Towards a Proximal Resource-based Architecture to Support Augmented Reality Applications

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• **Background and Motivation**
  - Small Devices
  - Big Applications
  - Thin Clients
  - Latency

• **System Architecture**

• **Utilities**

• **Adaptation of Google Earth**

• **Next Steps**
Big Applications

- Virtual Worlds
- Maps
- Augmented Reality

• Data/Computation Intensive, Context Dependent
Small Devices

Zypad Wearable

iPhone

Netbook

Nanotech

Contact Lens Display (UW)
Latency

Desktop

Thin Client
Second Life

- Massively Multi-player Online World
Computer Vision

- Find and follow objects in video
Augmented Reality

- Virtual objects integrated into live video
Google Earth 3D
Ancient Rome

- Interactively explore ancient Roman buildings
Application Characteristics

- Data Intensive
- Computation Intensive
- Sensor data
- Frequent user-interaction
• Background and Motivation

• **System Architecture**
  • Terminals
  • World
  • Architecture

• Utilities

• Adaptation of Applications

• Completed Work

• Next Steps
• A collection of input/output devices and sensors
• Various servers scattered over the internet.
Architecture

low latency

high latency

Work space

GPS
video
earpiece
PDA
terminals

web server
user’s server
game server
web server

world
The Purpose of the Workspace

- Mediates between world and client, adjusting for performance
- Quick communication with the client
- Dependence on physical location runs
- Add additional functionality to programs
- Create mash-ups between multiple programs
• Background and Motivation

• System Architecture

• **Utilities**
  - Display Forwarding
  - Sensor Input
  - Rendering
  - Video Augmentation

• Adaptation of Google Earth

• Next Steps
Utilities

- Based on Survey of Applications
- Data-Intensive
- Computation-Intensive
- Support Real-Time Interaction
Monitors display updates, forwards them to client.
Sensor Input

- Takes sensor input, translates, forwards.
• Receives geometric information, renders it into pixels
Video Annotation

- combines video with outside information
Utility Characteristics

- Offload computation from the client
- Do not require large alterations to apps
• Background and Motivation
• System Architecture
• Utilities
• Adaptation of Google Earth
• Next Steps
Data Model

Display -> Application -> Google server
Google Earth: Unmodified
Google Earth: Workspace
Demo
Next Steps

• Focus on I/O issues
I/O Devices

- camera
- microphone
- mouse
- accelerometer
- GPS
- temperature sensor
- light sensor
- RFID
- barcode reader
- keyboard
- biometric sensors
- touch sensor
- sound card
- video card
I/O

Local

device

Networked

application

device

application
functions

- Caching
- Polling
- Buffering
- Encrypting
- Compressing
- Synchronizing Multiple Datastreams

- Transforming
  - Adding Timestamps
  - Averaging
  - Discarding Non-Recent Updates
  - Predicting Future Updates
Questions?