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

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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
  - Entertainment
  - 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, authentication, non-repudiation, 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 wherever 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

- Context view
- Status view
- Geographical view
- Route view
- Logistic view
- Guidance view
- Geographical information view

Relations:
- Route search
- Geographical information view
- Point of interest search
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

Wireless network

Location Server

Application server

Information providers
  - Information source
  - Information source
  - Information source
Information Flow in LBS

Information sources

Geographical data

XSLT processor
XML parser

Analysis and integration

XSLT processor

XML

Client
Java-enabled

Client
Web browser

Client
WAP browser

Client ...

XML
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)

```xml
<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>
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

Information Providers

- Information Sources
- Location Server

LBS Provider

- WSDL docs
- XSD docs
- Servlets, CGI, Perl

- Publish business or service
- Retrieve WSDL Doc
- Invoke Service
- Find Business or Service

Mobile Portal

LBS Market Place

Wireless network

Information Sources

Servlets, CGI, Perl

UDDI Registry

Find Business or Service

Invoke Service

Retrieve WSDL Doc

Wireless network

Mobile Portal

SOAP Messages (HTTP)
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.