

# Rapid Prototyping and Handheld AR with the *Studierstube* Augmented Reality Platform



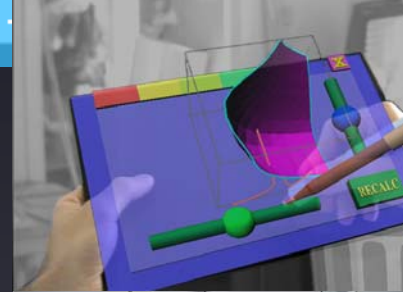
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# What is *Studierstube*?

- Long term research project on AR technology
  - ◆ Collaborative/distributed AR (since 1996)
  - ◆ Mobile/handheld AR (since 2000)
- Emphasis on 3D interaction & graphics
- Large body of useful software
  - ◆ Runs on Windows, Linux, SGI, ...
  - ◆ Freely available as open source
  - ◆ Rapid prototyping with scripting interfaces (XML, Python)
  - ◆ Latest version also for **Windows Mobile**

→ **Handheld AR**

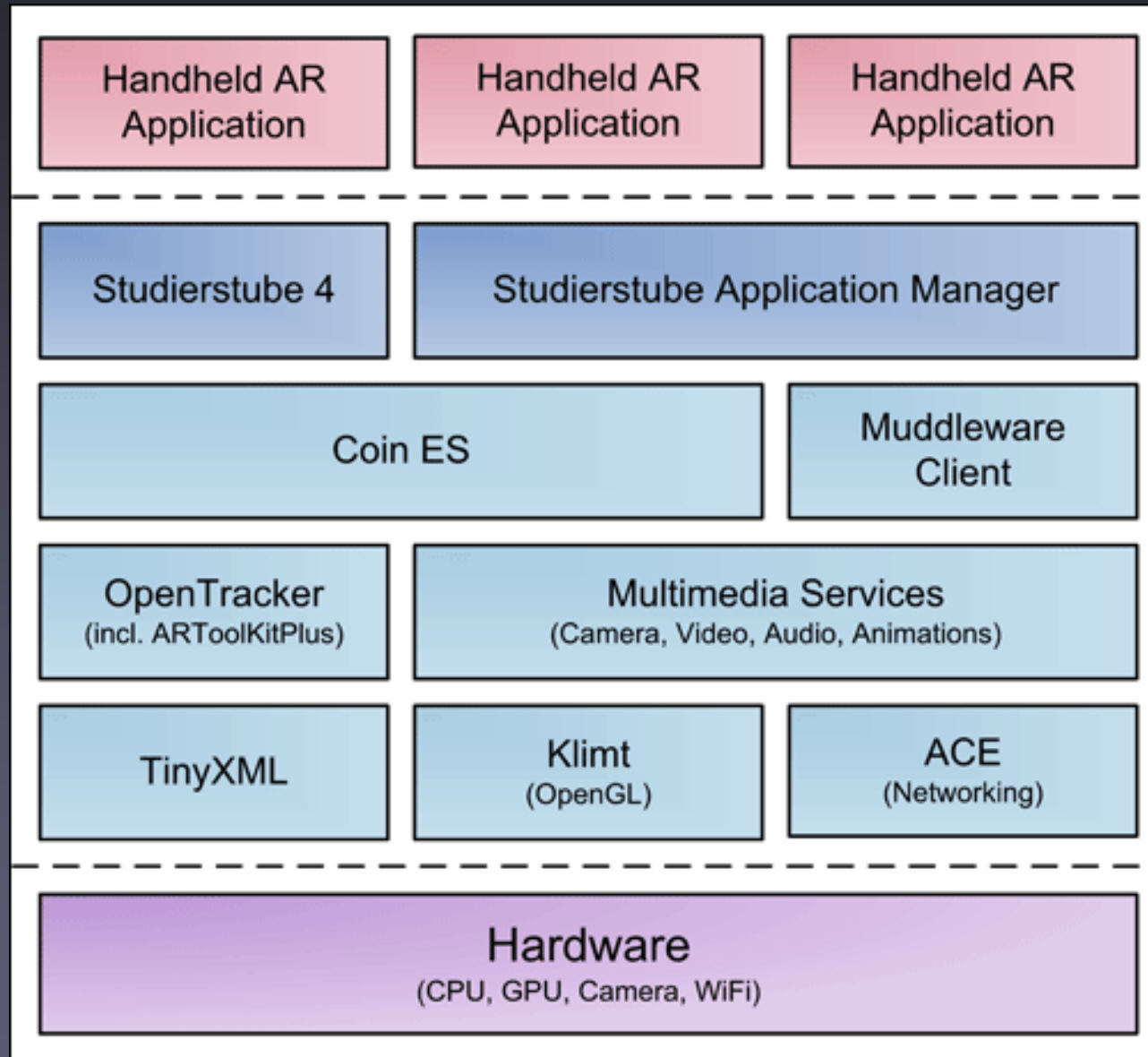


# Handheld Augmented Reality

- Stand-alone handheld AR on PDAs
  - ◆ Not a thin-client!
  - ◆ High scalability
- PDAs are
  - ◆ Inexpensive
  - ◆ Socially acceptable
  - ◆ Familiar
  - ◆ Discreet
  - ◆ Widespread
- All in one solution
  - ◆ Camera
  - ◆ Touch screen
  - ◆ Wireless networking

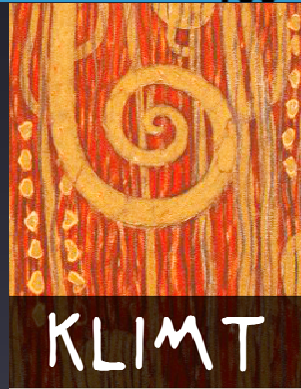


# Handheld AR Software Architecture



# Graphics: Klimt

- Custom 3D library for handhelds
- Portability & performance
- OpenGL & OpenGL ES subset
- Currently no real OpenGL (not -ES) alternative on PDAs
- Software rendering (70K Tri, 11MPix)
- Hardware (500K Tri, filtered textures)
- Coin port runs on top of Klimt



# Vision Tracking: ARToolKitPlus

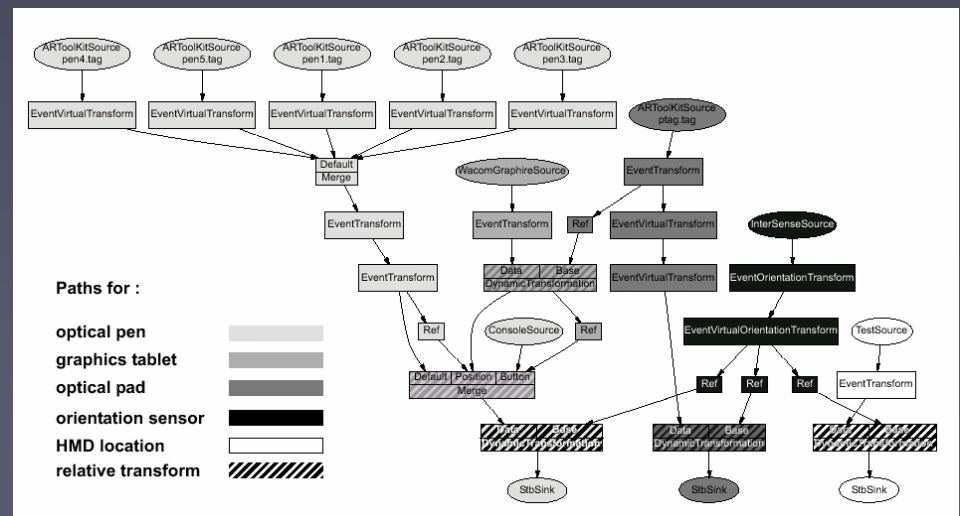
- Windows, Linux, Win.CE
- Vision tracking core
- Primary tracker on PDA
- Ported to PocketPC
- Up to 512 fast id-based markers
- Optimized for ARM:  
Up to 150 images/sec on a PDA
- Other sensors (GPS etc.) via **OpenTracker**



# Tracking Middleware: OpenTracker

- Extensive support for tracking devices
- User defined data flow graphs
- Many transformation and filter nodes
- Nodes can communicate over network

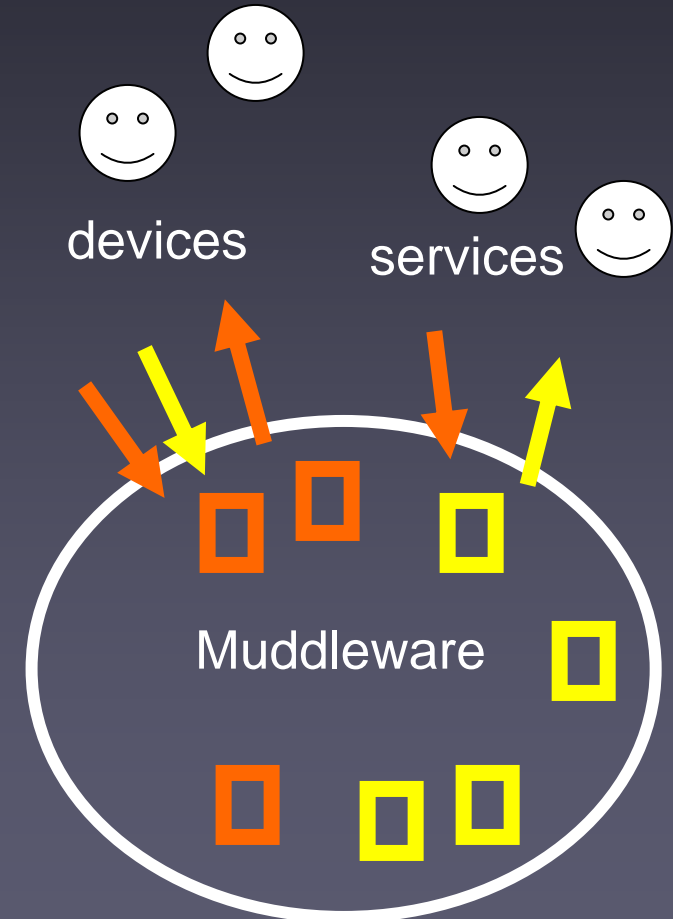
Example  
OpenTracker  
graph





# Muddleware Realtime Collaboration Server

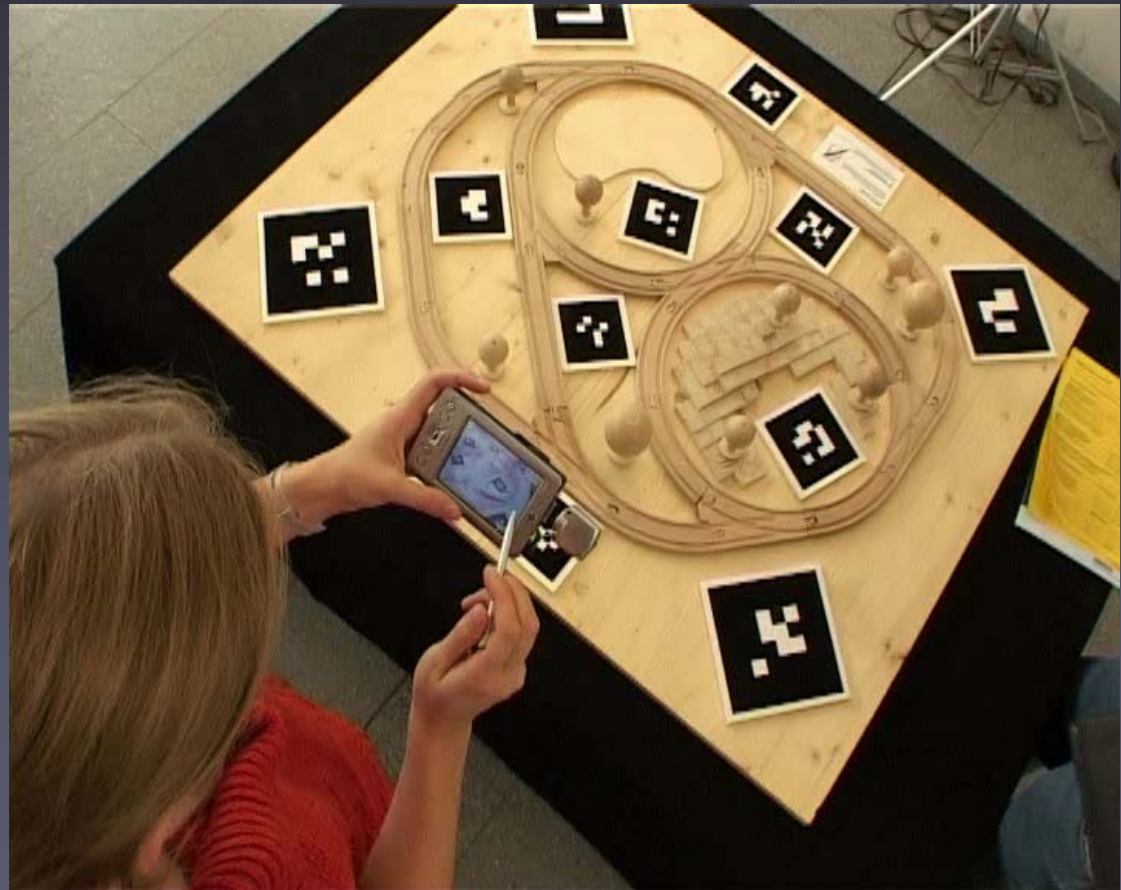
- For simple, scalable collaborative applications
- Tuplespace
  - ◆ For message exchange
  - ◆ But filled with hierarchical XML structured content
- Associative addressing
  - ◆ XPath
- Event channels
- Persistence





# The Invisible Train

- Multi-player game
- Demonstrates collaborative features of our Handheld AR Framework



# Mr. Virtuoso

Art history education goes AR!



# Thank You!

- Check out [www.studierstube.org](http://www.studierstube.org)
  
- Handheld AR Team
  - ◆ Daniel Wagner
  - ◆ Thomas Pintaric
  - ◆ Istvan Barakonyi



# Software Overview

- Fundamental library: scene graph
  - ◆ Provides 3D rendering and interaction
  - ◆ Open Inventor (originally SGI Inventor, now Coin – <http://www.coin3d.org> )
- General architecture
  - ◆ C++, Inventor runtime system (reflection...)
  - ◆ Extensions to Coin runtime system (tracking...)
  - ◆ Development by scripting (XML, .iv)
  - ◆ Extensions in C++
- Runs on Windows Mobile → **Handheld AR**