

Development of a DWARF-based display component for 3D scences on the iPAQ

- Systementwicklungsprojekt -

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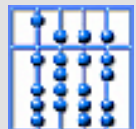
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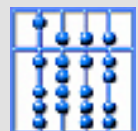
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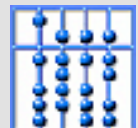
Summary

- Setup a development environment for the iPAQ
 - Find a suitable VRML browser
 - Port it to the iPAQ
 - Write a VRML Service, which connects the VRML browser to the DWARF Middleware
- DWARF Service for displaying 3D graphics on the IPAQ



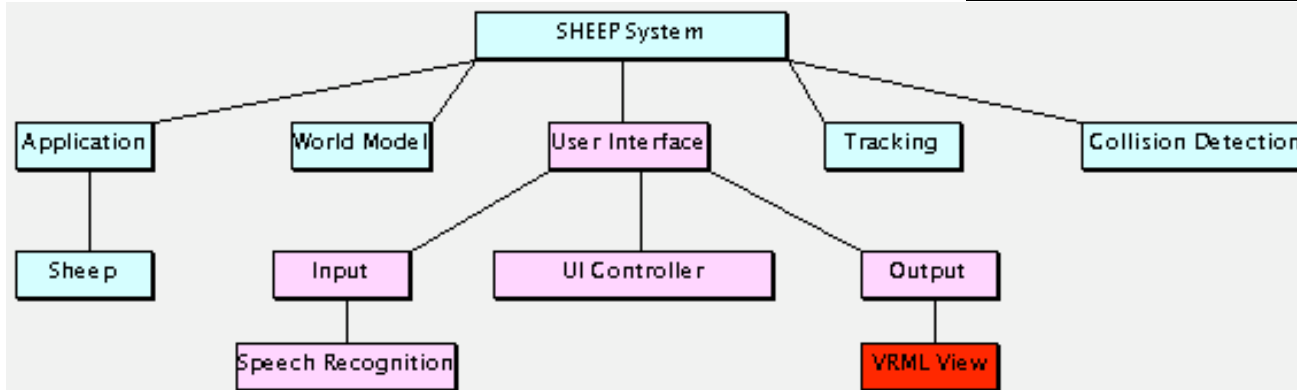
Outline

- Introduction – The SHEEP System
- Requirements Analysis
- Related Work
 - VRML
 - GCJ
- System Design
- Implementation
- Problems with the iPAQ
- Conclusion

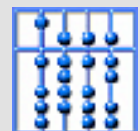


Introduction - The SHEEP system

- SHEEP: The Shared Environment Entertainment Pasture
- The SHEEP system is a multimodal multiplayer game
- Game is centered around a table with a beamer-projected landscape
- Players use intuitive interaction technologies (beamer, head-mounted display, (touch) screen, speech, gesture)

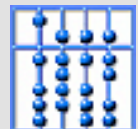


- Based on DWARF
- Interaction through DWARF services (the leaves of the tree)



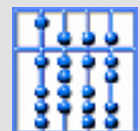
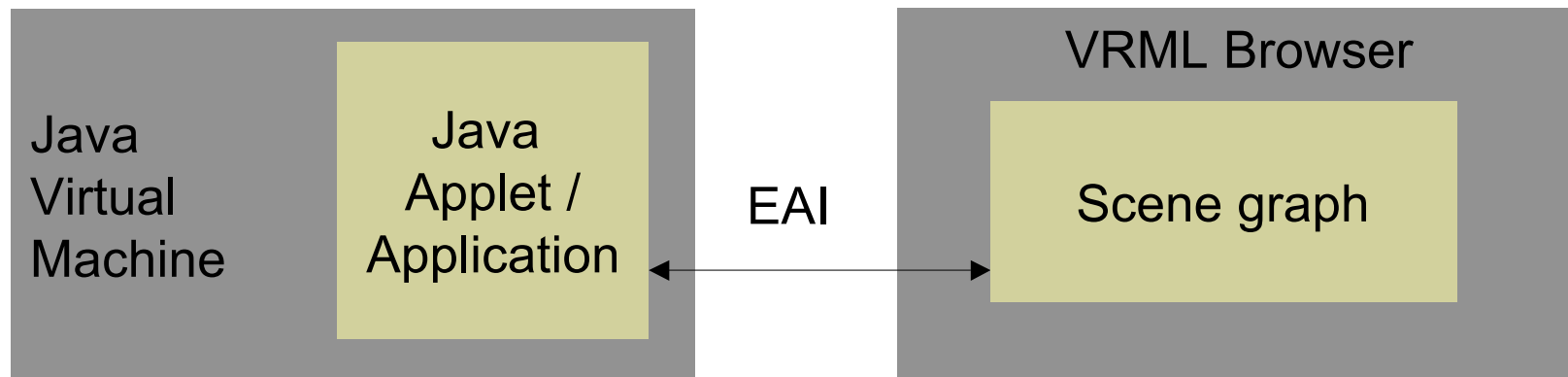
Requirements Analysis

- Functional requirements:
 - Display of graphics in 3D
 - Synchronization of changes in a displayed scene with the environment
- Nonfunctional requirements:
 - Velocity and efficiency of the system
 - Short waiting time for users
 - Convenient and easy manipulation of displayed objects
 - Adequate User Interface
- Pseudo requirements:
 - Hardware: Compaq iPAQ, StrongARM processor
 - No FPU → Floatingpoint emulator
 - No 3D acceleration
 - Operating system: Linux
 - DWARF: Connection to the DWARF middleware



Related Work - VRML

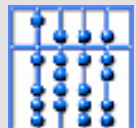
- VRML: Virtual Reality Modeling Language
 - Language for describing 3D image sequences
 - VRML browsers or viewers needed to view VRML scenes
- EAI: External Authoring Interface
 - Annex to VRML
 - API in Java
 - dynamic, interactive communication with VRML browser
 - manipulation of VRML scenes



Related Work - Browser Review

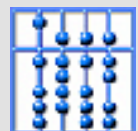
<i>VRML Browser</i>	<i>Platform</i>	<i>VRML Conformance</i>	<i>EAI Support</i>	<i>Performance</i>
VRwave	All	Very bad	Yes	Very bad
OpenVRML (Lookat)	All	Basic functionality	No	Bad
FreeWRL	Linux/Unix, Mac OS/X	Basic functionality	Yes	Ok

→ FreeWRL best choice



Related Work - GCJ

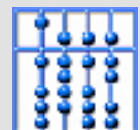
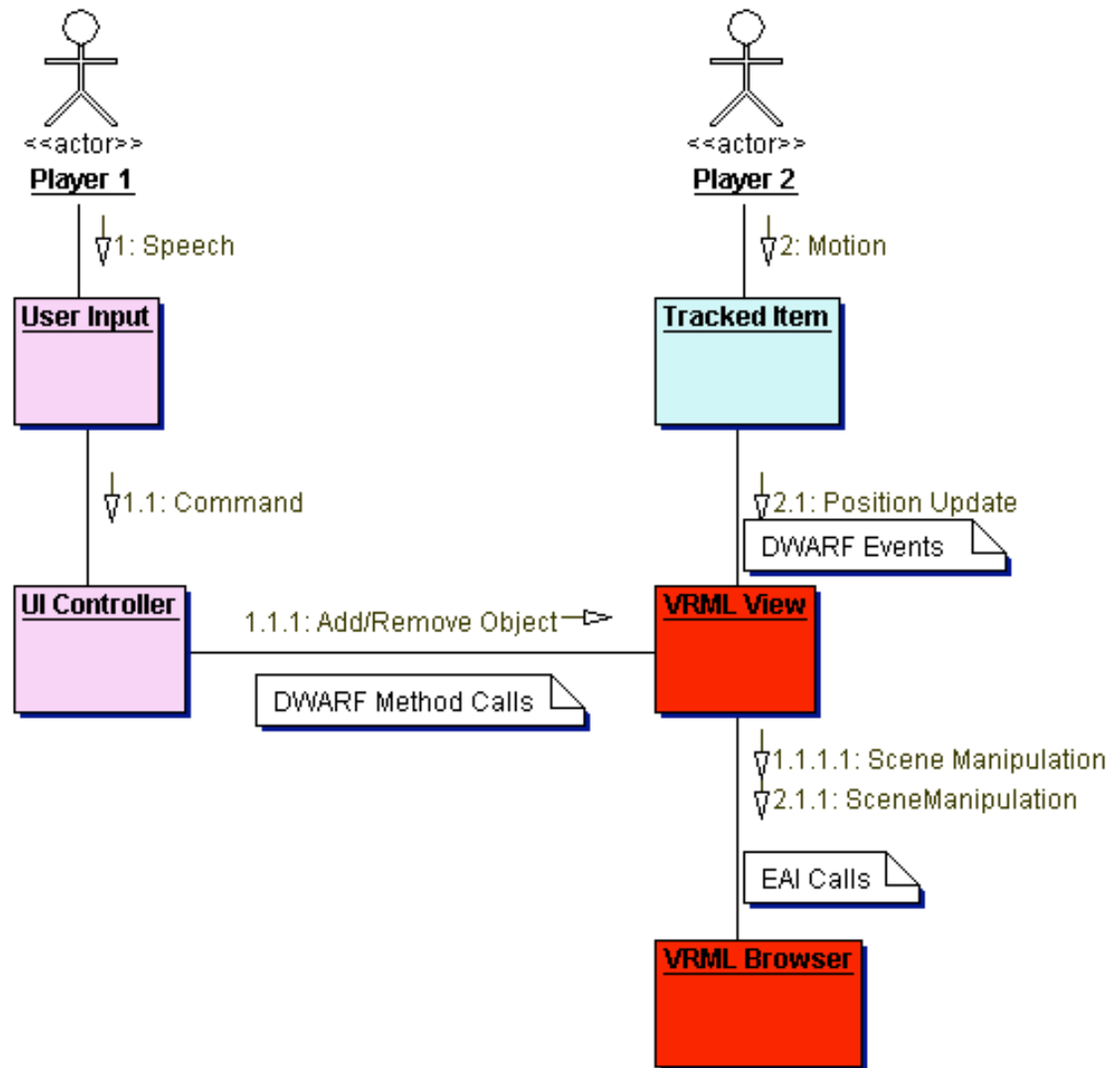
- GCJ - The GNU Compiler for Javatm
- First public release: 1999
- GCJ is capable of compiling:
 - Java bytecode to native machine code
 - Java source code directly to native machine code
- Linking of compiled applications with the GCJ runtime, libgcj, which provides
 - the core class libraries
 - a garbage collector
 - and a bytecode interpreter
- Possibility to invoke GCJ compiled Java code from a C++ application
- GCJ can be configured as a cross-compiler



System Design

VRML View gets

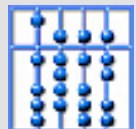
- Position/orientation data of objects as DWARF events (from tracked items)
- Method calls to add/remove objects (from UI Controller)



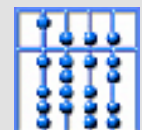
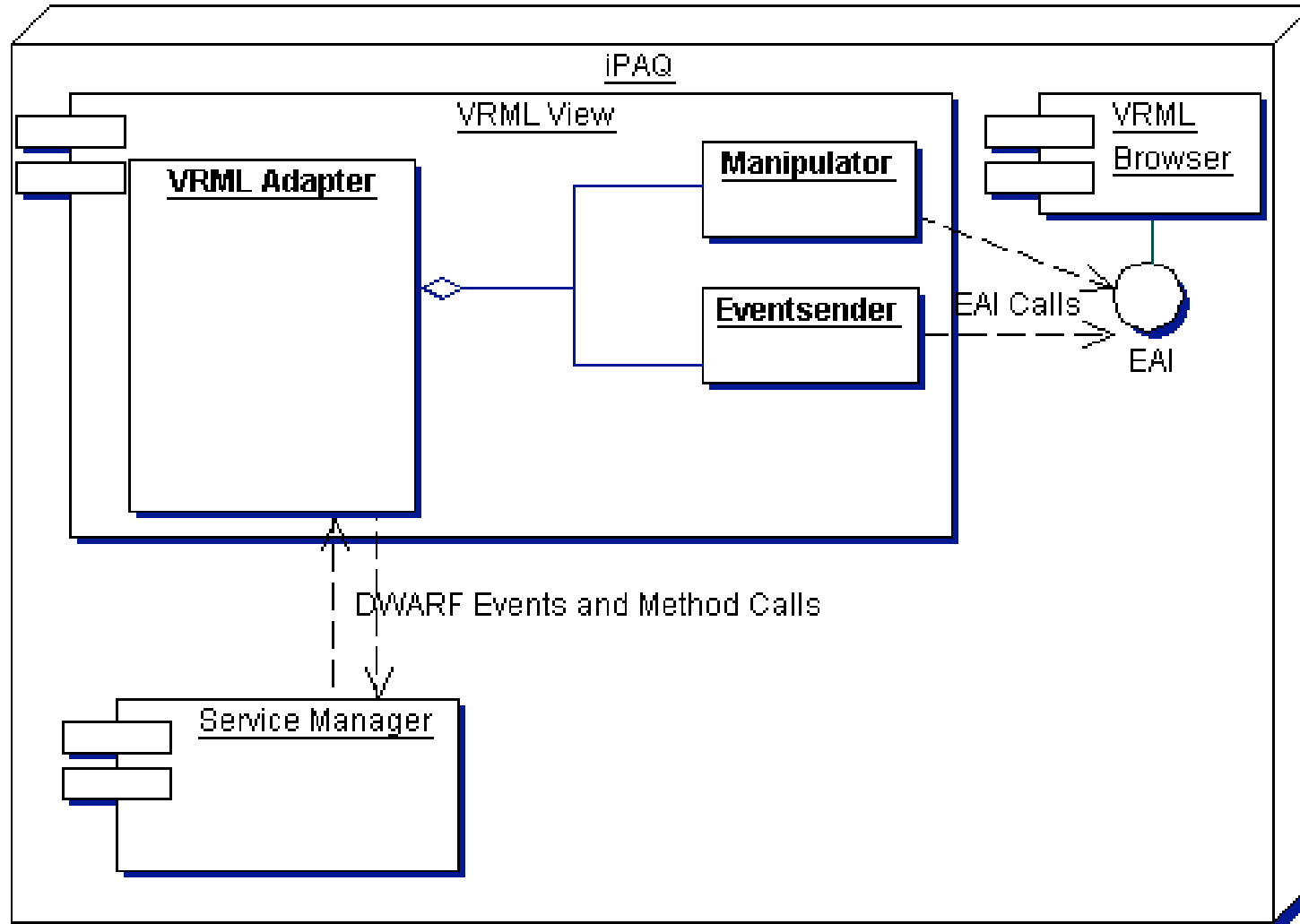
Implementation - The How

Goal: Connect the VRML View to FreeWRL

- FreeWRL's EAI in Java
- Java slow, native code more performant
- Native compilation using GCJ
- Native compilation on iPAQ slow
- Cross-compilation using GCJ

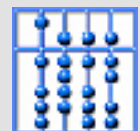


Implementation – The Details

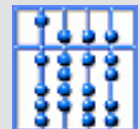
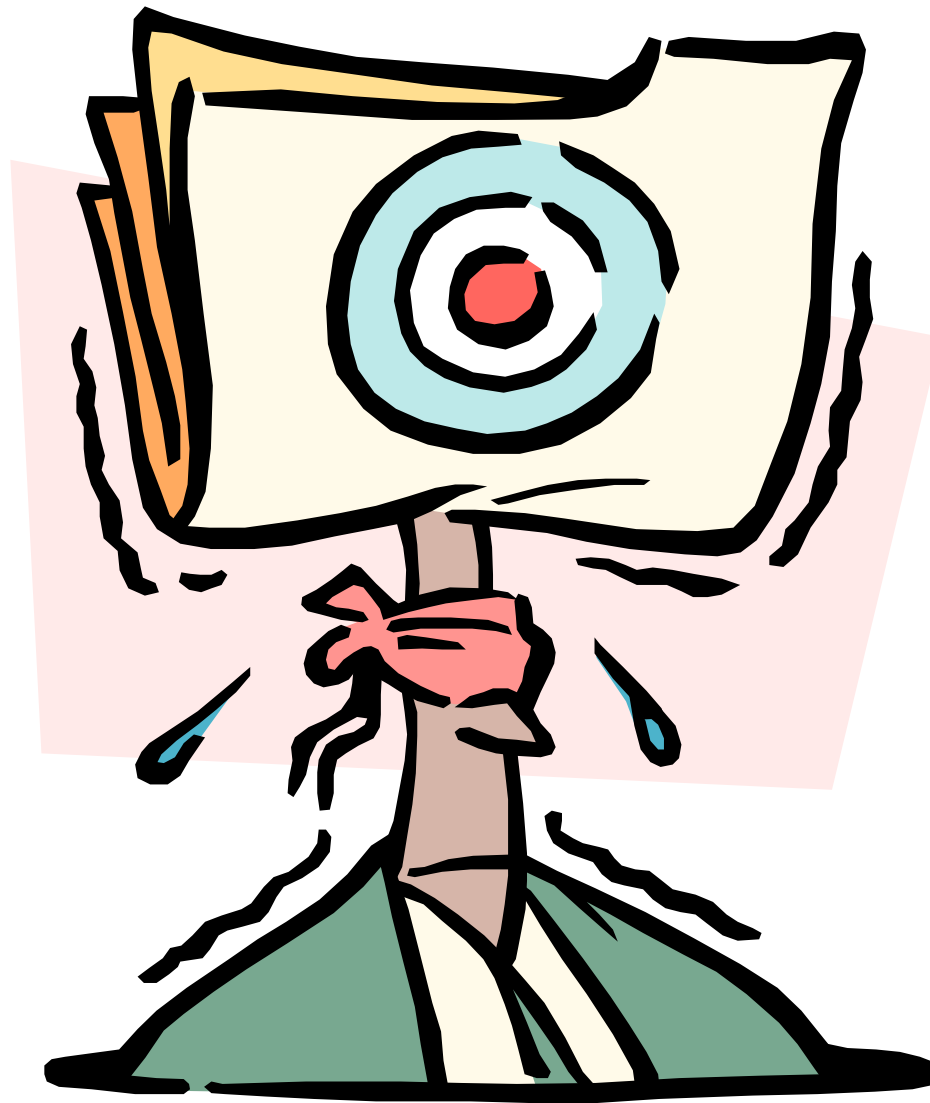


Problems with the iPAQ

- Limited number of packages for Familiar Linux
→ Installation of Intimate (Debian) Linux
- Limited amount of disk space
→ PCMCIA hard disk, NFS
- Kernel bugs
- Adjustments for compilation of FreeWRL
- Debugging of the build process for the cross-compiler for ARM (→HOWTO)
- ...And: When I got the iPAQ, someone has changed the password, so I had to reinstall everything from SCRATCH...

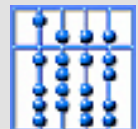


Problems with the iPAQ



Conclusion

- Future work for Adapter/Manipulator:
 - Refactoring of Manipulator
 - Integration of XML Parser/Configuration
 - Implementation of Eventsender
- iPAQ powerful enough for simple, but not for graphics-intensive applications
→ Next generation iPAQ!



End

- Thank you for your attention!
- Many thanks to everyone who was supporting my work (three little DWARFs, Franz, Ming-Ju 😊)
- Any questions?

