



Embedded OS/2

Using OS/2 Warp for
information appliances



What is an Embedded System?

- Hardware that provides a specific functionality
- A "black box" system (no exposure of internals to the user - no maintenance)
- Special software inside to control the hardware

Both hardware and software are designed to fulfill one specific purpose



Achim Hasenmüller
achimha@innotek.de

Evolution of Embedded Systems

■ ASICs

- *Application Specific Integrated Circuits* are chips that are designed for one special purpose and have everything in silicon
 - Long time and high costs for development
 - Cheap when manufactured in big numbers

Only used for rather simple logic and very high volume production



Achim Hasenmüller
achimha@innotek.de

Evolution - contd.

■ Microcontrollers

- General purpose controllers that have several I/O ports and can be programmed using a special tool (programming language)
 - Very popular for simple controlling applications
 - Cost per chip higher than for ASICs
 - Reduced development time
 - Special tools and software required



Achim Hasenmüller
achimha@innotek.de

Evolution - contd. 2

- **Microprocessors and Embedded Operating Systems**
 - Very complex applications possible
 - High processing speed
 - Very productive and powerful operating system services available
 - Operating systems available for more than one microcontroller, portability
 - Development can be done in C for most systems



Achim Hasenmüller
achimha@innotek.de

Evolution - contd. 3

■ Industry Standard PC Hardware

- Very powerful hardware available (PowerPC, x86, ...)
- High volume standard chips mean relatively low prices
- Many complete designs available (motherboards, subsystems)
- Huge amount of software available
- Very advanced development environments and tools



Achim Hasenmüller
achimha@innotek.de

Operating Systems for x86

■ DOS (MS, IBM, Caldera, ...)

- Cheap (or even free!) software license
- Limited capabilities (no GUI, multitasking)

■ Windows 95/98

- Very expensive license
- Poor reliability
- Limited customization possibilities

■ Windows CE

- Limited software compatibility
- Too thin for demanding appliances



Achim Hasenmüller
achimha@innotek.de

Operating Systems for x86 - contd.

■ Windows NT (Embedded)

- Very expensive software license
- Very fat system
- Limited customization possibilities
- Huge software and development tools portfolio

■ QNX

- Powerful multitasking, thin system design
- Limited software support, few development tools



Achim Hasenmüller
achimha@innotek.de

Operating Systems for x86 - contd.

■ Linux

- Stable and powerful operating system
- Free software - no royalties
- Source code available, perfect customization possibilities - but problems with GNU license for modifications
- Source code often has to be modified to achieve customization
- X as the graphics subsystem is very fat and not really suitable for embedded systems
- Missing compatibility to DOS and Windows



Achim Hasenmüller
achimha@innotek.de

What about OS/2?

- Surprisingly cheap license
- Very reliable and extremely efficient multitasking (low latency time)
- Good customization possibilities
- Very big choice of software and development tools available
- Runs well on flash disk systems
- Unmatched DOS (+ Win 3.1) support
- Very good Unix source level compatibility (EMX)



Achim Hasenmüller
achimha@innotek.de

The Original Embedded OS/2

- There has been a project at IBM Japan with the goal to create a stripped down version of OS/2
 - Only a subset of the OS/2 APIs supported
 - Limited application support
 - Advantages over established systems such as QNX, Nucleus?

When talking about "Embedded OS/2",
it's about using standard OS/2 for
embedded systems



Achim Hasenmüller
achimha@innotek.de

Startup Time

- OS/2 is a relatively big system with a long startup time. There are several ways to reduce it considerably:
 - Remove unnecessary drivers and speedup driver initialization (f.ex. IDE driver)
 - Use hardware suspend features if available (write memory + system state to HDD)
 - Use OS/2's hibernation mode (several restrictions apply)
 - Use a flash IDE disk-on-chip for the startup files if HDD present



An Example: Met@box 500

- The met@box 500 is an internet set-top-box for TV systems with online browsing and offline data reception over the PAL TV signal (BOT)
 - Based on the Cyrix MediaGX 200MHz integrated x86 design
 - 64MB RAM
 - 3GB HDD for offline content storage
 - Infrared keyboard
 - Integrated 33.6/56kbs modem
 - BOT decoder board



Achim Hasenmüller
achimha@innotek.de

BOT - Broadcast Online TV

- Jointly developed by Deutsche Telecom, TU Dresden and Metabox AG, protected by international patents
- Uses the horizontal blanking interval of the standard TV signal to transmit data
 - Vertical area used by f.ex. Intericast usually not available in Europe ("Videotext")
- Speed from 72KBit/s up to 2MBytes/s
- Inserted at the TV station, point to multipoint over satellite, cable, ...



Achim Hasenmüller
achimha@innotek.de

MPEG 1 Software Video

- Using the OS/2 DOS emulation, a software decoder has been developed that directly accesses the hardware
 - The hardware is just good enough for the MPEG player with all optimizations possible
 - An OS/2 program would have to use a special device driver for direct hardware access
 - DOS programming is much easier because of direct hardware access



Internet EMail Client

- Frontend is Netscape Navigator
 - Powerful layout possibilities
 - User interface consistency
- All pages are dynamically constructed using Rexx as the CGI language
- Email exchange is done using a C frontend for SMTP and POP3
- IBM has created a hook in Netscape to call external email programs when the user clicks on *mailto:* tags



Achim Hasenmüller
achimha@innotek.de

Fax client software

- Frontend is Netscape Navigator
 - Same interface as email software
- Backend has been developed in Rexx and uses the incredibly powerful and lightweight Fax framework from Dr. Harald Pollack (www.buntspecht.de/fax)
- Fax images use the TIFF file format which Netscape does not support so a special TIFF image plugin has been developed



Achim Hasenmüller
achimha@innotek.de

Web server

- Development has started with Apache under OS/2
 - Very resource consuming due to heavy use of the old Unix fork() process model
 - Several reliability problems observed
- Apache has been replaced by Xitami
 - Extremely slim and fast
 - Single process modell
- In the future, Apache will be used when it supports native OS/2 threads because of features and better source code



Achim Hasenmüller
achimha@innotek.de

Internet Resources

- **IBM "Embedded OS/2" Homepage**

<http://www.software.ibm.com/sw-sell/oem-sw/oemproducts/opsys/embos2home.html>

- **Metabox AG**

<http://www.metabox.de>

- **BOT - University of Dresden**

<http://www.ifn.et.tu-dresden.de/english/bot.htm>

- **InnoTek Systemberatung**

<http://www.innotek.de>



Achim Hasenmüller
achimha@innotek.de