



**DCGI**



## Virtual Worlds and Augmented Reality on PDA platform

Jiří Danihelka

# AUGMENTED REALITY

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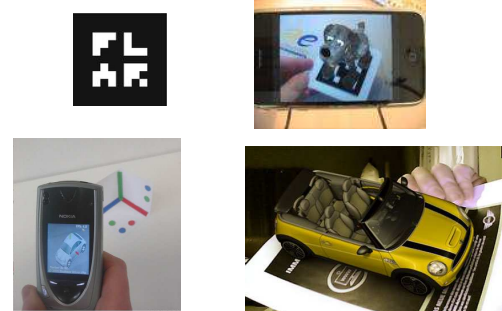
## Augmented reality on PDA



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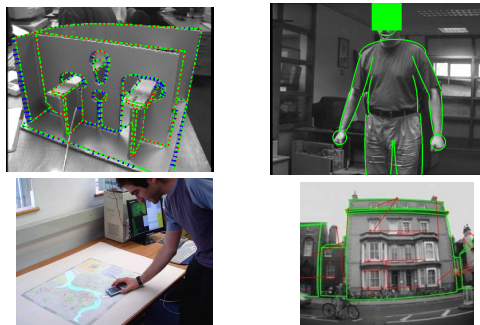
## Augmented reality on PDA



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## Feature points



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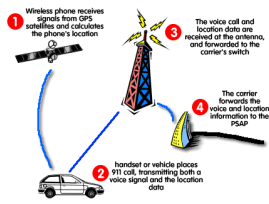
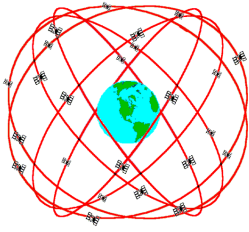


# PHONE LOCALIZATION

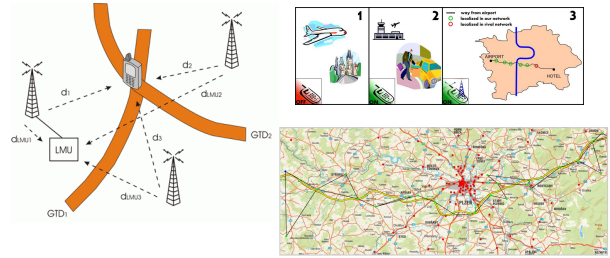
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## Global Positioning System - GPS



## GSM Localization

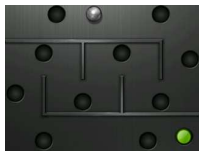


## CONTROL ELEMENTS

## Touch display vs. buttons



## Accelerometer - G-sensor



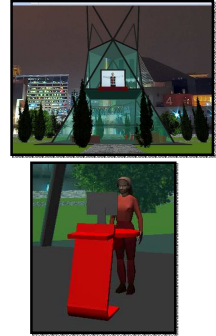
## OUR APPROACH

### Goal of the project

- Bring 3D worlds into mobile phones
- Use voice interface – synthesis and recognition
- Virtual customer care center (for mobile operator)

### Virtual Customer Care Center virtual store of Vodafone

- written in VRML language (Virtual Reality Markup Language)
- models were inspired by real Vodafone stores
- customers can choose mobile phones, see popular ads, ...
- Link: <http://internet3d.rdc.cz/vodafone/index.php>
- VRML browser is required
- Developers: Jiří Snížek, Václav Stolín, Jiří Danihelka



### Virtual Customer Care Center on mobile phones

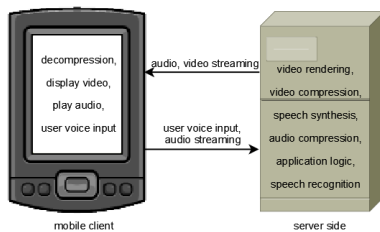
- uses Pocket Cortona VRML browser
- only minor changes from desktop version (smaller textures)
- some functionality is not available (no video-textures)
- user still can move in 3D environment, interact with objects, ...



## THREE POSSIBLE ARCHITECTURES

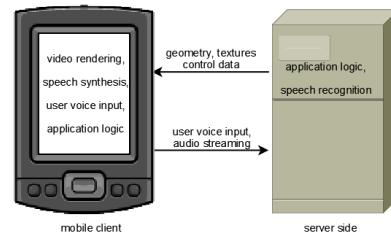
### Mobile Virtual Operator possible architectures

- Thin client
- Video streaming



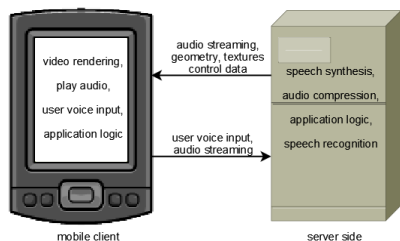
### Mobile Virtual Operator possible architectures

- Thick client
- Voice synthesis on client



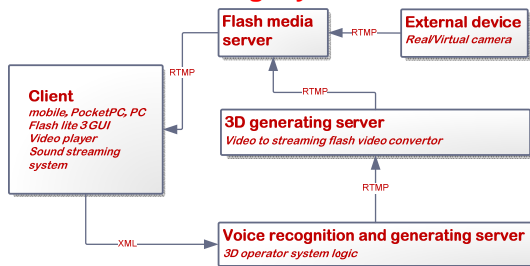
### Mobile Virtual Operator possible architectures

- Thick client
- Voice synthesis on server



## FLASH VIDEO STREAMING

### Flash video streaming: system architecture



- Server renders 3D virtual operator as video
- With assistance of FMS, video is streamed to client devices.

### Disadvantages of flash streaming

- Big latency (up to several seconds)
- Needs more bandwidth
- Bigger power consumption (for wireless transfer)

## GRAPHICS RENDERING ON MOBILE

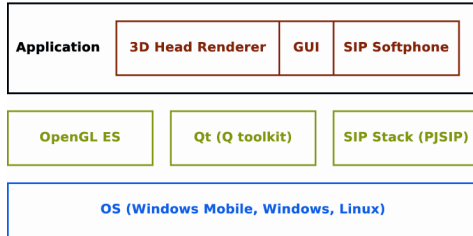
### Image Foreground Extraction on Mobile Image processing on mobile phone

- Rapid interactive and iterative image segmentation
- Working implementation of GrabCut – state-of-the-art high-performance algorithm (Rother, Kolmogorov, Blake - Microsoft Research Cambridge - Grabcut: Interactive foreground extraction using iterated graph cuts. SIGGRAPH, 2004.)
- Windows-Mobile based prototype implementation - feasibility
- Essential for 3D object modeling input



### Mobile platform independent architecture

- Able to run on most PDA phones
- Able to run on desktop computers and laptops



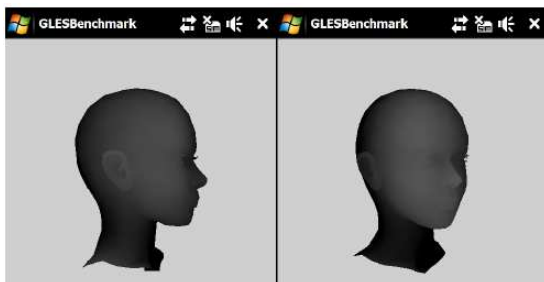
### Open GL ES - main differences:

- no glBegin, glEnd
- no display lists
- only vertex arrays
- no indexed colors
- limited floating point numbers support
- no stipple, no antialiasing
- 2D textures only



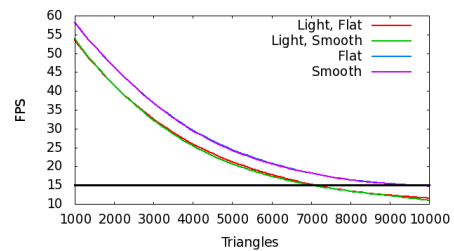
### Head rendering using OpenGL ES

- Female head (9000 polygons), fog shading, no textures



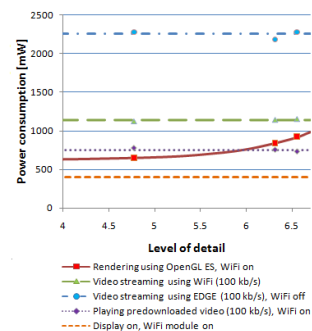
### Open GL ES rendering performance

- Critical frame rate for animation is 15 FPS
- Application can render up to 7000-9000 triangles

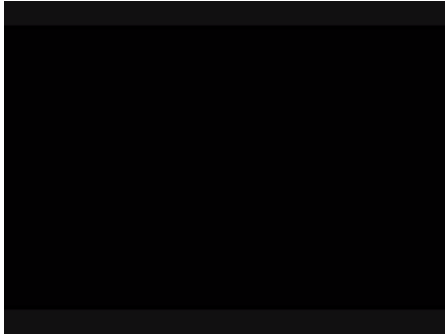


## STREAMING VS. RENDERING

### Power consumption during rendering/streaming on mobile



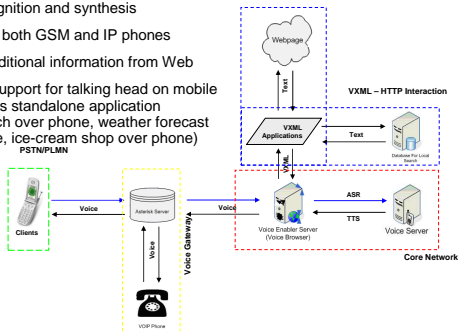
## Video streaming vs. rendering



## VOICE APPLICATIONS

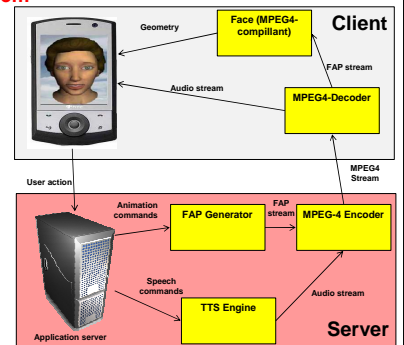
## Architecture of automated voice center

- voice recognition and synthesis
- works with both GSM and IP phones
- can get additional information from Web
- works as support for talking head on mobile phone or as standalone application (Wiki search over phone, weather forecast over phone, ice-cream shop over phone)



## Architecture of the system

- our system uses client-server distributed architecture
- application logic is stored on a remote server
- server generates voice using Text-to-speech engine (TTS)
- then for corresponding head animation Facial Animation Parameters (FAP) are generated in FAP Generator
- stream of the voice and the FAP stream are put together in MPEG4 Encoder
- mobile client decodes the stream and plays the voice and the animation



## RDC Overview

- Established
  - February 2001
- Location
  - CTU site: Dejvice, Prague 6
  - central, but close to airport
- Facilities
  - Ericsson full-blown GSM Network
  - Computer-equipped Lecture Room
  - Power & Server Room
- [www.rdc.cz](http://www.rdc.cz)



RDC Site



RDC Lecture Room



RDC GSM Network

THE END