

13th TWSTFT WG Meeting

SATRE Software Releases

Delft

15 / 16 November 2005

Alexander Pawlitzki

e-mail: alexander.pawlitzki@timetech.de

web: www.timetech.de

TimeTech GmbH
Curiestrasse 2
D-70563 Stuttgart
Germany

Phone: +49-711-678 08-0
Fax: +49-711-678 08 99

Contents

1. Introduction	2	3.1.1. FTP fetch via the internet	7
2. Software Design Goals	3	3.1.2. FTP get via command line	9
2.1. SATRE software design goals:	3	3.1.3. Transfer via TFTP	10
2.2. Challenges in SW design	4	3.1.4. Last resort – TFTP command line utilities	11
2.3. Problems in the past	5	3.2. Copying / packing into flash memory	12
3. Update Procedures	6	3.3. Releasing the firmware files	12
3.1. Transferring files	6	3.4. When SATRE should be updated	14
		4. Version History	16
		5. Future Development	17

1. Introduction

Our software design guidelines

Updating software

Why?

How to do it?

Development roadmap

What did we do?

What will we do?

2. Software Design Goals

2.1. SATRE software design goals:

- **Compatibility**
 - Compatibility between all kinds of modems (single channel / multi channel)
 - Compatibility within version of the same S/W lifecycle
 - Only one development tree for all modems
 - Core parts (calculation routines, measurement routines) unchanged !!
- **Offloading of M&C equipment**
 - Data reduction where appropriate
 - Reducing data rate to M&C equipment
- **Stand-alone operation**
 - Automated scheduler
 - Results database (minutely results)
- **Real-time operation and integrity check**
 - Real-time TWSTFT calculation (serves as real time consistency / quality check)
 - Exchange of core-calibration data
 - Real-time identification of problems (time jumps, references etc.)
 - Remote stations in unattended operation (US network)

2.2. Challenges in S/W design

Why changing software?

- **Bug fixes**

We want to fix problems and make this available to all users
Software errors (i.e. timestamp problem) shall be fixed

- **Integration of new hardware and functions into the modem**

I/IOTIC (RefDelay measurement)
Single / double / triple channel modem
Automated scheduler
Real time TWSTFT and results database
Doppler acquisition and tracking (inclined satellites)

- **Workaround for non-availability of hardware during modem lifecycle**

main processor
PCMCIA for transferring data

2.3. Problems in the past

Output formats

- configurable
(**SATERM.FLD** file)
- output depends on user needs:
 - à every second
 - à raw values
 - or
 - à mean values
 - à every 10 / 60 seconds

```

SATRE TwSTFT Modem 328 . TimeTech GmbH 1994-20 | .14 Nov 05 14:33:15 + none
-----Modem Output Port Settings-----
Output Port      Protocol      Output String      Rate  Ext  TIC  HrD
-----
<1 TCP/IP LAN  >>ASCII      >>long             ><0  ><X  <136 <N
<2 Serial line >>ASCII      >>short            ><0  ><N  <0   <N
<3 TCP/IP LAN  >>DataOutput  >>short            ><0  ><N  <0   <N
<4 TCP/IP LAN  >>ANSI-Term  >>short            ><0  ><N  <0   <N
<5 UDP/IP LAN  >>UDP_BCast  >>short            ><0  ><X  <136 <N
<6 UDP/IP LAN  >>Syslog UDP  >>short            ><1  ><N  <0   <N
<^ Datafile    >>ASCII logfile >>long             >><15 ><N  <0   >
Rotate datafile hourly (N = daily)                                <N>
-----<X>-----
Output Types: short = 80 character terminal compatible
               long  = up to 200 characters
Xmit Rate:    output is sent every xxx (0.255) seconds
Ext = Y -> %0 [old] and %Tx, %Rx1, %Rx2 [new] for each Rx channel
          X -> %Tx, %Rx formats [new only, no old] recommended
          N -> %0 [old only], backward compatible, no new formats
Press <Alt>-<. > in Output-String field to get selection
-----<ESC> cancel | <Return> accept all
x3: --- Searching ---
    
```

Changing formats in the past were done due to

- new functions (IIOTIC measurements, cal values)
- migration from old single channel format (%0) to channel based format (%Rx)
- constant values (cal data) shall not be merged into periodic formats
- recorded output data shall be suitable for postprocessing
 - à config-ID, modem-ID, remote-ID etc. in the data stream

3. Update Procedures

The update consists of two steps:

- transferring the data onto the SATRE modem
Normally a SATRE firmware update is one packed file (i.e. **UPDATE.EXE**)
- copying the files and ‘packing’ them onto the modem’s flash drive
Normally this is a batch file (**UPDATE.BAT**) which comes out of the update file.

3.1. Transferring files

The only way to transfer data onto the SATRE is the network link.
PCMCIA adapter chipset used in earlier modems is currently unavailable.

Integration of a SATRE modem into a network is done in different ways;
firewalls affecting network transfer.

File transfer requires integration of the modem into the station network.
DNS (name service) is not always available; use IP addresses instead.

3.1.1. FTP fetch via the internet

Ready-made script available, which can be accessed by the SATRE menu. This procedure covers the file transfer in a fully automated way.

```
=====enter IP address of update server=====
IP Address or Hostname : ftp.timetech.de
Host is reachable via Ping: <ping name OK>
select TFTP or FTP      : FTP
File to be transferred  : VX_XXX.EXE

----- applies for ftp update only -----
User account on Host    : satre
Pass (for logging only) : satre2002
Extract file after xfer : Y
chdir to (before ftp get) : update/vX_XXX
Cmd to be executed      : UPDATE.BAT
Upload-Dir for CFG-Report : config

===== <ESC> cancel | <Return> accept all =====
```

Problems:

- many modems are behind a firewall blocking ftp transfer
- many modems are in a separate network
`not capable of connecting to the internet

```

== SATRE TWSTFT Modem 328 . TimeTech GmbH 1994-20 | .14 Nov 05 14:48:58 x
|x Rcv| Rcv| Rcv| Measurement |isplay Global |et Modules | |
-----
Network Configuration
-----
new values      port  old values / alias
My IP Address   : 192.168.016.033  192.168.016.033
Netmask         : 255.255.255.000  255.255.255.000
Router Address  : 192.168.016.201  192.168.016.201
Name Server     : 192.168.007.001  router.timetech.de
UDP data target 1: 192.168.007.248  12544  192.168.007.248 : 12544
UDP data target 2: 192.168.000.200  12544  192.168.000.200 : 12544
NTP time server : 192.168.007.092  clean-roomrb.timetech.de
NTP backup server: 192.168.007.091  ntp1.timetech.de.7.168.192.IN-
Syslog server   : 192.168.007.250  192.168.007.250
LPR server (->lp): 000.000.000.000  000.000.000.000
TCP/IP Startup  : 2  TCP/IP stack
                  | 0 off      1 UDP      |
                  - 2 TCP/IP  3 BOOTP -
Access granted to: 010.*.*.*
                  172.016.000.000/12
                  192.168.*.*
                  Addresses: a.b.c.d
                  Subnets  : a.b.c.*
                              a.b.*.*
                              a.b.c.d/n
                  (n is subnet width)
-----
<ESC> cancel | <Return> accept all
    
```

SATRE network setup. When SATRE is powered up, it first restores its last known network settings (and uses last known IP address, even if running on BOOTP). These settings can also be used for command-line utilities.

3.1.2. FTP get via command line

If internet connectivity is not available, data can be fetched via a command line ftp client on the modem. It is available on the DOS command line. The network settings (IP address etc.) are preserved after the software quits.

The ftp client has the same commands as the windows / unix ftp client.

```
E:\NETZ\FTP ip_address_of_server
```

Transfer the files from TimeTech's ftp server onto a location inside your station network. Fetch the files with SATRE's ftp client.

Typically, place uploaded files on the modem into E:\TEMP.
This is the same location, where the automated procedure puts the files.
Unpack the update file (by calling **UPDATE.EXE**)
Then the update script (**UPDATE.BAT**) can be called manually.

Caveats:

- transfer files binary (BIN) à SATRE's client defaults to ASC mode!
- ftp client is case sensitive on the unix end, but not on the DOS end ...

3.1.3. Transfer via TFTP

TFTP (trivial file transfer) is a very simplistic protocol. It has no authentication mechanism (no user / password), so this is a possible security problem.

à normally TFTP ports are blocked via firewalls

à TFTP usually available only within the closed subnet

SATRE has a TFTP server, which is available, when the software is running. This can be used for uploading files.

Caveats:

- put SATRE into idle mode when uploading files
- upload speed is typically 5 to 10 kBytes/second.
A typical SATRE firmware image has ~ 1 MByte!
- Due to security reasons, every tftp upload to the modem must be confirmed!

3.1.4. Last resort – TFTP command line utilities

When SATRE main software can not be started, the network can be manually configured in the **E:\NETZ** directory.

The following tools are available there (usage like their unix counterparts)

- **PING**
as known in other operating systems
- **BOOTP**
tries to obtain a network configuration from a BOOTP/DHCP server
- **FTP** (see above)
- **TFTP** (see above)
- **TFTP SERVE**
starts a tftp server
- **INET STAT / INET DEBUG / INET CONFIG**
shows settings (IP addresses, errors etc.) from the loaded TCP/IP kernel

3.2. Copying / packing into flash memory

The SATRE file system consists of three parts

- firmware section (C-drive)
this drive holds the packed firmware
- configuration section / user data section (D-drive)
this drive holds all parts, which can be changed by the user
- working area (E-drive)
this is a volatile RAM drive, which gets set-up on system boot and gets filled with the firmware extracted from C: Any changes on the E-drive will be lost after the next reboot

Packing onto the flash drive is NOT performed by any update routine described above, because:

- if an update fails, one can cycle power on the modem and has exactly the LAST version
- one can 'try' an updated version without losing the original one

Packing is performed in the directory `E:\SATRE>` with the command `PACK`

3.3. Releasing the firmware files

TimeTech has set up a new ftp server

`ftp://satre.twstft.de`

user: `web1f4`

pass: `satre2002`

The 'old' server ftp.timetech.de will be maintained, but discontinued soon.

We put there

- firmware releases – including bug fixes
- version history, known issues etc.
- documentation and application notes

3.4. When SATRE should be updated

At one side

- keep the software in the field 'constant' (i.e. untouched)

But:

- make new functions available to others
- quick fix problems

Recommendation:

- major updates not more frequent than once per year
- defining of 'release versions', which will be kept in exactly this configuration on the server, so that the whole network can use this version. This version undergoes detailed testing and will include as much as possible feedback from the last period
- avoiding branches to ease maintainability of the software

```

== SATRE TWSTFT Modem 328 . TimeTech GmbH 1994-20 | .14 Nov 05 14:33:29 + none
Tx Rcv Rcv Rcv Measurement Display Global Set Modules
-----
----- Module and Software Revision Information -----
Module CPU-Ver CPU-Ser-# Mod-Ver Mod-Ser-# Firmware-Date FPGA Tun Ser-#
Tx 4.3 82 F/W 2 8.5 6, 0 3.10.1 20050929TX TXN4003
Rx1 3.1 9 F/W 2 8.0 33, 0 3.10.0 20051107RX RXN4003E 3.4 27
Rx2 3.1 8 F/W 2 8.0 55, 0 3.10.0 20051107RX RXN4003E 3.4 59
Rx3 3.1 10 F/W 2 8.0 34, 0 3.10.0 20051107RX RXN4003E 3.4 29
no GPS-Receiver installed
Module Version Ser-#
RefOsc 0.0 0 =
TIC 3.3 33 ExtBIOS @ E000
Main S/W Version 4.11.16h4 20051113p
S/W compile date 13.11.2005 15:41 MULTI4 FW 2.7 Hw 1.3 Ser [TA9340117 ]
CPU FW 2.1; Battery OK
----- Slave Board -----
II0: V020500-030630 timer 100us HD HD [IC25N030ATMR04-0] Ser [MRG2E1KBE]
IP 192.168.016.033 (00 80 0F 6E 30 B3)
TIC 2.1d XC 00:02

remote control by Terminal 192.168.004.180
Rx1: --- Searching ---
Rx2: --- Searching ---
Rx3: --- Searching ---
    
```

SATRE version screen (Display | *) showing hardware and software configuration.

4. Version History

Latest development areas (V4.8 to V.11) are

- automated schedules
capable of bi-hourly schedules
schedule and macro files uploadable by user commands
- IIOTIC (RefDelay) measurement
- Exchange of Cal-data (RefDelay, SysDelay etc.) via RF
to enable better real-time TWSTFT [ongoing]
- better characterisation
(thermal sensitivity, amplitude sensitivity) [ongoing]
- unified output format
to ease processing of single / multichannel modems
- data reduction (minutely measurements)

5. Ongoing Development

The following functions are under development:

- capability to acquire and track satellites in inclined orbits including TLE based prediction
- Rx outliers (delay spikes)
isolated spikes in tracking high chiprates in low noise conditions
(not relevant for 2.5 MChip links, but visible in high C/No 20 MChip links)
- new main processor
fully backward compatibility within the SATRE-4 software
continued removal of obsolete components
firmware on CF card – writable on every Windows based computer
à easy firmware exchange / S/W configuration control
- basic commanding / monitoring of remote unmanned stations
schedule upload, (limited) data retrieval