A Generic UPnP Architecture for AmI Meeting Rooms and a Control Point Allowing for Integrated 2D and 3D Interaction

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Ambient Intelligence

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EMBASSI

The vision:
Ambient Intelligence is the vision of a world where the user is surrounded by a huge amount of smart everyday appliances.

Peter and Ellen are chatting with a friend about today's stock market developments. In the mean time they watch the virtual presenter that informs them about the latest personalized programs that were stored automatically on the home server.

Philips

IPSI Roomware

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Reality: How to interact with devices ?

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Default control interface of the room

How to turn off the third left light and how to get my presentation started on the middle display using the default control interface of this room?

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Existing Solutions, Examples

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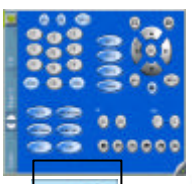
- CMU's Personal Universal Controller
- Philips iPronto
- Sony InfoPoint
- Nevo, KAMELEON, etc.



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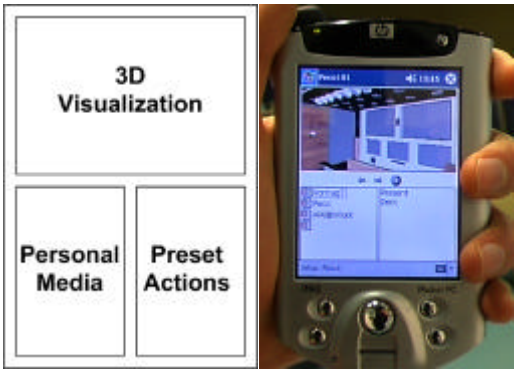
3D-Based Environment Manipulation

- Intuitive Orientation within the room
  - Device access
  - Document access
  - Drag&Drop, selection, clicking



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Requirements for Automatic UI Creation

- Dynamic creation of 3D-model when entering the room or environment changes (e.g., extension with new devices)
  - Need for Device Discovery
  - Need for Positioning System
  - Need for 3D Objects Database
- Device selection and access
  - Standard devices access interface
  - Addressing devices
- Device transparent media access
  - Finding Content directory
  - Browsing/searching content
  - Transfer of media objects

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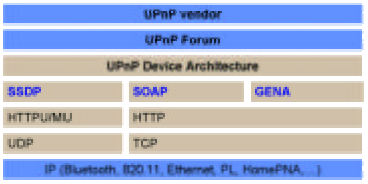
Universal Plug&Play

- Widely accepted standard
- Device Discovery
- SOAP-based Control
- Ontologies for some devices available:
  - Light
  - Security Cam
  - AV Architecture: Media Renderer, Media Server
- Many SDKs available
  - Microsoft, Intel, Siemens



- E.g., UPnP enabled Light
  1. SSDP Device discovery
  2. Provides XML Device Profile
  3. Provides XML Service Profile
  4. Provides Web Service Control Interface

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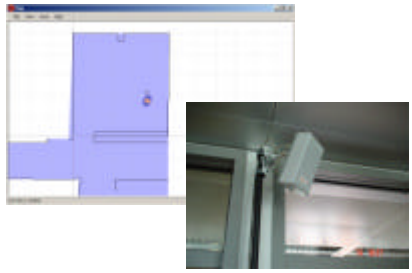
Indoor Positioning

- Ubisense Smart Space Platform
  - C++ and COM-based Interface
  - Provides events (call-backs) on object movement, e.g. entering a room, leaving an area
- RFID-based positioning
  - User defined regions (Rooms)
  - Position (x,y,z), Orientation



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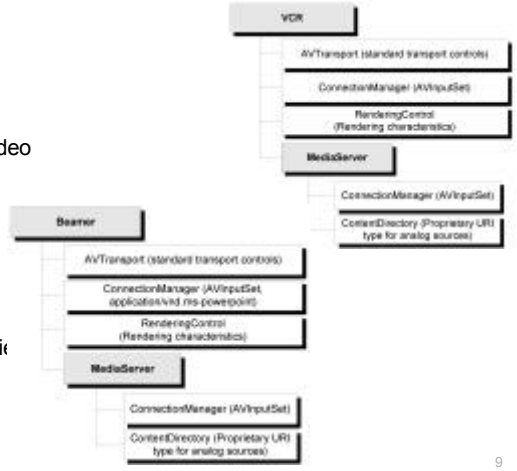
Designing UPnP Devices

- Several devices have been realized yet:
  - Lights, Shutters
  - VCR, Visualizer, Camera, Video Phone, Audio Mixer
  - Projector
- Supported document types
  - Power point slides (.ppt)
  - MP3 files, MPEG movies
  - analog input source as proprie content type



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UPnP Meeting Room Concept

Device	UPnP	Actions
Light	Dimmable Light	on/off, brightness up/down
Blind	Solar Protection Blind	up/down/stop
Projector	AV Media Renderer with embedded Server	on/off, source selection, shutter open/close
VCR	AV Media Renderer with embedded Server	play, stop, pause, rec, ffwd, rew, eject
Visualizer	AV Media Renderer	on/off, light on/off, focus more/less, zoom more/less, paper size A4/A5/A6
Camera	Security Camera	PIP on/off/change, move up/down/left/right, zoom more/less
Video-Phone	AV Media Renderer with embedded Server	Volume up/down/mute, source selection
Mixer	Two AV Media Renderers, one with an embedded Media Server	mic volume up/down/mute, line in volume up/down/mute

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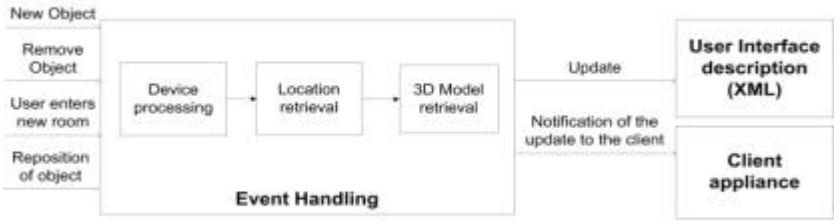
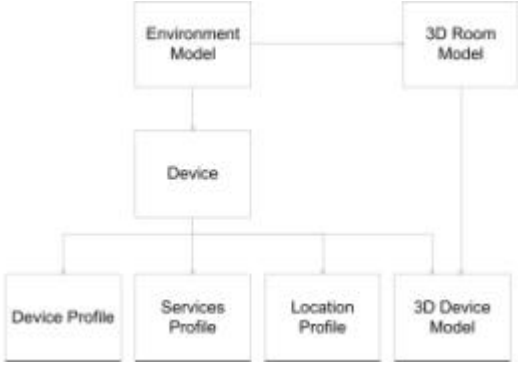
General Approach for UI Generation



Composition of the UI Model

- Environment Model
  - Room ID
  - Room description
  - 3D Object
- Device
  - Device ID
  - Device description
  - Position
  - Orientation
  - 3D Object (URL)
  - Device Control Services (URL)



Results and Future Directions

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- Location Aware Device Discovery system
  - Providing UPnP Stub for Devices of diverse Meeting Rooms of our Institute
  - A UPnP Meeting Room Architecture, allowing to model, e.g.:
    - Projectors with embedded media sources
    - External media sources
    - PECo 3D control interface as a usual UPnP Control Point
    - Analog sources and the “A / V cross bar”
    - Media control components (e.g. PowerPoint control, MP3 control)
  - Providing a UPnP based model for other devices (like Shutters)
- Automatic UI generation and update
- First Qualitative Evaluations conducted

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Personal Environment Control (PECo)

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Results and Future Directions

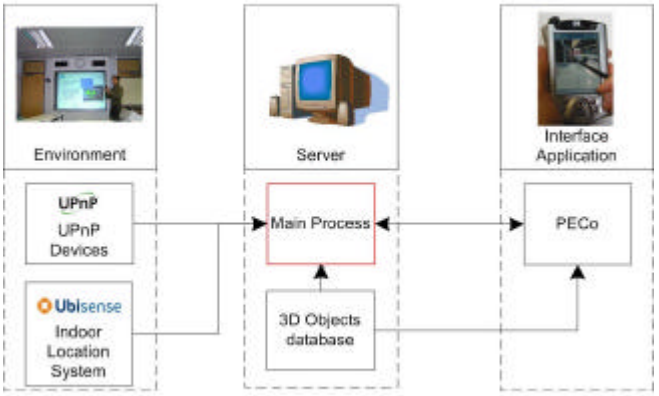
- Future work focuses on
  - Visual Feedback on PECo (e.g., animating shutter movement on PDA)
  - Quantitative User Evaluation (usability Testing)
  - Supporting more standards (e.g., EasyLON)
  - UPnP implementation tools (for fast integration of PECo within other environments)
  - Identifying and supporting other devices (e.g. smart phones)

„THE END“

Thanks for your attention.

Questions?

Implementation: System Architecture



Implementation: Eventing and Classes