The Mobile E-Commerce Services Landscape: Location-Based Services

Prof. Aphrodite Tsalgatidou

Department of Informatics and Telecommunications
University of Athens, Hellas (Greece)
afrodite@di.uoa.gr

Presentation Outline

- What is Mobile Electronic Commerce (MEC) ?
- Differences from Internet E-Commerce
- MEC Services and Location Based Services
- Location Based Services in E-Service Infrastructure
- Conclusions

What is Mobile E-Commerce (MEC)

Mobile E-Commerce (MEC) is defined as any type of transaction of an economic value conducted through a mobile terminal that uses telecommunications network for communication with the e-commerce infrastructure.

Differences of MEC from Internet E-Commerce?

- Implications of Mobile Terminals
- Implications of Wireless Networks
- Usability Implications

Mobile Terminals

Four categories of Mobile Terminals (based on processor, memory, battery capacity, application capabilities (SMS,WAP,Web), physical size and weight):

- Usual voice handsets with SMS capability
- WAP phones
- Communicators/PDA+wireless communication capability
- Laptops with wireless communication facilities

Characteristics of Mobile Terminals:

- Small screens, small and multifunction keypads -> require appropriate interfaces, different than the PC or laptop
- Less resources: memory, disk capacity, computational power
- Their operation relies on finite energy provided by batteries
- More vulnerable: easier to be stolen, damaged or lost -> higher risks to data stored and transactions performed

Differences of MEC from Internet E-Commerce?

- Implications of Mobile Terminals
- Implications of Wireless Networks
- Usability Implications

Wireless Networks

Wireless mobile computing infrastructure combines cellular networks, wireless LAN, private and public radio, satellite services and paging which add new challenges:

- C-autonomy
- Bandwidth restrictions and network topology
- Assymetric Communications
- Variant bandwidth and bursty traffic
- Variant tariffs
- Mobility

Differences of MEC from Internet E-Commerce?

- Implications of Mobile Terminals
- Implications of Wireless Networks
- Usability Implications

Usability Implications

- Location-awareness
- Conditions of usage
- Adaptivity
- Ubiquity
- Personalisation
- Broadcasting

MEC Services

- Internet e-commerce services using a mobile terminal. They utilise WAP or I-Mode… Examples:
  - Information
  - Banking
  - Retailing
  - Travel
  - Entertaintment
  - Payment
- Mobile e-commerce services without the need of an IP network. They utilise location-based service technology, Bluetooth,...
  - Ticketing
  - Payment
    - » On line electronic money
    - » Transferable electronic values
  - **Location-Based Services**

Location-Based Services (LBS)

- Information services, e.g. give me list of nearby petrol stations
- Functional services, e.g. order a taxi
- Location-aware services (push type of services)
- Searching services
- Tracking services

Geographic Information Service Input/Output (End User's View)

Destination

Geographic Information

in various presentation forms

Requirements for LBS

Geographical Information Services

- Security and Privacy Requirements
  - authorization, authenticaction, non-repudation, integrity, confidentiality
- Global Infrastructure Requirements
  - global coordinate reference system (e.g. WGS-84)
  - globally unique ids for the terminals (e.g. phone # or IP#) and users (private key)
  - location service that returns the location of the terminal in global coordinate reference system coordinates whenever and where ever the terminal is
  - mapping mechanism that finds the appropriate location service directory server whenever global coordinates of the terminal are fed in

Requirements for LBS (cont.)

Geographical Information Services

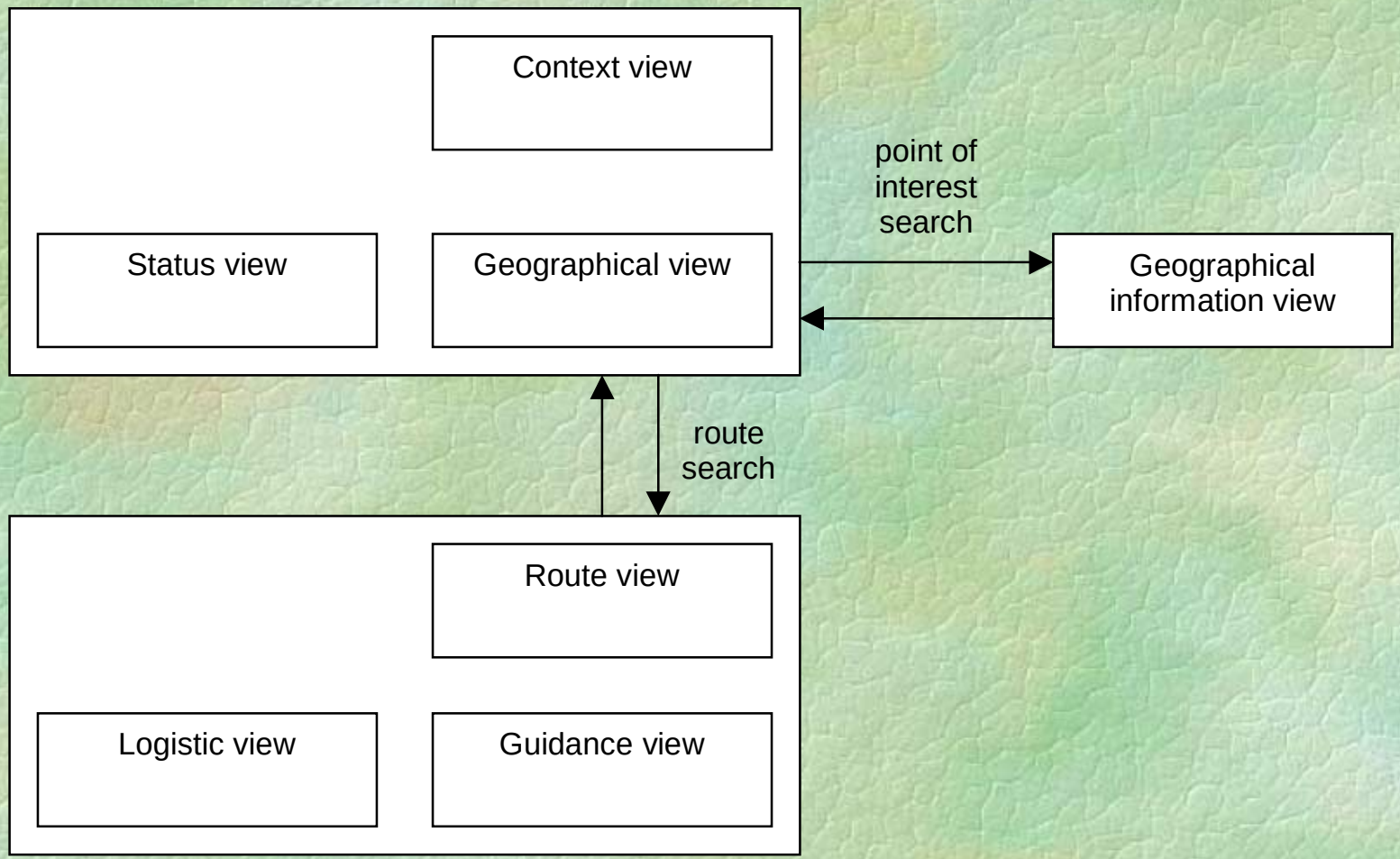
- User Requirements
  - Detect user's location
  - User profiling mechanism (type of information, analysis requirements…)
  - Query formulation
  - Presentation of relative information
  - Directions and guidance
  - …

Requirements for LBS (cont.)

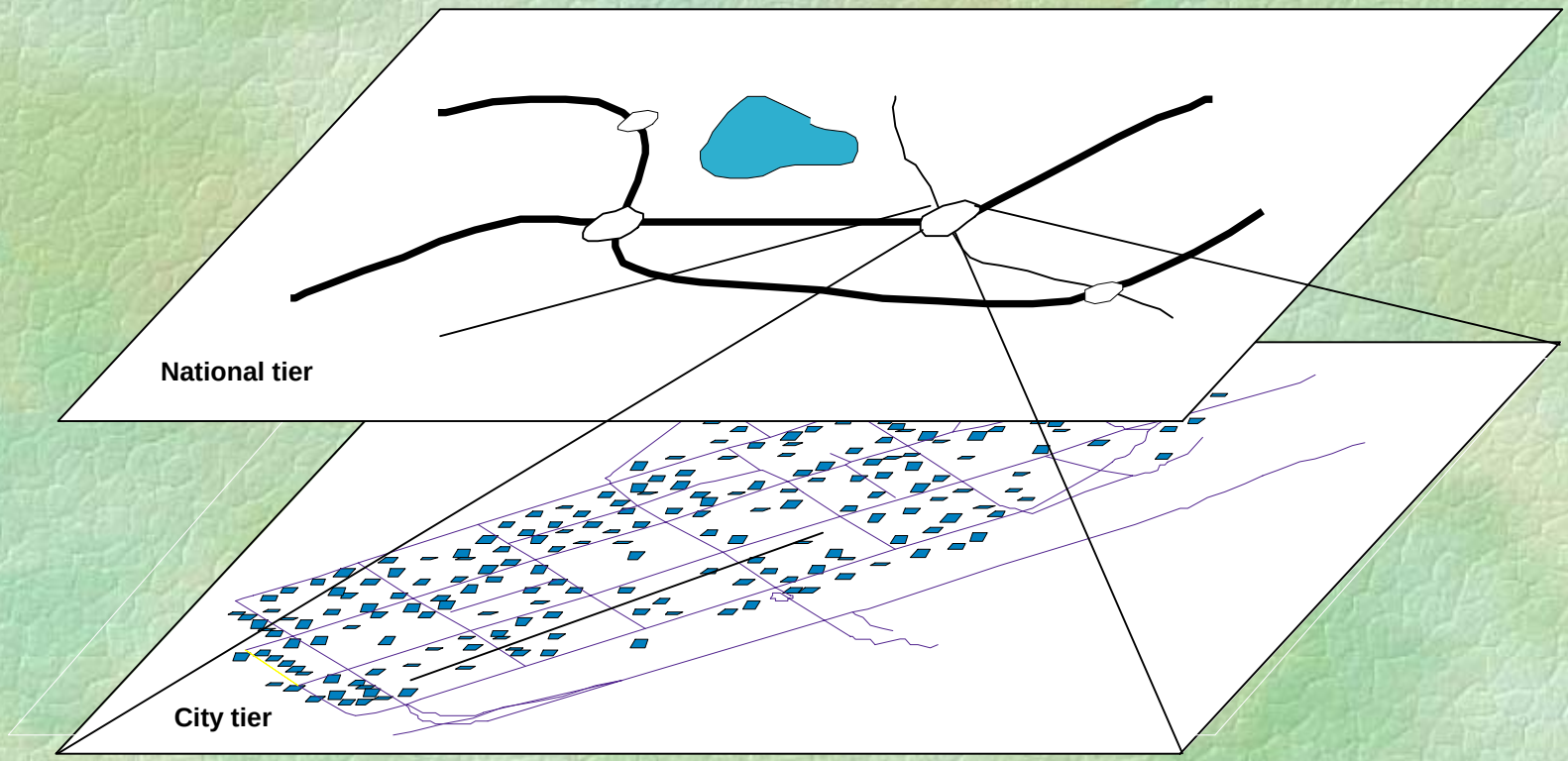
Geographical Information Services

- User Requirements
  - Map Representation
  - Browsing
    - Geographical View
    - Geographical Information View
    - Context View
    - View corresponding visual perceptions
    - Status View
  - Route Representation
    - Route View (map displays, arrow pictograms, text)
    - Logistic View (abstract route view)
    - Guidance View (picture, text or voice)

Views for Route and Information Representation



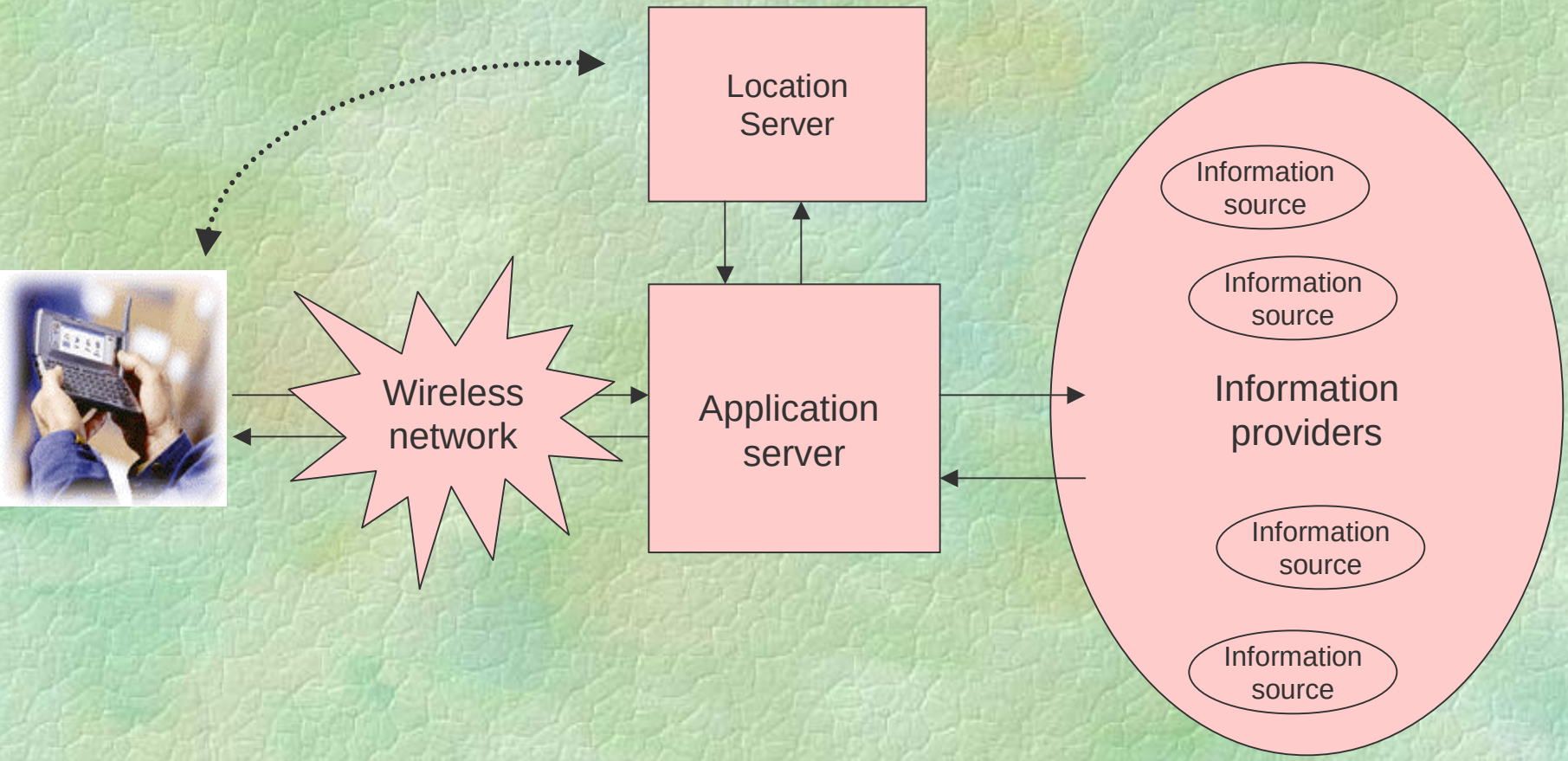
Multi-tier structure of the service



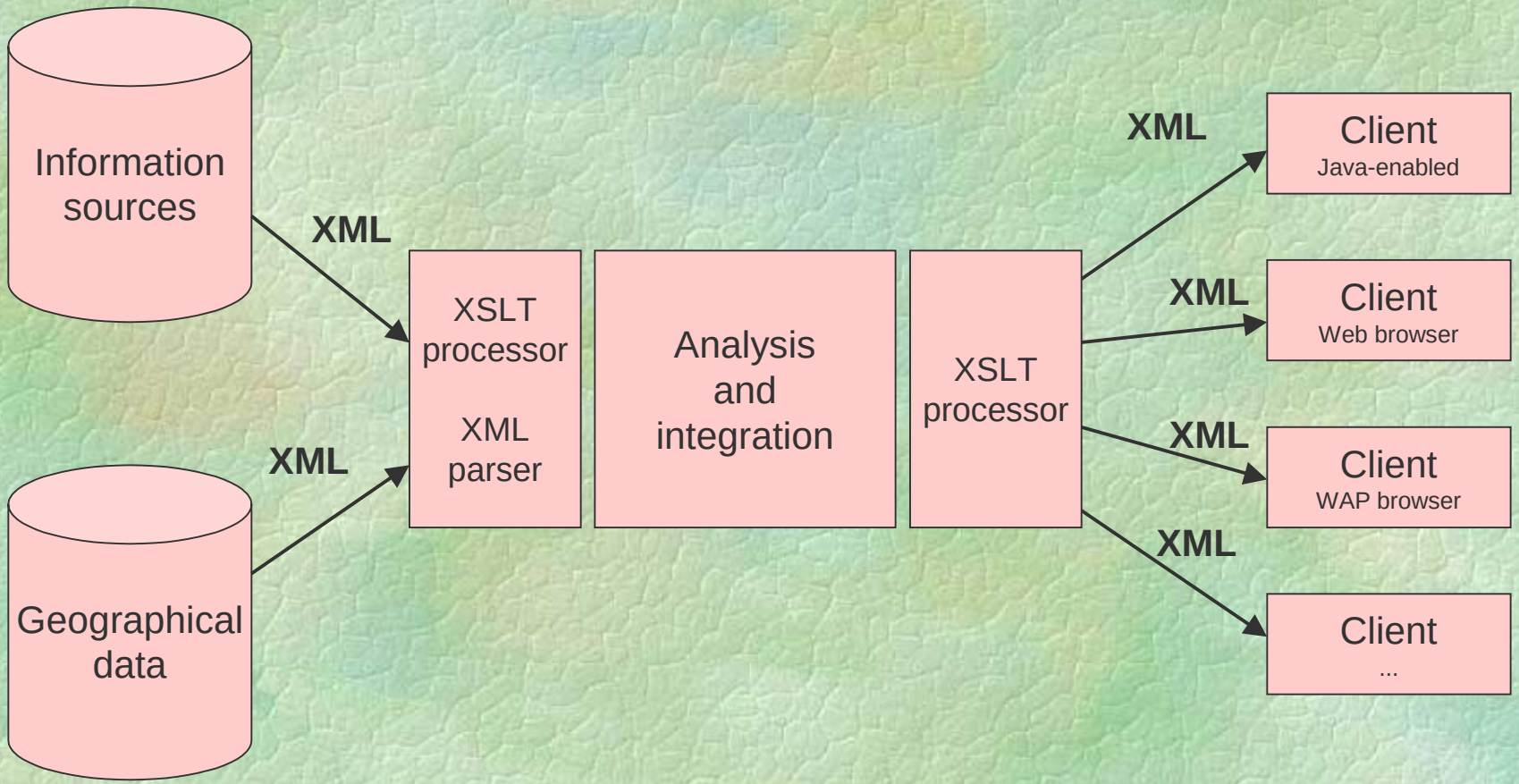
Some more user requirements

- Define in his request which layers s/he wants to receive
- Receive information only about objects and streets in spatial proximity to him/her
- Receive dynamic information (e.g. today's menu of nearby restaurants)
- Analyse the acquired information

System Architecture for LBS



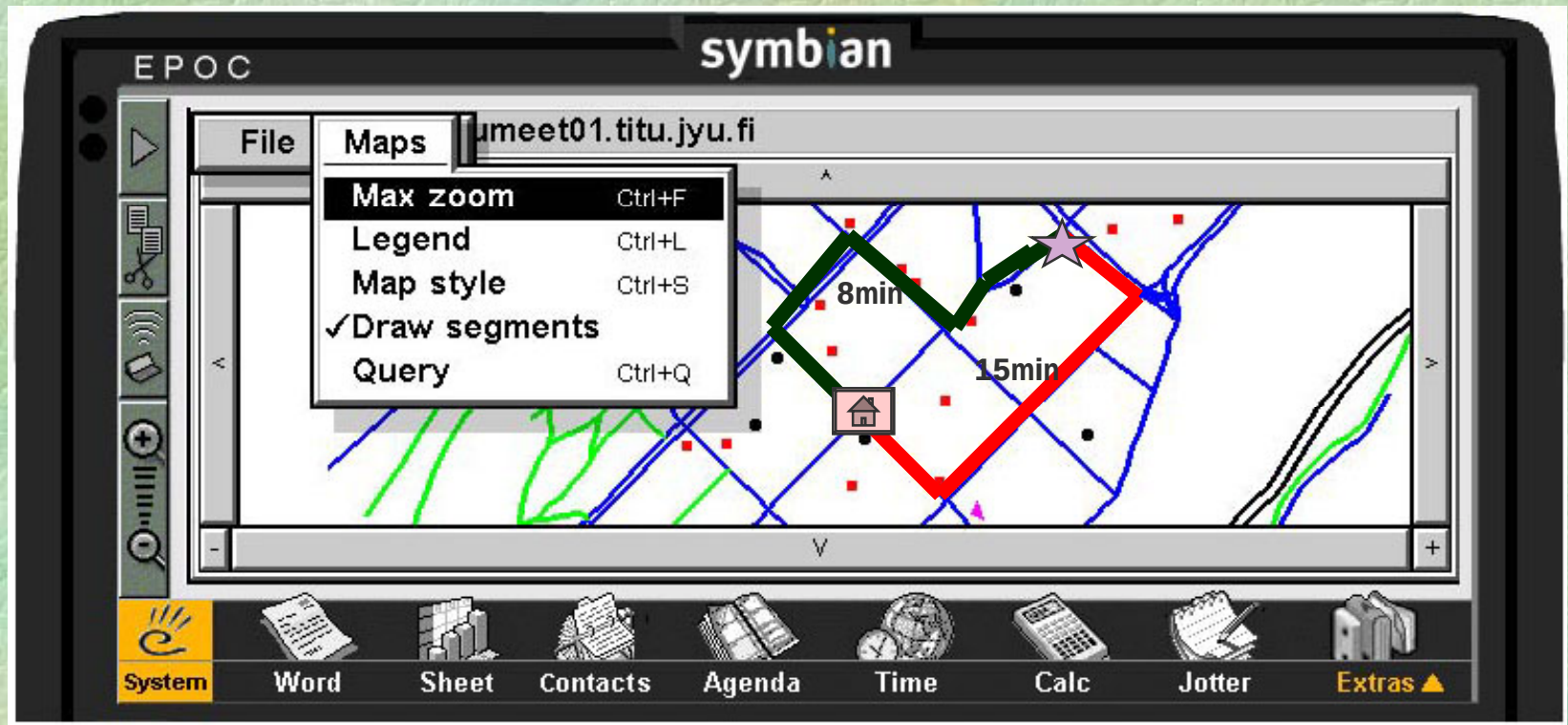
Information Flow in LBS



Why XML?

- Need for open and scalable architecture for Geographical Information Service (GIS) in order to incorporate new types of information sources and new types of functions
- Requirements for such architecture are similar to the ones that made the WWW a great success
- Logical structure of information is important for information analysis
- HTML defines primarily presentation of information
- XML deals primarily with logical structure and can be core technology for GIS
- XML is platform independent -> allows organization of interaction among any platforms and systems

Geographical view on the EPOC system



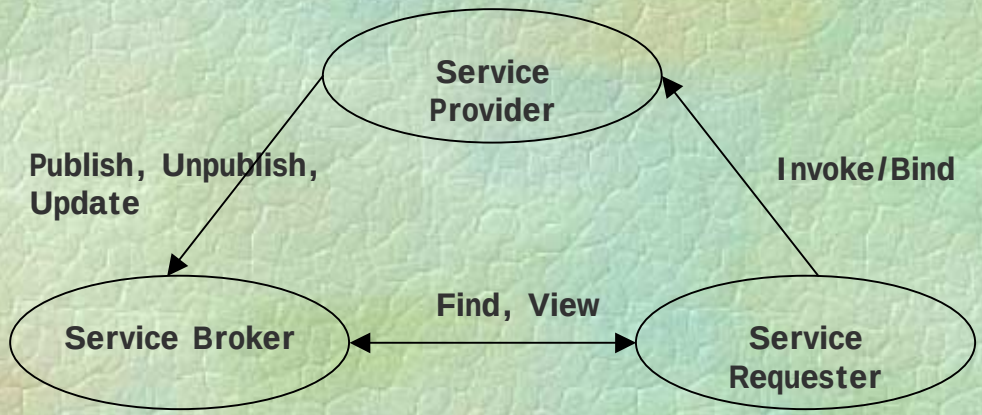
Location Based Services using an E-Service Infrastructure

The E-services definition

E-services:

- **self-contained, modular applications that can be described, published, located and invoked over a network.**
- **enable an application developer to satisfy a specific need by using an appropriate e-service published on the Web, rather than developing the related code from scratch.**
- **logical evolution from object-oriented and component-based systems.**

The E-services Architecture



Provider: holds the implementation of the service

Requester: looks for and invokes a service

Broker: repository where providers publish services and requesters find services

Advantages of E-services

- Easy and fast deployment
- Efficient application development
- Interoperability
- Just-in-time integration
- Reduced complexity by encapsulation
- Use HTTP to be firewall friendly
- Employ XML as an encoding schema

E-Service Enabling Technologies

- Standards being developed cooperatively by IBM, Microsoft, Ariba and others
  - Web Services Description Language (WSDL)
  - Simple Object Access Protocol (SOAP)
  - Universal Description, Discovery, Integration (UDDI)

WSDL – *Web Service Description Language*

- An XML grammar for specifying service properties/ interfaces such as what it does, where it is located and how to invoke it
- Plays a role similar in purpose to IDL
- WSDL document: uses seven elements in the definition of a service (type, message, operation, port type, binding, port, service)

A WSDL Example (excerpt)

```
<element name="GetBestRoute"
type=”tns:GetBestRouteRequest”/>
<complexType name=”GetBestRouteRequest”>
<all>
<element name="position" type="string"/>
<element name="destination" type="string"/>
</all>
</complexType>
</element>
<element name="GetBestRouteResponse"
type=”Route”>
<complexType>
<all>
<element name="Name" type="string"/>
<element name="duration" type="int"/>
<element name="Distance" type="float"/>
</all>
</complexType>
</element>
```

SOAP – *Simple Object Access Protocol*

- XML protocol for sending messages and making remote procedure calls over the Internet
- Independent of programming language, object model, operating system or platform
- Uses mostly HTTP as the transport protocol and XML for data encoding
- 2 types of messages, Request and Response
- SOAP message: header + XML payload
- XML payload: Envelope + {Header} + Body

A SOAP Request

```
POST /soap/servlet/rpcrouter HTTP/1.1
Host: www.bestrouteserver.com
Content-Type: text/xml
Content-Length: 461
SOAPAction: ""

<SOAP-ENV:Envelope
         xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/"
         xmlns:xsi="http://www.w3.org/1999/XMLSchema-instance"
         xmlns:xsd="http://www.w3.org/1999/XMLSchema">
 <SOAP-ENV:Body>
 <ns1:getBestRoute xmlns:ns1="urn:demo1:bestroute" SOAP-
ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
 <position xsi:type="xsd:string">Omonia</position>
 <destination xsi:type="xsd:string">Syntagma</destination>
 </ns1:getBestRoute>
 </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

A SOAP Reply

```
HTTP/1.1 200 OK
Content-Type: text/xml; charset=UTF-8
Content-Length: 425

<SOAP-ENV:Envelope
         xmlns:SOAP-ENV=http://schemas.xmlsoap.org/soap/envelope/
         xmlns:xsi="http://www.w3.org/1999/XMLSchema-instance"
         xmlns:xsd="http://www.w3.org/1999/XMLSchema">
 <SOAP-ENV:Body>
 <ns1:getBestRouteResponse xmlns:ns1="urn:demo1:bestroute" SOAP-
ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
 <return xmlns:ns2="urn:my_encoding" xsi:type="ns2:Route">
 <name xsi:type="xsd:string">ThroughStadiou</name>
 <duration xsi:type="xsd:int">4</duration>
 <distance xsi:type="xsd:float">1</distance>
 </return>
 </ns1: getBestRouteResponse>
 </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

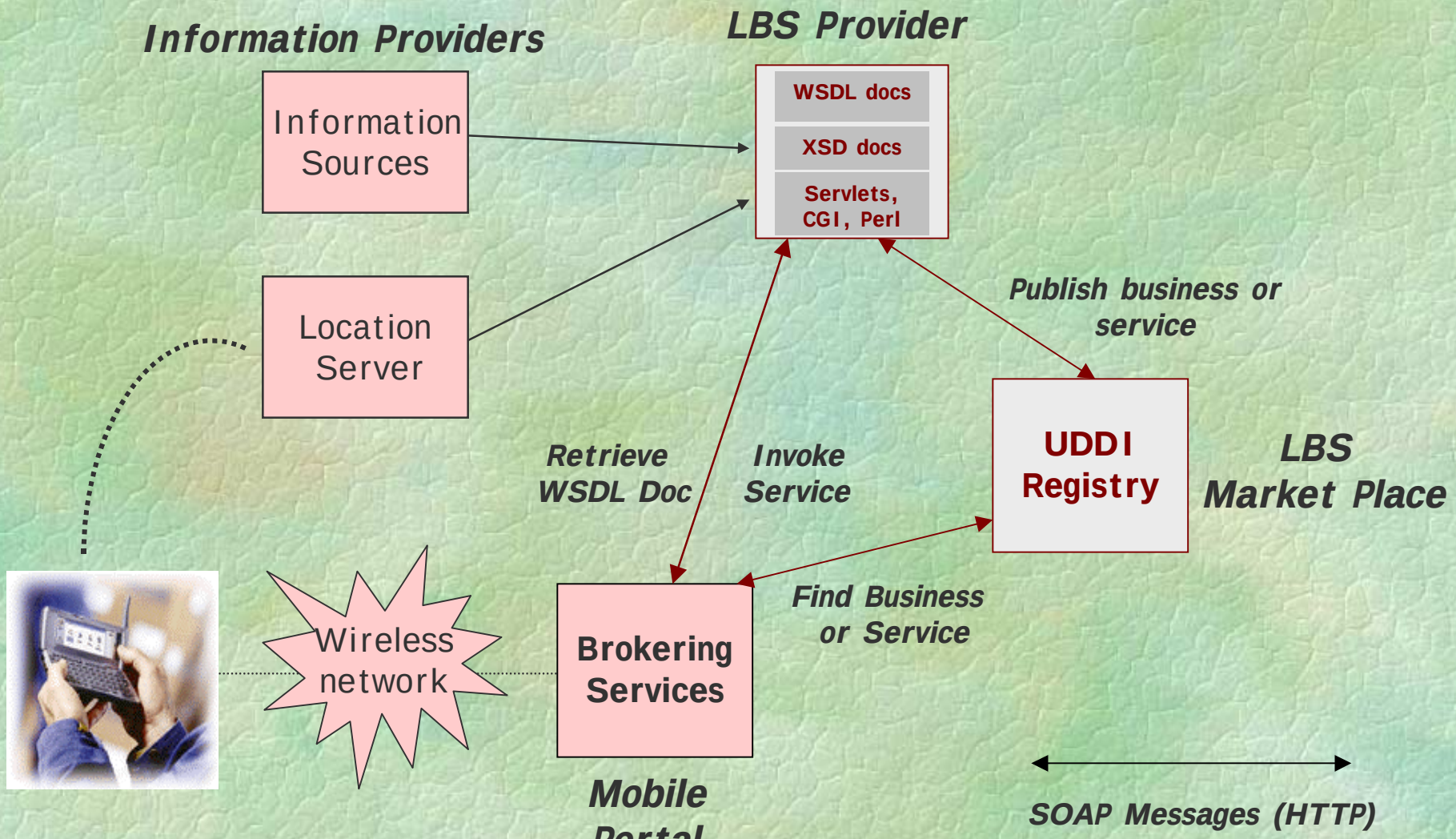
UDDI – *Universal Description, Discovery and Integration*

- UDDI servers act as directory of available services and service providers
- SOAP can be used to query UDDI for services
- UDDI specifications: XML schema for SOAP messages + UDDI APIs specification
- XML Schema: 4 key data structures (business entities, business service, bonding templates and tModels)
- UDDI APIs specification: Inquiry + Publishing
- Peer nodes (websites) - companies register with any node – registrations replicated on a daily basis

UDDI Business Registration

```
<businessList generic="1.0" operator="Microsoft Corporation"
    truncated="false" xmlns="urn:uddi-org:api">
  <businessInfos>
    <businessInfo businessKey="0076B468-EB27-42E5-AC09-9955CFF462A3">
      <name>Inforoute Company</name>
    <description xml:lang="en">Features services related to traffic in the routes of
Athens</description>
    <serviceInfos>
        <serviceInfo businessKey="0076B468-EB27-42E5-AC09-9955CFF462A3"
                        serviceKey="1FFE1F71-2AF3-45FB-B788-09AF7FF151A4">
          <name>Best Route Service</name>
        </serviceInfo>
        <serviceInfo businessKey="0076B468-EB27-42E5-AC09-9955CFF462A3"
                    serviceKey="8BF2F51F-8ED4-43FE-B665-38D8205D1333">
          <name>Weather Prediction</name>
        </serviceInfo>
      </serviceInfos>
    </businessInfo>
  </businessInfos>
</businessList>
```

LB Services and E-Services Architecture



Conclusions

- Location based services appear to be killer applications for MEC
- Integration of information from heterogeneous sources is essential for geographical information services
- By combining XML-based information sources and sending information to users again in XML-form
- Information analysis functions result in intelligent and customized services to be used in many areas

Conclusion (cont.)

- JavaScript and WMLScript couldn't provide enough facilities to process XML data
- A client developed in Java can implement analysis functions and be easily ported to many platforms
- Many companies position Java as the main tool for applications for mobile devices and provide JVM for mobile devices

Conclusion (cont.)

- The E-Service Infrastructure can further promote the development of flexible and scalable LBS
- E-Service Standards (UDDI, WSDL, SOAP) promote interoperability
- Cellphones don't seem to support SOAP yet but handhelds do
- What remains is for web and application server vendors to offer more support for SOAP