IST-1999-10700 ParcelCall
(01-01-2000 to 31-12-2001)

Final report

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Consortium Composition

1. EED - Ericsson Eurolab Deutschland GmbH
2. SAG - Siemens AG
3. SEC - Siemens Dematic AG
4. PRL - Philips Research Laboratories
5. LW - lesswire AG
6. TPG - TNT Post Group N.Y.
7. RWTH - RWTH Aachen Informatics IV
8. EDI - University of Edinburgh
9. HAM - Hammer GmbH & Co. KG

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1 Project overview

ParcelCall is a research and technological development project within the Information Society Technologies (IST) programme of the European Union's Fifth Framework Programme. Its consortium of leading European industrial and academic partners is creating a scalable real-time, intelligent, end-to-end tracking and tracing system for transport and logistics applications - to operate across all border, carriers and transportation modes.

While many carriers in transport and logistics have tracking and tracing systems in place today, these are typically proprietary solutions. At the same time, supply chains are becoming more and more complex, involving multiple carriers and multiple transport modes. There is a high demand for accurate and up-to-date information exchange across the different carriers and modes of transport.

ParcelCall has focused on interoperability, open interfaces, and standardization in order to allow seamless tracking and tracing across the entire logistics and transportation chain. Owing to its open and scalable system architecture, the ***ParcelCall*** system can be easily extended by adding new server components. A small trucking company can adopt the ***ParcelCall*** tracking and tracing services as well as a huge multinational integrator.

A Mobile Logistic Server (MLS), which has been developed by EED, keeps track of all transport items inside a vehicle or container. It is, at any time, aware of the identity, current location and status of all goods in the unit. The Mobile Logistic Servers is equipped with GPS receivers to provide accurate and secure global tracking and tracing. The MLS makes its information available to a network of fixed servers via mobile communication networks on demand and on a real-time basis. It can actively alert the owner of the goods or the transport operator if for example the goods deviate from a predefined route, a delay occurs, or an alarm has been generated.

Information are stored in a network of Goods Tracing Servers (GTS), which has been developed by SEC. Each GTS also represents an interface between the ***ParcelCall*** system and the respective local IT infrastructure. Users may access tracking & tracing information via Goods Information Servers (GIS), which has been developed by SAG. Cellular networks, ISDN and the Internet are used for information transfer.

All tracking and tracing information within the ***ParcelCall*** system is acquired, stored, and managed at the level of individual transport items (parcels). Detailed tracking and status information is available in real-time and for each complete transport cycle - even if a single item out of a large shipment gets lost, damaged, or takes a different route to the rest of the shipment.

Accurate tracking and tracing requires efficient and reliable identification of transport units and items. ***ParcelCall*** employs Radio-Frequency Identification (RFID) tags to complement existing automatic identification methods using bar codes and labels. Smart RFID labels allow reliable automated data capture and status acquisition for individual movements, key processes and events throughout the transport cycle.

ParcelCall goes beyond mere item (parcel) identification. Sensitive transport goods are equipped with "Thinking Tags" - compact reusable devices, equipped with sensors, processing power, memory and capable of active, two way radio communication. The Thinking Tags have been developed by PRL and LW. They monitor their environmental conditions, such as temperature, humidity or shock, record a history of status information, location, and measurement data, and actively send alerts or messages. Thinking Tags are associated with individual transport items (parcels), rather than with a container or other transport unit, to provide seamless end-to-end surveillance of status, location, and environmental data. Thinking Tags are particularly useful for perishable, sensitive and high-risk goods. These might include items such as pharmaceuticals, whose temperature needs to be monitored without interruption, or shock-sensitive electronic devices. This provides invaluable information in the case of theft or loss, and help in settling liability issues if damage or mishandling has occurred.

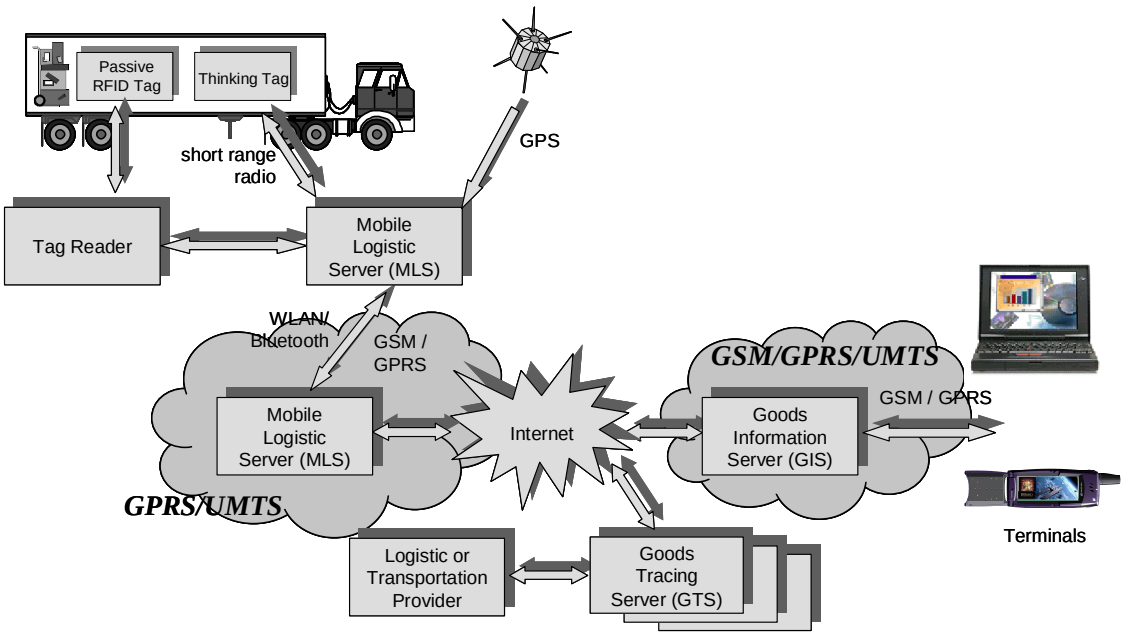

Figure 1 – ***ParcelCall*** System Architecture

2 Objectives of the project

The objective of ***ParcelCall*** was to realise an intelligent end-to-end tracking and tracing solution across all borders of carrier and transportation modes. It draws on emerging technologies, e.g., radio frequency identification (RFID), and public data communication networks to develop the system and verify the application in a realistic business context. Standard mobile phones are used, any time and anywhere, to get near real-time tracing information along the complete logistic chain.

The approach distinguishes three levels with increasing performance, flexibility, and scalability:

A: Development of an open tracking and tracing architecture across the complete logistic chain.

B: Integration of active sensors, providing the means to monitor and control environmental conditions and quality status of transport goods.

C: Incorporation of communicating sensors providing alert messages directly to the goods owner if environmental conditions deviate from their default ranges.

The ***ParcelCall*** project is driven by two scenarios, 2003 and 2008. In scenario 2003, passive radio tags are attached to individual transport items. Static information like identity, sender, and destination address is transmitted to a tag reader upon transhipping. In scenario 2008, active radio tags are combined with sensors to measure environmental data like temperature, humidity, or acceleration. Independent of transportation mode or carrier the ***ParcelCall*** system can notify a freight owner when unexpected conditions occur. Such properties are achieved by building a distributed system, where the constituents are the intelligent packet objects that communicate with each other and with the backbone system via invocation messages. More advanced, economically well suited networks have contributed to the communication subsystem such as Bluetooth for short-range and the cellular GPRS (General Package Radio Service) for long-range communication.

3 Work done

The ***ParcelCall*** project consists of eight work packages (see following table). All work packages, but WP1, WP4 and WP5 will run until the end of the year. The project is well on track and has achieved all its milestones. The following sections summarise the work undertaken in the different work packages of ***ParcelCall***.

WP No.	Work package title	Leader	Person months	Start month	End month	Deliv. No
WP1	Requirements	EDI	20	Y1 M01	Y1 M04	D01
WP2	System Architecture Design	RWTH	66	Y1 M01	Y2 M12	D11
WP3	Development of Thinking Tags	PRL	89	Y1 M01	Y2 M12	D06 D07
WP4	Implementation of the Open Architecture	SEC	101	Y1 M05	Y2 M08	D05 D08
WP5	System Trial	TPG	44	Y1 M09	Y2 M08	D09
WP6	Evaluation	EDI	17	Y2 M06	Y2 M12	D04 D10
WP7	Dissemination and Implementation	RWTH	24	Y1 M04	Y2 M12	D03 D12
WP8	Project Management	EED	33	Y1 M01	Y2 M12	D02
	TOTAL		394			

Table 1 – Work package list

3.1 Work package 1 – Requirements

Work package number :	WP1: Requirements								
Work package leader:	EDI								
Start date or starting event:	Y1 M01								
Participant:	EED	SAG	SEC	PRL	LW	TPG	RWTH	EDI	HAM
Person-months per participant:	-	-	4	-	2	4	2	6	2
Person-months spent:	-	-	4.6	-	1.0	4.0	2.3	6.0	2.3

The objective of WP1 was to identify the systems requirements and their implications for the overall system architecture and design. It ran for the first six months of the ***ParcelCall*** project. With the submission, on time, of Deliverable D01: System requirements and initial system concept, it has fulfilled its main objectives. In addition the Operator Task Force was set up under WP1 – which is described in more detail under Section A5. WP1 has surveyed the competing technologies solutions to package tracking. WP1 reached their main milestone in time:

To this end, the following activities were carried out in the reported period:

A literature search and interviews were carried out to investigate three key questions:

- A review was undertaken of competing technologies including EU projects in relate fields
- A study was undertaken of the business case for ***ParcelCall*** technology, drawing upon use cases
- A strategic analysis was undertaken of the key socio-economic factors that had implications for the development and exploitation of ***ParcelCall*** technology including such matters as security and standardization.

A user requirements workshop was held (Edinburgh, April 2000), involving a wide range of interested organizations, to analyse the potentially differing requirements of different kinds of player (including diverse transport and logistics operators, and their customers).

These results were combined with outputs from WP2 – and the results discussed at joint workshops and virtual exchanges – in drafting the first deliverable D01, which sought to establish the foundations of the ***ParcelCall*** project. Drafts of D01 were extensively discussed within the ***ParcelCall*** network and beyond.

Deliverables produced:

D01: System requirements and initial system concept

3.2 Work package 2 – System Architecture Design

Work package number :	WP2: System Architecture Design								
Work package leader:	RWTH								
Start date or starting event:	Y1 M01								
Participant:	EED	SAG	SEC	PRL	LW	TPG	RWTH	EDI	HAM
Person-months per participant:	15	11	8	-	-	2	28	2	-
Person-months spent:	10.2	7	5.5	-	-	1.0	17.8	3.5	-

The objectives of WP2 during the reported period were:

- To re-evaluate the initial design in the light of the experience gained from the actual implementation work and the system trial evaluation.
- To provide technical support for the standardisation activities

Design evaluation

During the implementation phase the initial system concept has been updated in regular intervals. In particular, experience gained from implementing the Exterior Goods Tracing Server (E.GTS) and the carrier hand-over scenario have been incorporated into the system concept.

In conjunction with the security approach a new access control scheme has been developed which allows modification of information attributes. With this scheme carriers can determine the precision of those values to be forwarded to their customers. This new access control scheme has been presented at the IST Mobile Summit and at the ITS World Congress.

A simulation model of a network of Goods Tracing Servers has been developed which is used to analyse system scalability. Two carrier approaches can be investigated with this model: Big players, i.e. carriers with a high capacity Internet connection, and smaller and medium carriers that typically only have an ISDN connection to the Internet. Finally, the model has been implemented and evaluated. Evaluation results have been used for the final system design.

The work conducted in this report period has been fed into the "Final system concept" deliverable D11.

Standardisation Support

WP2 has supported standardisation activities of the CEN MEET workshop. Primarily, work on CWA2 "An Architecture for Multimodal Tracking & Tracing Systems has been supported. Furthermore, presentations of the ***ParcelCall*** system approach have been given at workshop meetings. In conjunction with the work on CWA2 a Transport Transaction System Model has been developed which specifies

the requirements in the legacy IT system for Tracking & Tracing. Work conducted in this activity has been fed into D12 ("Standardisation Proposal") and CWA2.

Deliverables produced:

D11: Final system concept

3.3 Work package 3 – Development of Thinking Tags

Work package number :	WP3: Development of Thinking Tags								
Work package leader:	PRL								
Start date or starting event:	Y1 M01								
Participant:	EED	SAG	SEC	PRL	LW	TPG	RWTH	EDI	HAM
Person-months per participant:	-	6	-	53	30	-	-	-	-
Person-months spent:	2.0	1.5	-	41.6	28.5	-	-	-	-

Summary of activities:

During the reporting period October 2000 to October 2001 activity within WP3 has concentrated primarily on the completion of the proof of concept deliverable D07. This deliverable involved the final design and constructing of the active reader and thinking tags units that would take part in the trials scheduled for Q3 of 2001. In addition, and to accompany this hardware, a substantial document was produced that detailed all aspects of its design, construction and testing (D07).

Tag-MLS air interface specification:

During Q4 of 2000 a first version of an air interface specification was created within WP3 for use with the Thinking tag and MLS devices. Although not complete in it's first draft, this interface allowed basic information to be sent and received from the thinking tags, and aided the development of the wireless parts of the ***ParcelCall*** system. The interface specification was published in deliverable D06 (Refined System Architecture). By Q2 of 2001 a second and final version of the specification was released. This document contained all the commands and instructions needed to implement all the functionality that had been defined within the system. This included for example the ability to read any selected sensor values, set sensor threshold levels, write data to the tags, read a tag's unique identifier or monitor its battery voltage levels to name but a few. The final release of the specification (version 1.2) was made available in deliverable D07 (Proof of Concept).

Demonstrator components:

During the early part of 2001 initial planning was carried out for the field trials to follow later in the year. From the scenarios considered it was decided that 6 active thinking tags and 6 corresponding readers would be needed to meet the requirements of the trial. This hardware was completed in time to meet the planned deadline of April 2001.

To ease the problems of larger scale production, tags and readers were based on a common platform. Both devices were designed to be fully programmable therefore offering the flexibility of being able to accept application code updates as newer and more refined versions of the software became available. The thinking tags were built into small boxes about 10cm x 1cm x 4cm and contained the two way radio (including processor and software), single 3.6V battery and sensor board (containing temperature, tilt and shock sensors). The readers were built into slightly larger plastic enclosures for convenience, which were provided with a serial port for connection to the MLS devices. In situations where the reader did not need to be located in a position remote from the MLS the reader PCB's could be removed from their housings and located directly into the relevant MLS unit.

Full documentation describing the design, construction and testing of the thinking tag hardware was produced in written deliverable D07 (Proof of Concept).

Fine Scale location:

During the end of year 2000 we have been able to refine our ideas on possible fine scale location techniques. Although a number of potentially feasible ideas were generated during the earlier phases of the project, one idea in particular is now being pursued. This technique seems to offer the benefits of being compatible with the current low cost RF platform that has been designed for the thinking tags, whilst yielding measuring accuracy that is considerably better than could be achieved using conventional ranging techniques.

Standardisation:

From the start of 2001 PRL began to play an active role in the CEN/ISSS standardisation activities that had been initiated from Workpackage 2. A number of meetings were attended during 2001 with the majority of the contributions targeted towards aspects of the standardisation process that concerned active or "Thinking" tags.

Deliverables produced:

D06: Refined system architecture

D07: Proof of concept

3.4 Work package 4 – Implementation of the Open Architecture

Work package number :	WP4: Implementation of the Open Architecture								
Work package leader:	SEC								
Start date or starting event:	Y1 M05								
Participant:	EED	SAG	SEC	PRL	LW	TPG	RWTH	EDI	HAM
Person-months per participant:	36	24	20	-	-	-	21	-	-
Person-months spent:	37.8	20.7	27.9	-	-	-	23.0	-	-

WP 4 focus on the implementation of the ***ParcelCall*** system based on the concepts elaborated in WP2. The main activities during the reported period were:

- WP 4 workshop in Aachen on June, 15th and 16th, 2000
- WP 4 workshop in Konstanz on July, 12th and 13th, 2000
- WP 4 workshop in Munich on September, 27th and 28th, 2000
- WP 4 workshop in Aachen on December, 18th, 2000
- WP 4 workshop in Aachen on January, 17th and 18th, 2001
- WP 4 workshop in Munich on March, 1st and 2nd, 2001
- WP 4 workshop in Edinburgh on April, 11th and 12th, 2001
- WP 4 workshop in Edinburgh on July, 3rd and 4th, 2001
- The interfaces between the ParcelCall components are finally defined
- Field trial scenarios are defined
- Test scenarios were tested in preparation to the field trial
- Field trials

The report time range covers the full implementation period, which is the task of WP4. Starting on the basis of agreed interfaces these interfaces were iteratively elaborated according to the actual demands that were identified during detail design and implementation. There was always interest from the Operator Task Force side on the projects work but not as much input as originally assumed. Also the response to a questionnaire that was distributed to the Operator Task Force gave not the input to the requirements that was expected. A major difficulty is that there is no generally applicable cost model that allows an objective assessment of cost versus benefit to fulfil the identified Track & Trace requirements. Due to cost pressure in this business most carriers are reluctant to spend a significant budget in infrastructure for such a service because it is not clear how much a customer is willing to pay for the service enhancement.

During the first laboratory integration tests deficiencies were identified on the side of the GTS that were caused on insufficient testing. However, SEC managed to overcome these problems in the following months with additional test effort. The implementation work finished in time, so that the field trial started as planned. Here it turned out that problems on the side of Philips Intelligent Tags and the EED MLS did not allow continuing with the field trial as scheduled. The second field trial was postponed until September to give the involved teams time to overcome the identified problems. The second attempt achieved partially good results proving that the whole concept works, although stability problems on the MLS side showed that the prototype implementation of the project was not mature to run a field trial in the originally planned length.

From the technical side it can be stated that the proof of concept was successful carried out but within the given time it was not possible to develop a product like prototype that is stable enough to run lengthy field trial runs. Beside stability another problem is the partially poor GSM data coverage. Due to the late introduction of GPRS and UMTS it was not possible to consider these services in our implementation.

Deliverables produced:

D05: GTS, GIS, and MLS API specifications

D08: GTS, GIS and MLS implementations

3.5 Work package 5 – System Trial

Work package number :	WP5: System Trial								
Work package leader:	TPG								
Start date or starting event:	Y1M09								
Participant:	EED	SAG	SEC	PRL	LW	TPG	RWTH	EDI	HAM
Person-months per participant:	5	-	6	2	3	14	-	10	2
Person-months spent:	5.5	-	1.8	-	-	7.9	-	5.0	10.7

Activities of WP5 where focused on its main objective, the realization of the System Trial. Purpose of the System Trial was to allow an evaluation of the ***ParcelCall*** technologies being deployed in a live environment and being tested under realistic conditions.

Based on Deliverable D04 Evaluation Plan, WP5 provided System Trial specifications in Q1 2001. These System Trial specifications provided the project partners with an overview of the equipment to be used in the System Trial.

The System Trial specifications where developed further to become the basis of the System Trial Plan D09 of which the first draft was available in Q1 2001. As with the System Trial Specifications, main criteria for the development of the System Trial Plan D09 where the evaluation criteria of the Evaluation Plan D04.

D09 outlines the processes that apply during the field trial and further specifies the equipment that will be required during each of the process steps of the complete transport chain. The transport process from pick-up at the customer up to final delivery was split up in tasks. These tasks where assigned to the project partners that where involved in the field trial.

To allow a step-by-step approach to the final pan European multimodal field trial the System Trial was split in three phases. The first two phases focused on the testing of the active and passive technology in a local environment, i.e. in the network of one transport company only. The third phase included all available ***ParcelCall*** technologies to be moved on different transport networks by different modes.

According to the responsibilities assigned in D09 the project partners commenced with the field trial preparations in Q2. For the two project partners providing transport services this meant substantial work with regards to gearing up each of the networks for the field trial. A large number of employees such as general hub managers, operations managers, shift leaders, warehouse personnel and drivers had to be briefed about the project in general and the field trial in detail.

Some significant technical issues were encountered during the first trials in Q2, which caused WP5 and WP6 to rethink the three-phase approach. To limit the impact of delays on the field trial it was decided in agreement with WP6 that different elements of the ***ParcelCall*** system would be assessed separately. The elements, which had been identified, to be assessed independently were performance of passive RFID tags, performance of active tags, monitoring of condition and position data.

As further trials where realized in Q3 2001, focus was shifted mainly to the feature of real-time data and problems of mobile data transmission encountered in earlier tests.

With combine efforts of all involved parties WP5 managed to meet its objective in Q3 by undertaking a full scale Phase 3 System trial. This trial comprised a pick-up at a customer in Scandinavia, a delivery to a customer in the UK as well as a carrier hand-over. The goods used in the trial traveled on two different networks of the companies providing the transport services through seven countries making use of the transport modes road and sea. In the course of the transport the test shipments went through several scanning processes of which one of them included a carrier hand over.

The agreed changes to the System Trial required D09 to be amended accordingly several times which consequentially resulted in a delay of the date that the final version of this deliverable could be provided.

Deliverables produced:

D09: System Trial Plan

3.6 Work package 6 – Evaluation

Work package number :	WP6: Evaluation								
Work package leader:	EDI								
Start date or starting event:	Y1M07								
Participant:	EED	SAG	SEC	PRL	LW	TPG	RWTH	EDI	HAM
Person-months per participant:	-	-	-	-	-	5	-	10	2
Person-months spent:	-	-	-	-	-	2.4	-	5.5	0.4

The main objectives of WP6 are to evaluate the system trial and give an overall assessment of the developed technology; to assess future prospects and develop recommendations for the future evolution of ***ParcelCall*** technologies.

Though main activities of WP6 were scheduled to begin in June 2001,(though WP6 already produced one deliverable: the Evaluation Plan D04. This draws upon the analysis of user requirements and the business case for ***ParcelCall***, developed under WP1 (D01) to outline the main criteria against which the field trial can be developed. Detailed discussions were held involving WP 5 & 6 to plan the conduct and evaluation of the field trials. This included joint workshops of WP 5 & 6 in Edinburgh (April 2001), and Redhill (July 2001). We reviewed the outcomes from WP 4 and the initial experiences of the System Trial, which had thrown up some important technical challenges and constraints for WP4 to address. These unavoidably resulted in some delays and changes in the conduct of the Field Trial. For example lack of radio coverage in the Channel Tunnel necessitated a different route for the international trial and the legal difficulties regarding use of active tags in airplanes prevented trial of this mode at this stage. The trial further revealed hitherto unknown problems in compatibility between the existing mobile systems of different countries when used for data transmission (which can be seen as an important finding from the project). This in turn posed new challenges for the strategy and methods for evaluating and assessing ***ParcelCall*** achievements. A revised Field Trial plan was drawn up jointly by WP5 & 6 which included a significantly modified and elaborated strategy for Evaluation activities. Conclusions and recommendations were contained in an internal report on the Conduct of Field Trial circulated by Edinburgh University.

Semi-structured interviews proposed for a range of potential users (direct and indirect) of the technologies being developed by ***ParcelCall***. Drawing on pilot interviews, a list of questions and issues was drawn up as a guide for interviewing.

- Carriers (large and smaller)
- senior management
- despatch managers and hub managers;
- managers responsible for liaison between carriers
- drivers, loaders and hub operatives (though their limited experience in the trial may reduce the value of such respondents)
- call centre managers
- IT managers (involved in in-house legacy systems and in interfacing with their clients' systems – e.g. TPG Customer Interface Technology Manager)

Their Customers (direct: Consignors and indirect: Recipients)

- management and specialists, especially in Logistics.

Steps were taken to identify a wider range of such potential users (see also OTF meetings under WP7), in particular Consignors from different sectors.

Another, more fundamental change was in the conception of the field trial and how it might most usefully be evaluated. This was initially conceived as a series of tests of a fixed system (phase 1 passive tags, local trip; phase 2 active tags, local trip; phase 3 passive tags, international trip). In the course of project and especially in the first stages of the field trial, it became apparent that the different elements and features of the ***ParcelCall*** system could be assessed separately (e.g. performance of passive RFID tags; performance of active tags; condition monitoring; position data; real-time data; prospects for adoption of standards for interorganisational data exchange about goods in the logistics industry). Indeed early feedback from direct and indirect users suggested that different classes of user had different requirements (e.g. logistics players wanted real-time location information; goods senders seeking to monitor parcels were not necessarily needing to have information about conditions deviations in real–time as long as they could download the log). This discovery represents an important lesson from the trial itself. This step also offered benefits in terms of by-passing the need to wait until the technical difficulties encountered with overall system operation were overcome.

EDI evaluated the various components of the Field Trial as they were undertaken. This was completed in late October 2001. As part of the revised evaluation strategy, supplementary fieldwork was initiated to elicit views of a wider range of potential industrial users and other relevant players.

An unavoidable consequence of these contingencies has been some delay in the production of Deliverable D10.

Deliverables produced:

D04: Evaluation plan

D10: Evaluation results and project assessment

3.7 Work package 7 – Dissemination and Implementation

Work package number :	WP7: Dissemination and Implementation								
Work package leader:	RWTH								
Start date or starting event:	Y1 M01								
Participant:	EED	SAG	SEC	PRL	LW	TPG	RWTH	EDI	HAM
Person-months per participant:	-	-	1	-	-	5	8	8	2
Person-months spent:	-	-	0.1	-	-	0.7	11.0	3	0.4

The overall objectives of WP 7 during the reported period were:

- To contribute towards international standardisation (CEN/ISSS workshop)
- To raise public awareness of the ***ParcelCall*** project, especially through publications and presentations.
- To manage the Operator Task Force.

CEN/ISSS Workshop

The CEN/ISSS Workshop on "Multimodal End-to-End Tracking & Tracing (MEET)", which was initiated by ***ParcelCall***, has successfully continued its work. Five Workshop meetings were organised until October 2001. By then MEET has produced:

- A list of potentially useful standards for a tracking & tracing system.
- A document entitled 'Requirements on Multimodal Tracking & Tracing Systems'. This specification, which is pretty much based on the ***ParcelCall*** Deliverable 01, has been endorsed by the Workshop as a CEN Workshop Agreement (CWA). The formal procedures within CEN, which are required prior to the document's publication as a CWA, are under way.
- The 3rd draft of a document entitled 'An Architecture for Multimodal Tracking & Tracing Systems'. This document originates from the ***ParcelCall*** Deliverable 05. It's completion has been scheduled for December 2001. Work on the document is on schedule.

A CEN/ISSS Workshop is a high-profile means of delivering consensus-based specifications within a reasonably short period of time.

Publications and Presentations

The list of publications and presentations of the ***ParcelCall*** project members can be found in chapter A.8.

In addition to the papers and presentations, two invited sessions were organised.

- At the IFAC 'Telematics Applications' conference two papers on ***ParcelCall*** were presented at an invited session entitled 'Intelligent Transport Infrastructures'.
- A session entitled 'Communication Systems for E-Commerce Applications' was organised for the 2001 WSES conference. It included a paper on ***ParcelCall***.

The Operator Task Force (OTF)

The ***ParcelCall*** 'Operator Task Force' (OTF) has been established to enable and support co-operation with a wide range of stakeholders outside the project and also contribute to a wider dissemination of the ***ParcelCall*** results.

A first meeting in Edinburgh, involving a workshop on user requirements attracted considerable attention and was attended by more than thirty people.

The 2nd OTF meeting took place in January 2001 in Aachen. The project presented its work, and outlined and discussed its future plans. Information dissemination and discussions continued.

Deliverables produced:

D03: Dissemination and Use Plan

D12: Standardisation Proposal

3.8 Work package 8 - Project Management

Work package number :	WP8: Project Management								
Work package leader:	EED								
Start date or starting event:	Y1 M01								
Participant:	EED	SAG	SEC	PRL	LW	TPG	RWTH	EDI	HAM
Person-months per participant:	24	-	2	2	-	2	2	1	-
Person-months spent:	22.4	-	1.8	-	-	1.0	1.7	0.5	-

An effective project management has been established. WP8 guarantees with its daily operation a structured, smooth and efficient work within ***ParcelCall***. Major activities included the co-ordination of dissemination activities, exchange of information through meetings of project co-ordination committee (PCC) and electronic message exchange. The eight PCC meetings took place on:

- 11. - 12.01.2000 at EED in Herzogenrath, Germany
- 11. - 13.04.2000 at TPG in Amsterdam, The Netherlands
- 11. - 13.07.2000 at SEC in Konstanz, Germany
- 26. - 28.09.2000 at SAG in Munich, Germany
- 16. - 18.01.2001 at i4 in Aachen, Germany
- 10. - 12.04.2001 at EDI in Edinburgh, Scotland
- 03. - 04.07.2001 at PRL in Redhill, England
- 09. - 11.10.2001 at LW in Frankfurt/Oder, Germany

Please find below some details of the WP8 activities of ***ParcelCall***:

- The ***ParcelCall*** web page (http://www.parcelcall.com) consists of a public and an internal part. At the public side the visitor gets e.g., information about the project's objectives and the project's partner. More than 3500 hits have been counted so far.
- All communication inside the project – except for our meetings and workshops – is handled electronically. Thus, a number of different ***ParcelCall*** e-mail reflectors have been created:
  - all@parcelcall.com – all persons involved in the ***ParcelCall*** project are on this list. The list is only used for general information that is relevant for everybody participating in the project.
  - pcc@parcelcall.com – the PCC delegates of the ***ParcelCall*** project partners are on this list. The list is for PCC related information, such as finance, administration, and planning.
  - wp[x]@parcelcall.com – all persons involved in the corresponding ***ParcelCall*** work package are on this list. The list is only used for topics of the work package.
  - otf@parcelcall.com – the list is used for OTF related information. This list comprises external partners who participate in the OTF but not directly in the project. Please find the OTF members in Annex 7.
- The ***ParcelCall*** consortium agreement has been signed by all project partners.
- A contract amendment concerning the participation of Hammer has been filed and signed.
- The role of the ***ParcelCall*** project manager has changed from Axel Busboom to Jens Hartmann.
- A project brochure has been produced and distributed.
- Contact with a several other IST projects has been established and used. P
- A project video has been produced.

Deliverables produced:

D02: Project presentation (Web presence)

4 Project results and achievements

As outlined in the previous chapter, the ***ParcelCall*** project achieved a series of interesting results related to the different work items of the project. In this chapter the validation activities, co-operations with other projects and the project's dissemination activities are highlighted.

4.1 Validation Activities

Validation of the project is the responsibility of WP6: Evaluation of which the output, the "Evaluation Plan" (Deliverable D04), was delivered in August 2000. This lays out the criteria and methods to be adopted under WP6 in evaluating the ***ParcelCall*** field trial (WP5). D04 sets out (in section 4) some provisional 'requirements' by which the performance of the system can be judged. These are at present purely indicative of the operational scenarios in which the evaluation was carried out.

Deliverable D09 "System Trial Plan" specified the conduct of the field trial in greater detail to take into account the development of the system architecture and technological implementation. The system trial covered the entire end-to-end transport chain, from sender to the destination, via consolidation (depot), sorting (hub) and diversion (gateway). The system trial was executed in three phases:

Phase 1 was constrained to a local operation involving passive tagging. Just a few customers sent their parcels through a trial channel that was limited to one transport company and road-transportation only. The tested applications comprised identification of pieces using passive RFID tags, and real-time tracking of positioning and status information.

In phase 2 the trial was extended to active alerting, monitoring services and Thinking Tags applications developed in WP3. For testing purposes, only a limited number of parcels and a part of the transport chain (terminating at the delivering depot where the tags were removed for re-use) was used. The tested applications comprised identification of pieces using Thinking Tags, real-time tracking of environment conditions, recording of positioning and environment data history, and active user alerting.

Finally, in phase 3, a pan-European system trial was performed in a much broader setting of more complex logistic patterns, involving various carriers, countries, transportation modes, senders and receivers. The tested applications were identical with those in phases 1 and 2, but the exchange of tracking information among two transport operators and various transport modes has been verified.

WP5 in conjunction with WP6 produced a detailed draft system trial plan (D09) in May 2001. This has two elements:

(1) The initial system trial specifications will address the requirements of various players: End user requirements, requirements and constraints by the transport/logistics operators, technological, time, and cost constraints need to be taken into account.

(2) The detailed organization of the trial (e.g., locations of senders and receivers, hubs, transportation modes, and schedules) was agreed with all participants (system trial plan).

The three phases of the trial were due to be completed during May to July 2001. Evaluation of the trial started after the trials were implemented and fieldwork was thus planned to be completed in August 2001. Our previous Annual Report noted that 'the timetable for the trials and for their evaluation is extremely tight. Delays and operational difficulties in the trials could have serious consequences for the duration and timing of the evaluation. Given these pressures, a flexible approach was essential – in both the operation of the trial and its evaluation.' These anticipations proved well-justified – as WP4 had to grapple with an array of technical challenges. Further unanticipated technical difficulties (e.g. incompatibilities between national mobile phone systems when used for data transmission) were discovered in the initial trials. This necessitated delays in conduct of the field trial, and the re-conceptualisation of the field trial and how ***ParcelCall*** could be evaluated. The thrust of this was that, for pragmatic reasons, it was necessary to assess different aspects of the system operation independently. However this change in thinking was also helpful and useful in terms of assessing ***ParcelCall*** achievements and prospects. Indeed, one of the early findings from user assessment was that the different elements of ***ParcelCall*** could be unbundled one from another, and could be evaluated separately (not least since some elements had higher priority with particular groups of users that others). This development involved the elaboration of a wider range of trial activities and their evaluation – a development which blurred the boundary originally anticipated between the different phases of the trial.

The aim of the system trial evaluation was to analyse the utility and potential benefits of ***ParcelCall*** services to intermediate users (carriers and logistics providers) and final users (companies trading and exchanging goods). It thus provides a stronger empirical knowledge base for assessing the user acceptance and utilization of these technologies with implications for the likely market for this technology, its benefits, economic and commercial impacts, and other social implications for the user.

A radically revised design for the system trial and its evaluation was developed, with full implementation going on into October 2001.

It was originally planned to utilize four types of research instrument in conducting the evaluation:

- An ethnographic study of the trial systems in use (based on detailed observation and interviews).
- Semi-structured interviews were undertaken with significant system users to assess their experience of implementation and use and explore how the system has impacted on their roles.
- Observation of system operation and measurement of performance criteria based on user and business needs.

Though some ethnographic work was undertaken, this was mainly in relation to current practices and cultures within transport. The planned ethnographic study of the system in use was not possible because what was achievable (and achieved)

within the short timeframe of the ***ParcelCall*** project was a prototype rather than a robust finished product. The emphasis of evaluation work was on the last three types of research instrument – and in particular through observation and semi-structured interviews regarding the experience of the ***ParcelCall*** field trial. These studies also allowed for broader assessment of user awareness and evaluation of ***ParcelCall*** and related technologies (and thus an assessment of the weight and value to be attached to particular elements of ***ParcelCall*** technologies and service concepts respondents).

This kind of evaluation was carried out first with users in logistics firms and some of their customers involved directly and indirectly in the trial. Further activities were launched in order to broaden the assessment and evaluation process by addressing a broader range of potential industrial users. As these groups did not necessarily possess prior familiarity with ***ParcelCall***, a slightly different methodology was needed. For these groups face to face meetings (including workshops and focus groups) provided an effective means to familiarize potential users with ***ParcelCall*** achievements in preparation to a discussion about user assessment. To this end a number of initiatives were launched with the dual aim of disseminating ***ParcelCall*** achievements and assessing and evaluating potential user responses, which will be carried on into October and November 2001. This includes meetings with a range of individual companies (e.g. logistics firms or their industrial organizations with particular types of logistics requirements), and a series of meetings with members of the ***ParcelCall*** Operator Task Force (see discussion under WP7 dissemination.

Deliverable D10, comprising a technology and application assessment, focusing on strategic choices and economic and social prospects and implications. The experiences of the implementation and evaluation phase fed back into WP2, contributed to the final system architecture design (D11), and had impact on the standardization proposal (D12).

4.2 Cooperation activities with other projects and programme sectors

ParcelCall is an active player in the transport and logistic technology development society as well as in the telecommunication research community. The following list gives an overview over the most important dependencies of the ***ParcelCall*** project.

4.2.1 IST DRiVE

Brief Summary:

The overall objective of the IST DRiVE (Dynamic Radio for IP-Services in Vehicular Environments) project is to enable spectrum-efficient high-quality wireless IP in a heterogeneous multi-radio environment to deliver in-vehicle multimedia services, which ensure universally available access to information and support for education and entertainment. To achieve this objective the DRIVE project addresses the convergence of cellular and broadcast networks to lay the foundation for innovative IP-based multimedia services. Therefore, DRiVE tackles two key issues:

- Inter-working of different radio systems (e.g., GSM, GPRS, UMTS, DAB, DVB-T) in a common frequency range with dynamic spectrum allocation.
- Co-operation between network elements and applications in an adaptive manner.

Synergies and Co-operations:

DRiVE and ***ParcelCall*** work on mobile communication for vehicular environments and co-ordinate their activities to develop a common vehicular communication platform.

4.2.2 IST WSI

Brief Summary:

The European Wireless industry is facing important challenges. As a result of these considerations some of the key players in the field have agreed to co-operate in the IST Wireless Strategic Initiative (WSI) project to achieve the following strategic objectives:

- to kick start the market for future wireless applications and services
- to develop the basis for the definition of concepts for future wireless systems beyond third generation mobile radio systems (WWN)
- to create and maintain industrial momentum in wireless communications, services and applications through R&D collaboration.

Synergies and Co-operations:

Attaining ***ParcelCall***'s technical objectives will be of little significance if the technology is not widely implemented. Although individual companies could benefit from its local adoption, ***ParcelCall***'s full potential lies in the development of a standardized approach that can gain general acceptance in the industry. Success will not depend simply on the development of the 'best' technology; equally important is the development of a constituency of users. The success will depend upon aligning expectations to ensure that a sufficient number of key users (critical mass) will be convinced to take part. The WSI project, due to its dual role, is well placed to support ***ParcelCall*** in its endeavour. On the one hand, WSI has extensive access to leading edge users through its 3G testbed offer. On the other side, WSI is leading an open process to define the future of wireless communications. Close contact will ensure that future-safe choices are made for ***ParcelCall***.

4.2.3 IST LEAP

Brief Summary:

LEAP is addressing the need for open infrastructures and services, which support dynamic, mobile enterprises. It will develop agent-based services supporting three requirements of a mobile enterprise workforce: Knowledge management (anticipating individual knowledge requirements), decentralized work co-ordination (empowering individuals, coordinating and trading jobs), travel management (planning and coordinating individual travel needs). It will develop a reference Lightweight Extensible Agent Platform responding to the communication and co-operation needs of mobile teams, based on standards and capable running on advanced phones or mobile devices. The project will comprise two phases: In the first Phase, a feasibility study of 12 months, the project will define application requirements as well as reviewing current FIPA and WAP standards. The design of the Lightweight Extensible Agent Platform will be based on the development of an innovative, scaleable and "operating system agnostic" architecture for devices ranging from PDAs to 'phones to desktop systems. This architecture and a initial version of the LEAP application will be integrated and deployed in lab trials. In Phase 2, the Mobile team management applications will be deployed in the real world, in two Field Trials, over a one month time period, and covering large geographical areas. The field trials will evaluate both the scientific and usability aspects of the technology, showing how the technology is adapted and adopted by users in a dynamic networked organization in a ubiquitous environment.

Synergies and Co-operations:

LEAPS, as well as ***ParcelCall***, focus on an open infrastructure and a decentralized architecture in the field of mobile communication and among other things standards like WAP. A joint meeting on September 27, 2000 presented the status and the goals of the projects and discussed possible synergies.

4.2.4 IST WINEGLASS

Brief Summary:

The ***ParcelCall*** project partner Lesswire is a sin-off of the IHP and is working in very close relationship with this institute for next generation innovations. In the IHP a participation in the IST Wineglass project is going on. The main focus of the Wineglass projects is to establish an all-IP-network based on UMTS and other cellular technologies. The main partners of Wineglass are CSELT, Motorola, Cisco, Alcatel, Philips and the IMST as well as the IHP. An important part of Wineglass is the development of a middleware platform for new wireless internet applications especially applications that profit from mobility.

Synergies and Co-operations:

One class of the Wineglass applications are location or context aware applications for the end user. Here the relation to the ***ParcelCall*** project is obvious. Therefore Lesswire cooperates with the IHP (which is the main contributor in Wineglass on context aware and location aware Middleware and applications). Especially the concept of auras have been developed and used in both projects. Additionally some abstractions for aura management, location management and configuration management have been developed in close cooperation even if the environments for both middleware platforms are quite different. Therefore the final code will be different even if several concepts (e.g., the use of WLAN) and architecture components are similar.

4.2.5 GROWTH THEMIS

Brief Summary:

The prime objective of THEMIS (THEmatic Network in Optimising the Management of Intermodal Transport Services) is to co-ordinate on-going activities for research and development, in the field of information systems in Intermodal Freight Transport (IFT) in Europe, while providing at the same time a forum for dissemination and

concertation activities among all parties involved. The scope of the project extends to all areas of IFT including the technical, organizational, administrative, policy, socio-economic, and financial issues.

The Network is organized around a number of activities, which are supported by several teams of experts. The core of the work will be the following activities:

- Clustering of (4th and 5th FP) research projects.
- Collection of data, analysis and synthesis of results through 3 Working Groups.
- Full concertation activities that include among others regular concertation meetings between the research community and extended ”user” groups that involve intermodal operators, major users, ITS industry, member state representatives, etc.
- Dissemination activities, consisting of (among others) a website, Internet discussion groups, workshops in Eastern Europe and printed materials.

Synergies and Co-operations:

THEMIS is a horizontal project, and ***ParcelCall***’s findings will serve as input, and will be analysed and disseminated by THEMIS. Likewise, ***ParcelCall*** will benefit from value-added information compiled by THEMIS.

4.2.6 BMBF COMCAR

Brief Summary:

The COMCAR project targets at the conception and prototypical realisation of an innovative mobile communication network, which shall satisfy the increasing demand for IP-based multimedia and telematics services especially in cars and railways. The COMCAR project is a part of UMTSplus, a new system concept sponsored by the German Ministry for Education and Research (BMBF), which aims at "Universality and Mobility in Telecommunication Networks and Systems”.

Synergies and Co-operations:

COMCAR and ***ParcelCall*** deal both with communication to and from vehicles via different independent radio technologies. The routing of the traffic via the different radio interfaces is in the scope of the investigations of both projects. To maximize the synergy and the cooperation between the projects, a joint implementation of a "Communication Manager" and a "Resource Manager" is currently investigated. Both managers are responsible for controlling traffic flows through the network.

4.3 Dissemination activities and exploitation plans

Date and Type	*Details*
March 15, 2000, Edinburgh, Scotland, Kick-off Operator Task Force	32 participants, among others: SAS cargo, KLM Cargo, the British Post Office, and the International Freight Association.
March, 30-31, 2000, Germany, Dresden, ITG workshop	ParcelCall presentation to a the informatics group (ITG) of the German federation of Electrical Engineers (VDE) by Jens Hartmann.
October 1-4, 2000, Dublin, Ireland, IST Mobile Communication Summit 2000	Scientific paper entitled “ParcelCall: An open architecture for intelligent tracing solutions in transport and logistics” by Carsten Pils, Michael Wallbaum, Birgit Kreller and Jens Hartmann.
November 6-9, 2000, Turin, Italy, 7th World Congress on Intelligent Transport Systems	Scientific paper entitled "Intermodal end-to-end tracking and tracing - introducing the ParcelCall approach" by Kai Jakobs, Axel Busboom, Carsten Pils and Michael Wallbaum.
November 6-9, 2000, Turin, Italy, 7th World Congress on Intelligent Transport Systems	Workshop on European Freight Transport Operation in the Light of Supply Chain Logistics and Multimodality. Presentation “The ParcelCall project: Aims, Scope and Current Achievements” by Kai Jakobs.
November 16-17, 2000, Munich, Germany, GI workshop	Scientific paper entitled "Mobile Agents for Transportation and Logistics", by Jens Hartmann.
January 7-11, 2001, Washington, D.C., USA; Transportation Research Board Annual Conference	Scientific paper entitled "Security and Safety Issues in the ParcelCall Real-Time Tracking and Tracing System", by Michael Wallbaum, Carsten Pils.
March 7 – 9, 2001, San Francisco, USA; DISA's E-Business and Internet Conference	Scientific paper entitled "A new approach to open multimodal tracking & tracing", by Kai Jakobs, Axel Busboom, Carsten Pils, Michael Wallbaum.
March 19 – 22, 2001, Lausanne, Switzerland; 10th International Conf. on Management of Technology	Scientific paper entitled "An Integrated Approach Towards Next Generation Tracking & Tracing", by Kai Jakobs, Ian Graham, Ashley Lloyd, Robin Williams, Graham Spinardi.
April 24 - 25, 2001, Brighton, U.K.; Conf. on Mail Technologies – Evolution to e-Revolution	Scientific paper entiteld “ParcelCall: e.Network Continuous Hierarchical Track & Trace”, by Hanno Walischewski, Torsten Caesar.

May 28 – 30, 2001, Quebec City, Canada; NATO's IST Panel Symposium	Scientific paper entitled "ParcelCall - An Open And Standardised Tracking and Tracing Architecture", by Michael Wallbaum, Carsten Pils
June 28 - 29, 2001, Delft, The Netherlands, EURAS Workshop on Standards, Compatibility and Infrastructure Development	Scientific paper entitled "Developing a Standards-based Tracking & Tracing Infrastructure for Transport Logistics", by Kai Jakobs
July 11 - 13. 2001, Colmar, France, Int. Conf. on Networking	Scientific paper entitled "Using the Internet in Transport Logistics – The Example of a Track & Trace System", by Kai Jakobs, Carsten Pils, Michael Wallbaum
August 24 – 26, 2001, Weingarten, Germany; IFAC conference on Telematics Applications in Automation and Robotics	Scientific paper entitled "ParcelCall - A Network of Co-operating Track & Trace Systems", by Torsten Caesar.
August 24 – 26, 2001, Weingarten, Germany; IFAC conference on Telematics Applications in Automation and Robotics	Scientific paper entitled "Intelligent Tags and their Underlying Middleware Architecture for Future Logistic Applications", by Rolf Kraemer.
August 24 – 26, 2001, Weingarten, Germany; IFAC conference on Telematics Applications in Automation and Robotics	Scientific paper entitled "The Social Construction of Intelligent Parcel Tracking", by Ian Graham, Ashley Lloyd, Graham Spinardi, Robin Williams.
August 26 - 31, 2001, Oakland, USA, IEEE Conf. on Intelligent Transportation Systems	Jakobs, K.; Williams, R.; Graham, I.; Lloyd, A.: Scientific paper entitled "Next Generation Tracking & Tracing – A New Integrated Approach"
September 01 - 06, 2001, Malta, WSES/IEEE Multimedia, Internet, Video Technologies	Scientific paper entitled "Using the Internet for Tracking & Tracing in Transport Logistics", by Kai Jakobs
September 09 – 12, 2001, Barcelona, Spain, IST Mobile Summit	Scientific paper entitled ”The ParcelCall Security Approach: A Security Concept for Multi-Carrier Real-Time Tracking and Tracing” by Michael Wallbaum, Carsten Pils, Birgit Kreller.
September 09 – 12, 2001, Barcelona, Spain, IST Mobile Summit	Scientific paper entitled ”XML-based freight information over mobile networks” by Torsten Dinsing, Jens Hartmann.

September 09 – 12, 2001, Barcelona, Spain, IST Mobile Summit	Scientific paper entitled ”Broadening the Contribution of Socio-Economic Research to IT Research and Technical Development? The case of Smart Parcel Tracking” by Ian Graham, Ashley Lloyd, Marcus Redley, Graham Spinardi, James Stewart, Robin Williams.
September 30 – October 4, 2001, Sydney, Australia, 8th World Congress on Intelligent Transport Systems	Scientific paper entitled "Designing an open track and trace system – the socio-economic context” by Michael Wallbaum.
September 30 – October 4, 2001, Sydney, Australia, 8th World Congress on Intelligent Transport Systems	Scientific paper entitled "The field trial scenario of an inter-modal, end-to-end and real-time tracking and tracing system” by Birgit Kreller, Jens Hartmann.
September 30 – October 4, 2001, Sydney, Australia, 8th World Congress on Intelligent Transport Systems	Scientific paper entitled "The ParcelCall Security concept – security concepts for intelligent tracing solutions” by Carsten Pils.

Table 2 – List of publications

5 Deliverables and other outputs

The ***ParcelCall*** project has already produced nine deliverables. In detail:

D01 – System requirements and initial system concept

D01 is a comprehensive, more than 100 pages long report that analyses the state of the art in tracking and tracing solutions in logistics and in component technologies, and the socio-economic context for ***ParcelCall***, addressing social and economic issues (e.g. commercialisation/uptake strategy, security) and the business case. It seeks to capture the requirements of the different types of potential users, building upon an analysis of existing problems and use cases. An initial statement of user requirements is translated into functional requirements and in turn into technical system requirements. The 'Initial system concept' is laid out encompassing the conceptual approach, data flows, component specification, and studies on thinking tags, Middleware and Security issues.

D02 – Project presentation

D02 is addressing the ***ParcelCall*** web page (http://www.parcelcall.com). It has been redesign according to the project CI in July and continuously updated with news. This web presence consists of a public and an internal part. At the public side the visitor gets e.g., information about the project's objectives and the project's partner. More than 1000 visits have been counted in the first six months.

D03 – Dissemination and use plan

D03 outlines the project's plans for the dissemination of the achieved results, and the intended use of these results by its partners. It first describes the various routes the project will take to make its results available to the widest community possible. Subsequently, the plans of the individual partners on how to employ and exploit these results are briefly described.

D04 – Evaluation plan

D04 is the first output from work package 6. It lays out the criteria and methods to be adopted under WP6 in evaluating the ***ParcelCall*** system trial (WP5). This deliverable aims to establish the criteria to be adopted for evaluating the system implementation and field trial that will be undertaken of the ***ParcelCall*** tracking and tracing architecture.

D05 – GTS, GIS and MLS API specifications

D05 describes the internal interfaces among the components of the ***ParcelCall*** system as well as the interface to external legacy IT systems of carriers. After an overview of the general system architecture, a set of use cases is presented in order to verify the completeness of the specifications. Thereafter, the components of the complete system are described in detail. All Interfaces are described in XML Schema as well as IDL. Therewith, no specific realization is obstructed.

D06 – Refined system architecture

D06 concentrates on aspects of the proposed ***ParcelCall*** system that are encompassed by scenario 2008. The document investigates state of the art developments in tagging technology and expands on the user requirements for novel thinking tag devices. Detailed technical and functional descriptions are provided for the two variants of intelligent tag that are supported within the project which include the interface specifications that will enable these devices to communicate with the rest of the system architecture.

D07 – Proof of concept

D07 forms the basis of the ***ParcelCall*** field trial planned for the middle of 2001. It is essentially a “proof of concept” demonstrator that will act as a vehicle to test the validity of both the 2003 and 2008 scenarios developed during the course of the project. Although the main components of the deliverable are actually the real hardware and software that have been developed to carry out the trial, this supporting document seeks to provide extra information and illustration to help explain the concepts.

D08 – Pilot code deliverable

D08 describes the functional prototype system developed in work package 4, which has been delivered to work package 5 for the pan-European system trial. For the goods information server GIS, the exchange goods tracing server eGTS, the goods tracing server GTS, and the mobile logistics server MLS the system design is described as well as the installation process.

D09 – System Trial Plan

D09 provides a complete description of the system trial. It describes the processes that are to be applied during the trial and provides an overview of the equipment, hard- and software that are required for these processes.

This documents aims to provide detailed instructions for the preparation and execution of the trial to all participants. Descriptions of the routes that will be used for the testing of the ***ParcelCall*** system are part of this document. Furthermore it includes a time schedule for tasks and processes.

Clear assignment of responsibilities to individuals provided in this document will allow for a smooth operation and a successful completion of the trial.

D10 – Evaluation results and project assessment

D10 reviews the outcomes of the Field Trial of ***ParcelCall*** and the evaluation of the trial. It combines this review with a broader assessment of ***ParcelCall*** achievements and of future prospects for tracking and tracing technology. It thus builds upon activities of work packages 1 and 6 (and indirectly other work packages), and contributes to the final report and evaluation of the project as a whole (for example the Technology Implementation Plan).

D11 – Final system concept

Conceptually the ***ParcelCall*** system has not changed significantly compared to the specifications presented in earlier relevant deliverables, namely “D01: System requirements and initial system concept”, “D05: GTS, GIS and MLS API specifications” and “D06: Refined system architecture”. Consequently D11 presents a refined version of the system architecture and focuses on the changes and additions made to the original concept. It also contains supplementary information on message formats and ***ParcelCall*** Thinking Tags which could not be incorporated into previous deliverables.

D12 – Standardisation proposal

D12 describes the ***ParcelCall*** consortiums motivation to initiate standardization activities within the CEN MEET (Multimodal End-to-End Tracking & tracing) workshop and the workshops outcomes. It therefore gives an overview on the initial choices that were made with respect to the standards setting body to host this activity and gives details on the workshops history and the technical work that has been done. The documents produced by this workshop are included.

6 Project management and co-ordination aspects

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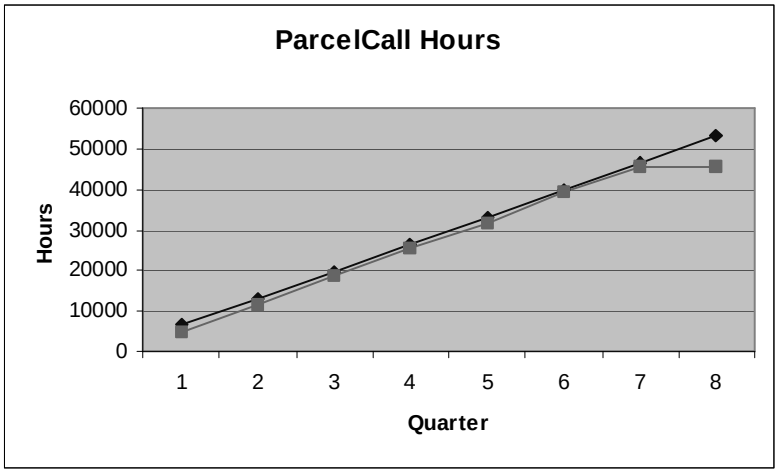

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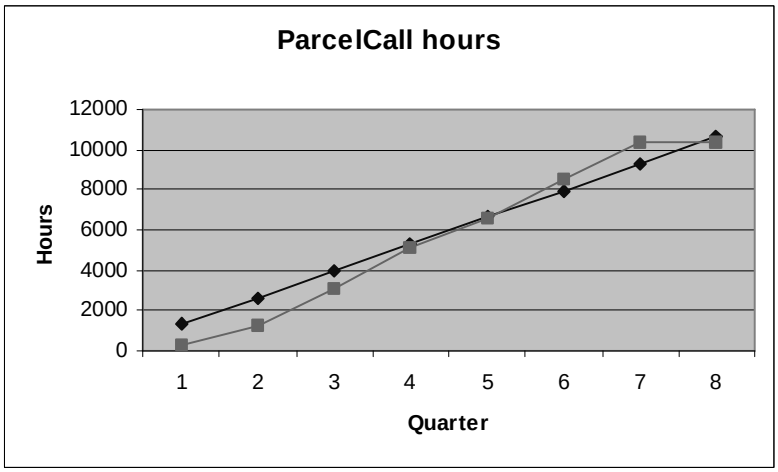

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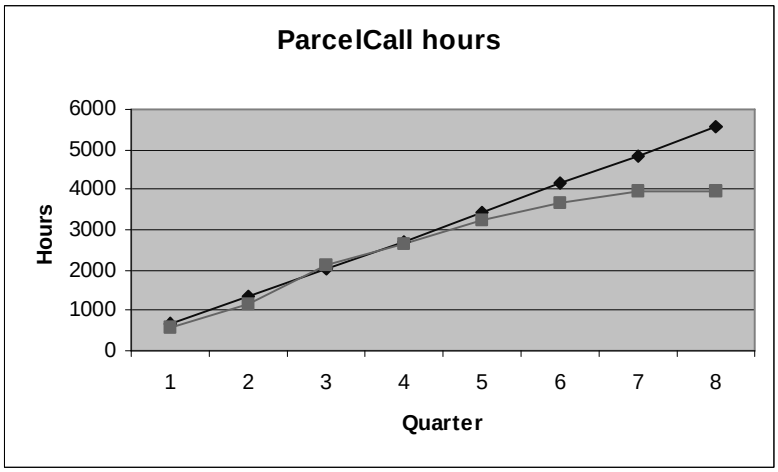

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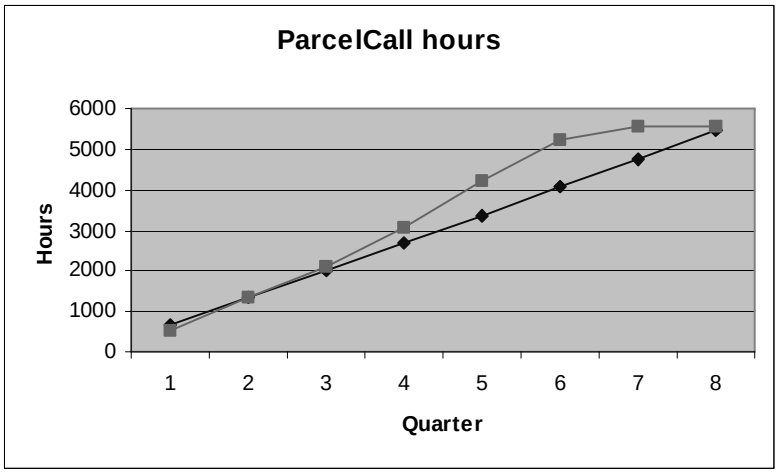
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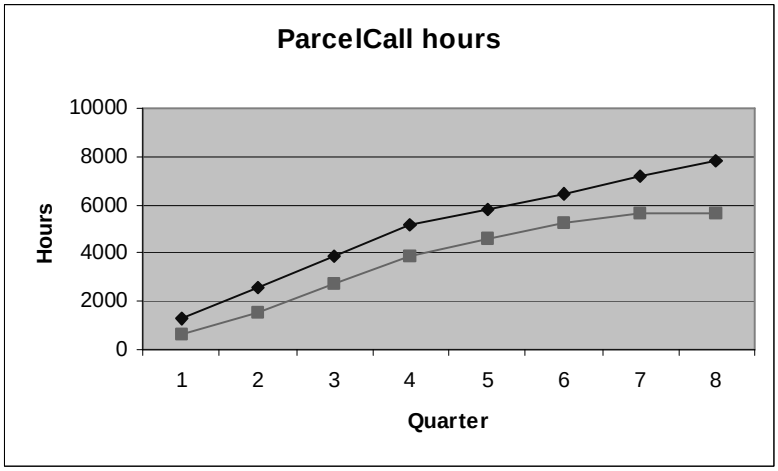
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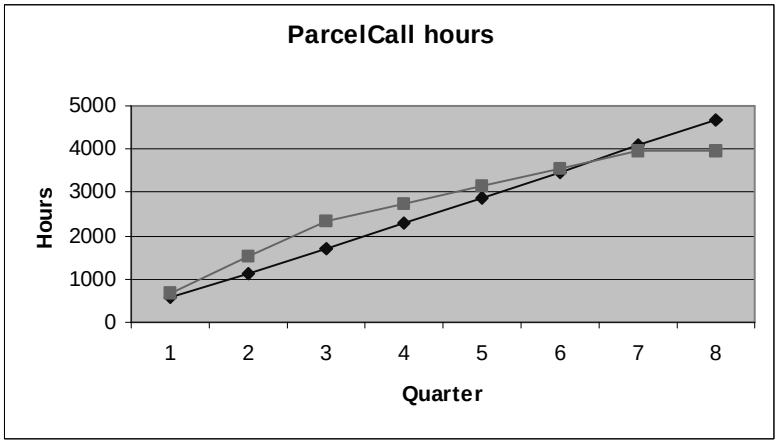
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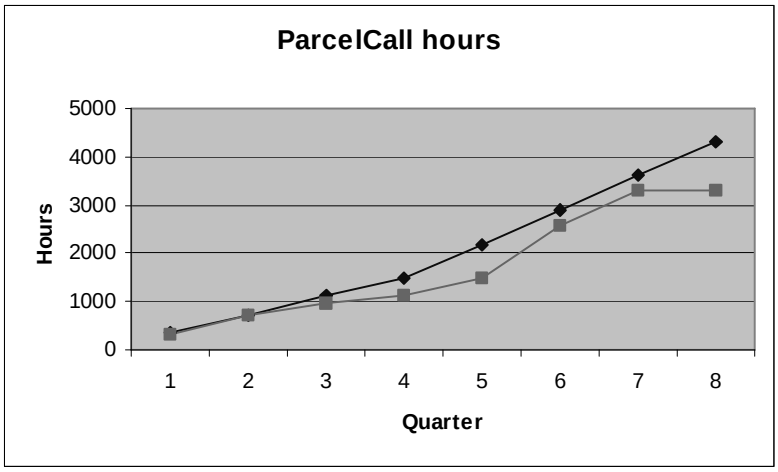
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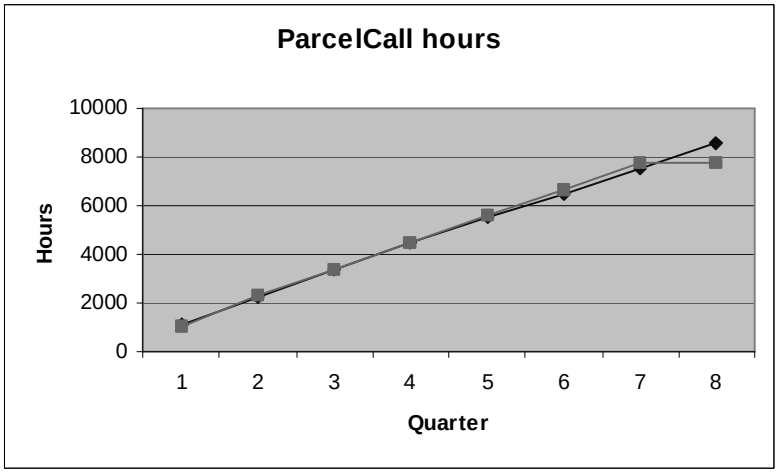
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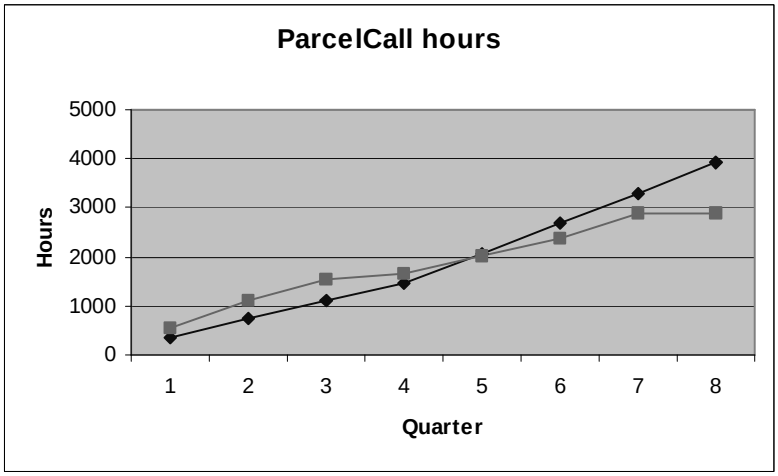
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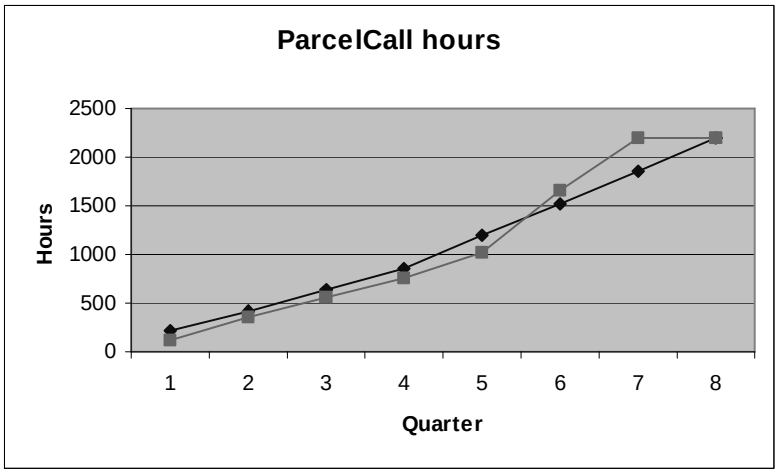
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7 Outlook

This chapter describes how the results and achievements of the project have benefited each partner and how the partners intend to use and exploit these further.

7.1 What is the likely thrust and direction of your exploitation plan?

The results are expected to be exploited by products and services development functions, business-planning functions and later by marketing forces of the consortium partners. The technology transfer to such functions started during the project through a plan especially undertaken for this purpose and continue after the project by transfer of people having been involved in the project to internal missions.

Short-term exploitation clearly focuses on the explored application scenarios in transport and logistics. Mobile and fixed server software as well as mobile user client software are foreseen to offer promising product opportunities for the technology providers. The implemented tracing services will enable the transport and logistics providers to offer improved and novel services to their customers as well as to exploit them for making their logistic processes more reliable and efficient. The new services will be provided at a significantly improved accuracy with respect to existing solutions and at significantly reduced costs.

In the longer term, the transfer of the developed new technologies to other application areas will become of predominant interest. Thinking Tags, equipped with sensing, computing, and storage capabilities, in conjunction with the corresponding aura-aware middleware architectures will open entirely new product markets, particularly as on-chip integration proceeds and hardware costs continue to fall. An extremely broad range of applications from health and child care, to museum, airport, city, or exhibition guiding systems, to environmental surveillance systems, to maintenance and life cycle management services is conceivable.

7.2 Do you foresee moving to an implementation phase of the project, perhaps in some other EU action?

An implementation phase is part of the ***ParcelCall*** project. Within the work package 4 the open architecture of a ***ParcelCall*** system has been implemented and tested within the system trial of work package 5. In parallel, as mentioned in the last section, the project key partners also focus on a short-term realisation of products and services derived from the experience made within the ***ParcelCall*** project.

7.3 Development and/or enhancement of services

It is one result of the ***ParcelCall*** project to enable seamless tracking and tracing across different operators and across different transport modes. This will be achieved by providing common open (and ideally standardized) interfaces among all system components, which will also allow an easy adaptation of legacy systems operated by the carriers to the new information infrastructure of the ***ParcelCall*** system. Additionally by employing satellite-based positioning systems, the accuracy of available location information will be significantly increased compared to existing systems.

Therefore, ***ParcelCall*** will enable the deployment of new products and services and the improvement of existing services. The unified information handling architecture with its public interfaces will open the transport market and improve the market opportunities for smaller carriers, even those which do not operate their own sorting centers.

Other industries will also benefit from a unified means of access, ease of use, and increased availability of accurate information. Using a common interface, they can integrate their own information systems, e. g., stock management, with the systems of their transport providers. The transport processes will become more transparent for the customer and enable them to optimise their supply solutions and to better inform their respective customers. In a similar manner, the consumer-supplier relationships will be improved as up-to-date tracing and quality data can be provided on standard mobile phones, anytime and anywhere.

As a further innovative step, ***ParcelCall*** explores the technological issues of active "Thinking Tags" instead of passive RFID tags. These Thinking Tags, developed by the project, will combine active short-range communication capabilities with sensing, memory, and computing power. Thinking Tags will offer opportunities far beyond the mere transmission of static identification information such as:

- continuous measuring and monitoring of environment conditions (temperature, humidity) for sensitive shipments (e. g., food) at the level of individual pieces,
- active alerting of the owner of a shipment in case of an alarm, e.g., deviation from the planned transport route, inadequate environment conditions, etc.,
- recording of the history (location, environment conditions, status) of a shipment in order to provide evidence in liability issues (e. g., for security transports).

By introducing Thinking Tags ***ParcelCall*** offers various possibilities for the introduction of new and value added services not only within the area of transportation and logistics, as already mentioned above.

7.4 Impact of work, including world leadership, catch-up and know-how

The impact of work within ***ParcelCall*** for the project partners is described in detail for each partner in the following paragraphs.

7.4.1 Ericsson Eurolab

As a leading European R&D centre for mobile and wireline switching products, systems and applications Ericsson Eurolab is able to provide its sound experience in application research to the ***ParcelCall*** project and its partners. It is Ericssons aim to broaden its experience in integrating mobile services from different application domains, such as transport and logistics. The identification of key characteristics and requirements of such Internet applications enables Ericsson to enhance given products as well as to develop further product and application ideas for wireless systems in general and for the transport and logistics domain in particular. Thus network nodes, which enable and enhance machine-to-machine information exchange over mobile networks and those that allow for a better service provisioning for mobile users will be developed. Respective counterparts on the mobile side, especially suited for a vehicular environment, will be targeted.

Contact-less identification and thinking tags are identified as playing a key role in future e-commerce applications. Ericsson has a strong interest not only in establishing contacts and gathering an insight into this product area but also in offering middleware solutions, which allow for a seamless integration of this technology into given und upcoming mobile networks.

7.4.2 Siemens AG / Siemens Dematic AG

Being a major supplier of postal automation systems, Siemens Dematic AG has a long-term and in-depth experience with this kind of solutions and related market segments. This expertise provided a profound base for the ***ParcelCall*** project. In accordance with this business focus there is a strong interest in broadening the expertise with open and easily extendable systems for postal service enterprises and open goods tracing systems with respect to the requirements of transportation companies. Furthermore, the experience gained with intelligent tag technologies will have an impact onto future product designs.

On the other hand Siemens Corporate Technology is in general responsible for the development and exploitation of key and cross section spanning technologies, which are relevant for several Siemens product divisions. Corporate Technology has several years of experience in designing mobile software architectures and integrating mobile services from different application domains. Thus they also represent Siemens in standardization efforts like Object Management Group, W3C, and others.

Both together Siemens Dematic and Siemens Corporate Technology are a strong team, which significantly contributes to the aims and objectives of the ***ParcelCall*** project. Some of the achieved results will be offered to customers upon successful completion of the project. They also provide a good starting point for other cross-domain services from the area of telecommunication networks and solutions, energy provisioning, home automation and medical systems.

7.4.3 Philips

Philips Semiconductors Identification is the world leader in read/write Radio Frequency Identification components and contactless smart card IC's, with tens of millions of units in everyday operation all over the world. Through its long-term experience in low power RF-ASIC design, reliable transmission techniques and RFID System design and customer focused innovation, Philips with its subsidiary Mikron has achieved average annual sales increases of 70 percent. The ***ParcelCall*** project will propose an effective radio interface for the much more capable active Thinking Tags, which can be implemented attractively and be standardised – essential for widespread adoption and technical and business success. It will thus be exploited by providing the conditions for a successful Philips business in supplying the radio components in large quantities, for use by equipment manufacturers and customers.

In a similar way, the I·CODE system now making an impact on the market resulted from the ALBATROS project under the ESPRIT programme.

7.4.4 lesswire

lesswire is a start-up company, now two years in business and experienced in the emerging market of location aware systems from the very beginning. Within this area, several new market sectors, such as fairs, museums, airport as well as logistics have been investigated. With the participation in the ***ParcelCall*** project, lesswire was able to approach the potential market of transport and logistics at a very early stage and to explore future business opportunities. As an example, due to the experience gained within ***ParcelCall***, lesswire was able to get into the segment of tracking and tracing of luggage, equipped with Bluetooth enabled badges. In addition, lesswire was able to conduct experiments both under laboratory and field test conditions. The feedback from these results was very valuable for further improving our location aware systems and to match further customer needs.

7.4.5 TNT Post Group

TNT Post Group (TPG) is a global company providing mail, express and logistics services. They include the time-sensitive collection, storage, sorting, conveyance and delivery of goods. TPG employs nearly 130,000 people in 58 countries and serves over 200 countries.

TPG is the world's first publicly traded company with roots in the postal business.

Mission

TPG's mission is to achieve a recognised world leadership position though excellent service to customers of our three divisions – Mail, Express and Logistics – based on a strong market position in Europe.

Strategy

Base leadership on:

- high brand awareness
- impeccable reputation
- above-average profitability and
- growth

Mail

Ambition: to have the postal operations recognized for quality, efficiency and customer service for producing the best returns in the industry for making optimal use of new technologies for making optimal use of liberalization.

Strategy

- continuous re-engineering of collection, sorting, transporting and delivery processes
- development and implementation of new technology
- developing value-added services
- good price/quality ratio for large international volumes
- geographical expansion of the network
- taking advantage of the emerging liberalization of the European postal market

Express

Ambition: to be the fastest and most reliable express distribution company in the world, with a well-established presence in Europe.

Strategy

creating outstanding levels of customer satisfaction.

- seeking recognition as an Investor in People organization.
- expanding our company-owned network of depots to offer later collection and earlier delivery times.
- introducing leading-edge support technologies
- increasing the number of line haul connections to achieve shorter transit times
- reducing costs
- improving services
- further strengthening of the TNT brand

Logistics

Ambition: to build leadership positions in targeted logistics markets on a global basis.

Strategy

- building credible mass through customers' trust and credibility in the market through sufficient geographic scale
- building economies of skills, developing new skills and utilizing mastered skills in contracts for new customers and in new market sectors
- building operational excellence in warehousing, transportation and IT execution, in management and in training

In order to achieve its mission and reach its strategic goals mentioned earlier, TPG strives to get insight in new technologies that it finds suitable to improve services to its customers. Main objective of the IT strategies of its three divisions is the early adoption of leading edge technology that enables them to improve transport and handling processes to achieve operational excellence.

7.4.6 Hammer

Hammer is the leading logistic-company in the most western part of Germany, right in the heart of Europe. One of the goals of Hammer is to convince his

customers offering new services based on new technologies using innovative concepts and products. One of these services implements a Tracking & Tracing System based on barcode and has been developed by the Hammer IT department.

The usage of RF-ID Tags in the transportation business opens new Dimensions in automating logistic services. Standardizing the interfaces between T&T-Systems of different companies in the global village will lower the costs for logistic services and is so one of the major advantages of the concept described in Parcel Call. Therefore Hammer has a great interest in the results of Parcel Call.

7.4.7 Universities

The Universities involved in ***ParcelCall***, Edinburgh and RWTH, contribute to the broader dissemination and exploitation of the ***ParcelCall*** project results through a variety of public channels. Dissemination has been achieved and will be continued in the future through conference and seminar contributions, through postgraduate research at Master's and Ph.D. level and through teaching at undergraduate and postgraduate levels. In addition the academics are closely involved in academic research programmes in these areas.

For example, for RWTH, work on ***ParcelCall*** has opened up a new research domain – Transport Telematics. Or rather, it has revived an earlier research focus, where work done within e.g. the Prometheus and DRIVE programmes in the early-mid eighties had turned out to be ahead of its time. Those topics are now being looked at again, and experiences gained then can be used today.

Co-operation has already started with a specialist SME based in the Aachen region, and further co-operation partners from both industry and academia are actively being sought. In particular, further standards-setting activities on Transport Telematics are most likely to commence in the near future. Here, RWTH can now also draw upon experiences gathered through the MEET workshop. Indeed, it is anticipated that Transport Telematics will once more become a major research topic.

For Edinburgh University the latest findings from technical research and from research on socio-economic impacts of modern communication technologies guided the project activities while at the same time, the problems addressed in the ***ParcelCall*** project and the solutions, which had been developed, feed into University research and study and thereby help to link public research efforts to industrially relevant subjects.

7.5 Future plans, commercial and market possibilities, and exploitation of results

7.5.1 Re-assessment of the market potential and of the markets to be addressed in the exploitation phase

During the initial months of the project, is has become more evident than ever that there is an urgent demand for seamless and continuous, end-to-end tracking and tracing across a broad range of market segments. These segments include:

Express integrators: Due to the high complexity of their systems, express integrators have the highest demand for – and would benefit the most from – the ***ParcelCall*** technology. On the other hand, it must be appreciated that most express integrators already have quite advanced tracking and tracing systems in place and also make use of state-of-the-art parcel identification technologies. Express integrators would strongly benefit from the "real-time" capability provided by ***ParcelCall***, i.e., the tracking of the vehicles – and hence the parcels transported by these vehicles – while they are on the road.

Postal services: Today, postal services typically have advanced identification and sorting systems, but tracking and tracing systems are the weak link. Therefore, this is a highly interesting market for the ***ParcelCall*** technology.

Air cargo carriers: Air cargo carriers are one of the most interesting markets for the ***ParcelCall*** technology. This is reflected in the high interest from the industry (KLM Cargo, SAS Cargo, IATA) in the ***ParcelCall*** Operator Task Force (see below). However, special consideration must be given to the "Thinking Tags" components of the ***ParcelCall*** system since IATA regulations strictly limit the use of radio communications – and indeed any electronic devices that might emit stray radiation – on board of aircraft.

Road forwarders: Road forwarders are typically small or medium-sized enterprises that are under an enormous cost pressure in a highly competitive market. Tracking and tracing systems are not in place in many cases. Many companies do not even use bar-code based identification, but rather identify the items manually. In this situation, the broad majority of road forwarders is not very likely to invest in a high technology tracking and tracing system. However, as road forwarders typically work as subcontractors for other, much larger players such as logistics providers, air cargo carriers, or express integrators, these customers might in the long run put pressure on the road forwarders to provide standardized tracking and tracing. There is little point for a large express integrator in having a sophisticated tracking and tracing system if the tracking information is lost while the shipment is being moved by a subcontractor. In conclusion, the road forwarders will become an important market in the long run, but cannot be expected to be "early adopters" of the ***ParcelCall*** technology.

Specialized transport providers: This is a rather small, but highly interesting market segment for the ***ParcelCall*** technology. Continuous tracking and tracking

without interruption as well as continuous monitoring is essential for certain transport chains. The main applications are security transports (high-value or security critical items), cooled transports (food and drugs) and shock-sensitive transports (electronics equipment etc.). In all three cases it is absolutely crucial that not only the location but also the condition (temperature, door locked, etc.) of the shipments is exactly known at any time. Today, it is typically possible by means of offline sensors to determine whether or not a shipment has been handled correctly (temperature, shock, etc.) throughout the transport chain, but it is not possible to track when a damage has been caused, and by whom. High savings in insurance fees could be made if it were possible to track exactly who is responsible for a damage. Also, in many cases damage could be avoided by means of online monitoring, e.g., when a cooled container could send an alarm message shortly before its allowed maximum temperature is exceeded.

7.5.2 Commitment and ability of the project participants to operate in the market areas involved

All industrial project partners that act as technology providers in the ***ParcelCall*** consortium (Ericsson, Siemens, Philips, lesswire) are committed to commercialising their respective contributions to the overall ***ParcelCall*** system. The initial focus will be on the respective components that each of the partners develops within the framework of the ***ParcelCall*** project, i.e., Ericsson will focus on the Mobile Logistics Server, Siemens on the Goods Tracing Server and Goods Information Server components, and Philips and lesswire on the Thinking Tags and necessary middleware. TPG and Hammer have a high interest in adopting the ***ParcelCall*** technology and in integrating it with their existing logistics systems. This will help them in further improving the services offered to their customers, in making the processes more transparent and efficient, and to reduce their costs for item handling, especially for handling falsely routed items. The universities will integrate the project findings into their educational and research work. The commitment and ability of the participants to operate in the market areas involved and to assure the transfer of the results into practical and effective use of the project partners are detailed for each partner below.

7.5.2.1 Ericsson Eurolab

Being a major supplier of telecommunications infrastructure, Ericsson is strongly involved in research and development of applications for a mobile environment. This concerns architectures for mobile services in general and key components in particular. Thus the experience and knowledge gathered from the ***ParcelCall*** project and its field trial is going to enter upcoming products for machine-to-machine data exchange between fixed networks and mobile terminals, especially in a vehicular environment. In addition the knowledge gain will be used to enhance future application design for mobile users.

7.5.2.2 Siemens AG / Siemens Dematic AG

Siemens Dematic has a long-term experience with postal automation systems. Together with Siemens Corporate Technology and their experience with cross-domain system architectures and mobile applications this provides a solid knowledge base for the ***ParcelCall*** project.

Based upon this expertise and market position there is a strong interest in transferring promising project results into future product generations. This tackles particularly both the developed seamless tracking and tracing solutions as well as the general overall system architecture. The valuable in-depth insight gained from the field tests and the co-operative developments with our project partners will also help shaping the next generation of products. As the development of key components of an open goods tracing system is of vital interest for Siemens Dematic AG, the developed results will be offered to customers upon successful completion of the project. They will complement Siemens Dematic AG's products in the area of mail inventory and quality measurement systems.

Besides this there are further exploitation possibilities for other business segments, which can be achieved through licensing agreements. This is based on the fact that adequate software architectures integrating mobile components and providing global services are crucial for the next generation of platform products for a number of Siemens divisions. The deregulation and opening of markets requires these new integrated software solutions enabling seamless services crossing domain boarders not only for the area of logistic systems but also for e.g. telecommunication networks and solutions, energy provisioning, home automation and medical systems. These efforts will be mainly driven by Siemens Corporate Technology.

Summarized, there is a whole bunch of business opportunities for Siemens Dematic, which enables a significant value-add in terms of quality of service for mobile tracking and tracing solutions and their sophisticated seamless infrastructure. Contributions to standardization efforts will further help strengthening the market position of Siemens.

7.5.2.3 Philips

Philips has a long tradition of offering expertise and solutions in a host of communications, interfacing and networking technologies. This includes innovations in areas such as 802.11 as well as Bluetooth, where Philips is a key supplier of silicon for Bluetooth enabled products. This innovative trend has also been extended to addressing lower data rate radio applications, where new radio technologies such as 'ZigBee' are being developed.

At the same time Philips also has a very strong position in the field of passive RFID, with products ranging from RF Identification tags to contactless smart cards.

The work that has been carried out as part of the ***ParcelCall*** project has concentrated on further developments of the ZigBee technology, whilst at the same time focusing on applications traditionally carried out by less capable passive technologies. In this way ***ParcelCall*** has helped Philips to bridge the gap between

these two previously separate, but otherwise closely related activities. Hopefully by doing this it should provide the conditions for a successful Philips Semiconductors Identification business in supplying the radio components in large quantities, for use by equipment manufacturers and customers.

7.5.2.4 Lesswire

The market of ITS is still new for lesswire, but with the technological skills and ability to adapt quickly to the customer needs, we were able to get into the market quickly. Furthermore the logistic market needs very similar solutions and this is very close to our current customer base. lesswire was one of the first companies world-wide being able to deliver Bluetooth based solutions, and we are still leading in performance of our products. During the CeBIT 2001, lesswire installed the world largest Bluetooth network covering an area of 250'000 square meters with more than 120 Bluetooth base stations. Together with the features of the LocalNavigator platform, lesswire is well positioned to conquer the segment of location aware services. lesswire sees the ***ParcelCall*** project as an enabler to get experience in other closely related market fields. For example, the security market is highly interested, where tracking and tracing of objects, e.g. luggage is of major concern. Getting feedback from real customers concerning the quality of our products, ease of use, quality of documentation and support is mainly agnostic to the market segment itself. From the participation in the ***ParcelCall*** project lesswire gained allot of expertise and helped to get much faster onto the learning curve.

7.5.2.5 TNT Post Group

The results of the ***ParcelCall*** project will be taken into consideration by IS departments for the development and implementation of new technologies and equipment to be used in its transport networks.

However, the experience gained during the System Trial has highlighted that the ***ParcelCall*** technology in its current form does not meet business requirements in terms of stability and reliability. Earlier plans to further develop ***ParcelCall*** technology for use in security applications will therefore not be pursued.

7.5.2.6 Hammer

The experiences gained during the System Trial showed the advantages of the designed system. It comes out of the System Trial that the main advantage of the Parcel Call Concept is the standardized interface of the Parcel Call System to the involved transportation companies. This standard interface reduces the IT-expenses if communication between transportation on a T&T-basis is necessary. It is of prime importance to establish this standard interface worldwide to simplify logistic services.

So long as this standardization didn't took place and the RF-Hardware involved in the System Trial is not more reliable and much more cheaper (especially the tags) Hammer would go on using proprietary T&T-Systems based on barcode-technology.

7.5.2.7 Universities

The results of ***ParcelCall*** are exploited by the involved Universities in form of lectures, seminars and through Master and Ph.D. theses. Likewise, research activities will benefit from the project findings, as noted above. Lectures and seminars, which cover various aspects of the project, will be held at both Edinburgh University and RWTH-Aachen. Edinburgh will hereby focus on the socio-economic aspects of the ***ParcelCall*** project

New insights, including results obtained from ***ParcelCall***, will continue to be disseminated through educational activities at RWTH and Edinburgh University. These include Diploma theses (one is ongoing, two more are planned for the near future) and PhD dissertations (two are ongoing, one more is planned). Likewise, selected topics from Transport Telematics have been included in postgraduate courses, and smaller related projects are being offered for postgraduate level seminars at RWTH, while Edinburgh in its educational activities focuses on the socio-economic aspects of the ***ParcelCall*** project.

7.5.3 Efforts so far undertaken and to be undertaken in the future to assure transition to a successful exploitation phase

To assure a successful exploitation phase several activities have been started and will be continued by the ***ParcelCall*** consortium. The project follows five different lines of activity, including:

- presentations at public scientific/industry events,
- the Operator Task Force (OTF) and standardisation activities,
- organisation of dedicated project specific events,
- educational activities at the participating universities and
- others (public web site, project flyer).

It is crucial for a successful exploitation phase that the ***ParcelCall*** approach is not only adopted by the contractors directly involved in the project, but also by a much wider community from a broad range of industry sectors. In order to ensure this broad adoption and acceptance, two forums have been established by the ***ParcelCall*** project:

The Operator Task Force (OTF)

The ***ParcelCall*** “Operator Task Force” (OTF) is one of the major mechanisms established by the project to enable and support co-operation with a wide range of stakeholders outside the project and also contributes to a wider dissemination of the ***ParcelCall*** results. Members of the OTF come from a broad range of industry sectors, including, but not limited to, transport and logistics companies, air cargo carriers, road forwarders, specialist software houses, authorities, postal services, etc.

Any company – or other legal entity – that has an interest in the ***ParcelCall*** project, can apply for OTF membership. Members are accepted into the OTF provided that none of the PCC delegates objects to the membership. The current list of OTF

members could be found in Annex 7. New members are continuously being accepted into the OTF for the entire duration of the project.

The OTF was established during a meeting in Edinburgh on March 15, 2000. Its objective is to keep interested parties in touch with the ***ParcelCall*** project without requiring any extensive commitment on either side. On the initial OTF workshop, the ***ParcelCall*** project was presented to the OTF members, and the participants were asked to comment on the project as a whole and to the specific user requirements from their respective points of view. The workshop received valuable input to the initial compilation of user requirements for the ***ParcelCall*** project.

OTF members are regularly kept up to date on the progress of the project, and receive copies of the public deliverables as soon as they have been submitted to the European Commission. The OTF members will also be invited to a roadshow demonstration during the ***ParcelCall*** field trial.

The high interest in the OTF from a broad range of players as well as its rapid growth during the first months of the project proves the validity of this concept. It gives interested companies the opportunity to observe the project progress without requiring any high key commitment from them at this early stage.

CEN/ISSS Workshop on "Intermodal End-to-end Tracking and Tracing"

The ***ParcelCall*** project has established a workshop on "Intermodal End-to-end Tracking and Tracing" within CEN/ISSS ("Information Society Standardization Systems"). The workshop has been accepted by CEN/ISSS. The initial workshop took place in Brussels on September 22, 2000. The activities of the workshop will continue throughout (and possibly beyond) the lifetime of the ***ParcelCall*** project.

The objective of the workshop was to ensure that as many as possible components and interfaces of the ***ParcelCall*** system are standardized and widely accepted. As an outcome, so-called CWA's ("CEN Workshop Agreements") will be produced which may subsequently be fed into the more formal standards setting process within the frameworks of CEN or ISO.

At least initially the workshop was based on the work done within the ***ParcelCall*** project. ***ParcelCall*** will provide input for discussion and possibly for endorsement. The project does not, however, expect that all input will be approved by the workshop. Obviously, the workshop will comprise a wide range of stakeholders, including – but not by any means limited to – the ***ParcelCall*** participants.

The CEN/ISSS workshop will:

- identify elements of the architecture that require standards setting activities,
- discuss the requirements provided by the ***ParcelCall*** project, and identify further requirements from the broadest possible set of stakeholders,
- translate the identified and agreed requirements into functional specifications,
- specify the interfaces between the elements of the system architecture,
- produce and validate those CWA's considered necessary,
- maintain Workshop web pages.

The major output of the workshop will be two CWA's, that will subsequently be fed into the formal standards setting process. Possible formal standards setting bodies to continue this work include CEN TC 278, CEN TC 225, CEN TC 331 and ISO TC 204.

The CWA's to be published by the workshop are:

- Agreed Requirements on an Open Multimodal Tracking & Tracing System.
- Functional Specifications of an Open Multimodal Tracking & Tracing System.

In addition the Workshop will produce dedicated guidelines for implementers.

7.6 Demonstrations, findings, conclusions and future possibilities

A major demonstration was the performed pan-European system trial with a broad setting of complex logistic patterns. Various carriers, countries, transportation modes, senders and receivers were involved. Within the field trial the applications on the different levels of the ***ParcelCall*** system were tested and verified. This included the identification of pieces using passive RFID tags and Thinking Tags, real time tracking of positioning and status information, active user alerting and others.

The system trial was specified in detail in the beginning of 2001 and was planned afterwards. The implementation of the trial was then performed and tested in the third quarter of 2001.

7.7 End Products of the Project

7.7.1 End Product Description Sheet

Within ***ParcelCall*** a real-time, intelligent, end-to-end, tracking and tracing system for transport and logistics applications – operating across all borders of carriers and transportation modes, enabling the re-engineering of the transport and logistics industry in Europe has been developed and verified. It draws on emerging technologies and networks (e.g. RFID tags, Internet, GPRS, Bluetooth) to develop and trial the system and applications in a realistic business context.

Thinking Tags play an important role. This means that the development and integration of active tags, linked together in wireless ad-hoc networks, with computing power, memory and sensors, providing the means to monitor and log environmental conditions and quality status of transport goods and to communicate alerts that conditions are deviating from their default ranges, are part of the ***ParcelCall*** system.

Source of output

Source of output form the ***ParcelCall*** project is an implementation of the ***ParcelCall*** system, consisting of its different components as they and their interfaces are described in detail within deliverable D05.

Goods Information Server (GIS): The GIS provides the portal to the information maintained by the GTS network. It serves as a gateway between the distributed GTS system and a multitude of mobile and fixed end-user devices, e.g. mobile phones, PDA's, or home and business PC's.

Goods Tracking Servers (GTS): The GTS network acts between the GIS at the human machine interface and the MLS as the entity recording and sensor monitoring devices. The GTS concentrates on the business logic of the ***ParcelCall*** system and provides the interface to the legacy system of the carrier.

Mobile Logistic Servers (MLS): The MLS as a part of each transport unit keeps track of the goods within that unit. To fulfil this task the MLS provides the functionality for the scanning of items, to organise the hierarchical structure of MLS's and parcels, to set and retrieves properties of transportation goods and is able to handle upcoming events.

Thinking Tags: Thinking Tags that interact with each other and with fixed devices in many ways and which are able to monitor environmental changes are part of the final ***ParcelCall*** system.

Type

The type of output of the ***ParcelCall*** project is a demonstrator for a real-time end-to-end Tracking and Tracing System, which have been evaluated in the field trial. The demonstrator consists of different servers and tag readers and their respective software, which is based on existing middleware or software developed within the ***ParcelCall*** project.

Client(s)/Users(s)

Transport and logistics companies are the main clients for the ***ParcelCall*** system. Owing to its open and scalable system architecture, the ***ParcelCall*** system can be easily extended and therefore small trucking companies can adopt the ***ParcelCall*** tracking and tracing services as well as a huge multinational integrator.

Due to the ***ParcelCall*** systems open interfaces customers and subcontractors in transports and logistics benefit, as well as end-customers, who may retrieve information of their transported goods via the public access to the tracking and tracing services.

Benefits

The developed system overcomes the limitations of existing tracking and tracing systems, as no real-time tracking of the actual position of individual parcels is currently available and only estimated arrival times are available during transport.

Additionally the surveillance of environmental parameters, such as temperature, shock, humidity, pressure or location and the optional generation of alarm messages in the case of violation of predefined conditions is possible. The end users are able to access the information of their parcels in different formats, e.g. WML, HTML, SMS either from a WAP enabled handset, a terminal attached to the internet or a normal mobile phone.

8 Conclusions

8.1 Assessment of ParcelCall outcomes

Despite the project not producing an off the shelf product, a great deal of valuable knowledge was acquired of both a technical and business nature. As well as the technical outcomes from the project there are a number of other important outcomes that may prove to be valuable in taking forward the work done during this period.

8.1.1 New technical projects

Some of the ***ParcelCall*** project members have used the knowledge and resources of ***ParcelCall*** to develop new projects or in planning new developments in related application domains. These include EED (an implementation of many elements of the ***ParcelCall*** system in the tracking of containers), TPG (are considering investing in more research in this area), PRL (some of the staff initially involved in ***ParcelCall*** have moved from a research to a development context where they are able to pursue commercial spin-offs from the project).

8.1.2 Standardistation

An important outcome of ***ParcelCall*** is the use of the research and ideas in the drafting of proposed standards by the MEET workshop.

8.1.3 Knowledge gained

First was the design of the information architecture, and the proposal of a system and standards to provide multi-modal tracking and tracking (T&T) at the parcel level. Second, an understanding of the state of the art of T&T and various technologies needed for future innovation. Third, a better appreciation of the application domain in transport and logistics and of the technical, social and business issues in implementing advanced tracking and tracing solutions. This includes, crucially, an understanding of the different processes. Fourth, understanding of the issues facing companies operating in different markets and technical domains and with different expertise who could be important players in the future development of advanced tracking and tracing solutions. Crucial in this case was the bringing together of the 'separate worlds' of mobile and internet technologies, as well as technology developers and technology users. Fifth, learning about the management and conduct of multi-partner EC projects, the limits and possibilities of R&D in this environment, and issues involved in integrating user organisations and social science research into RTD projects.

8.1.4 Specific lessons learnt

The underlying thinking that informed the ***ParcelCall*** architecture was validated as an effective distributed model for innovation. In particular it provided a framework for development of a number of interoperating elements - which allowed various partners to collaborate together. This model also meant that ***ParcelCall*** outcomes were not tightly coupled together as a unitary outcome, but allowed different combinations and configurations of ***ParcelCall*** technology for particular circumstances. The standardisation activities were crucial to this distributed model. Indeed even if none of the ***ParcelCall*** technologies were taken up, the standards could play a crucial role in enabling exchange of information between carriers! The original ***ParcelCall*** plan was underpinned by a generic presumption that more and faster information would be seen as beneficial for players in the logistics and transport industry. The ***ParcelCall*** project has allowed this to be unpicked. For example monitoring data may be important - but may not need to be accessed in real time. In particular it flags that different industrial players may have differing informational needs. Thus security (for high value products) is more likely to be a driver for the move to item level T&T - whilst for logistics as a whole unit level (eg container, lorry) is likely to be sufficient for the immediate future. The project generated important lessons in terms of understanding the scope and limitations for conducting field trials. In particular, within the short-time frame of an RTD project (2 years in this case) its may not be realistic to expect completed robust solutions, and it is very unlikely that realistic user trials can be undertaken. Longer term projects would be needed for such a goal. Attention is also needed to the methods of supporting such demonstrators and trials given the different needs and commitments of industrial users and technology developers, and the EC rules and funding models for such demonstrators which are unlikely to be attractive. The goal of a working demonstrator trial had a rather specific effects on the development of ***ParcelCall***. It forced the various partners to focus on getting the whole system to work, even in a rather limited manner. This called for closer co-operation between a number of the consortium members and made difficulties in getting the various parts to work together clear. In particular it put pressure particularly on the production of the MLS, which integrated a number of technologies (radio tags, mobile data communications, internet, GPS) in a novel way, and suffered from the difficulties of all of them. In this sense the trial caused difficulties and issues that might not have otherwise been encountered to be highlighted and addressed. In many ways this was helpful in terms of the project outcomes. It also had less productive aspects. For example the original expectation had been to utilise GPRS technologies. When it transpired that these would not be available at the European level it became necessary to use existing mobile services, initially GSM. When the problems with use of GSM for data transmission between different operators and countries were identified (itself an important outcome of the project), a further set of technical adaptations were necessary to port the application onto SMS (a service that had initially been ruled out because of known limitations). This entailed a large amount of technical work - that would not be essential for the future GPRS-based T&T solutions. The implication is that more flexibility may be needed in relation to the timing and goals of RTD projects (as well perhaps as greater ability to divert resources to tackling unanticipated technical etc difficulties).

8.2 Strategic overview of the scope for T&T technologies

Tracking and tracing technologies are being widely adopted within transport and logistics, alongside the use of GPS in vehicle tracking. Developments in transport and broader logistics/virtual manufacturing etc are likely to encourage the adoption of RFID technologies and tracking at the level of items. However, in the short-term, security is likely to be a more important driver than logistics. These and other niche markets (e.g., medical products) could play a role in fostering the technology in its early days while for example the technologies for thinking tags mature and become more affordable. However this will mean that the market is likely to grow only gradually. RFID-based T&T systems are likely to emerge in the short-term as proprietary extensions to in-house legacy systems. There are major constraints to the development and adoption of inter-organisational solutions (e.g., significant path dependencies/network externalities). ***ParceCall*** T&T technology has important benefits, and its architecture offers extensibility and flexibility to deal with this evolving market. ***ParcelCall*** standards, if widely taken up, could greatly reduce the costs of moving towards interorganisational information exchange. However this may depend upon other drivers such as public policy/regulation. Otherwise we are likely to see the emergence of incompatible proprietary solutions - with the emergence of industry standards (that may be incorporated into off the shelf logistics and ERP systems) in perhaps 5-10 years.