

Sincronizarea timpului în rețelele de calculatoare

Protocolul NTP - Network Time Protocol



Server de timp Stratum 1

ntp1.usv.ro

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De ce este necesară sincronizarea timpului ?

1. Corelarea informațiilor (tranzacții bancare, bursiere, etc.)
2. Sincronizarea evenimentelor legate de securitate
3. Semnături digitale și autentificare
4. Sincronizarea aplicațiilor industriale (transporturi, energie, gaze, etc.)

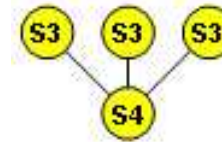
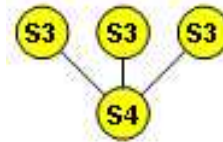
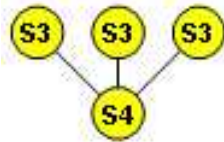
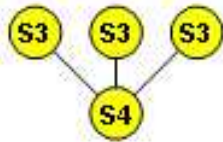
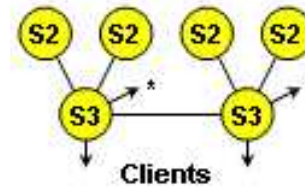
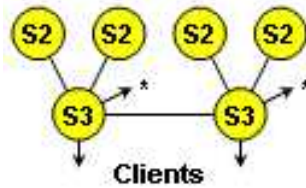
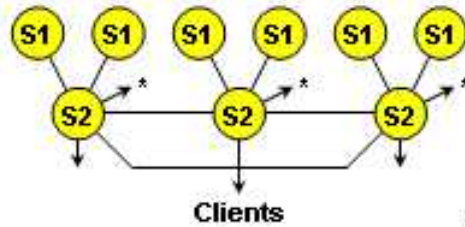
Protocolul NTP – Network Time Protocol

NTP Versiunea 3 – 1992 – RFC 1305

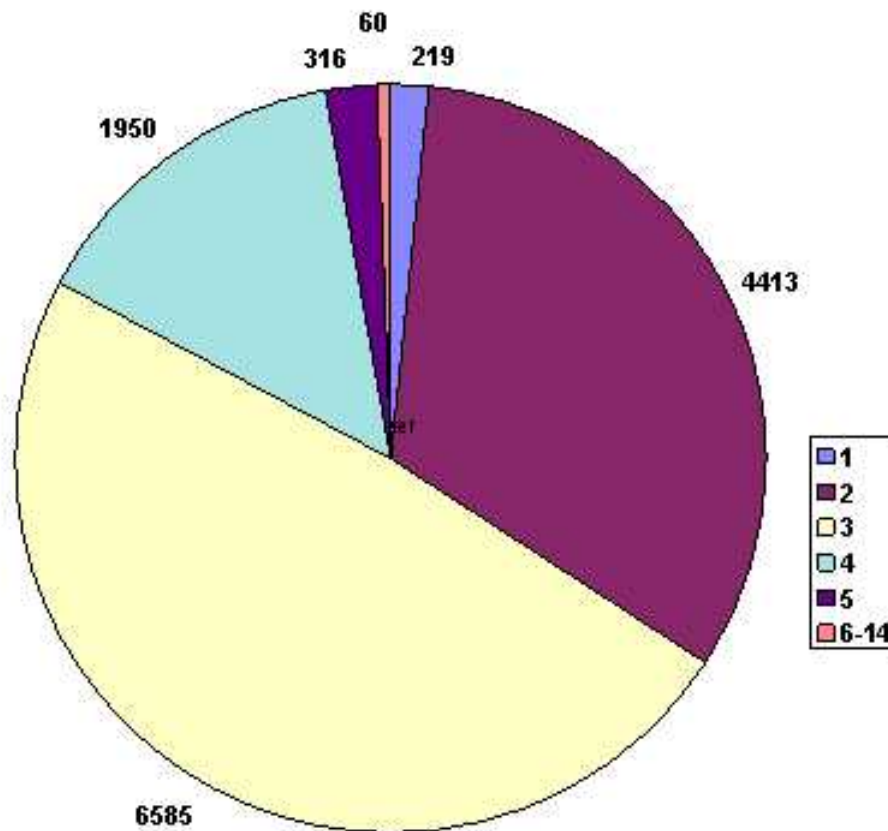
SNTP Versiunea 4 – 1996 – RFC 2030

Servere de timp - Stratum 1, 2, 3, ... , 16

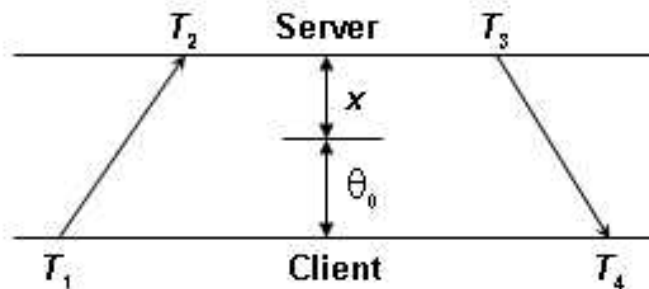
Servere NTP - Sincronizarea clientilor



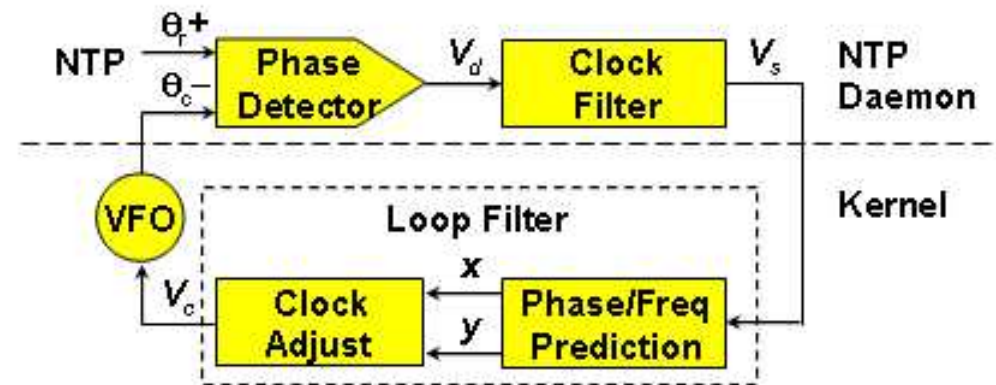
Protocolul NTP – Network Time Protocol



Protocolul NTP – Network Time Protocol



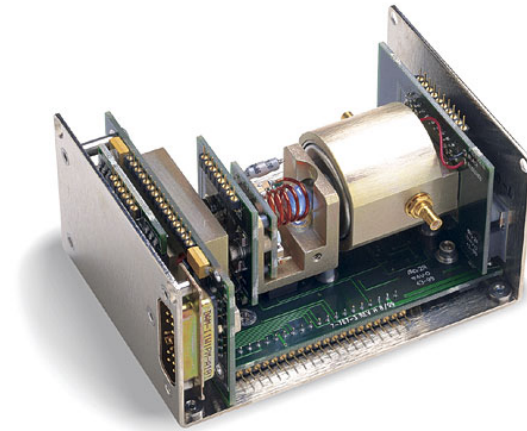
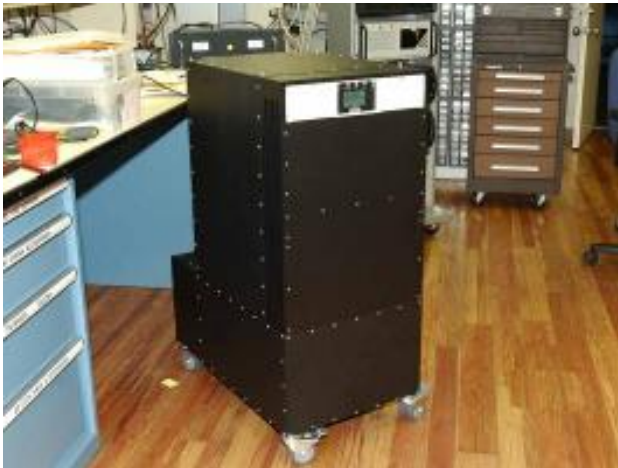
$$\theta = \frac{1}{2}[(T_2 - T_1) + (T_3 - T_4)]$$
$$\delta = (T_4 - T_1) - (T_3 - T_2)$$



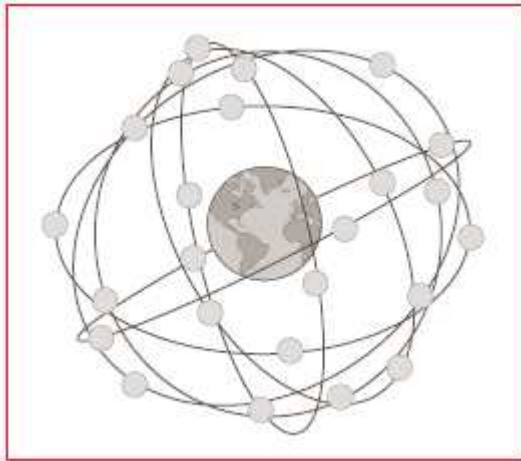
```
reference time:      c7425739.44c821ac  Thu, Dec  8 2005  8:54:49.268
originate timestamp: c7425864.714a8e6e  Thu, Dec  8 2005  8:59:48.442
receive timestamp:  c7425864.7072ae5d  Thu, Dec  8 2005  8:59:48.439
transmit timestamp:  c7425864.7049d2ee  Thu, Dec  8 2005  8:59:48.438
```

Surse primare de sincronizare (Stratum 0)

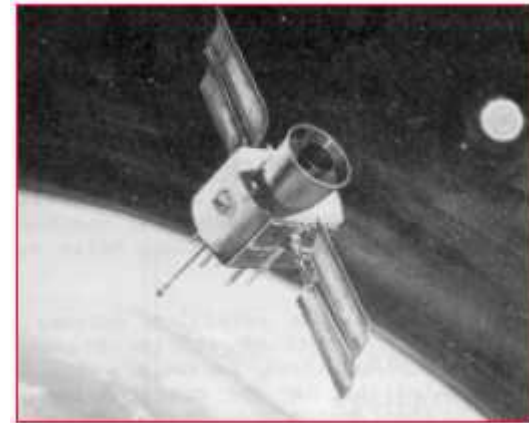
- Etaloane de timp primare (hidrogen, cesiu, rubidiu)
- Sistemul de sateliti GPS



Transmiterea timpului universal în sistemul GPS



2 rotații în 24 de ore



850kg / 800W / 65mil. USD

2 oscilatoare cu Cesium

2 oscilatoare cu Rubidiu

Eroare = 8 ... 17 ns / 24h

24 de sateliți aflați pe o orbită la 20200km de suprafața Pamântului

Transmiterea timpului universal în sistemul GPS



26-28 de sateliți din care 24 operaționali

Punctul central de comandă - Colorado Springs

Oscilatoare cu hidrogen – stabilitate pe termen scurt

Oscilatoare cu cesiu – stabilitate pe termen lung

Server de timp Stratum 1 - NTP1.usv.ro

Adresa IP: 80.96.120.253

1. Hardware

- Procesor AMD k6III/400MHz
- Memorie 256MB
- HDD 20GB

2. Software

- Microsoft Windows 2000 Server/SP4
- ntp v.4.2.0a

Alimentare de rezerva: 3 ore

Sincronizare de la receptor GPS

Garmin GPS18USB

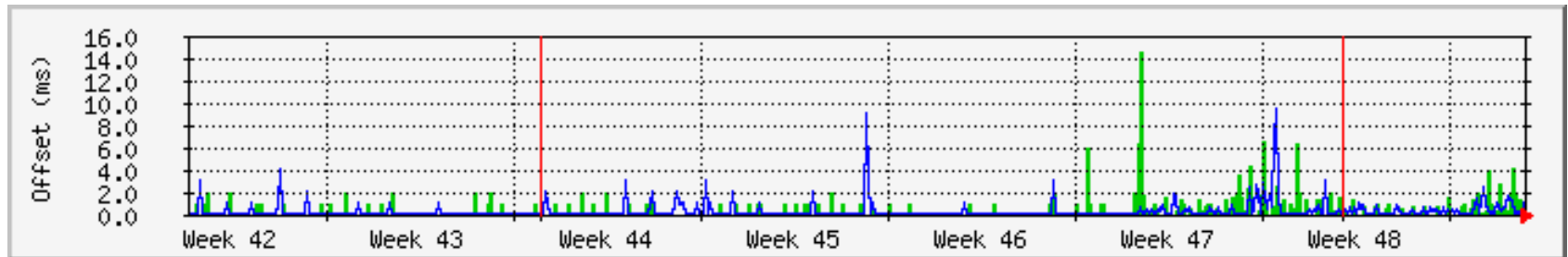
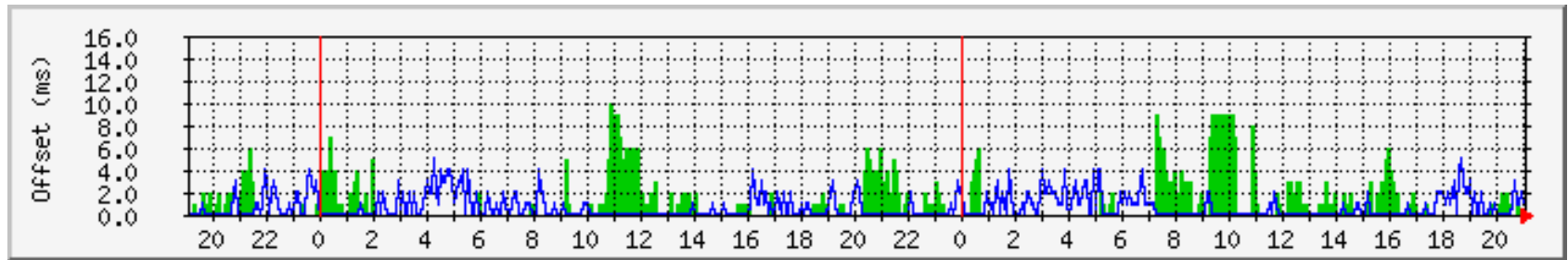


Sincronizarea timpului în rețelele de calculatoare - Protocolul NTP



Server de timp Stratum 1 - NTP1.usv.ro

Performante - OFFSET / GPS

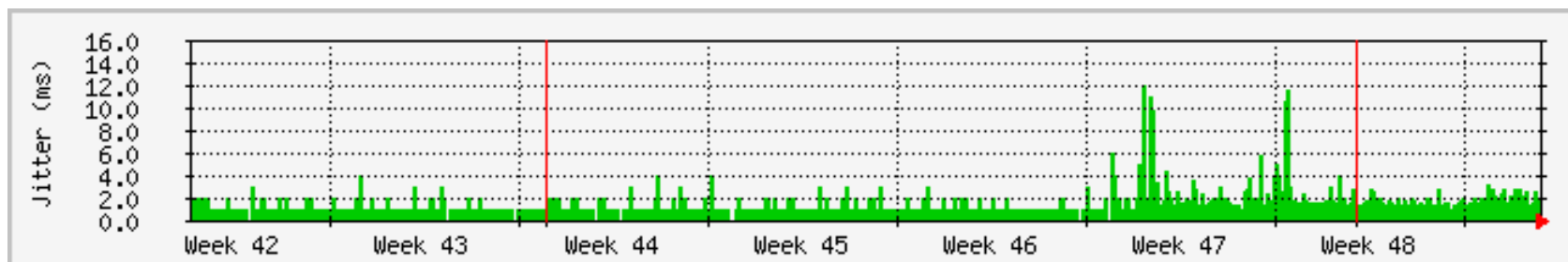
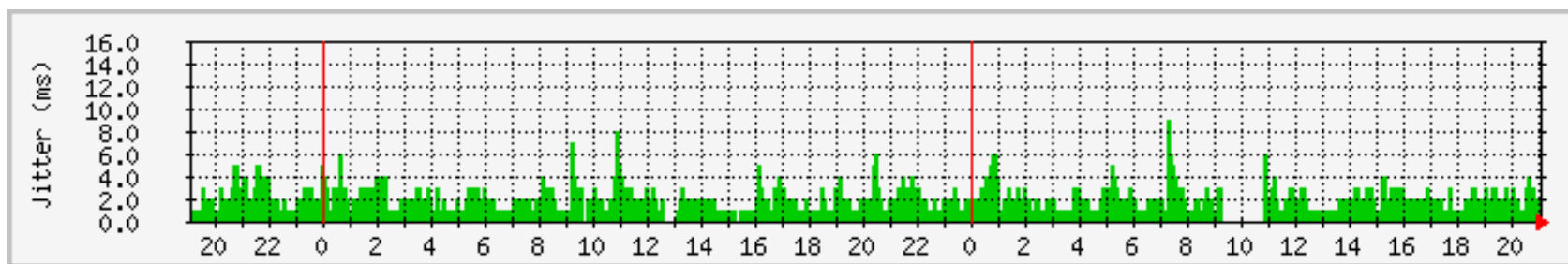


Sincronizarea timpului în rețelele de calculatoare - Protocolul NTP



Server de timp Stratum 1 - NTP1.usv.ro

Performante - JITTER / GPS

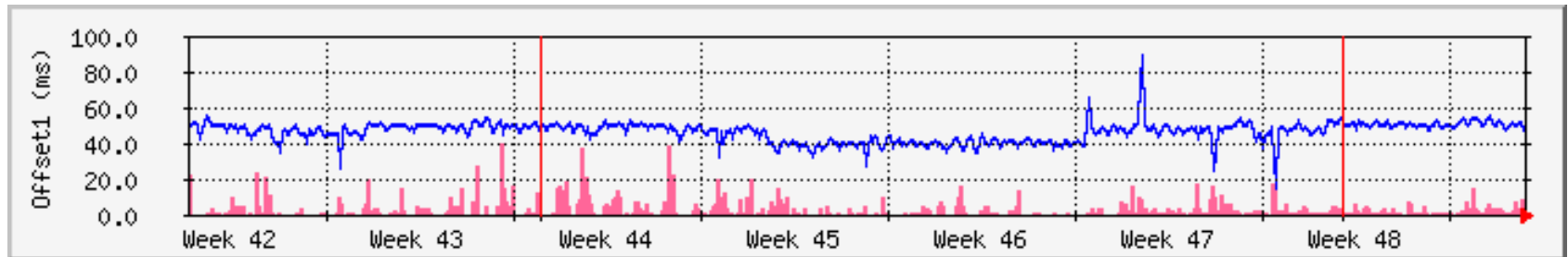
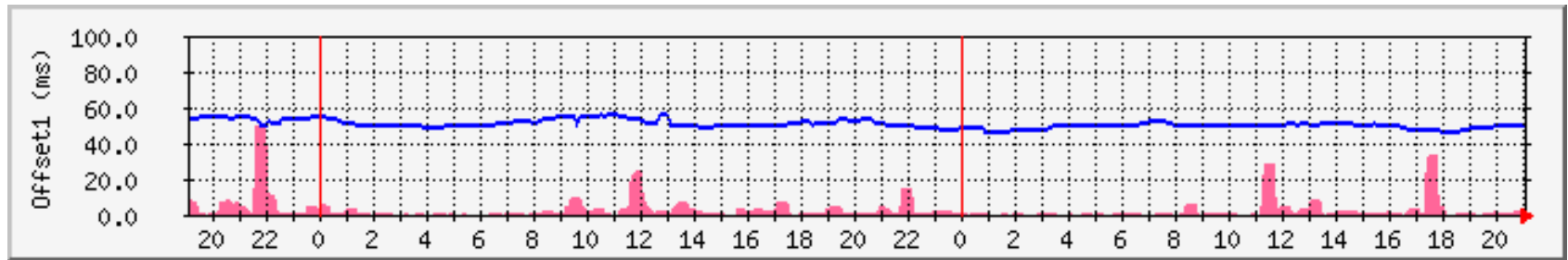


Sincronizarea timpului în rețelele de calculatoare - Protocolul NTP



Server de timp Stratum 1 - NTP1.usv.ro

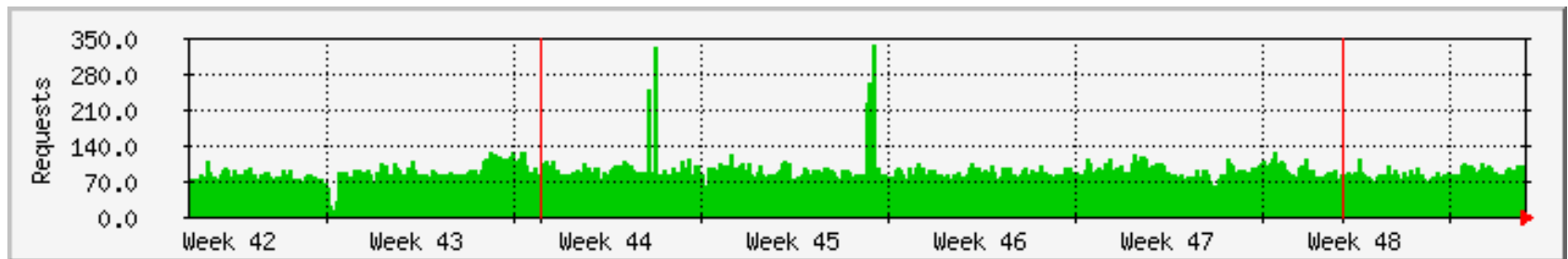
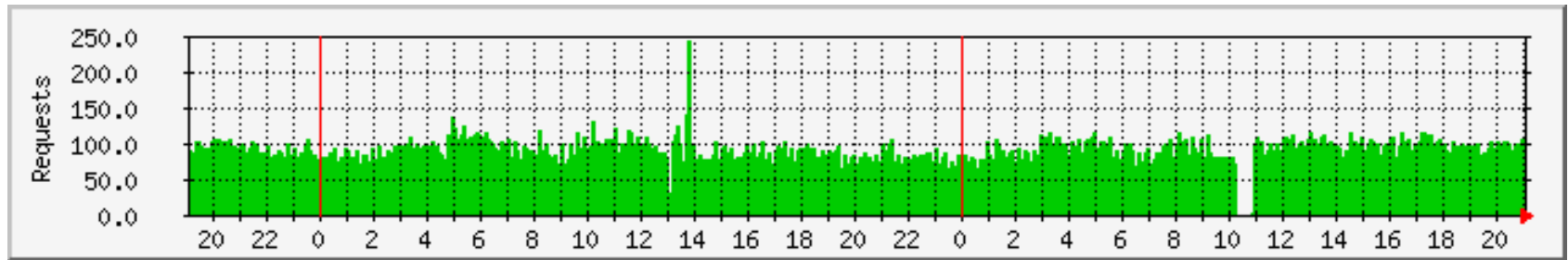
Performante - OFFSET / time.nist.gov





Server de timp Stratum 1 - NTP1.usv.ro

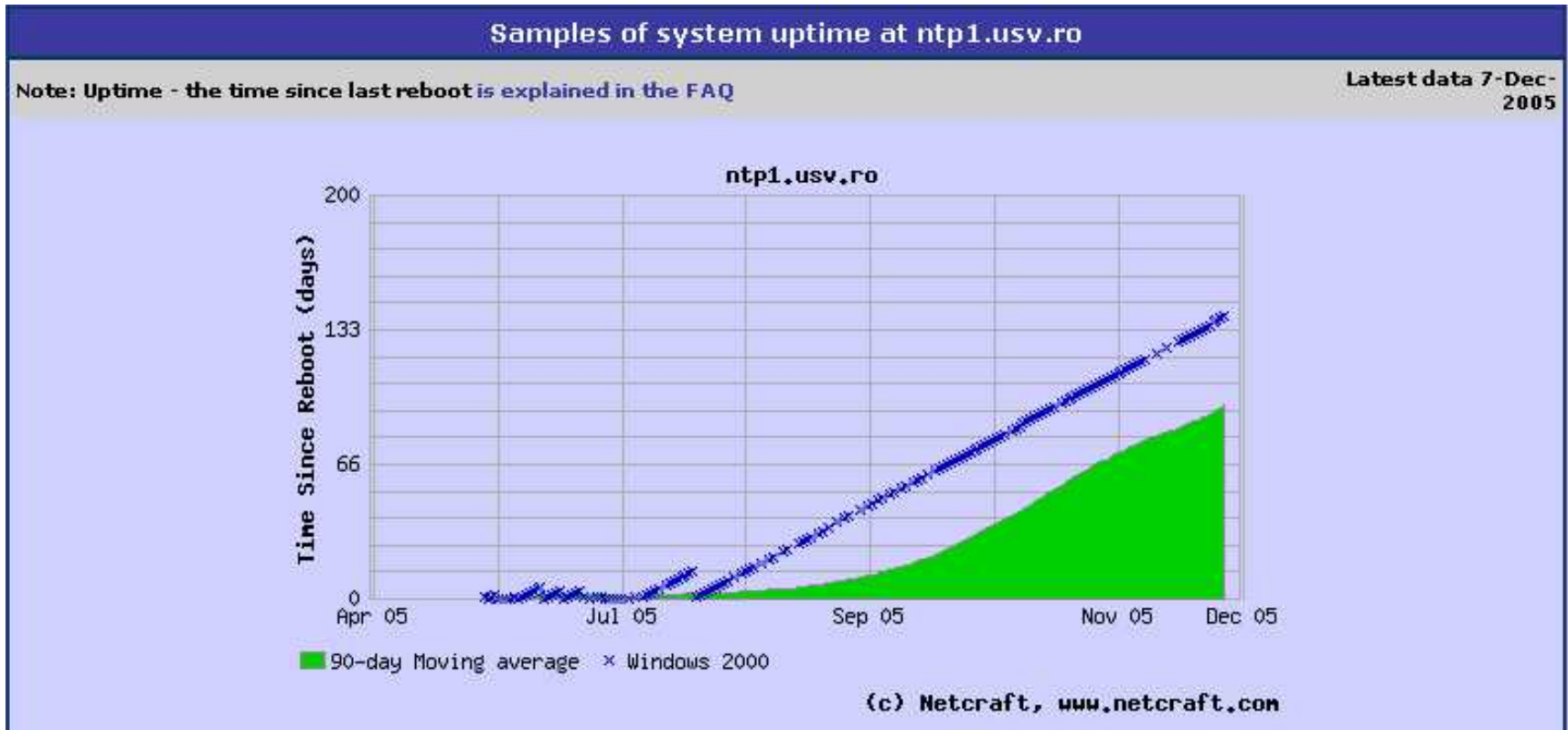
Performante - clienti



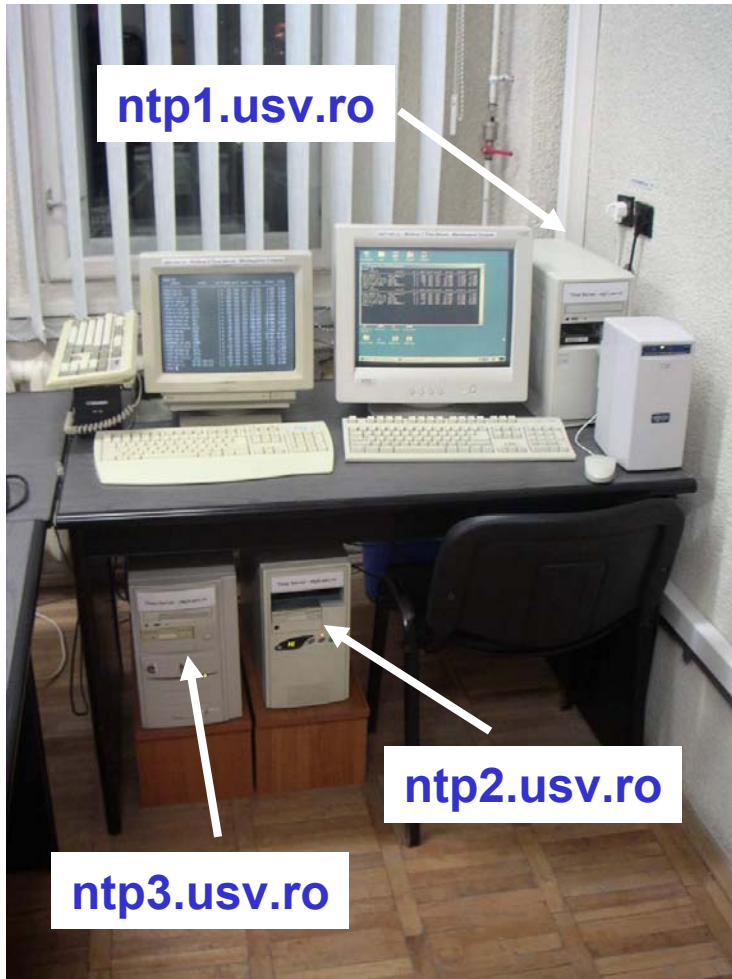


Server de timp Stratum 1 - NTP1.usv.ro

Performante - uptime



Servere NTP - Stratum 2



NTP2.usv.ro - 80.96.120.252

- Procesor Intel P1/200MHz
- Memorie 80MB
- HDD 10GB
- FreeBSD 5.4 (nanokernel)
- ntp v.4.2.0_1

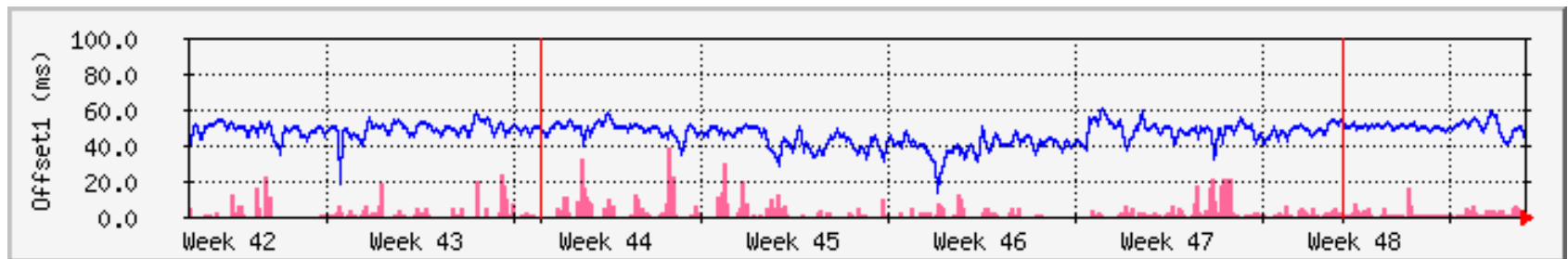
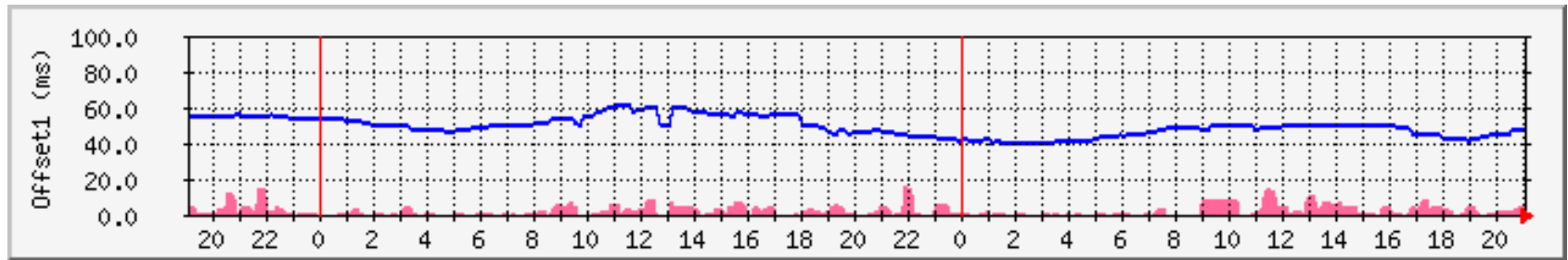
NTP3.usv.ro - 80.96.120.249

- Procesor Intel P2/266MHz
- Memorie 64MB
- HDD 20GB
- FreeBSD 5.4 (nanokernel)
- ntp v.4.2.0_1

Alimentare de rezerva: 2 ore

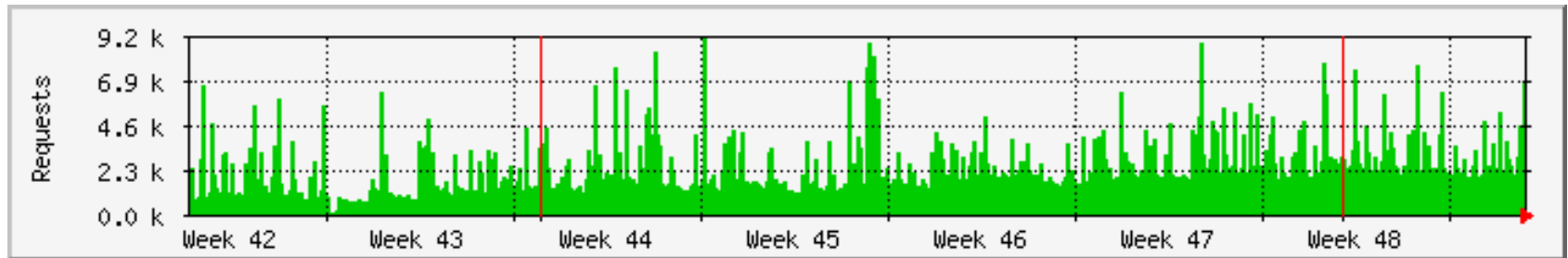
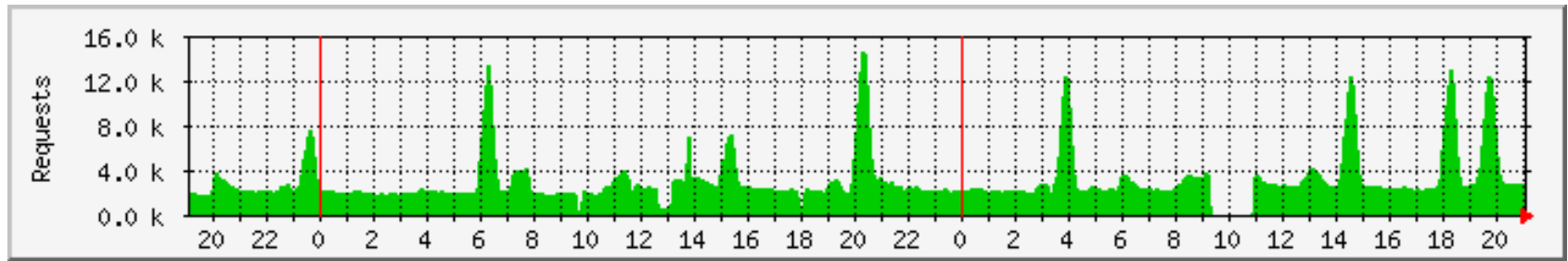
Servere NTP - Stratum 2 - Performante

Performante - NTP2.usv.ro - Offset / time.nist.gov



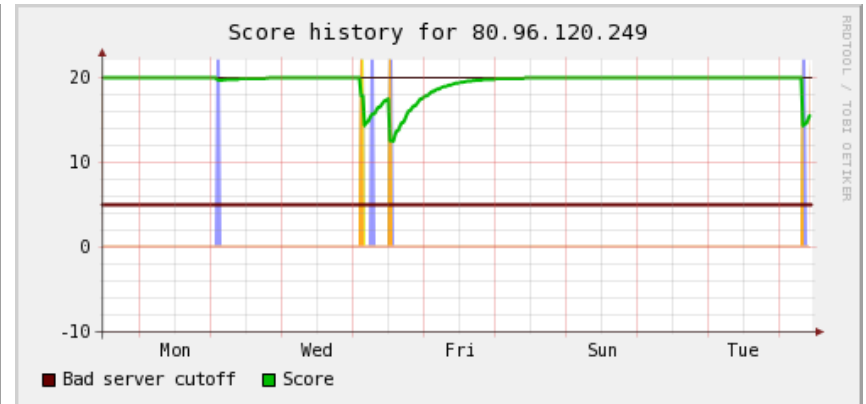
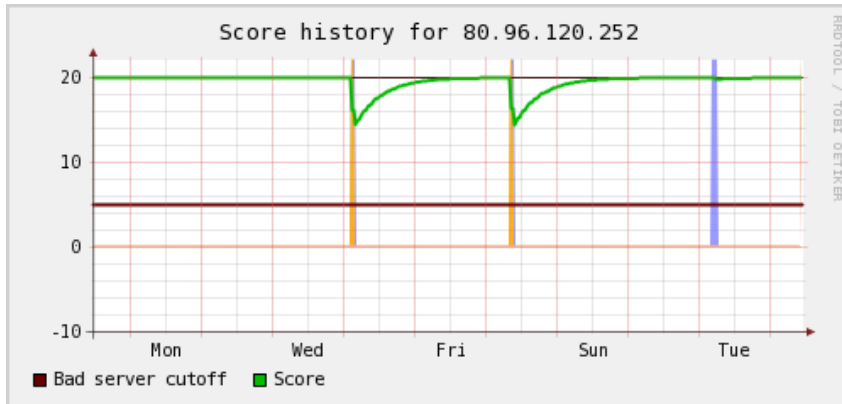
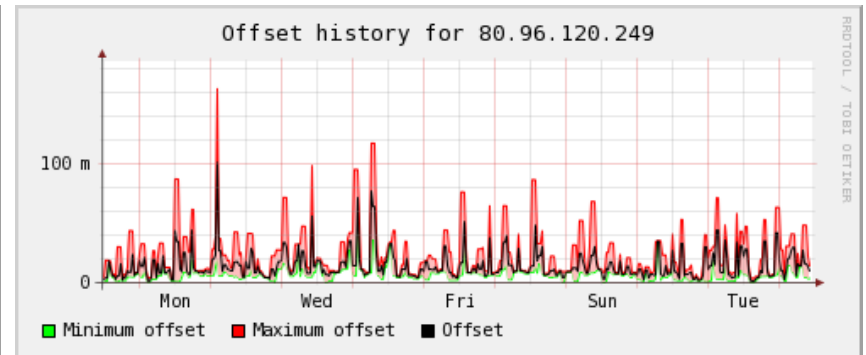
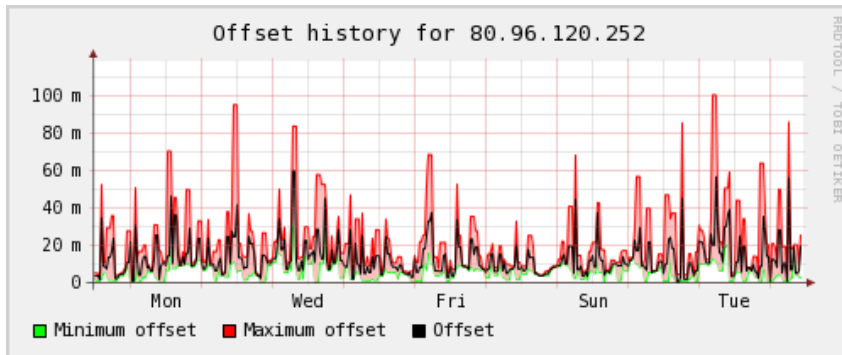
Servere NTP - Stratum 2 - Performante

Performante - NTP2.usv.ro - Numar de cereri



Sincronizarea timpului în rețelele de calculatoare - Protocolul NTP

RO.pool.ntp.org



Beneficii locale

Posibilitatea sincronizării timpului în rețelele de calculatoare pentru:

NTP1.usv.ro (Stratum 1)

- companii mici și mijlocii
- rețelele de cartier (>200 clienți)

NTP2.usv.ro și NTP3.usv.ro (Stratum2)

- utilizatori individuali

Detalii privind programele folosite la client se găsesc la adresa

<http://NTP1.usv.ro>

Resurse on-line

1. <http://www.ntp.org>
2. <http://www.eecis.edul.edu/~mills>
3. <http://www.pool.ntp.org>
4. <http://ntp.isc.org/bin/view/Servers/>



Directii de dezvoltare

1. Server Stratum 1 cu FreeBSD si sincronizare GPS cu iesire PPS (dec. 2005)
2. Server Stratum 1 cu FreeBSD, sincronizare GPS si etalon cu rubidiu (2006)

Intrebari ... ?