Prototype Plan for OS Deployment on Nodes

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[The installation of PSS hardware requires the deployment of new versions of the software system (OS and custom code) to a large number of nodes: MID count will be 500, and LOW 166. The manual approach to install one machine a time is of course vastly inefficient, as all nodes will share the same system, and we could have differences only in few configuration files.
The PSS team chose a structured approach, with some possible alternatives. In next sections we will present the procedure layout and some details of different alternative approaches tailored to the PSS Prototype, in order to gain the experience needed for the deployment of the final PSS engine.]

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LIST OF ACRONYMS AND ABBREVIATIONS

CDR	Critical Design Review
CSP	Central Signal Processor (Element or Consortium
DDD	Detailed Design Document
DRD	Document Requirements Descriptions
FPGA	Field Programmable Gate Array
GPU	General Processing Unit
PIP	Physical Implementation Plan
PSS	Pulsar Search Sub-element
OS	Operating System
SKA	Square Kilometre Array
SKAO	SKA Organisation (or office)

1 INTRODUCTION

Each key prototyping activity at the sub-element level during pre-construction will produce a Prototyping Plan, a Prototyping Test Report, and maintain the equipment, software, firmware etc. that was used to conduct the prototyping activity under configuration management. The Prototyping Plan will follow DRD-26. The Prototyping Test Report will follow DRD-24.

A Prototyping Test Report summarises the findings of a Prototyping Plan, including the scope of the test, the test procedure, test results, and conclusions concerning the conformance of the test results.

It is expected that prototyping will be a significant activity in the following CSP work packages:

- 1.2.28.n SKA.TEL.CSP.SE-STG1.TECH.XXX and 2.2.28.n SKA.TEL.CSP.SE-STG2.TECH.XXX technology work packages,
- 1.3.1.2 SKA.TEL.CSP.CBF-STG1.LOW.PIP and 2.3.1.2 SKA.TEL.CSP.CBF-STG2.LOW.DD correlator for SKA1-Low Array,
- 1.3.2.2 SKA.TEL.CSP.CBF-STG1.MID.PIP and 2.3.2.2 SKA.TEL.CSP.CBF-STG2.MID.DD correlator and central beamformer for SKA1-Mid Array,
- 1.3.3.2 SKA.TEL.CSP.CBF-STG1.SUR.PIP and 2.3.3.2 SKA.TEL.CSP.CBF-STG2.SUR.DD correlator for SKA1-Survey Array,
- 1.4.1.2 SKA.TEL.CSP.NIP-STG1.PSS.PIP and 2.4.1.2 SKA.TEL.CSP.NIP-STG2.PSS.DD non-imaging processor pulsar search,
- 1.4.2.2 SKA.TEL.CSP.NIP-STG1.PST.PIP and 2.4.2.2 SKA.TEL.CSP.NIP-STG2.PST.DD non-imaging processor pulsar timing,
- 1.5 SKA.TEL.CSP.CLK-STG1 and 2.5 SKA.TEL.CSP.CLK-STG2 clock and timing distribution,
- 1.6 SKA.TEL.CSP.LMC-STG1 and 2.6 SKA.TEL.CSP.LMC-STG2 local monitoring and control.

Other work packages may also require prototype activity to achieve TRL, including mostly analytical prototypes associated with modelling activities. The .TECH work packages are particularly intended for extensive prototyping activity, particularly the development of physical and highly-focused prototypes for specific technologies. The PIP and DDD will then use the outcomes from those (shared) prototypes, integrating them with prototypes specific to individual work packages to develop larger sub-element integration prototypes.

A first draft of a Prototyping Test Report is included at the 50% interim deliverable release. The 90% release may provide the Prototyping Test Report and all configuration management artefacts that prove the prototype configuration is known and the equipment is available. The report is reviewed at the sub-element CDR.

1.1 Purpose of Document

The purpose of this document is to describe the Prototyping Test Results for the key prototyping activity of the the deployment of a new versions of the PSS software system (OS and custom code)at the Pulsar Search Sub-element level during pre-construction by the PSS design team.

1.2 Scope of Document

This document describes the prototyping test results for the PSS as described. Further detail of the scope of the test is described in Section **Error! Reference source not found.**.

1.3 Intended Audience

This document is expected to be used by the CSP Element Consortium Engineering and Management Team, the SKAO System Engineering Team, and the SKAO CSP Project Manager.

1.4 Document Overview

Section 1 introduces the purpose, scope and intended audience for this document.

Section 2 lists applicable and reference documents.

Section 3 provides detail on the scope of the prototype.

Section 4 provides the procedure for the prototype testing.

Section 5 provides the test results from the prototyping activity.

Section 6 provides the test issues and related actions arising from the prototyping activity.

Section 7 summarises the conclusions from the prototyping activity.

Appendix A contains intellectual property declaration.

2 APPLICABLE AND REFERENCE DOCUMENTS

2.1 Applicable Documents

The following documents at their indicated revision form part of this document to the extent specified herein.

Table 2-1: Applicable Documents

Ref No	Document/Drawing Number	Document Title	Issue Number
None			

2.2 Reference Documents

The following documents provide useful reference information associated with this document. These documents are to be used for information only. Changes to the date and/or revision number do not make this document out of date.

Table 2-2: Reference Documents

Ref No	Document/Drawing Number	Document Title	Issue Number
None			

3 PROTOTYPE SCOPE

3.1 Sub-element Technology

This work is relevant to the Deployment plan of the OS to the nodes.

3.2 Scope of Prototype

In this report, we present a few approaches to the deployment of a new version of the software system (OS and custom code) to a large number of nodes: Low=166 and Mid=500. The manual approach to install one machine at a time is vastly inefficient, as all nodes will share the same system, and there could be differences only in a few configuration files. This report investigates a structured approach, with some possible alternatives. In the next sections, we will present the procedure layout and some details of different alternative tools required.

4 TEST PROCEDURE

4.1 The Deployment Procedure

The deployment procedure runs through the following steps:

1. Installation of a complete system on a *Master* machine. In this phase the OS, all the FPGA and GPU drivers, the ancillary/supporting tools, the LMC code and the pipeline software will be installed on a machine.
2. Save of the *Master* machine disk image in a compact form inside a portable disk/USB thumb.
3. Deploy of the *Master* machine disk image to a large number of target nodes. This can be accomplished in two ways:
    a) Plan B: simultaneous deployment of many machines. Faster but riskier
    b) Plan C: deployment of a machine at time. Slower but more secure.
4. Test of the target nodes
5. Configuration of Head node to access the local network (only during prototype or engineering tests)

Only for the ProtoNIP installation: upon completion of deployment procedure in order to gain remote access to leaf nodes a few more steps are required:

6. Wire the Ethernet connections as shown in Figure 4-1
7. Check to have *bridge* command installed on Master Node (‘modinfo bridge’)
8. Configure DHCP server, bridging and NATting on Master node.

In the following sections, the steps 1-5 will be described in more detail. Points 6-8 will be covered in an updated version of this document.

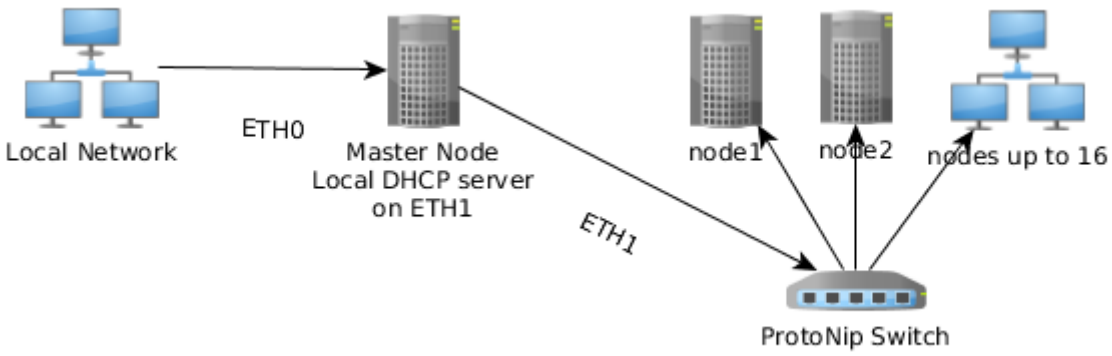

Figure 4-1: Local Area Network setting for ProtoNIP machine

4.2 Complete System Installation

The complete system installation comprises a few steps:

a) The OS installation.
b) The FPGA drivers installation
c) The NVIDIA drivers installation

4.2.1 OS Installation

Prerequisites:

i. A Centos 7 boot USB key. It can be easily written using tuxboot (http://tuxboot.org/). The centos can be found at https://tirgo.arcetri.astro.it/testvectors/centos/CentOS-7-x86_64-DVD-1611.iso. Successfully tested under windows. Does not work on all Linux distributions.
On a Mac the solution on https://wiki.centos.org/HowTos/InstallFromUSBkey can be used. Warning: the dd command does not forgive mistakes!
ii. 'UEFI bios' boot option set in target system Bios.
iii. Monitor, keyboard (I assume Usa-Ascii) and mouse connected to the target system
iv. A working internet connection (a DHCP connection, it will be configured later on).

4.2.1.1 Install Operations

→ means select. Most menu are in text mode, so the mouse is inactive. Navigate by means of <tab> or arrows.

1) boot the centos Key, then select following options:
   a) → "Test this media & install.. "

the system checks the install key. On my system it took less than 2 minutes
2) → select "English (US)" as the install language on graphical screen
3) → select "continue"
4) Select "Network"
   a) → select the correct network interface (on my machine is en01, can be imm/1)
   b) set the interface to "ON" (on the upper right)
   c) set a hostname with extension (like head.arcetri.inaf.it)
   d) → select "configure"
   e) → select "IPv4..."
   f) Verify "method" is set to "Automatic (DHCP)"
   g) → select "Save"
   h) → select "Done" (Upper left)
5) Verify language and keyboard are set to English
6) → select "Date and Time", then select the time zone. If needed set the correct time.
7) → select 1) continue
8) → select "Software Selection"
   a) → select "Compute Node" on the left
   b) → select "Debugging tool", "Hardware Monitoring", "network File System", "Development Tools", on the right
   c) → select "Done" (Upper left)
9) → select "Installation Destination"
   a) → select all three disks
   b) → select "Done" (Upper left)

10) → select “Security Policy”
    a) → select “Standard System Profile”
    b) → select “Select profile” (bottom centre)
    c) → select “Done” (Upper left)
11) → select “Begin Installation” (Lower Right)
12) On next screen → select “Root Password”
    a) Set it to “skapss@Meerk@t”
    b) Set confirmation
    c) → select “Done” (Upper left)
13) → select “User Creation”
    a) Set fullname as “pss toor”
    b) Set username as “toor”
    c) use the same password as “root”
    d) → select “Done” (Upper left)
14) → select “Finish configuration” (Lower Right)
15) The system installs itself. (Few minutes)
16) → select “Reboot” (Lower Right)
17) The system boots, please remove the Usb key

On reboot end the prompt should appear.

A “fdisk -a” command issued as root should give three partitions on /dev/sda (/dev/sda1, /dev/sda2…) and only one on other disks.

4.2.2 GPU Installation

Detailed instructions can be found at http://docs.nvidia.com/cuda/cuda-installation-guide-linux/index.html. A short summary is presented here.

Prerequisites:

i. a working internet connection.

4.2.2.1 Install Operations

A. Create a file at /etc/modprobe.d/blacklist-nouveau.conf with the following contents:
```
blacklist nouveau
options nouveau modeset=0
```
B. Reboot the system
C. Get the install run file either from NVidia site (https://developer.nvidia.com/cuda-downloads) or from https://tirgo.arcetri.astro.it/testvectors/centos/CUDA/
D. Run the installer and follow the on-screen prompts:
   $ sudo sh cuda_<version>_linux.run
E. The installer will prompt for the following:
   a. EULA Acceptance
   b. CUDA Driver installation
   c. CUDA Toolkit installation, location, and /usr/local/cuda symbolic link
   d. CUDA Samples installation and location

   The suggested location is `/usr/local/cuda`.

F. Environment Setup: The PATH variable needs to include executables path. To add this path to the PATH variable:
   $ export PATH=/usr/local/cuda-9.0/bin${PATH:+:${PATH}}

The LD_LIBRARY_PATH variable needs to contain library path. To change the environment variables for 64-bit operating systems:
$ export LD_LIBRARY_PATH=/usr/local/cuda-9.0/lib64\${LD_LIBRARY_PATH:+:${LD_LIBRARY_PATH}}
It can be useful to add those commands in the ~/.login file.

G. Reboot the system
H. Check the correct installation (example output from Arcetri test machine):

```
gpu-softir-~-754> nvcc --version
nvcc: NVIDIA (R) Cuda compiler driver
Copyright (c) 2005-2016 NVIDIA Corporation
Built on Sun_Sep__4_22:14:01_CDT_2016
Cuda compilation tools, release 8.0, V8.0.44

gpu-softir-~-755> nvidia-smi
Thu Oct 26 09:43:25 2017
+-----------------------------------------------------------------------------+
| NVIDIA-SMI 367.44                 Driver Version: 367.44                    |
|-------------------------------+----------------------+----------------------+
| GPU  Name        Persistence-M| Bus-Id        Disp.A | Volatile Uncorr. ECC |
| Fan  Temp  Perf  Pwr:Usage/Cap|         Memory-Usage | GPU-Util  Compute M. |
|===============================+======================+======================|
|   0  GeForce GTX 1080    Off  | 0000:01:00.0      On |                  N/A |
|  0%   52C    P0    57W / 198W |    108MiB /  8113MiB |      0%      Default |
+-------------------------------+----------------------+----------------------+

+-----------------------------------------------------------------------------+
| Processes:                                                       GPU Memory |
|  GPU       PID  Type  Process name                               Usage      |
|=============================================================================|
|    0      1193    G   /usr/lib/xorg/Xorg                             106MiB |
+-----------------------------------------------------------------------------+
```

4.2.3 FPGA Installation

This procedure will set up the Bittware FPGA software. Desired OS : CentOS 7.2 Kernel 3.10.0-327.36.3.el7.x86_64I. The installation procedure has been tested with 3.10.0-327.36.3.el7.x86_64 and 3.10.0-514.26.2.el7.

Prerequisites: a working internet connection.

4.2.3.1 Install Operations

Login as root

1. mkdir /root/aocl
2. cd aocl
3. Download the following file from https://tirgo.arcetri.astro.it/testvectors/centos/FPGA
    a. etc_profile.d_fpga_custom.sh
    b. aocl-rte-16.1.0-1.x86_64.rpm
    c. a10pl4_16.1.2_bsp.tar
4. You will see three files: 1- aocl-rte-16.1.0-1.x86_64.rpm , 2- a10pl4_16.1.2_bsp.tar , and 3 - etc_profile.d_fpga_custom.sh
5. Move all three files to /root/aocl
6. Verify there a nameserver is set-up and reachable.
    a. Test with a ping (e.g. `ping eso.org`).

   b. If ping was not successfully
7. NOTE: if kernel sources are already installed skip to step 8. The perl, gcc, CentOS kernel-devel packages are required to proceed further. If they are not installed already install these packages before proceeding to step-7:
   a. `yum install perl`
   b. `Yum install kernel` (going to upgrade to version 3.10.0-327.36.3.el7.x86_64 or 3.10.0-514.26.2.el7. Anything higher is not tested with FPGA tools)
   c. `yum install kernel-devel` (for kernel to 3.10.0-514.26.2.el7)
   d. `yum groupinstall "Development Tools"`
   e. Reboot the machine (it will boot into 3.10.0.514.xx version)
8. Execute `rpm -Uvh aocl-rte-16.1.0-1.x86_64.rpm`
9. if successful it would install aocl-rte-16.1.0-1.x86, by setting up:
   a. /opt/altera/aocl-rte and
   b. /etc/OpenCL/vendors
10. tar -xvf a10pl4_16.1.2_bsp.tar
11. It will produce 16.1.2_bsp directory.
12. Look for a10pl4 directory inside 16.1.2_bsp
13. Execute `mv a10pl4 /opt/altera/aocl-rte/board/`
14. Execute `cd /root/aocl`
15. Locate etc_profile.d_fpga_custom.sh
16. Execute `cp etc_profile.d_fpga_custom.sh /etc/profile.d/fpga_custom.sh`
17. Exit from terminal and re login in another terminal, so that the system variables from fpga_custom.sh are updated
18. aocl version (will report aocl version being 16.1.0.196 etc)
19. Now do the aocl installation using the command:
   a. `aocl install` (it will make the FPGA board driver module and install it).
20. To verify if this process went through fine, do:
   a. `lsmod | grep aclpci`
21. it would show on the screen: aclpci_a10pl4.drv 36672 0 (instead of 36672, it may be a different value!)
22. To verify if the FPGA side installation went fine, we need to run:
   a. `aocl diagnose` and
   b. `aocl diagnose acl0`

Also created a user: fpgauser with password "target s10 chip"

4.2.4 Save Image – Preliminary to Plan B & C

Prerequisites:

i. A Drbl boot USB key (it can be easily downloaded and written using tuxboot, http://tuxboot.org/.) Successfully tested under windows. It does not work on all Linux distributions. It does not work on Mac. The USB key needs to be of 1GB or more.
ii. A USB drive to store the master image. Create a save image directory. I use "centos". The master image size is about than 10GB, so even a large USB key (16BG or more) can work.
iii. The Head machine with OS and all auxiliary software installed.
iv. Monitor, keyboard and mouse connected to the Head machine.

4.2.4.1 Install Operations

→ means select. Most menus are in text mode, so the mouse is inactive. Navigate by means of <tab> or arrows.

1) boot the Drbl Key, then select the following options:
   a) → Other Modes.
   b) → Default settings, KMS mode.
   c) Some tens of seconds wait.
   d) → select languege EN-US.
   e) Select key map. Default is Usa Ascii.
2) If the system do not recognizes the graphic card (likely, “Continue...”), it presents three choices. Select '0' to let system detect graphic environment. If it fails, try '1'.
3) A graphical desktop appears after a while.
4) Start “clonezilla live”.
5) Maximize the terminal (handy).

Save Setup:

1. →Select “device-image”, <tab> to select <Ok>, <enter> to activate.
2. →Select “use local device”.
3. Insert the USB drive, <Enter>, wait some seconds and hit Ctrl-c when found. Take note of the name assigned to the USB drive. The name should be in the form /dev/sdX. With a 3 disks system should be /dev/sdd.
4. Navigate to the partition to hold the saved image. It is a partition of the device selected in 3. Double check! It should be something like /dev/sdd1.
5. →Select “Ok” (jump with <tab>, <enter> to activate).
6. Navigate to the directory where the saved image will be written (created in ii.).
7. →Select “Done” (jump with tabs).
8. Enter to confirm the /home/partimge choice.

Save image:

A) →Select Expert mode. (jump with <tab> to <Ok>, <enter> to activate)
B) →Select savedisk (“Save local disk…”), <enter> to activate.
C) Enter the name of the image to be written. The system proposes a name in the form “<date>-img”. That name is already ok, but it is better to add some identification such as “minimal_head_install”.
D) It may appear a menu asking the source disk(s). Jump with <tab> to <Ok>, <enter> to activate. Depending on how the Drbl OS sees the Head machine disk it can be one or three disks, and may be the Drbl key (easy to avoid as the program states the disk size). According to the display →Select or the single large disk or the three SSD disks. This point cannot be tested remotely.
E) →Select to use “q2” (partclone>partimage>dd) as it is faster.
F) On the multi option menu, check “Generate MD5 sum”. Jump to OK with tabs, <enter> to activate.
G) →Select to use “z1p” (Use parallel gzip) as it is faster.
H) Select a large number as the chunk size to have a single file (like 1000000).
I) →Select to skip checking source file-system.
J) →Select to check the image (it takes much less than 1 hour).
K) →Select to skip the -y* options.
L) →Select to “Not encrypt the image”.
M) →Select to “Choose <op> when image is finished”.
N) First warning “PS. Next time you can run….”. Press Enter.
O) The system performs some works (seconds).
P) Second warning “Are you sure you want to continue”. Check the hard disk to be saved is the correct one.

Q) Press “y” <Enter>.
R) The system performs some works (tens of seconds).
S) The save process starts and some graphical progress display appears.

The save process is slow with these terabyte sized disks (up to some hours). On the Arcetri test machine it takes less than 2 hours.

4.2.5 Restore Image to Multiple Machines – Plan B

Prerequisites:

i. A Drbl boot USB key (it can be easily downloaded and written using tuxboot, http://tuxboot.org/.) Successfully tested under windows. It does not work on all Linux distributions. It does not work on Mac.
ii. A USB drive with the Master Image (to be downloaded from network).
iii. A Master machine connected to the same subnet as target machines. A standard laptop can do the work. The procedure does not write on its disk(s).

We assume there is NO external connection to outside internet. If this is not possible, be sure there is no external DHCP active. If also this is impossible, contact me.

4.2.5.1 Install Operations

→ means select. Most menu are in text mode, so the mouse is inactive. Navigate by means of <tab> or arrows.

1) boot of Drbl Key, then select following options:
    a. → Other Modes
    b. → Default KMS mode
    c. some tens of seconds wait
    d. → select languege EN-US
    e. select keymap. Default is Usa Ascii
2) If the system do not recognizes the graphic card (likely, “Continue...”), it presents three choices. Select '0' to let system detect graphic environment. If it fails, try '1'.
3) A graphical desktop appears after a while.
4) Start “clonezilla server”
5) Maximize the terminal (handy)
6) “DRBL not ready”, press enter
7) Network setup.
    a. →Select the interface to set-up, usually eth0
    b. →Static IP
    c. →IP 192.168.100.200, netmask 255.255.255.0, gateway 92.168.100.1, dns 8.8.8.8
    d. If more adapters (eth1, wifi, etc.) do not configure them (“n”)
8) Local DHCP setup “There is only ...”: (if external dhcp is running some changes needed)
9) → Y to give DHCP services only to PXE clients

Restore Setup:

1. →Select ”use local device”
2. Insert the USB drive, <Enter>, wait some seconds and hit Ctrl-c when found. Take note of the name assigned to the USB drive.
3. navigate to the partition containing the saved image (can be tricky to identify it, but it is in)
4. →Select “Ok” (jump with tabs)
5. Navigate to the directory containing the saved image directory (labelled CZ_IMG)
6. →Select “Done” (jump with tabs)

7. Enter to confirm the /home/partimage choice
8. Enter to let DRPL service starts. It takes up to one minute
9. →Select to deploy to all clients
10. →Select Expert mode
11. →Select Restore Disk
12. On the multi option menu if not in an hurry, check “MD5 check”. Jump to OK with tabs
13. →Select to use partition table from image (it takes some time, up from 30 minutes)
14. →Check the image (it takes < 1 hour. Select at least once)
15. →Select to skip the -y* options
16. →Choose to reboot target machines after installation (does not work most of the time)
17. Navigate to the image (may be labelled CZ_IMG)
18. →Select “Ok” (jump with tabs)
19. →Choose SDA disk (the target machines only disk).
20. →Select Broadcast (slower than multicast, but it seems more reliable).
21. →Select “clients-to-wait”
22. Set the REAL number of machine to clone now (1-16). The restore process do not starts until this number of target machines is connected to the master one!
23. First warning “Range option selected”. Press Enter
24. The system performs some works (tens of seconds)
25. Second warning. Press Enter
26. The system performs some works (tens of seconds)

The system presents a shell prompt. The server is up and running.

Start the target machines with PXE network boot option.

Start the exact number of machine as specified in point 15!

It can be wise to check the monitor exit of one node. It does not require manual intervention.

The restore process is SLOW with these terabyte sized disks (many hours). On local test machines it takes less than 5 hours

4.2.6 Restore Image to a Single Machine – Plan C

Prerequisites:

i. A Drbl boot USB key (it can be easily downloaded and written using tuxboot, http://tuxboot.org/.) Successfully tested under windows. It does not work on all Linux distributions. It does not work on Mac.

A USB drive with the Master Image (to be downloaded from network or produced from HEAD machine).

4.2.6.1 Install Operations

→ means select. Most menus are in text mode, so the mouse is inactive. Navigate by means of <tab> or arrows.

1) boot of Drbl Key, then select following options:
    a. → Other Modes
    b. → Default KMS mode
    c. some tens of seconds wait
    d. → select languege EN-US
    e. Select keymap. Default is Usa Ascii

2) If the system do not recognizes the graphic card (likely), it presents three choices. Select '0' to let system auto-detect graphic environment. If it fails, try '1'.
3) A graphical desktop appears after a while.
4) Start “clonezilla live”
5) Maximize the terminal (handy)

Restore Setup:

1. →Select “device-image”
2. →Select ”use local device”
3. Insert the USB drive, <Enter>, wait some seconds and hit Ctrl-c when found. Take note of the name assigned to the USB drive.
4. navigate to the partition containing the saved image (can be tricky to identify it, but info in 3 can be useful)
5. →Select “Ok” (jump with tabs)
6. Navigate to the directory containing the saved image directory (labelled CZ_IMG)
7. →Select “Done” (jump with tabs)
8. Enter to confirm the /home/partimge choice
9. →Select Expert mode
10. →Select Restore Disk, →Select “Ok” (jump with tabs)
11. If the system asks to choose between different saves, select the first one, it should be 'minimal_head_install' or SDA.
12. →Choose with spaces SDA, B, C disks (all the target machines disks). Names can be slightly different, →Select “Ok” (jump with tabs)
    a. *Important*: if the system presented 3 saves in 11), one for each disk, the procedure needs to be repeated 3 times, separately on each disk SDA,B,C.
13. On the multi option menu if not in an hurry, check “MD5 check”. Jump to OK with tabs
14. →Select to use partition table from image (it takes some time, up from 30 minutes)
15. →Check the image (it takes < 1 hour. Select at least once)
16. →Choose to reboot target machines after installation (do not work most of the time)
17. The system shows the final command to be executed. “PS next time…. “. Press Enter
18. (Not always), “WARNING! ALL EXISTING DATA WILL BE OVERWRITTEN...” “Are you sure to start the copy?” → Y<enter> (Two times)

The system shows the progresses graphically. The restore should take less than ½ hour.

At the end, reboot and check if the system boot correctly.

5 CONCLUSIONS

The deployment procedure has been tested in laboratory and partially tested on the real hardware prototype. The process has been iteratively tested as many pitfalls have been found.

The deployment version presented here does not cover the last phase, the machine configurations, which will be object of a successive document.

6 APPENDIX A: INTELLECTUAL PROPERTY DECLARATION

6.1 Organisation A

6.1.1 Background IP Declaration

6.1.2 Foreground IP Declaration

6.1.3 Justification for IP

6.1.4 Foreground IP Declaration

6.2 Organisation B

6.2.1 Background IP Declaration

6.2.2 Foreground IP Declaration

6.2.3 Justification for IP