# Tangible Programming Interfaces

## On the Way to Ubiquitous Domestic Environments

Dejan Pilav
Advisor: Marc Langheinrich

# What Is This All About?

- It's important!
- It's challenging!


"Why is it important for today's kids to learn algebra? Because *I* had to learn this junk in school and now it's *your* turn, that's why!"

# Overview

- Programming? Tangible? Domestic Environment?
- Challenges
- Cognitive Demands
- Illustrating Examples
- An Example: Media Cubes

# What Is This All About?

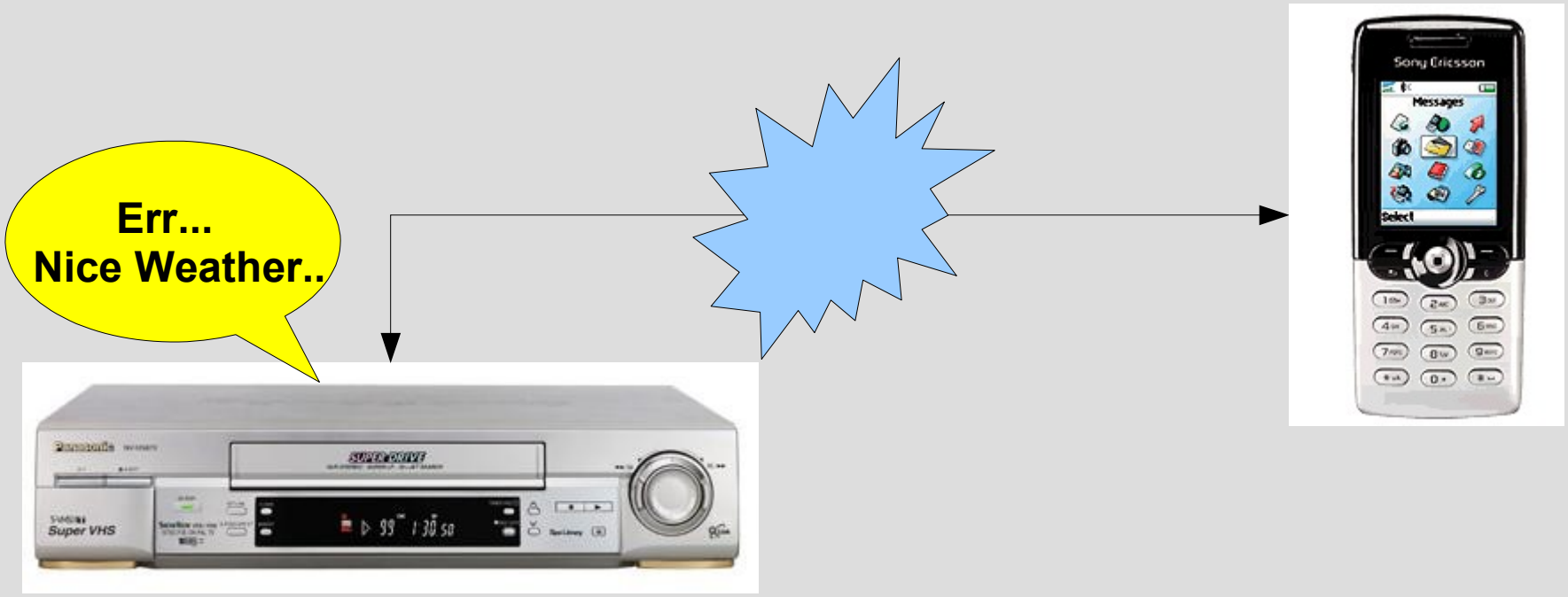
- Ubiquitous starts at home
  - Changes through Ubicomp Drivers
- Appliances must be programmed. Or not?
  - We already do.
  - Is that programming?

# What Is This All About?

- It's getting even worse
  - Device interaction
  - Feature creep
- Is that still the Ubiquitous Vision?

# Challenges

## What is out scope?



# Challenges

Who is our scope?

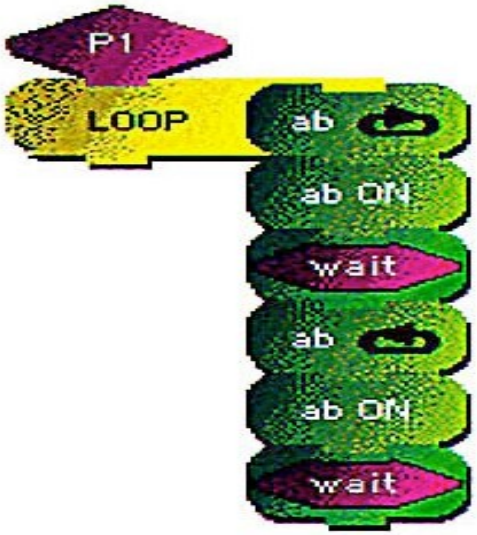
**User Centric**

# Cognitive Demands

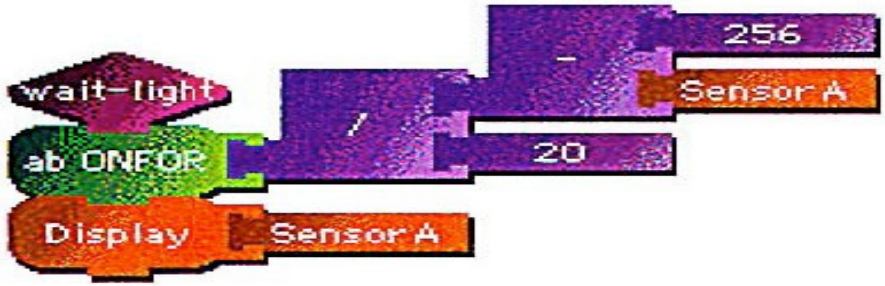
? “Easy to use”
“Convenient”
“Intuitive”

- The problem: Dealing with abstractions.
  - Over time
  - Over classes
- It's an investment, so try to keep the risk low.

# An Example


P1
LOOP
ab
ab ON
wait
ab
ab ON
wait


wait
IF
Sensor A
>
128
THEN
ELSE
wait-light
wait-temp

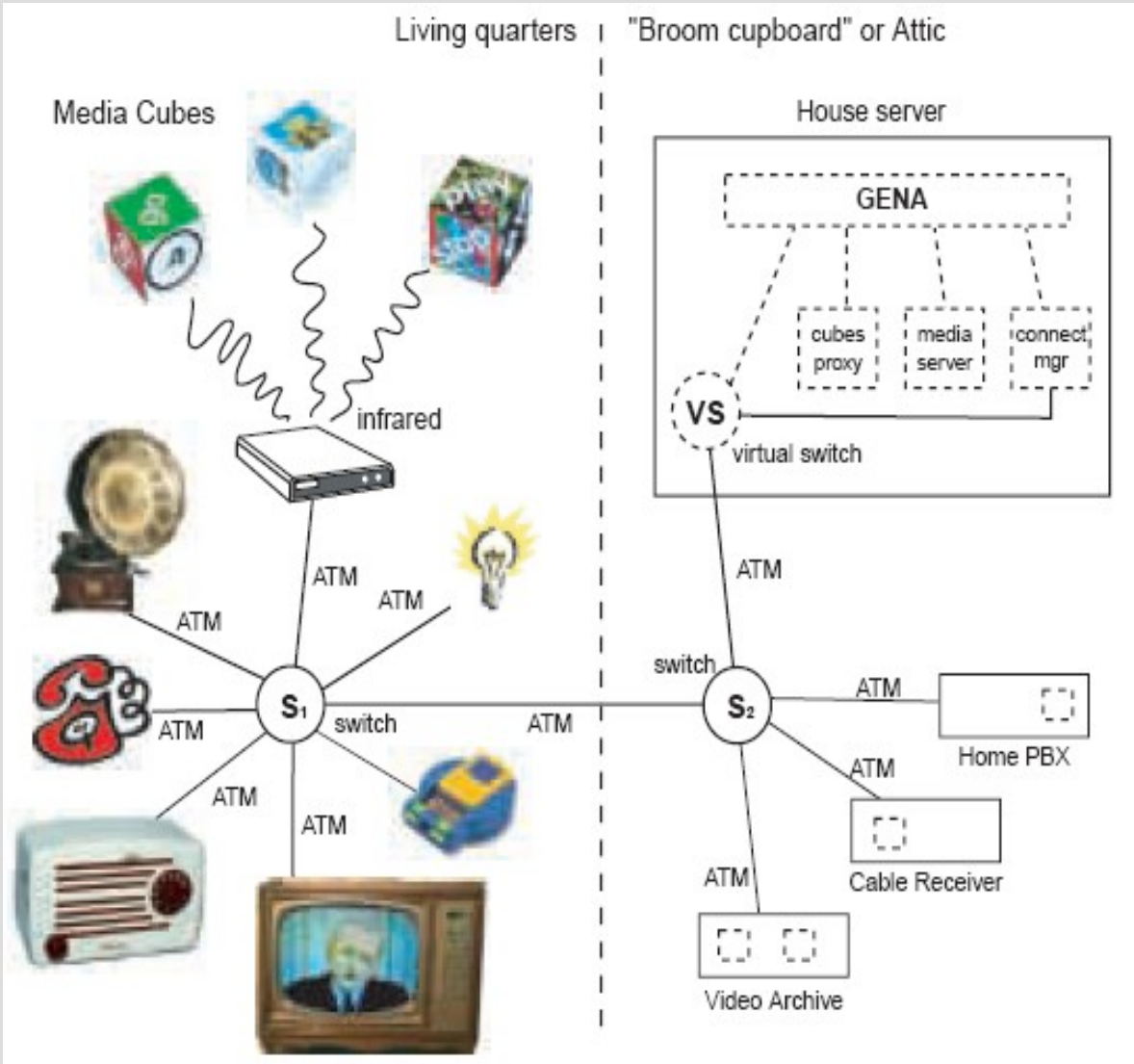

wait-light
ab ONFOR
Display
Sensor A
/
-
256
Sensor A
20


wait-temp
ab ONFOR
Display
Sensor B
/
-
120
Sensor B
20

# “Playing with the Bits”

# AutoHAN

- ATM
- 3 device types
- GENA
- Registry
- Leases, XML...



# Media Cubes

- Made of wood
- Single LED
- Piezo-electric transducer
- Single button
- 4 induction coils
- Array of infrared transmitters

# Media Cubes

- One-button remote
- Visual programming tool

# How to Tackle Challenges?

I. Demands on the solution?

- Risk assessable
- Direct manipulation

II. Demands on the user?

- Anybody competent to use a remote control

# Programming Paradigms

A different approach:

- Ontological abstraction
- Linguistic paradigm

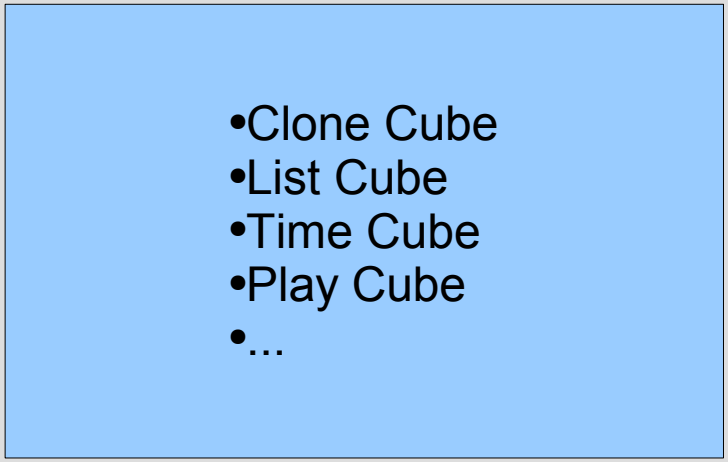
# Ontological abstraction

- Cubes represent an ontological type
- Faces represent an interaction of the given type

•Event Cube
•Channel Cube
•Index Cube
•Aggregate “Cube”

# Linguistic Paradigm

- Cubes represent words in a language



# Issues

- Turing powerful?
- Static or dynamic?

# Overview

- Programming? Tangible? Domestic Environment?
- Challenges
- Cognitive Demands
- Illustrating Examples
- An Example: Media Cubes

# References


- Alan F. Blackwell, Rob Hague
  ***AutoHAN: An Architecture for Programming the Home.***
  Proceedings of the 2001 IEEE Symposia on Human-Centric Computing Languages and Environments, pp. 150-157, 2001
- Tim McNerney
  ***Tangible Programming Bricks: An approach to making programming accessible to everyone.***
  MIT Media Lab, 2000
- Jan Humble, T. Hemmings, A. Crabtree, B. Koleva, T. Rodden
  ***'Playing with your bits': user-composition of ubiquitous domestic environments.***
  Proceedings of the 5th Annual Conference on Ubiquitous Computing (UBICOMP 2003), Springer-Verlag, Seattle, WA, USA, October 2003