# 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

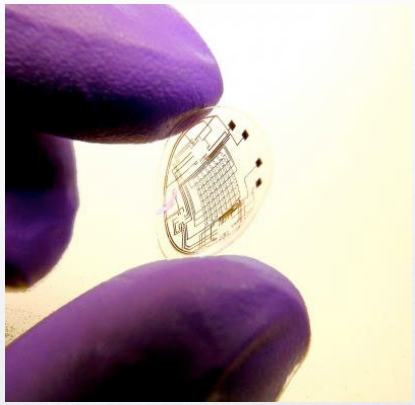
# Small Devices

Zypad Wearable

iPhone

Netbook

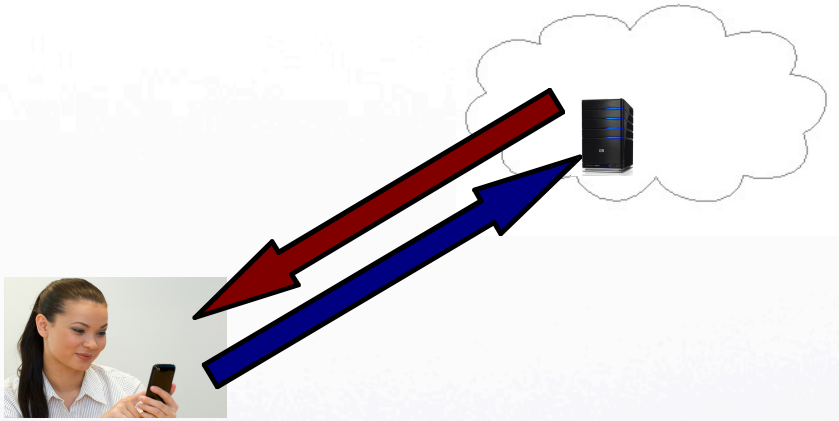
Nanotech



Contact Lens Display (UW)

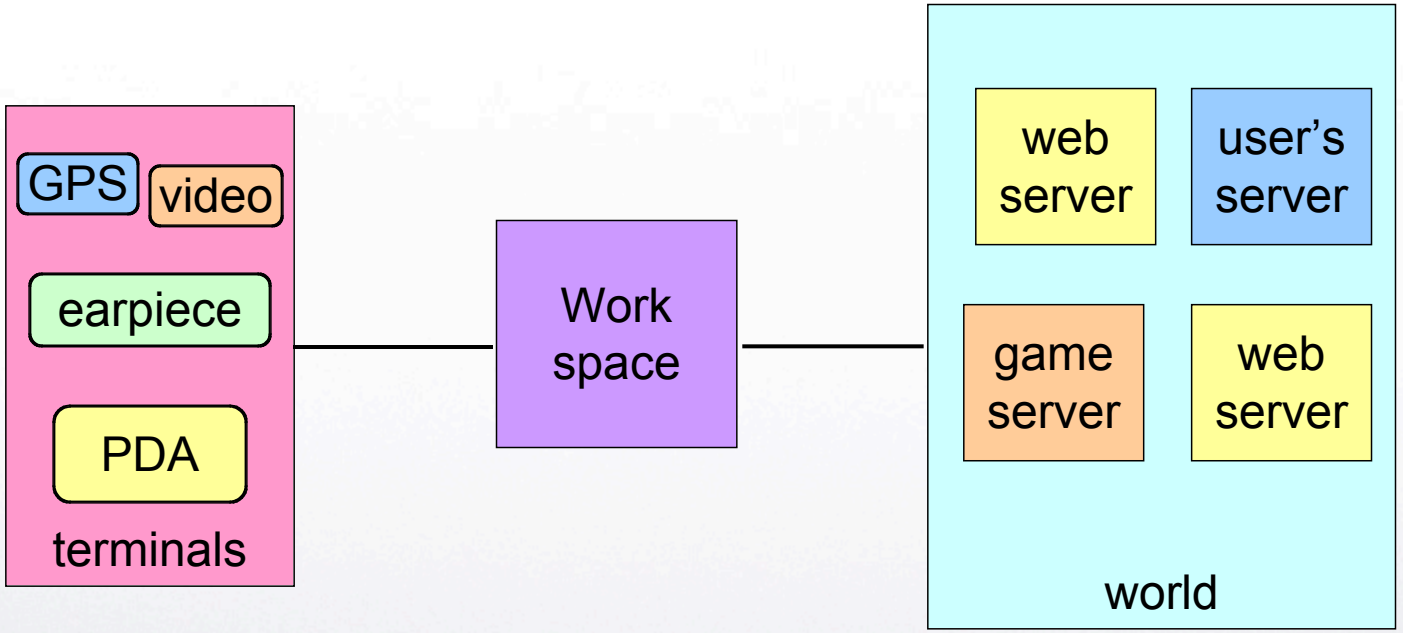
# Latency

Desktop



Thin Client

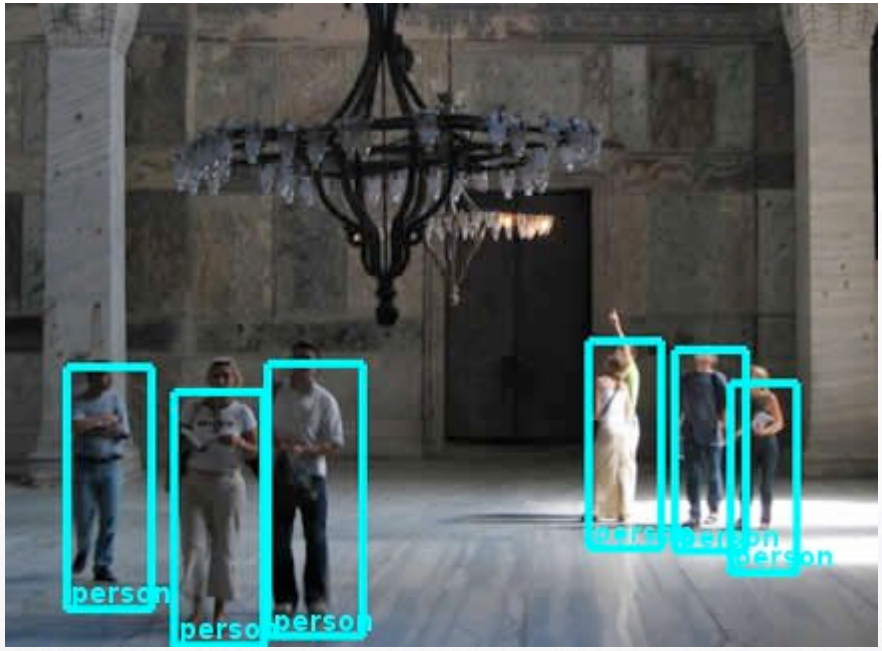
# Workspace


GPS
video
earpiece
PDA
terminals
Work space
web server
user's server
game server
web server
world

# Second Life

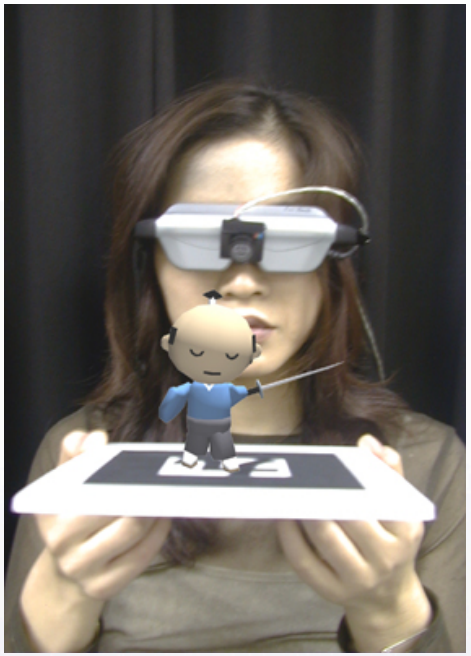

- Massively Multi-player Online World

# Computer Vision



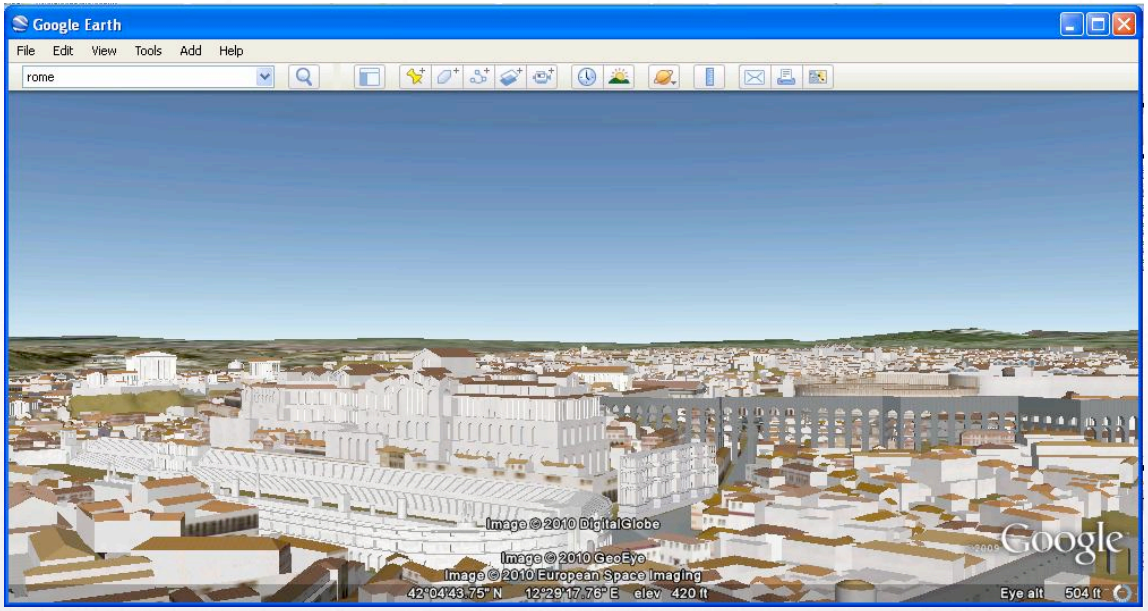

- Find and follow objects in video

# Augmented Reality



- Virtual objects integrated into live video

# Google Earth 3D Ancient Rome



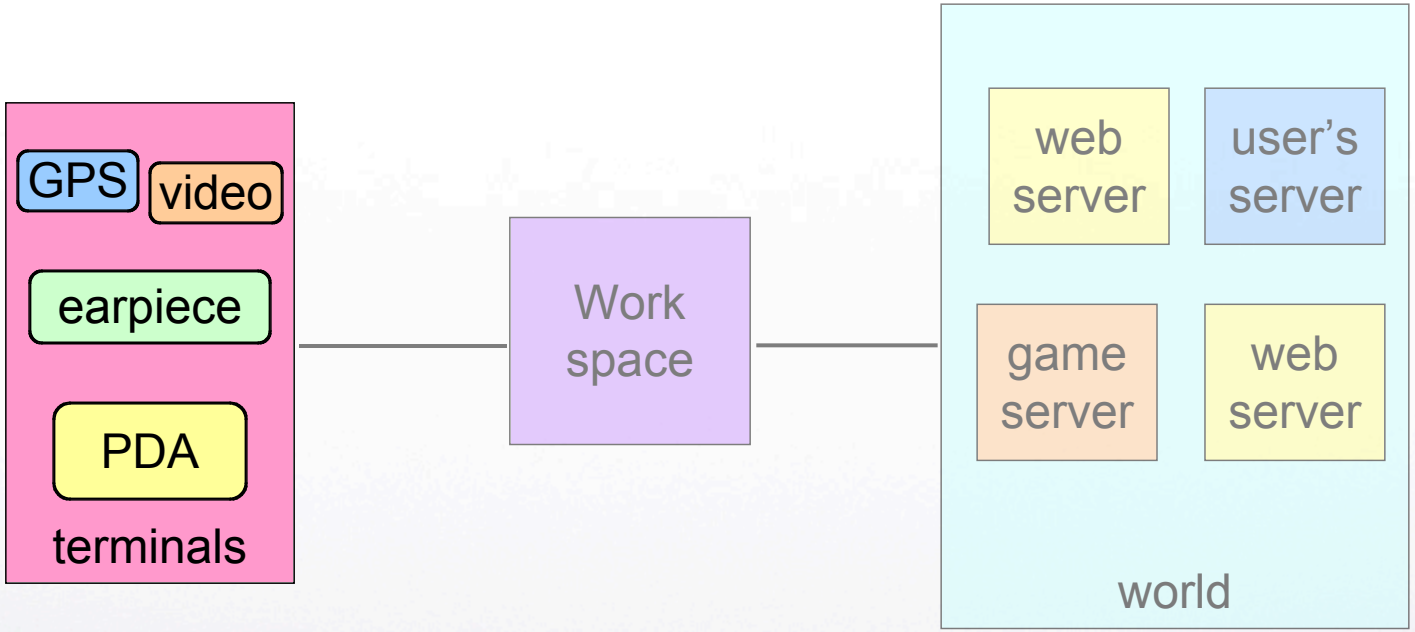

- Interactively explore ancient Roman buildings

# Application Characteristics

- Data Intensive
- Computation Intensive
- Sensor data
- Frequent user-interaction

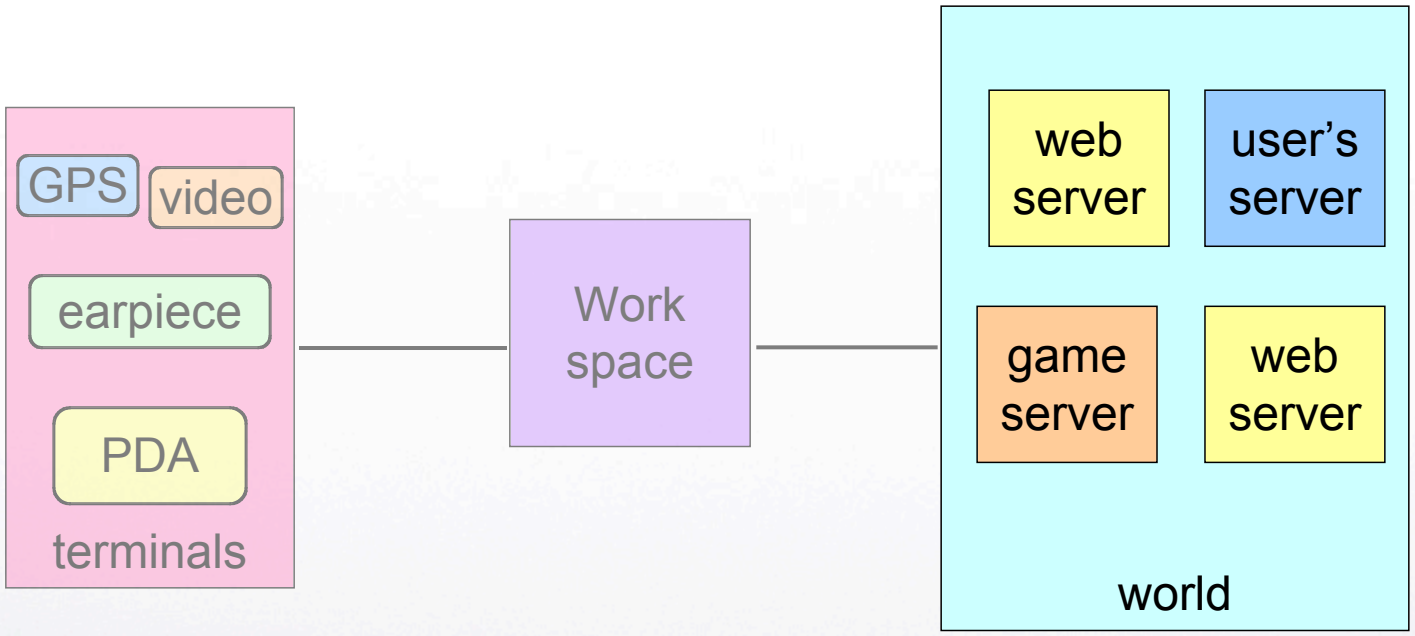
- Background and Motivation
- System Architecture
  - Terminals
  - World
  - Architecture
- Utilities
- Adaptation of Applications
- Completed Work
- Next Steps

# Terminals



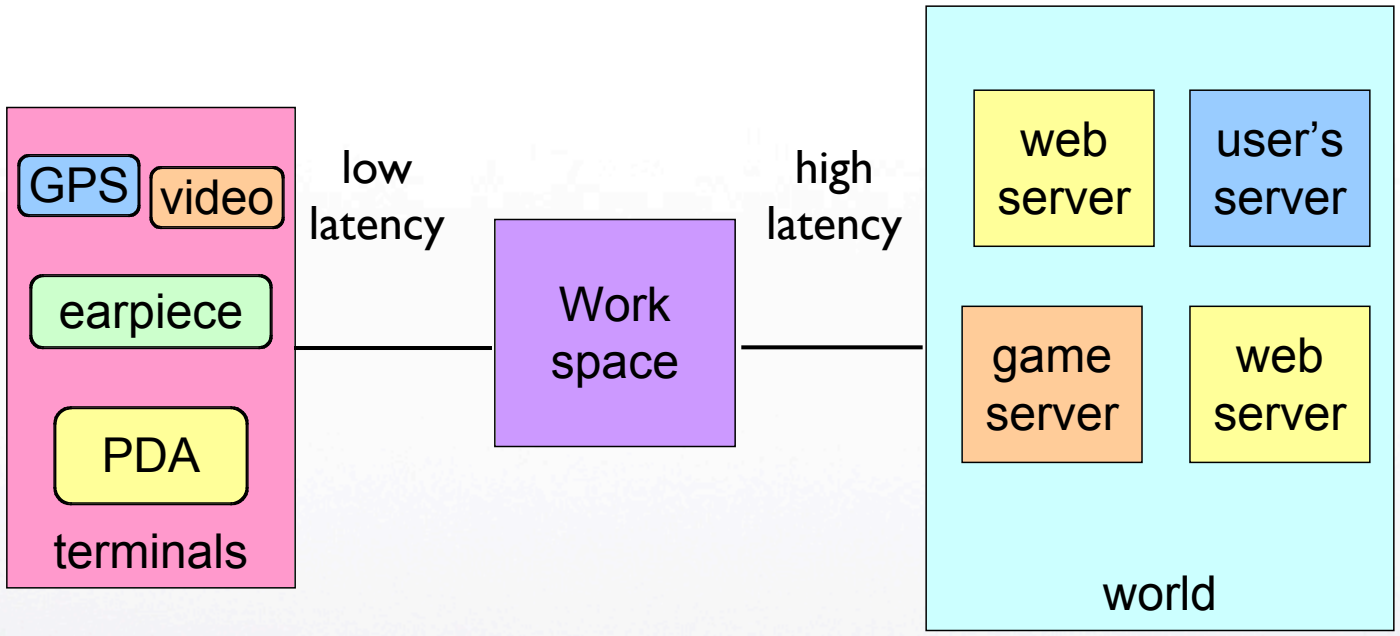

- A collection of input/output devices and sensors

# World

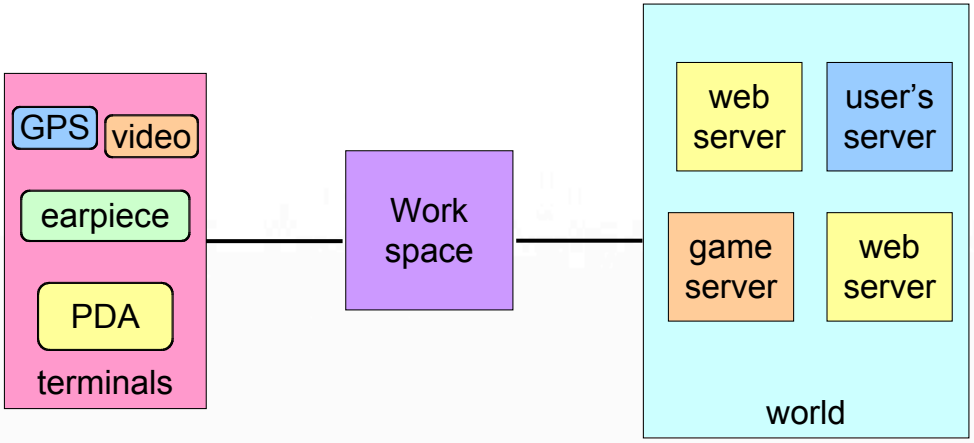



- Various servers scattered over the internet.

# Architecture



# The Purpose of the Workspace



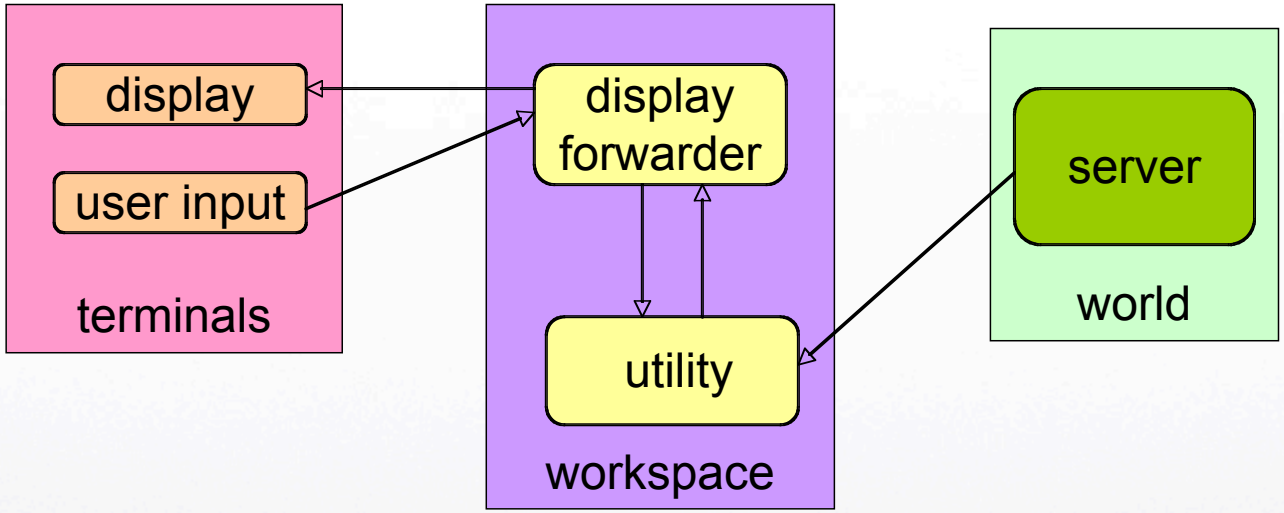

- Mediates between world and client, adjusting for performance
- Quick communication with the client
- Dependence on physical location runs
- Add additional functionality to programs
- Create mash-ups between multiple programs

- Background and Motivation
- System Architecture
- Utilities
  - Display Forwarding
  - Sensor Input
  - Rendering
  - Video Augmentation
- Adaptation of Google Earth
- Next Steps

# Utilities

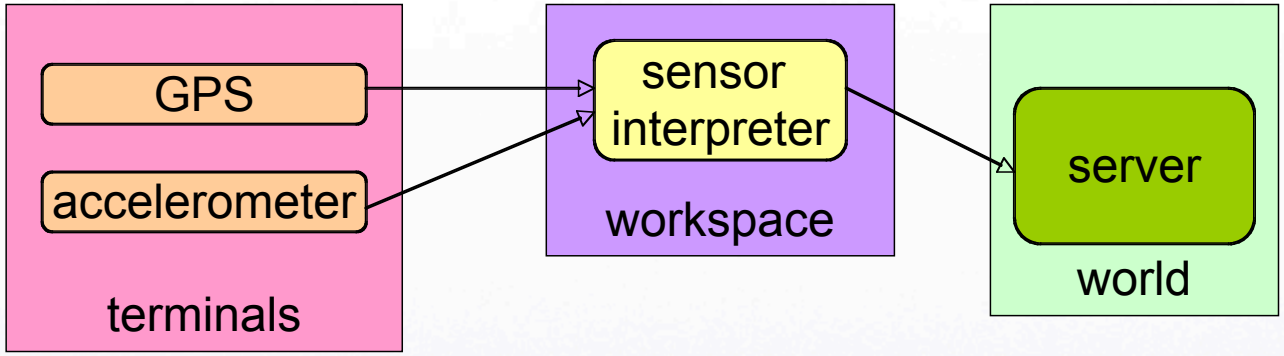
- Based on Survey of Applications
- Data-Intensive
- Computation-Intensive
- Support Real-Time Interaction

# Display Forwarding



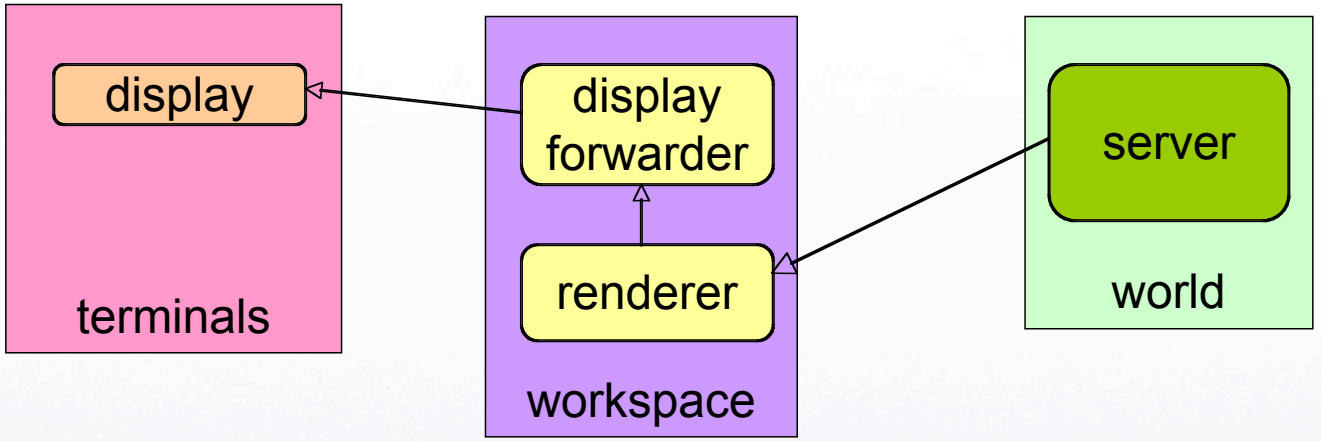

- Monitors display updates, forwards them to client.

# Sensor Input



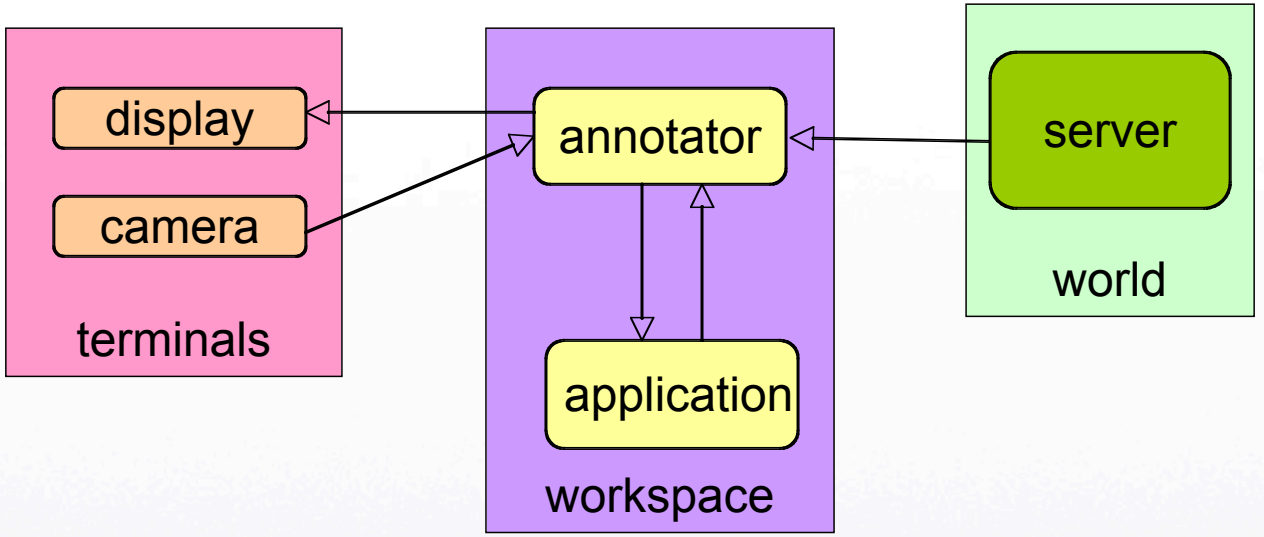

- Takes sensor input, translates, forwards.

# Rendering




- Receives geometric information, renders it into pixels

# Video Annotation



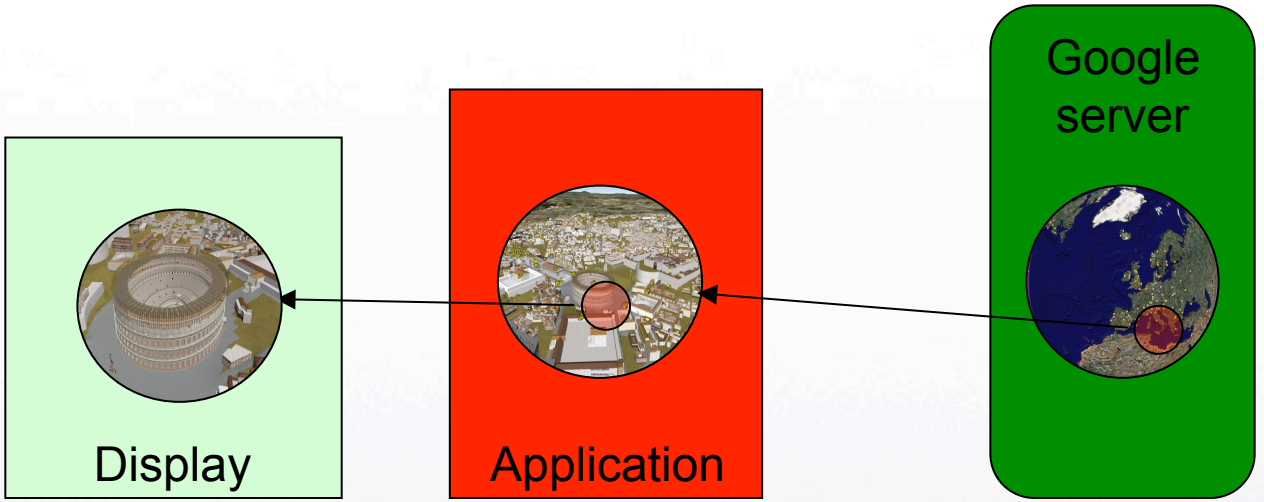

- combines video with outside information

# Utility Characteristics

- Offload computation from the client
- Do not require large alterations to apps

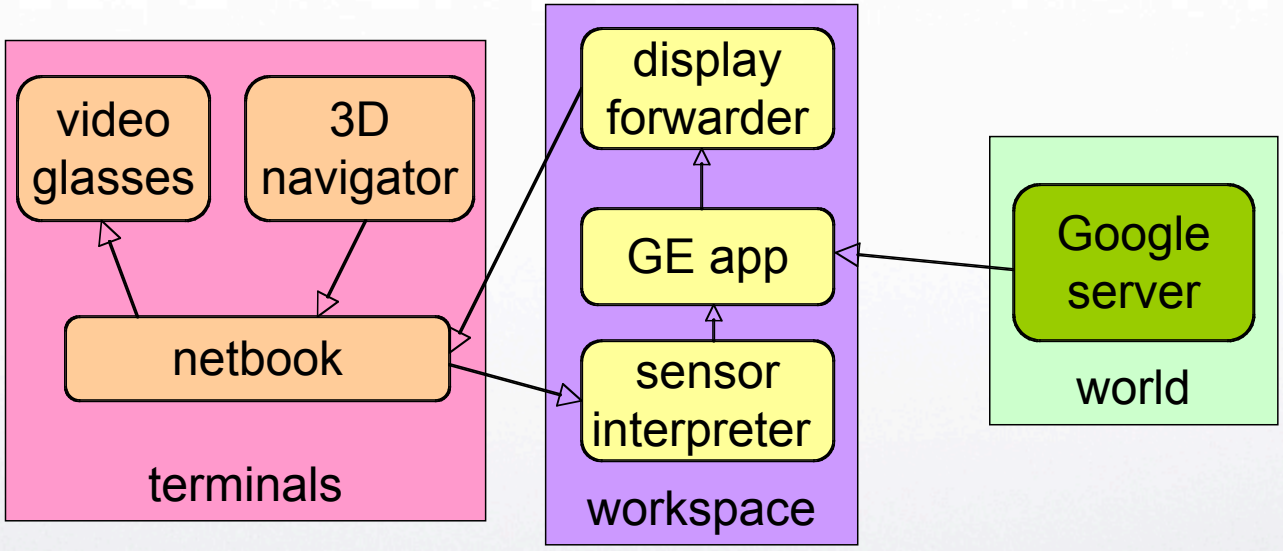
- Background and Motivation
- System Architecture
- Utilities
- Adaptation of Google Earth
- Next Steps

# Data Model



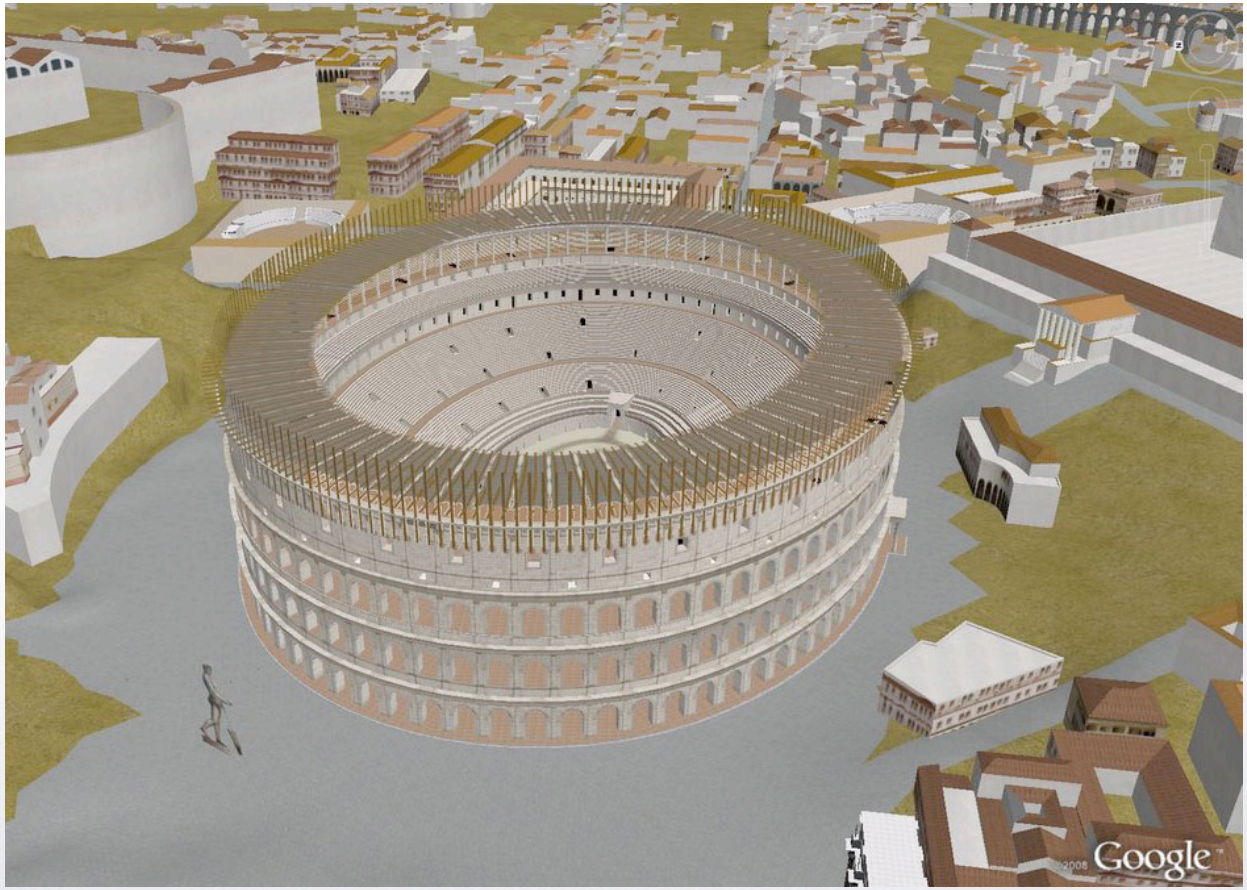
# Google Earth: Unmodified

# Google Earth: Workspace




lenovo

# Demo



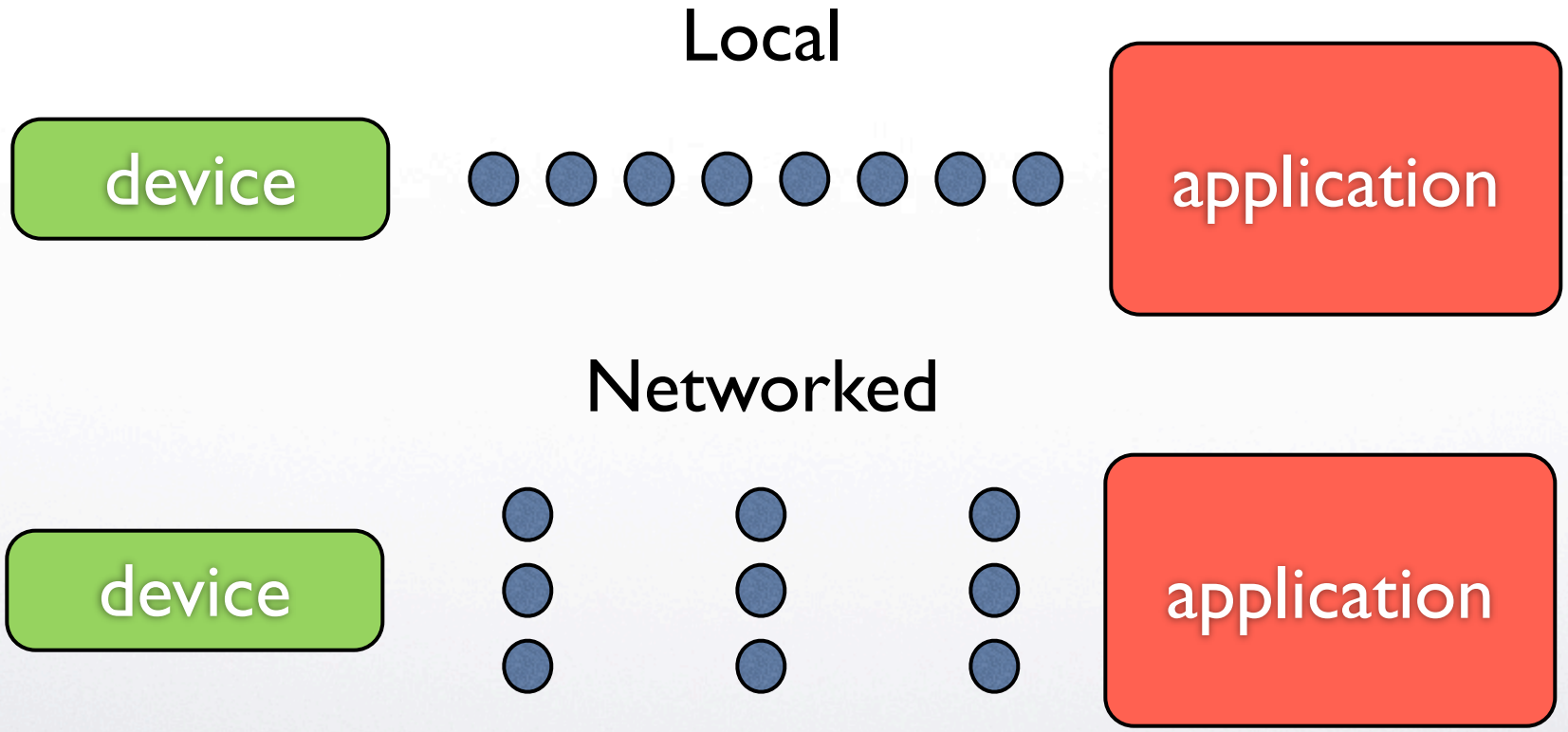
# Next Steps

- Focus on I/O issues

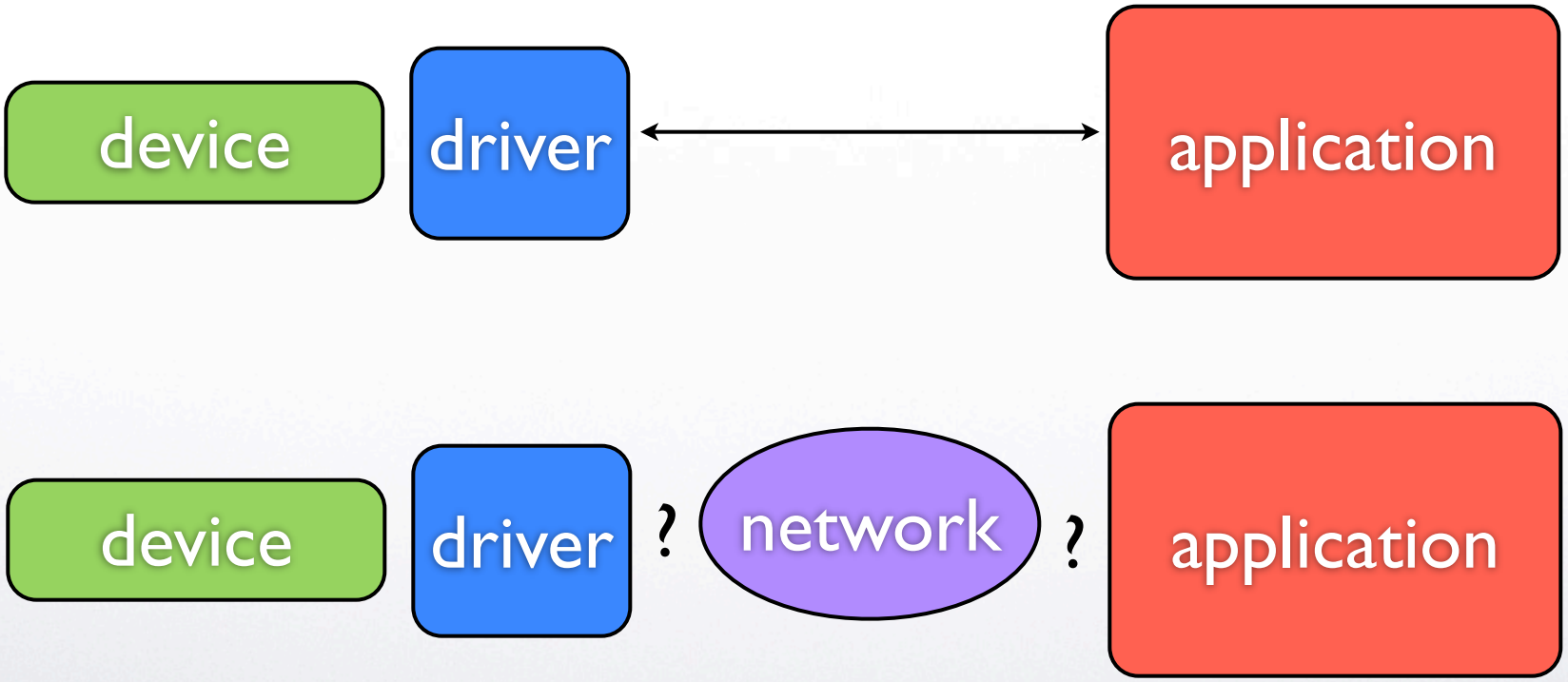
# I/O Devices

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

# I/O



# I/O


device
driver
application
device
driver
?
network
?
application

# functions

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

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

# Questions?