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Efficient and Reliable Transportation of Consignments (ERTOC)

Javed Akhtar, Ricardo, UK

John Bailey, Ricardo, UK

David Weatherby, GS1 UK, UK

Siraj Ahmed Shaikh, Coventry University, UK

David Ireland, IRIS Technology, UK

Daniel Payne, Ricardo, UK

Luke Antins, IRIS Technology, UK

Dave Barker, IRIS Technology, UK

ABSTRACT

This paper describes a new initiative to drive business improvement and sustainability throughout the supply chain from factory to point of sale. The effort, called Efficient and Reliable Transportation of Consignments (ERTOC), aims to develop a standards based open architecture data hub to deliver accurate information for transport operators and their customers to use and improve business efficiency and effectiveness. Only by understanding the true environmental costs involved, users will be able to compare and assess different transport options to make better informed choices. Such a need drives this effort to demonstrate how a standardised data hub can track the carbon costs of transport at consignment level. The paper presents the underlying architecture of the proposed system, which serves to integrate (diverse and third party) resources, involving collection of data, storage and provision of it for further processing.

Keywords: Carbon Tracking, Consignments, Logistics, Open Architecture, Standards

INTRODUCTION

This paper describes a new initiative launched by Ricardo UK, Unipart Logistics, IRIS Technology, GS1 UK and Coventry University to drive business improvement and sustainability throughout the supply chain from factory to point of sale. ERTOC is a two-year collaborative project aiming to develop a standards based open architecture data hub to deliver accurate

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information for transport operators and their customers to use and improve business efficiency and effectiveness.

The focus of the project is to demonstrate how a standardised data hub can track the carbon costs of transport at consignment level. By understanding the true environmental costs involved, users will be able to compare and assess different transport options to make better informed choices. The project will also develop a demonstration application that will use the information required for carbon tracking to show how a data centric open architecture can deliver new functions.

ERTOC aims to provide information that will drive the following benefits to transport operators, retailers, manufacturers and regulators. This will be achieved by

- Transport optimization, through the comparison of the true environmental costs of different modes of surface transport,
- Improved process efficiency, through the simplified and standardised flow of information between transport users and providers,
- Reduction in energy consumption and emissions, by providing standardised access to driver behaviour data, and
- Improved supply chain visibility, by providing timely information on the status and location of consignments.

Existing tracking systems are not integrated, expensive, closed and provide limited, vehicle centric information. ERTOC is designed to provide near real-time tracking of carbon emissions and provides for a single interface to multiple sources of data, allowing users in the transport and logistics sectors to be able to dynamically optimize operations at a consignment level. This offers a truly innovative systems for the sector and aims at convergence of all sources of transport and traffic data.

The rest of this paper is organized as follows. The following section presents the motivation for carbon tracking in the logistics sector. This is followed by an in-depth examination of the technical architecture underlying the ERTOC system. A test strategy for the entire system is subsequently discussed. The adoption of standards and design security is then examined in relevant detail. The last section concludes the paper.

Motivation

The purpose of this section is to present a case for a new approach to how logistics can be made more efficient and reliable.

Within the next few years either legislation or customer demand will push organisations to know, understand and declare their carbon emissions to external stakeholders, and also cost drivers will move organisations to look deeper and further along their supply chains. Currently organisations are using internal systems to understand their CO2 emissions but not at consignment levels and probably with only proxy data. ERTOC looks to address this situation with real data captured at the consignment level allowing accrued CO2 emission to be attributed to specific consignments when transported across distribution networks. The ability for an organisation to then compare their network distribution's emission performance against others that support similar transportation and consignment needs provides an insightful view of own performance as well as growing an awareness of alternative more efficient and emissions effective options for freight distribution.

The ERTOC initiative has a number of specific objectives that all fall under the umbrella of "moving goods more intelligently". It sets out to provide users with access to new data sources capable of being integrated with existing applications of differing levels of maturity that in themselves support businesses in the intelligent and efficient shipping of goods. Combined these provide end users/businesses with a means to monitor/assess key shipping parameters on a consignment level basis. These parameters include the increasingly important Carbon transportation cost necessary to support a carbon trading infrastructure and meet the future scope three Carbon Reduction Commitment requirements. ERTOC aims to develop a scalable architecture that supports road, rail, air and marine transportation modes for all stages of a consignments journey (including the last mile).

A critical aspect of the programme is the collection and intelligent storage of raw data from a number of sources in such a way to provide users with significant opportunities to make more informed decisions on how to ship goods. This will lead to a more effective use of the transport infrastructure through reduced congestion (increased use of multi-modal shipping), reduced emissions (more effective use of transport, sharing of load capacity and improvement in driver behaviour) and more informed choice for end users (better measurement of carbon shipping costs at product level) as well as enhanced accounting and forecasting capabilities.

One example would be a parcel which may be shipped on a next day delivery with a relatively high carbon shipping cost as a result of potentially empty transportation, verses using standard shipping where transportation may be more efficiently utilised (e.g., full) with a relatively low carbon shipping cost. The development of an open-interface to access and share data will encourage greater industry collaboration between freight users and freight operators and systems integration leading to significant business efficiency improvements.

Telematics data alone is insufficient to meet the needs of the multitude of stakeholders involved. Indeed, most telematics systems fail to deliver a compelling business case for all but the most determined vehicle operators, due to the narrow focus of the applications provided by their point solutions. ERTOC's unique proposition is to widen access to telematics data in such a way that all parties with a vested interest in the more efficient transportation of consignments can share and analyse a significant data repository of actual distribution network performance. Such analysis will provide opportunities for interested parties to develop both accounting and forecasting applications that utilise CO2 emissions, journey times and associated cost data from a vast range of data contributors via data-hub and open API technologies.

A further illustration how ERTOC may support the larger societal opportunity is with the use of telemetry data to support the intelligent selection of vehicle types (larger verses smaller trucks). A position paper (European Federation for Transport and Environment, 2007) the introduction of longer and heavier trucks on European roads. The paper concludes that if loaded at <=77% of capacity, a heavier truck has worse CO2 than a fully laden smaller lorry. The paper also states that transport costs per tonne/km, can be reduced by 20-25% for relatively light goods on larger trucks. The availability of an ERTOC system to support truck selection and sharing between operators can therefore lead to a potential 20-25% reduction in emissions.

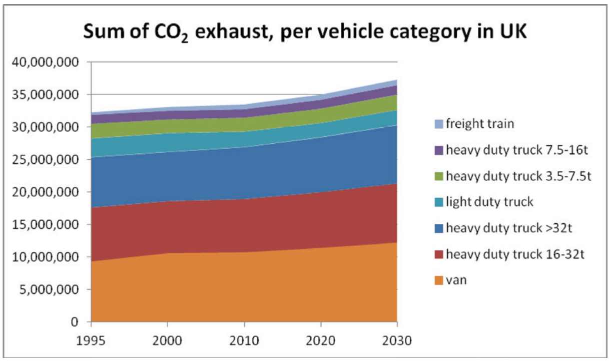
With the predicted growth in freight transportation, particularly road transportation the relative cost and efficiency of alternative transport modes becomes increasingly important. Figure 1 shows the sum of CO_2 exhaust per category of vehicles in the UK since 1995 and estimates it until 2030 (Transport & Mobility Leuven, 2007).

Rail and marine transportation are both generally more efficient than road transportation as shown by the TREMOVE in Figure 2 (Transport & Mobility Leuven, 2007). However, utilisation is an important factor in the actual efficiency of the different transport modes. The ERTOC system will support the operators in determining the efficiency of alternative multimodal transportation.

Examining the various opportunities for reductions in emissions and costs, there is the potential to achieve up to a 35% reduction through the application of shared data in improved transportation schemes. A similar conclusion is reached by the report "Sustainable transport: consequences of an 80-90% emission reduction", national institute of public health and the environment, the Netherlands.

'Local' (i.e., small) hauliers must be able to 'hook into' (interface) their journey metrics

Figure 1. Transport growth



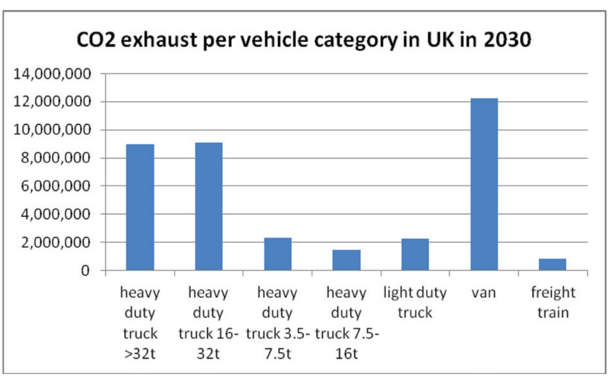
into ERTOC with ease. Such small hauliers may be using only rudimentary data capture / report methods, APIs aimed at these hauliers need to be easily adopted through smart phone applications.

TECHNICAL ARCHITECTURE OF ERTOC

This section describes the technical architecture underlying the ERTOC initiative, and the conceptual approach adapted to delivering a sector wide service for the logistics industry.

The system architecture is influenced by multiple drivers. Primarily the system exists as a platform to collect, collate, process and disseminate data from a variety of sources, be they public domain or proprietary to a particular organisation. For many potential applications, the larger the bulk of historical data which is amassed, the more useful and accurate the system will be (for example in the areas of forecasting and estimation). In order to achieve this and encourage up-take, the barrier to use of the system must be as low as possible and the service provides an open interface based on mature, existing technologies, while maintaining a rigorous access scheme to ensure that access to confidential information is appropriately restricted. The result is that building a software component to integrate an existing system, such as a fleet management system, becomes a relatively straight forward task. A variety of third-party applications are also expected to build on the proposed system, accessing and manipulating data through it, in

Figure 2. CO_2 emissions



order to employ the available data in novel and innovative ways.

When considering data sources it must be recognised that multiple models by which consignment, transport and network information can be represented are already in existence, ranging from relatively broad and standardised (British Standards Institute, 2006; INSPIRE, 2009) to the specialised, single-modal and proprietary (for example, those used for localised traffic analysis and optimisation). Due to the fact that ERTOC aims to collect multi-modal data from a variety of data sources including those which may be of limited accuracy, see Figure 3 below, the approach taken by ERTOC is to define a minimum set of data which is required in order to provide the basis for the forward calculations and also to associate a quality factor with the data. In this way it's possible to choose to fall back to data of a lower quality or even estimation when specific data is unavailable and conversely to make use of high resolution, high accuracy data if it exists.

By using such an approach it ensures that data may be taken from a wide variety of sources, while ensuring that consumers of the data are provided with a quality indicator which gives a high-level indication of the providence of the data upon which calculations or recommendations are based.

The ERTOC Service provides a single, unified interface to the data held within the ERTOC system. This interface recognises confidentiality while also allowing data to be shared in an anonymised and aggregated form where a client allows this.

The ERTOC Service is intended to support a variety of different users, ranging from business that are involved purely in the purchase of logistic services in order to transport their goods, through to fleet operators, through to mobile and telematics applications. The anonymised sharing of data opens up various interesting opportunities as compared to isolated, closed systems. These range from the identification and tracking of long-term trends through to comparison against real-time industry averages.

The process of modelling carbon usage and dividing an overall total associated with transport and warehousing between the consignments occupying the vehicle/warehouse is an area of active research and development and it seems likely that this will continue to be the case, meaning that currently there is no single standardised way in which to calculate the carbon cost of a specific consignment, though various guidelines are available (EEA, 2009). It seems likely that as part of the continuing development of regulation in the environmental emissions arena, such a methodology will become standardised, however there is no guarantee that there will be global agreement on this. ERTOC seeks to support multiple models for cost attribution, potentially including those specific to an organisation and allowing for increasingly detailed and refined models to be produced as part of future research efforts.

The proposed system architecture in Figure 4 will integrate a number of applications that share functional elements and data with a view to providing enhanced mechanisms for business efficiency improvement. This is becoming increasingly important with the focus on carbon offset and reduction schemes. The data may be supplied by a number of systems that are owned by different end users and stakeholders and as such this presents a significant challenge from the perspective of data integrity where data providers may wish to protect their own data and also be suspicious of data provided by entities which are essentially business competitors.

A key aspect of this programme is to develop an architecture that supports this data-centric approach to logistics management systems and provide a level of data integrity that will encourage data sharing and the development of further efficiency improvement systems.

Initially, ERTOC targets four distinct areas of functionality. The data collected will be analysed for a variety of purposes including

1. Route planning to ensure optimal multi-modal paths (allowing the user to balance distance, time, cost and environmental

Figure 3. Data architecture for ERTOC

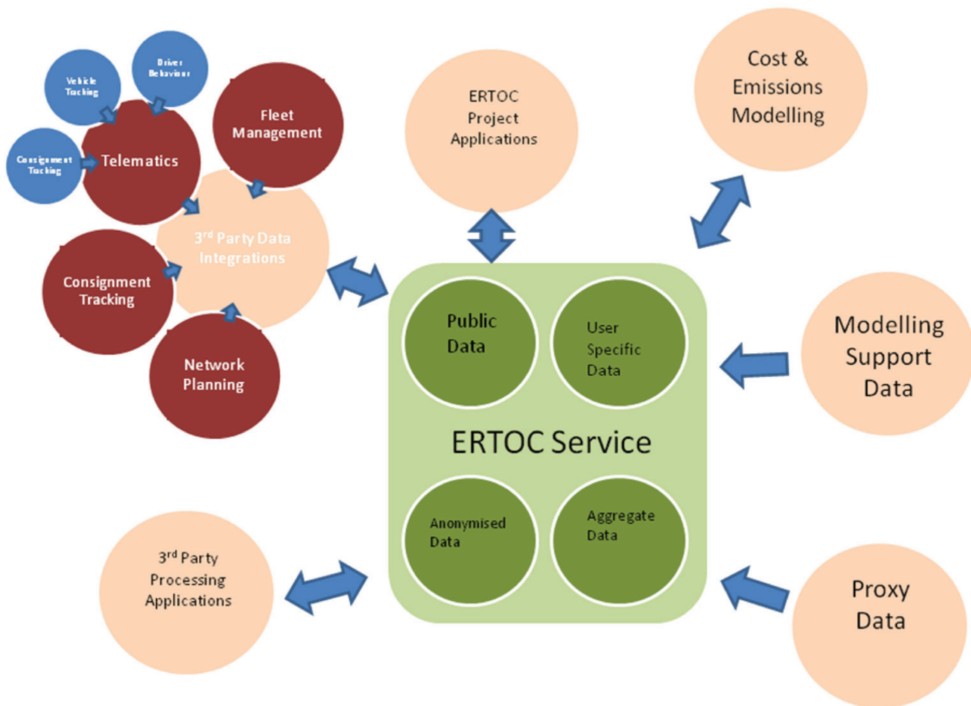
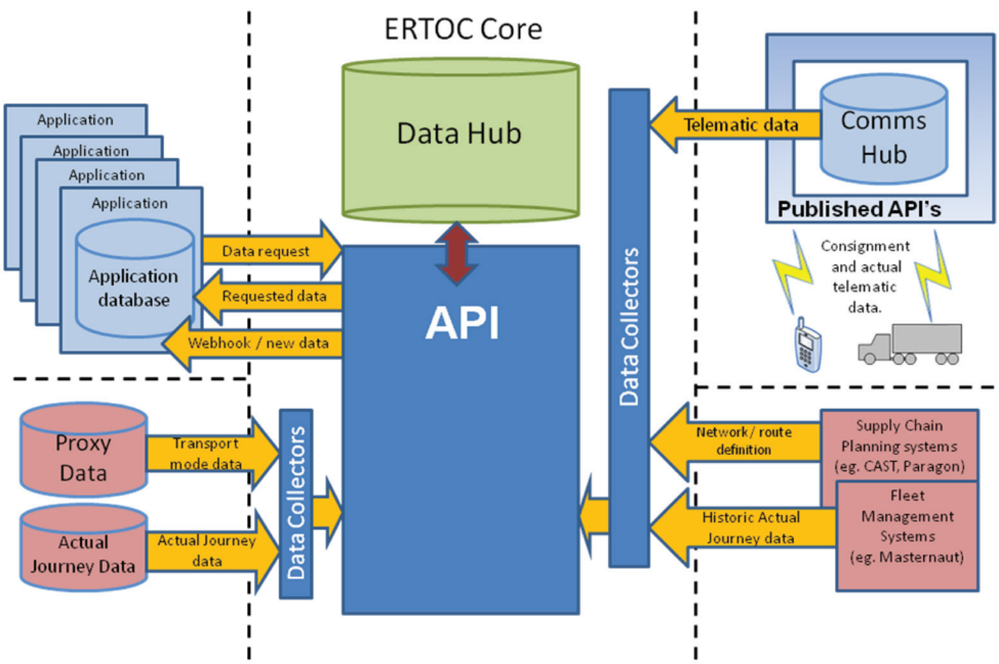


Figure 4. Technical system architecture for ERTOC



impact) from source to destination. Such planning will use proven algorithms to calculate optimal paths, using available data on transportation constraints (for example, traffic conditions, road works, weather-related delays).
2. Cost efficient transport with an aim to lower both the cost of delivery and the environmental implications. Such calculations will aim to take into account spare (fleet) capacity, fuel cost, mode of transport and fleet sharing, and would use established economic value and cost-benefit models to better predict cumulative delivery cost.
3. Improved driver behaviour for safer and more fuel-efficient driving. Based on performance data, drivers will be given feedback on their driving to improve safety (both other road users and pedestrian) and carbon emission minimisation. Such feedback will be summative, in the form of driving performance reports, with the possibility of on-the spot feed-back via an appropriate in-cab telematics interface.
4. Fleet management for streamlined fleet operations. The data collected will be processed to allow for better vehicle tracking and journey time estimations. Such information is critical for fleet operators to ensure smooth running of the supported supply chain, which often involves minimising costs on the one hand and maximising capacity and availability on the other. Continuous vehicle status updates combined with consignment information and intelligent prediction will be used as a basis for multi-criteria optimisation to allow fleet operators to balance fleet allocation during operation as desired.

The ERTOC project will enhance, integrate and modify three applications (fleet management, driver coaching and consignment identification) and from these demonstrate how a further fourth application can be developed to provide further information (actual Carbon/Financial shipping cost at a consignment level) and optimisation opportunities (multi-modal transportation planning), minimising costs on the one hand and maximising capacity and availability on the other. Continuous vehicle status updates combined with consignment information will be used as a basis for multi-criteria optimisation to allow fleet operators to balance fleet allocation during operation as desired.

ERTOC will enhance, integrate and modify three applications (fleet management, driver coaching and consignment identification) and from these demonstrate how a further fourth application can be developed to provide further information (actual Carbon/Financial shipping cost at a consignment level) and optimisation opportunities (multi-modal transportation planning).

APPROACH TO TESTING

Testing is planned, controlled and documented at a high level through “Stages”. Test strategy documents define the purpose, method and content of each stage.

The early stages of testing such as Unit tests, Technical tests and Integration testing are planned and executed by the development teams of the partners concerned to their own standards, as part of their normal process of delivering and commissioning high quality solutions. Testing stages which prove the operational practicality and functional delivery of the solution, i.e., Proof of Concept and Validation Testing, are carried out at a project level by a test team formed from all partners involved.

The test stages required to prove the performance and resilience of the technical solution under stress in a high volume operational environment will be a part of any exploitation project and are not included in this research and development project. Within the test stages included, “Scenarios” are identified and maintained by the test team. These define a business or technical situation which must be tested and specify how and when it will be tested.

These scenarios are broken down into detail test scripts (more than one script per scenario when different variants need to be tested) specifying the resources required, the actions of the testers and the data that must be created (both prior to and during the test), to prove the operational and functional capability of the solution.

As far as possible, operational equipment, facilities and staff are to be involved in the execution of the tests as this improves the quality of the test process and the validity of the test results.

The tests are organised and executed on the basis of the scripts, and the results analysed by the test team. If problems or defects are encountered the team will decide whether rework and re-test can be accommodated within the test programme or whether the test needs to be repeated at a later date. A defect log is maintained throughout to ensure that all issues are managed and addressed.

Proof of Concept Testing

Five proof of concept tests have been identified to provide early proof to stakeholders that the key technical and application deliverables of the project are demonstrable and appropriate to a commercial road transport environment.

The POC testing is internal to the ERTOC project team with the objective of confirming confidence in the technical solution before formal tests are conducted with a wider audience (including external parties) and the more extensive test scenarios later in the project.

Each test is designed to demonstrate that a "thin slice" of the technical functionality can work in a real world environment and to begin to expose any implementation issues, allowing them to be addressed by the technical teams in advance of the final validation at the end of the project. The five tests are:

1. Telematics solution (In-vehicle and data transmission technology aspects)
2. Integrated Driver Coaching
3. Intermodal Capacity Sharing
4. Intermodal Optimisation
5. Intermodal Audit

Final Validation

The five proofs of concept tests will be combined and applied to the final ERTOC solution prototype as a whole. The validation testing will, where possible, involve operational staff, vehicles and equipment. Where it proves non-viable to utilise specific modes of transport such as intercontinental freight shipments by sea and air, the validation test-bed will include the creation of pseudo data elements such as waybills and ASNs that mimic current data used by freight operators in, for instance, their EDI based processes.

The validation tests results will be used to support a rigorous critique of the ERTOC solution's ability to yield business benefits, the challenges to production implementation and the likely steps required for the generation and adoption of a production solution.

ADOPTION OF STANDARDS AND SECURITY

For wider adoption two aspects that are critical to the success of ERTOC are the use of relevant industry standards, and security and dependability of the system. This section comments on both to demonstrate how both have been addressed.

Importance of Standards

Well-designed supply chain standards play a very important role in business operations. They reduce complexity between and within organizations and make it easier to make the right decisions about purchasing hardware, software and equipment; they reduce the costs of implementation, integration and maintenance. Standards also facilitate collaboration between trading partners in the supply chain, making it quicker and easier to identify items, to share information (like order quantities, availability, or specific characteristics), to order and receive parts or ingredients from suppliers, or to ship goods to customers. They also enable global traceability and authentication, and ultimately improve efficiency through all of the above. In short, well-designed standards allow organisations to focus on how to use information rather than how to get information. They are more important than ever before in the context of today's challenging economy, because they are the foundation for clear, understandable exchanges that keep costs down for everyone by reducing complexity. With proper standards, the logistics of international supply chains are more efficient, more sustainable, and more profitable.

GS1 Standards support the information needs of companies interacting with each other in supply and demand chains, specifically the information required to support the business processes through which supply chain participants interact. The subjects of such information are the real-world entities that are part of those business processes. Real-world entities include the stuff of trade between companies, such as products, parts, raw materials, packaging, and so on. Other real-world entities of relevance to trading partners include the equipment and material needed to carry out the business processes surrounding trade such as containers, transport, machinery; entities corresponding to physical locations in which the business processes are carried out; legal entities such as companies, divisions; service recipients; business transactions and documents; and others. Real-world entities may exist in the tangible world (such entities are generically called physical objects in this document), or may be virtual or conceptual. Examples of physical objects include a consumer electronics product, a transport container, and a manufacturing site (location entity). Examples of virtual or conceptual entities include an electronic music download, a product class, and a legal entity.

Identification Standards

In the context of ERTOC the use of identification standards relates to uniquely and unambiguously identifying

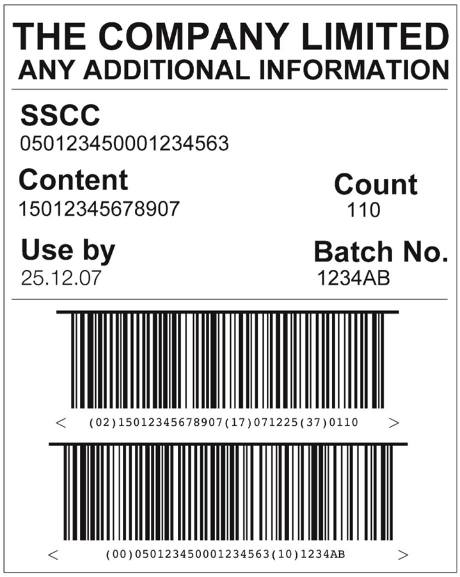
- Individual logistic units (e.g., pallets, plastic trays, roll cages) to be transported, using the GS1 Serial Shipping Container Code (SSCC),
- Products contained in the logistic units to be transported using the GS1 Global Trade Item Number (GTIN),
- Grouping of logistics units that comprise a shipment from one consignor (seller) to one consignee (buyer) referencing a despatch advice and/or bill of lading using the GS1 Global Shipment Identification Number (GSIN),
- Logical grouping of logistics units that are assembled to be transported together under one transport document using the GS1 Global Identification Number for Consignment (GINC),
- Equipment, such as container, tractor, ship or train wagon employed in the transportation using the GS1 Global Individual Asset Identifier (GIAI),
- Pick up and drop off points using the GS1 Global Location Number (GLN),
- Companies involved in the transport also using the GS1 Global Location Number (GLN), and
- Personnel (e.g., drivers, goods in staff) involved in the transportation using the GS1 Global Service Relationship Number.

The identifiers above each have a well defined structure of their own. However all are based on a company prefix, provided by GS1, followed by further characters provided by the company to whom the prefix has been allocated.

Capture Standards

Capture standards relates to the use of standardised structured GS1 bar codes and in future phases RFID to enable the automatic identification of physical objects such as logistic units, containers and wagons, and associated attribute information. For example, a GS1 128 bar code on a pallet, shown in Figure 5, can enable any capturing application to identify the logistic unit (SSCC) and additional information such as the ship to location (GLN), the product (GTIN), the number of cases (COUNT) and the production

Figure 5. Example of use of GS1 128 bar code on a pallet label



date. The type of information in the bar code is denoted by the codes in brackets, known as application identifiers. (02) defines that what follows is the GTIN of the product on the pallet while (17) defines the product's use by date etc. The section above the bar code contains the information in the bar code in human readable form. Alternatively a GS1 128 bar code could identify a specific rail wagon using a GIAI.

Share Standards

Share standards are to do with electronic messaging and product information data pools. Information about logistics units and products to be transported can be exchanged between senders, receivers and transport operators through GS1 standard electronic messages. These messages define journey start and end points, the count of products to be transported and the number and type of logistic units (e.g., pallets or stillages). ERTOC may use the information in the messages to calculate the weight and volume of loads and the trip mileage which are important factors in calculating transportation costs and associated carbon impacts.

These standard messages are encoded according to the GS1 EANCOM standard (based on EDIFACT) or the GS1 XML standard. These standards provide for a wide range of messages, those most likely to be used with ERTOC include

- Despatch Advice (aka Advanced Shipping Notification)
- Transport Instruction
- Drop-off & Pick-up Instruction
- Status Information

GS1 has developed standards for the attributes associated with products, for example the dimensions and weight of cases together with information about the temperature at which the product must be kept. Product manufacturers enter information about their products into one of the many GS1 Global Data Synchronisation Network compliant data pools. Their customers sign up to any compliant data pool of their choice to retrieve the information they require. The data pools communicate with each other through a standardised protocol to enable the relevant information to flow as required. ERTOC can combine the product information in the data pools with the information about transportations contained in electronic messages and use that in calculating journey costs and carbon impacts.

For ERTOC the most relevant product information in GDSN compliant data pools is expected to include the following:

- Case Height
- Case Width
- Case Depth
- Case Gross Weight
- Quantity of Trade Items Per Pallet
- Handling Instructions Code
- Dangerous Goods Hazardous Code
- Storage Handling Temperature Maximum
- Storage Handling Temperature Minimum
- Storage Handling Humidity Maximum
- Storage Handling Humidity Minimum

System Security

The underlying architecture of the proposed system serves to integrate (diverse and third party) resources, involving collection of data, storage and provision of it for further processing. The nature of data collected, particularly in terms of driver behaviour, vehicle tracking and fleet operations, and the frequency and scale of collection, poses a serious challenge to the security of such data. A variety of risks are potent here most notably including to driver privacy, vehicle (and consignment) location and the competitive advantage of businesses.

Measures are proposed to ensure that appropriate protection, as necessitated by the law and secure access to the data resource, are devised and implemented. This includes ensuring access to the data hub is authorised, privacy of consignments, drivers and vehicles is maintained, all forms of networked communication are authenticated, and the system is designed to provide configurable access to data that is both comprehensive and flexible. Such measures are critical if the system is to form a dependable and reliable bedrock for a truly modern information infrastructure for the transport and logistics sector.

At the heart of the proposed system lies the data hub responsible for storing telematics data as it is gathered from a variety of proxy and real-time sources. If applications are to be developed to provide for crucial decision-making in the wider transport sector, then dependable data sources are indeed critical, and hence the design and implementation of the data hub is important. Such storage needs to ensure two aspects of security.

- Availability, whereby data is made available to the relevant applications at all desired times. This would require that any possible failure of the database, accidental or otherwise, is dealt with by either providing some fallback source (possibly entirely proxy or directly fed from real-time sources) for data, or efficient fail over to a redundant database, maintained (updated) entirely for this purpose.
- Integrity of all data stored on the database. This is to ensure that any accidental corruption of data is avoided and can be addressed by ensuring reliable system software and hardware, periodic integrity checks and a backup store is maintained in case of irreversible damage to the data store.

The ERTOC system architecture takes advantage of the Internet Protocol (IP) standard for all communications. The IP technology is matured and well-understood, and provides for extensive computability and flexibility across several wired or wireless mediums, and most importantly, the Internet. The protocol, however, is inherently designed for addressability and interoperability over various media, and not for reliability or security of data. This makes it vulnerable to data leakage and spoofing. To address this, the secure hypertext transfer protocol (HTTPS) is adopted to ensure all forms of networked communication, both facilitating collection of vehicle data and access to the database, should be

- Mutually authenticated, so that both ends of a session are assured of each other's identity,
- Encrypted, to a reasonable standard, to prevent data leakage as a result of any eavesdropping, along with, along with
- Protected for integrity, to avoid any accidental or otherwise manipulation of data, and
- Error corrected, over unreliable and error-prone mediums, to ensure reliable streams of data are communicated in both directions.

HTTPS incorporates industry-standard protocols SSL/TLS which offers tried and tested mechanisms, and provides compatibility with almost all web browsers across different platforms including mobile. It also provides support for the use of digital certificates for key exchange and offers

- Scalability, as various repositories and tools are available to manage the issuance and storage of digital certificates,
- Fine-grained control, as certificates can be issued and revoked easily to allow for control of access. Certificates also allow easy fine tuning of access policy so that, for example, time-limited access can be implemented, and
- Trust management, so that a third-party certificate authority is allowed to manage access to the ERTOC system. This is not the aim of the current effort, but is feasible in the future as the system is rolled out to the entire sector particularly as a subscription service. A sector regulator may serve as a certificate authority to ensure access to ERTOC corresponds to legal and regulatory requirements, along with subscription arrangements.

In addition to the above, measures are proposed to test the system for any unexpected gaping holes that exist through the API or implementation. A thorough assessment would be undertaken that will involve purpose-designed penetration tests to validate the system against any vulnerabilities, particularly due to the underlying (operating system and application) platforms, that may have been designed in. The variety of measures proposed above serve to provide confidence in the system design and implementation.

CONCLUSION

ERTOC promises to provide unique insights into how the transport and logistics sector can be operated efficiently and reliably. The findings would serve to be of important use not just by the commercial sector and transport industry at large, but also academic and research communities engaged in a relevant focus. Two main areas of research that stand to benefit from this effort include

- The benefits of using an open-data hub and API for logistics applications, and
- Carbon tracking along with the benefits of accurate multi-modal assessment.

This paper has only introduced the initiative with relevant attention to the motivation, technical architecture and the critical need for standards and security mechanisms deployed. Further work to follow will reflect further on more operational aspects of the proof-of-concept system having undergone testing and pilot deployment. Of particular interest here, would be aspects to do with testing, near-real-time communication of data and its distribution across the Open API and any issues of competition between sector organisations that may arise.

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REFERENCES

British Standards Institute. (2006). *EN 12896:2006: Road transport and traffic telematics*. London, UK: Author.

European Environment Agency (EEA). (2009). *EMEP/EEA Air pollutant emission inventory guidebook* (Tech. Rep. No. 9/2009). Copenhagen, Denmark: Author.

European Federation for Transport and Environment. (2007). *Longer and Heavier Lorries (LHLs) and the environment*. Brussels, Belgium: Author.

Infrastructure for Spatial Information in Europe (INSPIRE). (2009). *D2.8.I.7: INSPIRE Data Specification on Transport Networks – Guidelines*. Brussels, Belgium: Author.

Transport & Mobility Leuven. (2007). *TREMOVE*. Brussels, Belgium: European Commission.

Javed Akhtar is a Technical Team Lead at Ricardo, United Kingdom.

John Bailey is a Principle Engineer at Ricardo, United Kingdom.

David Weatherby is a Business Consultant at GS1 UK, United Kingdom.

Siraj Ahmed Shaikh is a Senior Lecturer at the Department of Computing at the Faculty of Engineering and Computing at Coventry University, United Kingdom.

David Ireland is the Managing Director at IRIS Technology, United Kingdom.

Daniel Payne is a Software Application Development Consultant at Ricardo, United Kingdom.

Luke Antins is a Systems Architect and Engineer at IRIS Technology, United Kingdom.

Dave Barker is a Python, Ruby and Clojure Developer at IRIS Technology, United Kingdom.

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The mission of the *International Journal of Applied Logistics* (IJAL) is to provide a prestigious forum of innovative findings for applied research and development in logistics and supply chain management. Providing researchers, practitioners, and academicians with insight into a wide range of topics, this journal disseminates the theories and technological progressions in applied research, advances in logistics and supply chains, and industry experiences in the adoption of developed and emerging theories and technologies to enhance competitiveness towards enabling efficient and sustainable knowledge-driven economy.

Topics of Interest (include but are not limited to):

- **Enabling technologies**
  - Business process automation and re-engineering
  - Data engineering and decision support systems
  - GPS, GIS, and location based systems
  - Security, vulnerability, and risk management
  - Service science and service oriented computing
- **Impact and application domains**
  - Banking and financing
  - Manufacturing
  - Marketing and advertisement
  - Public and communications
  - Tourism
- **Innovation management and sustainable development**
  - Collaborative development of innovations
  - Green logistics and supply chains
  - Innovation drivers, metrics, and management
  - Innovation process and methodologies in logistics and supply chains
  - Organizational innovations in logistics and supply chains
  - Reverse logistics and returns management
  - Social and environmental responsibility
  - Sustainable supply chain networks
  - Technology adoption and risk management
  - Waste management, avoidance, and reduction

Logistics and supply chain management
  - Agile, lean, and resilient supply chain
  - Best practices and benchmarking
  - Collaborative planning and forecasting
  - Computational logistics
  - Demand management
  - Facility logistics (warehouse, transportation, and distribution)
  - Inventory and materials management
  - Metrics and performance measurements
  - Modeling and optimization methodologies
  - Partnership formation, strategic alliances, and entrepreneurship
  - Project management
  - Sourcing and procurement management
- **Organizational and economical issues**
  - Business integrity and insurance
  - E-business, internet-enabled logistics, and supply chain practices
  - Enterprise interoperability, integration, and management
  - ERP, CRM, SRM, and WFM
  - Integration of financial and physical flows
  - Knowledge and information management

All submissions should be e-mailed to:
ZongWei Luo, Editor-in-Chief
E-mail: eic.jal@gmail.com

Ideas for Special Theme Issues may be submitted to the Editor-in-Chief.

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