FROM AN EMPTY PC TO A RUNNING CONTROL SYSTEM: A KNOPPIX LIVE-CD FOR DOOCS

G. Grygiel, DESY Hamburg, Germany

Abstract

Software deployment of operating and control systems is a hard task for beginners and can be an error prone one for experts. As an evaluation of a potential, fast deployment technique, a Linux/Knoppix Live-CD [1] for the DOOCS [2] control system software has been developed. This CD contains a DOOCS core system, some example and middle layer server programs and basic client applications. Optionally, one can install a Knoppix and DOOCS system directly from the CD. All DOOCS and operating system software are provided as Debian [3] packages. This paper will describe the Live system CD in more detail and discuss the interaction of Java Web-start based applications, other control system client applications, DOOCS name service and device servers.

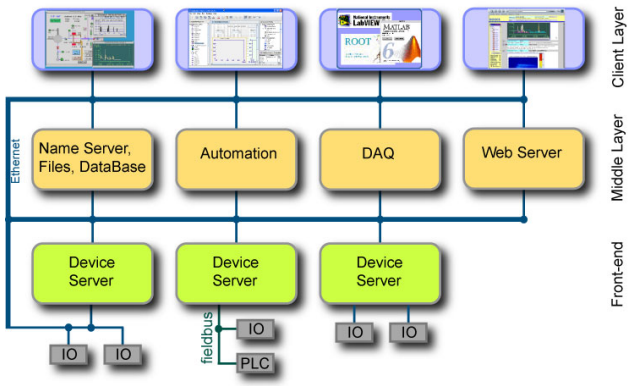

Figure 1: DOOCS Architecture

MOTIVATION

The idea is to run the DOOCS control systems with all major programs directly from a CD. The 'experts' have then an always available and workable system and this e.g. is an USB flash drive on the keychain. It's ment to provide an overview of the entire system, without complex installation and configuration. A beginner receives a fully equipped and functional system. It is possible to start immediately with the development of control system servers and having all tools at hand. The Live-CD also demonstrates the integration of the various controls system architectures, like DOOCS, EPICS [4] or TINE [5], used at modern accelerator facilities.

Features of the CD are:

- Any time, every where available.
- Quick start for beginners.
- Debug tool for experts.
- Demonstrates the whole chain, from the name service, device servers, up to the display.
- Demonstrates the interaction of the various control systems (DOOCS, TINE, EPICS).

CHOICE OF DISTRIBUTION

For almost all components, DOOCS Debian packages have been developed, therefore it should be a Debian based distribution. Currently at DESY the Ubuntu [6] distribution is used. Various tests have shown that the Live-CD made by Klaus Knopper is significantly faster than the Live-CD of Ubuntu or Debian. The KNOPPIX distribution has a very good driver support; it is fast and designed to be run directly from a CD / DVD (Live-CD) or USB stick. The first attempt to remaster a KNOPPIX live CD was immediately successful.

RECIPE TO BUILD THE LIVE-CD

Start with booting from the KNOPPIX CD. A minimum of 3 GB free disk space should be available. Then copy the complete disc to the free space. Then again one can boot the usual Linux system and start changing the content of the KNOPPIX CD. Use 'chroot' to install and configure all control system and other software. With chroot one is able to run a command or interactive shell in a special root directory. Also Internet access is possible out of the chroot environment. Change the look and feel to give the CD a personal note e.g. titles, graphics, menus. All it takes to remaster a KNOPPIX CD is described in the KNOPPIX_Remastering_Howto [7]. There are many UNIX commands to execute; therefore a good UNIX/Linux knowledge is required. It took a view interactions until everything worked and looked as expected.

To speed up the development process:

- Create the CD image.
- Start this image under qemu [8] (processor emulator) with KVM [9] support.

KVM (Kernel-based Virtual Machine) with native virtualization support helped a lot to speedup the development process. The boot up process takes less than a minute. If KVM with native virtualization support is present, it will be used by qemu automatically.

CONTENT

The CD contains a DOOCS example server (SINGENERATOR) which talks also the TINE protocol. Furthermore DOOCS, EPICS and TINE command line tools (CLI) and some graphical java programs.

In detail:

- DOOCS
  - Server programs
    - ENS (equipment name server).

        - watchdog (controls other DOOCS servers).
        - sine generator which also talks TINE
    - Client programs
        - CLI tools (doocsget, doocsput).
        - jddd [10] (Java DOOCS Data Display) talks also TINE, EPICS and Tango .
        - jDTool (Tool for displaying and changing DOOCS data.
- TINE
    - CLI tools (tget, tput, …).
    - InstantClient (Tool for displaying and changing TINE data).
- EPICS Base R3.14.11
    - CLI tools (caget, caput).
    - Server (excas).

A complete development environment for creating your DOOCS server is also available. In addition, the original content of the KNOPPIX CD is available (MPlayer, Internet access software, Mozilla Firefox and Thunderbird, GIMP, Open Office and a lot more). The latest version can be downloaded from http://doocs.desy.de/.

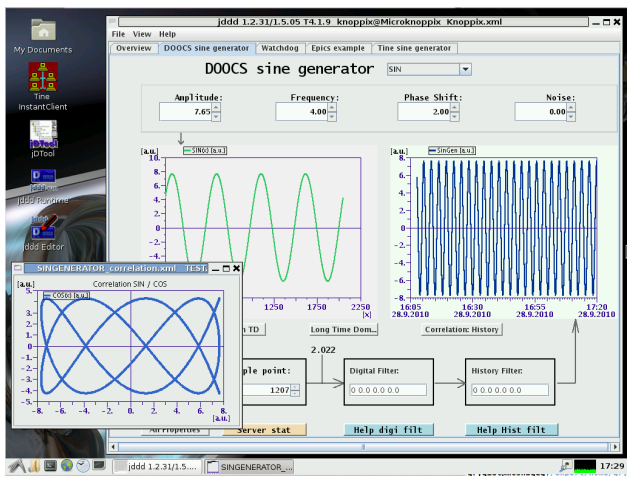

Figure 2: Knoppix with DOOCS Singenerator

BUILD A DOOCS SERVER

- Enter the following commands in a terminal:
  cd doocs/source/server/test/example
  make
- And run it:
  /home/knoppix/doocs/Linux/obj/server/test/example/example_server
- Try to change the files eq_example.h and example_rpc_server.cc, Add a further D_float property.
- Create an operator panel with jddd.

JAVA CLIENT PROGRAMS

The control system client programs are mainly java based. JavaWS (Java Web Start) is a clever mechanism to start java programs. JavaWS guarantees that you are always runs the latest version of the application and it eliminates complicated installation or upgrade procedures. The disadvantage is the dependence on a functioning Internet connection. That is why all Java programs are installed directly on the CD; it does not depend on the network to use the CD.

GOODIES

- Explore the DOOCS system and its capabilities by using the ready-to-go runtime version of DOOCS and TINE/EPICS/TANGO clients.
- Build your own DOOCS server and run it.
- Build your own DOOCS client as graphical user interface using the JDDD framework.
- Connect to the internet to browse the web, read mail, and ...
- Change your environment to access extern control systems
    - DOOCS ENS host:
      set ENSHOST
    - EPICS gateway:
      set EPICS_CA_ADDR_LIST
    - TINE:
      set TINE_HOME
      unset TINE_STANDALONE

REFERENCES

[1] KNOPPIX http://www.knopper.net/knoppix/
[2] DOOCS http://doocs.desy.de/
[3] Debian http://www.debian.org/
[4] EPICS http://www.aps.anl.gov/epics/
[5] TINE http://tine.desy.de/
[6] Ubuntu http://www.ubuntu.com/
[7] Knoppix_Remastering_Howto
http://www.knoppix.net/wiki/Knoppix_Remastering_Howto
[8] qemu http://wiki.qemu.org/Main_Page
[9] KVM http://www.linux-kvm.org/page/Main_Page
[10] jddd http://jddd.desy.de/