Debian on Handheld Computers
The Pocket Workstation Project

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Contents

- Status of the project
- Why??
- Limitations of the platform
- Bootstrapping Debian
- Choosing the applications
- Design Decisions
- The next-generation handhelds
- Where to go from here
Introduction

• The goal of the project: running a full Debian environment on a handheld computer

• Supported platforms:
  – Sharp Zaurus 5x00 and SL-C7x0
  – HP/Compaq iPAQ handhelds

• WARNING: inflammatory subjects ahead – this is all from a very subjective point of view, and many other solutions are possible
Why??

• Handheld environment should resemble desktop OS
  – My first handheld:  
    The dos-based HP 200LX

• Large selection of programs available
  – not limited to those designed for handheld

• Why Debian?
  – Huge archive of pre-compiled software for ARM
  – Excellent package management

• Is it something for everyone – not really...
Current status

• Requires SD/MMC card
  - at least 128 MB storage
  - chroot / pivot-root
• Uses Xvnc / fbvnc client
  - native X (TinyX) optional
• Most Debian apps work
• Problems
  - resource limitations
  - ported apps not working
Limitations of the platform

- Low screen resolution
  - 240x320 not sufficient for 80-column text
  - most apps work better on landscape display
- Keyboard missing or incomplete
- Touch screen as primary input
  - One button mouse only
  - Hard to do drags or complex maneuvers
Solved limitations

• Disk space
  - SD/MMC cards available up to 512 MB (but expensive)

• Main memory
  - current models have 64 MB RAM (but no swap space)

• CPU speed
  - StrongARM CPUs fast enough for most apps (but no FPU)
Handheld Zoology

• No expansion slots at all
  – All apps and data must fit in limited flash ROM (16 – 32 MB)
  – Example: original Compaq iPAQ 3630
• One expansion slot only
  – can't use network and storage card together
• Two expansion slots or built-in networking
  – One slot (MMC/SD or CF) can be dedicated to storage
  – Example: Sharp Zaurus, new HP iPAQs
Target platform for Debian port

- Sufficient storage capacity is available
  - at least 128 MB SD/MMC card
- Separate networking capability
  - free CF slot for expansion cards
  - builtin WiFi / Bluetooth
  - Infrared, serial, USB networking
Bootstrapping Debian

• Goal: get *apt-get* working
• Starting point: a working Linux system
  – can be minimal, not many tools needed
  – not usable for WinCE-only handhelds
• Option A: use *debootstrap*
  – ... but I didn't know about that at the time
• Option B: reinvent the wheel
  – shell script using *sed* and *grep* to solve dependencies
Bootstrapping continued

- Use a *chroot* environment for the Debian FS
  - avoid conflicts with native Linux system
- Run Debian inside *chroot*
  - hardware independent, uses drivers of native OS
  - can be annoying to use
  - wasted resources (two copies of C library)
- Dual-boot using *pivot_root*
  - needs more configuration work to support hardware
Choosing applications

# apt-get install galeon
Reading Package Lists... Done
Building Dependency Tree... Done
The following NEW packages will be installed:
  docbook-xml esound-common galeon galeon-common gconf gdk-imlib1 gnome-bin
gnome-libs-data gnome-mime-data libart2 libaudiofile0 libcdparanoia0
libesd0 libgconf11 libglade-gnome0 libglade0 libgnome-vfs-common
libgnome-vfs0 libgnome32 libgnomesupport0 libgnomeui32 libgnorba27
libgnorbagtk0 libnspr4 liboaf0 liborbit0 libscrollkeeper0 libxml1 libxml2
libxslt1 mozilla-browser oaf scrollkeeper sgml-base sgml-data
0 packages upgraded, 35 newly installed, 0 to remove and 163 not upgraded.
Need to get 17.1MB of archives. After unpacking 51.3MB will be used.

# apt-get install konqueror
Reading Package Lists... Done
Building Dependency Tree... Done
The following NEW packages will be installed:
  gcc-3.3-base kdebase-libs kdelibs3 kdelibs3-bin konqueror lesstif1
  libdb4.1 libfam0c102 libkonq3 libcms libmng1 libpcre3 libqt2 libssl0.9.7
  libstdc++5 libxml2 libxslt1 python python2.2
0 packages upgraded, 19 newly installed, 0 to remove and 163 not upgraded.
Need to get 17.6MB of archives. After unpacking 56.7MB will be used.
Web browser: *links* -g

- built-in anti-aliased fonts
- some JavaScript support
- handles SSL, tables, frames, downloads
- bookmark management
Web browser: *dillo*

- key features missing
  - SSL
  - file download
- Advantage: being able to read the text on web pages
  - limit text line length to display width when reformatting paragraphs
Design decisions

• What to do if the application requirements and the platform's features don't match?

• The *Procrustes* method
  – chop off bits until what's left fits the space available
  – painful for developers and users

• The *Matrix* method
  – virtual platform simulates that expected by apps
  – painful for users
Qtopia, GPE and TinyX

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- What's wrong with this picture?
The virtual environment

- Based on VNC client
  - simple thin client
  - virtual display
- fbvnc client
  - Anti-aliased rescaling and rotation
  - Virtual keyboard overlay
  - 3 mouse button emulation
  - fast
Xvnc configuration

- Run Xvnc with virtual screen larger than physical display
- rotate and resize to fit the current app on-screen
- surprisingly fast, but not suitable for video and games
  - run those on framebuffer directly
  - use shared memory ?
More virtual things

- Virtual Opie
  - Qt Embedded supports VNC server back-end
  - needs to be recompiled to support it
  - run: `QWS_DISPLAY=VNC:2 datebook -qws`
  - connect VNC client to localhost:2

- Virtual paper
  - pipe pixmaps to fbvnc client, and display them using built-in scaling and rotation
  - shell scripts use `gs` and `anytopnm`
Next-generation handhelds

• Sharp SL-C7x0
  - good keyboard
  - 640x480 landscape display
  - 64 MB RAM on C750 and C760
  - SD/MMC and CF expansion slots
  - IR, serial/USB port, stereo headphone / microphone connector

• Yopy, Sony Clie
  - keyboard and screen have wrong orientation
Where to go from here?

- PIM applications needed
  - Opie apps don't work well in X11 environment
  - GPE apps missing key features
  - sync with desktop difficult
  - Current favorite: *jpiilot*

- Enhancements to *dpkg* and *apt*
  - space savings (three copies of *Packages* data?)
  - relocate apps across filesystems (*ipkg* does this)
Enhancements cont'd

- Use standard ways of doing things
  - *apm* for power management
  - *hwclock* for real-time clock management
- OpenZaurus handles much of this
  - should be merged in Debian distribution