

Instrumented Environments

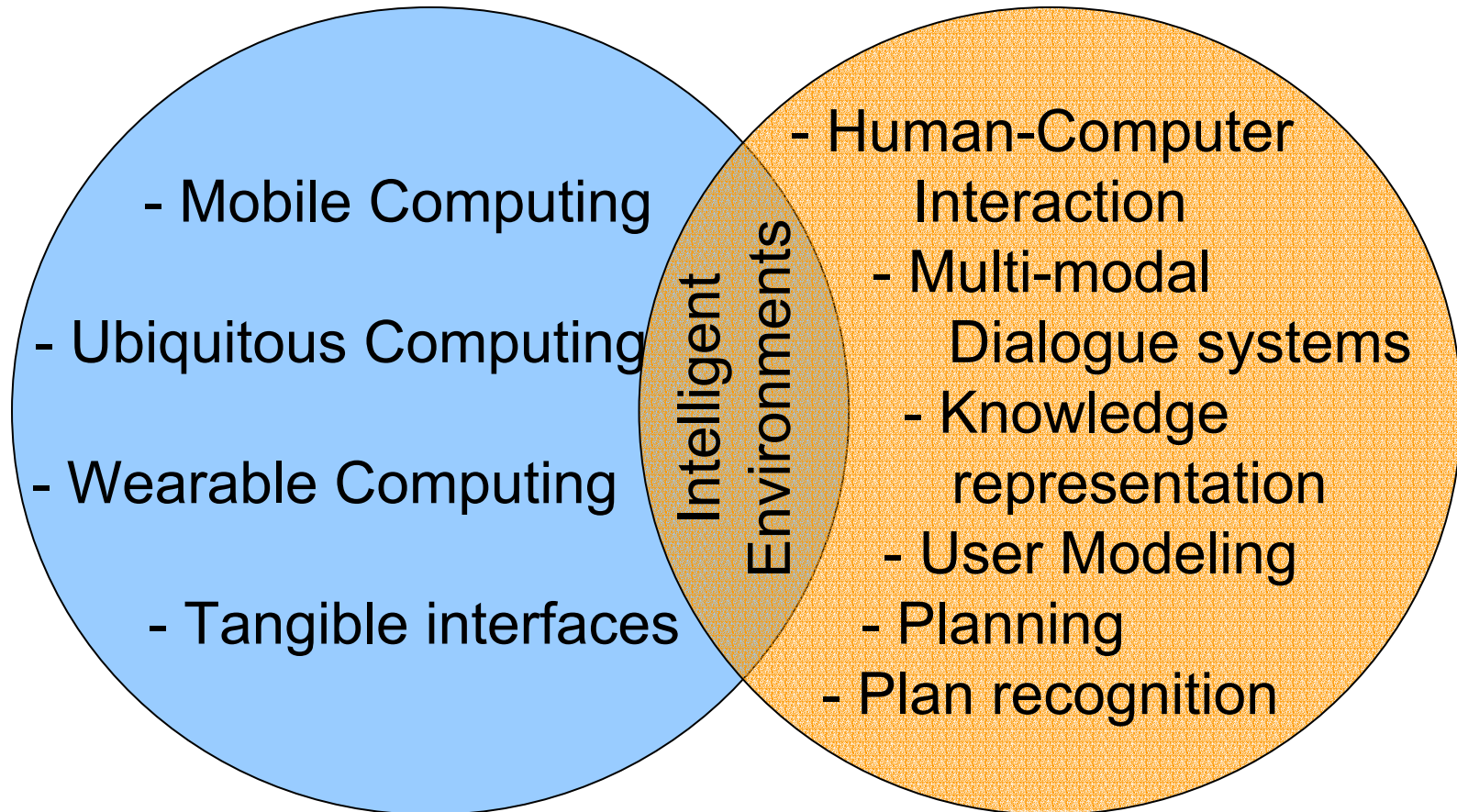
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Mon, 10-12 Uhr, Theresienstr. 39, Room E 46



Instrumented Environments

Intelligent User Interfaces



Topics for the rest of the lecture

- A **very** brief intro to user modeling
- A **little** more on planning
 - Spread throughout the following section:
- Multimodal interaction
 - Mostly along examples
 - Multiple devices
 - Multiple contexts
 - Multiple modalities
- Examples of IEs and IE Infrastructures
 - ..until the cows come home..

A very brief intro to user modeling

- A user model is:
 - Any kind of information about the user
 - Stored in one or several systems (→distr. UM)
 - Used for adapting system output and/or behavior

- Example:
 - Recommendations by Amazon

A practical example for UM

The screenshot shows the top of the Amazon.de website. At the top left is the Amazon.de logo. To its right are navigation links: a shopping cart icon, 'WUNSCHZETTEL', 'MEIN KONTO', 'HILFE', and 'IMPRESSUM'. Below this is a horizontal menu with categories: 'HOME', 'ANDREAS' SHOP', 'BÜCHER', 'ENGLISH BOOKS', 'ELEKTRONIK & FOTO', 'MUSIK', 'DVD', 'VHS', 'SOFTWARE', 'PC- & VIDEO-SPIELE', 'KÜCHE, HAUS & GARTEN', and 'SPIELWAREN & KINDERWELT'. A 'NEU' starburst is next to 'SPIELWAREN & KINDERWELT'. Below the menu is a blue navigation bar with buttons: 'INTERNATIONAL', 'FREUNDE WERBEN', 'TOPSELLER', 'PREIS-HITS', 'GUTSCHEINE', and 'JETZT VERKAUFEN'. Below that is a yellow search bar with 'SCHNELLSUCHE' on the left, a search input field, a dropdown menu set to 'Alle Produkte', and a 'LOS' button. Below the search bar is a yellow banner with the text 'Weihnachtsgeschenke zu Bargeld machen. Jetzt verkaufen!'.

ANGEBOT DER WOCHE

Wetten, dass..?



Die Stars der *Wetten, dass..?*-Show vom 22. Januar aus Hannover.

UNSERE SHOPS

Buch, Musik & DVD

- [Bücher](#)
- [English Books](#)
- [Zeitschriften](#)
- [Musik](#)
- [DVD](#)
- [Video](#)

Elektronik & PC

- [Elektronik](#)

Hallo, Dr. Andreas Butz! Hier sind [Ihre persönlichen Empfehlungen](#).

(Wenn Sie nicht Dr. Andreas Butz sind, [klicken Sie bitte hier](#).)

Jetzt bei **Spielwaren:**
**Mehr kaufen -
mehr sparen!**



5-EUR-Gutschein für einen Einkauf über 50 EUR
10-EUR-Gutschein für einen Einkauf über 100 EUR

[Hier klicken](#)

Dr. Andreas Butz, verdienen Sie **EUR 1080,10**. [Jetzt verkaufen](#) und Platz schaffen!

Bis zu 35% reduziert!



Höchster Kaffeegenuss zum kleinen Preis: Kaffee- und

Espresso-Maschinen wie die *Saeco Magic Comfort Plus* [bis zu 35% reduziert!](#)

700 CDs ab 7 EUR

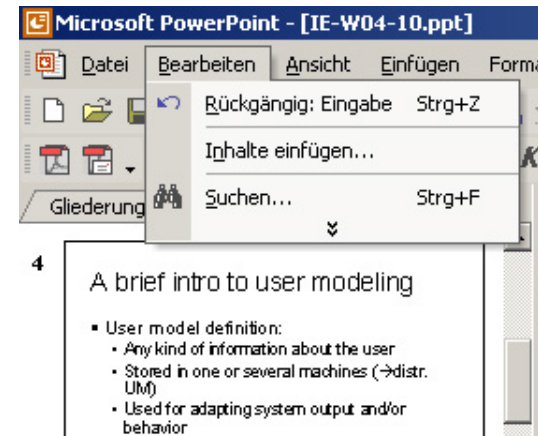


Notting Hill,

Tatsächlich...Liebe und viele weitere Top-Angebote: [700 CDs ab 7 EUR!](#)

Acquisition of data for a UM

- Explicit
 - Type in your name, age, address, credit card
 - Adjust your preferences, skills, interests
- Implicit
 - Items purchased in the past
 - Money spent
 - Pages visited / items looked at ?
 - Navigation speed ??
 - Automatic detection of web bots ;-)



Construction of a UM from data

- According to data collected, systems can
 - Store an individual profile of the user
 - Assign the user to a predefined stereotype
 - Find new stereotypes by clustering users
 - Make default assumptions for missing info
 - From global defaults
 - From stereotype

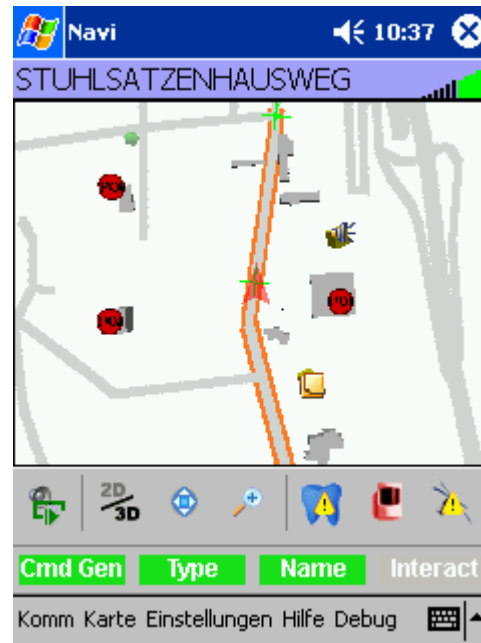
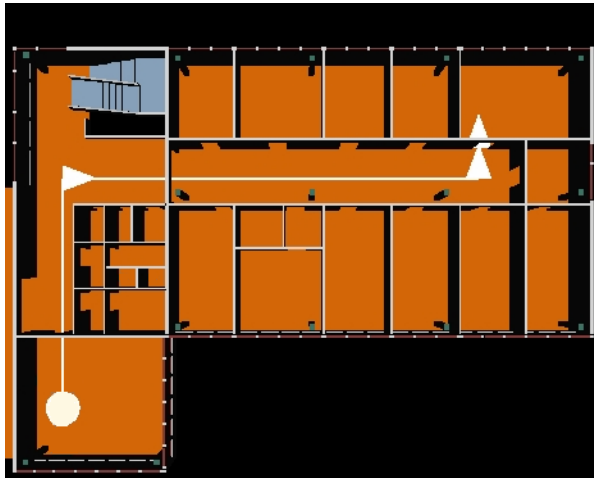
Adapting system behavior from UM

- Greeting customers by name
- Offer customers to sell their used stuff
- Filling in the correct credit card number
 - →security issues, cookies,
 - Try signing on to amazon.co.uk with your account (email address & PW) from amazon.de
 - What parts of the UM do they have?
- Recommendations from domain models
 - Buyers of a DVD Player need DVDs
- Recommendations from „collaborative filtering“
 - Customers who bought X, also bought Y in the past

Multimodal interaction

Some examples

REAL (Saarland University, 1998-2004)



Research Problems

- Given an instrumented environment and a user's navigation task
 - How to adapt route descriptions to
 - the technical resources of the environment?
 - the cognitive resources of the user?
 - How to adapt presentations to
 - technical resources of the environment?
 - user preferences and interests?

Limited Resources

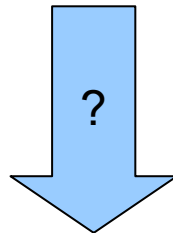
- Technical resources (of the **environment**)
 - Available media: e.g. displays, loudspeakers
 - Media attributes: screen size & resolution, colors
 - Quality of positional data: user's location (e.g. indoor/outdoor), orientation and speed
 - Available CPU-power and memory
 - Communication bandwidth

Limited Resources (2)

- Cognitive Resources (of the **user**)
 - Cognitive load:
 - Use of working memory
 - Time pressure
 - Familiarity with the environment
 - Personal preferences:
 - Media, content and presentation styles
 - Limited vision, hearing, motor skills, etc.
 - Communication abilities: limited use of modalities, e.g. use of gesture and speech

Approaches

technical resources X cognitive resources X user's task

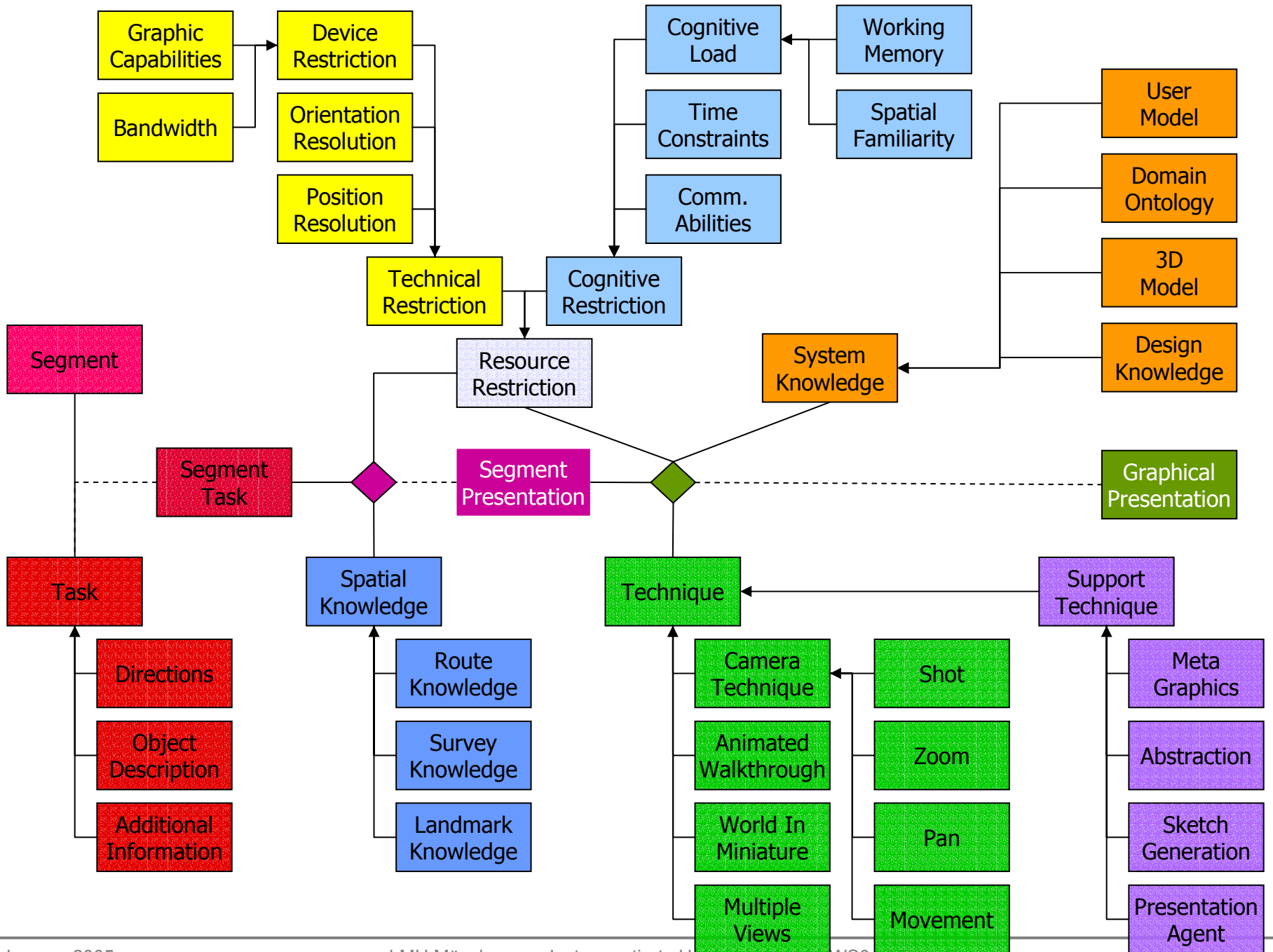


Reaction of the intelligent environment

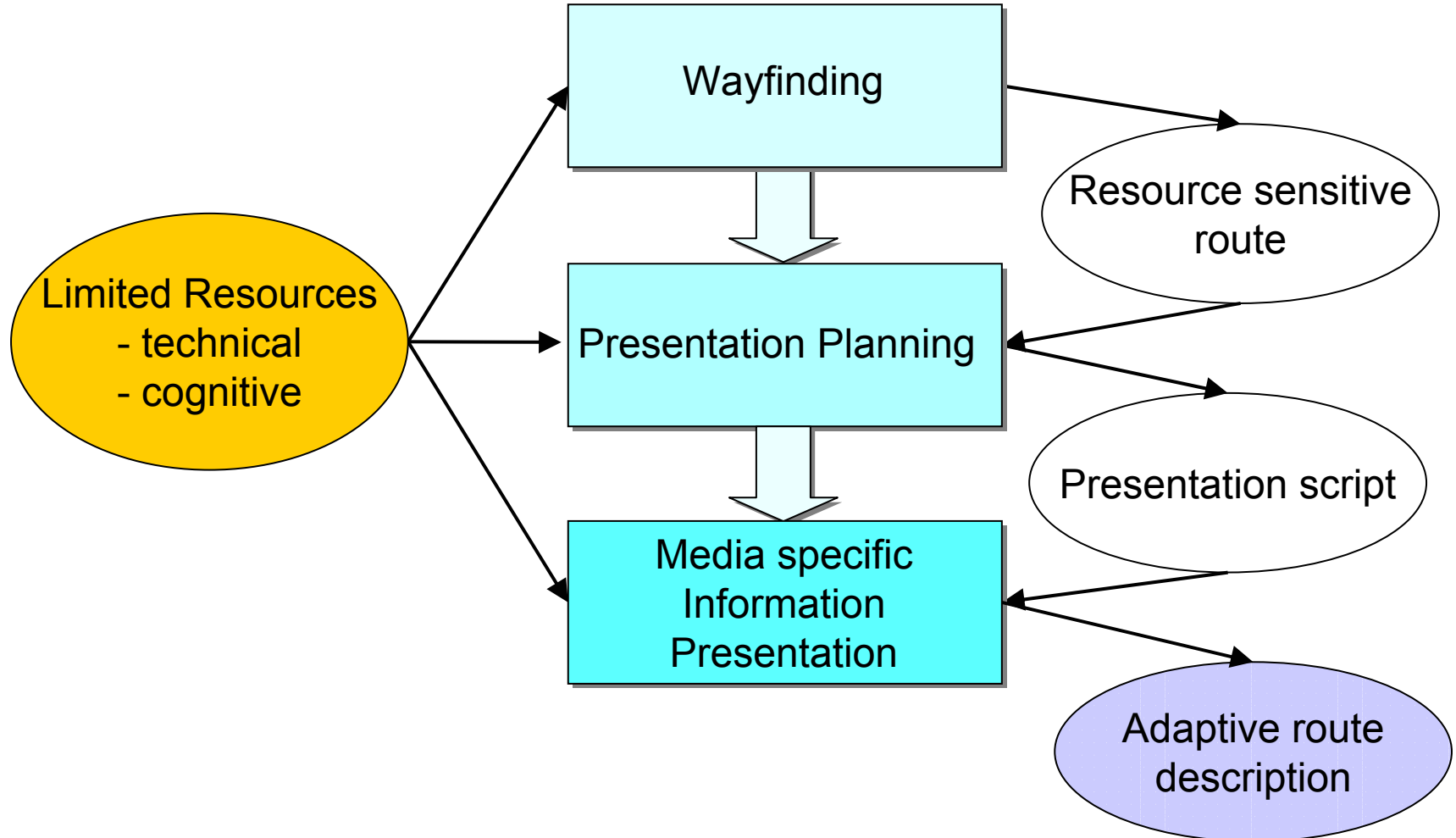
- Content presentation
- Interaction possibilities

A1: Design an architecture that supports **resource adaptivity at several levels.**

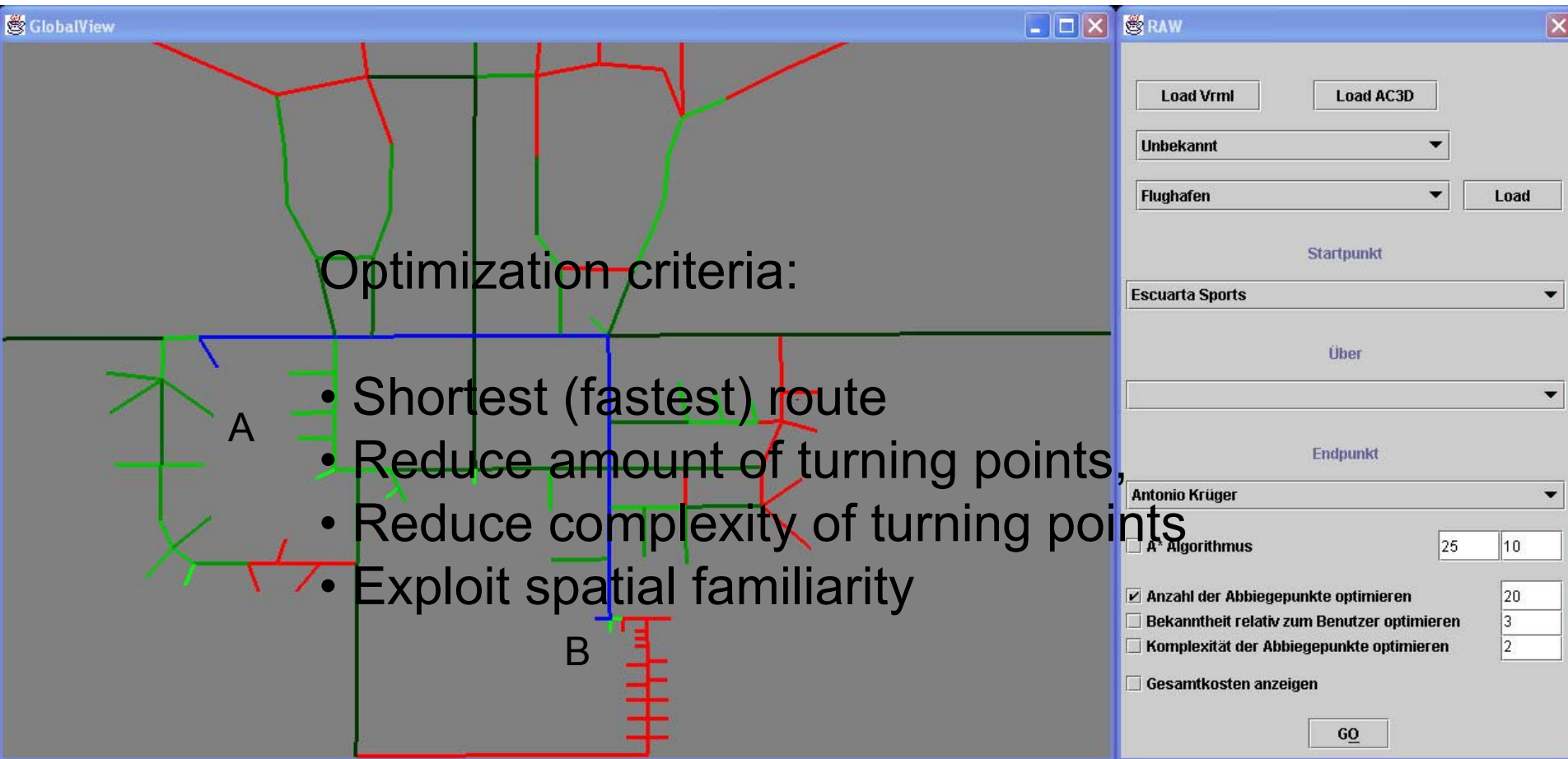
A2: Use a **declarative approach** to specify system behavior under limited resources, **represent what has to be presented!**



Adaptive graphical route descriptions



Resource-adaptive route finding



The image shows a screenshot of a software interface for route finding. The main window is titled "GlobalView" and displays a network graph with red and green lines. A blue line represents a route starting from a point labeled "A" and ending at a point labeled "B". The text "Optimization criteria:" is overlaid on the graph, followed by a list of criteria:

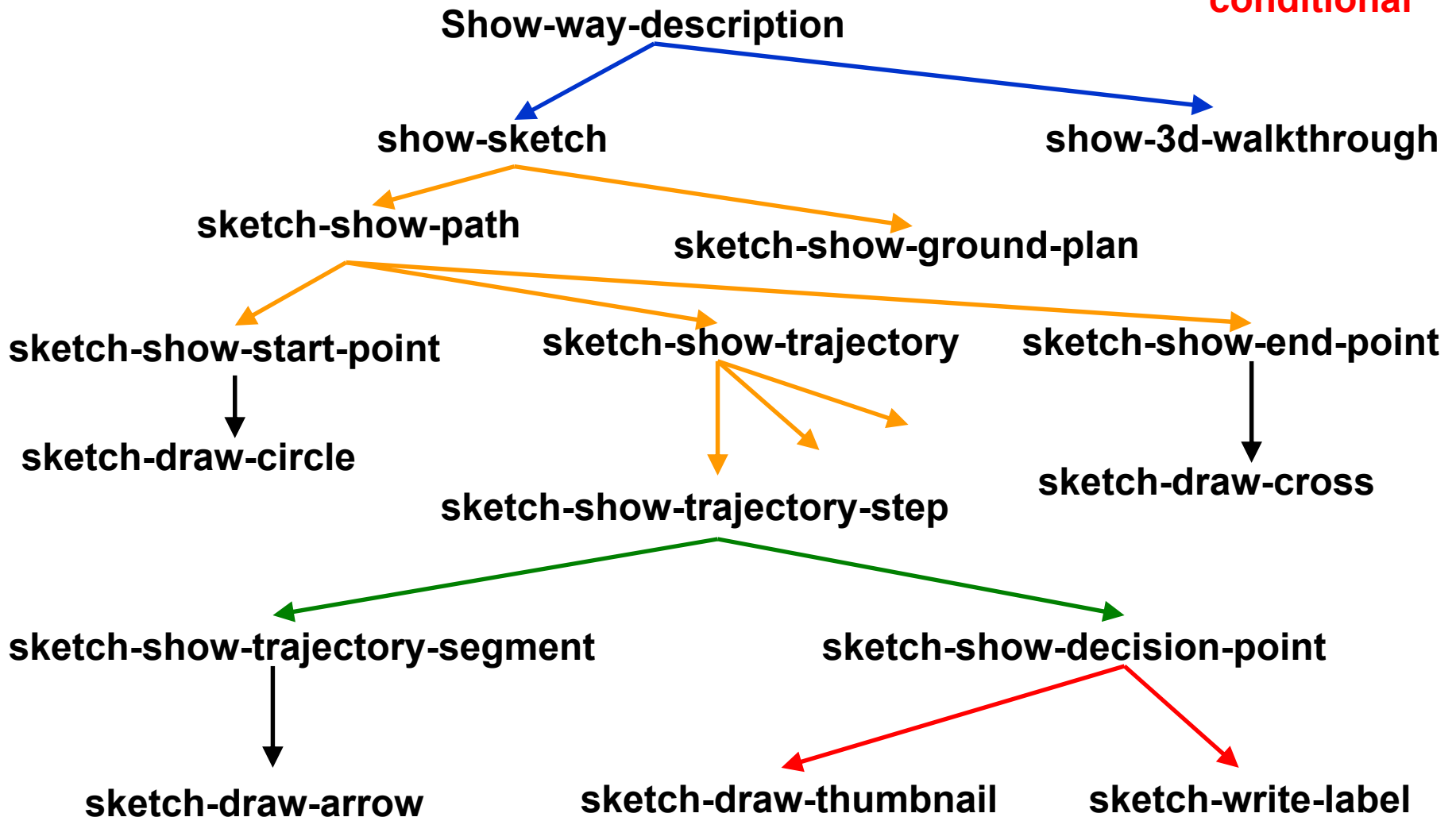
- Shortest (fastest) route
- Reduce amount of turning points,
- Reduce complexity of turning points
- Exploit spatial familiarity

To the right of the graph is a control panel titled "RAW". It contains several settings:

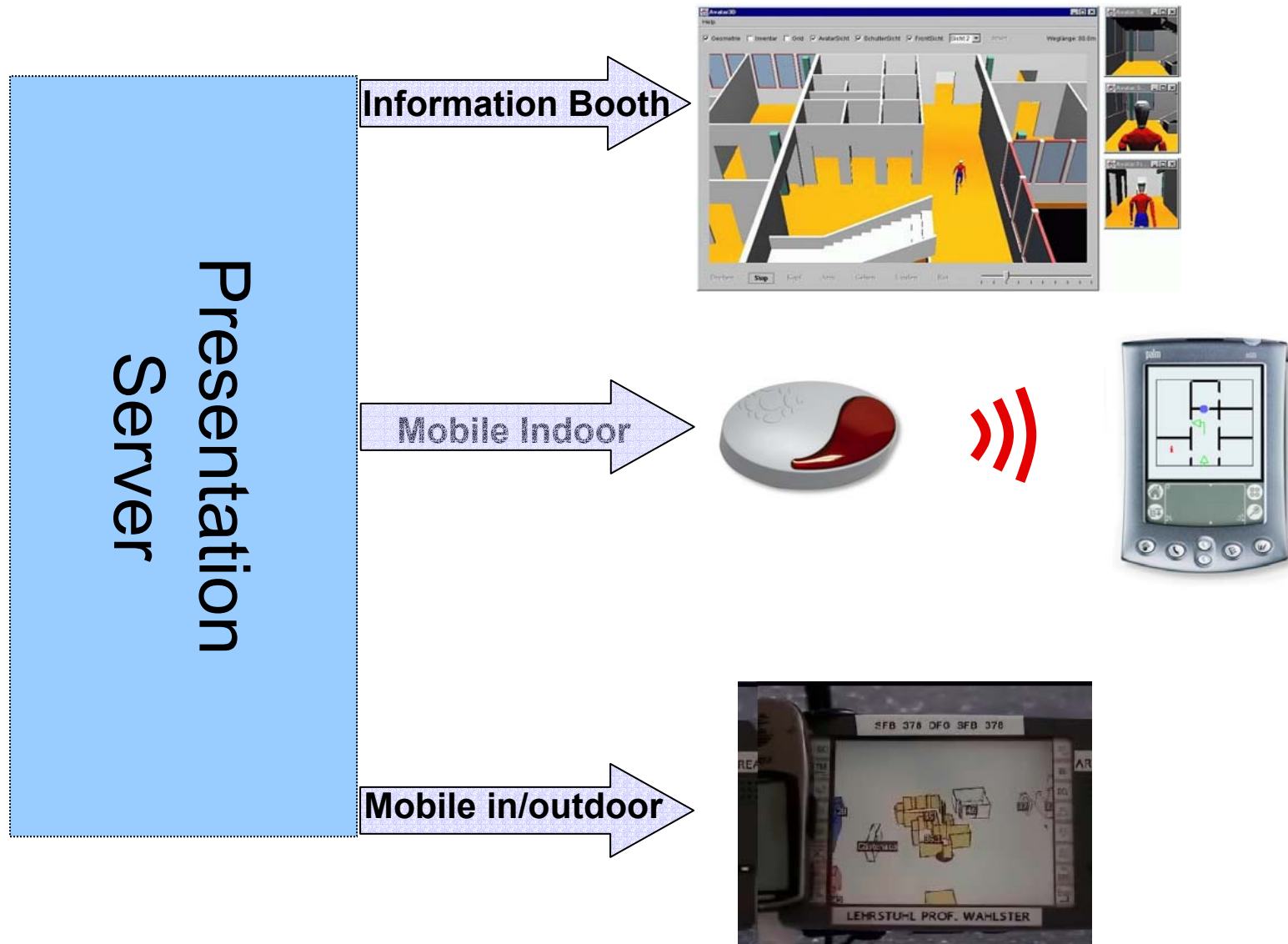
- Buttons: "Load VrmI", "Load AC3D"
- Dropdown menu: "Unbekannt"
- Dropdown menu: "Flughafen" with a "Load" button
- Section: "Startpunkt" with a dropdown menu showing "Escuarta Sports"
- Section: "Über" with a dropdown menu
- Section: "Endpunkt" with a dropdown menu showing "Antonio Krüger"
- Section: "A* Algorithmus" with input fields for "25" and "10"
- Section: "Anzahl der Abbiegepunkte optimieren" with a checked checkbox and an input field for "20"
- Section: "Bekanntheit relativ zum Benutzer optimieren" with an unchecked checkbox and an input field for "3"
- Section: "Komplexität der Abbiegepunkte optimieren" with an unchecked checkbox and an input field for "2"
- Section: "Gesamtkosten anzeigen" with an unchecked checkbox
- Button: "GO"

Hierarchical Planning Formalism

alternative
incremental
additional
conditional



Output for different devices + contexts



Using Information Kiosk and PDA

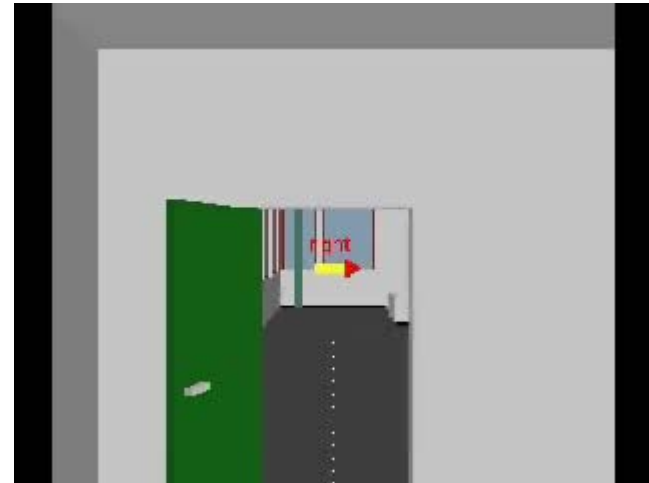
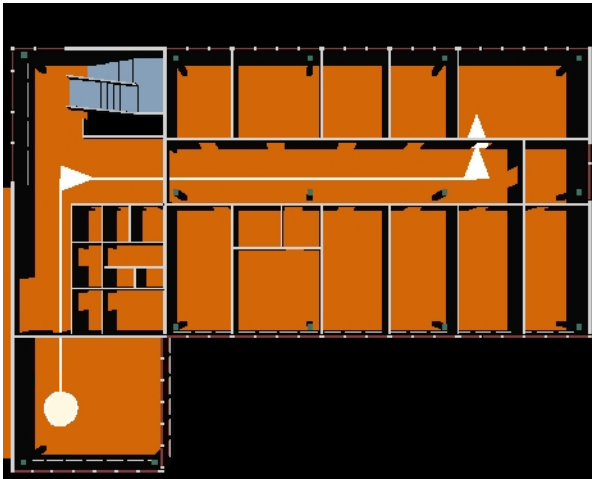


Requesting a route description at the Information kiosk **without time pressure**



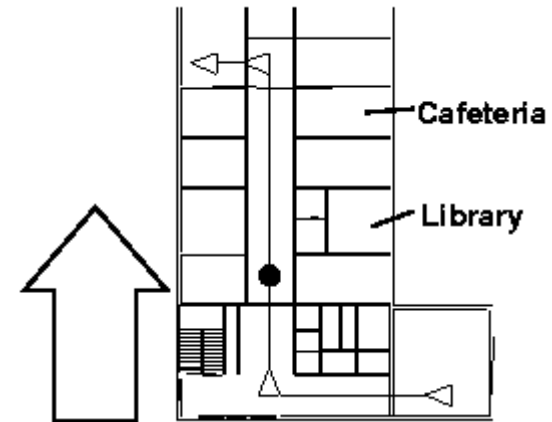
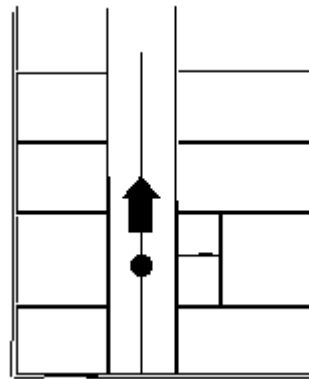
Requesting route descriptions **on the fly**.
A Special transmission protocol adapts the **level of detail** to the **user's speed**

Adaptation: Information Kiosk



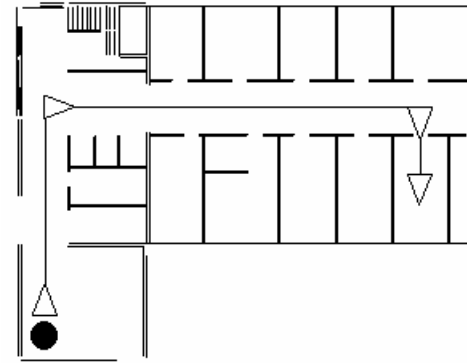
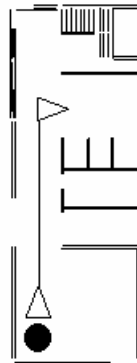
Presentation time (low to high) →

Adaptation example PDA (1)



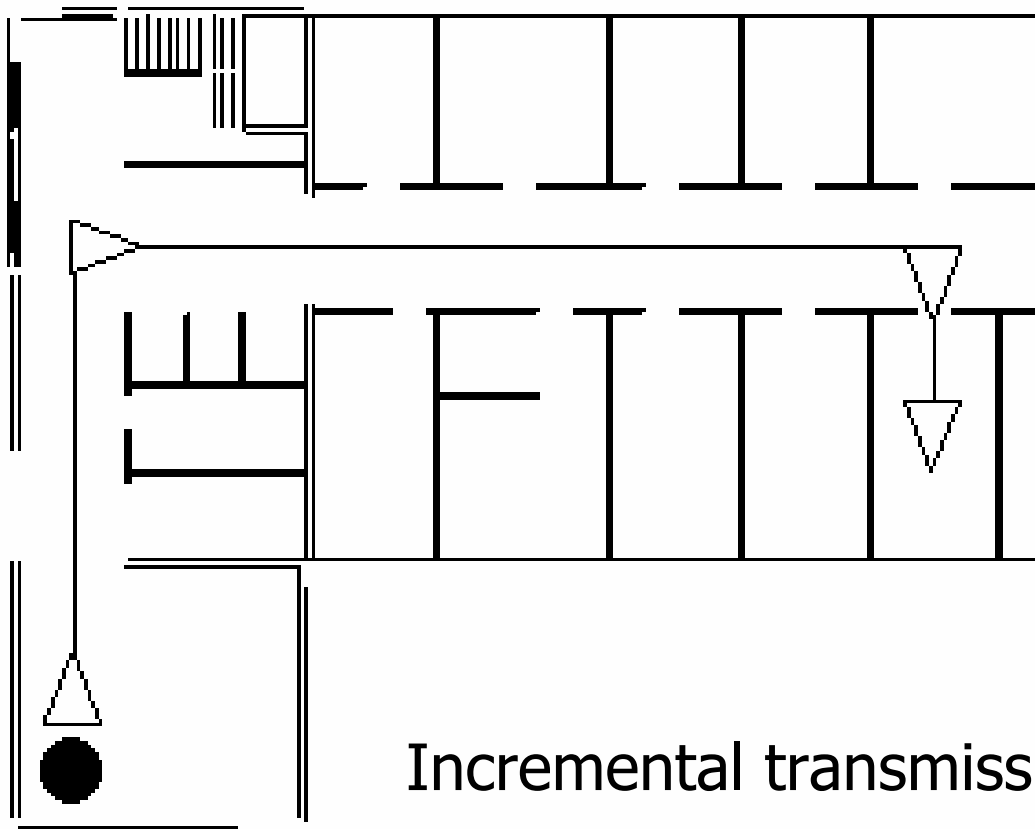
Cognitive load (high to low)

Adaptation example PDA (2)



Quality of positional information (high to low) 

Coping with Limited Bandwidth



Incremental transmission of vector graphics

Indoor-Outdoor Navigation



System adapts 3D-graphics to **user's position and speed** and uses different positioning technologies (**GPS, infrared**).

Extensions of REAL → M3I

- Put all the functionality on a PDA
- Introduce speech and multimodal interaction
- Adapt to computational constraints by using resources of the environment
 - Speech processing on server
 - Use Displays/microphones in the environment

Pedestrian Navigation System

- Navigation server and Pocket PC
- Pocket PC
 - Mobile multi-modal interaction (M3I) platform
 - Supports indoor and outdoor navigation and exploration

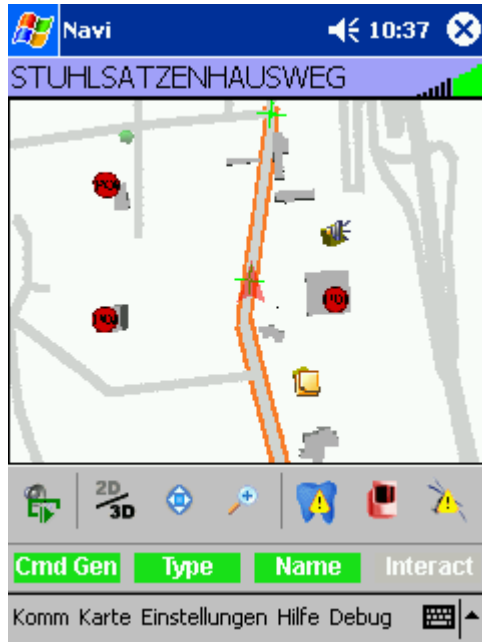
Language: C/C++

Incorporated packages: IBM Embedded ViaVoice formant synthesizer & dynamic rule grammar recognizer, Cortona PocketPC VRML 2D/3D graphics

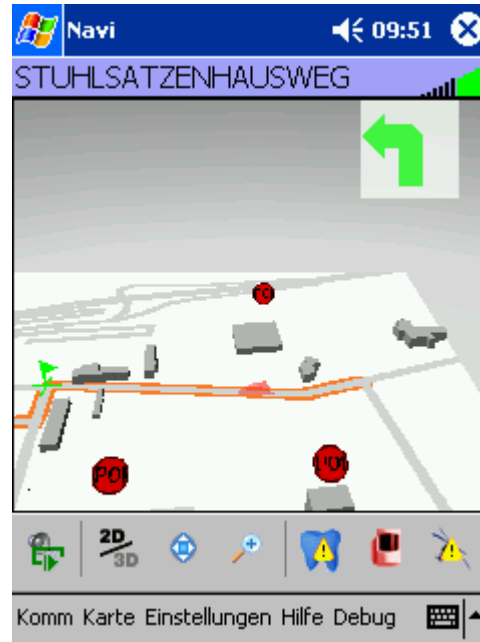
Hardware: GPS, infrared port, magnetic compass, bluetooth (communication with car/server over HTTP).



Graphics output on PDA



2D maps



3D bird's eye



Ego perspective

Multimodal input (gesture + speech)

Types of gestures

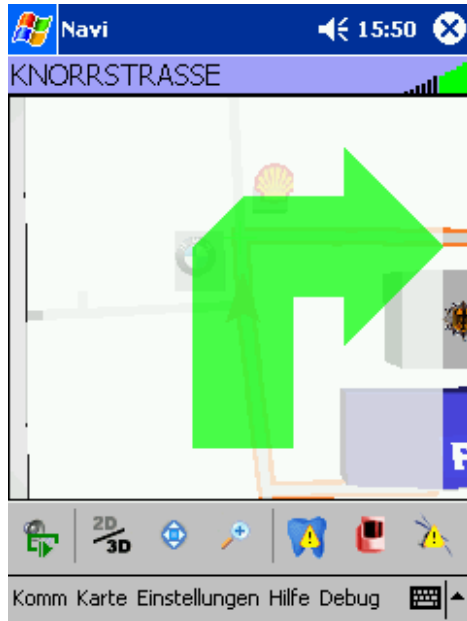
- Intra – pointing gesture on screen
- Extra – pointing to world objects

Intra-gestures

- point (building)
- line (street)
- circle (Area)



Speech recognition and synthesis



Long speech segment:
Gehen Sie 210 Meter. Biegen Sie dann nach rechts
ab in die MAX-DIAMAND-STRASSE.

Middle speech segment:
Biegen Sie demnächst nach rechts ab in die MAX-
DIAMAND-STRASSE.

Short speech segment:
Hier nach rechts in die MAX-DIAMAND-STRASSE.

Fusion of speech with Intra-gesture

„Command and Control“

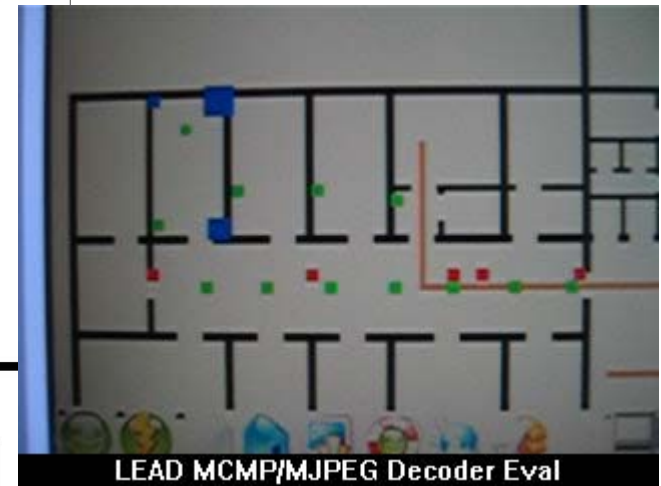
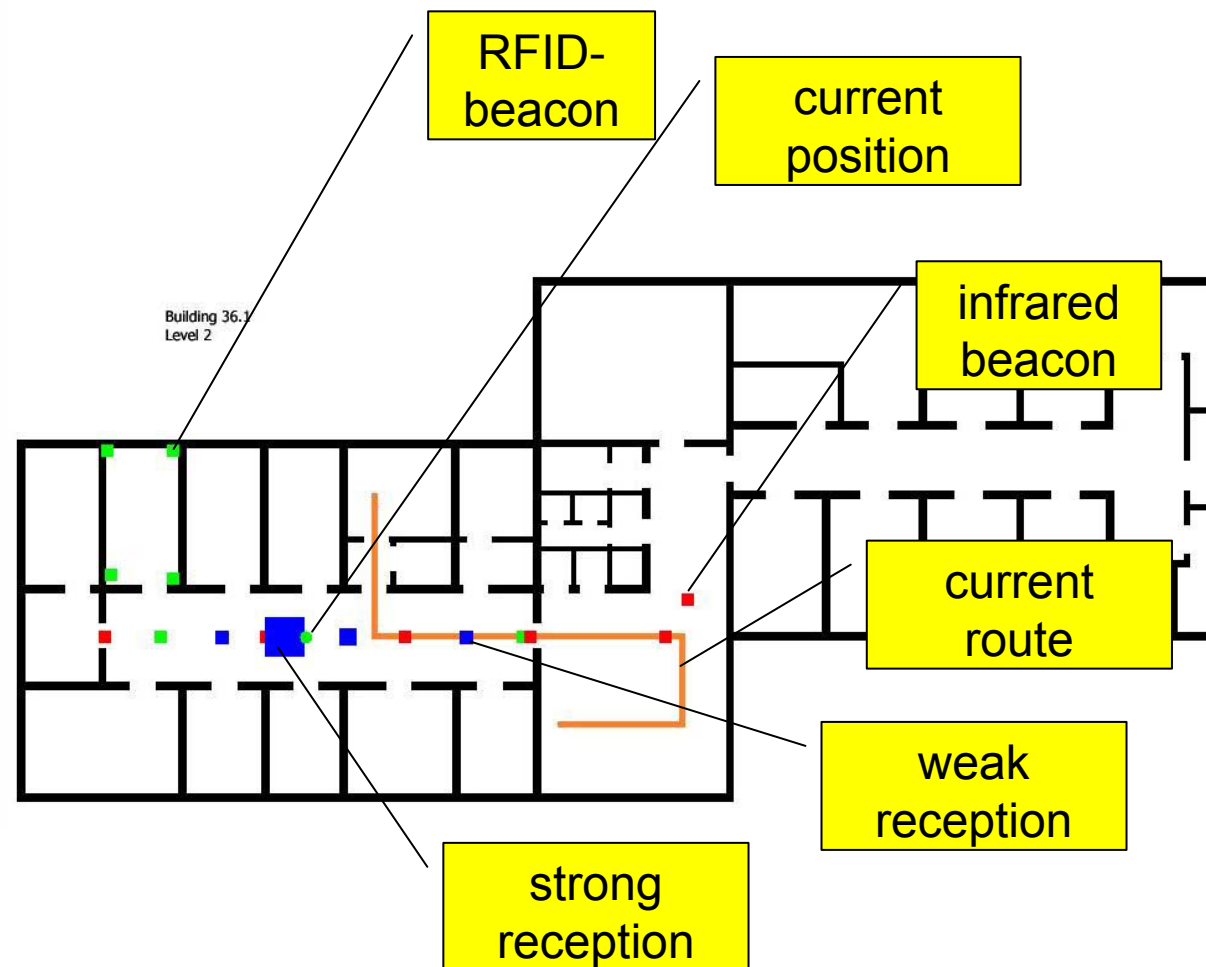
Landmarks, point gesture

Street, line gesture



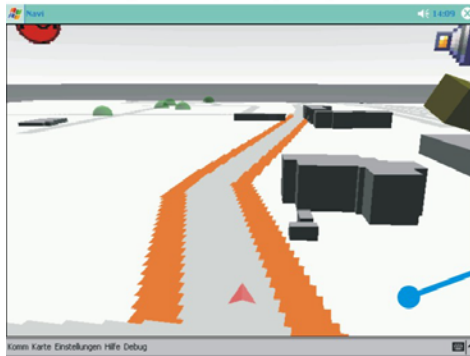
Hybrid positioning within a building

Position of /134.96.240.31

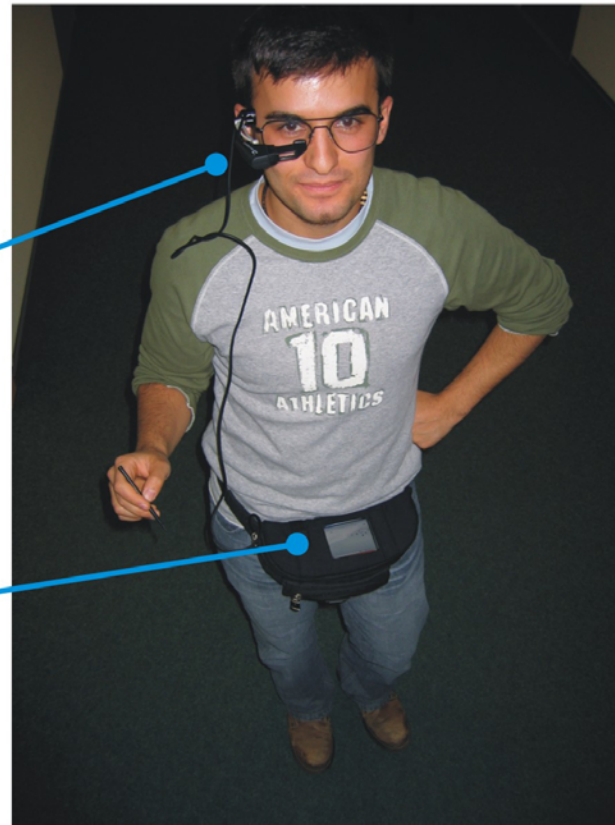
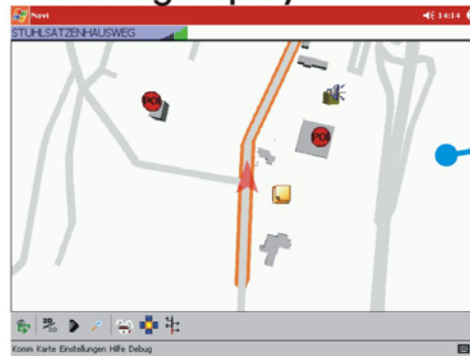


Another physical variation: The Bum Bag Navigator

MicroOptical Display



Bum Bag Display



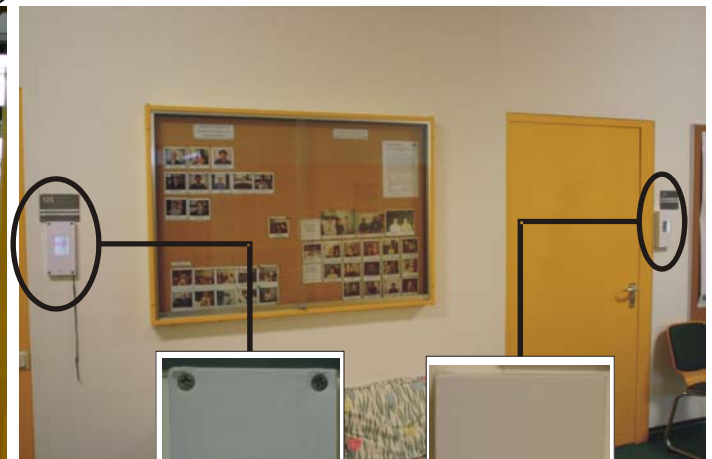
Using other displays in the environment



mobile client



steerable projector



intelligent door signs

Implicit interaction and fusion across multiple modalities



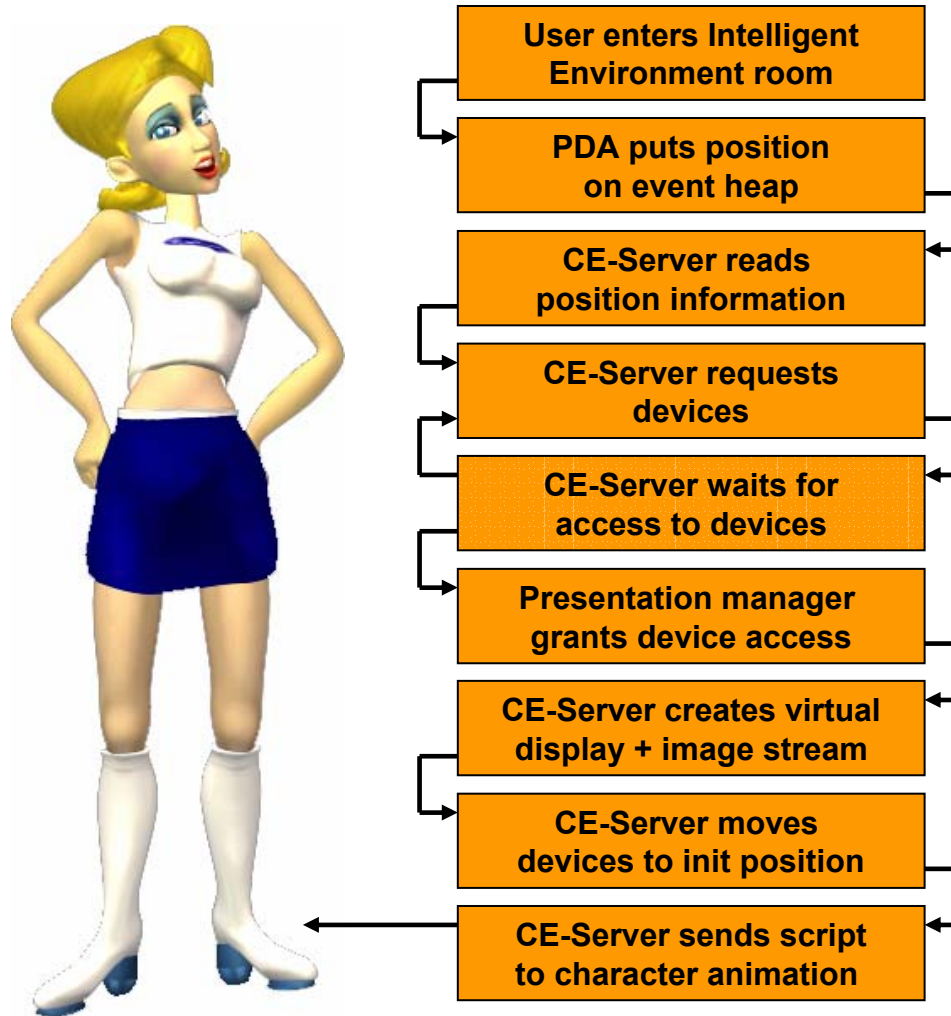
The Virtual Room Inhabitant



Character Engine

- Character engine server (Java) and character animation (Flash) connected via XML socket connection
- Different character gestures can be combined smoothly using a top level movie and several gesture sequences
- CE-server also controls and synchronizes the spatial audio device and the steerable projector

Example Scenario



Demo

