Embedding Samba 4

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More than 10 years of «Samba in the box»

- 1995 – Samba 1.9 release spurred number of embedded Linux and FreeBSD devices
- 1996/1997 – Whistle Communication's InterJet
- 1997/1998 – Cobalt Qube family of embedded GNU/Linux with Samba

With variety of operating systems:
GNU/Linux, FreeBSD, NetBSD, OpenBSD, Mac OS X, Solaris, ...
and architectures:
x86, PowerPC, MIPS, ARM, Sparc, ...

More than 10 years of «Samba in the box»

- Fast forward to 2006 – there are dozens of embedded Samba devices:
  - Linksys NSLU2, Buffalo LinkStation, Maxtor SharedStorage, Lacie Ethernet Disk Mini, Intel SOHO NAS, and many more
  - Now even Samba on Chip with Broadcom BCM4780P NaSoC solution
- Versions used:
  - Samba 2.0, 2.2, 3.0
  - With little or no modifications of Samba core code
  - Extensions are done usually via external programs or VFS

«Let hundred flowers bloom»

- Embedded Samba usage (so far):
  - ➢ Small NAS device for Home and Office
    - File sharing
    - Print server
    - Basic workgroup support
  - ➢ Integrated gateway for external storage systems (USB-attached drives, wifi-enablement)
  - ➢ Streaming and media applications support (e.g. ApplianceWare platform for Intel NAS)
  - ➢ Integrated authentication for other applications (Proxy servers, SSO for specific applications)
  - ➢ Automatic back-up solutions

«Let hundred flowers bloom», part II

- New devices on the market allow for more innovative approaches:
  - Nokia 770 “Internet Tablet”, and others:
    - Pervasive access, pervasive administration
    - Rich client experience possible but requires exposure of client-side Samba interfaces
  - Linksys NSLU2:
    - Micro-domain controller for masses:
      - Take cheap home device and introduce full-featured ADS-compatible domain controller for home use
    - Automatic workload scenario generator with Samba 4 CIFS proxy and nbench features
  - PlayStation 3: ultimate home media center

Prerequisites for embedding Samba

- Device requirements
  - Enough resources (RAM, disk space, CPU)
- Build system requirements
  - Cross-compilation and toolchain support
  - Easy way to include only needed functionality
    - No need to add printing core if there will be no printing support at all
- Integration requirements
  - Easy way to manipulate configuration subsystem
  - Performance monitoring facilities

Device requirements

- Anything with RAM ≥ 64Mb is good for consideration
  - Samba 4 has less memory consumption than Samba 3
- Anything with frequencies ≥ 200MHz (ARM9, MIPS, PowerPC)
  - DMA support is important
  - Good context switching support is highly desired
  - Decent peripherals, “higher LAN speed ⇒ higher CPU”
- Disk space: ≥ 128Mb (40Mb for full Samba 4 install)
  - Occupied disk space could be lowered significantly

Build system requirements

- Any operating system with decent file systems and decent POSIX support
  - GNU/Linux is the preferred choice today (Embedded Debian variations, Denx.de, etc.)
  - FreeBSD is supported as well (ACLs, xattrs)
  - mmap support is very recommended
- Toolchain support: GCC is preferred, 3.4 is better than 4.x for our goals
  - Use vendor's compiler if the platform is better supported with it (i.e., Cell BE)
  - CPU transparency support is very welcomed
  - Scratchbox is supported and generally gives better results than a regular cross-compilation

Samba 4 build system

- Samba 4's build system:
  - Modular design
  - Support for private and public dependencies between modules
  - Both shared and static builds are supported
  - Out-of-tree builds are supported
  - The build system uses perl, GNU make, and m4
  - Perl-based PIDL generator
  - Two C-based code generators in embedded Heimdal

Build system, part II

✖ Red crosses of cross-compilation

- Macros for checking results of program's execution:
  - `AC_TRY_RUN`
- Macros for checking libraries which might include system ones:
  - `AC_CHECK_LIB`
- Binary code generators:
  - `asn1_compile` and `compile_et`
- Checks for run-time features (interfaces, /proc)

Samba 4 enjoys all of them

How to remove red crosses?

- Use native builds
  - For example, ApplianceWare NAS toolkit for Intel IOP is built natively using RPM on GNU/Linux on XScale (ARM9)
    - Takes ages to compile (glibc takes 9 hours, Samba takes 3 hours)
  - For most of embedded x86 SBCs regular PC could be used with appropriate compiler's flags
  - For ARM targets Scratchbox.org is the right answer
  - For Cell BE/PowerPC there is Full-System simulator available for regular PCs

How to remove red crosses?

- If nothing helps, cross-compilation could be fixed
  - For building Heimdal's code generators we need to configure Samba 4 for host system
    - Heimdal uses Samba'4 `config.h`
    - Out of tree build is required
    - Use –`srcdir` option to specify original source tree
  - After `asn1_compile` and `compile_et` are available, they can be copied to bin/ of the main tree to satisfy make rules
  - Configure main tree for target system as usual
  - Build it!

How to remove red crosses?

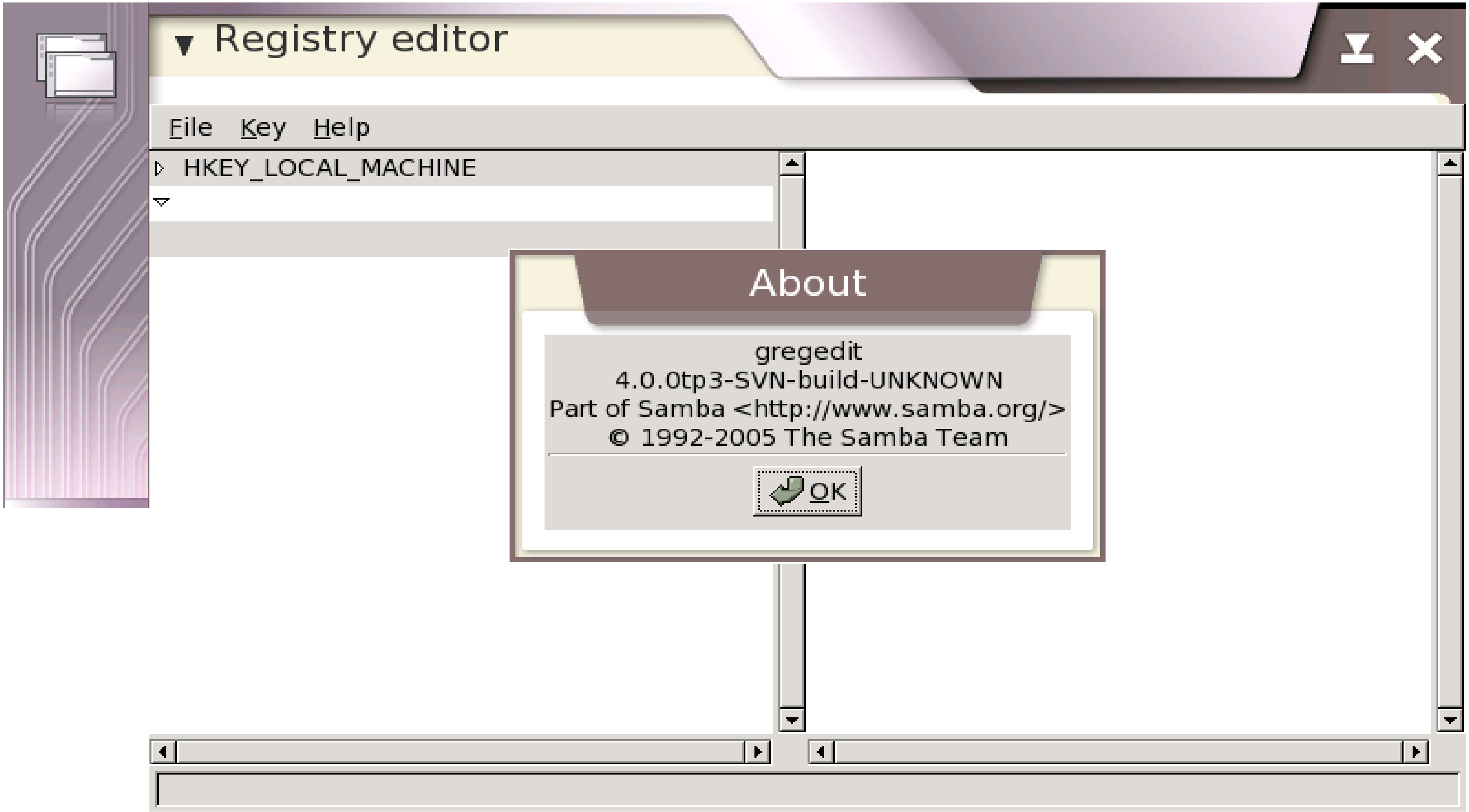
- What's about AC_TRY_RUN?
  - AC_TRY_RUN has third argument “cross-compilation”
    - If not specified, AC_TRY_RUN will stop during cross-compile
    - All Samba 4 AC_TRY_RUN use cases safely continue configuration process during cross-compilation
- A developer should know target's platform better than autoconf:
  - Use autoconf's cache to specify proper values for AC_TRY_RUN tests
  - AC_CHECK_CACHE() wraps every AC_TRY_RUN so every test can be safely pre-configured

Fine-grained Samba 4 builds

- Samba 4 isn't a single program
  - It isn't a monolith code block also
    - Includes sub-systems, libraries, modules, and binaries
    - Each component links only with required components
- Each binary can be made small as much as possible
  - Libraries can be created easily out of sub-systems using definitions in `config.mk` files
    - Hard facts: we have 106 libraries and 90 modules currently
  - Binaries can be linked against only required libraries, including external ones

Demo

- Samba 4 registry editor running in scratchbox for Maemo platform (ARM architecture)



gregedit
4.0.0tp3-SVN-build-UNKNOWN
Part of Samba <http://www.samba.org/>
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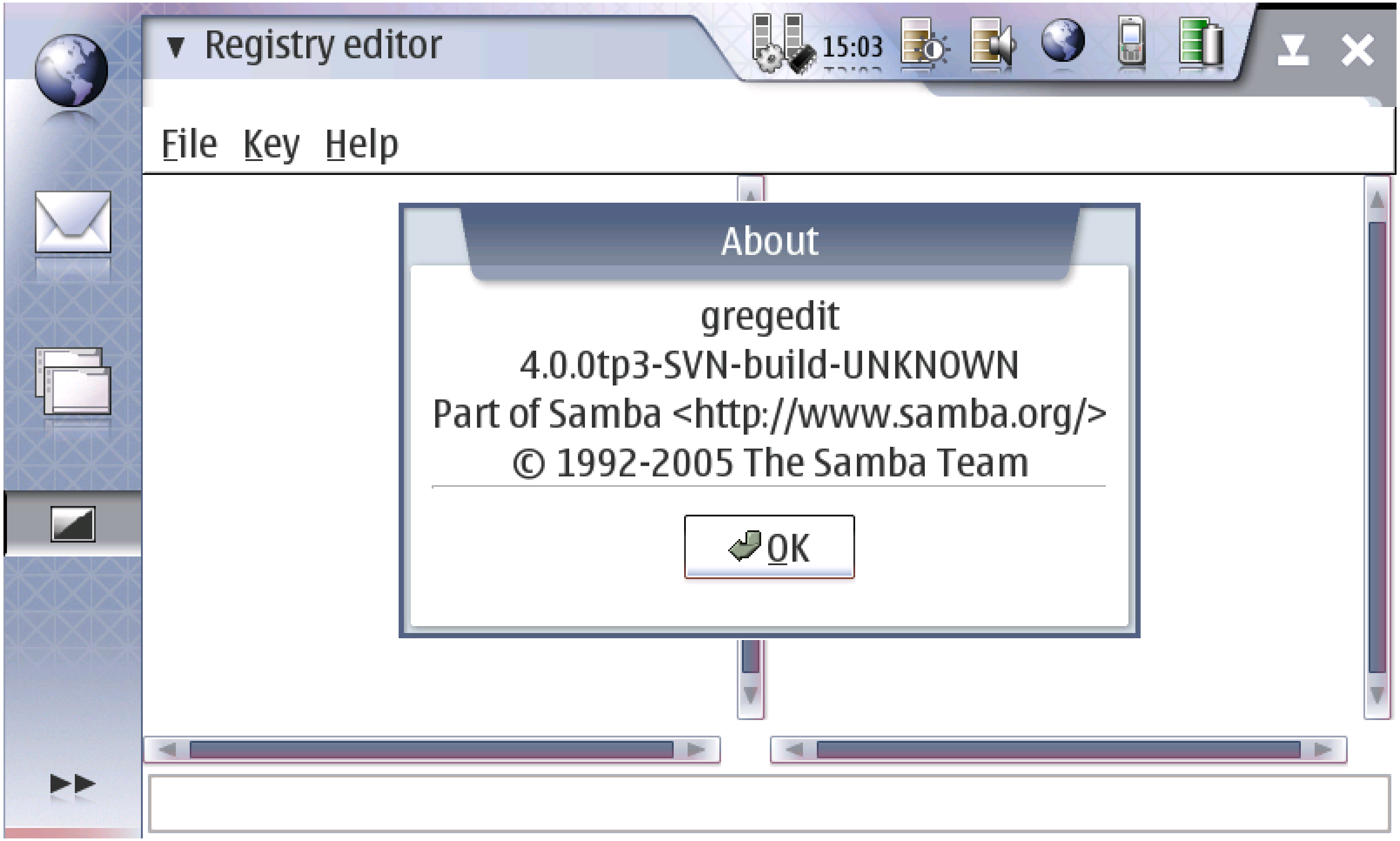
Demo running on real device

- The same Registry Editor running on a real device:



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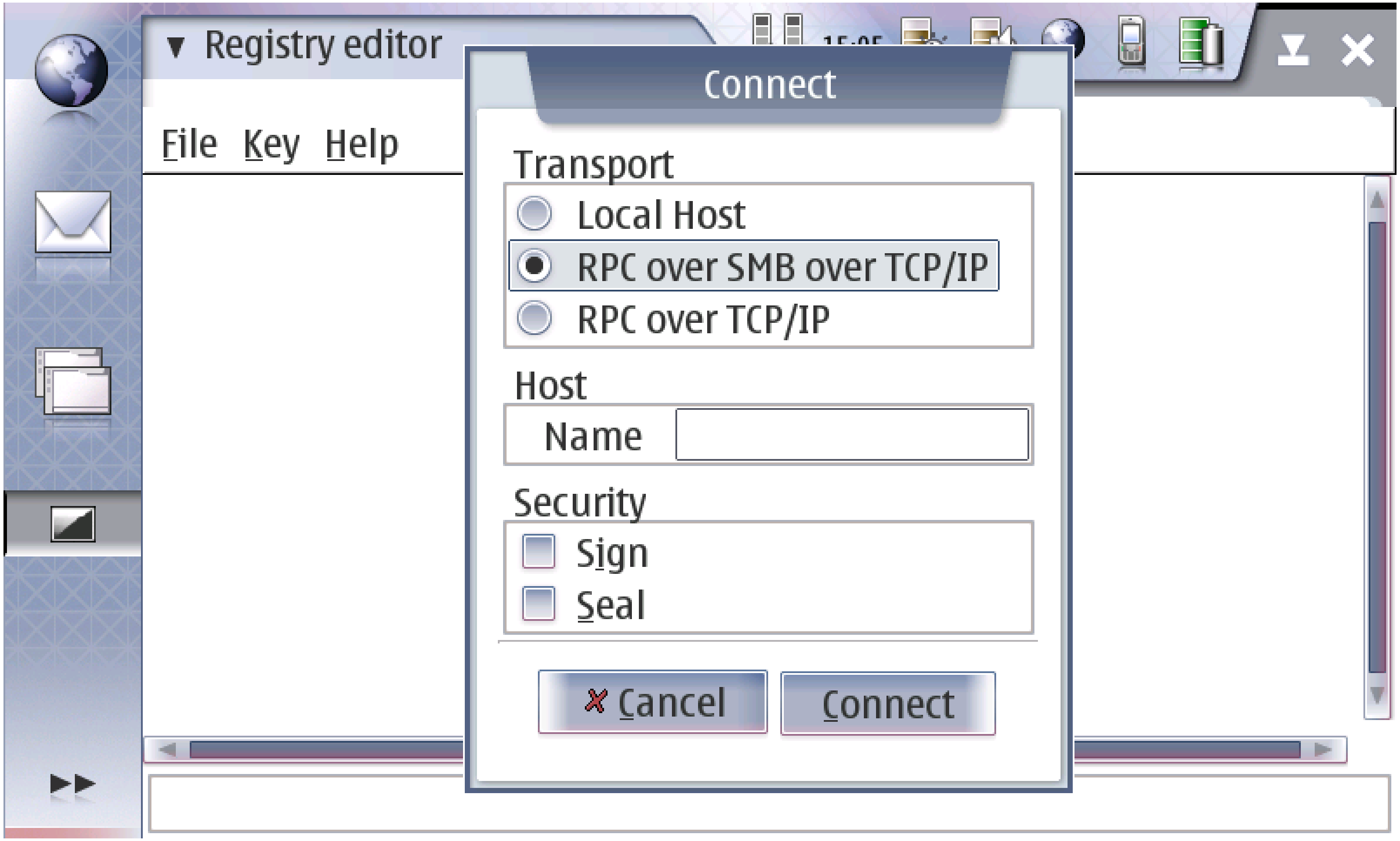


Connect

Transport

○ Local Host
● RPC over SMB over TCP/IP
○ RPC over TCP/IP

Host

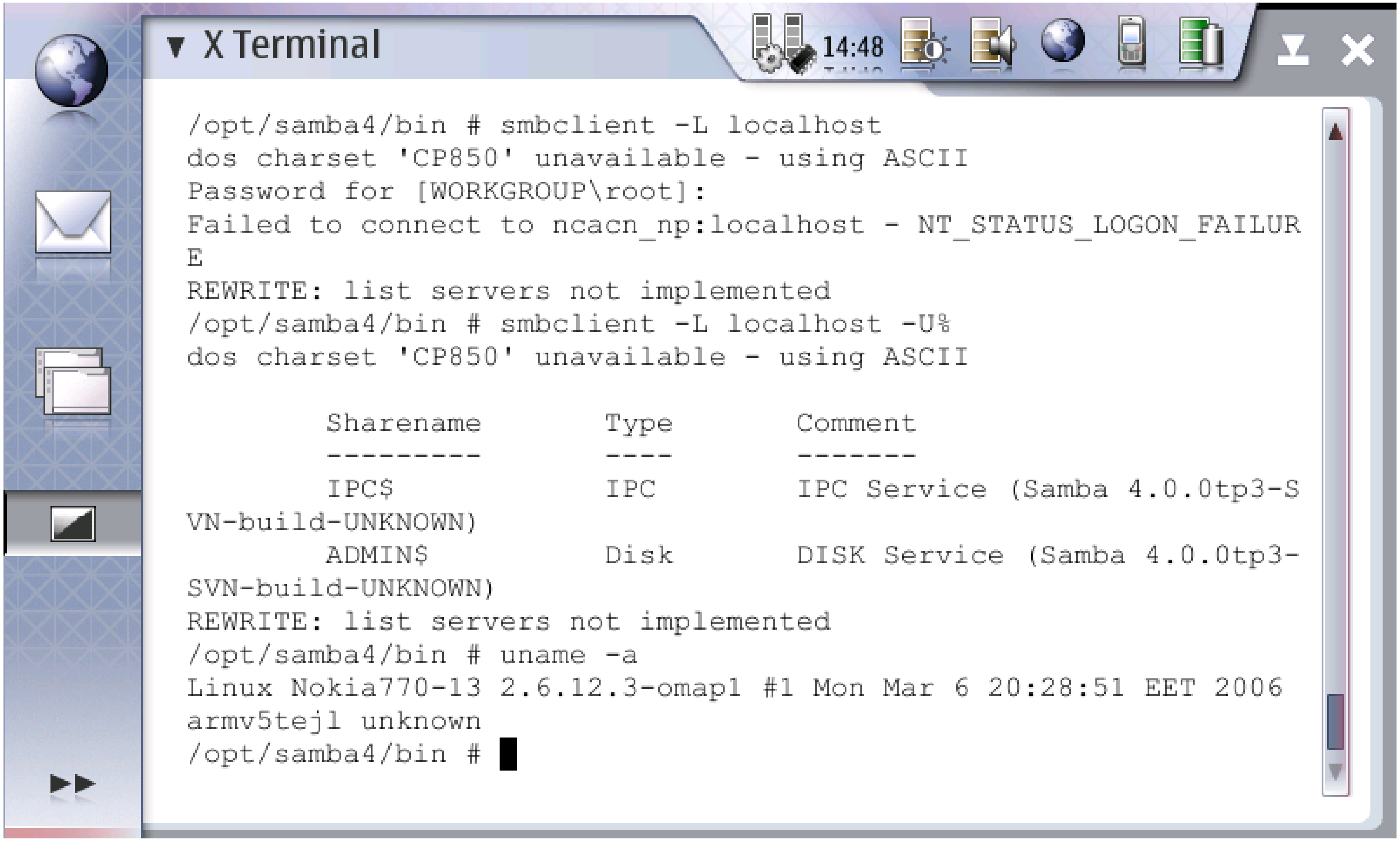
Name

Security

□ Sign
□ Seal

Demo running on real device

- Sample session of accessing smbd from an smbclient running on the same device:



```
/opt/samba4/bin # smbclient -L localhost
dos charset 'CP850' unavailable - using ASCII
Password for [WORKGROUP\root]:
Failed to connect to ncacn_np:localhost - NT_STATUS_LOGON_FAILUR
E
REWRITE: list servers not implemented
/opt/samba4/bin # smbclient -L localhost -U%
dos charset 'CP850' unavailable - using ASCII

        Sharename       Type       Comment
        ---------       ----       -------
        IPC$            IPC        IPC Service (Samba 4.0.0tp3-S
VN-build-UNKNOWN)
        ADMIN$          Disk       DISK Service (Samba 4.0.0tp3-
SVN-build-UNKNOWN)
REWRITE: list servers not implemented
/opt/samba4/bin # uname -a
Linux Nokia770-13 2.6.12.3-omap1 #1 Mon Mar 6 20:28:51 EET 2006
armv5tejl unknown
/opt/samba4/bin # █
```

Questions?

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