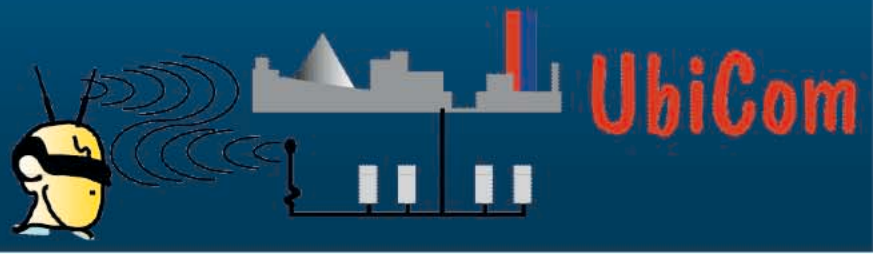
Technological challenges of Augmented Reality

W. Pasman

TU Delft



Overview

UbiCom: Mobile AR.

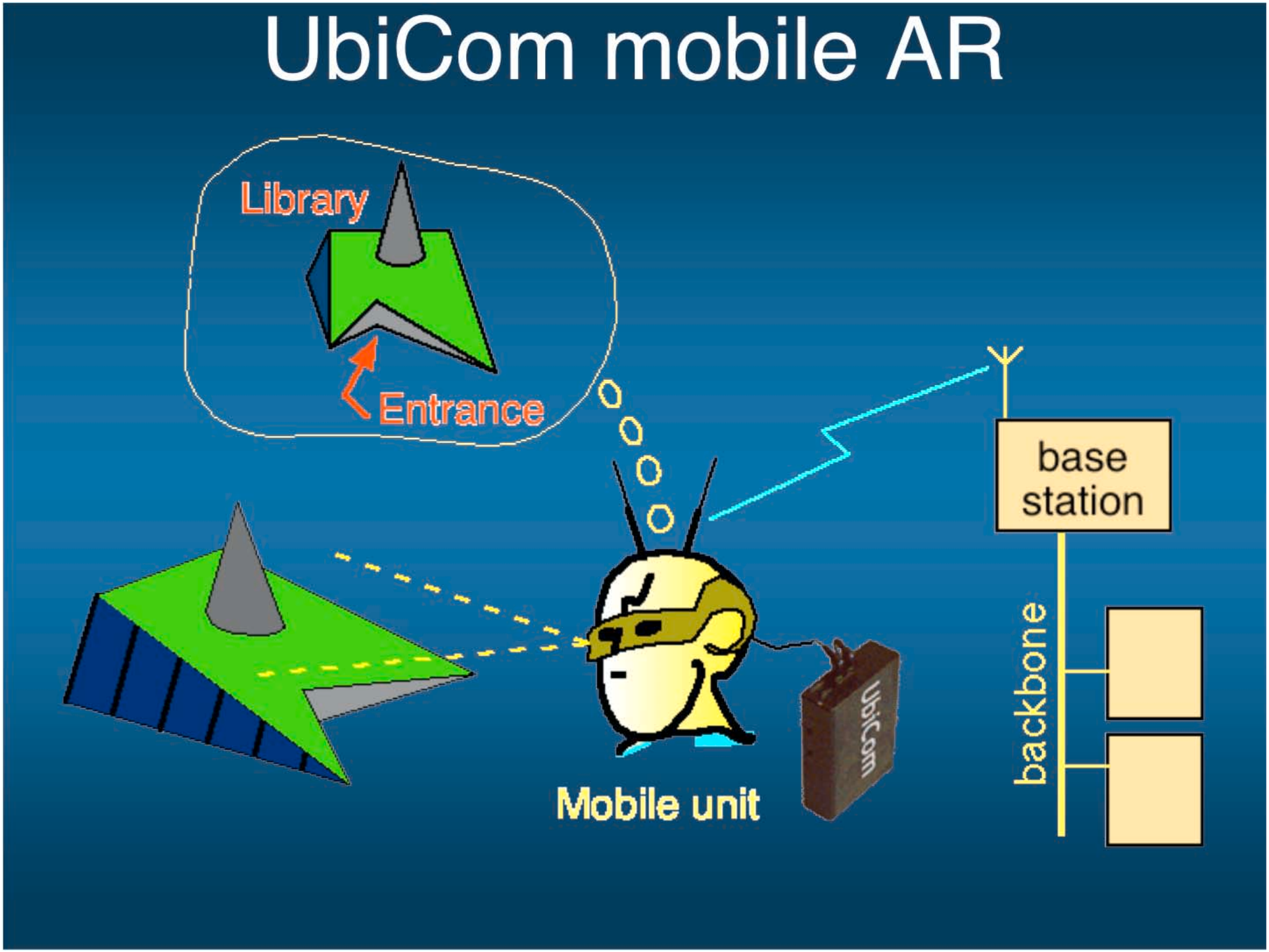
Video: Overview of UbiCom problems and solutions

UbiCom rendering QoS management

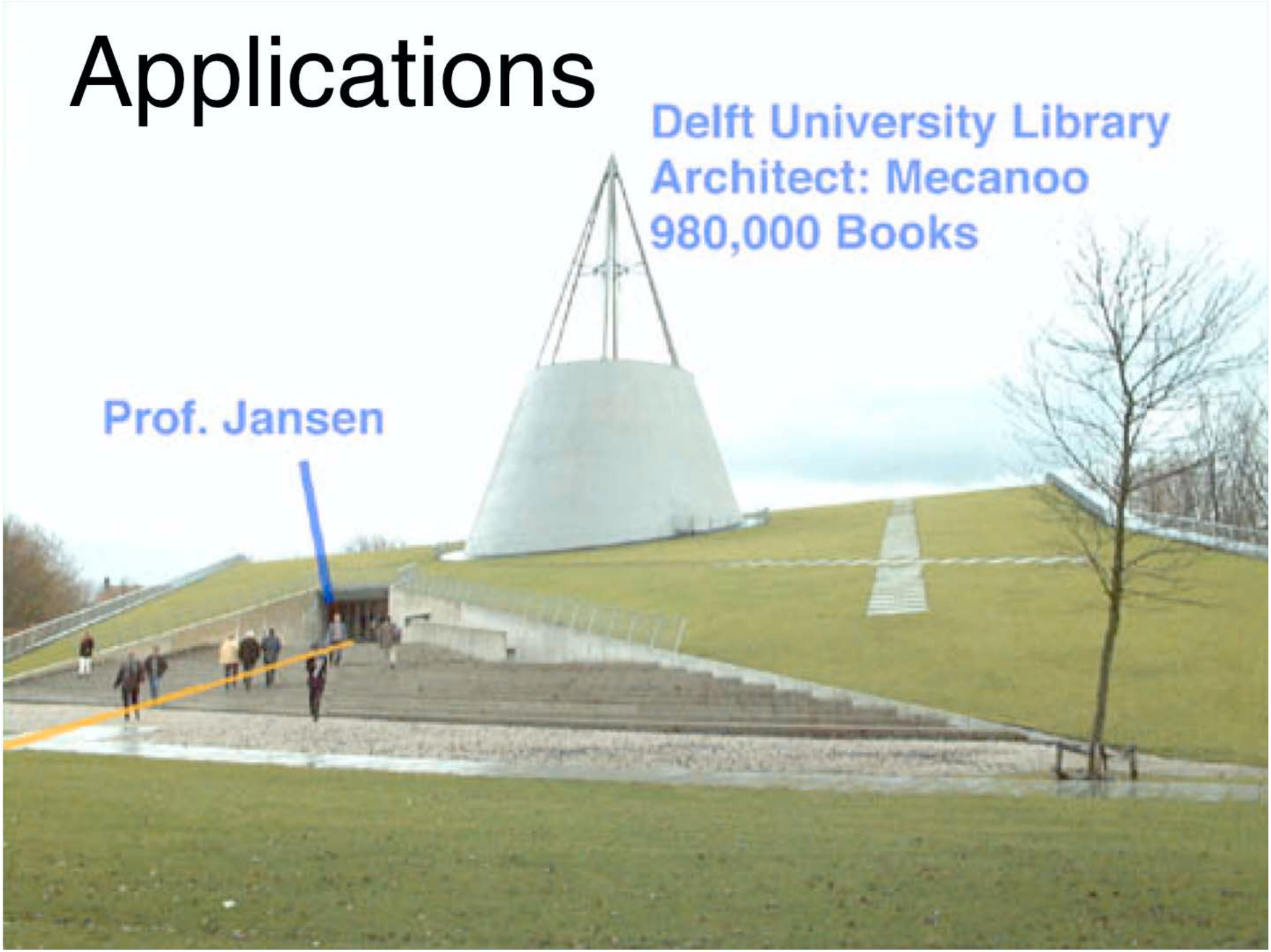
Video: Statue on Campus illustrating LL rendering

NISHE: mobile AR on PDA

UbiCom mobile AR

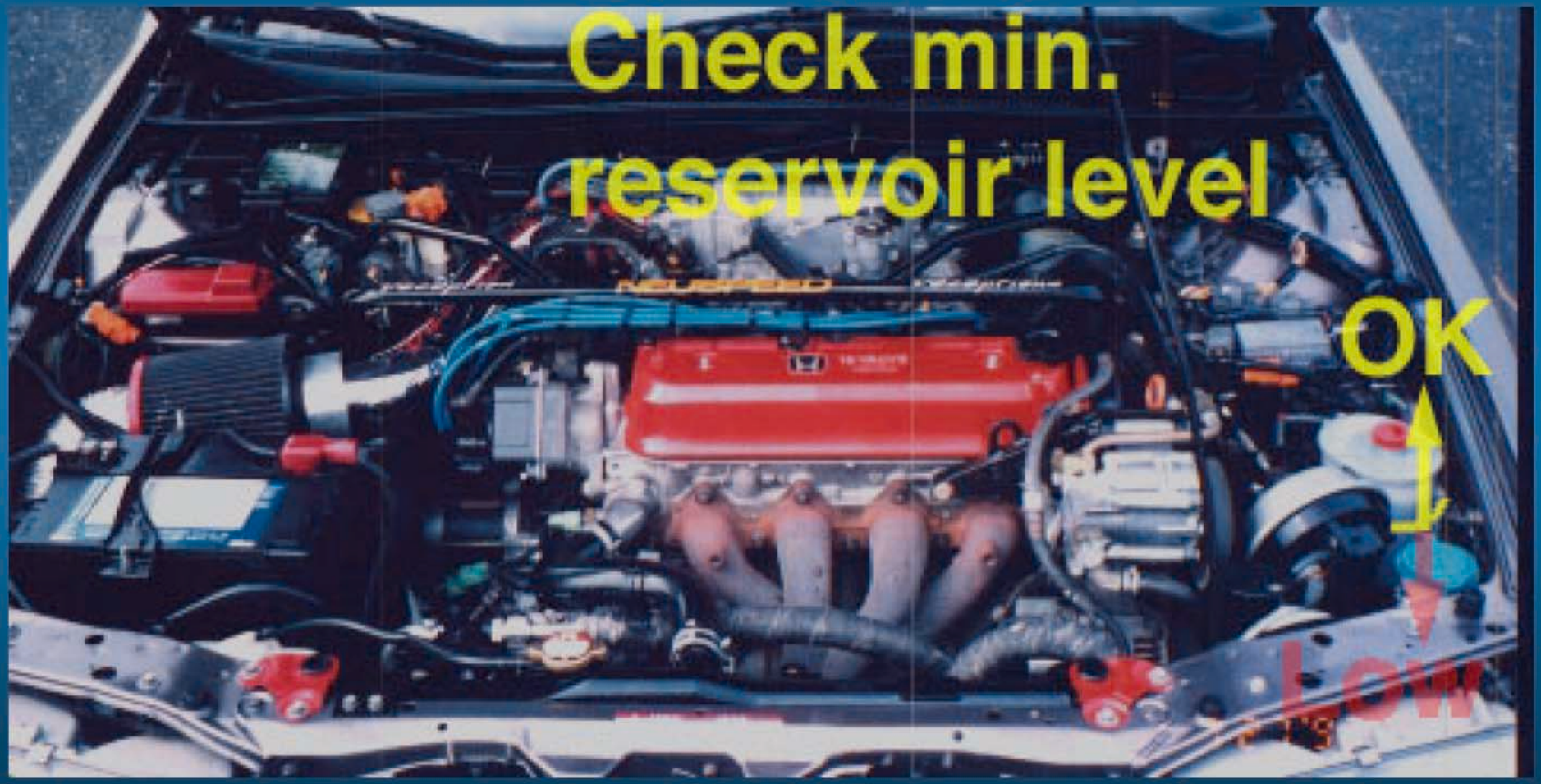


Applications

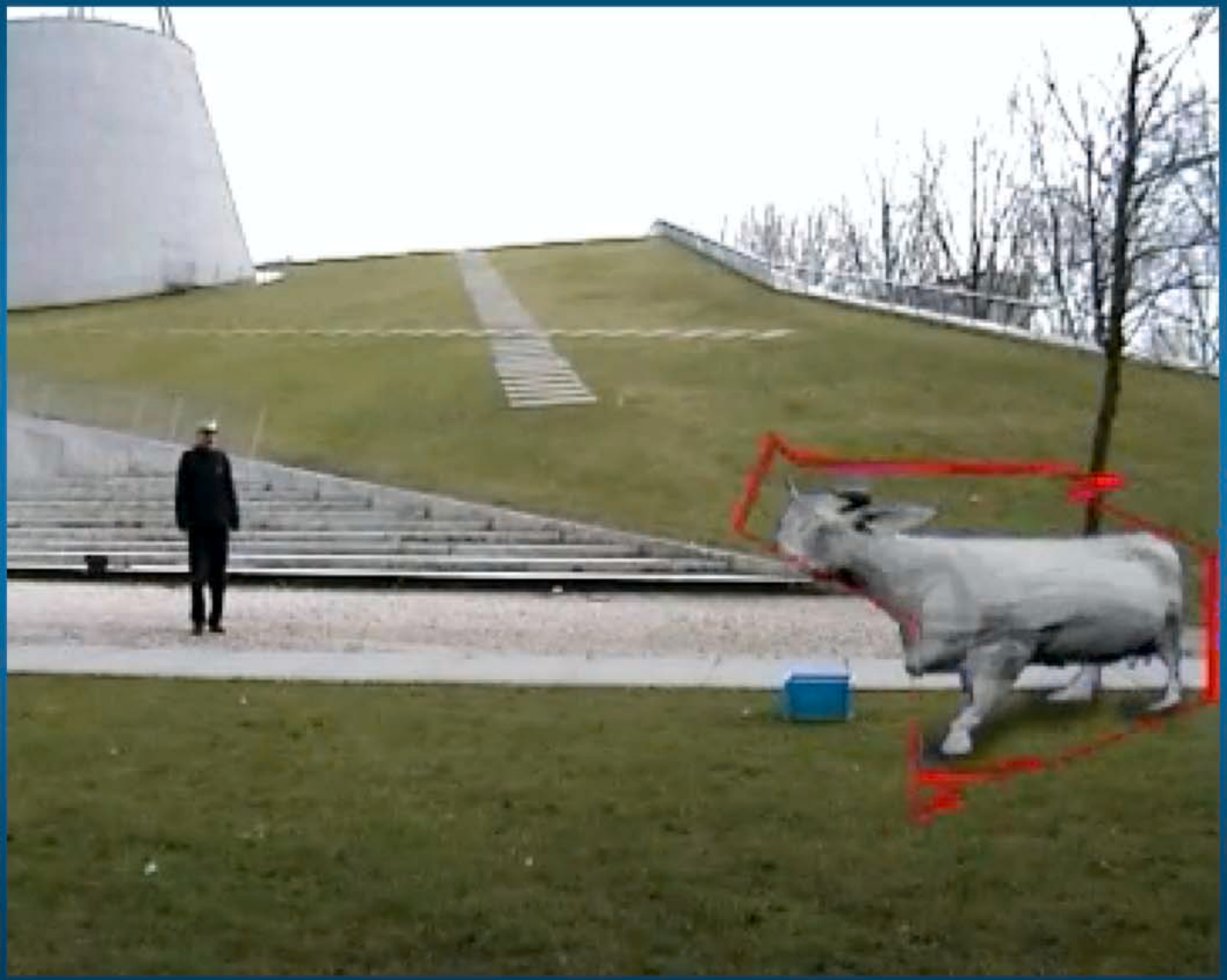


Augmented Reality
Virtual Reality

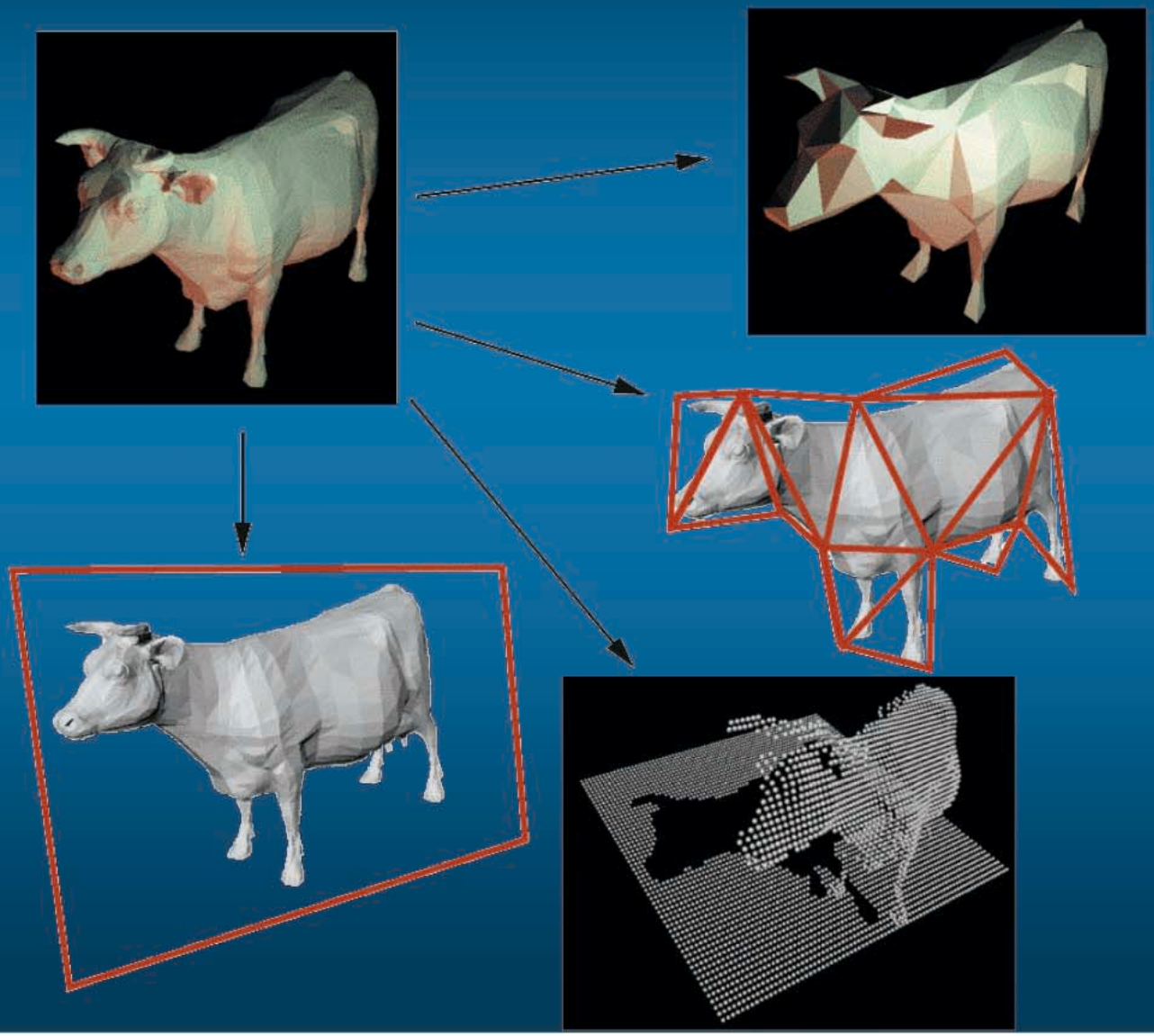
Maintenance, assistance



Video: UbiCom AR



Dynamic Simplification

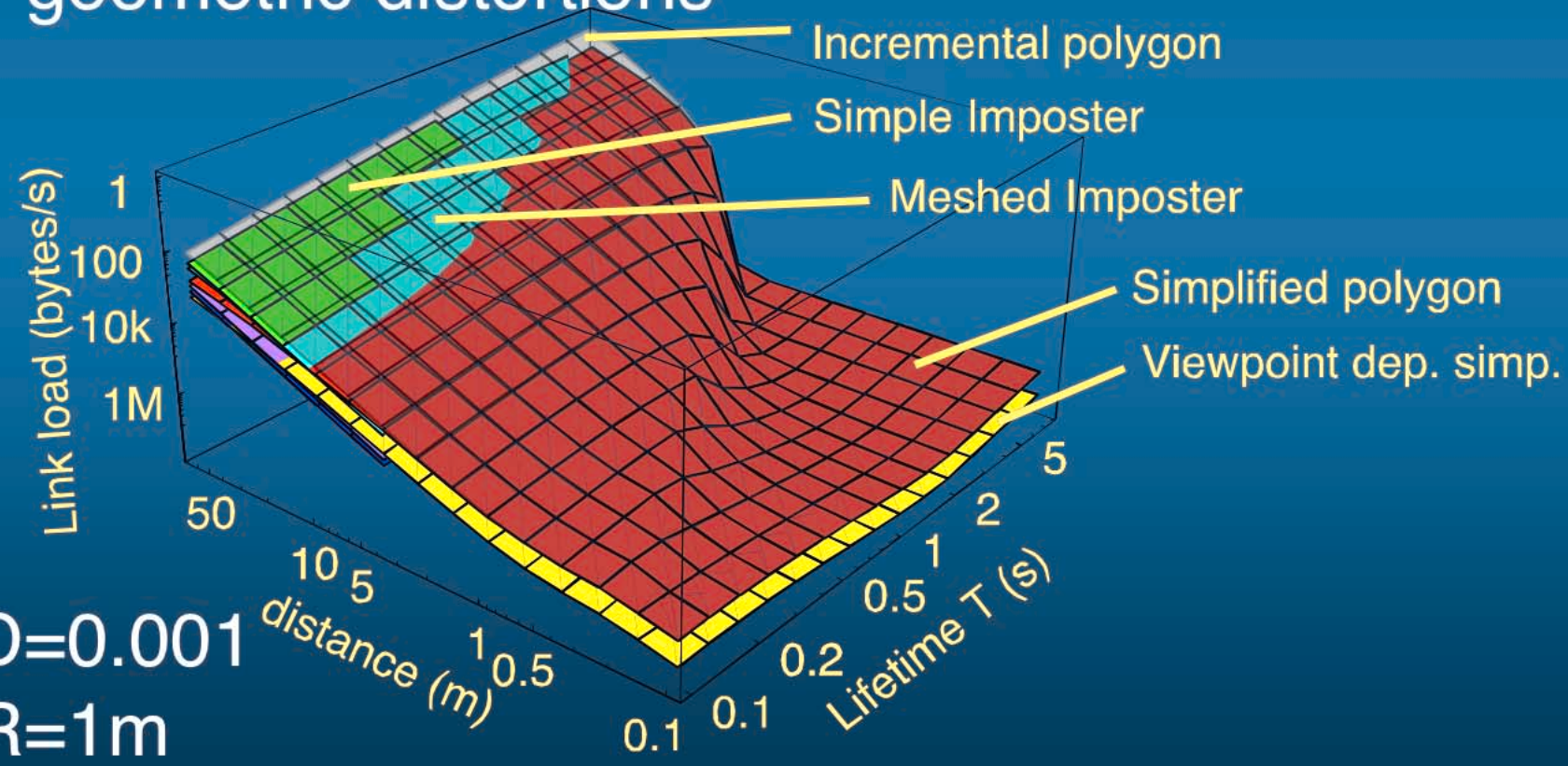


Dynamic LoD generation in backbone

Maximize perf/cost ratio in headset.

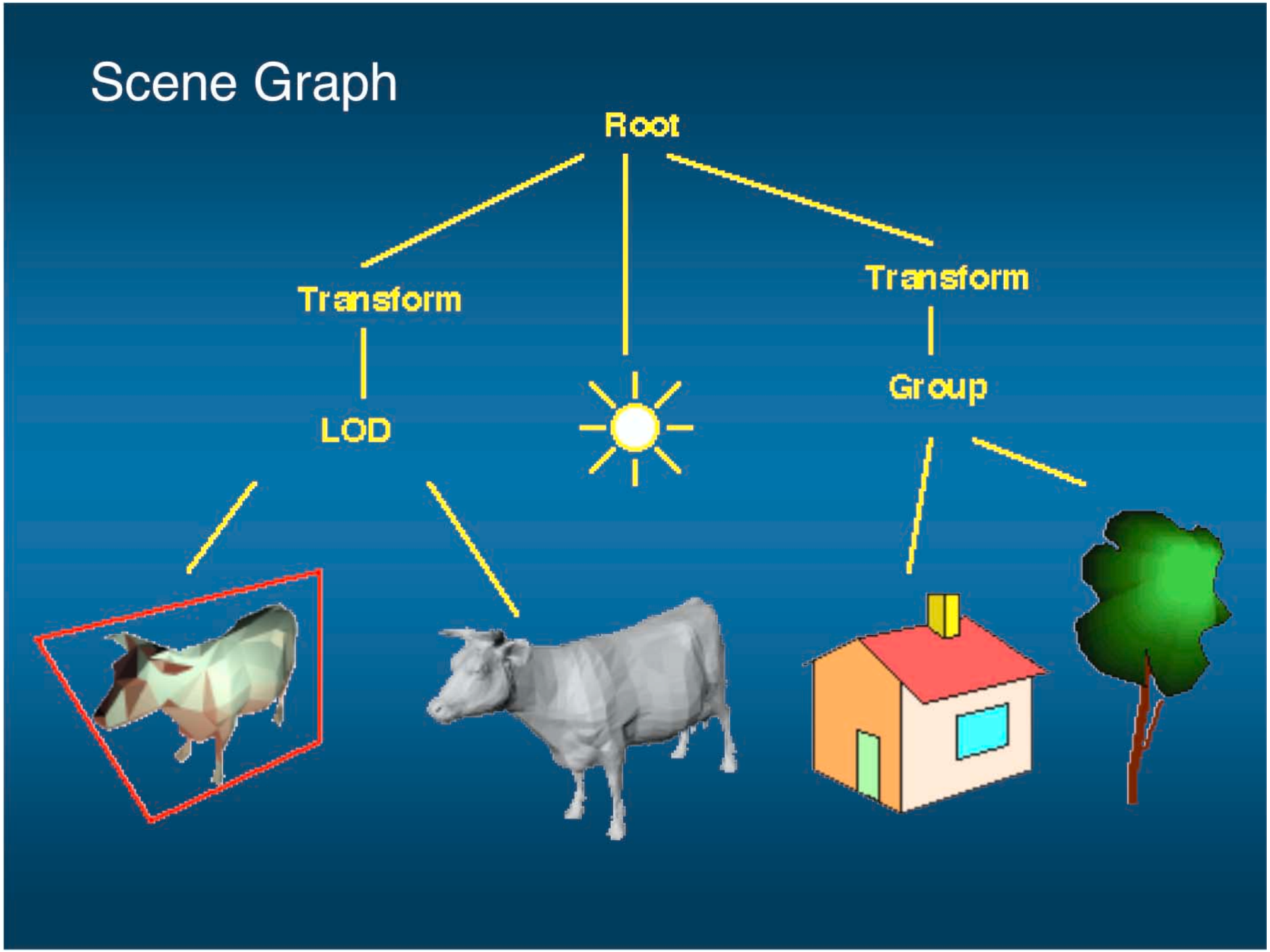
Mathematical model per object

- Estimate link and CPU load, memory usage, lifetime of objects, etc
- Est screenspace error and geometric distortions

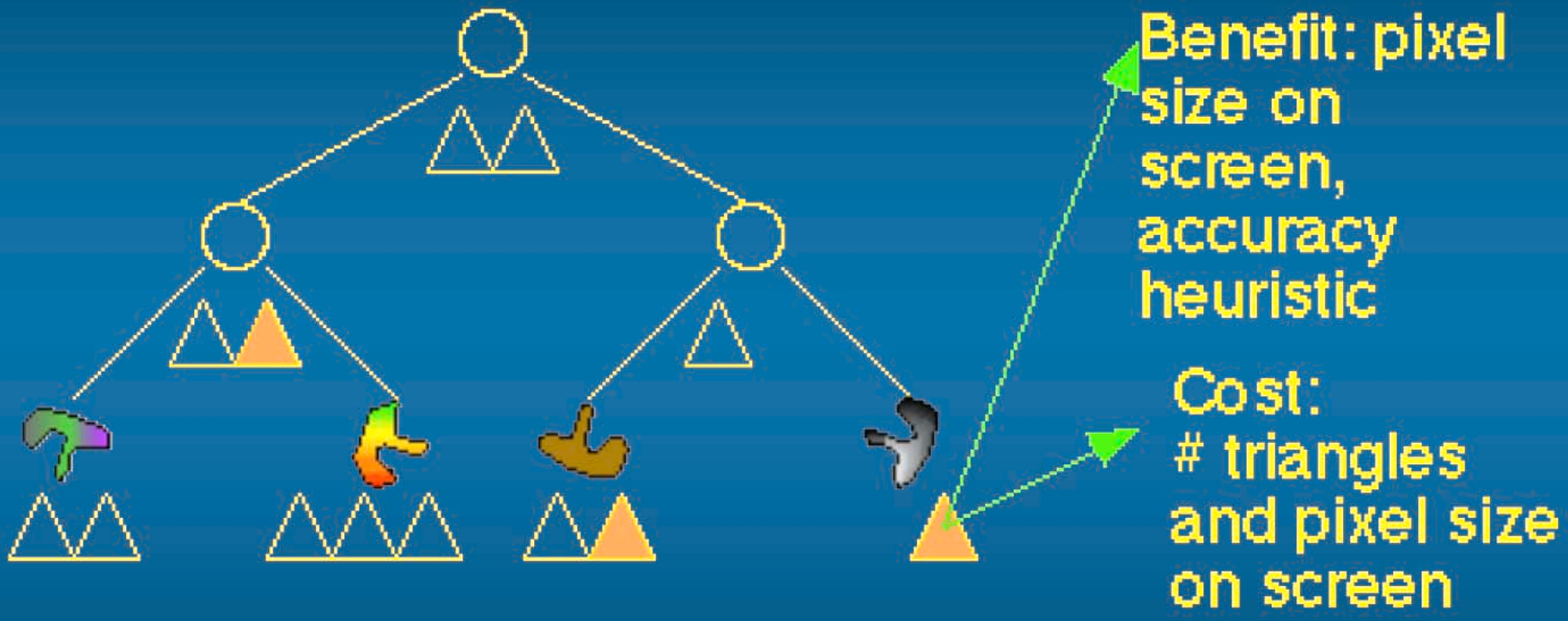


D=0.001
R=1m

Scene Graph



QoS: Scheduling of resources



Usual Goal: maximize benefit within a cost budget.

this problem is NP complete..

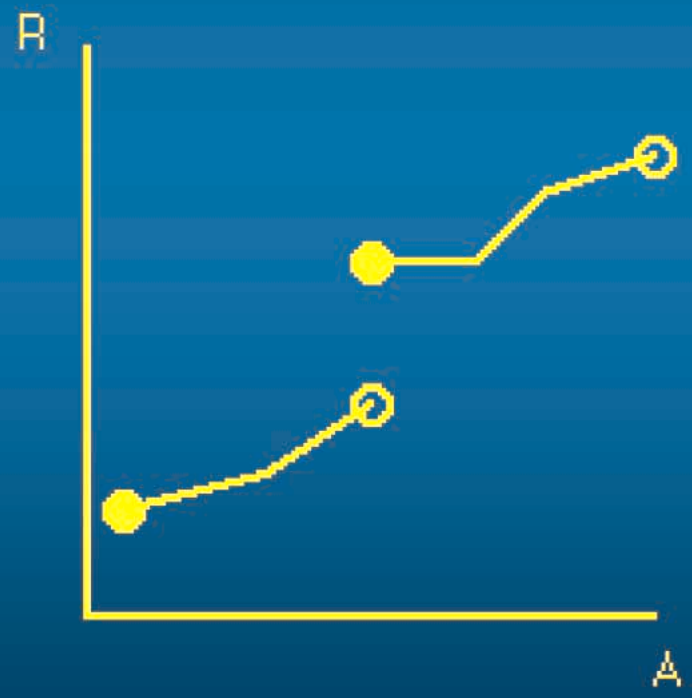
- Iterative approx giving in worst case half the maximum possible quality
- Quality only known after iteration
- Only feedback loop with application possible

Accuracy Curves

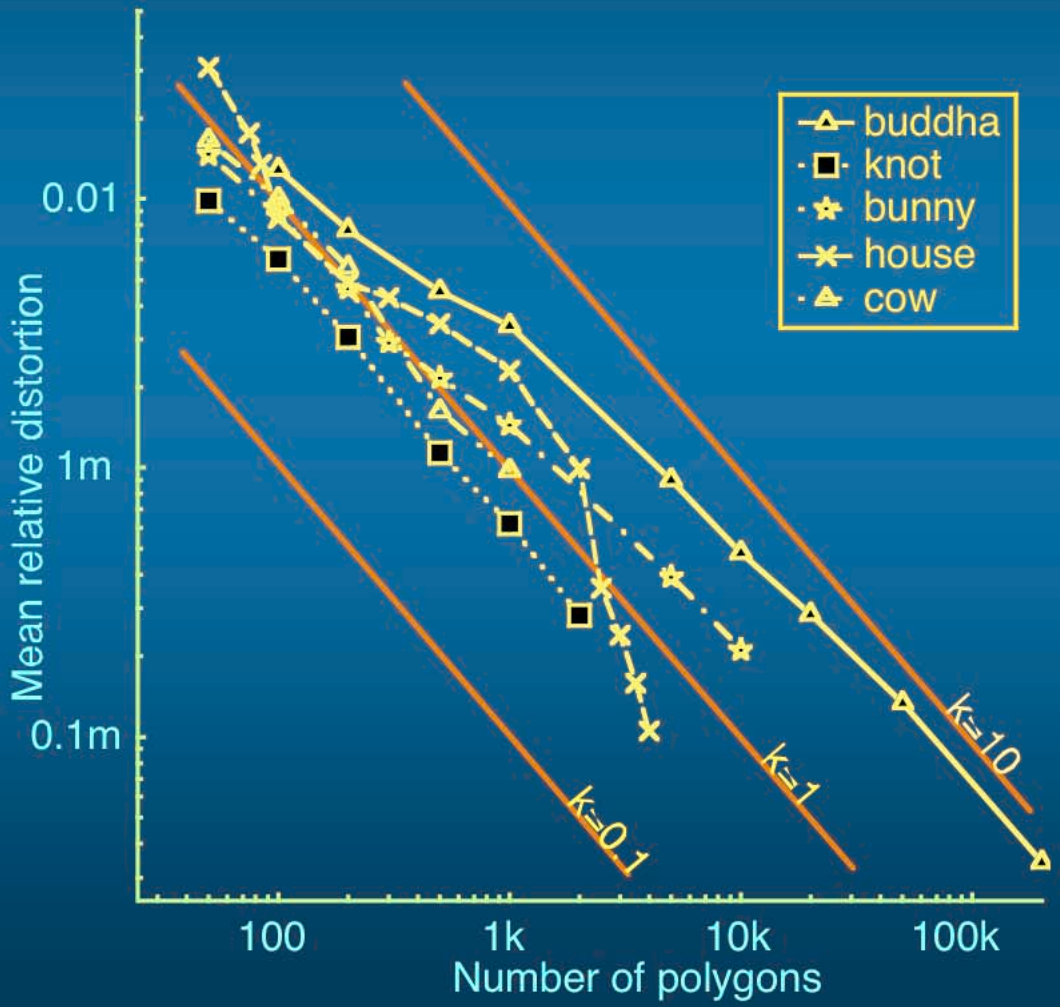
each node in scene graph is assigned an accuracy curve

- required resources as function of accuracy target
- monotonically increasing.

R->#polygons



Measurement of geometric distortion *d* as function of number of polygons *n*



$d \sim C/n$.

Accuracy $a = 1/d$

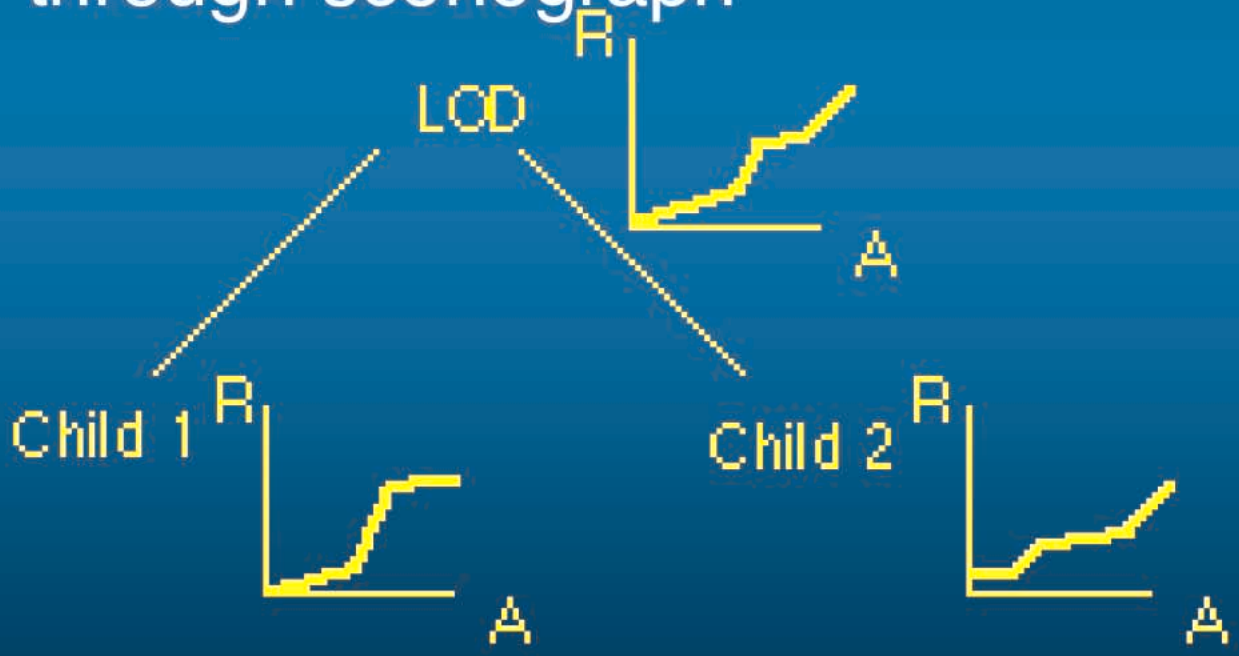
Resource usage $r = K\,a + R_0$

-> piecewise linear function

Propagating accuracy curves

Leaf nodes: accuracy curve from (1) mathematical model or (2) measurements

Other nodes: propagate curve upwards through scenegraph



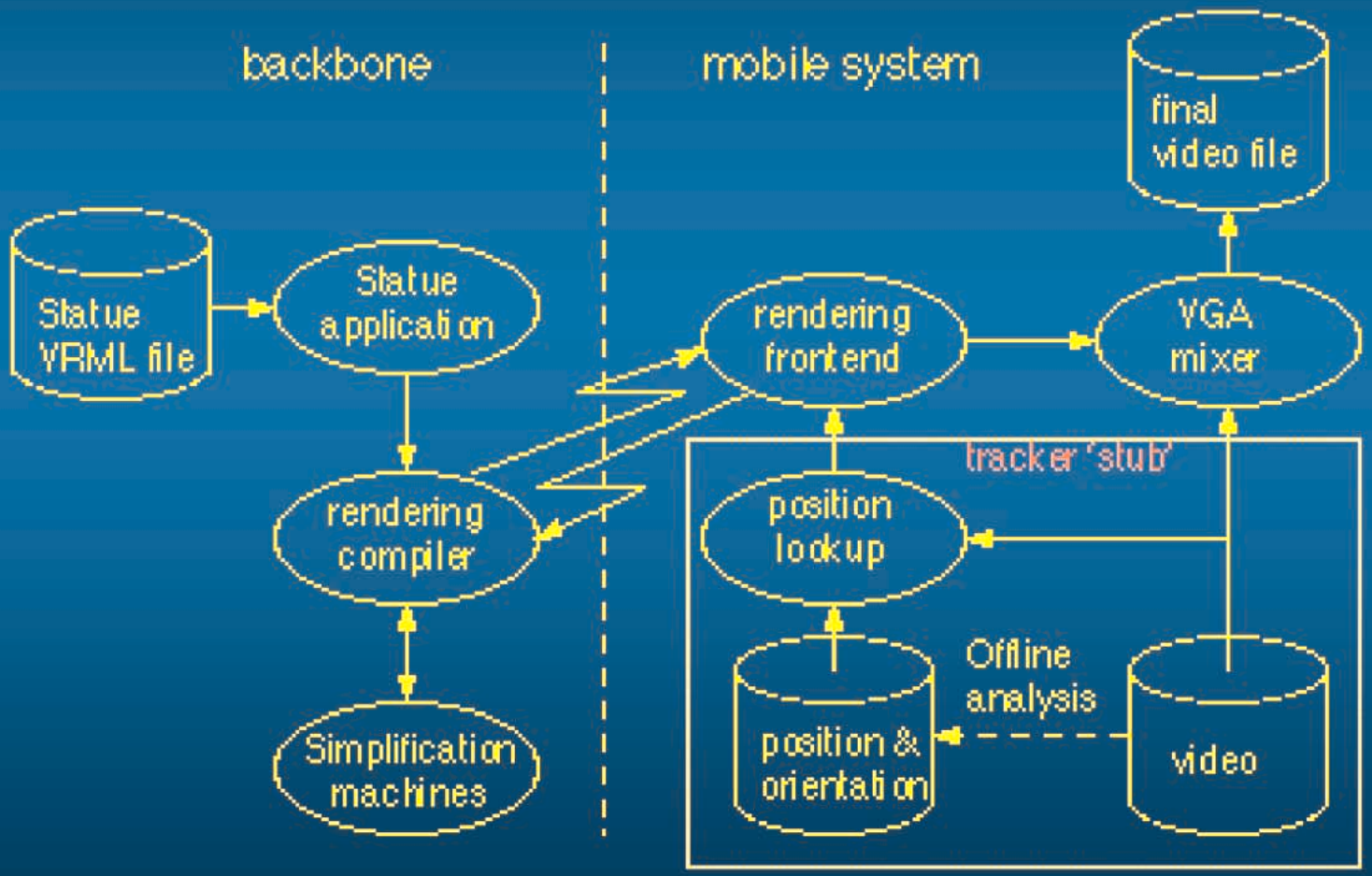
Statue on the campus

-Prototype implementation of all previous

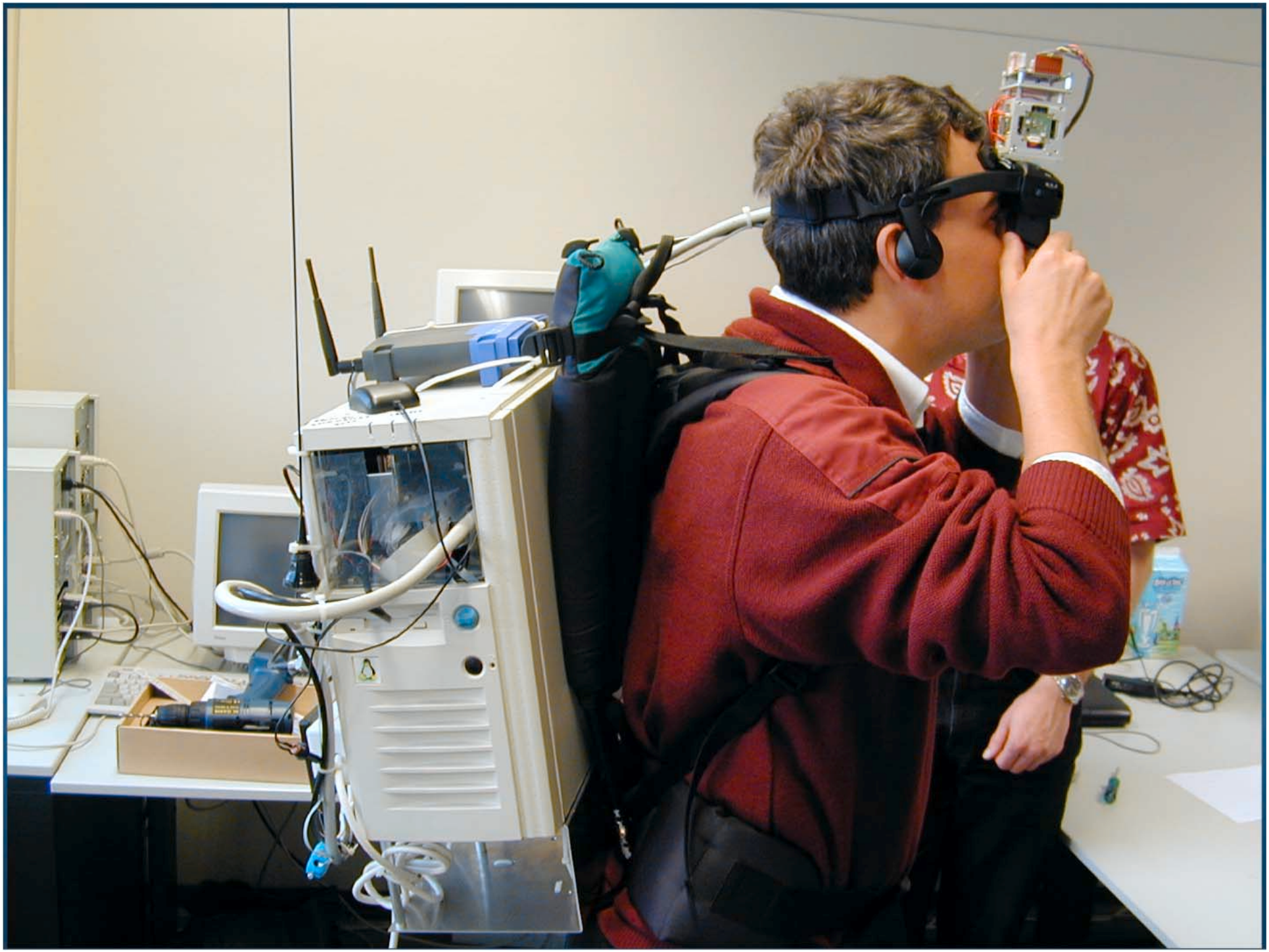
-Very complex, implementation was simplified at several places (caching, prediction, etc)

Statue application

Tracker was not yet working -> tracker stub



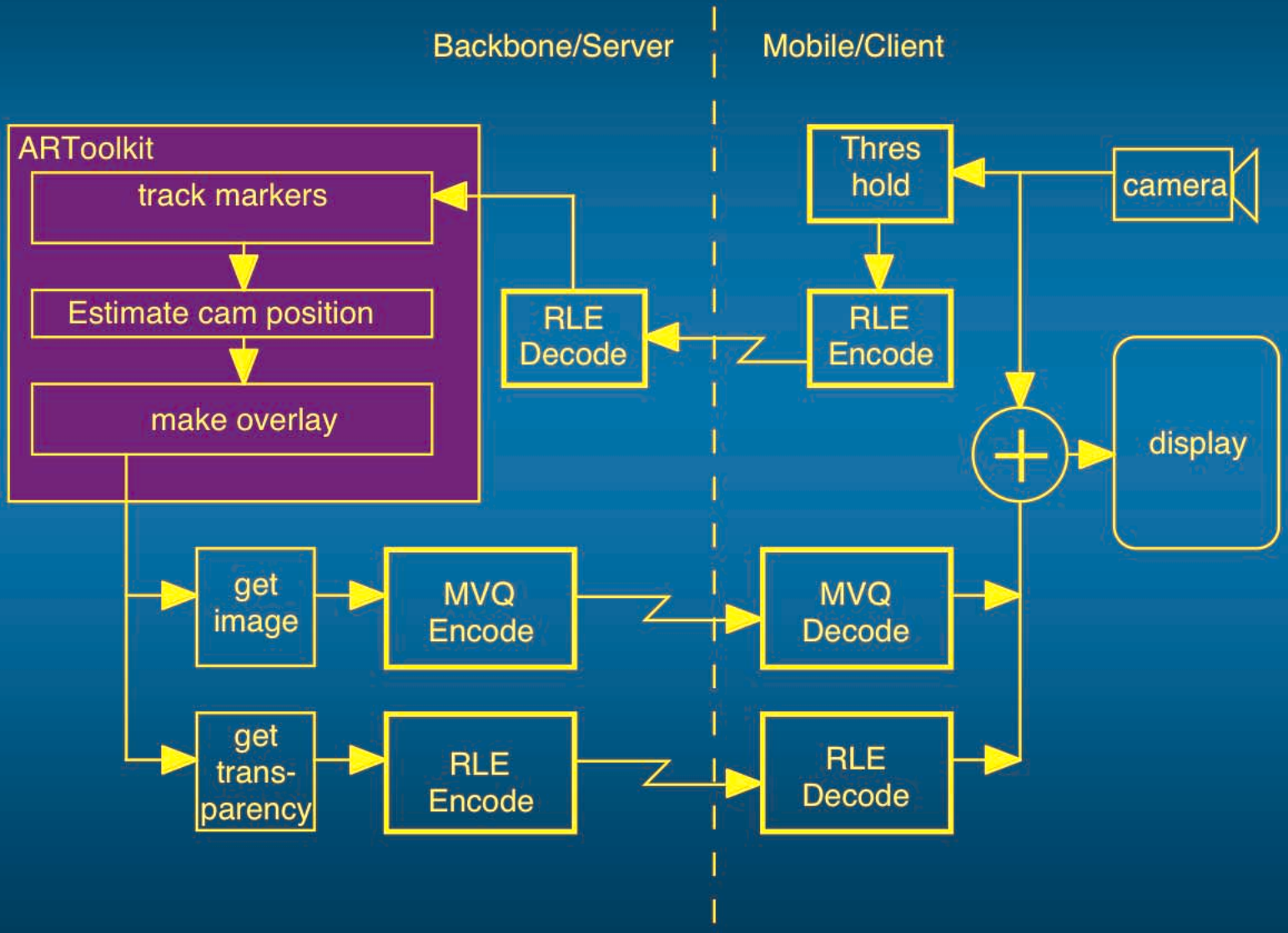
DEMO VIDEO

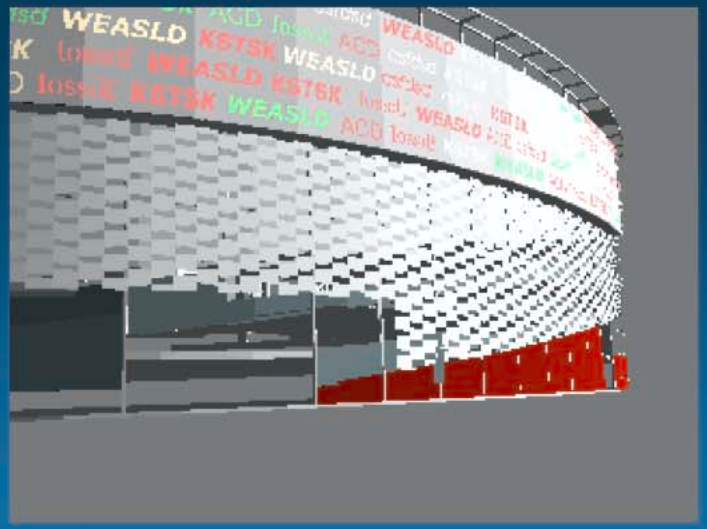


NISHE project: AR on PDA

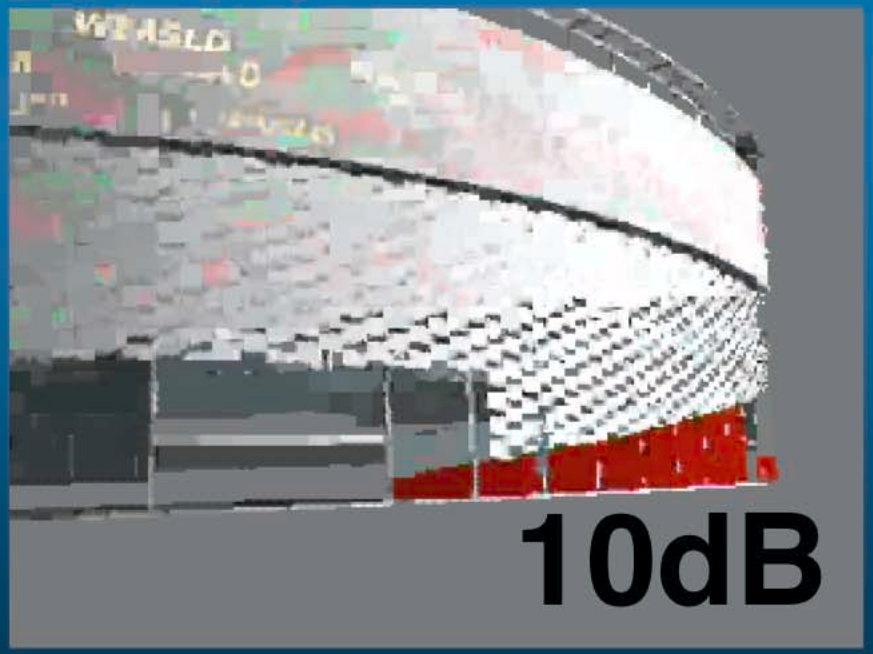
D-Link
DCF-650W
11Mbps Wireless CF Card
D-Link Air
COMPAQ
iPAQ
Pocket PC
Capture
Setup
X

Implementation issues

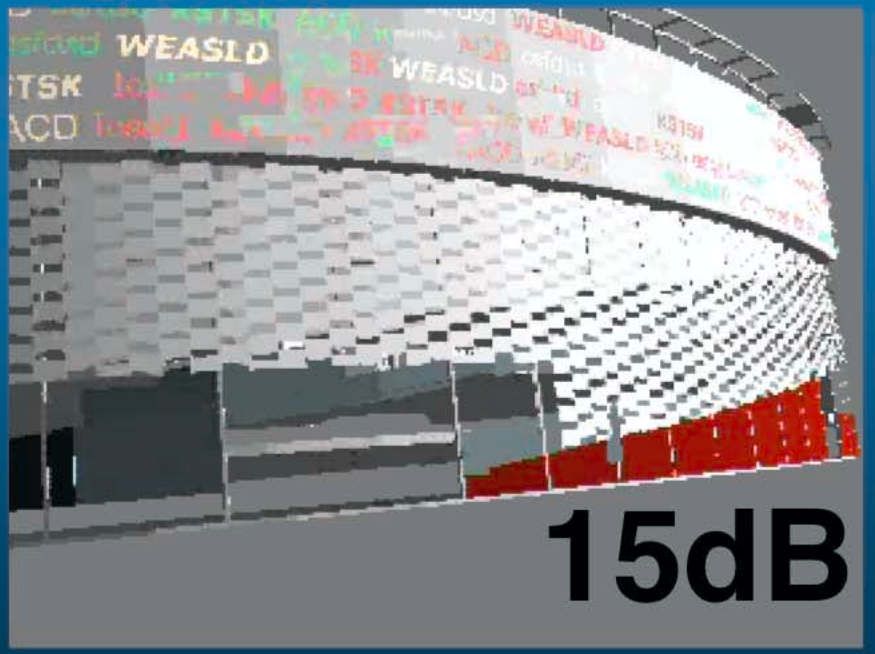




original



10dB



15dB

Speed tests

After lot of optimizations ...

800 ms per frame (WLAN)

5s per frame (GPRS)

1s per frame (USB)

Conclusions

Current handhelds no 3D accel

Semi-realtime (eg, architecture apps)

Not good for AR using HMD

3D accelerator needed for HMD AR

Realtime simplification and LL rendering for optical mixed AR (as in UbiCom) and for very complex scenes