Deployment Experiences of a Geographic Messaging Service in a Campus WLAN

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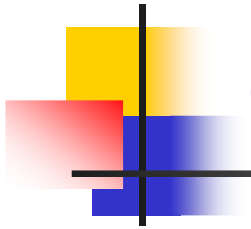
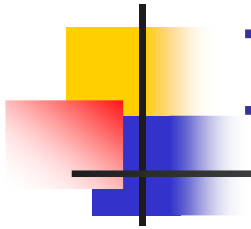


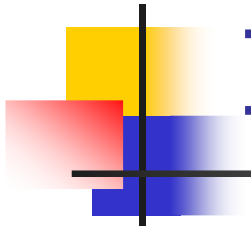
Overview

- Introduction
  - Context, motivation, and contribution.
- Development of the Geomessaging Service
  - Scenario of application; campus wireless infrastructure; geolocation infrastructure, geolocation process, geomessaging process, buddies location process.
- Deployment Experiences and Results
  - Location accuracy, concurrent access to database, topology and performance, message contents, client-server interaction, transport services.
- Conclusion and Future Work



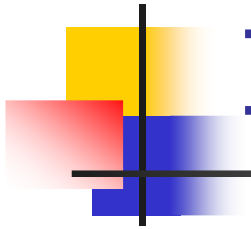
Introduction

- WLANs based on the IEEE 802.11 standard have become the main wireless technology to access the Internet.
- They now spread across private and public places, e.g., enterprise buildings, homes, schools, airports, restaurants, malls, parks, and tourist zones.
- A plethora of small, wireless, and mobile devices, like handheld computers, PDAs, smart phones, and cell phones, are rapidly becoming the main tool to access the wireless Internet.
- WLANs represent a high-bandwidth and low-error wireless technology, appropriate for buildings and campuses.



Introduction

- The high degree of connectivity and mobility of WLANs is merging with novel indoor geographic location technologies, where GPS technology is handicapped.
- A great number of location-based services (LBSs) are emerging around the world in both 3G and WLANs technologies. Most mobile telephony providers are migrating from only voice-based services to multimedia location-aware services.
- Geographic Messaging is the *sending* of a *message* to only those nodes located in a *specific* geographic area.
- Geomessaging also opens up the possibility to query a particular area for a particular service (where is …?)



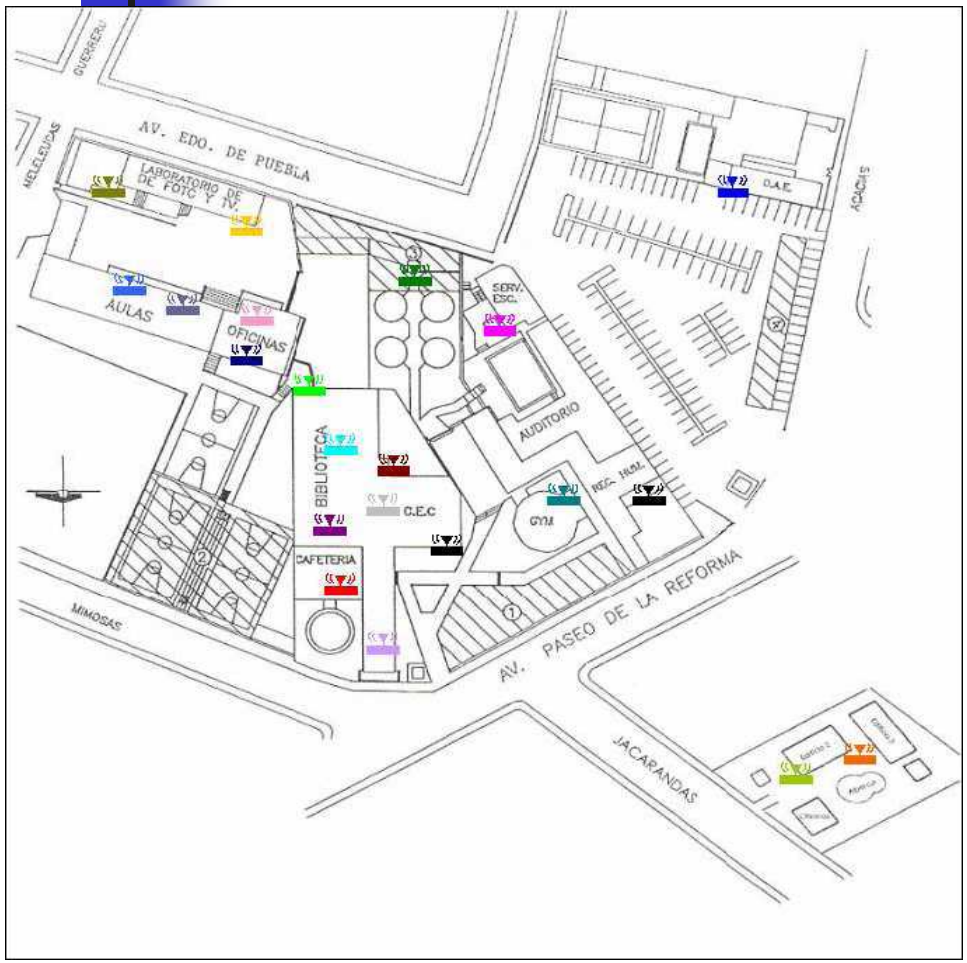
Introduction

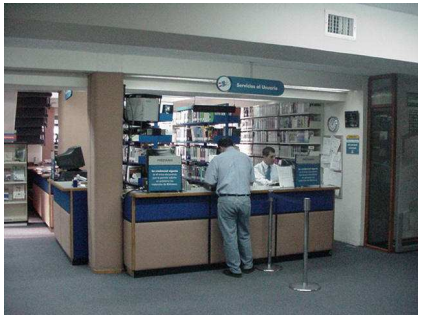
- What do I need to deploy a geomessaging service in a campus WLAN?
- Answer the following questions: What will the purpose of the conveyed message be? What type of data will the message contain? What kind of interactivity is required between mobile user and geographic service provider? What degree of location accuracy is required?
- This paper provides answers to those questions according to our own scenario of application.
- This paper shares deployment experiences of a geographic messaging service intended to provide route guidance and dynamic announcements to campus visitors.

Scenario of application

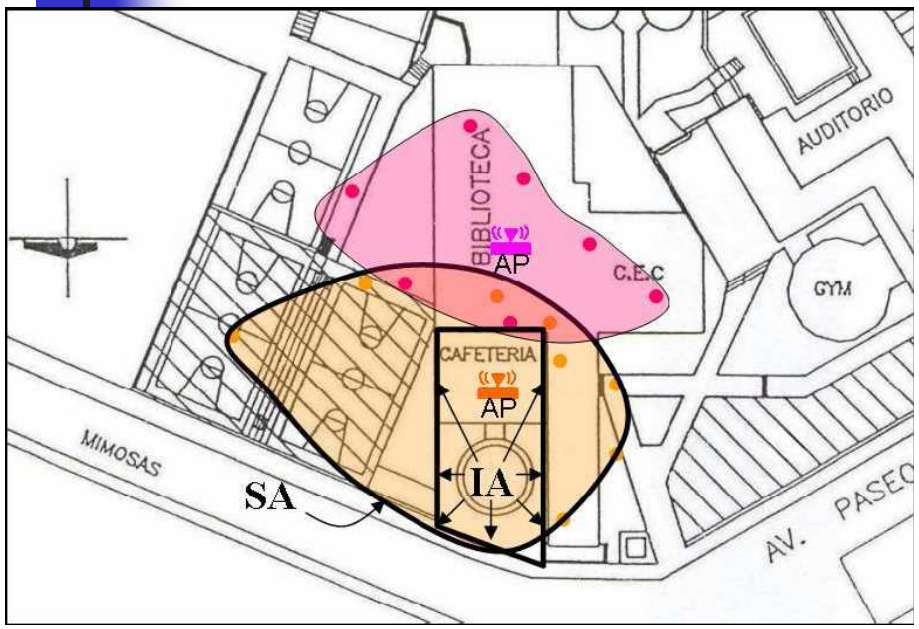
ANIMATION

Campus wireless infrastructure





Geolocation infrastructure



The cell-id location method: wireless devices associated to one AP are geographically located within that AP service area.

- Making the APs "geographically aware" means that the SA of each AP corresponds to a specific geographic IA. SA $\approx$ IA.
- An SNMP manager station is polling continuously every AP and saving the fetched data in a local MySQL database.

Geolocation infrastructure

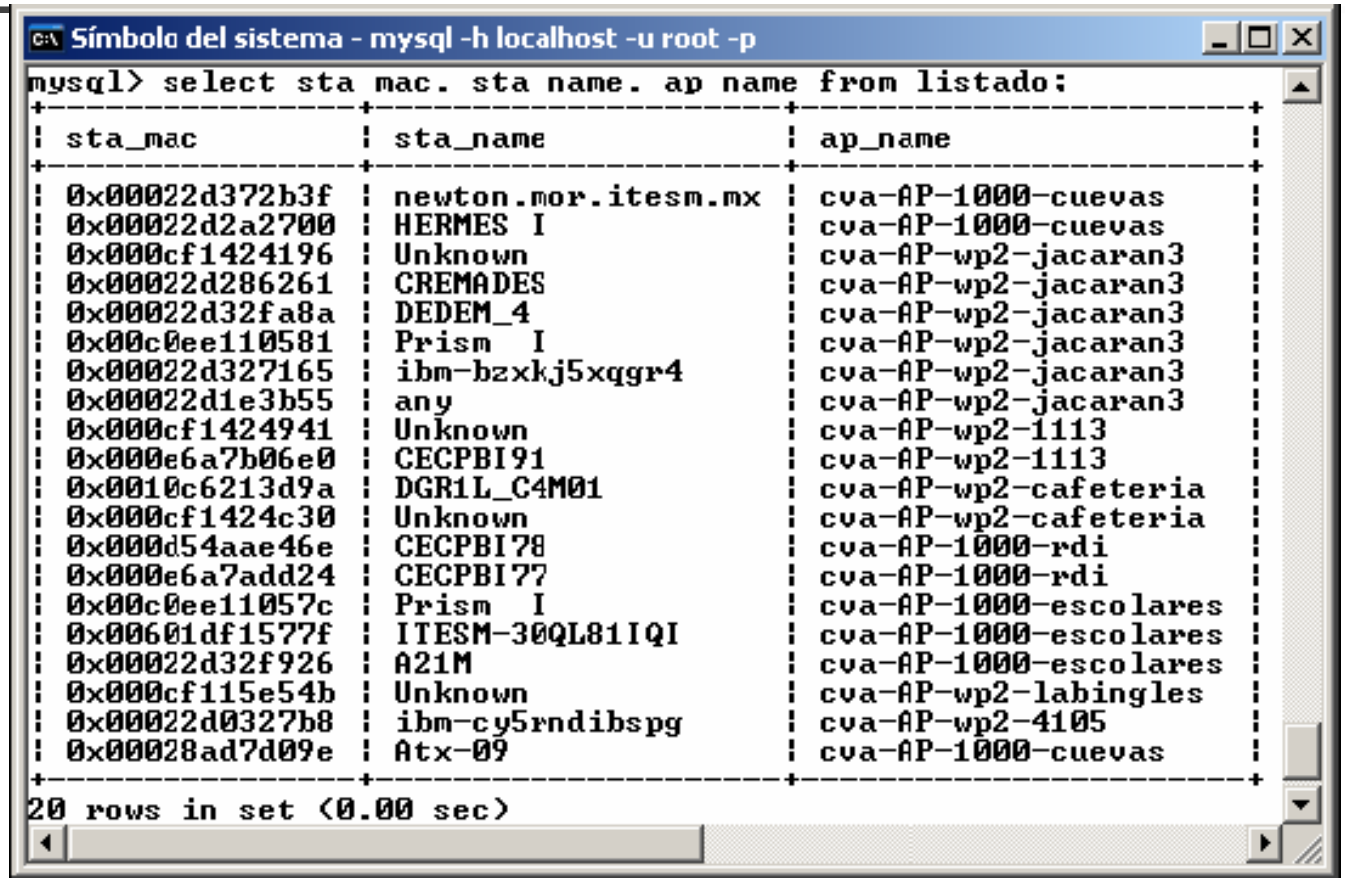
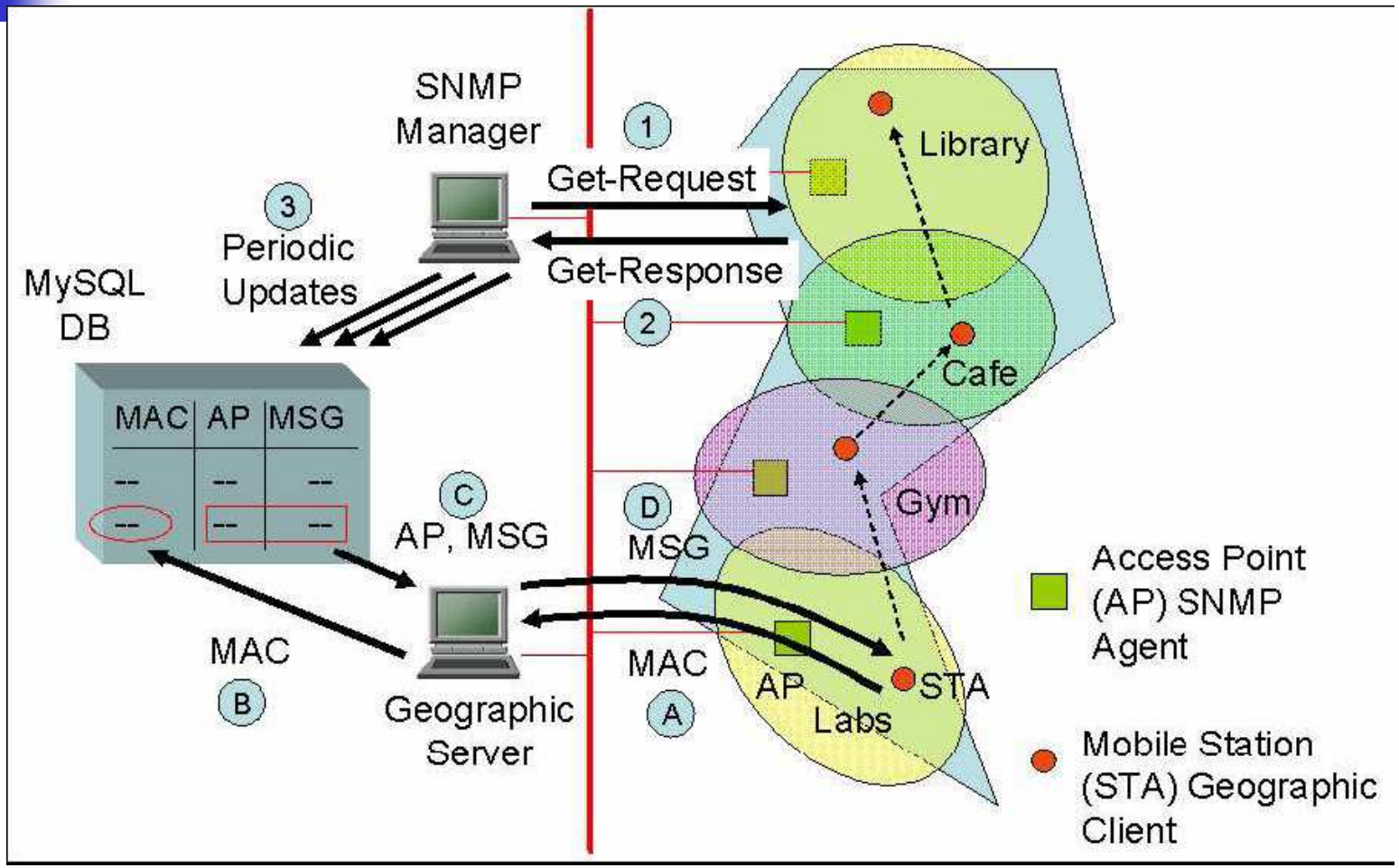
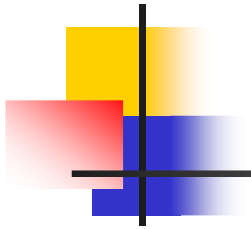


Figure shows a view of the position database created and updated by the SNMP manager.

Geolocation process & LBSs



Geomessaging screenshots



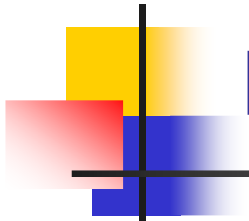
Deployment experiences & results

- Location accuracy
  - The cell-id location method with geographically aware infrastructure is correct for our scenario
  - Location accuracy increases as long as the visitor gets closer to the AP or point of interest
  - The client is free from the geolocation process
  - Location latencies vary from 7-500 ms
- Concurrent access to database
  - Data corruption due to concurrent access of writers and readers can be minimized in MySQL servers.

Deployment experiences & results

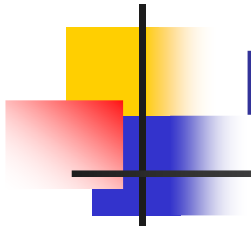
- Topology and performance
  - Do not place the SNMP manager in a wireless station; the monitoring traffic may significantly reduce the wireless bandwidth of the BSS.
  - The manager and database server run in a single computer, and geo-servers run in a separate computer in the wired part of the network.
  - The time that takes the manager to fetch all monitored data from each AP are 300 ms in average. Thus, to poll 20 APs results in a refresh cycle of 6 seconds average.
  - Solution: Hierarchical polling in parallel.

Deployment experiences & results

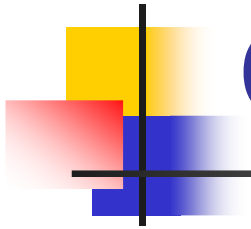


- Message contents
  - Pictures, maps, animations, reside in the local handheld memory and displayed as needed. Thus, the application response time is reduced; but, more handheld memory is used.
  - The text part of messages is stored in the database and retrieved in real-time by request.
- Client-server interaction
  - Intrusive messaging is not useful because the on/off characteristics of handhelds.
  - A sent-when-requested interaction is more appropriate for interactive assistance applications.

Deployment experiences & results



- Transport services between mobile client and geographic server
  - UDP versus TCP
  - Unreliable versus reliable
  - To offer interactive assistance we observed better performance using TCP services.
  - For voice & video interactivity UDP services should be used.



Conclusion & Future Work

- The prototype can be extended to monitor various Campuses WLANs (scalability)
- Cell-id location method is a *low-cost* geolocation technology, but location accuracy shall be improved.
- Improving location accuracy is a challenge. Radio fingerprints and videometry for mobile robots over fixed paths.