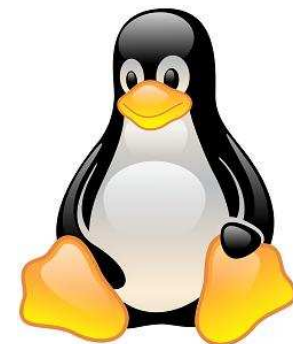




State-of-the-art open source for embedded
From Linux distributions
to multimedia frameworks



ESSESIUM



There is an open source package that fits your needs

- ❑ When developing software, reuse existing packages

- ❑ Free & Open Source Software
 - offers maximal control
 - No vendor lock-in
 - no license cost :-)
 - *sometimes* offers good support

- ➔ Choose packages wisely

The



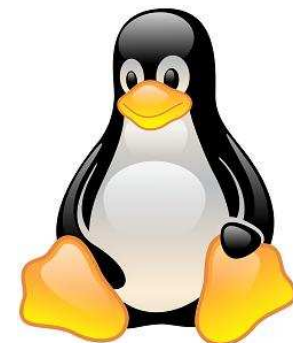
Seal of Approval

Linux and Open Source Solutions for Embedded Systems



ESSESIUM

Arnout Vandecappelle
Senior Embedded Software Architect

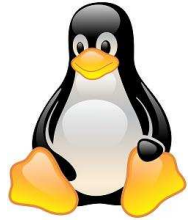


- Core system
 - The kernel
 - The distribution

- Basic services
 - Remote Procedure Calls
 - Networking

- Graphics
 - Graphical User Interface
 - Multimedia

Core system: the kernel



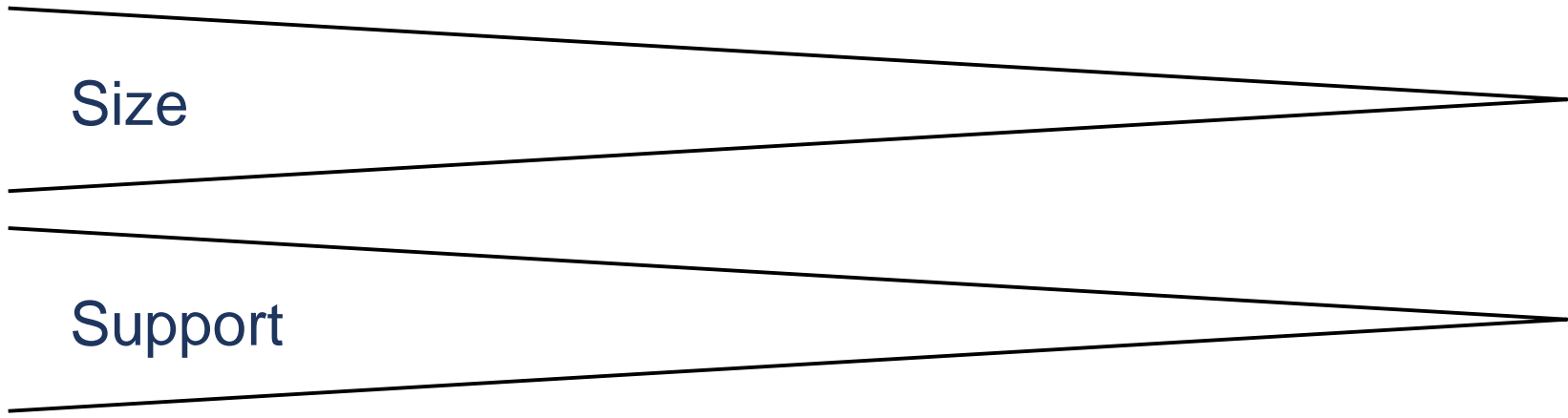
Linux
<http://kernel.org>



RTEMS
eCOS
<http://rtems.org>
<http://ecos.sourceware.org>



FreeRTOS
<http://www.freertos.org>



Examples of the kernel

In-flight entertainment:
Linux



Flight controls:
RTEMS



Hydraulics: FreeRTOS

- ❑ Code size estimates (order of magnitude)
 - Linux: >1MB
 - RTEMS/eCOS: >100K, >300K with networking
 - FreeRTOS: 5K or even less
- ❑ RTEMS: old versions stay supported for 10 years
- ❑ eCOS: bears more resemblance to POSIX
- ❑ FreeRTOS: no generic drivers,
but existing ones for e.g. ARM can serve as example
- ❑ Linux: use one from kernel.org (or from distribution)
 - Still get important updates to older kernels (2.6.27 currently)
 - Much easier to upgrade (using git)
 - Many more users, so more testing
 - Extremely good support on kernel mailing list
 - ❑ ... if you know how to formulate the question

Core system: the distribution



<http://debian.org>



openembedded

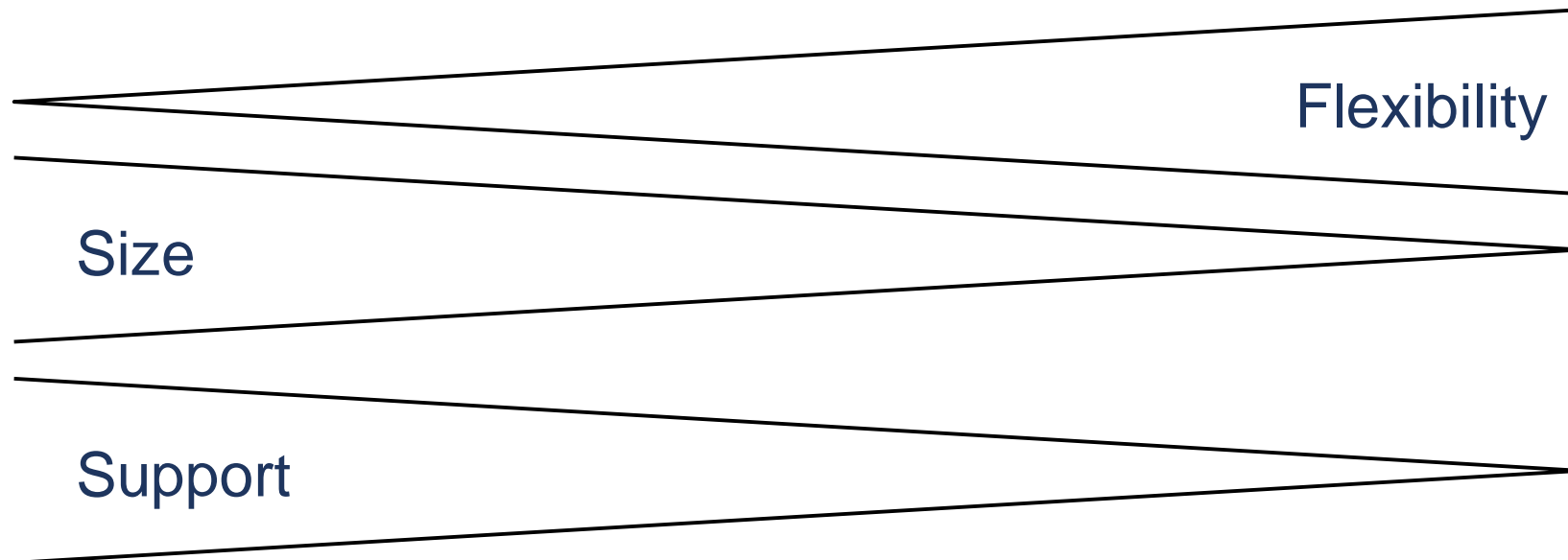


<http://ubuntu.com>

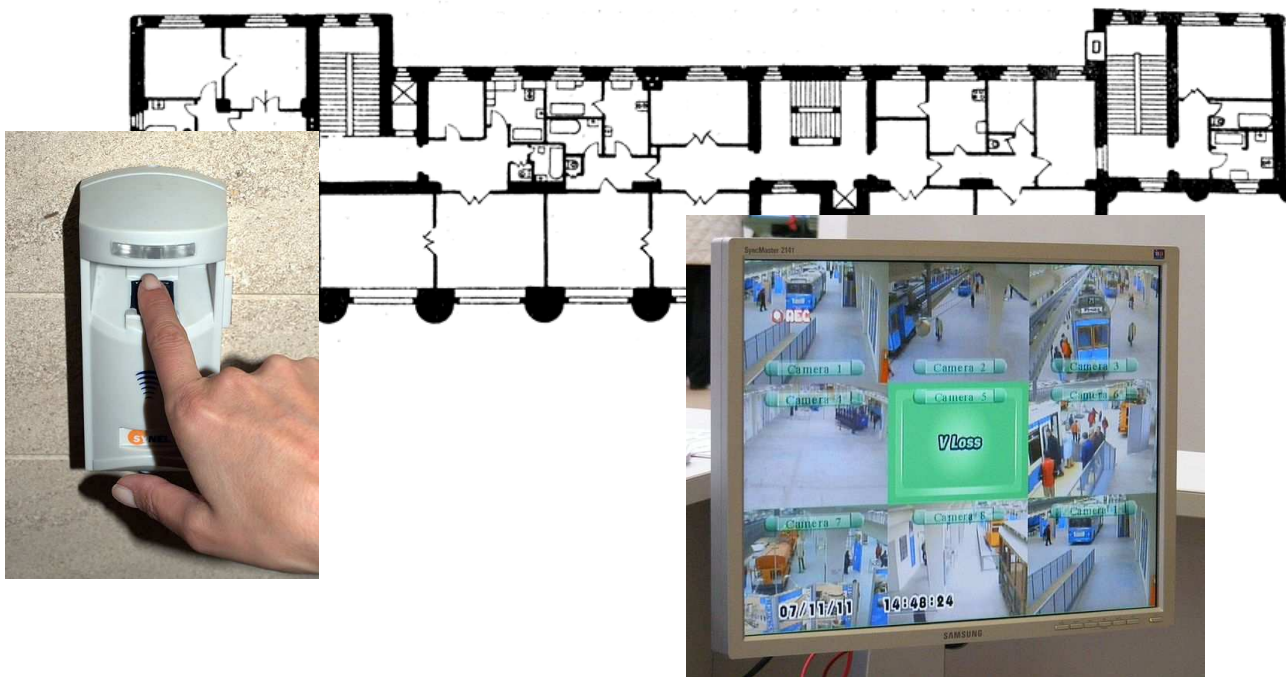
<http://OpenEmbedded.net>

Intel, PowerPC, MIPS, some ARM

All architectures



Examples of the distribution



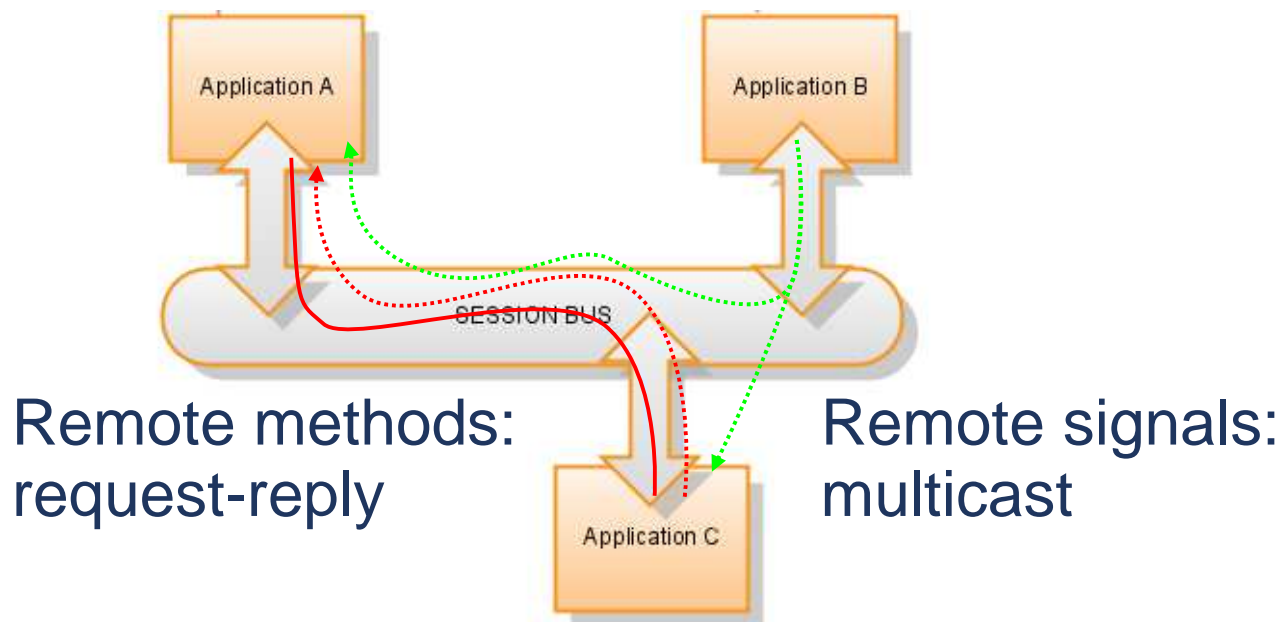
Access point:
OpenEmbedded

Security center:
Ubuntu

Tips on the distribution

- ❑ Code size estimates (order of magnitude)
 - Debian/Ubuntu: >100MB
 - OpenEmbedded: >1M (busybox + simple application)
- ❑ OpenEmbedded is extremely flexible, but not trivial to use the flexibility
 - “Standard” distributions are simple to use
 - ❑ Ångström, OpenMoko, OpenZaurus, ...
- ❑ Buildroot is an alternative for OpenEmbedded
- ❑ Debian & Ubuntu only support native compilation
 - Must build on the same system as target
 - Typically in chroot and even in emulator
 - emDebian tries to overcome this (immature)
- ❑ Ubuntu is the choice for PC-like systems
 - Better support for recent video hardware etc.
 - Possible to mix&match Ubuntu & Debian packages

Basic services: D-Bus Inter-process communication



- ❑ Relatively small footprint (600K)
- ❑ Very flexible (access control, language bindings)
- ❑ Much more reliable than custom systems

<http://dbus.freedesktop.org>

Basic services: NetworkManager Network abstraction and control



- Database & access methods for networks
- Checks availability of network connections and sets them up automatically
- Provide information about networks
- Application interface for network configuration

<http://projects.gnome.org/NetworkManager/>

Graphics: Graphical User Interface



Qt/Xorg
80MB

<http://qt.nokia.com>
<http://x.org>



Qt/DirectFB
20MB

<http://qt.nokia.com>
<http://directfb.org>



SDL
5MB

<http://libsdl.org>

Size

Support

Example of graphical user interface



Door bell video:
SDL



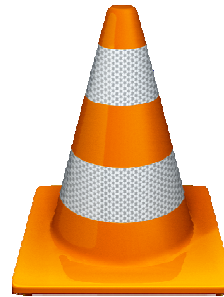
TV Media Center:
Qt/FB or
Qt/Xorg

- All of them have hardware acceleration (OpenGL), but supported hardware varies
- SDL perfectly suitable if there is a single application and no windows
- Xorg perfectly suitable when running multiple applications
- Xorg often chosen because more hardware is supported
- Gtk: Alternative to Qt. Slightly smaller, otherwise similar
- KDE: Desktop environment on top of Qt



GStreamer

<http://gstreamer.freedesktop.org>



VLC

<http://videolan.org>



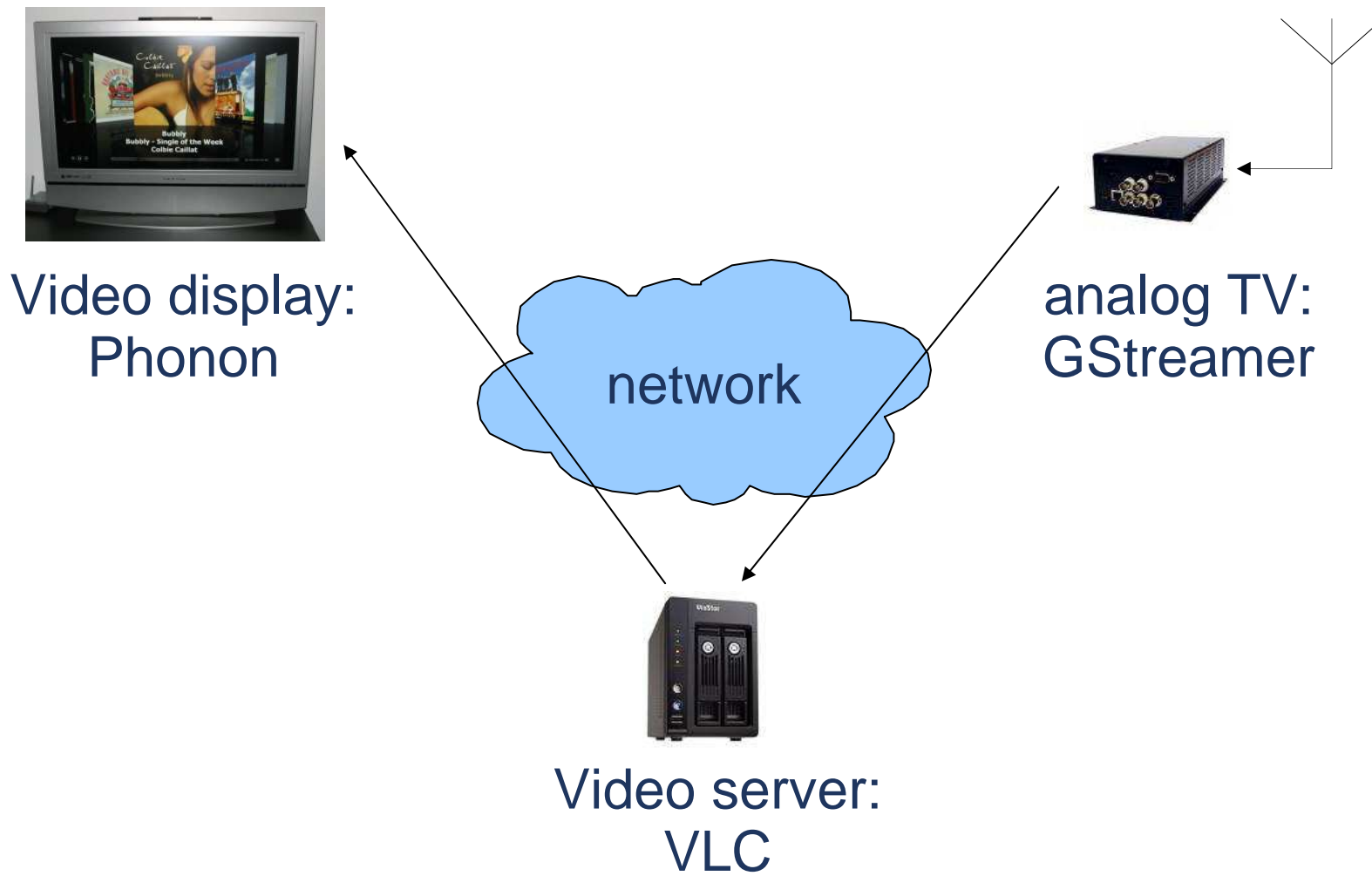
Qt/Phonon

<http://qt.nokia.com>

Complexity

Flexibility

Examples of multimedia



- Use cases
 - Phonon is ideal for simply playing multimedia
 - Play, pause, seek
 - Configure output (resize, volume control, ...)
 - Audio effects (equalizer, resampler, ...)
 - VLC good if doing other things too
 - Simultaneously play and record
 - Stream over network
 - Transcoding
 - GStreamer for really complex stuff
 - Using hardware encoders
 - Custom manipulations of a stream
- Backends
 - Phonon uses GStreamer as a backend
 - VLC and GStreamer use libavcodec, libdvdread, ...

- ❑ Reuse open source packages

- ❑ Stable, well-supported, full-featured packages exist
 - for basic system
 - for system services
 - for graphics

- ❑ There is an open source package that fits your needs



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