Hochschule für Technik Stuttgart
HfT Stuttgart – University of Applied Sciences

HOCHSCHULE LUZERN
Engineering & Architecture

Towards online position information integration in a location based services gateway

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Outline:

- Location based services gateway (LBG)

- iLoc+ ILS

- Bringing together LGB and ILS

Overview LBG

- Gateway is “glue” between existing automation systems and user client application
- Gateway offers

  2D/3D building map data

  automation / information object information
  - access path (Link, address)
  - Semantic information about the control interface (i.e. WSDL, UPnP description)

  session handling
  - authorization
  - access control

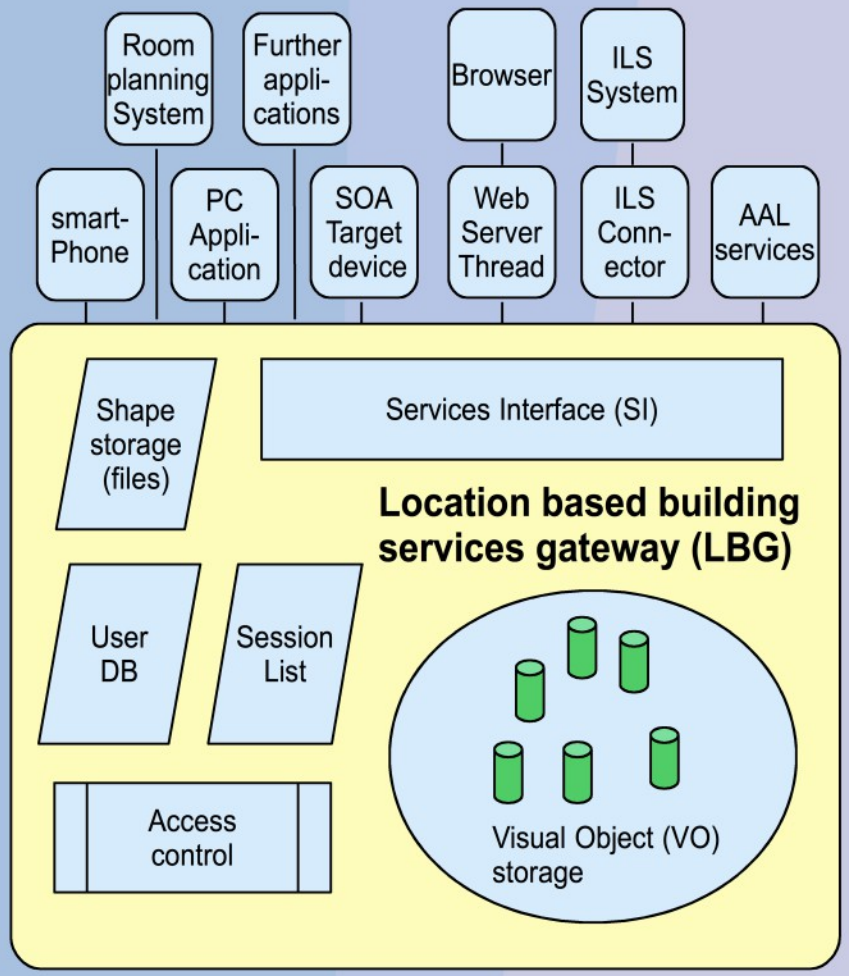
Overview LBG

- User client applications obtain information from the Gateway
- They use this information for
  - Building visualisation
  - Device information and control

  supporting users of a building to
  - navigate
  - receive information by spatial context
  - explore automation devices
- Image outlines some typical applications
  - Status information
  - Room information
  - Door control / lighting control

Gateway Architecture

- items represented by „visual object”
  - VO comprises its visual appearance
- Visual objects represent for example:
  - Sector maps of the building
  - items with textual information
  - link-providing objects
  - automation objects
- Objects are accessed via the location based building services gateway (LBG) using web services



Visual Object

- Shape
  - Visualisation, Icon for the Object
- Position
  - Where the object is located / shall be displayed by the client
- Permissions
  - For accessing/modifying the VO
- XMLInfo / link
  - May contain WSDL, Information text or other object information / link to control interface
- SubscriberList
  - to manage notifications on state changes

Visual Object (VO)

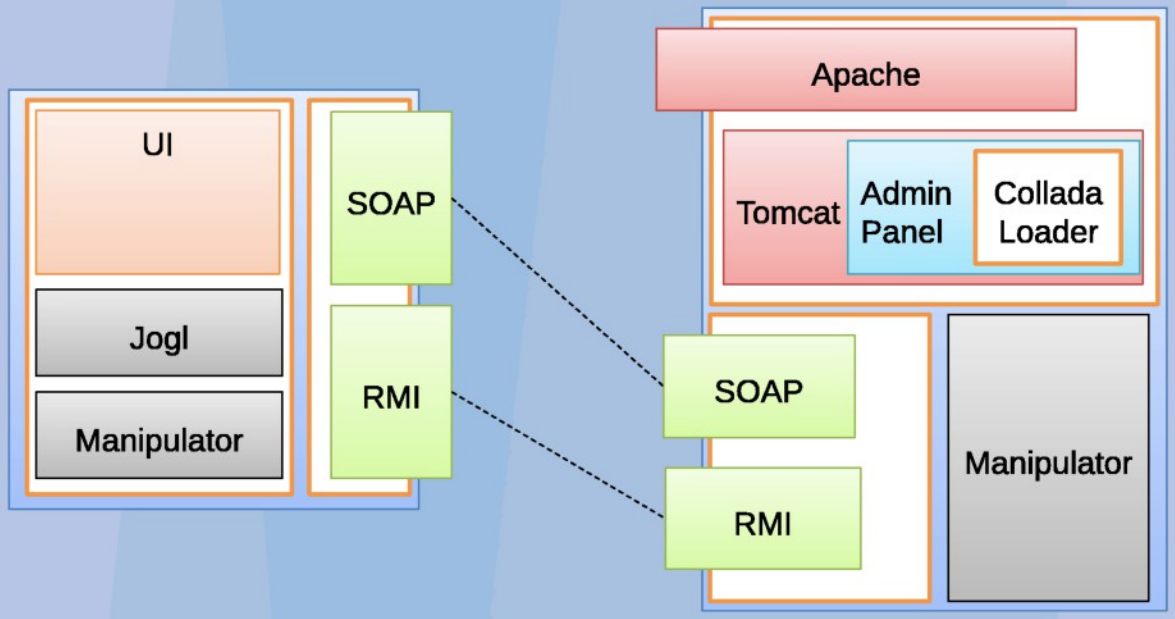
Attributes:

ID
persistent
active
permissions
position
shape
category
xmlinfo
link
credentials
subscriberList

Operations

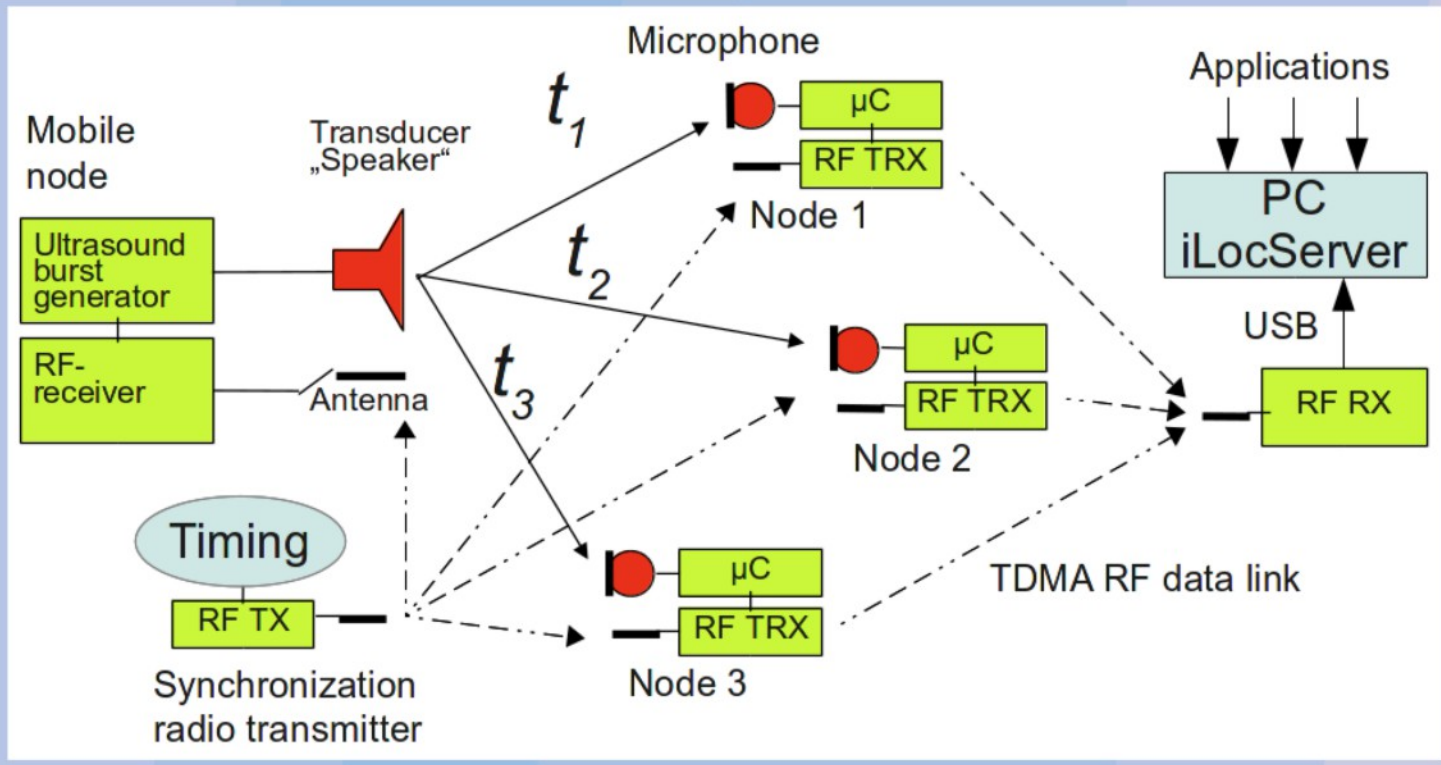
set/get attributes
create(ID)
delete()
addSubscriber(sessionID)
removeSubscriber(sessionID)
ProcessMsg(message)
attributeChangedEvent(position, attributeNames)

LBG Implementation

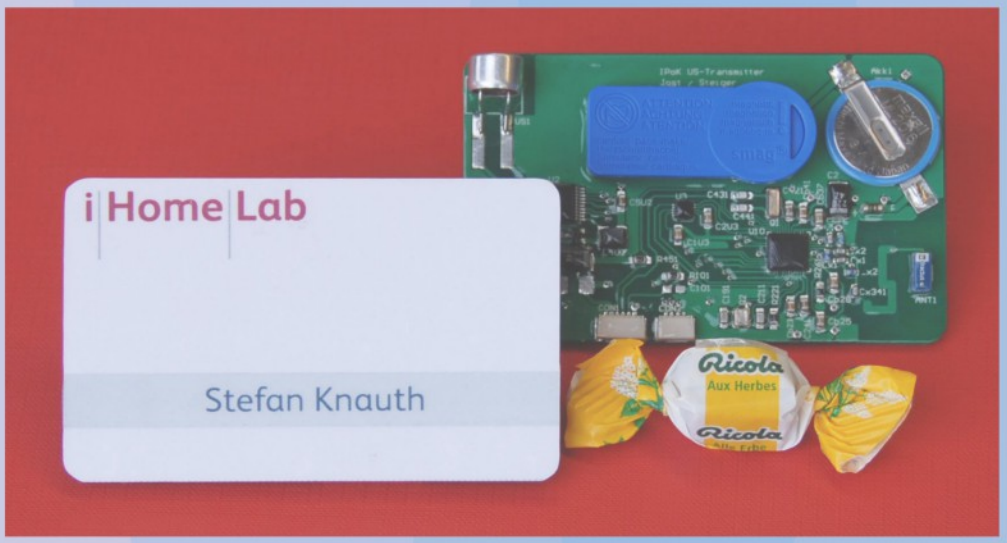


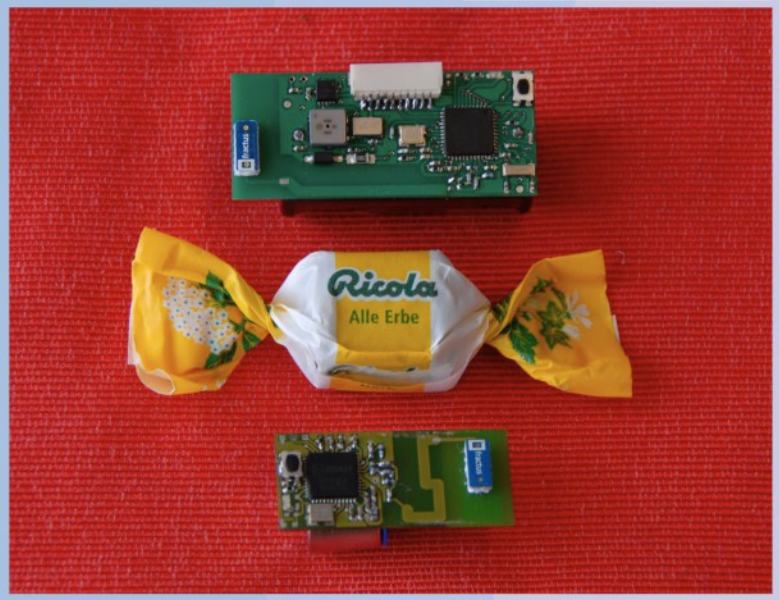
- Object repository managed by “manipulator” component
- Client keeps copy of VO's in his spatial region
  Alignment between Client and Server by notifications
- Same manipulator code is used in client and server
- Collada loader allows import of standardized 3D files
- Client-Server connection via RMI or Web Services

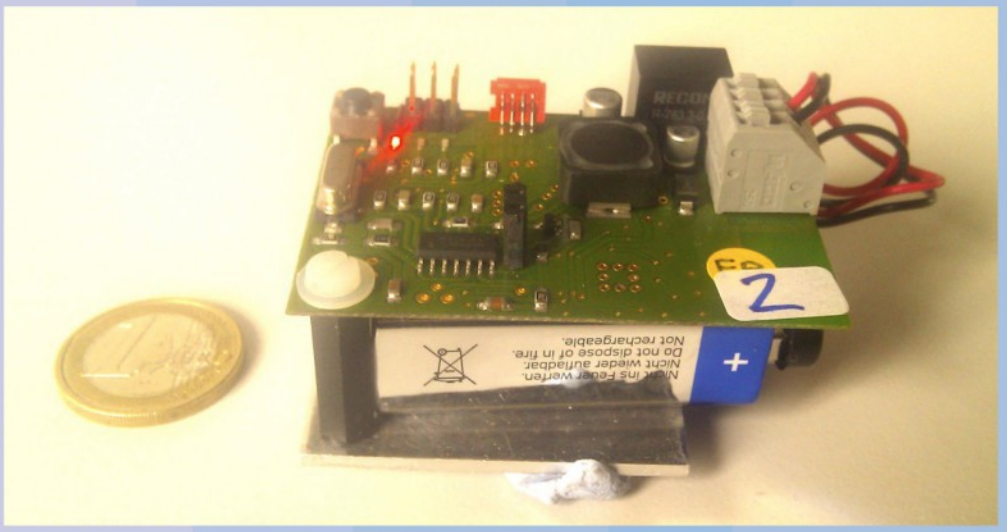
iLoc+ ILS Overview



- Mobile nodes (one shown) transmit synchronized ultrasound pulses
- Ultrasound Time-of-Arrival data of the pulses is recorded by the reference nodes
- Reference nodes transmit their received TOA data by radio to the iLoc Server
- TDMA operation is controlled via a central synchronization radio transmitter
- HFT deployment is 8 receivers and 4 transmitters







- Localisation Tags
  - Interactive (may send / receive data)
  - Remotely updateable poweless e-book display
  - Acceleration sensor, temperature sensor
  - long battery life

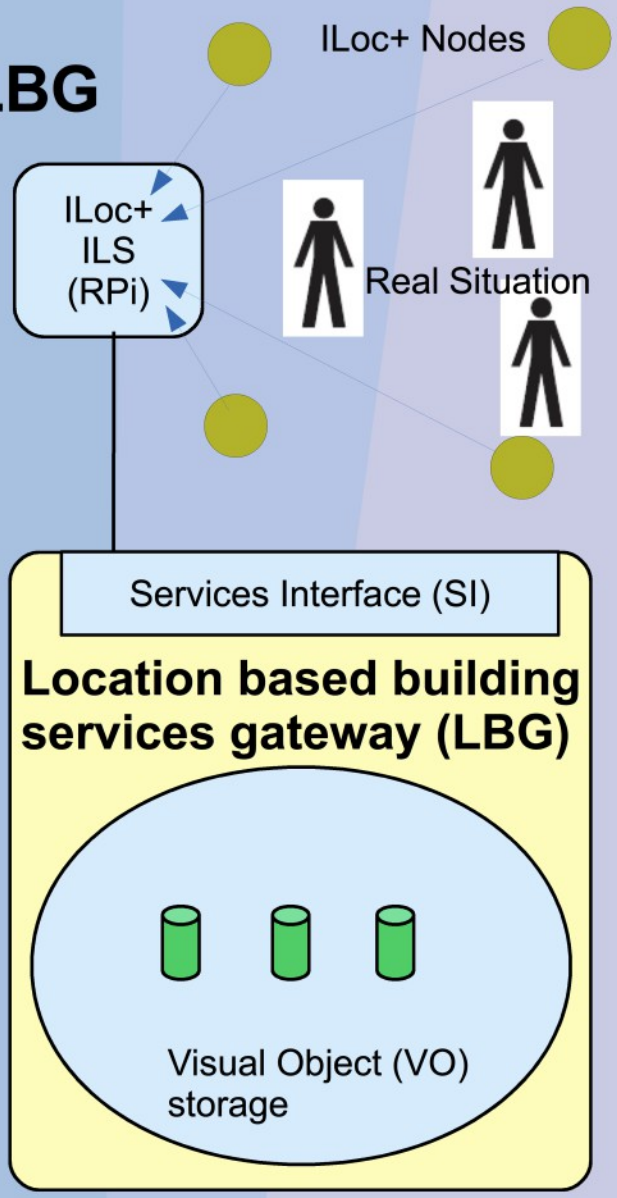
Wireless Ultrasound Receiver Unit

- 3rd prize at EvAAL 2011

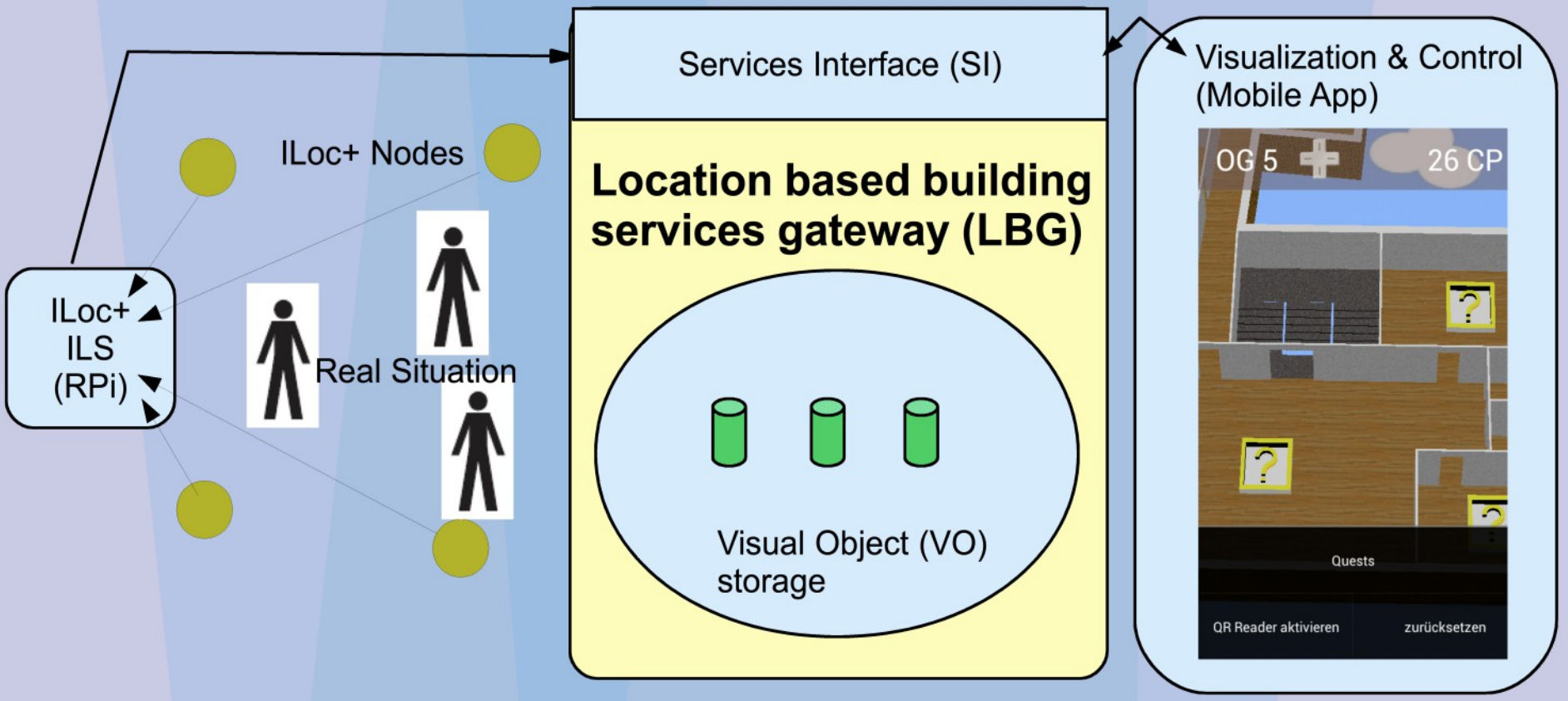
- Hardware prior to EvAAL 2012 deployment (18 temporal transmitters for autolocalization, 26 receivers)

Integration of ILS into LBG Concept

- Integration of ILS via LBG services interface
- ILS extended to commicate to the SI (alternative Approach: a light middlewar)
- ILS localizable items-> Visual Object in the LBG. This can be persistent or dynamically created by the ILS
- ILS pushes position updates to the LBG ("set attribute value" method)
  Update rate is configured within the ILS, LBG acts as slave



Coupling of iLoc+ and LBG (Overview)



Integration of ILS into LBG
Setup

- iLoc+ generated position estimates (dummy positions) of 4 Objects are communicated to the LBG server at a rate of 2*4 per second
- An Android visualization application is also connected to the LBG, independently of the LBG
- The app is notified by LBG on attribute updates of subscribed VOs
  → online tracking
- ILS pushes position updates to the LBG
  Update rate is configured within the ILS, LBG acts as slave
- ILS does not care about applications accessing the Information of the VOs via LBG

Results

- A LBG (“Location based building services gateway“) references elements of a building.
  Typical elements: automation devices, visualisation data, assets, actors etc, modelled as VOs (”visual objects“).
- prototype Setup comprising LBG server, iLoc+ indoor localization system and Android app for online position tracking/visualization
- System works well

  Advantages:

  LBG offers abstract interface
  → Applicatios are independent of ILS
  → Various ILS may connect to the LBG
- Identified drawbacks:
  - Clients are notified each time a position update is given → LBG client update rate should be configurable
  LBG hibernate/mySql and Web Services are resource hungry