Syste...
Windows Management Inst...	Provides a c...	Running	Automatic	Local Syste...
Windows Licensing Monito...	This service ...	Running	Automatic	Local Syste...
Windows Internal Database ...	Provides th...	Running	Manual	Local Service
Windows Internal Database	Provides int...	Running	Manual	NT SERVIC...
Windows Installer	Adds, modi...		Manual	Local Syste...
Windows Font Cache Service	Optimizes p...	Running	Automatic	Local Service
Windows Firewall	Windows Fi...	Running	Automatic	Local Service
Windows Event Log	This service ...	Running	Automatic	Local Service
Windows Event Collector	This service ...		Manual	Network S...
Windows Error Reporting Se...	Allows error...		Manual (Trig...	Local Syste...
Windows Encryption Provid...	Windows E...		Manual (Trig...	Local Service

Network Time Protocol Daemon Properties (Local Co...) Dialog Box

General | Log On | Recovery | Dependencies

Service name: **NTP**

Display name: Network Time Protocol Daemon

Description: Synchronizes the local system clock to a reference time source and (eventually) provide this time to NTP

Path to executable: C:\Program Files (x86)\NTP\bin\ntpd.exe -U 3 -M -g -c "C:\Program Files (x86)\NTP\bin\ntp.conf"

Startup type: Automatic

Service status: Running

Buttons: Start, Stop, Pause, Resume

You can specify the start parameters that apply when you start the service from here.

Start parameters:

Buttons: OK, Cancel, Apply

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.

```
C:\Users\Administrator>
C:\Users\Administrator>
C:\Users\Administrator>
C:\Users\Administrator>ntpq -c pe
=====
remote               refid              st t when poll reach  delay  offset  jitter
=====
time.cloudflare      10.107.8.117       3 u  91   64   17  14.657 +2633.4 0.370
*ns3.intendia.co     150.214.94.10      2 u   -   64   17  23.589 +2631.4 2.039
dns01.masbytes       212.183.233.76     2 u   5   64   3   59.024 +2625.6 0.353
+pob01.aplu.fr       194.29.130.252     2 u  92   64   17  42.764 +2629.6 0.793
82-64-165-222.s      .GPS.               1 u   5   64   3   55.251 +2629.6 0.604
C:\Users\Administrator>
```

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 for Windows NT/2000/XP/Server 2003, Server 2008/Vista/7/8

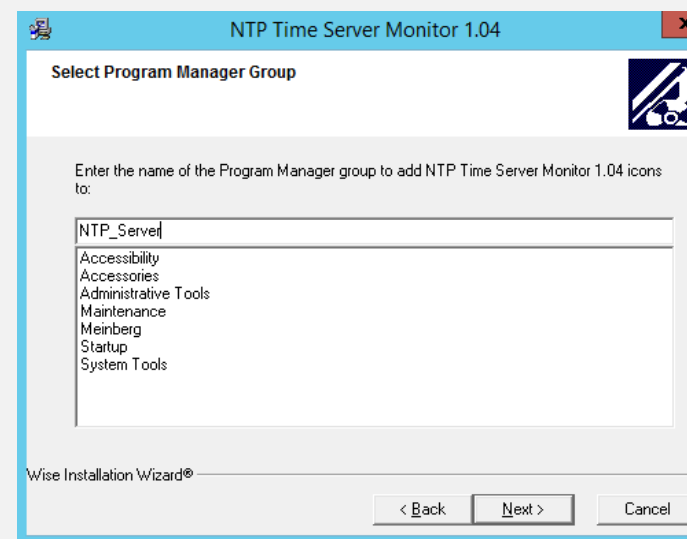
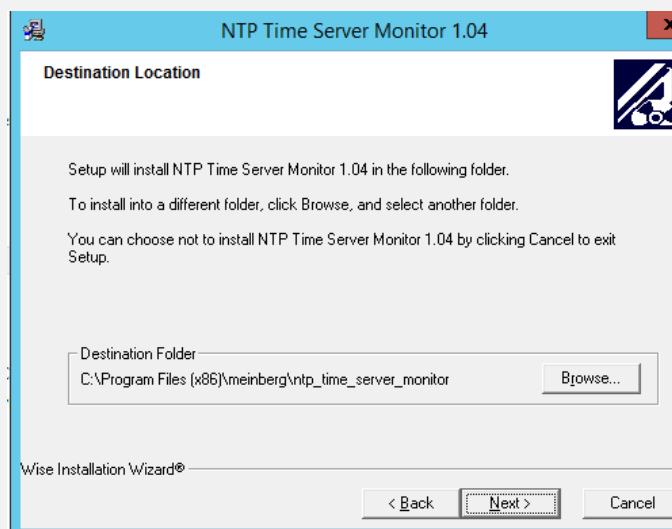
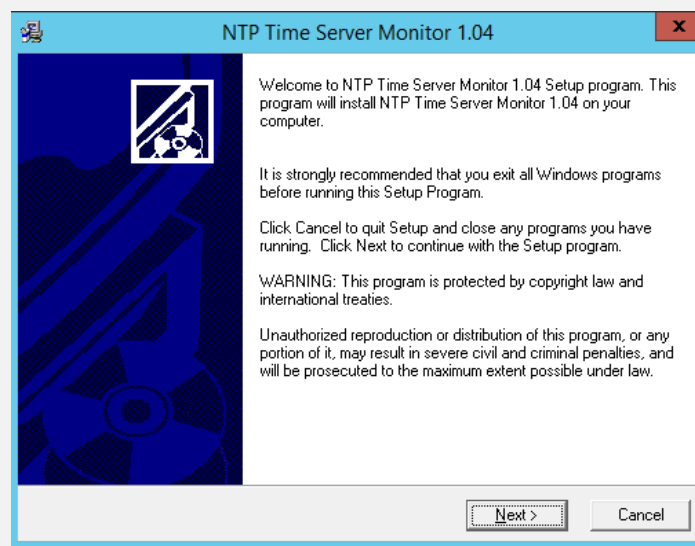
 [ntp-time-server-monitor-1.04.exe](#)

1,15 MB

The 1.0 package is the first **stable release**, It is a self-extracting exe file for Windows NT/2000/XP/Server 2003/Vista, including a GUI setup program,

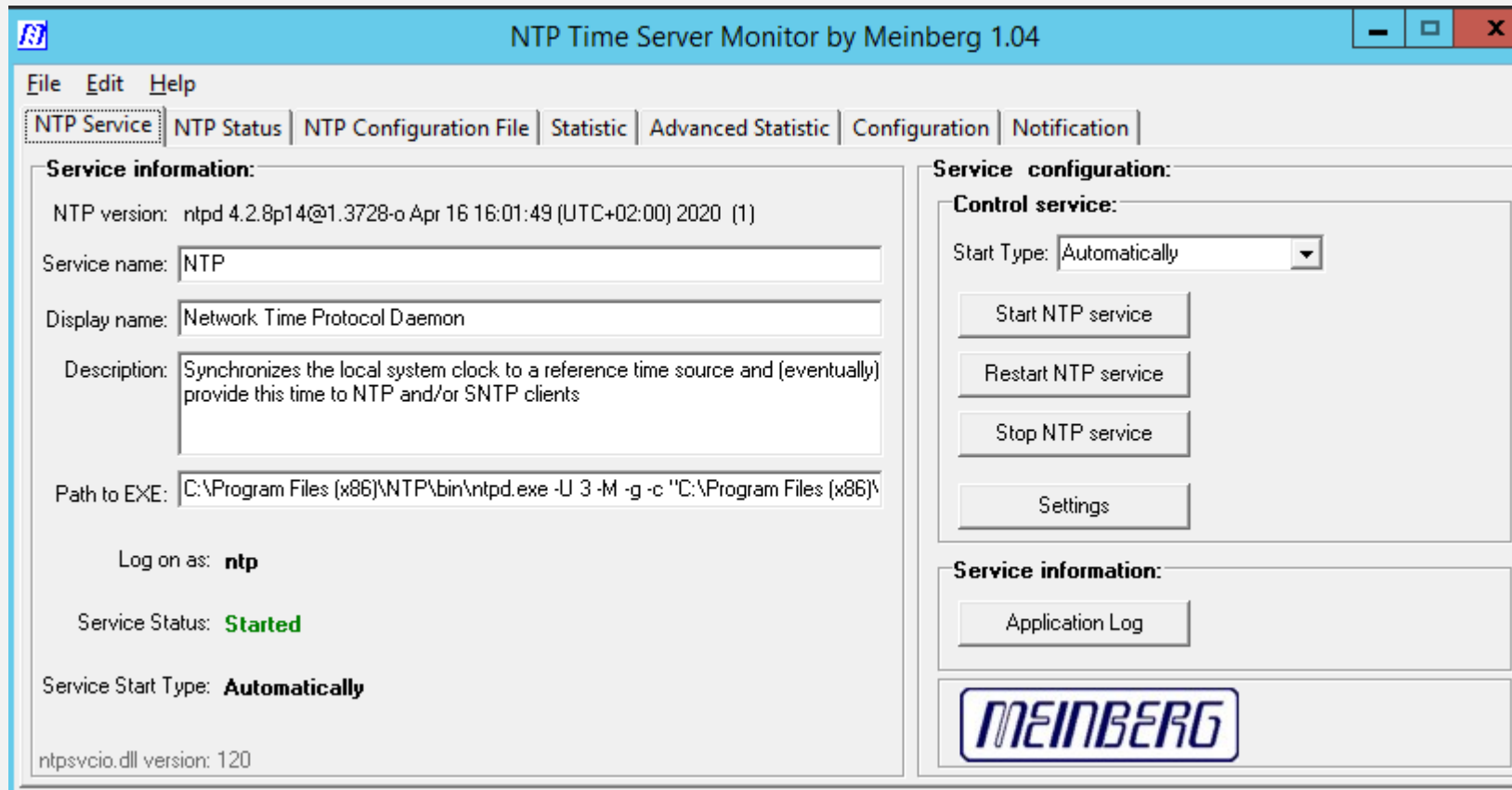
Please note: This version should not be used in production without intensive testing

NTP Time Server Monitor - Instalação



NTP Time Server Monitor - Operação

- Allows you to manage the NTP service



NTP Time Server Monitor

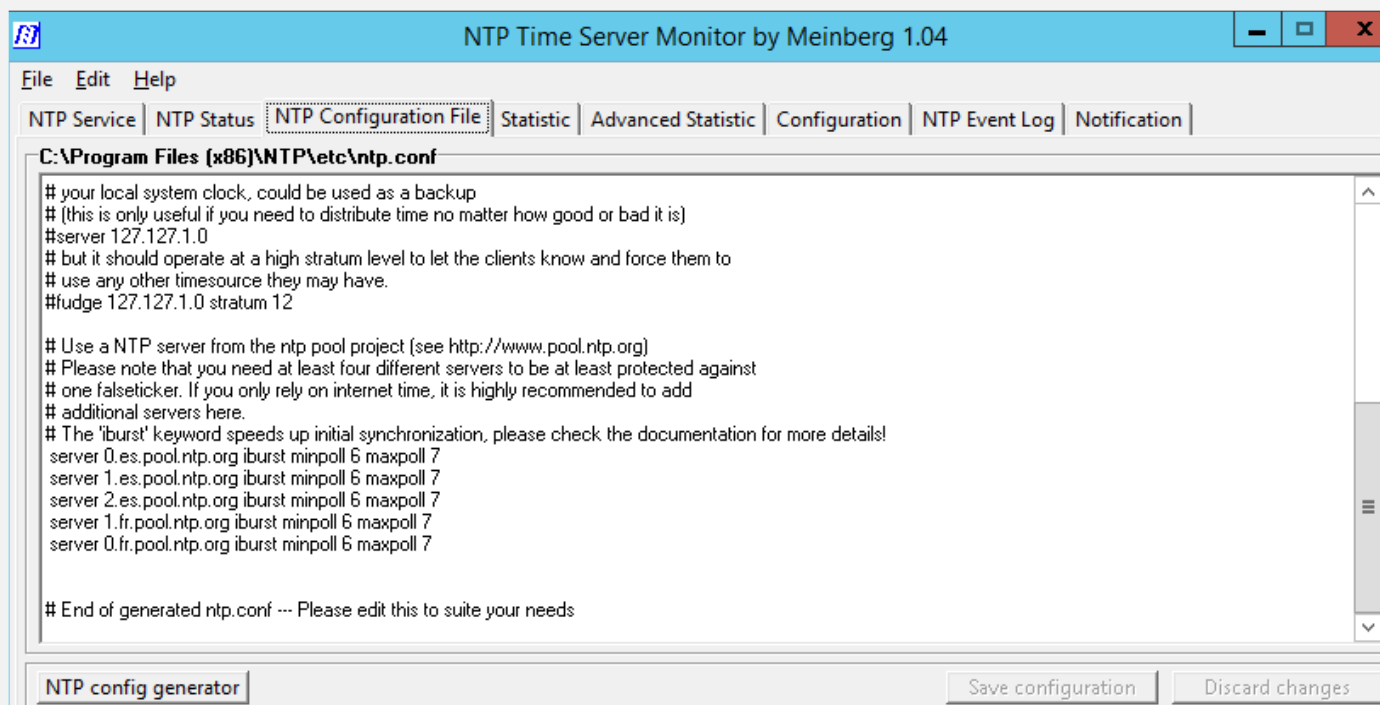
- View the status of the servers you are using to set the time:

The screenshot shows the NTP Time Server Monitor by Meinberg 1.04 application window. The title bar is blue with the application name and standard window controls. The menu bar includes File, Edit, and Help. The main menu contains NTP Service, NTP Status (selected), NTP Configuration File, Statistic, Advanced Statistic, Configuration, NTP Event Log, and Notification. Below the menu is a 'Localhost' button. The 'Current local NTP Status' section shows 'Sync to: 82.64.165.222', 'Offset: 2617.689ms', and 'Stratum: 2'. To the right is a 'Refresh Interval' set to 10 seconds. The 'NTP Status' section contains a table of NTP servers. The table has columns for Remote, Refid, Stratum, Type, When, Poll, Reach, Delay, Offset, and Jitter. The servers are listed with their respective status indicators (plus, minus, or asterisk) in the first column. The bottom status bar shows 'Polling Status:', 'Running NTP Version: ntpd 4.2.8p14@1.3728-o Apr 16 16:01:49 (UTC+02:00) 2020 (1)', a red circle icon for 'DNS lookup', and a 'Legend' button.

	Remote	Refid	Stratum	Type	When	Poll	Reach	Delay	Offset	Jitter
	162.159.200.123	10.107.8.117	3	Unicast server	14	64	377	15.207	2620.925	25.754
+	37.139.121.60	150.214.94.10	2	Unicast server	16	64	377	25.032	2618.480	47.269
	5.56.160.3	212.183.233.76	2	Unicast server	19	64	377	57.405	2613.299	1.533
	151.80.124.104	131.188.3.222	2	Unicast server	15	64	377	43.216	2617.214	16.809
*	82.64.165.222	GPS	1	Unicast server	19	64	301	54.512	2617.689	1.031

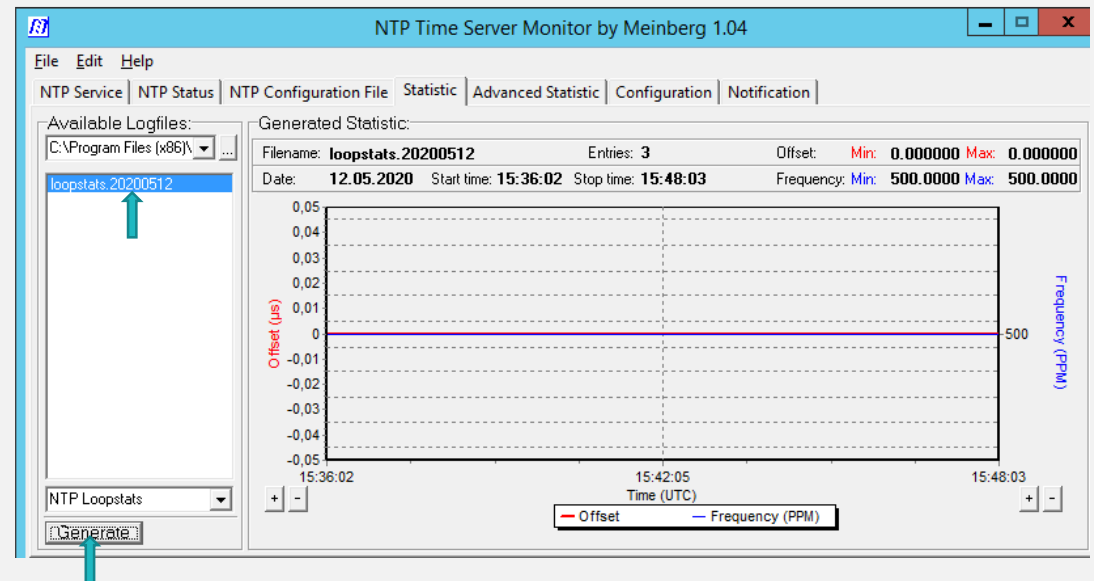
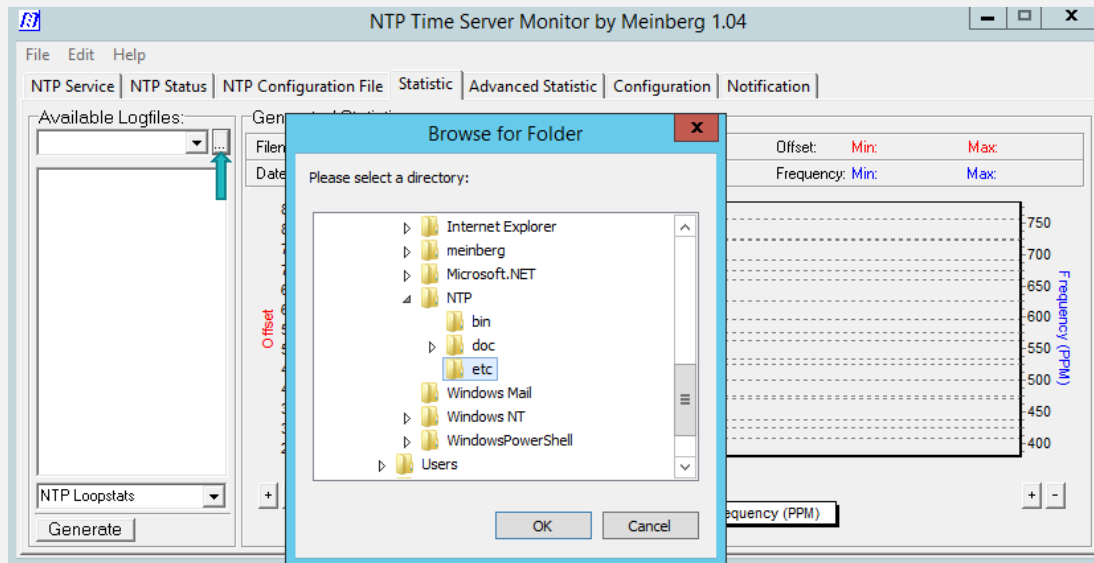
NTP Time Server Monitor

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



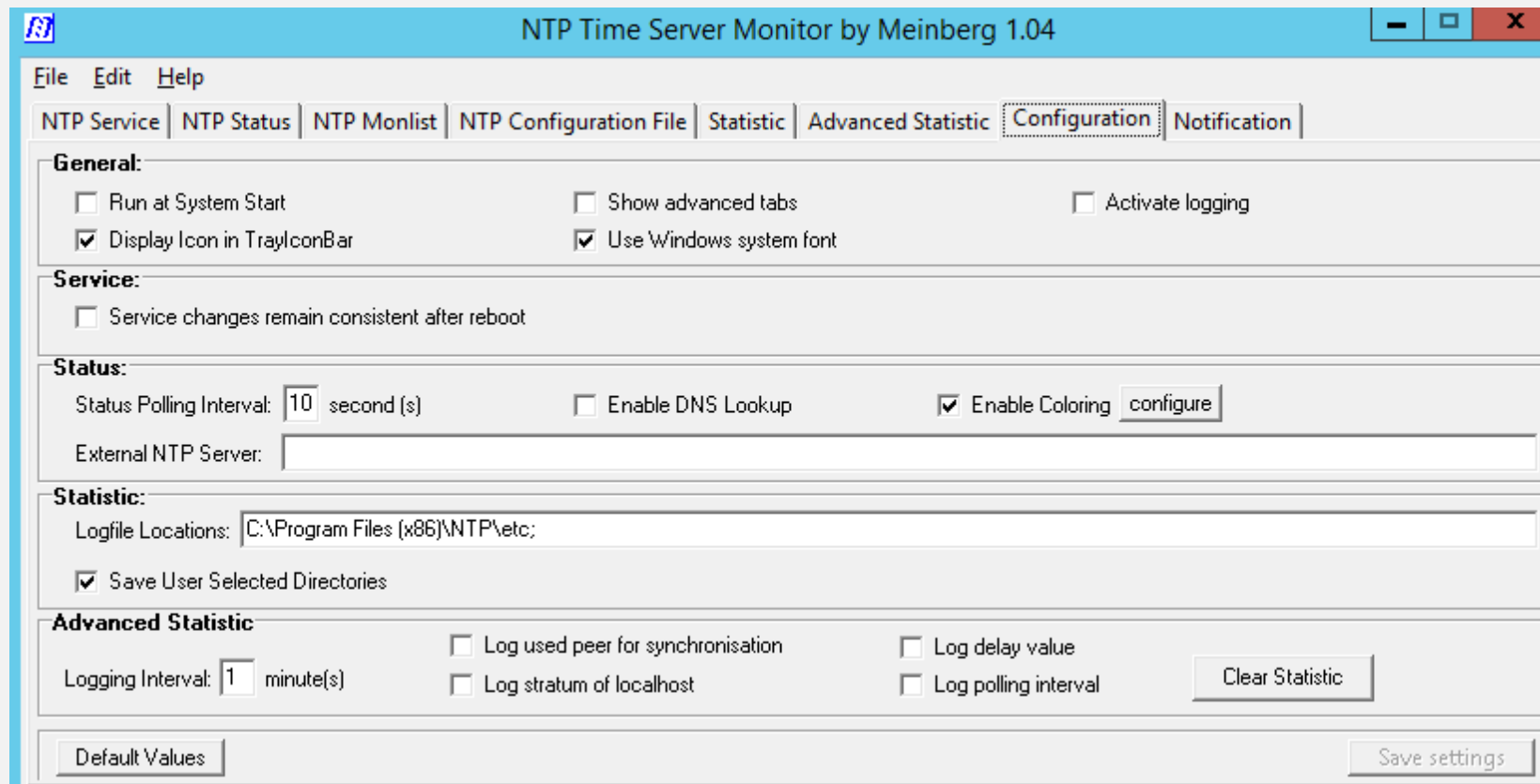
NTP Time Server Monitor

- 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.

The screenshot displays the 'Notification' configuration window of the NTP Time Server Monitor by Meinberg 1.04. The window features a menu bar (File, Edit, Help) and a tabbed interface with the following tabs: NTP Service, NTP Status, NTP Monlist, NTP Configuration File, Statistic, Advanced Statistic, Configuration, and Notification (the active tab).

The 'Notification' tab is divided into several sections:

- Email configuration:** Includes fields for Mail Server, Port (set to 25), User Name, Password, From address, To Address 1, and To Address 2.
- NTP notification configuration:** Includes a Min. Stratum level (set to 10) and a Max. Offset (set to 1000 ms).
- SNMP configuration:** Includes fields for SNMP Manager 1, SNMP Manager 2, and SNMP Community.
- Syslog configuration:** Includes fields for Syslog Server 1 and Syslog Server 2.
- Notification conditions:** A table of triggers with checkboxes for Mail, SNMP, and Syslog notifications.

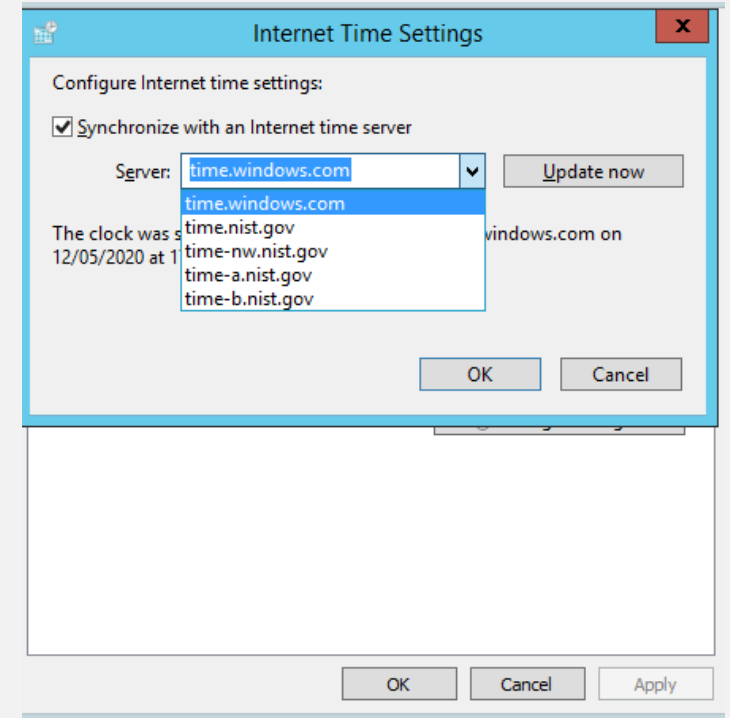
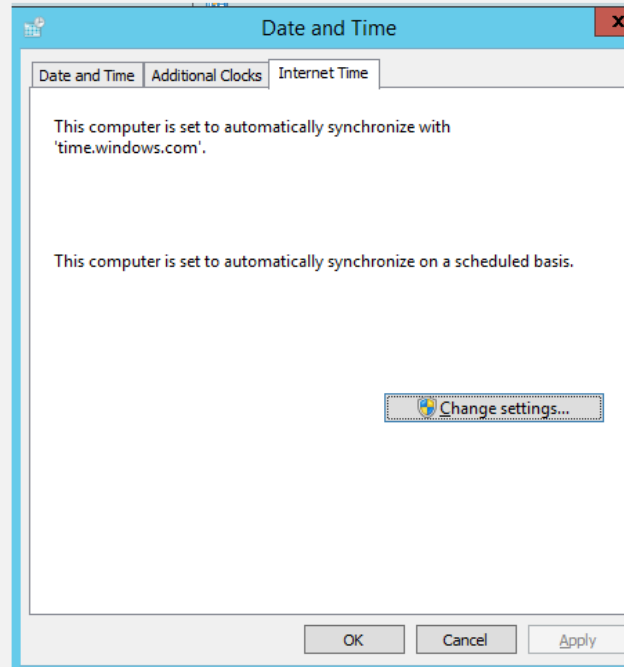
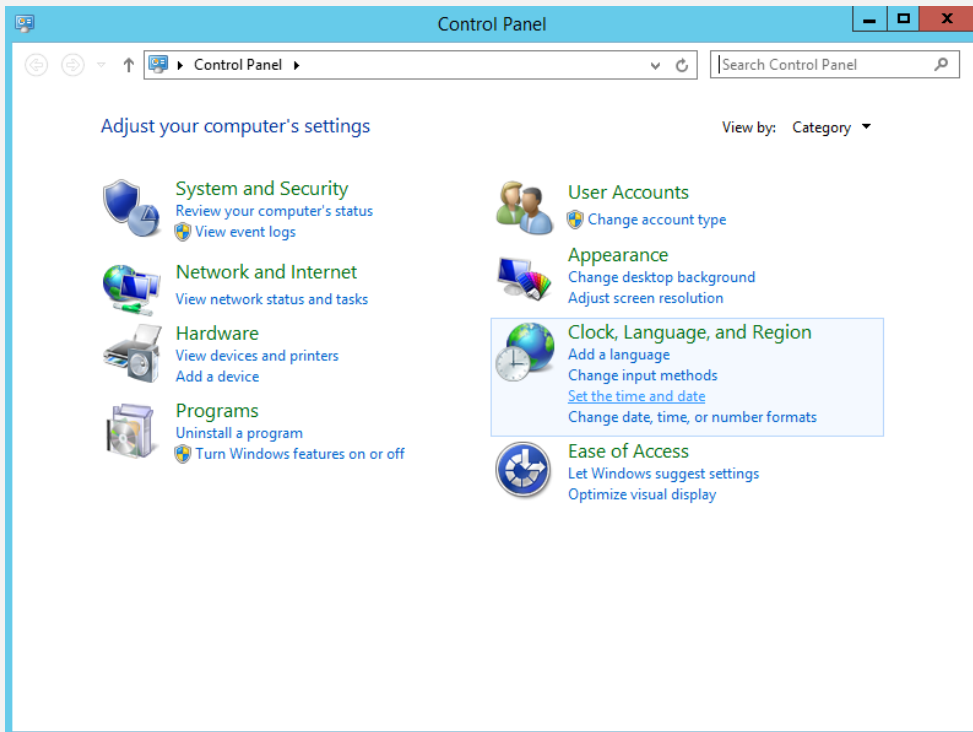
	Triggers		
	Mail	SNMP	Syslog
NTP not sync:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
NTP stopped	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
NTP Stratum level too large	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Max. Offset exceeded:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Below the table is a checkbox labeled 'Send notification if condition abrogated'.

A 'Send test notification' button is located at the bottom right of the configuration area.

A 'Save' button is located at the bottom right of the window.

Changing the NTP server on a client



Dúvidas



Referências

- <https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/bsm/configuration/15-2mt/bsm-time-calendar-set.html#GUID-A1071998-72BE-4F2E-8BC0-3A9FDC5D67EE>
- <https://www.youtube.com/watch?v=E7nglsM5n2Y>
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