WebPark
IST-2000-31041

Geographically relevant information for mobile users in protected areas

Final Report

D1.1.6

Public Deliverable

Report Version: 04
Report Preparation Date: 10 March 2005
Classification: Restricted
Contract Start Date: 17 October 2001
Duration: 3 years
Project Coordinator: GEODAN
Partners: CU, EADS, GIUZ, LNEC, SNP

Project funded by the European Community
under the
"Information Society Technology" Programme
(1998-2002)

DELIVERABLES SUMMARY SHEET

Project Number: IST-2000-31041

Project Acronym: WebPark

Title: Final report

Deliverable N°: D1.1.6

Due date: Oct-2004

Delivery Date: Dec-2004

Partners owning: Geodan

Partners contributed: EADS, CU, LNEC, GIUZ, SNP

Made available to: EC, project partner

Financial / Administrative Coordinator

Name: Euro Beinat
Address: Geodan Mobile Solutions, President Kennedylaan 1, 1079 MB, Amsterdam
Phone: +31 (0) 20 5711311
Fax: +31 (0) 20 5711333
E-mail: euro.beinat@geodan.com
Project websites: http://www.webparkservices.info

Executive summary

The aim of the WebPark project was to identify the geographic information needs of mobile users in protected and nature areas, to provide to these users geographically relevant personalized location-based services (LBS) and to create new G-commerce value-chains for the area administrations and for data integrators. To this end, seven work packages were designed, dealing with user needs and market surveys, geo-information services, information display and user interaction on small devices, location based service development, privacy and personalisation, location enabled online/offline software architecture, testing and validation, commercial exploitation models, and the dissemination and exploitation of results. The location based services and applications developed in this way were also used as a platform for scientific research in the fields of knowledge discovery, software agent technology and map generalisation.

Two full implementations of WebPark have been created: one for the Swiss National Park and one for the Wadden Sea area in The Netherlands. Visitors of these parks have tested the applications numerous times, and based on their feedback the system has been gradually improved. Among other things, users were able to see themselves walk on the map, get multi-media information on the flora, fauna and the facilities in their direct surrounding and create personalised spatial bookmarks that were visible to other users.

On many occasions, the WebPark concept and system have been presented to the public and to the professional community, including prime time television coverage. The creation of the spin-off company Camineo in Toulouse, that from now on will bring the results of the WebPark project to the European market, demonstrates clearly that the project has been a success, which was clearly acknowledged during the final review. New projects for further implementation of WebPark have already been setup. These facts, taken together with the evident grow of the market for mobile applications, indicate that the future looks bright for WebPark.

Document information

Revision history

Version number, date	Author(s)	Summary of changes to previous version
01, 15 September 2004	E.J. van Kootwijk	Initial version
02, 31 December 2004	E.J. van Kootwijk	Intermediate version
03, 10 March 2005	E.J. van Kootwijk	Final version

Distribution list

Name	Organisation
Mr. Brice Lepape	EC
All Partners	All Partners

TABLE OF CONTENTS

1 Project overview

In the WebPark project, a consortium of 6 organisations has jointly created a mobile location based information platform for use in protected areas and natural environments. All aspects of delivering location based services have been dealt with: market potential, user needs and park administration needs, software architecture and implementation, mobile hardware, personalisation of services, interoperability standards for geo-information services, localisation technologies, features for selection, generalisation and presentation of information, geographic data preparation and database design, geo-information value chains and business models.

The table below lists the consortium members and shows their expertise and roles:

Name	Type of organization	Relevant expertise	Role in project
Geodan Mobile Solutions (NL)	Private	Spatial databases, LBS, spatial metadata, web mapping	Coordinator, commercial aspects of LBS, GIS integration, metadata
European Aeronautic Defence and Space Company EADS (FR)	Private	GI service provider, software development	Web portal, middleware, payment services
City University London, CU (UK)	University	Geolocation, GI knowledge discovery, DTM modelling	Geolocation, LBS, knowledge discovery, terrain position
National Civil Engineering Laboratory, LNEC (PT)	Government	User interfaces, Spatial intelligent agents	Agent reasoning, web-based information retrieval
Geographic Institute of the University of Zürich, GIUZ (CH)	University	DTM's, map generalization, data integration	Data integration, generalization, device-dependent display
Swiss National Park, SNP (CH)	National Park	Information provision to park users	User surveys, trials of LBS, premium data provision

2 Project objectives

2.1 Aims

The overall aims of the WebPark project are to identify the geographic information needs of mobile users, to provide to such users geographically relevant personalized location-based services (LBS) and to create new G-commerce value-chains for recreation/ protected area administrations and data integrators. At present, the geographic information needs of walkers, sailors, mountaineers, cyclists and protected/recreation area tourists are met through many informal and asynchronous channels of communication. However, the widespread availability of mobile internet devices in the next few years with geolocation capabilities will create a market opportunity to meet the information needs of this user group through the provision of location-based services. The WebPark project aims to prepare a marketing, technology and business process platform that can take advantage of the opportunity to meet these established user needs using new methods which form new value chains.

This project also aims to foster integration between public sector information stakeholders and private sector data integrators as envisaged in the EU Green Paper on Public Sector Information (1998). This will help the public sector to achieve its policy objectives (in WebPark, for environment and public safety) and will allow the private sector to take advantage of a market platform for GI provision. The WebPark project also aims to create new value chains in which the private sector can add geographic value to (often) public sector 'framework' data in an environment in which the mobile user has an easy point of entry to GI purchases through micro payments using the chosen mobile device. This modus operandi will lead to market efficiencies by virtue of the rapid signals from the user to the suppliers of information services and the added value.

The WebPark project aims to demonstrate the technology platform and business process template and to package the intellectual property to allow service providers to implement the service in a variety of local circumstances.

2.2 Context

Mobile internet services are becoming available with the advent of GPRS and UMTS networks. The availability of smart phones makes it possible to deliver text, maps, imagery and sound to mobile users, and to tailor the information sent to the environment around the current position of the user. This position can be determined using small and practical GPS modules or GSM-network methods like Cell-ID. With the progress of geographic information (GI) data integrators there is now a supply of digital GI content that can be delivered using e-commerce.

New geographical commerce (G-commerce) applications can use position and time of the user to offer 'just-in-time' and 'just-in-place' information that leverages knowledge from adaptive personalization. Such location based services (LBS) can offer users information that is adapted to their interests and current situation, as well as providing them with control over their private location and transactional information. To deliver on the promise of info-mobility in GI requires that new groups of G-commerce partners be brought together to form new value-chains. Since many of the GI data providers are in the public sector this project offers opportunities for administrations of protected and recreation areas to exploit their information (see EC Green Paper on Public Sector Information COM 585 1998). This is also the kind of integration project that the International Federation for Information Technology and Tourism (IFITT) has proposed to enhance the market for.

2.3 Overview

In WebPark, personalized value-added LBS for recreation in coastal, rural and mountainous areas were developed by assembling a consortium of nature reserve administrations, GI integrators, GIS

researchers, G-commerce developers and service providers. These services build on existing information delivered to tourists and professional users of recreation and protected areas via CD, kiosk and web. They were developed around a centrally maintained personalized user profile with input from the user and a flow of positional information. Information is 'pulled' by the user and stems from a variety of distributed data sources. Information can be priced and charged for using micro payments and/or subscription. Users can be alerted when they approach features that are of personal interest. Intelligent agents are used to detect the terrain position or geographic context. Information is adapted and filtered for the type of device that the user is using.

The target users for these new location-based information services are users with outdoor interests in protected areas such as national parks and recreation areas such as rivers, forests and coastlines. Experience from the administrations of such areas suggest that users already take their phones with them when they go hiking, cycling and mountaineering and will be prepared to buy information to help them make more informed decisions about their daily plans. This information will have to be geographically relevant and charged by micro payment to be an attractive on-site purchase. The extension of service coverage by mobile operators into rural areas also means that protected/recreation area administrations and the safety authorities have an interest in such services. Such bodies wish to be able to deliver alerts to the mobile device and such services could even be used to implement enhanced 112 emergency services.
In the WebPark project a functioning system was built, generating intellectual property that can be licensed to service providers. The WebPark service may also attract investment from public administrations.

2.4 Detailed objectives

WebPark had five main objectives:
Objective 1: to identify the user needs and delivery mechanisms for mobile valued-added location-based services:

- Benchmark existing information services and their delivery;
- Carry out user surveys on content, delivery, multilinguality and privacy;
- Assess user reactions to prototypes through scenario-building and demonstrations.

Objective 2: to specify/standardize/price GI-based multimedia content from leisure/ tourism sectors:

- Develop interoperability standards for exchange of GI and multimedia content;
- Install data services for trial service areas;
- Develop micro payment G-commerce services;
- Develop G-commerce marketing and info-brokering strategies.

Objective 3: to study and develop spatio-temporal knowledge discovery and reasoning and use the results for the various services:

- Develop personalization through user-configurable user profiles;
- Extend knowledge discovery methods for place and time domains;
- Develop intelligent spatial agents to reason about place and time behaviour;
- Provide device-dependent information display.

Objective 4: to design and develop a distributed GI architecture to provide LBS:

- Engineer interfaces to GPS and network location services;
- Develop and test web clients for LBS delivery over 2.5G and 3G networks;
- Engineer a software architecture for content delivery based on a web portal;
- Link service delivery to payment services.

Objective 5: to show the results in a location-based information system for recreation and protected areas:

- Define conservation/safety agendas of recreation/protected area administrations;
- Trial LBS in realistic scenarios using server and client test beds;
- Create a pool of technological and business process intellectual properties that can be licensed to service providers.

3 Approach

The formulation of the objectives was based on largely intuitive visions on future developments in mobile applications. An approach was chosen in which all aspects relevant to these developments were addressed: the market, GI value chains, user needs, available and required technology for service delivery, the organisational, social context in which these applications would have to function. We aimed at substantiating the visions by performing market surveys and user needs analyses on the one hand, and by exploring and developing the required technology on the other hand. An alternative approach would have been to focus more on one of the aspects, for instance on developing the GI value chains, or on developing techniques and technologies for mobile services delivery. It was felt however that all these aspects were very much related, and that developments in one field would strongly influence the shaping of other fields. Therefore the approach was chosen in which our capacities were distributed evenly over the relevant fields.

To achieve the objectives seven workpackages were designed. The table below shows the outline of these work packages:

Work-package	Workpackage title	Lead contractor	Person months
WP1	**Project management**	Geodan Mobile Solutions	8
WP2	**Market and user surveys**	City University London	22
2100	Existing information services		
2200	User surveys		
WP3	**GI standards and services**	Geodan Mobile Solutions	42
3100	GI interoperability and metadata standards		
3200	Data services for testing and demonstration		
3300	G-commerce processes		
WP4	**Location-based service development**	City University London	72
4100	Personalization		
4200	Knowledge discovery methods		
4300	Intelligent spatial agent		
4400	Device dependent information display and generalization		
WP5	**Architecture and delivery**	EADS	52
5100	Interface to geolocation services		
5200	Web clients for location-based services		
5300	Web portal		
5400	Payment services		
WP6	**Validation and testing**	Swiss National Park	23
6100	User reactions to prototypes		
6200	Trial LBS using scenarios		
WP7	**Dissemination and exploitation**	Geodan Mobile Solutions	27
7100	Conservation/safety agendas		
7200	Evaluation, dissemination and exploitation		
		Total	246

3.1 Workpackage 1: project management (leader Geodan)

This workpackage includes the overall and technical management of the project. Overall management includes the coordination of the various phases of the project, scheduling, monitoring and reviewing progress of work, handling of administrative procedures between the European Commission (EC) and the project consortium, and reporting to the EC. Technical management includes responsibility for critical technical decisions that might affect the project as a whole, quality assurance, and evaluation of the products developed in the framework of the project and ensuring their delivery. The WebPark web site will be developed in this workpackage.

Deliverables	
D1.1.1	Project description and fact sheet
D1.1.2	Project Management plan

D1.1.3	Project presentation brochure, website and groupware activation
D1.1.4.1	Quarterly progress report (01-06)
D1.1.5.1	1st periodic progress report (1-12)
D1.1.4.2	Quarterly progress report (13-18)
D1.1.5.2	2nd periodic progress report (13-24)
D1.1.4.3	Quarterly progress report (25-30)
D1.1.5.3	3rd periodic progress report (25-36)
D1.1.6	Final Report

3.2 Workpackage 2: market and user surveys (leader: CU)

WP 2100 Existing information services (leader: CU)
This workpackage starts by benchmarking the information services with a geographic footprint that are already provided to users in recreation/ protected areas through paper publications, notice boards, newspapers, telephone voice services and web sites. This evaluation will analyze the information content of this information, the mechanisms by which users can ask questions and the required accuracy of the answer in spatial and temporal terms. The work will also identify which information can be classified as 'framework' information e.g. base mapping provided for public service or to generate 'hits', and which information can be classified as 'premium' information which requires knowledge of a personalization profile and a specific revenue stream. The output of this work will be a collection of typical information requests with their domains of spatial and temporal relevance. From this set of real user requests an abstraction will be defined to act as a template for the design of WebPark services.
The analysis of spatial and temporal relevance for information requests will also set delivery targets in the light of the likely performance of the geolocation technology and the characteristics of the potential framework and premium information sources. This work will focus on two trial areas viz. the Swiss National Park and the Wadden Sea National Park in order to determine the geographic resolution and accuracy targets for the location-based information services.

Deliverable	
D2.1.1	Service template report and Manual of geographic resolution and accuracy

WP 2200 User surveys (leader: SNP)
Visitors of recreational and protected areas need geographic information to plan their trips safely. While information services delivered on the web and via telephone have proved popular, their transfer to mobile Internet platforms needs to be assessed through structured user needs assessment. User needs will be surveyed by exploring prototypes through scenarios that simulate completion of tasks carried out in recreational/ tourist visits. Usage scenarios for recreation/ protected areas will explore levels of service with potential and actual users. Completion of this task will require the use of questionnaires at existing points of information delivery, including post-use surveys for the DIBIS system used in the Swiss National Park and the web-based Interwad system for the Wadden Sea National Park in the Netherlands. This task will also require the 'shadowing' of users of the parks through participant observation techniques, which will log their information needs and use. Users with mobile devices who are currently working with the partners will be used for the surveys to ensure that the perspectives of different socio-economic groups are considered. The results of the questionnaires and observation will be written up in the Analysis and definition of user needs report to be considered alongside the Service template report and Manual of geographic resolution and accuracy from WP2100.
The questionnaires and observation will also explore the privacy and security requirements of potential WebPark users through simulation of the location-based information services and their use of them. This work will set up web-based user profiles for selected test users with several levels of user-configurable privacy and security and allow them to set and manage their own configurations for real information services. This work will seek to identify commonalities in the personalization characteristics of the different user groups to identify the privacy issues associated

with personalization. The output of this work will be a report on the privacy/security assessment and design requirements dictated by information access experiments. On the basis of these user surveys and experiments in privacy, a usability testing template will be developed to be used in the testing WP6100. These deliverables will be produced with multilingual design provisions.

Deliverables	
D2.2.1	Analysis and definition of user needs report
D2.2.2	Privacy/security assessment and design requirements
D2.2.3	Usability testing template

3.3 Workpackage 3: GI standards and surveys (leader: Geodan)

WP 3100 GI interoperability standards (leader: Geodan)
Currently available and new geographic information services inevitably have a heterogeneous nature. It is necessary to specify an interoperability platform through which GI and georeferenced content can be sourced and deployed to users. This platform must be capable of handling Points of Interest (POI) data, raster and vector data, a variety of map projections and coordinate systems as well as multimedia data. Ideally data sources can be used without special preparation for WebPark, reading the metadata about the data sources and translating (reformat, reproject) data automatically before delivery to the mobile device. Existing metadata and reformatting services will be utilized where possible, and will be integrated into the WebPark system. WebPark will work with G-commerce data suppliers on a fully commercial basis to obtain and resell GI content.
The platform will be based on the architecture of commercial platforms (such as Autodesk Location Logic or Oracle Locator/Spatial) extended and complemented with OpenGIS mapping facilities based on the Geodan Spatial Components. The specifications for communication between modular elements of the platform, Location Determination Technology, and distributed mapping components will be based on OGC and LIF specifications as available at the time of designing the platform. An OGC-based coordinate conversion engine will be used to ensure compatibility of data layers and to implement fusion on spatial data from distributed sources. A metadata management system, based on OpenGIS metadata specifications, will facilitate data discovery and service capabilities external data sources. The system will build upon previous work for the Commission on metadata, in particular the ESMI project.

Deliverable	
D3.1.1	GI interoperability platform and metadata services.

WP 3200 Data services for demonstration (leader: GIUZ)
Geographic information services identified as suitable for WebPark during surveys in WP 2100/2200 will be packaged and integrated for location-based services using trial data from the test areas in the Swiss National Park and the Wadden Sea National Park. This will involve the development of a database of geographically referenced information that is structured so that information requests at different levels of spatial and temporal resolution can be met by the selection of appropriate 'data chunks' suitable for delivery to users. This structuring will be based on the characteristics of user requests and also on the properties of the information available. The output of this work will be a trial location-based service database, structured according to the likely geographical character of user requests.
These processes will be carried out for specimen framework and premium information sources available from WebPark partners and business partners. Spatial and temporal metadata for these data sources will be generated both from the characteristics of the data and of the user requests so that the user is given an indication of the information quality in the location-based service. The output of this work will be a trial service accessed over the web offering information services for location-based queries in which framework and premium information are delivered separately but designed to be used together as 'framework+premium' information.

Deliverable	
D3.2.1	Location-based service database structure design

D3.2.2	Framework and premium information source and metadata service

WP 3300 G-commerce processes (leader: EADS)
Within the constraints of the user preferences for security and privacy identified by users in WP 2200, G-commerce process will be developed to charge the user for information requests. These processes will use the 'data chunking' and 'framework+premium' information services from WP3200 to calculate information pricing on volume. This volume pricing will then be scaled by output from the geographical/temporal relevance computed from personalisation in WP4100 and knowledge discovery outputs in WP4200. The output will be a pricing engine that will be integrated with the location-based service delivery.

Deliverable	
D3.3.1	Micro-payments and pricing strategy for information using geographic relevance

3.4 Workpackage 4: location-based service development (leader: CU)

WP 4100 Personalization (leader: EADS)
WebPark will provide location-based geographic information services that are driven by an understanding of the geographic context of the user. This spatial and temporal context will be derived from personalization, which in turn will be driven by user input and automated knowledge discovery/ intelligence. This work will involve the design and implementation of a user profile database that the user can access and configure through the web or through their mobile device. The nature of the user configuration will be determined from the user surveys in WP2200.
The user profile will also be designed to store details of the user's spatio-temporal profile i.e. where they were and when. This information will be delivered by the knowledge discovery and intelligent spatial agent components using spatial and temporal data types and will be stored at user-controllable levels of detail. The spatio-temporal profile will include spatio-temporal error assessments, depending on the geolocation service used. The output of this work will be the user profile database and its interfaces to the other components.

Deliverable	
D4.1.1	User profile database component and component interface

WP 4200 Knowledge discovery methods (leader: CU)
As the user moves over the terrain (or marine bathymetry) the types of terrain context will be characterized in topographic terms (slope angle, slope azimuth, altitude/bathymetry, summit/ ridge/ channel) by analyzing the DTM for the area in real time. If these automated processes are switched on by the user, the geolocation information record in the user profile will be data mined to identify:

- the 'envelopes' of daily and weekly movement;
- the kinds of activity in the local area (based upon speed, correlation with map features);
- the times and distances of trips 'out and back' from a base;
- types of places/times where information has been requested.

This information will be stored in raster surface form so that they can be queried by automated processes that can evaluate the geographic context against tests set by the user e.g. altitude, distance from shore or set by information providers e.g. entry into prohibited areas, inclusion in severe weather warnings. The output of this work will be the data mining components that interact with the user profile database and the data structures for the results of the data mining.

Deliverable	
D4.2.1	Knowledge discovery components for envelopes, patterns and characterisations

WP 4300 Intelligent spatial agents (leader: LNEC)
The output of the knowledge discovery processes will be stored in the user profile alongside personalization information contributed by the user. The characteristics of visit times/places, the

types of information requested by time/place and the terrain position will be stored in the user profile as raster 'activity surfaces'. This empirical record will be used to endow the intelligent spatial agent 'representing' each user with a set of intentions. The agent will reason about the user's record of spatio-temporal behaviour and learn from the pattern of information requests made by the user. This will allow it to rank geographic information relevancy of available premium information services.
This will allow WebPark to select relevant geographic information services of potential interest to the user by evaluating the relationships between the different activity surfaces including the user's personalization preferences. The output of this work will be an intelligent spatial agent and an interface to the spatio-temporal knowledge discovery in the user profile database.

Deliverable	
D4.3.1	Spatial intelligent agent component to reason about prospective routing/place selections

WP 4400 Device dependent information display and generalization (leader: GIUZ)
The information services will be customized for the mobile device. A wide range of operating systems, user interfaces and browsers will be available for mobile devices and WebPark will develop a display profile appropriate to some representative combinations of these elements. This will require the specification of the requirements of the supported mobile devices such that the content can be generated to display correctly. The output of this work will be a series of device profiles.
On-the-fly generalization will be needed to adapt the GI content to the scale of the display and the target mobile device depending on the capabilities of the device. Once the Data Services component in WP3200 has been instructed to send a particular dataset, the generalization component will simplify and stylize the geographic information on-the-fly as appropriate to the device. The output of this work will be a component to carry out this generalization that will work within the WebPark user interface developed in WP5200.

Deliverables	
D4.4.1	Information delivery device profiles for WebPark supported mobile devices
D4.4.2	Component to provide generalization services for GI content

3.5 Workpackage 5: architecture and delivery (leader: EADS)

WP 5100 Interface to geolocation services (leader: CU)
Delivery of the location-based geographic information services will require a flexible and modular distributed architecture integrated with geolocation services and web clients on various kinds of mobile devices. Research in this workpackage will use metadata about the type of geolocation information (e.g. dilution of precision for GPS data) to determine the appropriate error circle for positioning and from this will set constraints on generalization. Geolocation information will be read from the device or from a network source and stored in the user profile before being data mined. Precise positional data will be overwritten after a user-determined interval. The output of this work will be an interface specification for the supported mobile devices and the WebPark components.

Deliverable	
D5.1.1	Interface specification for geolocation data stream to WebPark service.

WP 5200 Web clients for location-based services (leader: LNEC)
A user interface template for supported mobile devices will be developed to communicate the location-based services that WebPark offers through a browser. This interface will be designed to accommodate multilingual alternatives. This interface will define how the geographic information 'styled' by the generalization component developed in WP4400 will be represented within the user interface on the mobile device. The output of this work will be a user interface specification that is 'generalization-aware' and which gives the user easy access to the location-based services.

Deliverable

D5.2.1	User interface designs for microbrowser platforms

WP 5300 Web portal (leader: EADS)
WebPark will develop a client/server architecture with a back-end user profile database integrated with payment services, and a web portal to allow user access. The WebPark service will be integrated with other services such as the spatial metadata, geographic conversion and geographic data services developed in WP3100. The output of this work will be the web portal service component with interfaces between external services and WebPark software components.

Deliverable	
D5.3.1	Develop web portal software component

WP 5400 Payment services (leader: Geodan)
Payment services will be developed to allow the user to add 'premium information' to the free framework GI. These services will use Secure Socket Layer (SSL) protocols in mobile device micro browsers to provide encryption of payment data. This workpackage will explore the use of the Platform for Privacy Preferences (P3P) as a means for protecting the privacy of users requesting information through WebPark based on their personalization profile. These payment services will implement the payment agreed by the user through the pricing engine in WP3300. The output of this work will be an interface to the payment services in use by the suppliers of 'premium' information for the trial WebPark service.

Deliverable	
D5.4.1	Interface specification between the G-commerce micro payment processes and the web portal

3.6 Workpackage 6: validation and testing (leader: SNP)

WP 6100 User reactions to prototypes (leader: SNP)
To ensure that the WebPark prototype services that are designed and implemented are practical and commercially viable, it is necessary to test them in use. This will help involve potential service partners to influence the specification before they are invited to purchase the technological and business process package. This will involve the re-evaluation of the Analysis and definition of user needs report and the Privacy/security assessment designs proposed in WP2200. This will be achieved by the use of the usability testing template from WP2200 to assess the prototype WebPark service with representative users. The output of this work will be a report on design adjustments that need to be made to the trial service.

Deliverable	
D6.1.1	Design and specification of test environment

WP 6200 Trial location based services using scenarios (leader: Geodan)
For the potential of the WebPark value chain to be fully exploited, the delivery and purchase of geographically relevant information services must be trialled and shown to meet the needs of business and protected/ recreational area administrations. Work will be undertaken to ensure that the public conservation and safety objectives are met through user surveys and that the business needs are met through full-scale integrated testing.
The project will develop a series of test scenarios that include the main uses of WebPark (information, alerts, emergencies). These scenarios will be designed together with managers of recreation areas and content providers. The user scenarios will be tested in selected areas including:

- an area within the Swiss National Park,
- an area in the Waddenzee and its coastal area, in the north of the Netherlands.

Tests will be carried out with a limited number of users that will be equipped with mobile handset and a test version of WebPark system and content. Users will simulate the situations identified in the scenarios and test the usefulness and appropriateness of WebPark in these circumstances. Templates for carrying out the test and for reporting on their results will be prepared before tests

initiate. The test will be completed with a test report and recommendations for WebPark. The usability testing template can be re-evaluated when the service trials have been carried out.

Deliverable	
D6.2.1	Report on testing and validation

3.7 Workpackage 7: dissemination and exploitation (leader: Geodan)

WP 7100 Conservation/safety agendas (leader: SNP)
WebPark aims to enhance the use of protected areas through the provision of information services that serve conservation and safety in addition to the needs of users. The project will audit the conservation and safety policies that are positively impacted by the WebPark services in the trials.

Deliverable	
D7.1.1	Audit of conservation and safety policies

WP 7200 Evaluation, exploitation and dissemination (leader: Geodan)
The work of the consortium will be evaluated in terms of its contributions to EC objectives and trial validation results. Dissemination and exploitation of the results will be pursued through a technology implementation plan, a dissemination and use plan and an exploitation plan. Partners will contribute to international conferences in order to publicize the project and to obtain peer feedback on technical developments, whilst taking steps to protect the technological and business process platform.
WebPark will provide exploitation and dissemination plans in the form of a business plan. The market analyses and exploitation plan will be provided in the standard form, including market segmentation, analyses of user needs and willingness to pay, competition analyses, analyses of substitute services, and assessment of the overall market potential for a period of 3 years. The technology implementation plan will provide the road map for a final and commercially viable version of WebPark. The exploitation plan will include the marketing and contractual agreements between partners for the commercial exploitation of the project results. A final workshop, open to a selected range of potential users and scientists will mark the end of the project and the beginning of the exploitation.

Deliverables	
D7.2.1	Dissemination and use plan
D7.2.2	Technological implementation plan (draft)
D7.2.3	Technological implementation plan (final)
D7.2.4	Business and exploitation plan (draft)
D7.2.5	Business and exploitation plan (final)
D7.2.6	Final workshop

4 Project results and achievements

This chapter describes the results and achievements realised in terms of:

- Scientific/technological quality and innovation;
- Community added value and contribution to EU policies;
- Contribution to Community social objectives;
- Economic development and S&T prospects.

4.1 Scientific/technological quality and innovation

The creation of an effective, robust and fast platform on which to explore research questions without interference from technical issues was major achievement. It offers the potential to escape the technological bind that can hamper LBS research and focus on core issues in geographic inquiry from a unique 'situated' perspective. In addition, establishing a qualified economic and societal demand for LBS in the natural environment setting was a very important justification for present and continued research.

From a purely research point of view, the project shed light on many novel and interesting questions and exposed several new research avenues for continued investigation. These included:

- How context-based technology can shape individuals' behaviour and beliefs about the environment, of vital consequence to sustainable development, was opened up through the project outcomes;
- The representation of geographic space was found to have unique considerations in the natural environment setting, these allowed innovative methods and data structures to be used and suggested future cross-disciplinary research directions;
- Existing knowledge about how to present geographic information was enhanced by the consideration of new constraints posed by devices with limited capabilities and small screens and the 'ego-centric' nature of use. Satisfying such constraints is critically important to the economic success of LBS and will continue to be a major research theme.

WebPark has contributed to the quality and innovation in a number of scientific and technological fields:

Architecture
The client/server architecture of the WebPark platform is built on open standards like GML, XML, WFS, WMS, and Java. Its flexibility makes it easy for developers to manage the effects of being offline and online alternately; for the user the connection to the server is as much as possible transparent: the application continues to work when the connection is dropped. This happens often in remote places like the Swiss National Park. Contrary to urban areas, this is not a temporarily situation. For many years to come network coverage will stay patchy in natural areas, because antenna masts conflict with the desire to keep nature natural. Because the application is built on open standards, the system is platform independent to a high degree. This was proved during the project: several types of devices and versions of the operating system where used, all running the same software.

Mobile internet
The development of WebPark will be a contribution to the success of the 3G mobile internet technologies in which European enterprises have invested huge amounts. Without innovative services such as WebPark, which extend the benefits of 2G and 3G to areas outside the cities there is a risk that these technologies will not become profitable.

Adaptive information filtering
WebPark offers a range of information filtering methods to avoid information overload. Users are supposed to enjoy nature and the environment, and not be looking all the time at their mobile device. Instead of being flooded with information, of having to browse endlessly, the user can (but doesn't have to) apply filters that pick out just the essential bits, or the pieces of personal interest. Information can be filtered by personal topical preferences as specified in the user profile, by

location (what's around me) or by direction of movement (what's ahead of me). For the adaptive filtering, use is made of agent technology. Agents are software programs that run in the background and reason about what information is most relevant for a specific user at that time, at that location.

Spatial bookmarks
The bookmark functionality allows the user to create localised notes. Notes can be either personal or public. The personal notes can be taken home as a souvenir and may be linked to pictures taken at those locations. The public bookmarks enable the exchange of experiences between users, and increase the dynamics of the system.

Map generalisation
The map generalization features make it possible to put more information in a readable form on the small screen displays of handheld devices.

Route profiles
Tracks set out in the park can be visualised on the device in two ways: altitude against distance and altitude against time. This gives a clear picture of what's still to come, and of how far you are down the track. It makes it easier to decide if you should continue or go back, making trips safer in that way.

Search
An integrated search tool allows you to search the content for terms. The content is also organised with a hierarchical category structure, making it possible to quickly find information.

Services
WebPark has delivered a strategy and an implementation for information publishing to visitors through LBS, including maintenance, multilinguality and personalisation. It offers an innovative publishing technology that makes it possible to reduce the large number of *information boards* in parks. These boards are useful in supplying interesting information to visitors, but at the same time they diminish the natural atmosphere in the park. They are also costly and need to be maintained, which for remotely placed boards can be quite tedious. Moreover, WebPark information can be queried anywhere; it is not bound to a number of fixed locations. They offer vast possibilities for publishing multi-media content that could never have been shown with traditional means on the spot where the information applies, where it matters. This should result in a higher visitor's awareness about the aims of the park and nature protection. Safety in the park should benefit from the self guidance capabilities of visitors that make use of maps and GPS. The WebPark services form a two-way communication channel between visitors and the park. Through bookmarks, user position logs, and statistics on user behaviour the park administration can find out what interests and drives the visitors.

4.2 Community added value and contribution to EU policies

4.2.1 General issues

At a general level the WebPark project contributed to a number of EC policies. Europe's protected and recreational areas are essential 'breathing spaces' for the increasingly stressful lives of urban dwellers and they are important sources of income for the rural inhabitant. As such access to these natural and cultural resources is more important than ever. The WebPark project helps administrations and workers in these areas to influence the attitudes and preferences of the urban visitors through the flow of information to their mobile devices, while at the same time deriving economic benefit from their visits.

Many of Europe's protected and recreational areas straddle national and regional boundaries because they are mountainous or marine in nature. These areas often suffer from being peripheral to regions. The delivery of location-based services (LBS) allows administrations and agencies in

these border crossing areas to cooperate better, through work to standardize the GI content available to professionals, tourists and leisure users of these areas.

The WebPark project aids education in conservation and safety objectives by providing information from administrations that gives the background on the natural and cultural resources. WebPark allows park managers to publish time- and place-sensitive 'alerts' on safety or ecological grounds to the mobile devices.

4.2.2 Specific issues

The WebPark project involves the integration of expertise in GI and multimedia content, device-sensitive delivery and adaptive terrain and landscape intelligence. This creates new value chains that can be reproduced locally for the many thousands of protected and recreational areas of Europe. However, without action at the European level such new information services may be unachievable or invented separately and incompatibly all over the European Union. These developments are also compatible with EU Natura 2000 policies.

The EU Information Society Project Office (http://www.ispo.be/) has stressed the importance of privacy and personalization in its policies. Since privacy is an important issue to users of 2G and 3G information services, the WebPark project places considerable importance on this aspect in its design.

4.2.3 European level

WebPark works with organizations such as Europarc (http://www.europarc.org/) to ensure that its developments are marketed throughout the sector in Europe.

4.2.4 Conservation policies

The Convention on Biological Diversity (CBD) was negotiated under the auspices of the United Nations Environment Program (UNEP). It was opened for signature at the June 1992 UN Conference on Environment and Development and entered into force on 29 December 1993. As of October 1998, more than 170 countries had become parties. The three goals of the CBD are to promote the conservation of biodiversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising out of the utilization of genetic resources. Article 13 of the CBD declares that contracting parties should (a) "Promote and encourage understanding of the importance of, and the measures required for, the conservation of biological diversity, as well as its propagation through media, and the inclusion of these topics in educational programs", and (b) "Cooperate, as appropriate, with other States and international organizations in developing educational and public awareness programs, with respect to conservation and sustainable use of biological diversity." IUCN has established a Commission for Communication (CEC) which leads the communication and education of conservation programs and protected worldwide. CEC propose a tool for change called CEPA for protected areas. CEPA stands for Communication, Education and Public Awareness and provides the link from science and ecology to people's social and economic reality. The World Summit on Sustainable Development 2002 recommended to the United Nations General Assembly that "it should adopt a Decade of Education for Sustainable Development starting in 2005" (paragraph 117d, Plan of Implementation). In December 2002, resolution 57/254 on the United Nations Decade of Education for Sustainable Development beginning 1 January 2005 was adopted by consensus.

4.3 Contribution to Community social objectives

The WebPark project can make a contribution to the European Union's social objectives in two main areas.

4.3.1 Equalizing access to information

Developments such as WebPark will allow access to information resources to all levels of society as these envisaged services will be cost-effective and because the mobile device is now pervasive throughout most European countries.

New 'information ecologies' will be created by the WebPark project since mobile devices will allow information to be shared and traded among administrations and among user groups. The contextual and location-sensitive access to information can make a contribution to an improved quality of life by making recreation and tourism more informed. The approach to privacy based on the user control of personalization can enhance the public's confidence in mobile information services.

4.3.2 Promoting effective access to natural and cultural resources

WebPark will make it possible for more people to achieve full awareness of the richness of natural and cultural resources, since their mobile device will be capable of offering information about the places they visit. At a time when protected and recreation areas are under extreme pressures from the sheer weight of visitor numbers, WebPark information services can ensure that the visitors and tourists make eco-friendly and safe use of the environment. The development of information services on a standard template that is developed with an input from a wide range of European organizations will allow a degree of standardization, which will beneficial to those who have to localize the content.

4.4 Economic development and S&T prospects

The WebPark project is a research and technological development (RTD) proposal, and as such it offers a practical and realistic technological implementation plan and appropriate dissemination activities to enable it to succeed as a business service. This planning and dissemination work was focused on ensuring employment, especially in small and medium enterprises (SME's). In most cases locally based SME's will be best placed to carry out data aggregation from the local sources that will provide the most valuable knowledge of conditions to be offered as part of the service.

WebPark is riding the wave of mobile information technology that is currently rising. Looking at just the number of new mobile technologies today, like UMTS, cell broadcast, location based data services, Galileo, all-in-one devices (phone, computer, GPS), it is clear that development efforts put into this field will not be spent in vain.

5 Dissemination

5.1 Knowledge transfer

The table below lists the conferences, workshops, demonstrations that were attended or organised after the project or that are foreseen. Other forms of technology transfer are also listed. Events that took place during the project are documented in one of the yearly or process reports.

Date	Event	Details
20041115	Presentation of WebPark on VIAS symposium, WICC, Wageningen, Netherlands	WebPark presented by Evert van Kootwijk
20051201	EU-LAT Workshop on e-Environment San Jose', Costa Rica	WebPark presented by Eduardo Dias. http://www.eu-lat.org/index.php?location=10

5.2 Publications

The table below lists the articles published, press coverage or other publications that occurred after the project or that are foreseen in the near future. Publications during the project are documented in one of the yearly or process reports.

Date	Item or Event	Details
200502	HP customer report.	http://h41174.www4.hp.com/5c/hp/ch/de/any/-/welcome/-/118343223/Top1/HP_emarketing/ch_de_t12_all_nationalpark/ch_de_t12_all_nationalpark_top1-top2-x01.html/643563356561376434323161303162 30?http://h41111.www4.hp.com/gomobile/ch/de/customerstories/success/webpark.html

5.3 Website actualization

The WebPark website at www.webparkservices.info has been updated with the latest developments in the projects.

5.4 Final workshop

The final workshop was held on September 14, 2004 in the Park House of the Swiss National Park in Zernez.

5.4.1 Invitations

A large number of invitations were sent to various organisations. See appendix A for the invitation text.

5.4.2 Program

10:15	Address of welcome and introduction (German/English)
10:25 – 11:00	The concept: How to build a Location Based electronic park guide? (English)
11:00 – 11:40	From GIS databases to Location Based services (English)
11:40 – 12:00	Open discussion with participants

12:00 – 13:30 Lunch (individually)
13:30 – 16:30 Demonstration of the WebPark application in the field (in groups)
16:30 End of the event at the National Park House

5.4.3 Participants

The workshop was attended by people from various organisations:

CPNS (one of the Italian national parks)
HP (hardware supplier)
SNP (national park, employees that were not involved in the project)
Technical University of Munich (university)
Tourismus Organisation Plaiv (a local tourist board)

Persons from the following organisations responded to be interested, but were unable attend to the workshop at that time:

AWT
BBW
Bereich Communication
Computerworld
ENPK
FOK/ ENPK
Geoinformatik
Grand Cariçaie
Jagd GR
NPB
Scuol Tourismus
Swisscom

5.4.4 Discussion subjects

The following subjects were discussed with the workshop participants:

- Rental model versus the download model. This subject deals with the question how to supply the WebPark functionality to users: either by renting out devices for a short period of time with the software and data installed, or download software and data to the personal devices of visitors. Currently, the rental model is the only viable option, since the percentage of visitors that carries suitable devices (smartphones or PDA's, GPS) with them, is still very limited. However, looking at the growing numbers of suitable devices being sold, the download model will probably be feasible within a few years.
- Communication possibilities between users. In the current implementation of WebPark, users can only communicate through public bookmarks. When a visitor sees something of interest, a public bookmark with details on the spotted feature can be created, that is directly visible for other users. In that way, users can share their experiences. Using standard facilities of the mobile platform, users can also communicate by phone and e-mail.
- Danger of giving information on location of species. Showing the locations where plant and animal species can be found carries the danger of disturbance of wildlife. However, this is actually not an issue of WebPark itself. It has to do more with information management, through whichever channel. The information that is distributed through WebPark can be easily changed and adapted to current situations. Areas can be closed and opened as needed, and the actual whereabouts of visitors can be monitored and related to allowed visiting pressure.
- Willingness to pay for rent of device. Having seen the WebPark system, most participants said they would be willing to pay some usage fee, varying from €5 to €10 per day.

However, in reality these figures may turn out different. Real users with real needs may be willing to pay more than people that only have to imagine that they would use the service.

- Flexibility in pricing schemes. The importance of having different pricing schemes was stressed, based on the experience with current services. It should be possible for example to give discount to groups, or to have special arrangements for school classes that visited the park.
- Competing services. Some participants mentioned initiatives that to some extent offered services similar to WebPark. One of those initiatives comprised of mountain bike tracks that could be downloaded from the internet at low cost. Using a GPS the tracks could be followed in the field. No other integral system like WebPark however was known to the audience.
- Additional income sources. According to the business plan, the rental of devices alone can probably not generate enough revenue to support the system. Several additional income sources were put forward, like advertisements and sponsored links. Close cooperation with local hotels and restaurants fits into this scheme. At the same time the necessity to get other parties onboard was mentioned: telecom operators, hardware suppliers. Having a broader base of organizations that can benefit from the system would make exploitation
- Estimates for number of users.

5.4.5 Main conclusions

The workshop yielded useful feedback on the WebPark team. Target groups (national parks, tourist organizations) are interested and actively participating. There is a broad welcome for the concept. The functionality and layout of current implementation of WebPark for SNP, using the QTek 2020 smartphone, was met with appreciation. Participants thought they would be willing to pay a rental fee of €5 to €10 for the services offered by WebPark.

6 Highlights

In this chapter we will describe a number of milestones and successes that were reached during the project.

Data
Geographic and non-geographic data of various sources and formats is integrated by WebPark. Raster, vector, text, movies, photos, and sounds can be served to the mobile application. The data is delivered using OGC and W3C standards like GML and SVG. Tools for data preparation and conversion tools were developed to make the import of data from GIS databases to LBS databases easier. By adding spatial footprints to existing non-geographical data, and subsequently making that data available in the field, we could to our satisfaction watch the value-adding of LBS take place.

From PDA to Smartphone
The first versions of the system consisted of three separate devices: a bluetooth enabled PDA, a bluetooth mobile telephone and a bluetooth GPS. The PDA had to maintain two simultaneous bluetooth connections: one with the phone for wireless access to the server, and one to the GPS to determine its position. Apart from the fact that it is not very practical to carry around and maintain three devices, this setup also proved to be quite unstable because of the double bluetooth connection. The issue was resolved with the appearance of PocketPC smartphones on the market, which effectively combined the PDA and the mobile phone. The smartphone meant a big boast for the WebPark system: suddenly a number of bottlenecks were overcome and the system became feasible in practice.

Academic achievements
The project helped support a number of Diploma theses, as well numerous publications. Experiences acquired, as well as the case study itself, will also be integrated into didactic material for undergraduate and Master's courses.

Three PhD studies and one MSc study of participants were based on work done in WebPark.

- PhD Alistair Edwardes (GIUZ): completion expected in 2005
- PhD David Mountain (CU): completion expected in 2005.
- PhD Eduardo Dias (Geodan/VU Amsterdam): completion expected 2006.
- MSc António Gonçalves (LNEC): completed in 2003.

Involvement of end-users
A very important factor contributing to the success of the project was the focus on user needs and the involvement of end-users for evaluation and testing. Having the SNP end-user organisation as a consortium member ensured that the solutions we created were not just figments of our imagination, but were things that could the test of reality. The test campaigns allowed us to define and improve the system in the right way, instead of implementing useless functionalities. The consequence of the strong user involvement was that we could not get away with developing a mere prototype, but that much attention had to be paid to the user interface, the stability and the usability of the system. For an R&D project this is certainly not very common.

Media attention
When the WebPark project starts in 2002, the internet hype has just evaporated, WAP has failed and mobile applications are not on anybodies agenda anymore. When the project finishes by the end of 2004, we see a revival of mobile internet initiatives and there is again a strongly growing interest in mobile applications (not because of WebPark of course). This interest is demonstrated by the attention from the media that WebPark receives in 2004. Radio interviews were given, many magazine articles were written, and WebPark even featured a number of times on TV. Most notably was the 10 minutes news item on prime time national Swiss TV, showing school children testing out and commenting on WebPark in the Swiss Mountains.

Spin-off

As a direct result of the project, a spin-off company was created by the EADS project leader at the start of 2005. The WebPark partners have handed over the IPR on the methods and software created during the project to the Toulouse-based company, Camineo, of which they are shareholders. The creation of Camineo proves that the project has been successful, since it has yielded results that are usable and that have commercial value.

Teamwork
The project was a cooperation of people from multiple disciplines and of different types of organisations in five different countries. The logistics necessary for proper communication are substantial: shared workspaces, shared source control, conference calls, travelling to get together, sitting for days in one room to use the time use the precious time spent together optimally. WebPark was characterised by strong teamwork of the developers. Notable are the many nights that were spent coding together during the technical meetings of the project. When all team members got together for a week, the real progress leaps were made. The strong bond between the partners created a constructive atmosphere in which good ideas could flourish. The technical development cycles used prototyping and consecutive testing each summer with real users: development during the winter season of 2001/2002, followed by testing in summer 2002, followed by development in the winter season of 2002/2003, followed by summer testing in 2003, and so on. However, sometimes also shorter cycles were necessary: development from 18:00 to 09:00, followed by testing from 09:00 to 18:00 followed by development from 18:00 to 09:00.

7 Deliverables and other outputs

In this chapter, the major project deliverables are briefly described.

The table below lists all the project deliverables:

WebPark deliverables.
Date refers to the month (1-36). Type: R=report, P=prototype. Dissemination level: RE=restricted, CO=consortium, PU=public.

Nr	Deliverable title	Deliv. date	Type	Diss. level
WP1	**Project management**			
D111	Project description and fact sheet	M1	R	CO
D112	Project Management plan	M3	R	CO
D113	Project presentation brochure, website and groupware activation	M3	R	PU
D1141	Quarterly progress report (01-06)	M6	R	CO
D1151	1st periodic progress report (1-12)	M12	R	PU
D1142	Quarterly progress report (13-18)	M18	R	CO
D1152	2nd periodic progress report (13-24)	M24	R	PU
D1143	Quarterly progress report (25-30)	M30	R	CO
D1153	3rd periodic progress report (25-36)	M36	R	PU
D116	Final Report	M36	R	PU
WP2	**Market and user surveys**			
D211	Service template report and manual of geographic resolution and accuracy	M6	R	RE
D221	Analysis and definition of user needs report	M6	R	PU
D222	Privacy/security assessment and design requirements	M6	R	PU
D223	Usability testing template	M6	R	PU
WP3	**GI standards and services**			
D311	GI interoperability platform and metadata services	M12	R/P	PU
D321	Location-based service database structure design	M15	R/P	CO
D322	Framework and premium information source and metadata service	M15	P	RE
D331	Micro-payments and pricing strategy for information using geographic relevance	M21	R/P	CO
WP4	**Location-based service development**			
D411	User profile database component and component interface	M18	P	RE
D421	Knowledge discovery components for envelopes, patterns and characterizations	M18	P	CO
D431	Spatial intelligent agent component to reason about prospective routing/place selections	M24	P	CO
D441	Information delivery device profiles for WebPark supported mobile devices	M30	P	RE
D442	Generalization services for GI content	M24	P, now R	PU
WP5	**Architecture and delivery**			
D511	Interface specification for geolocation data stream to WebPark service	M24	R	RE
D521	User interface designs for microbrowser platforms	M15	R	RE
D531	Develop web portal software component	M21	P	CO
D541	Interface specification between the G-commerce micro-payment processes and the web portal	M30	R	RE
WP6	**Validation and testing**			
D611	Design and specification of test environment	M27	R	RE
D621	Report on testing and validation	M36	R	PU
WP7	**Dissemination and exploitation**			
D711	Audit of conservation and safety policies	M36	R	PU
D721	Dissemination and use plan	M6	R	RE
D722	Technological implementation plan (draft)	M24	R	RE
D723	Technological implementation plan (final)	M36	R	RE
D724	Business and exploitation plan (draft)	M24	R	RE

Nr	Deliverable title	Deliv. date	Type	Diss. level
D725	Business and exploitation plan (final)	M36	R	RE
D726	Final workshop	M36	R	PU

7.1 Description of major deliverables

7.1.1 Geoaccuracy Report (D.2.1.1)

This deliverable describes the relationship between location accuracy and location-based services. It provides an overview of the service requirements of the most common types of LBS in terms of position accuracy. The major location technologies are then described and the relationship between LBS and accuracy is provided. The report then focuses on tourist applications and focuses the analyses on location determination and tourist location-based services.
Main conclusion:

- Location accuracy, in terms of the ability to precisely locate a user/handset/terminal, determines the range and variety of services that can be deployed. With low accuracy, the choice of suitable services is limited (e.g. weather forecasts or local news) and the ability to generate revenues is correspondingly limited. As accuracy increases, the range of possible services widens, up to the point at which with location technologies such as assisted GPS virtually all LBS services can be implemented in a commercial way.
- Accuracy has two sides. First, it determines if a service can be deployed or otherwise; second, it determines the quality of the service. The services that are strictly dependent on accuracy, that is the services that below certain accuracy make little practical and commercial sense, are rather limited. The vast majority of services can be deployed for a range of accuracy levels, with the quality of service increasing with better location capabilities.
- For services that demand accuracy in the range of meters, GPS, assisted GPS or beacon networks are necessary. The lack of them would prevent the deployment of the service. For most other services, however, the service can be deployed with various degrees of accuracy, which in turn determine its quality. Services such as person location, friend finder, nearest POI, advertising, dating etc. can be deployed with rather simple LDT. The improvements in accuracy would determine a clear improvement in quality of service, but not the possibility of deploying the service.
- On the contrary, emergency services, panic button, find and rescue, personal door-to-door navigation and the like require precise location determination. If the location cannot be determined with an accuracy in the range of 10-100m the service becomes of little or no use.
- The goal areas for WebPark are typically rural areas with a limited number of Base Transceiver Antennas and limited coverage, for this reason Cell ID would not be a solution for the deployment of the WebPark services.
- GPS appears to be the best solution for the location determination in the WebPark development framework. The WebPark services intend to assist visitors of protected and recreational areas that engage in outdoor activities, for this reason the indoor limitation of the conventional GPS solution is not an issue and the accuracy enabled by the GPS is enough.

7.1.2 Service Template Report (D.2.1.1.a)

This deliverable concentrates on the theoretical and practical issues associated with the character of the available information, the characteristics of the information delivery mechanisms, the drivers behind the ‘information needs’ of the potential user, especially their tasks and the modes of access supported by the system. To explore these issues, the existing information available in the Swiss National Park was classified and analyzed against likely demand for location-based services. In the light of this survey consideration was given to the work likely to be needed on the information

assets currently held before they could be made available to the proposed WebPark service. These requirements together define the Service Template needed to permit the functional design of the WebPark system.

7.1.3 Analysis and definition of user needs (D.2.2.1)

This deliverable specifies and evaluates the information needs of visitors to recreational and protected areas. Specific goals include gaining insight into the characteristics of the target group (those who expressed an interest in accessing mobile information within National Parks) and identifying which services users are most likely to use. The research has focused on two study areas; The Swiss National Park (SNP), Switzerland; Wadden Sea (WZ), Netherlands.

The main conclusions can be summarized as five points covering information content and delivery;

1. Safety: identified as essential content in both areas.
2. Navigation aids: digital maps and more abstract concepts such as terrain profiles are required by users.
3. Animal and plant wildlife: both background information and where to find species.
4. Silent solution: audio mobile alerts and spoken content were not favoured.
5. Personalized delivery: users want control of when and how they access information; especially "pushed" information.

7.1.4 Privacy / security assessment and design (D.2.2.2)

Visitors of recreational and protected areas need geographic information to plan their trips safely. Moreover, they want to have contextual information on topics of interest while involved in outdoor activities. To deliver the best information service at home and/or on mobile devices, the WebPark project has to take into account privacy / security issues in association with personalization. This deliverable focuses on the management of personalization characteristics, and the associated privacy / security issues.
Main conclusions:

- The WebPark service should only gather the data necessary to deliver specified services and it should always seek to justify carefully any data collected and stored in the user profile, (especially on location) by constant communication with the user;
- For the WebPark service the profile must only be accessible by and for the user, and the service must not pass on private information to third parties without agreement;
- The user should have access to the user profile data to check its accuracy, edit its contents or to update preferences as it is suggested that this will engage the user with the database and build confidence in the service;
- The default operation of the service should be to provide information in 'pull' mode on user demand, with the availability of 'push' services for user-specified services;
- Location data should be not be collected by default, but if authorized should be collected independently of the device identity and matched when necessary;
- Data mining and profiling will require careful grounding against our privacy and security policy, especially with respect to location, which should be summarized wherever possible to reduce the physical and privacy overheads of the location information;
- The personalization information in the user profile must be configured to take advantage of protocols such as P3P to enable transparent access to the WebPark privacy policy;
- The architecture of the WebPark service should be designed to strictly guard against unauthorized access to the user profile;
- The regulation and legislation of privacy must be built into the business models that the WebPark service develops from the outset.

7.1.5 Usability Testing Template (D.2.2.3)

This deliverable describes how materials for testing usability of applications should be developed by researchers. It initially describes what is meant by usability testing and the purpose for it with regard to the WebPark project. How test users should be selected to reflect the target audience is then explained. The report continues by outlining the main techniques for usability testing that will be employed in WebPark. This focuses on Monitoring or Shadowing, Questionnaires, Interviews and "Thinking aloud". The document further makes recommendations as to how testing should be conducted in the field. Finally a discussion of methods for data analysis is made. The annexes of the deliverable provide template documents and samples of testing materials.

7.1.6 GI interoperability platform - Metadata services (D.3.1.1)

This deliverable focuses on the metadata services for the WebPark project. A small introduction to metadata is given in the first paragraphs and then the available standards and metadata tools are discussed. A metadata infrastructure for the WebPark services is proposed.

7.1.7 GI interoperability platform - review of OGC Specifications (D.3.1.1)

This deliverable provides a review, comparison and discussion of the OpenGIS Consortium (OGC) initiatives that are relevant to the WebPark project. For the purposes of comparison and discussion the initiatives are split into two groups, Open Web Services (OWS) that aim to facilitate the use of GI-Services over the Internet and the Open Location Services (OpenLS) which aim to facilitate the use of GI-Services over the mobile Internet. The aim of the report is to provide a basis for discussion and decision-making about the interoperability aspects of the WebPark platform. The report first outlines the OGC Specification development process and goes on to provide an overview of each of the initiatives. It then provides a comparison of the work of the two groups, highlighting where they complement each other and where they diverge. Finally it discusses their potential adoption in the WebPark platforms and makes tentative recommendations on the interoperability strategy that might be followed by WebPark with regard to these discussions.

Recommendations:

- Use OWS (WMS, WFS, SLD, GML) to provide access to data services, since this will ensure development on a stable set of standards through COTS software.
- Adopt the framework of OpenLS for the application service layer (XML/Schema, ADTs) and where relevant the ADT encodings. This will ensure that if an OpenLS compliant platform is desired at a future point this can be achieved relatively easily through XLST translations.
- Participate in or formally observe OLS1.1 – This would provide early access to specifications and enable the consortium to adopt new more relevant encodings that are developed. In addition it will provide an opportunity to standardise the consortium's own interfaces.

7.1.8 GI interoperability platform - Webmapping (D.3.1.1)

This deliverable focuses on the step of choosing and developing a webmapping application. The first chapter briefly explains the webmapping concept. Then a description of the most important standard (OpenGIS) is given. Three different and popular webmapping tools are evaluated and compared. As a result of this evaluation, one webmapping tool is proposed and described in detail: the Geodan Spatial Components.

7.1.9 Database Structure Design (D.3.2.1)

This deliverable shows the database design process for WebPark services. It starts with a general but short explanation of the whole design process which could be subdivided into planning and analysis, conceptual design, logical design, physical design and implementation. During the conceptual design the user requirements and the application requirements are investigated. There are some functions listed which are required for WebPark services with attributes of spatial and temporal relevance. The functions needed are also compared to available base data. The

application requirements for webmapping, species search, personal bookmarks and hiking/trekking determines directly the creation of entity-relationship diagrams of georeferenced and non-georeferenced data. An example of logical database design for non-georeferenced data from the SNP CD is presented.

There is no deliverable foreseen for the process of data preparation, because in the original plan the idea was to make use of online data services and associated metadata services. In practice, the data services did not exist, and were not created, but a large amount of data was prepared for WebPark. This data preparation turned out to be a very substantial part of the work done for WebPark. GIUZ has described and documented this process in "WP_3200_DataProcessing v02.doc".

7.1.10 Framework and premium information (D.3.2.2)

This deliverable explores the concept of a two-tier model of charging for WebPark services in which the user has access to "Framework" or basic services for free, and wherein further access to "Premium" services must be paid for. The document examines what these 'forms of access' might entail through a consideration of the logic of the consumer, the value-added by WebPark services, and the costs to the provider of WebPark services and methods for charging. It concludes with a table examining different discriminators on which to base further discussions.

7.1.11 Micro payments and pricing strategy using geographic relevance (D.3.3.1)

This deliverable explains the process that is available to WebPark services (applications) for pricing of information and services. This process has to be compatible with constraints of user preferences for security and privacy, and has to allow applications to use all identified discriminators.
The report states all constraints on the design of the component (called pricing engine) implementing the pricing process for WebPark services.

7.1.12 User profile component and its interfaces (D.4.1.1)

This deliverable describes the User Profile component and the interfaces used by the WebPark services.
Section 1 describes security and privacy issues and requirements.
Section 2 describes the user profile component architecture.
Section 3 describes the interfaces between the knowledge discovery and user profile components for cleaning incoming positional data and providing a user speed model.
Section 4 describes the interface with the geographic bookmarks component.
The report describes the implementation prior to WebPark Summer testing 2003. This model can be extended to incorporate system development planned for 2004.

7.1.13 Knowledge Discovery Methods (D.4.2.1)

This deliverable defines the techniques contained within the knowledge discovery component that will be used to derive information from the data generated by users of the WebPark service. It describes the prototypes that have been developed and the interfaces by which other WebPark components can access representations generated by the knowledge discovery component.
The report starts with a literature review. Then the four main types of representations generated by the knowledge discovery component are described. Briefly these are:

- Focal representations: knowledge representation based upon a geographic framework relevant to a single location or feature within the representation.
- Global representations: knowledge representation based upon a geographic framework relevant to all locations within the representation.
- Instance tables/decisions trees/rules: traditional knowledge representations using tables, trees and rules rather than a geographic framework.

- Visualization: representations produced specifically for visual interpretation by human users.

Data structures, client-server issues and application interfaces are then described.

7.1.14 Spatial intelligent agent component (D.4.3.1)

This deliverable focuses on the intelligent mechanisms enabling WebPark Location Based Services (LBSs) to select geographic information and provide relevant information to users that is simultaneously user, location and time adaptive. Software agents are used to implement these mechanisms in a proactively and intelligent manner.

The document is divided in 5 parts. First an introduction to agents technology is given. Secondly, the requirements, the aims of the spatial agents and the constraints on the multi-agent system imposed by the WebPark architecture described. The third part presents the specification of the multi-agent system, its architecture and how to implement its components. The fourth part describes more implementation details. Finally some comments are made about the research done on intelligent agents and LBS.

7.1.15 Information delivery device profiles for WebPark supported devices (D.4.4.1)

This deliverable defines the capabilities of the reference client for WebPark software, given the design decisions and constraints associated with the Web Portal identified in D5.3.1. This document can be read as a specification for a mobile device capable of running WebPark services. WebPark software offers a variety of applications to an appropriately configured client as described here. Users should consult this document and subsequent versions to ensure that WebPark software will run on a target device.

7.1.16 Generalization Services (D.4.4.2)

The deliverable discuses map generalization in the context of the WebPark project, considering the problem and issues unique to this deployment. It presents a model of the problem and considers the possibilities for creating a dynamic generalization engine through an examination of current available solutions. It goes on to present an architecture based on the customization of standard web mapping components.
Main conclusions:
The lack of suitable software for on-demand generalization has meant that the generalization engine is being created by customizing more mainstream web mapping and GIS tools. The Oracle Spatial database was selected because this fits in with the current project infrastructure, provides a robust system for managing spatial data and allows a broad degree of freedom for adding operators for data manipulation through its Java interfaces. The framework of Deegree was selected to provide the middleware processing component since this meets all relevant standards, is open-source, therefore allowing a high degree of customization and is 100% Java. The proposed architecture presents a model that will be fully compliant with all relevant OGC standards, which simplifies integration into new environments as well as reducing the work that would otherwise be required to create similar interface specification. In addition the architecture places no restrictions on the types of client and client deployment (online/sync-ed) it can support.
The generalization process can be decomposed into three units; a controller to orchestrate the generalization process, a set of autonomous operators to manipulate display elements according the need for legible graphics and database embedded with operators to prepare content according to resolution constraints. This model takes into account current thinking on automated generalization (Edwardes et al, 2003) as well as the specific needs of WebPark. Java can be used to create all three units in a manner which is tightly integrated with the third party infrastructure. It also allows a single object oriented programming language approach and maximizes the amount of code that can be reused in different areas.

7.1.17 Interface specification for geolocation data stream to WebPark service (D.5.1.1)

This deliverable defines the interfaces (and their implementations) that comprise the WebPark solution to managing the storage and retrieval of a geolocation stream. The solution is implemented for a client side GPS solution. New drivers can be written for other geolocation streams (such as Galileo or network based solutions) as they become available. The only constraint is that the geolocation stream solution is available as a series of spatial references and associated time stamps.
All of the interfaces (and associated methods) have been implemented and were tested in the Swiss National Park (July 2003) and Waddenzee (October 2003).

7.1.18 User Interface Designs for Micro Browser Platform (D.5.2.1)

This deliverable focuses on the user interface (UI) for Location Based Services (LBS) to be offered by WebPark. In order to design the UI, research was done into three main aspects: 1) to identify micro-browser platforms to be used in the WebPark LBS; 2) to identify UI design guidelines for WebPark LBS according to the design rules and constraints of the chosen micro-browser; 3) to identify interface components for WebPark LBS. The results and conclusions of these research issues are design screens for the selected micro browser platform – the Pocket PC Internet Explorer. The UI screens are map centric: a cartographic display is reachable from every screen. Therefore, the screens for two WebPark LBS contexts are presented: the "Cartographic Display" and the "Mapping & Querying Display". These UI screens are design according to a set of usability guidelines.
An addendum reports the progress of the developments on user interface screens after the summer of 2003 testing campaign in the Swiss National Park and winter of 2004 testing campaign in Texel (Holland) and in the Swiss National Park. The first chapter presents the evolutions in UI designs and also describes, locally (for each significant change in each screen), the reasons for the changes. The second chapter shows the final status of the UI screens in terms of navigability (i.e. how to reach some functionality among the several existent UI context screens). This chapter also presents some comments about future developments. The third chapter presents conclusions. Finally, an annex with all screens organized by UI context (applications in the terminology of the WebPark system) is added.
Main conclusions:
It is assumed that WebPark LBSs behave like PDA applications: they launch quickly and the interface should implement an event model that allows immediate feedback. This will be achieved with the Microsoft Pocket Internet Explorer micro-browser. It implements standard browser interface components such as the back button, stop/refresh button and the home button, which are not replicated in the UI screens. UI screens are guided by two types of guidelines: micro-browser platform-specific constraints and guidelines that are standard across platforms for usability.
Since the initial prototyping phase presented in the first part of D5.2.1, a second UI design was created. The UI has evolved since the 1st summer testing campaign, to make it more intuitive and easier to use. The basic objectives were:

- Minimizing need of text;
- Maximizing use of buttons;
- Increasing the size of the buttons in order to allow the use of fingers.

The main change is that the UI interaction model changed from choosing from tiny items in the drop down menu to touching larger buttons, by developing menu pages with big touchable buttons on the pages. It allows navigating between pages in a more adequate interaction model for small screen devices. As future developments some UI widgets like a measure tool for the map display and a UI screen legend for the map are planned. Further UI enhancements like how the user interface should be adapted for left-hand writers and disabled users should also be considered.

7.1.19 Web Portal Design (D.5.3.1)

This deliverable deals with the design principles for the Web Portal, the software infrastructure for the WebPark services. WebPark services are meant for mobile users in protected areas. This

specification puts several constraints on the hardware and software architecture. The goal of this report is to state these constraints explicitly and to assert design choices for the Web Portal of WebPark services.

Constraints
Since the user is mobile, the communication with WebPark services is wireless (GPRS/UMTS). The type of area targeted by WebPark services are protected areas, which means partial coverage for wireless communication. To cope with this partial coverage condition, WebPark services should not rely on fulltime permanent connection (see first testing session in Zernez), not even on constant bandwidth. Since the user is mobile and pedestrian, the devices used are palm-sized. So WebPark services can rely only on limited resources and computing power from the user terminal.

Design choices
For permanent connections and thin clients, the success of the internet proves that Web Applications are a good architecture. These applications use HTML for the user interface, rely on omnipresent Web Browsers (any platform has a decent Web Browser nowadays), and they can have several architectures for server-side processing, for example the well-known J2EE architecture. However, this architecture was not designed to cope with intermittent connections. So the WebPark portal cannot be a standard Web Portal. On the other hand, it would be too much of an effort to design a new architecture for the WebPark portal. The WebPark portal should stay as close as possible to the usual design pattern of standard online Web Portals, in order to leverage skills, tools and expertise of all partners. The WebPark portal is therefore designed as a two staged J2EE architecture.

7.1.20 Micro-Payment Processes / Web Portal Interface Specification (D5.4.1)

Visitors to recreational / protected areas should be able to access park-related geo-information that is pertinent to their personal interests, so as to maximize the quality of their experience as well as their personal safety. To deliver the best geographical information service on mobile devices, the WebPark project intended to make use of payment services to add supplemental premium information based on the users' personal information to give added context to the WebPark geo-information. For these added-value services, WebPark will need to implement a billing system. Bearing in mind the associated privacy / security issues, as well as the economics of WebPark services, both detailed in related reports, this deliverable draws up an inventory of various mobile payment systems, selects one appropriate to the WebPark project, and suggests a functional framework for the implementation of the selected system.

7.1.21 Test planning (D.6.1.1)

This deliverable provides the design and specification of the users tests performed in the Swiss National Park and in Ecomare in the Wadden Sea area. The testing area, testing group, the test setup and the logistics are described here. Aspects that have been tested were:

- Use of geo-information on small screen:
  - Test of user interaction with the services available on the screen, visibility (general, sun, rain, dependent on actual weather conditions), size of device, size of display, size and resolution of displayed data;
  - navigation through applications and information content;
  - general ease of operation, is the navigation built up logically for the user? is the information easily to get to and relevant to the respective user?
- Testing of applications;
- Mapping application;
- Cartographic display, zoom and pan functionalities, display of POIs with additional multimedia information, possibility of changing POI selection criteria, bookmarking functionalities;
- Trekking & Hiking application;
- Display altimetric and planimetric view of chosen route, time to go, time from start, current altitude, actual position;

- Species application;
- Search for species of fauna and flora, search for projects with relation to species.
- Add observations as bookmarks;
- Geographic bookmarks application;
- Built-up database of spatio-temporal reference points for individual or group usage, add, push, navigate or browse personal, reference or route bookmarks;

7.1.22 Testing and validation (D.6.2.1)

The technical and user-perceived qualities of the WebPark system have been validated three times during the summers of 2002, 2003 and 2004 at two European trial sites, the Swiss National Park (SNP) in Switzerland and the Dunes of Texel National Park in the Netherlands. This deliverable reports on the testing and validation at both trial sites. It includes an analysis of reasons for acceptance and rejection of the system by users.

7.2 Data preparation tools

At the end of the project, data preparation tools were developed to ease the preparation of data for WebPark. Although WebPark is able of using data in different formats, by now means any data is suitable for use.
Figure 1 shows the steps that need to be taken to make data useable for WebPark.

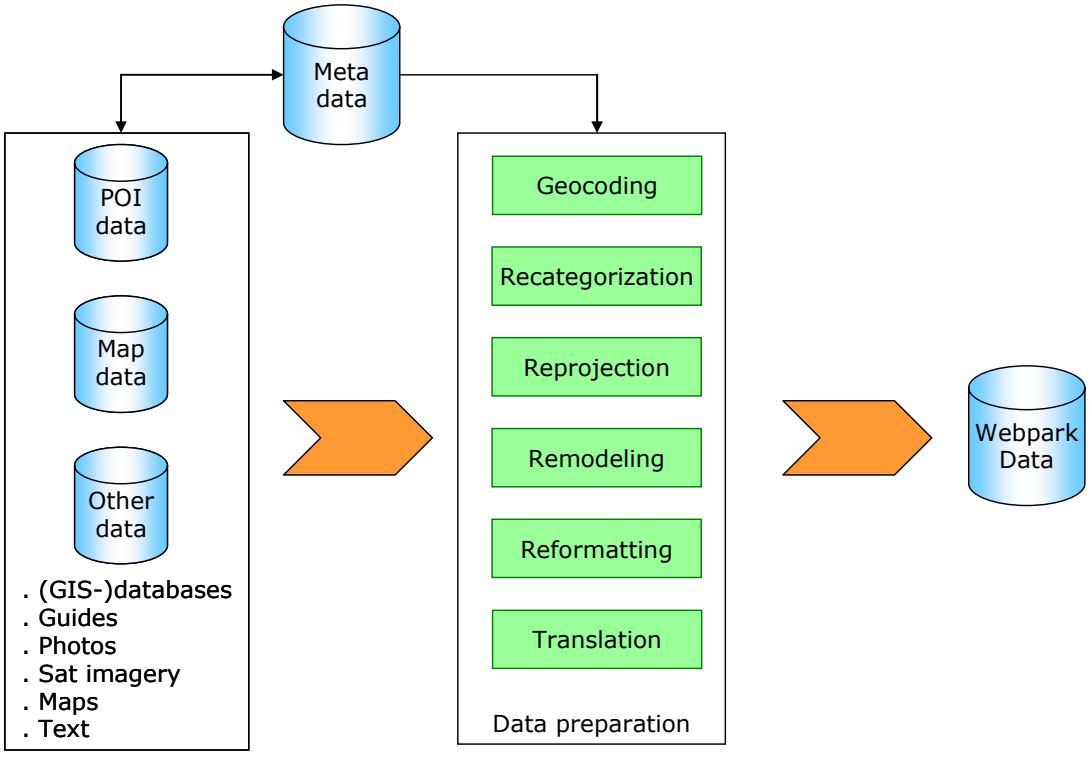

Figure 1: Layout of the data preparation process.
Geocoding refers to the process in which non-localized data are put on the map. Often the address of points of interest can be used to this purpose.
Recategorization refers to the process of classifying features into a number of hierarchical categories, to support search and browse functionality. Because data from different sources are used, all using different categorization schemes, one overall scheme need to be devised and all data needs to be fitted into that one scheme.

Reprojection refers to the process in which maps are converted to one and the same map projection and datum.
Remodeling is the process to make the data model of all the input data sets equal, so they can be merged into the same database.
Reformatting is the process in which data from different sources are converted to one and the same data format (i.e. an Oracle database), and data items are formatted in a uniform way (i.e. telephone numbers are formatted in such a way that they can be dialled by clicking them on the screen.
Translation means that all information needs to be made available in four different languages (English, German, French and Dutch).
Metadata can be used to (automatically) control the data preparation process.

The project has shown that the original idea of WebPark tapping from generic information sources is far from reality. Such sources and the G-commerce infrastructure needed to exploit and maintain them simply do not exist yet. This is probably the point where WebPark stayed farthest away from its original goals, formulated in one of the objectives of work package 3: "WebPark will work with G-commerce data suppliers on a fully commercial basis to obtain and resell GI content" (see paragraph 3.3). In practice, all data had to be prepared by the WebPark team from various sources that were not designed for this purpose. The data preparation as carried out for WebPark is further described in a document from GIUZ:

1	WP_3200_DataProcessing v02.doc

The data preparation process is expensive because it is labour intensive. After some time, recurring tasks within the process begin to emerge, and tools were developed by the City University staff to automate these steps. The objective was to create tools that could be used by park employees to update and expand the initial data sets, in that way making these organizations less dependent on external data providers. These tools were not foreseen in the project plan, so there is not deliverable associated with them. The tools are described and documented in:

2	WP_Structuring_Data_dmm_v05.doc
3	WP_Using_GIS_for_Mobile_Datasets_idg_v01.doc

8 Outlook

8.1 Benefits and intentions for further use

The knowledge that Geodan gained in the fields of data preparation, WFS configuration, web mapping, mobile online working, device capabilities, application possibilities, the PocketPC platform, the needs of users, and many more, will be used in many of the applications the Geodan Mobile Solutions is producing for the growing market for mobile applications. The benefit of the WebPark project for Geodan was the possibility to explore technologies and markets that could not be exploited commercially at the time. Together with the Camineo spin-off company Geodan will carry out a follow-up project for the Ecomare test site, where an improved version of WebPark will be build before the summer of 2005. Practical issues like the rental and maintenance of devices will also be dealt with in this new project.

City University London is developing a LBS platform for research use in future projects. With WebPark, CU staff has gained considerable expertise in all aspects of such a platform, like spatiotemporal knowledge discovery, geographic relevance, LBS and mobile computing. WebPark has led to opportunities for further dissemination of CU's expertise through articles and presentations at conferences. With the expertise gained during the WebPark project, CU has successfully gained funding for two further LBS projects with industry and academic contacts. The WebPark project members formed a highly competent team with excellent working relations. A large number of long term working relationships were formed that will without doubt result in the production of journal articles and further projects. City University has already made great progress with the implementation of WebPark in Dartmoor National Park.

Swiss National Park has gained a deep knowledge of the user needs and reasons for acceptance or denial of location based services. To the public, SNP became not only just a wilderness area, but also an organisation with innovative and progressive ideas. Moreover, the multimedia and GIS data already in use have been evaluated with respect to its fitness for mobile applications and location based services. Overall, the IT-department of the SNP benefited from the expertise of the other partners. This knowledge will be shared with other parks in the future, as the SNP will be a reference for LBS in these areas. The board of SNP has decided to maintain the prototype of WebPark for the next three years and will offer the service to the public. The dissemination of WebPark in Switzerland was successful: the system of SNP will be sponsored for the next two years by Hewlett Packard Switzerland GmbH (devices) and Swisscom (mobile network).

In Portugal, LNEC is assigned the task of making contingency plans for several types of emergency situations, like dam bursts and floods. LNEC investigates systems that will help avoiding emergencies by efficient collection of information in the field, and also systems that will support dealing with emergency situations. With the knowledge that was gained about the use of GPS in combination with GPRS/UMTS, LNEC will develop tools for inspections of hydraulic structures, such as dams, dikes, pipes, channels, etc. Using such tools, LNEC's databases can be updated by technicians in the field with information about the status of those structures, while at the same time field workers can access online information about the structures. If disasters do occur, there is a high demand for instant information, coordination of teams, knowledge of their whereabouts and putting locations of people and resources on the map in real-time. Though the field of application is quite different from WebPark, the underlying technology is similar.

The use of different types of map for different types of information and usage scenarios suggest that different user groups have different preferences for portrayal. Exploring the relationships amongst these variables as well as the strategies adopted by users for using portrayal types selectively to navigate heterogeneous information sources will be the subject of future research of GIUZ.

8.2 Possible evolution of the system

Systems similar to WebPark can be spotted on the market today: systems to support golf players, skiers, mountain bikers, tourists. Also, more and more types of smart phones can be bought these days. This clearly shows the market for mobile applications is opening up. WebPark will fully benefit from this development, setting off with a head start given by all the results of the WebPark project. Since the system that was developed during the project is in fact a prototype, it will without doubt go through a rapid evolution. A new version is already planned for summer 2005 for the Ecomare test site in the Netherlands. This version will have to function in a real production environment, which means that much attention will have to be paid to improvement of the usability and robustness of the system. Rental and maintenance services for the devices will be set up, supported by the local tourist industry. An important feature of this new version will be the full integration with the content management of Ecomare's own visitor information system, which now supplies information to visitors and tourists through several fixed information points with touch screens. This certainly is a move into the desired direction in which mobile applications can tap from location based data services that are more or less independent of the devices and applications. At present these data services and the underlying geo-information value chain are still uncharted territories, but they will without doubt come into existence in the coming years. When they do, systems like WebPark will become everyday utilities that will be used on a large scale.

9 Lessons learned

Management
A project like this needs both organisational as well as technical management. Skills for both of these types of management are seldom combined in one person. It would therefore be good to have two project managers: a technical manager steering the technical development, and an organisational manager to control the process of the project. These roles should be explicitly assigned to project staff.

Crises
A multidisciplinary and international project like this has to go through critical phases. The first one was in 2002, when after about a year still no agreement had been reached on how to actually build the platform that could meet the expectations. Time for debate was running out, and it took some brave decisions to cut the knot and start working with software components that were available and could be used as a starting point for further development. The second crisis occurred by the end of 2003. An application had been built on the proposed architecture, but its poor stability, speed and usability rendered it practically useless for real users. During the summer testing, we receive much criticism about the system. SNP stated that it would not expose its visitors to prototypes like this anymore. Instead of accepting the fact of life that prototypes are not meant for real use but just for the demonstration of concepts, the technical team came together and in a joint effort produced a new version that actually did perform as a real system. It took many nightly hours of the team over a period of several weeks in Zernez to accomplish this feat. This version was tested in the summer of 2004 by about 100 different users without major problems. Crises can thus be overcome if the spirit is right. This stresses the importance of creating a coherent team.

Data and data services
The age of freely available data services is not yet there. Data had to be specially prepared for WebPark. There is no infrastructure of G-commerce data suppliers that sell GI on a commercial basis. There is no metadata based data discovery. Now that more and more handsets capable of tapping into such services are being used, this is becoming a bottleneck, and a challenge. The collation and management of diverse and heterogeneous data sources required to provide high quality services in this environment entailed a great deal of time and many technical, conceptual and administrative issues which could not be solved with a single generic (metadata) model or workflow. Such demands should not be underestimated when designing such a project.

Mapping
Cartographic information on a small screen device has to be generalized to make it legible. It was found that if the information is divided into static and volatile (dynamic) types (base map data and foreground thematic information respectively), different strategies can be applied allowing real-time and client-side graphical generalisation.

Map generalisation
Retrieval of information needs to be permanently available in spite of network connection issues. This requires different (model generalisation) techniques for representing the spatial properties of the information so that it can be spatially indexed and retrieved in a location sensitive way.

Unstructured sets of points were found to be the most common type of dynamically generated data, in response to LBS information retrieval. Real-time generalisation focusing on this type of data is therefore very important. The necessity for representing base map features during the generalisation to force some structure on these point sets was also recognized.

Capabilities of GPRS devices
The current devices appeared to be capable of running concurrently in multiple threads a thin web server, a number of monitoring agents and an application that interacted with the user. However, there was not enough computational power to run algorithms for the on-the-fly computation of the shortest path or what can be seen from a certain point in the terrain.

Development method
An iterative approach to usability, interface definition and application design, in response to continuous user testing is extremely useful for development because it allows user needs to be better represented, keeps development efforts focused and allows research questions to be posed without interference from usability difficulties.

Development priorities
Considerable technical effort is required to create a platform which can be properly validated through user testing and is sophisticated enough to ask useful research questions. This means that the time required for undertaking application design, development and optimisation, and data preparation and processing should not be underestimated in favour of activities that are more distant from the direct user experience, such as the development of server-side middleware.

Research goals
One of the goals was to test the application with real visitors. To be sure that the verdict of the users on the location based services would not be strongly biased by a failing, weak or incomplete system, a robust and convincing application had to be developed. This desire to develop an application that would be appealing to users conflicted with the research goals. The rapid prototyping and user feedback were good ways to produce usable tools in a short time frame, but they had a negative effect on the more innovative and fundamental research goals of the project. By always focussing on user needs in terms of performance, user interface and usability, research goals got lower priorities. Fewer journal and conference papers were released as a direct result of this conflict.

Use of standard products
The application framework (or platform, or architecture) was not readily available and had to be almost built from the ground up. This took its toll on other areas of development, like functionality and user interface, that could have been elaborated further when an existing platform could have been used. The amount of work needed to create a platform and a properly functioning user interface was probably underestimated.

Documentation
Whilst poor documentation speeds up the coding process for one developer, overall this slows down the process for the team as more people struggle to use the code. An agreed standard of documentation would have led to more rapid development progress.

Modern technology in the natural environment
According to the conservation principles of SNP, new installations of any sort in the area are forbidden. In the beginning of the project WebPark was seen as an unwanted intrusion by many of SNP staff and also by a fare share of the visitors. The project team has been able to take away that resistance to a large extent with a continuing process of open information exchange, discussion and demonstration.

10 Conclusions

The WebPark project is concluded in a successful way. It received a very positive review by the Commission, and the many tangible results will live on in the spin-off company Camineo. The future looks bright, as more and more mobile applications are emerging. Most of them however target the urban life. WebPark is special in that is aims at increasing nature protection awareness and supporting protected area management. The project was a good experience for the partners. The bonds that were created will without doubt lead to new co-operations in the future.

APPENDIX A
Workshop invitation

European Commission IST-2000-31041

WebPark

PARC NAZIUNAL SVIZZER

Newsletter WebPark – Final Workshop Zernez, 19 August 2004

Dear ...,

The EU-research project "WebPark - Geographically relevant information for mobile users in protected areas" closes at the 15th of October, 2004. On behalf of the project consortium, our team would like to invite you to participate in the final workshop of this project in Zernez, Switzerland. This event will take place on the 14th of September here in the National Park House.

During the course of this summer, many visitors tested the devices, of which three in total were available with two different trial routes – and still are. The technology was in use almost daily thanks to the enormous interest shown by park visitors. Numerous helpful suggestions provided by the users allowed a new and advanced version of the program to be successfully implemented at the beginning of August. In particular improvements were achieved regarding the interface, user interaction with the technology and the structure and accessibility of contents.

As a matter of course, we will additionally demonstrate the result of the application on the handheld computers in the field, and for any remaining questions the whole of the project team including all individual responsible partners and specialists will be at your disposal to provide competent and at first hand information.

Agenda

10:15	Address of welcome and introduction (German/English)
10:25 – 11:00	The WebPark concept: How to build a Location Based electronic park guide? (English)
11:00 – 11:40	From GIS databases to Location Based services (English)
11:40 – 12:00	Open discussion with participants
12:00 – 13:30	Lunch
13:30 – 16:30	Demonstration of the WebPark application in the field (in groups)
16:30	End of the event at the National Park House

The event is free of charge and includes the attendance of the presentations and the transportation into the National Park. However, for the journey, catering and accommodation is each individual participant responsible. We are happy to welcome you here at the National Park House on the 14th of September and look forward to meeting you soon.

Best regards, your WebPark-Team

R. Haller

Ruedi Haller (Swiss National Park)
Evert van Kootwijk (Project coordinator)

Information
More information regarding the WebPark project is available under www.webparkservices.info and http://www.nationalpark.ch/snpWP.html (here a flyer with a description of the project can be found)

Journey
Zernez can be reached within 2.5 to 3 hours from Zurich. Further information is provided by www.sbb.ch

Accommodation
In Zernez hotels with various price classes are available. Contact the local tourist office under 081 856 13 00 for more detailed information. Alternatively, hotels can be directly booked under www.zernez.ch.

Registration
To be able to arrange and coordinate transportation into the National Park, we would like to ask you to register until no later than 7.9.2004 via email at webpark@nationalpark.ch providing us with following information:

Surname
Name
Address
Institution
Email