**ParcelCall**

**An Open Architecture for Intelligent Tracing Solutions in Transport and Logistics**

**Funding:** European (5th RTD Framework Programme)
**Duration:** Jan 2000 - Dec 2001
**Status:** Complete with results

**Background & policy context:**

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.

The RTD project 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.

**Objectives:**

The objective of ParcelCall was to realise 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. 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:

1. Development of an open tracking and tracing architecture across the complete logistic chain.
2. Integration of active sensors, providing the means to monitor and control environmental conditions and quality status of transport goods.
3. 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 transshipping. 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.

**Methodology:**

From the organisational point of view, the ParcelCall project consists of seven groups of activities.

1) Requirements.

The objective of this group of activities was to identify the systems requirements and their implications
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 the “System Architecture Design” – and the results discussed at joint workshops and virtual exchanges.

2) System Architecture Design.

The objectives of WP2 during the reported period were the following.

- 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.

3) Development of Thinking Tags.

This group of activities involved the final design and construction of the active reader and thinking tags units that would take part in the scheduled trials. In addition, and to accompany this hardware, a substantial document was produced that detailed all aspects of its design, construction and testing.

4) Implementation of the Open Architecture.

This group of activities focused on the implementation of the ParcelCall system based on the concepts elaborated. The main activities during the reported period were:

- definition of the interfaces between the ParcelCall components;
- definition of the field trial scenarios;
- testing of the scenarios in preparation to

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Partners:

Germany:
Ericsson Eurolab Deutschland GmbH; Siemens AG - Corporate Technology ZT SE 2; Siemens Dematic AG, Germany; Lesswire AG; WTH Aachen Informatics IV; Hammer GmbH & Co. KG

The Netherlands:
TNT holdings B.V. - TNT Post Group N.Y.

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Key Results:

The end product of the project is the development, demonstration and evaluation of 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.

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.

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.

The main benefits of the developed system consist in that it 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.

Finally important outcomes of ParcelCall are the use of the research and ideas in the drafting of proposed standards by the MEET workshop and the knowledge gained, among which:

1. the design of the information architecture, and the proposal of a system an

Technical Implications

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 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 Mobile Logistics Server, which integrated a
Policy implications

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 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. ParceCall 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.

Documents:
 ParcelCall Final Report (Final report)

STRIA Roadmaps:
Cooperative, connected and automated transport, Network and traffic management systems

Transport mode:  Multimodal transport
Transport sectors:  Freight transport
Geo-spatial type:  Other