ESPRIT Project N. 25 338

Work Package L
Periodic Progress Report
10/97 to 03/98

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Change History

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dl1.doc	draft	M. Breu	30.4.98

1 Summary of Key Indicators of Project Progress

The objective of the FollowMe project is to create a support infrastructure for mobile users. Users are enabled to connect to network-based services using a variety of devices and from different locations. The project will implement core facilities for the development of distributed mobile applications and a number of representative pilot services.

The project progress is measured against the planned results of the project. These are

1. a component **architecture** for distributed mobile applications that includes object mobility and distribution control, a framework for autonomous agent, and user access facilities.
2. an **infrastructure prototype,** providing a complete basic set of components for FollowMe application, to be integrated into marketable products for servicing mobile agents
3. two **pilot application** that demonstrate the architecture and the components,
4. a **public report** on the architecture, user needs, implementation guide, and the pilots.

The measures for theses results are the timely availability, and the quality of the intermediate deliverables and their benefit to support other work packages.

The project uses a spiral model to produce its results. I.e. each work package is cycling through its development process to allow gradual refinement and extension of the results.

The **architecture** is now available in a second version (deliverable DA1.2) as planned. It is based on the design documents fed back from the technical work packages. It structures the results of the work packages as a toolbox of complementary components to construct applications for mobile users. It lists the design patterns that are developed in each work package. All partners have contributed to the architecture, formally reviewed the document, and will use it to base their implementations onto it.

For the **infrastructure prototype** there exists now a set of design documents (deliverables DB3, DC2, DD3, DE3, DF3, DG3, DH3) and also interface specifications (DB4, DC3, DD4, DF4, DG4, DH4). The design documents have stabilised now. The interface specifications may undergo some further revisions during the further project. The second release of the mobile object workbench (MOW) is available. Each deliverable was mutually reviewed by another partner. The MOW is in use by each partner to built first experimental examples.

Both **pilot applications** have ended their requirements capturing phase as planned (DI2, DJ2). The requirements have been used to align the design of the basic components. First design concepts for the pilot applications were started.

The production of the **public report** has not yet started. The architecture description (DA1.2) will serve as a backbone for this report. The other deliverables will be adapted and included during the further progress of the work.

The partners have agreed on the intellectual property rights (DK1) with the signing of the consortium contract. A first draft of the consortium exploitation plan (DK2) is under preparation.

Overall the project is on schedule. Experience showed that the spiral approach is working, however the iteration through the implementation cycle will also include refinements on design and interface specifications. The planned results are on target. The project team is under full operation and has established a close interaction through a set of project meetings. A formal review process of the deliverables ensures an accepted level of quality and a common understanding of the project achievements.

2 Project Progress

2.1 Management Information

The project is organized in a series of technical work packages (WPs). WP A was the focal point for the development of the architecture. The work packages B to H producing one component of the FollowMe framework (see

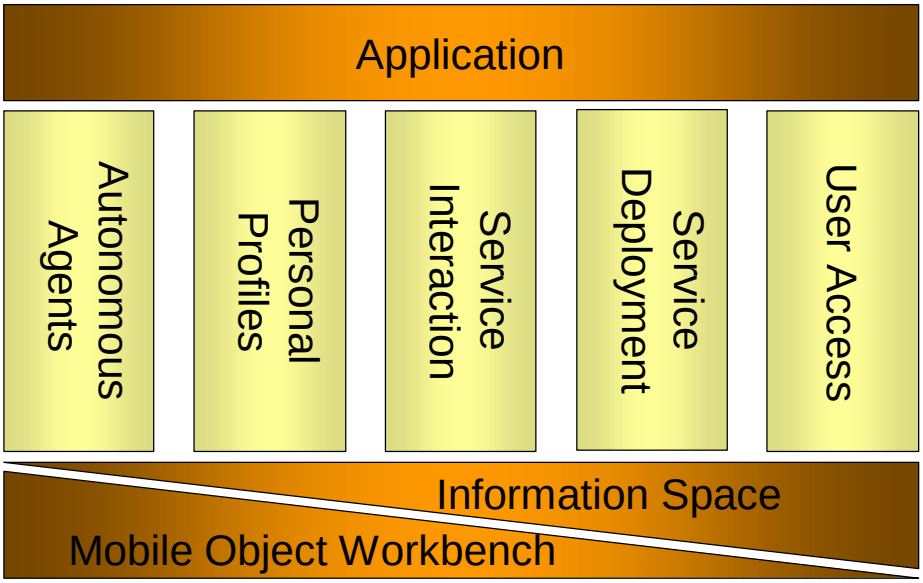

Figure 1).

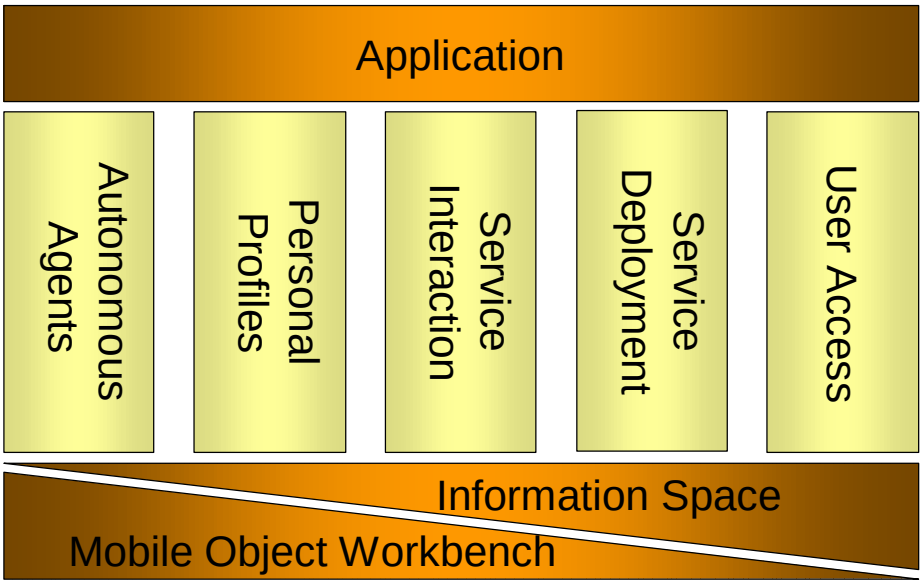

Figure 1: FollowMe Framework

The foundational components are the mobile object work bench and the information space, developed in work packages **B**: Mobile Object Workbench and **C**: Information Spaces respectively. Sitting on top of these two components are the extension components that provide additional, commonly needed, capabilities that can be utilised in building applications. These additional capabilities are provided by autonomous agents, personal profiles, service interaction, service deployment and user access delivered from work packages **D**: Autonomous Agents, **E**: Personal Profiles, **F**: Service Interaction, **G**: Service Deployment and **H**: User Access.

The Pilot Applications **I** and **J** are build on top of the framework.

Finally there are two further non-technical work packages **K** (Exploitation) and **L** (Project Management)

The following subsections describes the results and progress of the individual work packages in detail.

2.1.1 WP A (Architecture)

The initial architecture effort went into developing a common understanding of FollowMe concepts. Deliverable DA1.1 (internal report) defined the core object concepts of Mobile Objects, Places and Agents. It identified the scope of and relationships between the work packages.

The architecture effort in month six went into examining the designs that the work packages had produced, and generalising the results. The design components from the work packages provide more than a single ‘FollowMe System’; they provide a toolkit of design patterns and implemented components which may be usefully reused across a range of application development projects.

The FollowMe architecture document DA1.2 therefore defines a meta-architecture for mobile applications. It uses the concept of design pattern to present the results of FollowMe. The basic patterns provide a vocabulary for discussing objects, distribution, reflection, mobility and storage. The foundational patterns relate the most general patterns for mobility and

storage to the components provided by the Mobile Object Workbench and InformationSpace work packages. The Agent Framework patterns present the key ideas of the Autonmous Agents, Personal Profiles and Service Interaction work packages. The extension patterns present the tools provided by the Service Deployment and User Access work packages. The application patterns generalise the information provider architecture and agent interaction frameworks of the pilot application work packages.

2.1.2 WP B (Mobile Object Workbench)

The Mobile Object Workbench (MOW) extends the standard "sea of objects" abstraction of distributed computing, with the facility for objects to move from host to host. The MOW provides facilities for encapsulating groups of object into clusters to enable them to be managed as a unit. Within a cluster, object communicate using standard Java method invocation. Between clusters, objects communicate using remote method invocation. It is transparent to a client object if a server object has moved since it was last accessed. This transparency is supported using a distributed relocation service that is scaleable and secure. Clusters may be considered as 'virtual processes' and security mechanisms ensure that clusters have restricted access to operating system facilities, and that clusters may restrict access to themselves by other clusters. Clusters are autonomous in the sense that they have sole control over their movement, however a 'place' in which a cluster resides, may forcibly terminate it.

APM has deployed an implementation of the Mobile Object Workbench that supports cluster encapsulation, mobility, location transparent communication and access to the Abstract Windowing Toolkit, as an example of an wrapped operating system resource. Currently, APM is developing security mechanisms, including a 'Java Security Manager' like mechanism for restricting access to Java/OS facilities on a per-cluster basis, Secure communication using SSL, and mechanisms for ensuring the integrity and confidentiality of data within mobile objects that pass through untrusted hosts. These mechanisms have been designed and prototyped, and are currently undergoing implementation.

Reports on the software, deliverables DB 7.2 and 8.2, are on schedule for the end of April.

2.1.3 WP C (Personal Information Space)

The InformationSpace work package (formerly 'Personal Information Space') will provide transparency mechanisms to give mobile users and distributed clients consistent logical views of their information. It will implement persistence transparency ('robust objects') and a range of migration and replication transparencies for robust objects.

The design has two principle layers. The low level Store and Directory abstractions allow object to be saved onto a storage area (an abstract file system or database). The high level object managers control invocations on 'live' information objects, transparently saving the object back to storage after an invocation. Object managers can be extended with algorithms for concurrency control, transaction management, object migration and replication.

A first implementation of the file system (or 'black box') model for object storage has been written. This allows objects to be sent and retrieved by value to the store. Test code, a demo with a distributed client and server, and an InformationSpace browser have been written.

The code will be released together with the next version of the MOW, mid April. The document deliverables, DC 1, 2, 3 and 6.1 (Requirements, Design, Interfaces and Report) have been published.

2.1.4 WP D (Autonomous Agents):

The Mobile Object Workbench (MOW) provides the infrastructure necessary to support the creation and movement of Java objects from Place to Place. The Autonomous Agents work package is developing the components necessary to create specific Task Agents which can carry out tasks on behalf of users and continue those tasks whilst moving across the network and independently of the user's location. Agent systems have generally used scripting languages to describe agent behaviour and a number of scripting languages were surveyed at the start of the project. The JavaScript language was eventually selected as an ideal technology because it could be used directly in web browsers and in conjunction with Java. It has also recently become an open standard (ECMAScript). Conclusions that may be drawn from the Survey and Requirements phases of the Autonomous Agent work package are that there are many examples of autonomous agent like systems available (Aglets, Concordia, etc) which enable agent like entities to be constructed and are capable of exhibiting autonomous behaviour with mobility but these systems lack a framework to construct systems of any complexity.

The solution in FollowMe is the creation of a Task Agent which is created automatically for the user to perform a certain function. The creation of a Task Agent is a bootstrapping process which depends on the existence of a Personal Assistant. The Personal Assistant acts as a mediator between the user and a set of Task Agents. A Task Agent factory is used to create specific Task Agents based on Service Profiles which have been returned to the Personal Assistant by a Trader. The intention is for service providers to provide generic components which can be turned into Task Agents by the user without having to program them.

The deliverables DD1 to DD4 were produced.

2.1.5 WP E (Personal Profiles):

The personal profile is intended to hold a range of information relating to the individual user. Some of this information will be facts about the user, the profile will also hold information about the location of the user at given times so that e.g. User Access can locate them to deliver information or service deployment can be planned. Fairly early on in the project it was recognised that there was a strong requirement for a diary object to complement the profile.

The survey looked at the work of a number of organisations and consortia for storing of profile information and Versit's vCard and vCalendar were identified as candidate approaches. The eXtensible Markup Language (XML) was targeted as the most suitable language in which to express profiles; both vCard and vCalendar can be easily mapped onto XML. The advantage of XML is that it is extensible; the syntax of XML can be extended arbitrarily by the use of Document Type Declarations (DTDs).

The design (DE3) of the personal profile was completed in February and implementation is well underway.

2.1.6 WP F (Service Interaction):

The vision of agents roaming the Internet and connecting to arbitrary services is appealing. However, most services are designed to be used by humans rather than autonomous agents. Whilst it is possible to publish interface specifications to services, using a standard such as the Common Object Request Broker Architecture (CORBA) Interface Description Language (IDL), the construction of suitable clients is usually a manual task either because of the complexity of the service interface or of the information returned. The IDL merely describes

the interface signature, *not* its behaviour. The scope of the Service Interaction work package was to investigate the boundaries of this problem and to propose and implement a solution that provided for close integration with the design of the Autonomous Agents work package.

The requirements phase concluded that there is a general set of use-cases which can be applied to any type of service to be interacted with. However, it is up to the service provider to take these general use-cases and use them as a basis for specifying the requirements specific to their service. This is why the Service Interaction work package and Autonomous Agents work package are closely interrelated.

The solution described in the design deliverable DD3 recognises the problem of constructing autonomous clients to arbitrary services by encapsulating the description of a suitable client as an executable script which the Autonomous Agents work package can process by a suitable factory. The factory then creates an agent that can move to and connect to the service. This is similar in concept to the idea of supplying a Java Applet that can connect to a CORBA service or even to a web browser launching a suitable helper application when a file of a known MIME type is received. The meta-level service description, or service profile, contains the interface description to the service and the service contract and is described using XML. DD3 therefore contains a proposed IDL/XML mapping.

2.1.7 WP G (Service Deployment)

The Service Deployment work package provides a set of mechanisms that can be used by FollowMe applications in order to enforce the quality of service they provide to end-users, whatever are the users' locations. Two types of problems may impede the efficiency of large scale, information-oriented applications such as the ones that can be developed on top of the FollowMe infrastructure. The first problem is caused by the large variance in the time taken for transferring data from individual information sources, and also by the large variance of workload imposed on nodes that can potentially be used for the deployment of a distributed computation. This first problem is tied to the overall performance of the underlying layer supporting applications; in contrast, the second problem is caused by the difficulties for an application to anticipate on the queries submitted by users, and therefore to anticipate the contents and the volume of data that must be returned to users. In addition, the context of nomadic computing makes difficult for applications to determine the final physical destination of data, that is, the path data ultimately follows between the data provider and the user terminal. Taken together, all these problems deprive applications from determining an appropriate scheduling for data and computation movements. This results in problems for globally balancing the load of the system.

To address the above problems, the Service Deployment work package provides tools that fall into two broad categories: (i) monitoring tools and (ii) knowledge discovery tools. These tools are designed to be used as a foundation for getting the required knowledge about resource consumption (in the large) thereby allowing load-balancing strategies to be implemented within applications.

The monitoring tools provide various quantitative information, each reflecting the usage of a particular resource like the CPU, the memory, the disks or the network links. The gathered data is typically accumulated into profiles on which several complex and customised filters (e.g., averaging, smoothing, etc.) can be applied to return meaningful results to applications. It is possible to configure the monitoring tools to further return additional, more sophisticated information. This includes predictions of possible behaviours of the monitored resources in the short term, based on all the gathered information that form somehow an history of past

performance. Predicting a possible performance-related behaviour for the resources is, for instance, interesting to plan in advance, to anticipate and to better schedule bulk-transfers at specific times for example. In general, it serves to enforce the quality of a service and the balancing of the load.

Knowledge discovery tools are used to extract significant knowledge, regularities, specific patterns and high-level information from a large amount of data. In the context of FollowMe, knowledge discovery tools will be extensively used in order to extract valuable information from the data stored in the profiles of users. In general, knowledge discovery tools will be used to discover groups of users sharing a specific pattern like geographical location, accessed services or type of requests (keeping track of typical and frequent requests in the profiles enables anticipating requests and the prefetching of data). Once groups have been determined, it is possible to assign each on the server(s) that is (are) best suited for that group, thereby achieving load-balancing between servers.

WP G has produced a survey document that looks at several existing tools for monitoring resources and investigates data mining tools for discovering knowledge. WP G then have delivered a requirement document that describes the needs for profiles in which resource-related consumption information can be kept. It also introduces the notion of an history of performance and ways for building composite tools of an increasing complexity by aggregating elementary tools. The design (DG3) of these tools is complete, an initial interface was published and the implementation is underway.

2.1.8 WP H (User Access)

The need for an infrastructure that enables the communication between mobile users and their mobile agents through a variety of different media is evident. The user access is a component of the FollowMe architecture that provides standard means for agents to interact with the user. Both off-line interaction with users via e.g. fax or SMS and on-line interaction e.g. with a web-browser is provided.

Main requirements of the user access component are

- the support of java-enabled and non-java-enabled devices via common interfaces,
- the provision of a generic mark-up language to describe the contents and the layout of the rendered documents, and
- mechanisms to adapt the transmitted information and layout (i.e. the quality of service) to the performance of the system.

A survey (DH1) on the availability of java-enabled devices like fax, telephones, or PDA showed in October 97 that such devices would not be on the market in time to serve as a reliable basis for the pilot applications. Therefore the scope was extended to support also non-java-enabled devices for output. This required more effort in the requirements and the design phase.

As a generic mark-up language XML was chosen to describe the contents of documents in combination with the extendible style definition language XSL. This allows to separate data specified together with its structure in an XML file and its layout in an XSL file. In XSL an appropriate layout mode for an output device with specific capabilities can be selected.

The layout mode is the key to the adaptation of the quality of service. The quality of service module can select an appropriate layout mode to define the quality of the information (e.g. color-picture vs. b&w-pictures).

The requirements document (DH2) was delivered end of January. A first stabilized version of the design document and an interface specification (DH3 & DH4) is available since end of March.

2.1.9 WP I (Pilot Application Bavaria Online)

According to the overall project timeline, the major goals for WP I "Pilot Application 1" for the first six project month were to identify two specific pilot services within two different application domains, to describe the system requirements for these services and to plan the development and deployment of these services within the Bavaria Online citizens network.

One of the first steps on our way towards achieving these goals was to decide about the basic nature of these services. Since one of the core aims of FollowMe is to provide mechanisms that assist the mobile user in his everyday information management, this work package started by developing an overall agent-based architecture framework for automated, user customizable information retrieval systems. The architecture was discussed with project partners responsible for the technical work packages and it was agreed on using the upcoming standard of XML/XSL to describe data objects within our agent systems (e.g. profile data, service specific data like stock and regional event information).

On top of the overall application architecture framework we decided to implement a service that supports the management of a stock portfolio and a service that provides the user with up to date information on all kinds of events taking place in the user's geographical region (cinema, markets, exhibitions, concerts, etc.). These application domains where identified in close cooperation with our project partners in the Bavaria Online citizens network, who ensured us that services in these domains are of interest to a significant percentage of the Bavaria Online users.

To determine what should be the core features of our services we did a survey on what kind of services in the domains of stocks and regional event notification are currently available on the Internet. The results of this survey are documented in the project internal deliverable DI.1 (Dec 97).

A close communication channel to our partners in the Bavaria Online citizens network, was established through a contact manager. Together with the partners from the citizens network we identified five Bavaria Online nodes that committed to actively participate in the deployment of the FollowMe pilot services at their sites. She also helped us in defining a data structure for regional events by surveying the interests of the average Bavaria Online user.

Finally we did a detailed system requirements analysis by describing all system use cases and required system components and by providing component interaction diagrams and sequence charts. The results of this work can be reviewed in the project internal deliverable DI.2 (Mar 98). Preliminary versions of this document where frequently sent to the other project partners to ensure a common understanding of the requirements of our work package with respect to the underlying mobile object and agent technologies.

Taking the requirements specification as input, we already started with the detailed design specification of our pilot application. We also started experimenting with the code that was delivered by the technical work packages.

2.1.10 WP J (Pilot Application Etel++)

The creation of an online version of Ouest-France (which is the largest regional daily newspaper in France) was initiated in October 1995. It is called ETEL. The ultimate goal is to offer to subscribers, around 1999, an online access to Ouest France, with value-added features like personalization, multimedia, gateways to related services, access to archives, digest of news, etc.

The FollowMe infrastructure provides good opportunities for enhancing ETEL since it offers support for mobility, service deployment, multi-terminal access and a support for agents, leading to the ETEL++ pilot application. Agents are useful for breaking down the traditional client-server model on which ETEL is based. Agents increase the level of autonomy of the various components of the system, and may help when the scale of the system will grow. In addition, agents can be used to discover services that match user interests. This is particularly useful when the information to deliver is impacted by the actual location of the user: agents can be used to discover a German weather forecast service when a French user consults his personalized edition from a German town.

In addition, mobility of data (and code) is a good basis for an efficient deployment of the service. The physical deployment of ETEL++ is based on three entities : (i) the Ouest-France server, (ii) a set of several secondary servers referred to as FollowMe Places and (iii) finally user terminals. Computing the electronic version from the raw (paper-oriented) data can take place either in one of the entities, or in any combinations of these. Close interactions with WP-G are required to determine a good placement for data and computations to minimize response times. To opportunistically decide upon data and code movements, ETEL++ needs to have a detailed view on the performance of the infrastructure, which is offered by WP-G tools.

WP J has produced a survey document (DJ1) that describes the current work in electronic press services. It details the specificities of electronic press services with respect to traditional paper-based newspapers and presents both ETEL and ETEL++. WP J released a requirement document (DJ2) for ETEL++. The design of ETEL++ is well advanced.

2.1.11 WP K (Exploitation)

With the consortium agreement (DK1) the intellectual property rights (IPR) have been clarified. Simply speaking, each partner keeps the IPR on that parts of software it develops. The other partners can use them.

Also a first common draft exploitation plan (DK2) was compiled (see section 4).

2.1.12 WP L (Project Management)

The task of the project management in the first six months was to start-up the project and to establish a technical and organisational infrastructure for the project team.

The technical infrastructure consists of

- a set of email exploders for the project team, the project board, etc.
- a project logo
- a web-server based on Hyperwave for the external visible project home page, and as a project internal repository of project results and deliverables.

- an electronic discussion board.

For the start-up an intensive series of monthly and bi-monthly project meetings was organised to build up and sustain a joint understanding of the project and the responsibilities.

The organisational infrastructure includes a monthly reporting scheme from each work package to the project manager and an project report of the project manager to the project team and the project board.

The project status is reported every 3 month to the CEC.

2.2 Project Meetings

The following project meetings took place. Minutes and/or slides are available on the project server.

Date	*Location*	*Meeting*
15th/16th Oct. 97	Munich	Project kick-off meeting (all)
29th Oct. 97	Bristol	Integration of APM and UWE work packages (APM, UWE)
30th/31st Oct. 97	Rennes	Technical meeting ETEL requirements and User Access (INRIA, TCM, FAST)
10thNov. 97	Windsor	MOW and Agent integration (APM, UWE)
17th/18th Nov. 97	Bristol	Technical project meeting (all)
11th/12th Dec. 97	Munich	Technical project meeting and board meeting (all)
3rd/4th Feb. 98	Cambridge	Design walkthrough of MOW (APM, UWE)
26th/27th Feb. 98	Rennes	Technical project meeting (all)
22nd–24th April 98	Cambridge	Technical project meeting and board meeting (all)

2.3 Roster of Personnel on the Project

The following staff members contributed to the project.

Company	*Name*	*Role in the Project*
APM	M. Bursell	Architecture and Mobile Workbench
	D. Donaldson	Architecture, MOW and Personal Information Space
	D. Franklin	Architecture and Personal Information Space
	W. Harwood	Architecture and MOW

Company	*Name*	*Role in the Project*
	R. Hayton	Architecture and MOW
	A. Herbert	Chief Architect
	R. Chiltern	MOW
	J. Cooper	MOW
	M. Madsen	Internal Review
	T. Ugai	Security
FAST	M. Breu	Project Manager
	L. Gebauer	Contact Manager, Bavaria On-line
	R. Haggenmüller	Project Coordinator
	H. Nandasena	Project assistant
	S. Pöllot	Full time software engineer
	A. Rajakarunana-yake	Software engineer
	H.-G. Stein	Work package coordinator WP J
	A. Sindermann	Full time software engineer
	E. Triep	Work package coordinator WP H
INRIA	L. Amsaleg	Full time engineer, works on ETEL++
	M. Banatre and V. Issarny	Project leaders
	M. Billot	Full time engineer, work on WP-G
	P. Couderc	PhD student,works on mobility of documents
	A-M. Kermarrec	Researcher, works on mobility of documents
	J-P. Routeau	Engineer, helps in building the bridge between ETEL and ETEL++
TCM	M. Le Nouy	Engineer, works on Etel++.
	C. Philibert	Project leader ETEL, Etel ++ , and management board,
	B. Toullier	Engineer, works on Etel++,
UWE	S. Battle	Software Engineer and Research for WP D, E and F
	L. Bull	Project Mentoring for WP D, E and F
	N. Taylor	Software Engineer and Research for WP D, E and F
	J. Tidmus	Software Engineer and Research for WP D, E and F

Company	*Name*	*Role in the Project*
	M. Yearworth	Work Package leader for WP D, E and F, FollowMe Management Board and Project Management at UWE

3 Deliverables

The following list of deliverables show the status of each deliverable as of 31/03/98:

Deliverable	*Name*	*Type*	*Month*	*Status*
DA1.1	Architecture Report	Report	2	Internally available[1]
DA1.2	Architecture Report	Report	6	available
DA1.3	Architecture Report	Report	12	
DB1	Survey	Report	1	Internally available
DB2	Requirements	Report	2	available
DB3	Design	Report	3	available
DB4	Interface Specification	Software	3	available
DB5.1	O/S Objects	Software	4	available
DB5.2	O/S Objects	Software	7	
DB6.1	Object Locator	Software	4	available
DB6.2	Object Locator	Software	7	
DB6.3	Object Locator	Software	9	
DB7.1	Mobile Object Workbench	Software & Report	4	available
DB7.2	Mobile Object Workbench	Software & Report	7	available
DB7.3	Mobile Object Workbench	Software & Report	9	
DB7.4	Mobile Object Workbench	Software & Report	12	
DB8.1	Mobile Data Object	Software & Report	5	Internally available
DB8.2	Mobile Data Object	Software & Report	7	available
DB8.3	Mobile Data Object	Software & Report	9	
DC1	Requirements	Report	3	available
DC2	Design	Report	4	available
DC3	Interface Specification	Software	5	available
DC4	Object Sharer	Software	9	
DC5.1	User Authentication	Software	9	
DC5.2	User Authentication	Software	13	
DC6.1	PIS Object	Software & Report	6	available
DC6.2	PIS Object	Software & Report	9	
DC6.3	PIS Object	Software & Report	13	

[1] Internally available means, this documents are available on the server, but as intermediate reports not handed over to the reviewers. They can be made available on demand.

Deliverable	*Name*	*Type*	*Month*	*Status*
DD1	Survey	Report	3	Internally available
DD2	Requirements	Report	4	available
DD3	Design	Report	5	available
DD4	Interface Specification	Software	6	available
DD5.1	Task Agent Shell	Software & Report	7	
DD5.2	Task Agent Shell	Software & Report	10	
DD5.3	Task Agent Shell	Software & Report	13	
DD6.1	Personal Assistant	Software & Report	7	
DD6.2	Personal Assistant	Software & Report	8	
DD6.3	Personal Assistant	Software & Report	10	
DD6.4	Personal Assistant	Software & Report	14	
DE1	Survey	Report	2	Internally available
DE2	Requirements	Report	3	Internally available
DE3	Design	Report	4	available
DE4	Interface Specification	Software	4	available
DE5.1	Profile Object	Software & Report	5	Internally available
DE5.2	Profile Object	Software & Report	8	
DE5.3	Profile Object	Software & Report	11	
DF1	Survey	Report	2	Internally available
DF2	Requirements	Report	4	Internally available
DF3	Design	Report	5	available
DF4	Interface Specification	Software	6	available
DF5.1	Service Shell	Software & Report	7	
DF5.2	Service Shell	Software & Report	10	
DF5.3	Service Shell	Software & Report	13	
DF6.1	Service Directory	Software & Report	7	
DF6.2	Service Directory	Software & Report	10	
DF6.3	Service Directory	Software & Report	13	
DG1	Survey	Report	3	Internally available
DG2	Requirements	Report	4	Internally available
DG3	Design	Report	6	available
DG4	Interface Specification	Software	7	
DG5	Group Profile Analyser	Software	8	
DG6.1	Service Deployer	Software & Report	12	
DG6.2	Service Deployer	Software & Report	14	
DH1	Survey	Report	2	Internally available

Deliverable	*Name*	*Type*	*Month*	*Status*
DH2	Requirements	Report	3	Internally available
DH3	Design	Report	4	available
DH4	User Interface Language	Report & Software	5	available
DH5.1	Device Adapters	Software	6	1st prototype avail.
DH5.2	Device Adapters	Software	9	
DH5.3	Device Adapters	Software	13	
DH6.1	User Access Module	Software & Report	6	1st prototype avail.
DH6.2	User Access Module	Software & Report	9	
DH6.3	User Access Module	Software & Report	13	
DI1	Survey	Report	3	Internally available
DI2	Requirements	Report	6	available
DI3	Design & Objectives	Report	8	(architectural design ready)
DI4.1	Working system	Software	10	
DI4.2	Working system	Software	15	
DI5	Evaluation Report	Report	18	
DJ1	Survey	Report	3	Internally available
DJ2	Requirements	Report	6	available
DJ3	Design & Objectives	Report	8	
DJ4.1	Working system	Software	10	
DJ4.2	Working system	Software	15	
DJ5	Evaluation Report	Report	18	
DK1	Agreement on IPR	Report, External	6	available (in DL 1)
DK2	Consortium Exploitation Plan	Report, External	15	first draft int. available
DL1	Consortium Contract	Contract	3	available
DL2	Project Progress Report	Report	6	(this document)
DL3	Project Progress Report	Report	12	
DL4	Final Project Report	Report	18	

4 Exploitation

It was decided by the project board not to have a joint exploitation of the project results. Each project partner will retain the exploitation rights of the software he has produced and undertake its own exploitation.

To this end an first draft of a exploitation plan (DK2) was compiled that shows the individual exploitation strategies:

APM: APM Ltd has two routes to exploitation of FollowMe technology. The first is through its consulting business, and the second through its software product business (e.g. CAGE) which trades as "Digitivity". In the consulting business APM considers the paradigm of mobile objects and intelligent agents as a logical extension of the distributed object technology, and sees FollowMe as an investment into the skill set of its staff. APM has already started to integrate FollowMe results into its CAGE product for remote java application deployment.

FAST: In 98 FAST is making approx. 2.25 Mio ECU revenue in the area of internet and intranet based projects. It is already foreseeable that the traditional business of WWW content development, deployment and maintenance will be taken over by lower-profile companies on the long term. FAST is therefore building up expertise in leading-edge internet technology as e.g. mobile agents to keep itself attractive for its customers. It is planned that services implemented by using agent-based technology will govern 50% of the future business growth of FAST’s internet and intranet business. As a second strain FAST is starting a product and services line. The pilot applications developed inside FollowMe will be marketed together with the Bavaria-Online Citizens network and offered as a service to users and information providers.

INRIA: First, Inria wants to generalize its research and development on multimedia information services (a newspaper service in our case) in order to integrate new facilities developed in the context of the FollowMe project. This may be part of the future electronic newspaper service under investigation by its associate partner (TC MULTIMEDIA). Also the project will serve as an architectural testbed for other projects and have a strong influence on INRIA’s research about embedded systems and services in general

TCM: TCM’s interest in Follow-Me project is twofold: First it is an investement for getting skills with new software technologies such as java, mobile objects and agents. It completes TC Multimedia background trough its consulting and providing onlines services business.

Secondly within the context of project ETEL, FollowMe's objectives and expected results, give a real opportunity to provide much more easily accessible information,. Precise information availability completed with news services or value-added services as weather forecast, movies schedules, dependant on user's geographical localisation, diffusion on the internet, and multi-devices user's terminal, increase the potential number of subscribers to ETEL electronic newspaper.

UWE: UWE's Intelligent Computer Systems Centre (ICSC) intends to exploit these results through

- Providing consultancy to organisations and companies requiring assistance in the development of such systems for the Internet
- Participating in industrial and other consortia to design, develop and deploy agent based systems on the Internet
- Designing and deploying systems directly

Main markets where FollowMe results can be exploited are areas such as process control, real time road traffic management and on-line market places.

5 Next Reporting Period

The focus in the next reporting period is on the implementation and the integration of all components. This will then be the basis for setting up the pilot applications.

As a preliminary step on each site (i.e. Cambridge, Bristol, Munich and Rennes) a FollowMe Server is installed that jointly serve as an early testbed for all components.

In June/July a joint workshop is planned, were the designs of pilot applications will be discussed in context with the detailed support from the FollowMe framework.

6 Updated Project Snapshot

The next page shows the current project snapshot. It is unchanged wrt. to the version of the technical annex.

PROJECT No: 25,338	**ACRONYM: FME**

TARGET MARKETS:

IT- Sector in general, Financial sector, Press & Information sector, Travel intensive organisations

TECHNOLOGIES:

Intelligent Mobile Software-Agent Systems, CORBA IDL, Java Beans

EXPLOITABLE RESULTS:

1. an **architecture** for mobile intelligent agents, to improve development processes and to ensure inter-operability of mobile agents,
2. an **infrastructure prototype,** providing a complete basic version of the FollowMe working system, to be integrated into marketable products for servicing mobile agents (APM: CAGE)
3. an agent based **pilot application** for internet services through the "Bavaria Online" Network (FAST) to be offered as an add-on service also for other customers (e.g. saving banks),
4. an agent based **pilot application** for accessing the Ouest-France newspaper (TCM, INRIA) to be offered as a service to other newspapers,
5. a **public report** on the architecture, user needs, implementation guide, and the pilots to distribute the know-how of intelligent mobile agent systems.

ANTICIPATED OR DEMONSTRATED BENEFITS:

1. The **architecture** ensures the global inter-operability of mobile agents. Standardized customer services can be offered on a globally networked market over a variety of interfaces, thus extending the potential customer base dramatically.
2. The **infrastructure prototype** demonstrates the architecture. Together with the **public report** it will be made available for research and experimentation, it will produce a market push for the new paradigm.
3. The first **pilot application** demonstrates the implementation and acceptance of intelligent services and the different access facilities by the users.
4. The second **pilot application** demonstrates the use of intelligent mobile agent technology to reduce network load and to balance server load by analyzing and anticipating user information needs.

APPLICATION AND ASSESSMENT OF RESULTS:

- It is planned to integrate the results of the architecture and the infrastructure prototype as agent facilities into APM's Digitivity Enterprise CAGE product.
- Moreover the pilot applications shall be transformed into services provided by INRIA, TCM, and FAST.
- APM will deliver the FollowMe-Results to Research Partnership.
- INRIA and UWE will use the results to enhance the current research programmes

INNOVATIVE ASPECTS:

The project will employ and test the paradigm of intelligent mobile agent systems. The pilot applications will demonstrate solutions to support the mobility of information users, the balancing of network load, and service based information retrieval

Annex: Table of Resource Consumption

In order to adapt the project plan to the actual needs of the project and to the availability of staff the partne
of their effort across their tasks. This will not change the overall effort or the dates of any deliverables. The
by the project board. The changes are reflected in an project implementation plan.

		Planned					Total		Used				
	Architecture												
TASK	*NAME*	*APM*	*FAST*	*INRIA*	*TCM*	*UWE*		*APM*	*FAST*	*INRIA*	*TCM*	*U*
TA1	Scenarios	1,0	1,0	0,5	0,5	0,5	3,5	2,0	1,0	0,5	0,5	
TA2	Model Creation	4,0	1,0	0,5	0,5	0,5	6,5	1,8	1,1	0,3	0,4	
	Total:	**5,0**	**2,0**	**1,0**	**1,0**	**1,0**	**10,0**	**3,8**	**2,2**	**0,8**	**0,9**	
	Mobile Objects Workbench											
TASK	NAME	APM	FAST	INRIA	TCM	UWE		*APM*	*FAST*	*INRIA*	*TCM*	*U*
TB1	Survey	1,0					1,0	1,0				
TB2	Requirements	1,0	0,5	0,5		0,5	2,5	1,5	0,5	0,5		
TB3	Design	2,0					2,0	2,0		0,5		
TB4	Interface Specification	2,0	0,5	0,5		0,5	3,5	2,0	1,0			
TB5	Implementation	14,0					14,0	4,8				
TB6	Tests	3,0					3,0	1,0				
TB7	Deployment	3,0					3,0					
	Total:	**26,0**	**1,0**	**1,0**		**1,0**	**29,0**	**12,3**	**1,492**	**1**	**0**	**0,**

	Personal Information Space											
TASK	*NAME*	*APM*	*FAST*	*INRIA*	*TCM*	*UWE*		*APM*	*FAST*	*INRIA*	*TCM*	*U*
TC1	Requirements	0,5					0,5	0,5				
TC2	Design	1,0					1,0	1,0				
TC3	Interface	0,5					0,5	0,5				
TC4	Implementation	4,0					4,0	0,7				
TC5	Tests	1,0					1,0	0,3				
TC6	Deployment	1,0					1,0					
	Total:	**8,0**					**8,0**	**2,96**	**0**	**0**	**0**	
	Autonomous Agents											
TASK	NAME	APM	FAST	INRIA	TCM	UWE		*APM*	*FAST*	*INRIA*	*TCM*	*U*
TD1	Survey					2,0	2,0					
TD2	Requirements	1,0				2,0	3,0	1,0				
TD3	Design					3,0	3,0					
TD4	Interface Specification					2,0	2,0					
TD5	Implementation					16,0	16,0					
TD6	Tests					3,0	3,0					
TD7	Deployment					2,0	2,0					
	Total:	**1,0**				**30,0**	**31,0**	**1**	**0**	**0**	**0**	**4,**
	Personal Profiles											
TASK	NAME	APM	FAST	INRIA	TCM	UWE		*APM*	*FAST*	*INRIA*	*TCM*	*U*
TE1	Survey					1,0	1,0					
TE2	Requirements	1,0				1,0	2,0	1,0				
TE3	Design					2,0	2,0					
TE4	Interface					0,5	0,5					
TE5	Implementation					5,0	5,0					
TE6	Tests					1,5	1,5					
TE7	Deployment					1,0	1,0					

	Total:	**1,0**				**12,0**	**13,0**		**1**	**0**	**0**	**0**	**4,**
	Service Interaction												
TASK	NAME	APM	FAST	INRIA	TCM	UWE			*APM*	*FAST*	*INRIA*	*TCM*	*U*
TF1	Survey					1,0	1,0						
TF2	Requirements	1,0	2,0	1,0	1,0	1,0	6,0		1,0	1,9	1,0	1,0	
TF3	Design					2,0	2,0						
TF4	Interface					1,0	1,0						
TF5	Implementation					5,0	5,0						
TF6	Tests					1,0	1,0						
TF7	Deployment					1,0	1,0						
	Total:	**1,0**	**2,0**	**1,0**	**1,0**	**12,0**	**17,0**		**1,0**	**1,9**	**1,0**	**1,0**	
	Service Deployment												
TASK	NAME	APM	FAST	INRIA	TCM	UWE			*APM*	*FAST*	*INRIA*	*TCM*	*U*
TG1	Survey			2,0			2,0				2,0		
TG2	Requirements	1,0	2,0	2,0	1,0	1,0	7,0		1,0	0,2	2,0	1,0	
TG3	Design			3,0			3,0				3,0		
TG4	Interface			1,0			1,0						
TG5	Implementation			8,0			8,0						
TG6	Tests			1,0			1,0						
TG7	Deployment			1,0			1,0						
	Total:	**1,0**	**2,0**	**18,0**	**1,0**	**1,0**	**23,0**		**1**	**0,165**	**7**	**1**	
	User Access												
TASK	NAME	APM	FAST	INRIA	TCM	UWE			*APM*	*FAST*	*INRIA*	*TCM*	*U*
TH1	Survey		2,0				2,0			3,5			
TH2	Requirements		2,0				2,0			3,5			
TH3	Design		3,0				3,0			3,6			
TH4	Interface		2,0				2,0			0,5			
TH5	Implementation		16,0				16,0			0,8			

TH6	Tests		3,0				3,0						
TH7	Deployment		2,0				2,0						
	Total:		**30,0**				**30,0**		**0**	**11,94**	**0**	**0**	
	Pilot Application 1												
TASK	NAME	APM	FAST	INRIA	TCM	UWE			*APM*	*FAST*	*INRIA*	*TCM*	*U*
TI1	Survey		2,0				2,0			2,2			
TI2	Requirements		3,0				3,0			4,1			
TI3	Design		4,0				4,0			1,1			
TI4	Implementation		24,0				24,0						
TI5	Deployment		6,0				6,0						
TI6	Trials		9,0				9,0			1,9			
TI7	Evaluation		3,0				3,0						
	Total:		**51,0**				**51,0**		**0**	**9,241**	**0**	**0**	
	Pilot Application 2												
TASK	NAME	APM	FAST	INRIA	TCM	UWE			*APM*	*FAST*	*INRIA*	*TCM*	*U*
TJ1	Survey			2,0			2,0				2,0		
TJ2	Requirements			2,0	2,0		4,0				2,0	2,0	
TJ3	Design			3,0	1,0		4,0				2,7	0,3	
TJ4	Implementation			21,0			21,0				2,1		
TJ5	Deployment			6,0	2,0		8,0						
TJ6	Trials			3,0	0,5		3,5						
TJ7	Evaluation			2,0	0,5		2,5						
	Total:			**39,0**	**6,0**		**45,0**		**0**	**0**	**8,8**	**2,25**	
	Exploitation												
TASK	NAME	APM	FAST	INRIA	TCM	UWE			*APM*	*FAST*	*INRIA*	*TCM*	*U*
TK1	Exploitation	2,0	2,0	2,0	3,0	2,0	11,0			0,3	1,2		
	Total:	**2,0**	**2,0**	**2,0**	**3,0**	**2,0**	**11,0**		**0**	**0,3**	**1,2**	**0**	
	Project Management												

TASK	NAME	APM	FAST	INRIA	TCM	UWE			*APM*	*FAST*	*INRIA*	*TCM*	*U*
TL1	Projekt Management		9,0				9,0			3,1			
	Total:		**9,0**				**9,0**			**3,1**			
	Overall Total	45,0	99,0	62,0	12,0	59,0	277,0		23,0	30,3	19,8	5,1	1
									51%	31%	32%	43%	2