

OK-Net: An Oxygen Kiosk



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OK-Net on 1st floor



“Under-the-hood”



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Kiosk Specs

- **Touch Screen Monitor**
 - no stylus, yes finger
 - 3M 17" Monitor with build-in speakers
 - microphone array on top
- **Small Computer (contained within kiosk)**
 - Slimpro 300, Pentium 3, 1.4 GHz, 30 GB 2.5 disk
- **Minimal Infrastructure**
 - WiFi card, bluetooth USB dongle
 - Must be near wifi base station & power outlet
- **Hacker-Hardened**
 - Linux, no console, rebootable at any time
- **Nothing Exposed except power cord**

Computer behind monitor



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All fits except power cord



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Interaction Modes

- **General Public**
 - Information harvested automatically from web, email
 - Similar to browser: point-and-click
- **CSAIL Demonstration Platform**
 - Provides ability to highlight research demonstrations
 - Add peripherals as needed
 - Open to others via VNC on Kiosk (revert to Skinny when idle)
- **Adapt to user**
 - Kiosk is an extension of user's digital world
 - Kiosk is an extension of user's mobile devices

Finger as mouse



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Bluetooth device as mouse



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Interaction

- **User input**
 - touch & speech
 - phone and pda as remote finger
 - *supports multiple users at once*
- **Information Transfer**
 - sms and email (requires user id)
 - bluetooth connection-less (OBEX push)
 - bluetooth connection (requires authentication & authorization)



Why bluetooth?

- **Short range, wireless communication**
- **Stable, inexpensive, mature**
- **Other choices:**
 - IrDA: directional, line of sight
 - 802.11: too coarse grained
 - RFID: expensive readers
 - RF/US: more precise, too expensive



Device Groups



- **User must authenticate device with kiosk**
 - usually done via pin
- **One authentication should suffice**
 - pairing with one kiosk should enable pairing with any OK-Net kiosk
- **Want all my BT devs to belong to a group**
 - pairing with any one device, should allow pairing with any other
- **Group is a key pair (public,private)**
 - all group devices in group share the private key
 - device initial pairing returns BT address signed by this private key
 - this is used by device to pair with other group members



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Device Groups

- **Group G --**
 - private key: used to join members
 - public key: used to verify members
 - proof of group membership: Bluetooth Address signed by G
- **How to join a group**
 - device A joins; it gets (A signed by G), (Public G)
 - device A wants to prove to B that it is a member:
 - B has public G, can decode A



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Guidance though building

- **Stata is hard for a visitor to navigate**
- **Kiosk provides several guide modes**
- **Passive:**
 - show & push map to bluetooth-enabled device
- **Active:**
 - guide user along the way
 - user must be identified along the way (face, rfid, cricket, bluetooth)

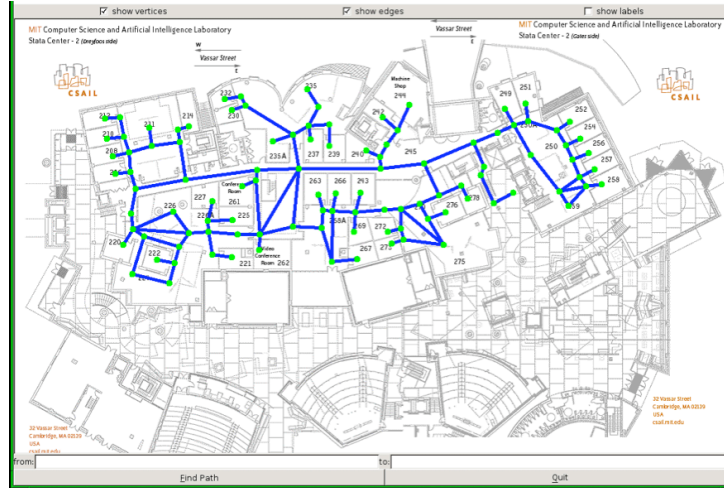


Phone or PDA gets applet



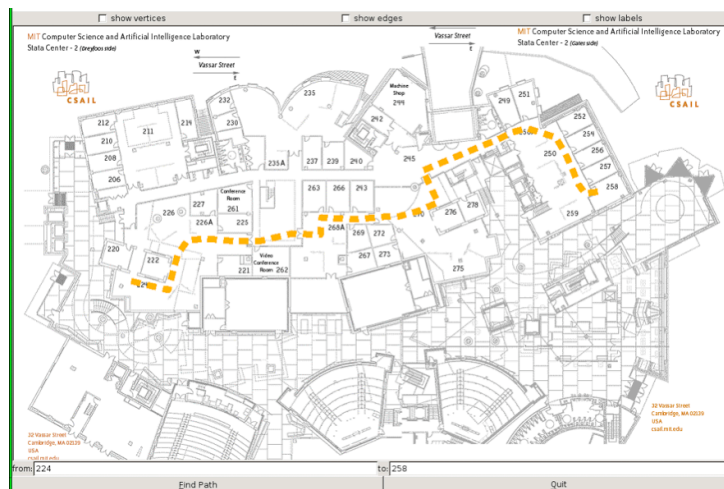
Create graph for each floor

Nodes: junctions or destinations



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Compute path



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Not always easy to follow the map (especially in Stata) Stata can follow you!



- **Bluetooth phone can be tracked**
 - kiosks and embedded microprocessors communicate and all scan for user's device
 - when found, they send update to device
- **Bluetooth phones in discover mode can be hacked**
 - "spamming" and "toothing"
- **Cricket has taught that**
"It is better to receive than to give"



Trivial Deployment

- **Identified 30 neighborhoods in Stata Center**
- **Every neighborhood contains computers**
 - does not matter if Windows, Linux, or Mac
- **Place bluetooth in a machine/neighborhood**
- **Name according to location, eg. "OKN-G868"**
- **Database learns name for each BT#**
 - Devices discover new BT#'s and update DB



Trivial Deployment

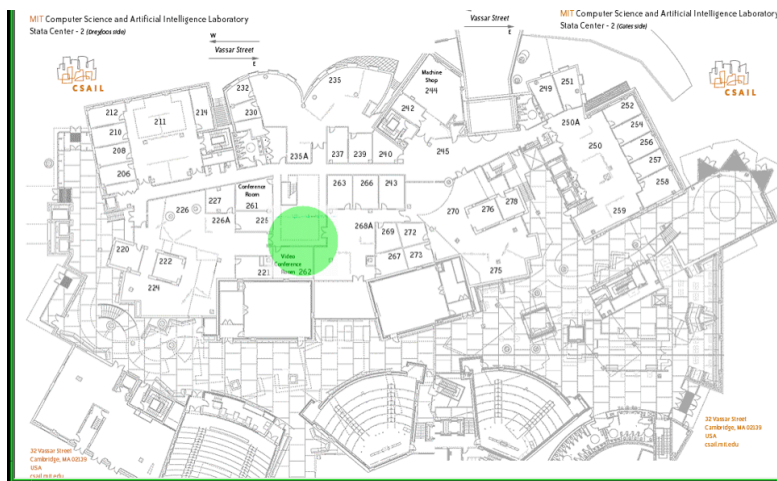
- **Dongle is discoverable**
 - no connection need actually be made
 - very simple deployment issues
- **Device scans and updates location**
 - first device heard is location, additional ones ignored.
 - after first device is silent for 15 seconds, start over



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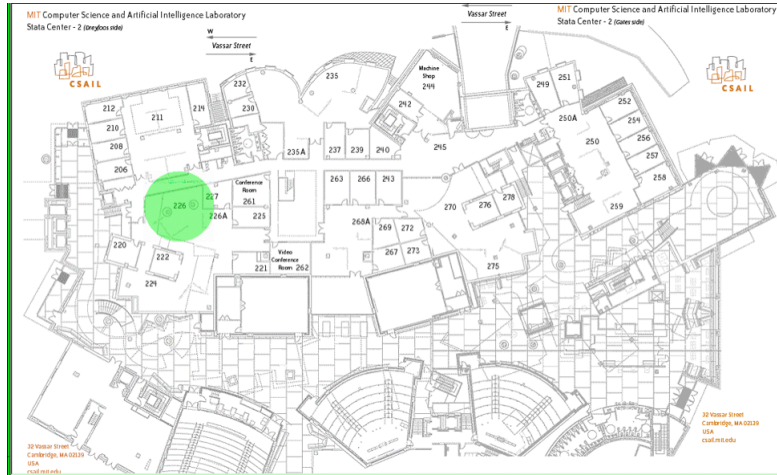
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When hear BT dongle, update map loc



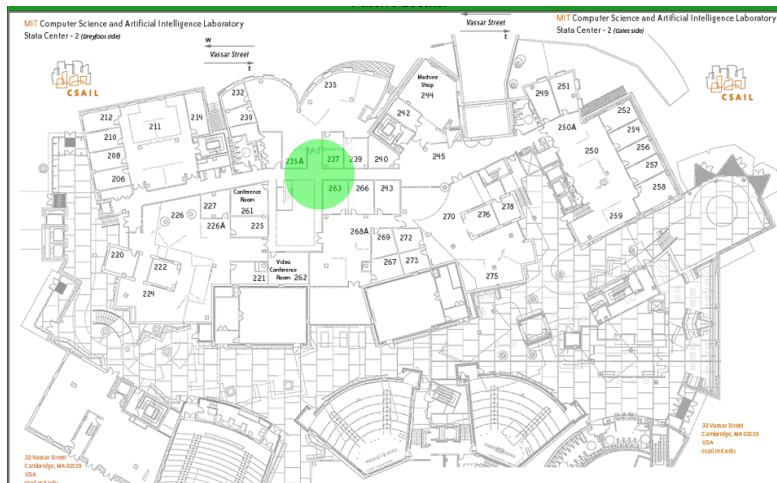
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When hear BT dongle, update map loc



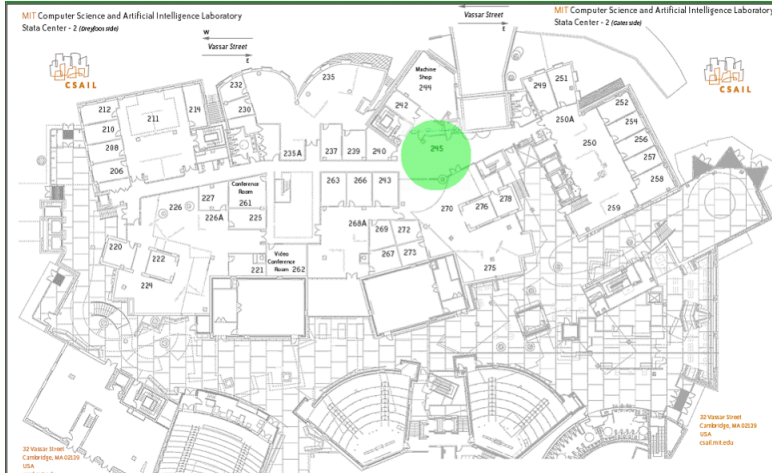
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When hear BT dongle, update map loc



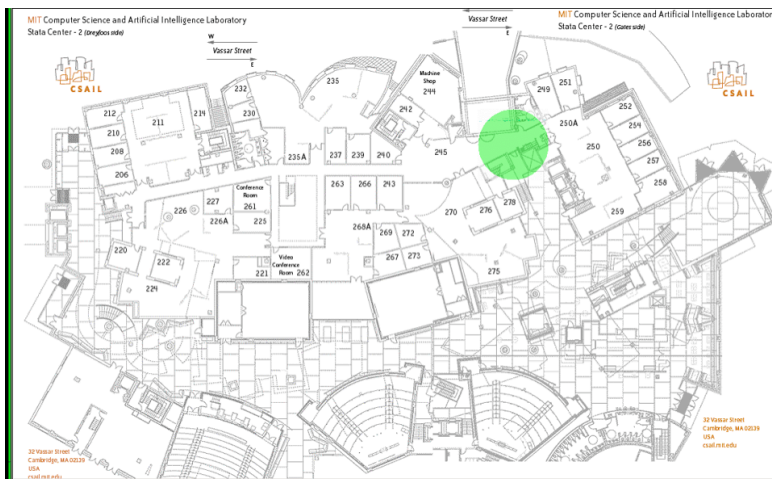
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When hear BT dongle, update map loc



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When hear BT dongle, update map loc

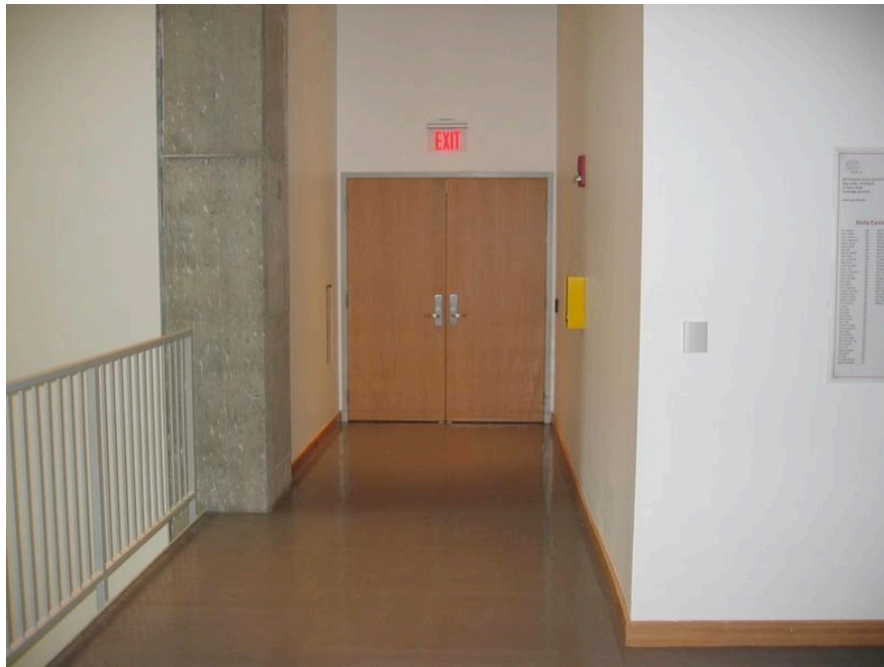


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Some people cannot

- A “human-centric” navigation guide
 - without sound
 - without abstraction
- Picture reality
 - use graph
 - at each junction node, record pictures of path
 - user looks for the reality that matches image







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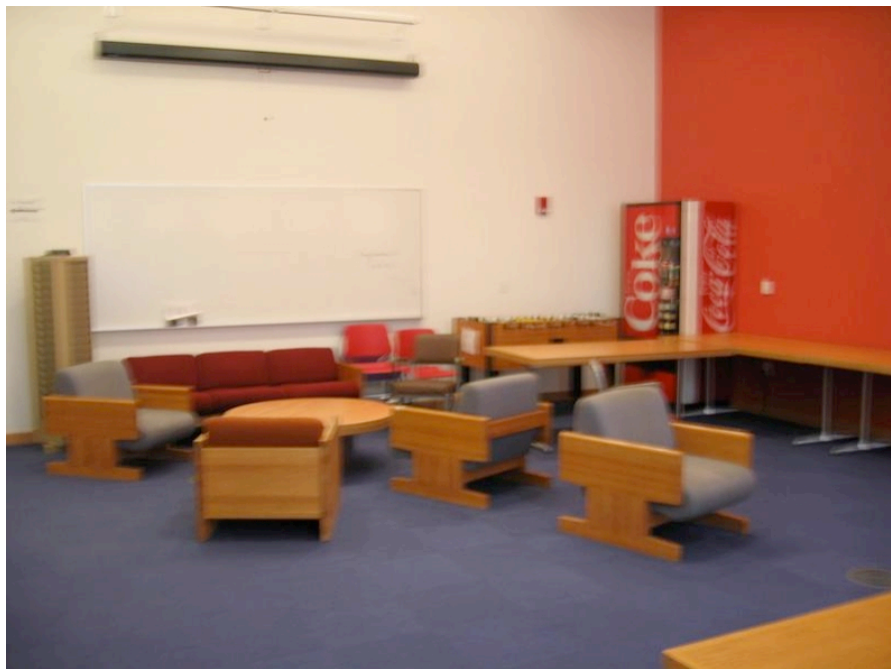
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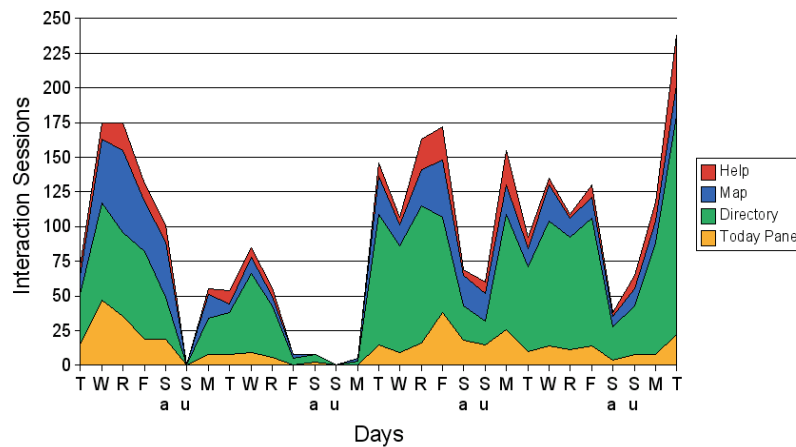
Conclusion

- **Kiosks: new interaction model?**
 - are they just glorified web browsers?
 - interaction with hand-held devices
 - proximity provides simple, everyday protection



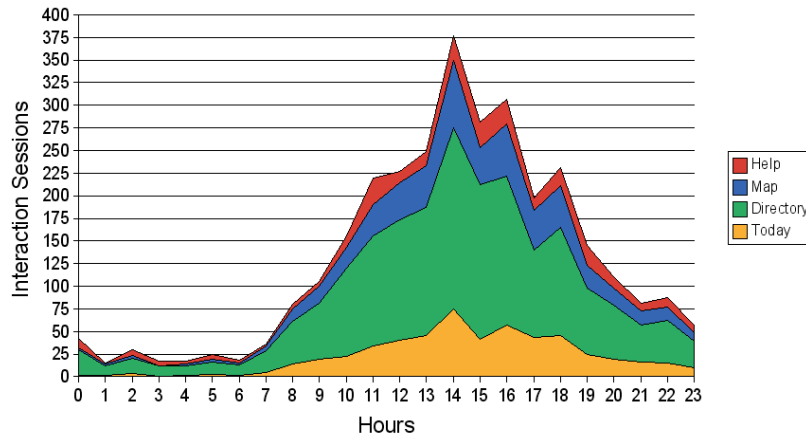
One month of usage, even on weekends

Daily Pane Usage



One day of usage,

Pane Usage Hourly



Kimono: Kiosk-Mobile Phone Knowledge Sharing System

Albert Huang

Kari Pulli

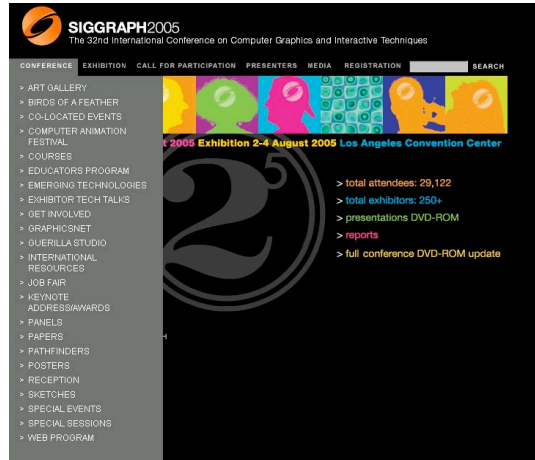
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SIGGRAPH is confusing

- Big conferences are difficult to navigate
 - especially SIGGRAPH (just too much going on)
 - even the web page is huge
 - not convenient to navigate from laptop or mobile phone while at conference
 - do you really get connection always?
- fold-up printed programs work better
 - but still don't remind me where I should be when



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What could I do with a smartphone?

- Pros
 - programmable information appliance
 - could have all the data there
 - it's always with me
 - one-hand operation
 - it can remind me where and when to be
 - I can input data to it
 - text
 - speech
 - photos, video
 - might even know its location
 - from beacons (BT, WiFi)
- Cons
 - small screen
 - difficult text entry
 - no mouse for easy navigation



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How to get data into handset?

- Two main options, really the same
 - get the information from the web
 - either directly to handset
 - or first to laptop, then to handset
- Still problems
 - the content has been designed to be accessed through a WIMP device
 - there's too much information, much of it I just don't care (and won't have space for it all)
 - the potential capabilities of my smartphone don't interoperate well with that data



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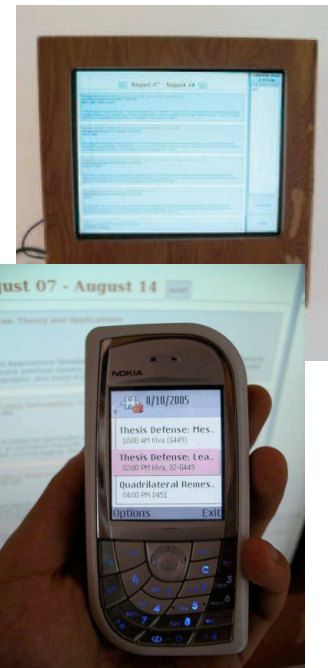


Kimono: Kiosk-Mobile phone kNOWledge sharing system

- Use information kiosk to access and mark information you are interested in
 - easy browsing and selection from a large touch-panel display
- Transfer the data to your handset
 - get a kiosk proxy that travels with you
 - phone is aware of the data, knows when and where events take place, can remind
- Bonus
 - use other phone capabilities to add and annotate the data, and share it
 - text, speech, photo, video



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Key concepts for simple UI



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Associations

- Associations are the key to information organization
 - avoids the tedium of selecting all the individual items, allows selection as a group
 - synchronization protocols can move closely related data together
- Two kinds of associations
 - topics, e.g., “MUM 2005”
 - individual objects (each object has a unique ID)

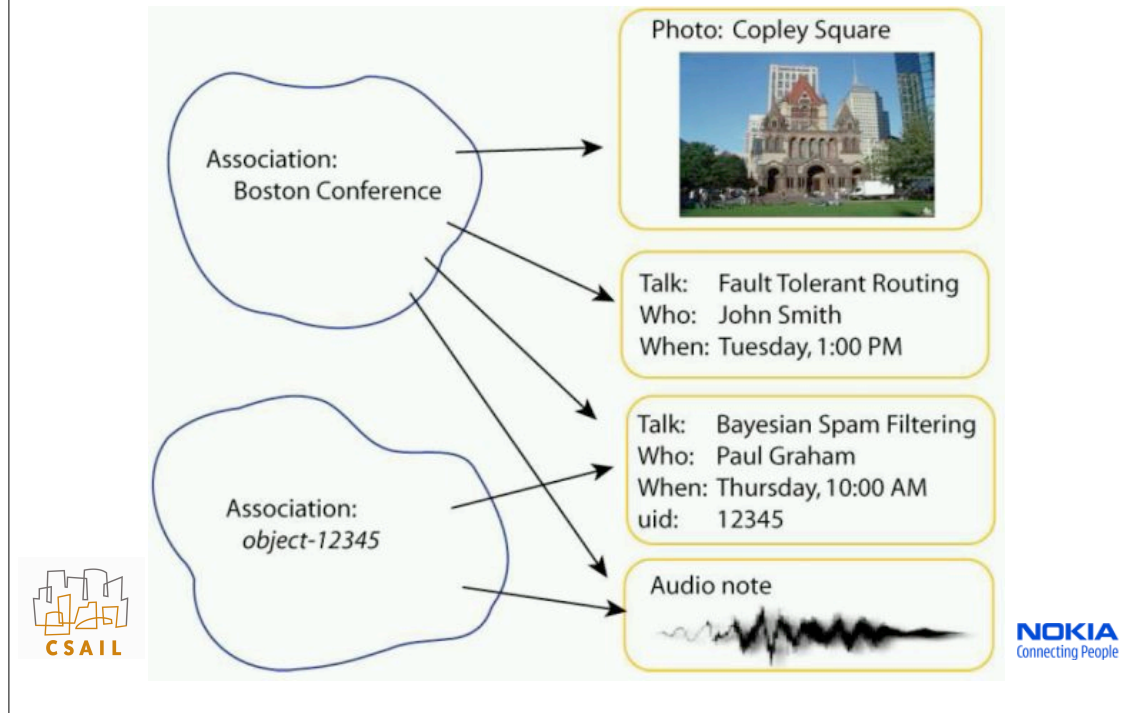


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Association examples



Policies

- Associations enable automating decisions
 - policies tell what is actually done
- Example policies
 - fundamental object type
 - gives precedence to a specific object type, e.g., events are more important than sound clips
 - default associations at object generation
 - e.g., associate photo with the current event, or previously viewed event
 - interested in
 - items selected as interesting get precedence over others for display and transfer
 - public / private
 - different rules to handle objects associated with special "private" or "public" objects





Kimono system

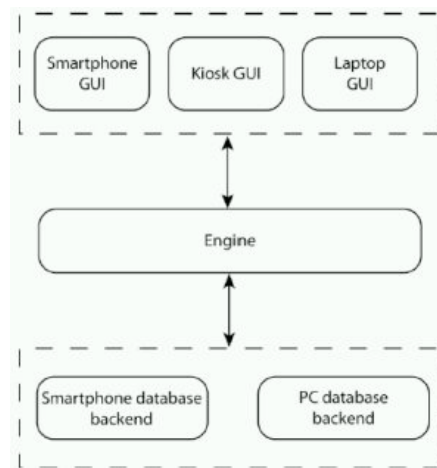


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Kimono architecture

- OK-net rewritten fully in Python
 - since S60 now supports Python on handsets, the same core engine can run both on device and kiosk
 - different backends for databases on PC vs. phone
 - different GUIs for the Kiosk, phone, or laptop
 - anything that supports Python and Bluetooth can be a device



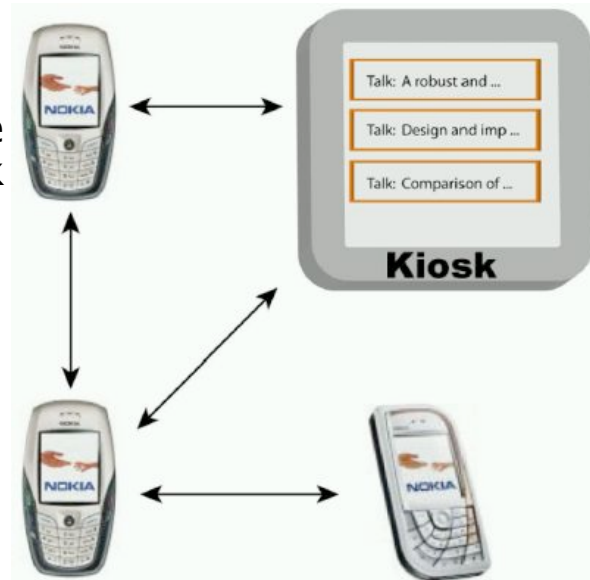
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Kimono data exchange

- Information may flow
 - from kiosk to device
 - from device to kiosk
 - directly between devices
- Short-range connectivity via Bluetooth



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Data exchange

- Steps
 - handshake
 - set up Bluetooth connection
 - offering
 - what is available (new since last exchange)
 - request
 - what the device wants from the offering
 - object upload
 - (wait...)
 - disconnect
 - done



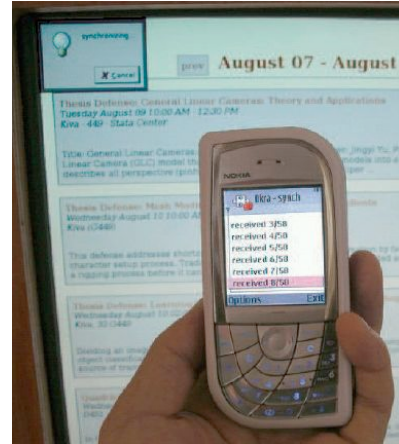
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Triage of data

- Not all data on kiosks is necessarily of interest, and
 - handset has limited memory
 - transmission of data takes time
- Mark items on the kiosk as interesting or not interesting
 - interesting ones get sent to handset
 - not interesting ones are ignored
 - the rest depending on policy



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Getting information

- Operator input
 - the default way
 - does not scale
- Data harvesting
 - the system consults databases in the background
 - department event db
 - university general event db
 - weather forecasts
 - set up once, automatic after that
 - scales
- Contributions from mobiles (users)
 - users may contribute blogs, opinions, voting results, ...



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Security considerations

- Security through physical access
 - websites are much more likely to be defaced because anybody can attack them from anywhere
 - bulletin boards are seldom defaced because access requires physical proximity
- Moderating kiosk content
 - can borrow concepts from wiki pages
 - some entries can be defined to be system / operator changeable only, others could be edited, others only added but not edited, ...
- Man-in-the-middle attacks
 - somebody could pretend to be the kiosk and hijack data
 - solutions exist: can display number sequences that work as keys, ...



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Future work



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Conference kiosk

- The basic system architecture implemented
- Conference information kiosk is an ideal application for Kimono
 - data of conference web site
 - program: schedule and rooms
 - may be updated during the event
 - handset reminds of interesting talks
 - associate notes, images, etc., with events
 - exchange virtual business cards
 - download the information to own laptop, create a personal “travel report”



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Multimodal input

- Vision and speech groups at MIT have experimented with OK-net
 - e.g., video tracking can help the system to figure out when a user is talking to the system vs. a friend
 - perhaps port some of those capabilities to Kimono



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Summary



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Two messages

- A smartphone and an information kiosk together are more than either one alone
 - Kiosk is location-dependent beacon and storage of information with good browsing and data selection capabilities
 - Phone works as a smart mobile proxy for the kiosk, it's with you, knows what you want to be reminded of, allows adding notes and data
- Key for simple UI on the phone
 - separate the policies (how to automate selections, etc.) from the framework (associations)



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