How to build an Acquisition System with Samba

The Installation Kit for Samba comes in 2 parts, plus a third one optional dedicated to RedPitaya-based acquisitions:
1. This guide, to be open and read first: "**HowToInstallSamba.pdf**";
2. A pack which contains the entire Samba stuff: "**Pack_NEWSG.tar**". Use of this pack is described in this guide.
3. A pack to fill a µSD card you need if you use a RedPitaya with Samba: "**RP30.img**".

1. Network configuration for the computer

First of all, your computer needs to have an access to 2 different networks:
i) the Acquisition Network,
ii) the Public Network.

The *Acquisition Network* is the way to access the data that your ADC box delivers. In principle, there should **not** be another device connected to this network, unless it participates also to the acquisition (e.g. for the slow control).

The *Public Network* allows to exchange run data, various information, to get some help from the rest of the Collaboration (and the world…), and above all to get all the components of the Acquisition System!. At the opposite of the Acquisition Network, this one is managed at your institute level. Request the IP information from your network manager.

However, it's up to you to setup these 2 networks in the proper way.

1.1 Hardware issues

You need, then, 2 physical ethernet ports.

At least one port should be able to transfer 1Gb/s. This excludes the WiFi and the USB-to-ethernet connectors. This port will be dedicated to the Acquisition Network.

The other port can be whatever else.

Usual combinations are (in the *acquisition* then *public* order):
- the built-in RJ45 + the Wifi;
- or a Thunderbolt-to-ethernet (or USB3-to-ethernet) connector + an USB-to-ethernet connector;
- or a Thunderbolt-to-ethernet (or USB3-to-ethernet) connector + the Wifi;
- or a first built-in RJ45 + the other one, if you have 2 of them (as for some MacMinis).

1.2 Software setup

On a Mac, under the leftmost apple icon (), open "Network settings > Network preferences"[1]. Try to identify your 2 ports, named "services".

In order to make the connections from outside easier, the Public access should be the first in the list of all services. At the bottom of the leftmost panel, click on the ⚙ then "Define service order" to be able to push the Public interface at the top of the list, and to push the Acquisition interface in the second position.

Select then the Public access. If it is via WiFi, you have nothing special to do more at this level. In the other cases, probably you should have been told to configure it via DHCP. If so, on the first line, "IPv4 configuration", select DHCP and that's it. If the network manager needs our MAC address, go to "Advanced" then select "Hardware": you should have this address, shown at the first line. The whole configuration of this service will be automatically filled as soon as the connection is physically achieved (WiFi activated, or ethernet cable connected).

Select now the Acquisition access. As this is a pure "private" network, its setup is to be completed manually, like as follows:
- IP address (it's *yours*): **192.168.*x.y*** where $0 \leq x \leq 7$ and $2 \leq y < 253$ [2]
- Sub-network: **255.255.248.0**
- Router: 192.168.0.1 (actually not quite applicable).
- DNS server: not applicable, forget it.

⚠ *Your* IP address **should not** be the same as the ADC box one. See the following §3 ("*Preparing the ADC box*") to find this address.

⚠ Mind that your Public Network address may be also in the form *192.168.x.y*. If x > 7, no problem anyway. If $x \leq 7$, consider the following chart:

If x = 2, this is somehow catastrophic. Try to negotiate an other network, orthogonal to "192.168.2/24". If not possible, at the end send a mail to michel.gros@cea.fr...
If $x \neq 2$,
- Set the Acquisition IP address to **192.168.*2.y*** where $100 \leq y < 253$,
- Set the Acquisition sub-network to **255.255.255.0,**
- Set the Acquisition router address to **192.168.2.1**

[1] may be not the exact *French to English* translation… this remark applies for all the document!
[2] other constraints on *x* and *y* are explained below

Note that in order, for these network services, to get the green light, the Wifi has to be activated or the "public" cable connected, and the "acquisition" cable connected to a *running* ADC box as well.

2. Installing Samba and the experimental setup

There is an infinity of ways to organize the files related to the Acquisition System, SAMBA. But, if you are a beginner, the best is to adopt the "standard" installation in the following way[3]:

i) under a shell (e.g. with Terminal), create a folder, preferably just in your top directory, preferably called "`Samba`" or "`Acquis`" (example: from `$HOME`, enter "`mkdir Samba`"). Let's refer to it by <`my_samba_folder`>.
ii) "`cd`" to it;
iii) download the Samba Pack dedicated to NEWS-G: `Pack_NEWSG.tar`;
iv) move the Samba Pack inside: "`mv <my_downloads_folder>/Pack_NEWSG.tar .`";
v) untar it: "`tar xvf Pack_NEWSG.tar`";
vi) install stuff with the standard script: "`./executables/install_std`";
vii) make the Samba executables directly accessible from shell: "`cp ./executables/tcsh_login ../.login`"
viii) set *tcsh* as the default login shell for Terminal: "`chpass -s /bin/tcsh`" (you will have to supply your password)
ix) if possible, enter "`sudo cp executables/sysctl.conf /etc`" (you will have to supply your *administrator* password)
x) Icons appeared in your Dock. Click on "StartSamba" and you will see Samba running, with an emulation of the detector. You can begin to play with it, eventually displaying the built-in Generator to get events.

Some documentation is available in the folder `docs`. For instance:

- `FormatSambaV3.pdf` : Format of the run files produced by Samba.
- `libarch` : A library to read Samba runs, and an example of using it.
- User's guide for the Saclay's ADC box, named "CALI".

Note that the *current* shell has not yet the direct access to the acquisition-related executables. The next ones will have it. So you may now exit this current shell, and open a new one.

3. Preparing the ADC box

3.1 The CALI

The CALI is a plug-and-play device. Only connect the ethernet cable, between it and the Acquisition port of the computer, and plug the power supply (5V, 6A). Nothing more to do, to make it delivering data. Its address is **192.168.2.*y***, where *y* is its serial number, also engraved on one of its face.

However, have a look on the User's Guide (in the folder `docs`) in order to manage the gain and baseline for each input.

3.2 The RedPitaya

The RedPitaya has to be programmed, and the appropriate programming file is to be obtained separately, as it's pretty big. The Installation Kit includes "**RP30.img**", which by the way will give your RedPitaya the fixed address **192.168.2.30**. So:

i) Connect a µSD card (16MB) to your acquisition computer (eventually through a µSD to SD connector);
ii) Launch the ApplePiBaker application (inside the folder "<`my_samba_folder`>`/executables`");
iii) The `Admin password` requested is ***your*** password (you are supposed to be an *administrator* of your Mac);
iv) Don't forget to select your drive in the top-left panel (hopefully, this should not be the System drive);
v) Best to begin by a reset of your SD card: click on the "`Prep for NOOBS`" button;
vi) When finished, supply the file "**RP30.img**" inside the "`IMG file`" input, at the top-right of the window;
vii) Check "`Auto eject after successful restore`" (right below the previous input);
viii) Click on the "`Restore Backup`" button (right above the previous input);
ix) **When finished**, remove the µSD card and insert it into the appropriate connector on the RedPitaya;
x) Connect the ethernet cable between it and the Acquisition port of the computer, and plug the power supply.

4. Taking real data

The current pack is designed to directly run with a Redpitaya with the above address. However the setup has, at the time of the installation, the option to simulate the data (in order to allow a quick check that all is well installed). To swap to a real data taking, do the following:

i) Open "<`my_samba_folder`>`/setup_NEWSG/Hardware/Dispatcher`";
ii) On line 4, replace "`simule`" by "`valide`", and save (and close) the file. Relaunch Samba.

Samba is then ready to take data from both inputs of the RedPitaya.

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[3] by the way, this will simplify my interventions to help you further...