SALSA service manual: Reference document for SALSA support

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Abstract

SALSA-Onsala ("Such A Lovely Small Antenna") is a 2.3 m diameter radio telescope built at Onsala Space Observatory, Sweden, to introduce pupils, students and teachers to the marvels of radio astronomy. The sensitive receiver makes it possible to detect radio emission from atomic hydrogen far away in our galaxy, the Milky Way. From these measurements we can learn about the structure and kinematics of the Milky Way.

This document is not intented for users of SALSA. Instead it is intented for the support and maintenance of SALSA, as a document to collect instructions and useful notes about how the system works in detail and how to fix errors or perform certain support duties.

Coverimage: Image of the SALSA telescopes in Onsala.

Chapter 1

Basic maintenance

1.1 Remote power control

Sometimes it is needed to cut the power to a part of the SALSA system, for example to reboot the USRP. The SALSA electronics are connected to an electric outlet which can be remotely controlled via internet at `http://pwcontrol2.oso.chalmers.se\verb`

1.2 RIO

RIO 47200 from Galil comref: `http://www.galil.com/download/comref/com47xxx/index.html#cov`
Weather: http://www.oso.chalmers.se/weather/ Try to keep below 10m/s

1.3 Usage report

To compile a usage report, go to the Usage Report page on the admin pages in the SALSA portal. Then, enter date interval to select. Note that long interval, such as a year, may take a few seconds to load. When loaded, open up LibreOffice Calc. With the pointer, mark the table on the webpage and copy it. then Paste it in a Libreoffice Calc sheet. You now have a column with time for each booking. Problem is, the booking time should be doubled if we have two telescopes for the session. One way of doing this is the following¿ add a new colum besides the one with times. In one cell in this column, insert

```
=IF(OR(B246="Vale, Brage",B246="Brage, Vale "),A246*2,A246)
```

with 246 being the row numbers, change accordingly. Then drag downwards, and it will follow the relative cell paths, causing all duplicated bookings to show dopuble hours. Then, sum the new time column at the bottom, and you have a total time for your date range.

Chapter 2

System installation

In this chapter we describe how to set up a SALSA system from scratch. Currently only the software part is included, the hardware part will be added later.

2.1 Software

This log was written by Eskil Varenius 2015-11-16 as he re-installed all software on the computer vale from scratch. Below follows the polished log, where I have tried to improve the clarity of the text for easy reading. All commands in the terminal are in bold face. In general things should work as described, but there may be one or several reboots of the computer missing to read in config files etc. If you get stuck, try a reboot. This manual may also be useful for a client computer like brage which is not running the booking system server. In that case, large parts can be omitted, in particular setting up mysql and apache servers, and only a mysql client should be needed.

2.1.1 Pre-requisites

At the start of this, I had one completely clean computer (Dell Optiplex 760) and one Live-DVD of Linux Mint 17.2 Mate 64-bit. I also had a backup of the directories /opt and /var/www as well as a SQL-dump of the drupal database.

2.1.2 Installing Linux Mint 17

First I plugged in the internet cable and inserted the live-DVD. I had to press F12 when starting the system to get the boot menu, then wait a minute until I was sure that the computer had accepted the DVD, and then press Boot from dvd option. After some time, the Linux Mint Live environment was up and running, and I used the Install Linux Mint option on the desktop. I ran the guide with default options, since the hard-drive was clean no re-formatting etc. was needed. When the install finished the screen was black, probably because I left it long enough for the screen-saver timer to start, but no screen save was active. I had to press space on the keyboard to wake it up, and it then asked me if I wanted to restart or continue with Live DVD. I choose restart and was then told to eject install media and close tray. I choose `salsa_admin` as user and choose a new password to reflect the year :). The system now booted up all fine.

First thing I did was to choose not to display the startup dialogue all the time. Then I ran a complete update using the graphical software updater. Then I rebooted the system. To remove Mint Welcome screen for new users, which is only confusing to describe in the instructions for remote login, I ran sudo apt-get purge mintwelcome. Finally I installed the editor vim which I like to use to edit config files etc. by typing sudo aptitude install vim.

2.1.3 Network configuration

To make Vale resolve other local computers, as being able to write ssh brage instead of the ssh brage.oso.chalmers.se, manual config was needed. The file `/etc/resolvconf/resolv.conf.d/base` was edited to contain the following four lines

```
domain oso.chalmers.se
search oso.chalmers.se
nameserver 129.16.1.53
nameserver 129.16.2.53
```

Setting manual IP

The SALSA computers have two network cards: one to the outside world (public), and one used for the USRP/RIO units (local). The only important requirement is that for the USRP (local) the card has to do 1Gbps (i.e. 100Mbps is not enough). For the public network, vale has a dedicated IP-address, so I changed to manual IP using the graphical tools: Control center-¿ network connections -¿ Wired connection 1 -¿ IPv4. For easy reference I also changed the name of this connection to Public internet, as in connected to the outside world. The IP was set to Manual and one adress line was added (IP, netmask, gateway) as 129.16.208.184, 255.255.255.0, 129.16.208.1. (Brage has 129.16.208.20). I did not specify any DNS. For the local card I needed two lines of adresses since the USRP and RIO boxes were different: 192.168.10.10, 255.255.255.0, 192.168.10.1 for USRP, and 169.254.212.10, 255.255.255.0, 169.254.212.1 for RIO.

2.1.4 Setting up SSH-access

To be able to login remotely to Vale via SSH, I installed open-ssh server: sudo aptitude install open-ssh server and no further configuration was needed.

2.1.5 Install webserver and mysql database

I used apache2 as web server. Install by sudo aptitude install apache2. Then I replaced the contents of /var/www/html (only default index.html) with the backed up files, i.e. index.html and salsa-folder. I made sure of permission by running sudo chown -R www-data:www-data salsa/ in the /var/www/html-folder. Then I installed a mysql server by sudo aptitude install mysql-server and when prompted I choose the root password as the standard admin password. Then I installed phpmyadmin to handle mysql administration sudo aptitude install phpmyadmin, where I selected apache2 using space key and set the password to the admin password. I also installed mysql client, not sure if it was needed, as sudo aptitude install mysql-client.

Finally, phpmyadmin complained that so I solved it by running sudo php5enmod mcrypt and sudo service apache2 restart.

2.1.6 Creating MySQL users and tables

Now I logged in to vale.oso.chalmers.se/phpmyadmin as root. First I added the user `salsa_drupal`, with hostname localhost and selected the option Create database with same name and grant all privileges. Note that the username and password chosen here has to be match in the file /var/www/html/salsa/sites/default/settings.php line 567 for drupal to work, and in the crontab bash script for the handling of bookings to work. I now want to import the old database structure, but before doing so in phpmyadmin we need to allow large files to be imported, since the SQL-dump is around 240Mb. To up the limits, we edit the file /etc/php5/apache2/php.ini to say

```
upload_max_filesize = 512M
memory_limit = 512M
post_max_size = 512M
```

, and then we restart apache as sudo service apache2 restart. Now the import worked fine and the database was imported, along with the `salsa_archive` table. I now created the `salsa_archive` user and opened privileges for this user only on the archive table, using phpmyadmin edit privileges. This was done only for localhost access, and nicely returned the message `GRANT SELECT , INSERT , UPDATE , REFERENCES ON ‘salsa_drupal‘.‘salsa_archive‘ TO ’salsa_archive’@’localhost’;` as confirmation.

Enable access to booking system

To be able to read the mysql-database from another computer (i.e. not localhost) I need to add another user with name `salsa_drupal` but specify host=brage.oso.chalmers.se for brage. But, for this security layer to be considered, I first have to allow access from anything else than the default 127.0.0.1. this is done by editing the file /etc/mysql/my.cnf (on the server computer vale) and commenting the line bind-adress=127.0.0.1 followed by sudo service mysql restart. NOTE: this was also needed for the `salsa_archive` user to be able to send the new fits files.

2.1.7 Setting up Apache and Drupal

For drupal to work we need to make sure the login credentials are OK in the file settings.php. I also made sure the settings.php file had proper permissions as sudo chown go-rwx settings.php. Just checking the webpage showed that I could not access anything except for the front page. Several issues had to be sorted out. It seems Drupal needs the gd library, so we need to install it by sudo aptitude install php5-gd and then sudo service apache2 restart. I then found out that drupal needs `mod_rewrite` enabled in apache2, so I did sudo a2enmod rewrite and sudo service apache2 restart to enable it. After this I needed to modify /etc/apache2/apache2.conf to allow overrides, else the CleanURL-config in Drupals .htaccess file will not work. So I changed the section on /var/www/ in the apache config file to say AllowOverride All instead of none, i.e.

```
<Directory /var/www/>
       Options Indexes FollowSymLinks
       AllowOverride All
       Require all granted
</Directory>
```

For future drupal maintenance, the software drush is very useful, so I installed it as sudo aptitude install drush. Finally I changed the password of the web-admin account.

2.1.8 Install and configure Cendio ThinLinc

This is a wonderful remote desktop service which is free for less than 10 simultaneous users, perfect with SALSA. First I requested the latest version on the cendio webpage and got an email where I could download the file tl-4.5.0-server.zip. This was unzipped and I ran the graphical installer Thinlinc Server installer. Following instructions, this also runs a setup utility afterwards, where I choose password for the web admin tools etc. The utility installs a lot of missing dependencies, the only thing I skip is to configure printers. ThinLinc can restrict user access in terms of groups. It is easy to modify the group membership of users via the cronjob script, so I created a group where I place the current user(s) who can login to the computer using the ThinLinc webaccess as `sudo addgroup salsa_weblogin`. This is then read by ThinLinc after modifying the file

`/opt/thinlinc/etc/conf.d/vsmserver.hconf`

where I set `allowed_groups=salsa_weblogin`. Now I want to tailor the software to SALSA. First is to remove the welcome windows by setting `show_intro=false` in

`/opt/thinlinc/etc/conf.d/profiles.hconf`

I also replaced Cendio thinlinc with SALSA Vale in short welcome lines. Then I want to make the login-page that users see a bit more SALSA-like. This page is reached at vale.oso.chalmers.se:300. First I edit the welcome page by editing the file

`/opt/thinlinc/share/tlwebaccess/templates/main.tmpl`

with custom replaced html. It should be possible to use the templates in a better way, rather than replacing , but this works. I also also added logo.png to the folder

`/opt/thinlinc/share/tlwebaccess/www/images`

to show SALSA logo on the login page. Now ThinLinc was ready for use!

2.1.9 Setting up the cronjob

The SALSA booking system works by crontab running a bash-script every minute to check for new bookings. This script needs some software, e.g. members which was installed as sudo aptitude install members. From the backup directory (or from github repo with appropriate modifications) I then copied the crontab files to /opt/salsa. I also copied the skel-files which

will be used by the cron-script to place desktop shortcuts to the control program. For this, an icon was also included in the /opt/salsa directory. I also needed to add the group `salsa_users` by running `sudo addgroup salsa_users`. The crontab could now be ran, and was started by using sudo crontab -e, and adding the line:

```
*/1 * * * * /opt/salsa/crontab/update_salsa_access_from_drupal.sh
```

at the bottom of the file.

2.1.10 Installing the SALSA control software

The SALSA control software can be obtained from Eskil Varenius github:

```
git clone https://github.com/varenius/salsa.git salsa.git
```

The files in the folder `/Control_program` was now copied to /opt/salsa/controller. The default config file was renamed to SALSA.config and then edited with computer/telescope specific settings. To make SALSA easily accessible by all users, the global configuration file /etc/profile was edited to append the PATH command

```
export PATH=$PATH:/opt/salsa/controller/
```

To make the SALSA python software run, the following was needed sudo aptitude install python-tk python-scipy python-astropy python-mysqldb python-dev python-matplotlib python-pip Then, using pip (installed above) the following two python modules were installed sudo pip install pyephem; sudo pip install tendo;

Make sure that the SALSA item in the /opt/salsa/controller is a symbolic link. Sometimes, when copying, it may be replaced with an actual python file. This will work, but then when updating the software it will not be updated and problems may arise. To create the symbolic link to main.py, use sudo ln -s main.py SALSA.

The SALSA program can now be started using SALSA in a terminal (after logging out and in again), or via /opt/salsa/controller/main.py.

Done!

2.1.11 Backup

We want SALSA to be backed up. Currently this is done via root-access using a public ssh key which I got from Glenn Persson in Onsala. By default, root-login was enabled without-password in ssh-config so no changes needed apart from adding the public key to `/root/.ssh/authorized_keys`. Note that the folder .ssh and files had to be created. Permissions were set using `chmod 700 .ssh` and `chmod 600 .ssh/authorized_keys`. Backed up folders (as of 2015-11-17) are

```
/home/salsa_admin/
/opt/salsa/
/opt/thinlinc/
/var/lib/mysql/
/var/www/
```

2.1.12 Setting up GalilTools for RIO development

To develop new features it is useful to communicate directly with the RIO using the software GalilTools available from Galil. Downloaded from

`http://www.galil.com/download/software/galiltools/linux/`

I used the file `galiltools_1.6.4_amd64.deb` from the folder Ubundu 14.04. and installed with `sudo dpkg -i galiltools_1.6.4_amd64.deb` and then i could start the software using only galiltools in a terminal.

2.1.13 Qt-designer for graphical UI development

I use the graphical designer software called qt4-designer to construct the SALSA GUI. It is installed by typing sudo aptitude install qt4-designer. Then, the SALSA user interface is edited by typing `designer SALSA_UI.ui`. Once saved, the designer file needs to be converted to python code. This is done using the pyuic tool, which first has to be installed through `sudo aptitude install pyqt4-dev-tools`. Then, one may run `pyuic4 SALSA_UI.ui > UI.py` to update the UI.py file. Possible hooks for buttons etc. are implemented manually in main.py.

2.2 Obtain HTTPS certificates

This section describeds How to install HTTPS certificates for SALSA. This is needed to avoid warnings when connecting through the ThinLinc HTML5 browser client. The following commands are a mix of brage/vale commands. Make sure to change the compute name accordingly, e.g. to either brage or vale in all such references.

2.2.1 Create and install certificates

We follow the instructions at https://letsencrypt.org/, i.e. us the certbot script.

```
sudo mkdir /opt/certbot
cd /opt/certbot
sudo wget https://dl.eff.org/certbot-auto
sudo chmod a+x certbot-auto
sudo ./certbot-auto
```

Answer yes to install packages. Add email salsa.onsala@gmail.com. Choose not to share email adress. Agree to terms of service. Enter domain brage.oso.chalmers.se or vale.oso.chalmers.se Finally, when prompted, choose alternative 1: Easy - Allow both HTTP and HTTPS access to these sites.

Set correct file permissions

For some reason, certificate file permissions are set to 644 instead of 600 by the certbot script. ThinLinc requires 600 to run, so we change:

`sudo chmod -R 600 /etc/letsencrypt/archive/brage.oso.chalmers.se/`

2.2.2 configure ThinLinc

Edit Thinlinc config files

To use cert files, edit `/opt/thinlinc/etc/conf.d/webaccess.hconf` to say

```
cert=/etc/letsencrypt/live/vale.oso.chalmers.se/fullchain.pem
certkey=/etc/letsencrypt/live/vale.oso.chalmers.se/privkey.pem
```

To make sure hostname is correct (else thin linc will redirect to use IP adress, for which cert is not valid), edit the file `/opt/thinlinc/etc/conf.d/vsmagent.hconf` to say

```
master_hostname=brage.oso.chalmers.se
agent_hostname=brage.oso.chalmers.se
```

Restart ThinLinc

ThinLinc needs to be restarted to read new configuration files.

```
sudo service vsmserver restart
sudo service vsmagent restart
sudo service tlwebadm restart
sudo service tlwebaccess restart
```

NOTE: If the above do not solve the issue, try rebooting to make sure all is restarted.

2.2.3 Restart Apache

Apache needs to be restarted to red new config:

```
sudo service apache2 restart
```

2.2.4 Add crontab entry to update certificates

Certificates from Lets Encrypt are valid for 90 days. To automatically update the certificates, we add a cronjob by running `sudo crontab -e` and adding

```
# Update httos-certificates at 02:23 every night
23 2 * * * /opt/certbot/certbot-auto renew --quiet --no-self-upgrade
24 2 * * * chmod -R 600 /etc/letsencrypt/archive/vale.oso.chalmers.se/
```

Second line needed because else thinlinc client wont start, as cert-files have read permissions.

2.2.5 Troubleshooting

If you need to remove all Let's encrypt files, e.g. to start over, run

```
rm -rf /etc/letsencrypt /var/log/letsencrypt
/var/lib/letsencrypt ${XDG_DATA_HOME:-~/.local/share}/letsencrypt
```

2.3 Hardware

2.3.1 RIO

No drivers or files are needed for the RIO because we are using telnet for that. We can however install the *GalilTools* software to communicate with the RIO for e.g. troubleshooting.

2.3.2 USRP

For the USRP to work we first need drivers. These can be installed by To get GNUradio and USRP things:

```
sudo aptitude install gnuradio libuhd-dev libuhd003 uhd-host
```

The USRP also need some extra settings, else it will complain and suggest one to run the commands `sysctl -w net.core.rmem_max=50000000` and `sysctl -w net.core.wmem_max=1048576`. But, this only works temporarily, I need a permanent fix for all users. From the USRP documentation it is said that this could be fixed by editing the file /etc/sysctl.d/uhd-usrp2.conf to contain

```
# USRP2 gigabit ethernet transport tuning
net.core.rmem_max=50000000
net.core.wmem_max=1048576
```

While doing this, we can also get rid of the USRP warning Unable to set the thread priority. by adding, at the end of the file /etc/security/limits.conf, the following lines:

```
@salsa_admin    -    rtprio    99
@salsa_users    -    rtprio    99
```

USRP N200 firmware update

If the USrp comlains that FIRMWARE FPGA is too old, e.g. with *Please update the firmware and FPGA images for your device*, then update the firmware. This can be done in two steps. First, run

```
/usr/lib/uhd/utils/uhd_images_downloader.py
```

and then run

```
uhd_image_loader --args="type=usrp2,addr=192.168.10.2,reset"
```

where the IP is the IP of the USRP which needs to be updated. Instructions taken from `https://files.ettus.com/manual/page_usrp2.html`