Introduction To Familiar Linux

A Brief Look at Running Linux on an iPAQ PDA

-or-

How to Make Your iPAQ More Interesting Than It Was with PocketPC

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Agenda

- Background
- PDA Hardware Description
- Linux-on-iPAQ Specifics
- Available Applications
- Why Do This To Yourself?
- Software Development Considerations
- Interacting with the iPAQ
- Sample Screens
- Future Trends

Background

- HP's Cambridge Research Laboratory (CRL) in Boston created the "Familiar" Linux distribution to run on iPAQ PDAs in 2001.
- Although CRL used Familiar Linux for their projects, the products group declined to make it a mainstream choice for iPAQs.
- CRL worked closely with the open-source community:
  - Actively developed the distribution,
  - Hosted several developer conferences,
  - Hosted handhelds.org for wiki and CVS server.

Background

- Today, development has transitioned entirely from HP to the open-source community.
- Handhelds.org is a non-profit company managed by George France.
- The Familiar Linux community is a small contingent of dedicated developers and interested companies.
- Efforts are focused on models like the hx2000s, hx4700 and the hx6000s.

Know Thy Hardware

Familiar Linux runs best on those iPAQs where:

- HP is able to make information public. Sometimes consortium constraints, such as SD, means that HP is unable to release documentation on a particular interface.

- A comprehensive amount of information about the peripherals is available (like PCMCIA).

- The results of reverse-engineering efforts have been posted to the web: xda-developers, sdgsystems.

Just A Computer… with mystery components!

- A PDA is a computer with (mostly) fixed peripherals.
- PCMCIA services allow for plug-and-play in the CF slots.
- Some peripherals may be specifically developed for PDA OEMS and have a unique interface (video, wifi, SD).
- Some peripheral vendors are open-source friendly and provide detailed specifications in order to facilitate Linux device driver development.

Typical PDA Computer Architecture - 32-bit CPU

- Speed ranges between 208MHz to 624MHz. With such minimal speeds, CPU will be pegged running an application.
- Speed is a trade-off with battery life. Fortunately most PDA applications don't require raw horsepower.
- ARM CPUs offer many power control features such as Turbo Mode (peak frequency), Run Mode (best power/performance trade-off), Idle Mode (activity lull), Sleep Mode (can still maintain I/O state and RTC).
- Examples:
  - Intel StrongArm SA1110,
  - X-Scale PXA250, PXA270,
  - Texas Instruments OMAP 1510.

Typical PDA Computer Architecture - Memory

- ROM: Amount of ROM depends on model. Generally, the range is 32MB to 48MB. The flash ROM holds PocketPC and is replaced with Linux.

- RAM: typically 64MB for OS & applications. Running 'free' on a 3870 with no apps running yields:

```
root@iPAQ3870:~# free
             total         used         free       shared      buffers
  Mem:        63380        31168        32212            0           28
 Swap:            0            0            0
Total:        63380        31168        32212
```

Typical PDA Computer Architecture - Meida, Wireless, etc.

- Media: Secure Digital (SD), MMC, Compact Flash.

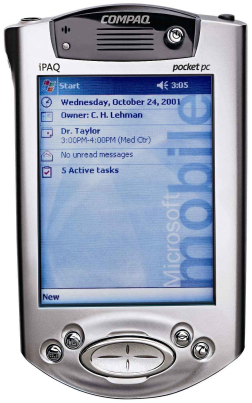
- Basic integrated wireless:
  - 802.11 B (networking),
  - Bluetooth (printing, networking, GPS, etc.),
  - Infrared.

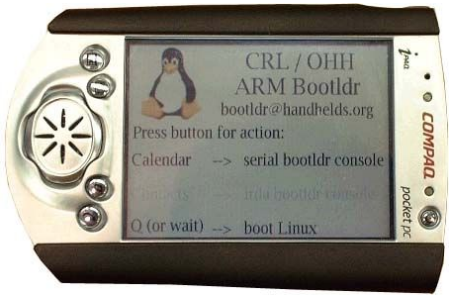
- New generation offers even nicer wireless: GSM/GPRS & GPS!

- Other integrated peripherals include touch-pad, high-fidelity audio, microphone, light sensor, client-side USB, & a camera on some models.

iPAQ 3000 and 5000 Series

- Built during the 2001-2003; recall that:
  - CF was dominant & still relatively expensive,
  - SD & MMC were fledgling with no clear leader,
  - Wireless networking was relatively new.
- Microsoft PPC 2002 or 2003.
- CPU:
  - 36/37/3800s - Intel StrongArm 1110 @ 208MHz,
  - 3900 & 5000s - Intel XScale 250 @ 400 MHz.
- Expansion sleeve permits things like:
  - WiFi,
  - Compact Flash storage.
- Familiar Linux runs great on these models!
  - A lot of attention from CRL,
  - General PDA buzz at that time,
  - Hardware details and interfaces are *now* well understood yielding improved drivers over time.





iPAQ 2000, 4000, 6000 Series

- The 2000s and 6000s are the current models. The 4700s recently reached end-of-life.
- In general, PDAs are moving towards a converged device with more and more integrated components that allow for basic organizer (traditional PDA stuff), music, corporate email communications and telephony.
- CPU: Mostly Intel XScale, but some TI OMAP.
- Microsoft PocketPC 2003 or Windows Mobile 5.
- Familiar support looking good, but not even across all models. IMHO, best supported model is hx4700.

Linux-on-iPAQ Specifics

- Version 0.8.4 of *familiar* will be released soon (rc1 is out now).
- Some iPAQs will stay at 2.4 kernel series while more capable iPAQs use 2.6-based kernels.
- Filesystems:
  - JFFS2 for root,
  - FAT for removeable media,
  - SMBFS and NTFS for access to files over the network,
  - /tmp is in RAM and therefore *really* is temporary.
- Networking:
  - IPv4 and IPv6,
  - Ethernet over USB.
- Use of cardmgr and PCMCIA services for expansion sleeves.
- Serial ports: console, bluetooth, IR.
- /proc has special entries for access to things like the model number, unit serial number, light sensor value, etc.

Development Considerations

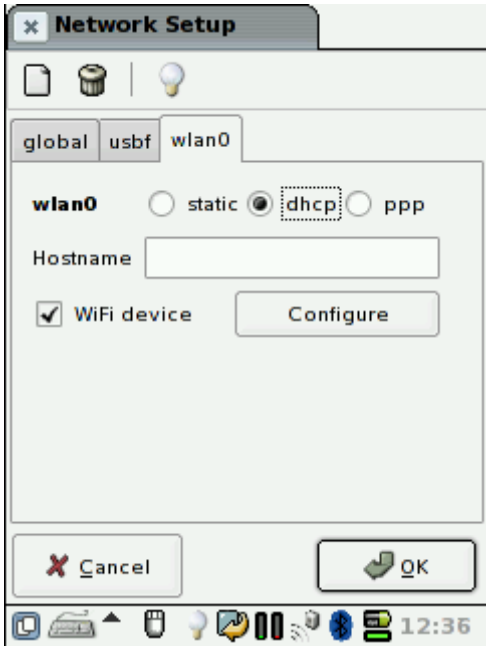
- GUI components are built for either Opie or GPE:

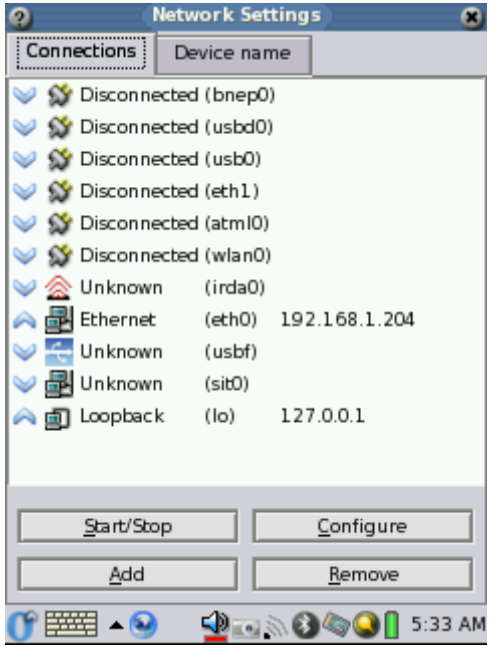
- Software development for iPAQ is the same as any other Linux platform for daemons, server processes, etc.
- Use gcc on a host (typically x86) machine and cross-compile for the target. This means that an ARM version of all your libraries must be available.

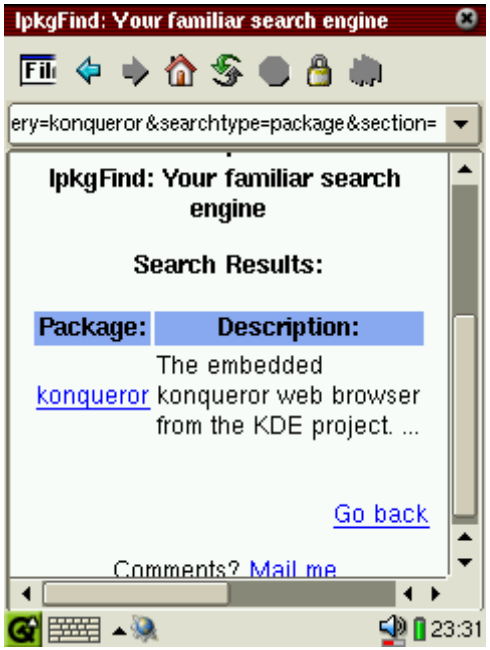
Linux on a PDA? Why Do This?

- Because you can! Stated differently: *novelty*.
- Same Unix/Linux API, programming model, and tool suite known by *lots* of developers.
- Great experience developing embedded ARM applications.
- Incredible choice of applications available:
  - Web browsers,
  - Web servers (yes, Apache has been compiled for ARM!),
  - Audio players,
  - IM clients,
  - Email clients,
  - SSH server,
  - NFS,
  - Samba server and client,
  - VOIP,
  - Festival text-to-voice software from Carnegie Mellon.

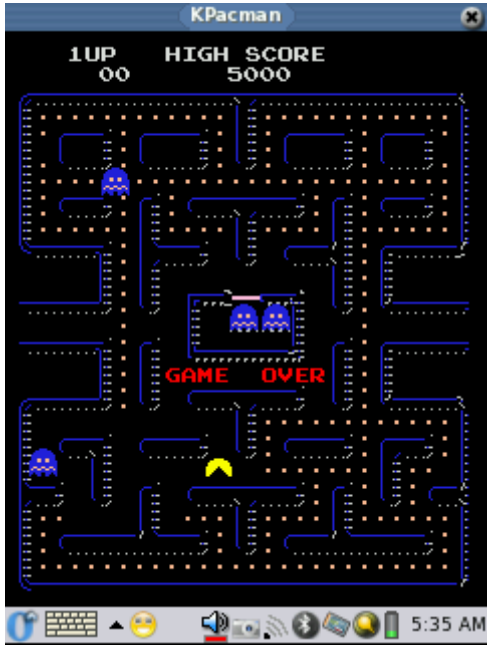
Sample Screens: Configuring eth0 & Using Konqueror



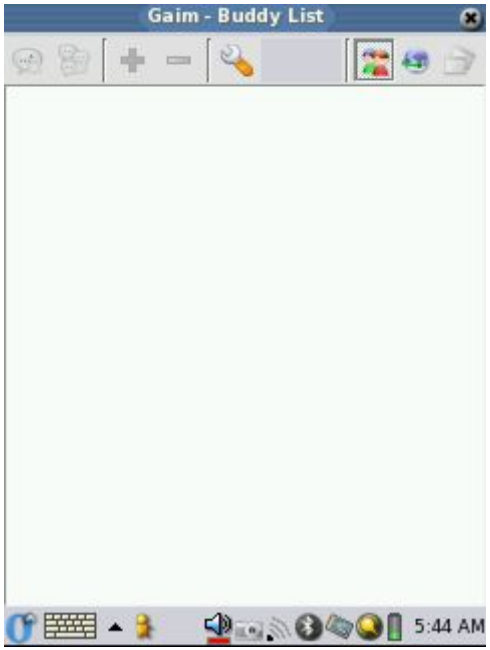




Sample Screen: Games



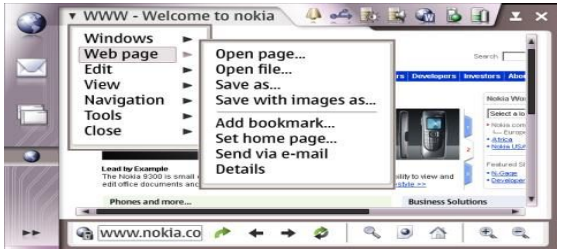
Sample Screens:
GPE Web Browser and Gaim Application



Sample Screens: Showing Off GPE

Next Steps

- Handhelds.org was recently separated entirely from HP and established as a non-profit.
- Many from HP-CRL have moved to Nokia in Boston and continue to work in embedded Linux.
- Momentum and experience from PDAs will help the new generation of Linux-based Ultra-Mobile PCs (UMPC) such as the Nokia 770.



- Embedded Linux continues to see major growth in mobile phone market.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