Analysis of the Compatibility of a Single/Multiple WIMO Architecture with the TAF TSI Regulation

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Executive Summary

The subject of this consultancy was to analyse whether multiple Wagon and InterModal Operating (WIMO) databases support the objectives of the TAF TSI[1] more effectively than having a single central WIMO. The mandate also referred to other TSIs and related Safety and Interoperability initiatives which include the important issue of vehicle maintenance management. As the study progressed it became clear to the Consultants that these related issues, most of which do not come under the direct heading of TAF TSI, were of critical importance to the successful implementation of Interoperability and Safety for both Freight and Passenger Operations. This observation does not invalidate the original mandate; what it does is to shape the response into two parts; Part 1 in relation to the TAF TSI itself and Part 2 in relation to the other Interoperability Safety Directives.

Part 1 in relation to the TAF TSI

When the Functional Requirements of the TAF TSI were studied as part of this analysis, it became evident that a Single Central WIMO architecture was significantly superior to a Distributed WIMO approach - primarily because of the cost, risk, time to implement and lack of usability of a distributed architecture. The primary reason for this finding was that the Distributed WIMO approach involved the installation and operation of approximately 600 local on-line databases requiring 24x7, 99.9%+ availability. The vast majority of the companies that would be required to host these 600 on-line databases would be small organisations with limited I.T. and financial resources. These hosting requirements would also constitute major barriers to entry for potential new RUs, Keepers and ECMs.

On a Net Present Value basis, the Costs of developing and operating the Distributed WIMOs were estimated to be significantly higher than for the Central approach. In addition, the time to implement a Central WIMO was estimated at being up to four years shorter than the Distributed approach – involving less risk. (A central WIMO represents a proven approach – both in Europe and North America - whilst a distributed WIMO approach is unprecedented within the Rail Freight industry.) With a central WIMO, the conclusion was that such an approach did not prevent large Stakeholders from utilising the option of hosting local WIMOs or RSRDs (Rolling Stock Reference Databases) in order to meet unique needs and/or to utilise existing systems.

Despite the WIMO assessment completed during the preparation of the original SEDP, the European Rail Freight Industry subsequently decided to implement a purely distributed WIMO architecture to realise the TAF TSI.

One of the factors that influenced the European Freight Industry's choice of a distributed WIMO approach was the perception that it provided greater data

[1] Commission Regulation (EC) 62/2006 of 23 December 2006 OJ L13 of 18.1.2007.

security. In fact, as explained in Chapter V, data security measures become more complex and difficult with distributed WIMOs than with a central WIMO.

Part 2 in relation to the Interoperability & Safety Directives

The Functional Requirements of fifteen other conventional rail TSIs and related Interoperability/Safety initiatives have also been analysed. The findings indicate that eleven of the fifteen TSIs/initiatives could utilise or indeed depend upon data sourced from a central TAF TSI WIMO architecture. These interdependencies did not exist during the development of the TAF TSI and therefore were not factored into the Strategic European Deployment Plan (SEDP) recommendations. Consequently, the Consultants question whether many of these other TSIs/Initiatives can now effectively deliver their benefits because of the subsequent decision to adopt a distributed WIMO architecture within the TAF TSI.

This part of the report considers the need for readily available maintenance data for each vehicle (freight wagon, Passenger carriage & Traction Units) circulating on the European network, which is a common requirement to thirteen of these fifteen TSIs and related initiatives. Centralised data would have supported this important safety requirement by providing an easily accessible repository for the required data; (e.g. for vehicle kms, tonne kms for freight wagons, faults, fault repairs and loads handled).

The Analysis reveals that the uses of data sourced under the TAF TSI heading far exceed the Functional Requirements of the TAF TSI itself. This report recommends therefore that a Data Interoperability Project is put in place as soon as possible to ensure that Vehicle data becomes available to all relevant parties in the European Rail Industry in order to:

- achieve the benefits of the relevant parts of the Interoperability & Safety Directives
- provide an optional local WIMO for TAF TSI purposes for those companies wishing to use it, thus lowering the barriers of entry to the European Rail freight market.

This proposed Vehicle Data Safety & Interoperability Project should, however, take on a more appropriate designation for its central single database (rather than TAF TSI WIMO) which the consultants recommend as the European Rail Vehicle Information Database; i.e. the **ERVID platform.**

Key Recommendations:

1. In order to meet the objectives of the TAF TSI and to control the relative complexity, risk, cost and time to implement the TAF TSI, the consultants strongly recommend the implementation of a central platform, referred to in the report as the European Rail Vehicle Information Database – i.e. the ERVID. This would serve as a centralised WIMO for all Freight RUs to deliver the expected benefits of the TAF TSI.

2. One of the additional benefits of the proposed approach is that Freight RUs would also be given the option of hosting local WIMO databases for their own traffic – some of which already exist. These local WIMOs would be required to automatically interface with the central ERVID platform using the TAF TSI common interface, which is currently under development.

3. A further critical benefit of this approach is that the ERVID platform concept will support vehicle data requirements essential for the realisation of other TSIs and related Interoperability and Safety initiatives. To achieve these benefits, the European Rail Vehicle Information Database platform should be implemented rapidly and include necessary freight wagon, passenger carriage and traction unit data for the Interoperability and Safety initiatives to be fully realised. This is in the interest of all stakeholders, including the Safety authorities.

4. In order to minimise I.T. costs, European Freight RUs (especially new entrants) should be encouraged to utilise the central ERVID in lieu of expenditures on their own local TAF TSI WIMO systems.

5. In a similar manner, vehicle Keepers should be encouraged to utilise the the central ERVID platform instead of hosting their own Rolling Stock Reference Databases (RSRDs).

6. The consultants recommend that a Task Force be set up to include representatives of Safety Authorities and other stakeholders to oversee the introduction of the ERVID platform and the operation of the ongoing service.

Note: See Chapter IX, page 29 for additional recommendations.

Chapter I: Introduction:

The TAF TSI describes the high level Functional and Operational Capabilities required to support Rail Freight Interoperability in Europe especially in the areas of Quality of Service and Performance (productivity). These high level Functional and Operational Capabilities were specified in more detail in the SEDP Deliverable-2. These Deliverable-2 specifications included diagrams (illustrated in Appendix 2) which clearly described the Single WIMO architectural approach originally recommended by the SEDP team.

As shown in Appendices 4 & 5, the Wagon and Intermodal Unit Operational database is a repository of Administrative, Design and Operational for each (individual) wagon that circulates on the European network. This involves approximately 750,000. wagons. Wagon Administrative and Design data are relatively static, however Operational data is very dynamic – especially the wagon movement events which are illustrated in Appendix 4.

The WIMO serves as a source of information for many enquiries such as;

- Preparation of Train Composition Lists,
- Quality of Service Reports and
- Productivity Measures.

Although the WIMO represents 15% to 20% of the I.T. effort required to develop the TAF TSI, it is an essential component that is required to support over 80% of the specified functional capabilities. Clearly, an effective WIMO architecture is essential for successful TAF TSI implementation.

As indicated in SEDP Deliverable 3 and the Final SEDP Project Report, the SEDP Steering Board rejected a Single WIMO and mandated a Multiple WIMO architecture. This architecture is illustrated in Appendix 3. As a result of the changed architectural approach, some TAF TSI Stakeholders are now concerned that the Functional & Operational Requirements specified in the TAF TSI and the fifteen other TSIs and related Interoperability/Safety initiatives effectively could not be delivered if a Multiple WIMO architecture were utilised for implementation.

Given the above, **the primary objective** of the analysis is to put forward recommendations which will provide the best architectural configuration for the WIMO when the overall objective of the TAF TSI and the needs of the Stakeholders are considered.

However, since the TAF TSI was completed, fifteen other TSIs and related Interoperability and Safety initiatives have been developed, or are under development and

it is apparent that centralised data of the form defined within TAF TSI for WIMO data and/or architecture may have been assumed to be available to support these.

The **secondary objective** of the analysis is therefore to review these additional applications to determine their requirement for centralised data of the form defined within TAF TSI WIMO and/or architecture and make the appropriate recommendations based upon costs/benefit trade offs.

A three step Methodology was utilised in the analysis.

Step 1 involved the mapping of the systems architectures/capabilities specified in SEDP Deliverables 2 & 3 and the Final Project Report versus the mandatory functional requirements and the operational rules specified in the TAF TSI. The systems capabilities (especially the single/multiple WIMO architecture) were evaluated in terms of relative complexity, risks, costs and time to implement.

In Step 2 the functional requirements of other TSIs and related initiatives were evaluated against the TAF TSI architecture.

In Step 3, the results of Steps 1 & 2 were integrated and evaluated.

Chapter II: Functional Requirements: TAF TSI & SEDP Deliverable 2:

Enquiries

a. Operational enquiries:

TAF TSI 4.2.2 & 4.2.3 states that train composition information is required for ad hoc path requests and for train composition messages that are sent from the RU originating the train to the IM(s) involved and to the downstream RU(s). Most of the information required for these messages, (especially train length and weight), is derived from the wagons that make up the train. This wagon information in turn must come from the WIMO. Given the above, a WIMO enquiry will be triggered by each ad hoc path request and by every freight train preparation process. **These enquiries alone represent major volume demands on any WIMO architecture.**

b. Quality of Service enquiries: (Reliability)

Transit Time Reliability: TAF TSI 4.2.10 specifies that, collectively, RU(s) must have the capability of measuring wagon/consignment transit time reliability between the shipper's (consignor's) siding and the consignee's siding over a period of time e.g. monthly. This section of the TAF TSI also states that the RU(s) must have the capability of analysing the wagon event data in the WIMO to determine the root causes of unreliability and to take corrective action. This measurement process must be ongoing. Since transit time reliability is the number one priority for freight shippers; this is a major function of the WIMO and is one of the primary reasons for the need to structure the database to support wagon/consignment trip enquiries.

In addition to supporting Transit Time Reliability initiatives for loaded wagons, this enquiry capability can also improve wagon fleet productivity when empty wagon trip times are measured and delay locations/reasons are identified.

c. Quality of Service enquiries: (Tracking)

Wagon/Consignment Tracking: TAF TSI 4.2.12.2 specifies that the WIMO is most important for the tracking of wagons. SEDP Deliverable 2 Appendix b 2.9 expands on this capability and adds the tracking by consignment number or Intermodal Loading Unit (ILU) functionality.

It is important to note that the primary parameter for many of the enquiries listed in SEDP Appendix b 2.9 is NOT wagon number; rather they are by wagon

location, destination, origin and Customer. As explained in Chapters III & IV of this report, this is a significant factor in WIMO architectural design.

d. Performance (Productivity) enquiries:

The main goal of Keepers and Fleet Managers is to improve the productivity of their fleets in terms of transit times, load empty ratios and maintenance requirements. Both real time and historic trip based information are essential to achieve these objectives. In some cases (primarily private wagons) wagon number(s) based enquiries are sufficient to support Keeper/Fleet Manager productivity initiatives. In other cases (primarily RU “owned” wagons) analysis of flows (trips) of wagons based on wagon type enquires independent of Keeper designation are most effective in reducing empty wagon kms.

One of the most important measures of wagon, RU and IM productivity is the ratio of empty to total wagon kms. This measure reflects, not only the productivity of the wagon fleet but also the revenue tons per train and revenue tons per train metre.

The ability to measure, analyse and subsequently improve these productivity parameters is of key importance. To be useful, these measurements must be primarily by type of wagon therefore Data Security Rules and a Keeper “For Hire” flag for each wagon should reflect this requirement.

Chapter III: Systems Architecture – Single WIMO:

As illustrated in SEDP Deliverable 2 (See Appendix 2), the SEDP team specified a single, central WIMO. Appendix 5 of this report displays this architecture in more detail.

The key features of this proposed architecture were;

Data Inputs

Batch or Near Real Time Inputs (as listed in Appendix 1 and illustrated in Appendix 4) from the 200+ RUs and 500+ Keepers/ECMs. For example a Business Rule that all wagon movement events and changes in wagon Admin, Design and Operational Data must be reported to the WIMO within one hour of their occurrence. This rule would not preclude faster real time data updates from RU or Keeper/ECM systems to the WIMO if desired.

Most of the 200+ RUs and 500+ Keepers/ECMs are small entities (e.g. 300 of these 500+ Keepers have less than 1000 wagons) and many of these have very limited, if any, systems capability. These small Keepers could be provided with a web address and a password related to the central WIMO where their fleet data would be securely hosted with the capability of inputting modifications when necessary. The only "system" that they would require would be a low end PC (or internet device), a standard internet browser and an internet connection – even GSM mobile would be adequate in many cases. Smaller, low volume RUs could input their wagon events in a similar low cost manner. The TAF TSI common-interface functionality would be delivered to these low-end devices by an internet plug-in.

Data Quality: **(See TAF TSI 4.4 Operating Rules)**

WIMO Data quality is a key success factor for successful TAF TSI implementation.

The four main attributes of Data Quality are:

- Completeness
- Accuracy
- Consistency
- Timeliness

Within the TAF TSI architecture, the WIMO, the Common Interface and the Reference Files all play a role in providing the edits and the measures that are

essential for the achievement of the necessary levels of Data Quality. The WIMO's role lies primarily in providing Data Completeness and Timeliness measures which are essential for the major task of improving data quality.

One example of Completeness that will be important during the TAF TSI start up phase is the capability of indicating whether all mandatory fields for each wagon number contain logical values. Another example of Completeness, which will be most important on an ongoing basis, is a measure of wagon events that have not been reported during a wagon trip. For example; a yard departure with no arrival, a wagon Fault report with no reported repair or an Interchange Notice with no Interchange acceptance/refusal.

Timeliness of WIMO data can be measured by comparing the elapsed time from the actual occurrence of an event until the WIMO has been updated. Within this broad measure, there are two sub measures; time from the event occurrence until the time that the reporting message is sent and time from sending the message until the time that the WIMO is updated.

To a limited extent the WIMO functionality can enhance data accuracy such as performing plausibility checks on wagon type and commodity codes. For example if a commodity code indicated liquid petrol loaded onto a flat wagon, there is obviously a data input error.

The central WIMO would require robust **Operating Capabilities** (e.g. 99.9%+ availability – 24 x 7, and rapid response times as well as functionality to calculate wagon kms and update fault counters.

Enquiries

The extensive range of **Enquiries** (based on all WIMO parameters) from thousands of users would be focused on one database which would contain the logic required to gather data from various sections of the WIMO, then rapidly assemble and format the responses to meet user needs

This single WIMO architecture does not preclude individual RUs (or groups of RUs) from operating local WIMO type databases - some of which already exist. It is important to note that if an RU selects this option, the Business Rules that apply to data Input would have to be observed.

These local WIMOs would not require robust Operating Capabilities. In fact they should NOT contain the wagon km calculator and fault counter capability as this would lead to an extremely complex situation relating to these capabilities.
RUs with local WIMOs could select to download all or part of the data (that security rules allow) from the central WIMO. If this option were selected, strict

Business Rules would be required (e.g. updates at least hourly) to avoid the RU(s) using obsolete data.

If an RU utilised a local WIMO to store local events without sending them to the central WIMO many enquiries could become very complex since a portion of the data to respond to the enquiry could be available locally whilst the remainder would be stored in the central WIMO.

This complex enquiry situation could also apply if only a portion of the central WIMO's data was downloaded to the local WIMO.

In a similar manner, the single WIMO architecture does not preclude Keepers/ECMs from developing and operating their own RSRDs. The Business Rule re updating the Central WIMO within 1 hour would apply in this case as well. Keepers/ECMs would also have the capability of making enquiries and downloading information relating to their wagons into their local RSRD.

Chapter IV: Systems Architecture – Multiple WIMOs:

The term “multiple WIMOs” was not defined in SEDP Appendix 3 nor in the SEDP Final Project Report. It could be assumed that it means one WIMO for each RU in Europe. There are 216 RUs that are signatories to the GCU. It is well known that there are other RUs who have not signed the GCU although the exact number is difficult to determine. For the purposes of this report it is safe to assume that there are 250+ RUs in Europe and that the number will grow over time.

All of these RUs are obliged to meet the TAF TSI requirements therefore it would be logical for some RUs to join together to share the modification and/or development of the required systems.

The degree of cooperation will be constrained because most of these RUs view other RUs as competitors. (This is unfortunate since, with 10% market share, the real Rail Freight competitor is road transport.) Given the above; if the Multiple WIMO architectural approach to TAF TSI implementation moves forward and assuming an **unprecedented** level of cooperation between RUs; it is assumed that there would be a minimum of 100 distributed WIMOs in Europe.

With this distributed WIMO configuration, Wagon Events and some wagon Operational data generated at individual RUs would populate and update the 100 individual WIMOs located at each RU (or RU grouping).

In a similar manner, wagon Administrative, Design and some Operational data would populate Keeper databases (RSRDs). There are 490 Keeper signatories to the GCU. In addition, the concept of an ECM which could be a separate entity from the Keeper would increase the number of RSRDs to over 500. Since many Keepers view other Keepers as competitors, the likelihood of Keepers/ECMs sharing databases is remote.

In order to respond to the enquiries outlined in Chapter II , at least one, but generally several, of the 100+ WIMOs and 500+ RSRDs would have to be accessed in an “on – line” environment whilst respecting data security rules. This raises two major issues; which databases to access, and, each of the 600+ databases would need to have the robust Operating Capabilities (e.g. 99.9%+ availability, 24 x 7 and rapid response times) specified for the central WIMO.

To facilitate response capabilities for wagon number based enquiries, the SEDP team developed a “Pointer File” approach. This Pointer File would contain a permanent record of each wagon number circulating on the European network. The address of the WIMO where the wagon was last reported would be related to the permanent wagon number. This current WIMO address capability would be achieved by having each RU input its wagon interchange notices to the Pointer File. (The TAF TSI message defined in 4.2.9.2) The receiving RU would also be required to input its wagon interchange received or interchange refused messages to the Pointer File. (TAF TSI messages defined in 4.2.9.4

& 4.2.9.5) Using this interchange data, an application in the Pointer File would provide the current WIMO address for each wagon.

In addition to the current WIMO address for each wagon, the Pointer File would contain the RSRD file address for the Keeper and the ECM (if different from the Keeper). This data would not be as dynamic as the current WIMO address described above, however changes to the Keeper or the ECM associated with a wagon would have to be kept current in the Pointer File through data inputs.

With the Pointer File in operation, enquiries with a wagon number(s) as the primary search criteria would be "pointed" to the appropriate distributed WIMO(s) and/or RSRD(s). Note that this pointer approach **will only handle enquiries whose primary search parameter is wagon number**. Many frequently used enquiries utilise non wagon based primary search parameters such as wagon destination, wagon type, ILU number and consignment number. If ad hoc path requests and train preparation WIMO enquiries are excluded, experience has shown that enquiry volume (as measured by number of wagons) is higher for non wagon number parameters than for those utilising wagon number based parameters. Enquiries by wagon(s) destination(s) are the most utilised non wagon number search since they are used by Customers and Fleet Managers.

As explained in more detail in Chapter V, this Pointer File approach reduced but did not eliminate the "which file to access" problem of distributed WIMOs and RSRDs. It had no impact on the need to have 600+ robust, on line WIMOs and RSRDs – all with 99.9%+ availability and 24 x 7 capability.

A detailed diagram of the Distributed WIMO architecture is contained in Appendix 6.

Chapter V: Findings: Impacts of Multiple versus Single WIMO Architecture:

As outlined in the Introduction (Chapter I) the WIMO(s) serves as a repository for wagon Administrative, Design and Operational data for the 750,000. wagons that circulate on the European network. With this data, the WIMO(s) serves as a source of information for a wide range of enquiries such as; Train Composition List Preparation, Quality of Service Reports (Tracking & Transit Time Reliability) and Productivity measures. Rapid and up to date responses to these enquiries on a 24 x7, 99.9%+ availability basis are the primary Functional Requirements of the TAF TSI.

A central WIMO could handle these functional requirements by utilising a single, robust database hosted in a secure location with the backup capabilities that are common in the I.T. industry today. A single database also facilities rapid enquiry response times.

A distributed WIMO approach would require 600+, individually hosted, on line databases, all with 99.9%+ availability on a 24 x 7 basis.

Clearly, the distributed WIMO approach would be more complex. The impacts of this increased complexity are outlined below:

Cost

The primary impact of a Multiple WIMO architectural approach as compared to a single central WIMO is complexity, which leads to higher costs – especially initial development/implementation and ongoing operating costs, (including modifications).

Many RUs and Keepers/ECMs have existing systems however there is limited commonality among them. The costs involved in modifying these systems to provide batch WIMO update capability is a fraction of what would be required to provide rapid on line enquiry response times. The complexity of the enquiry logic and the robust requirements to provide rapid response times would likely mean that most existing systems would need to be replaced to meet the requirements of a distributed approach.

The operating costs of hosting 600+ WIMO and RSRD databases all over Europe with robust capabilities such as 99.9%+ availability, back up and rapid response capability is five to ten times more expensive than providing this capability at a single location. This holds true despite the fact that many of 600+ WIMO and RSRD files would be small in size.

Although the size of the databases will differ, both the Pointer File and the Central WIMO will incur similar operating costs since the requirements for availability and response times will be similar.

The network costs associated with the batch updating of the Central WIMO plus enquiry responses will be more than offset by the very high performance network required to rapidly access the distributed, on line 600+ WIMO and RSRD files, bring the data to a central logic location, formulating and sending the response

If the primary enquiry search parameter is NOT wagon number (e.g. wagon destination, ILU number or consignment number, then, for the distributed WIMO concept, potentially **ALL 600+ WIMO AND RSRD FILES WOULD HAVE TO BE SEARCHED** with the resulting impact on response times and network costs. While this type of search capability is theoretically possible, the costs involved in providing it within **acceptable** response times are enormous.

It could be argued that the pointer file concept could be expanded to include primary search parameters such as consignment number and ILU number. This would be possible, however, as this approach is expanded, the requirements of a pointer file **becomes closer and closer to those of a central WIMO.** Even with the pointer file limited to wagon numbers, WIMO addresses, and Keeper/ECM addresses, it could be considered as a central WIMO "Lite" with costs in the same order of magnitude.

For a summary of relative complexities between the Central and Distributed WIMOs, see the Matrix in Appendix 7.

The cost of the required commercial software licenses will also be higher for the 600+ on line WIMOs and RSRDs as compared with the batch update capability of the central WIMO outlined in Chapter IV.

Proprietary software development costs could be comparable since all local WIMOs and RSRDs could use a standard design.

When costs are considered, it must be remembered that the vast majority of the Keepers and RUs are small and generally unsophisticated actors. The costs and I.T. capabilities required to host an on-line database that must be available 24x7, 99.9%+ of the time would be overwhelming to many of them. These requirements would also be a significant barrier to entry for potential new RU and Keeper/ECM entrants.

A central WIMO also lends itself to a turnkey/ongoing operations approach by a single vendor which could be paid for on a usage basis, thus further reducing barriers to entry. A distributed WIMOs configuration would make this turnkey/ongoing operations approach impracticable.

Risk:

If a distributed WIMO concept were to be followed, the coordinated efforts required to implement 100+ WIMOs and between 500+ RSRDs, all with on line, rapid response capability in the same time frame would be a daunting task within an industry not known for its cooperation, and its capability for meeting deadlines It must be remembered that these 600+ actors are distributed throughout Europe, are not part of any single entity or

organisation and have various levels of financial strength and I.T. capability. **Also most of them view the others as competitors!**

European Railways per se form a network and therefore must operate on the basis of the "weakest link in the chain" i.e. **up to date information is essential for every wagon in a train before it can proceed. If all the 500+ RSRDs are not on line simultaneously, trains would stop running!**

It should also be noted that the central WIMO represents a proven approach – both in Europe and North America whilst distributed WIMOs are unprecedented in the Rail Freight industry.

The risks associated with focusing on a single central WIMO with batch updates from RUs and Keepers/ECMs as described in Chapter III are significantly lower.

Time to Implement:

Many of the factors described above in Risk also apply to implementation time issues. However there is an additional, unique factor involved. The Pointer File associated with multiple WIMOs requires the input of electronic wagon interchange messages from both of the RUs involved.

Currently, there is virtually NO electronic wagon interchange messaging between RUs in Europe. Most of the RU systems will require modifications to develop this capability and this will take years to implement. Without interchange messages the Pointer file would not be able to point to the local WIMO where the data required to respond to an enquiry resides. A central WIMO can begin to function without interchange reports by utilising yard arrivals and departures for wagons and this type of reporting is currently well developed. A proven technique called "gapping" can automatically generate logical interchange locations and approximate times which can be used until a satisfactory level of interchange reporting is achieved.

This fundamental difference between a Distributed WIMO/Pointer approach and a Central WIMO has the capability of advancing the Central WIMO implementation date by years as compared with Distributed WIMOs. (See Recommendations – Chapter IX)

Flexibility:

TAF TSI requirements and capabilities will not remain static as the needs of Freight Shippers in the EU evolve.

The interconnected group of systems and systems components therefore must be able to react to changes in a rapid and efficient manner. Changes in Functional Requirements would be faster and much easier to implement with a Single WIMO versus 100+ distributed WIMOs and/or 500+ RSRDs.

It is also highly likely that there will be additional RUs and Keepers/ECMs within and outside the EU. The process of adding one of these (probably small) actors would be far less difficult with a central WIMO versus a local on-line database requiring 99.9%+ availability, back up etc.

Data Security:

Data security concerns associated with the WIMO(s) can be categorised into three areas. These three areas are addressed below:

1. Commercial Data – Customer Identification: The SEDP – Deliverable 2 specifies that Shipper (Consignor) and Consignee information can be stored in the WIMO as free text. This specification would effectively frustrate any unauthorised searches of the WIMO for Customer related information. An even more secure approach would be to programme the WIMO(s) enquiry system(s) to reject any enquiries with the Consignor or Consignee fields as a search parameter. This solution would apply equally to a central or distributed WIMOs.

2. Commercial Data – Freight Rates: There is no provision for this data in the WIMO.

3. Wagon Technical Data: The SEDP – Deliverable 2 specifies that wagon technical data should be accessible (on a read only basis) to IMs, RUs and workshops only if the wagon is under their control or currently en route to them. The "under their control" portion of this specification does not represent a major I.T. challenge, however the "en route to them" qualification does present a complex situation if a distributed WIMO approach is followed. This routing information is available in the central WIMO as part of the operational consignment data, therefore the validity of an enquiry on the WIMO could be readily verified. With a distributed WIMO approach, the validity of an enquiry would require a consignment number which would identify which RU created it. A secondary enquiry would then have to be automatically generated to this RU. Only after a successful match of consignment numbers could a response to the enquiry be processed. A further complication arises when an RU or IM is in the current route of a wagon but has already interchanged (or handed over) the wagon to a "downstream" RU or IM. If this has occurred then the RU or IM is not authorised to access the wagon data. To meet this requirement further automatic enquiries on distributed WIMOs would be required before a response to the original enquiry could be provided.

Experience in Europe and North America has shown that with a central WIMO, Data Security issues can be addressed in a manner that is acceptable to all stakeholders.

The key parameters required to determine if an Actor can access specific wagon data are; Keeper/ECM, Consignment Information, and Duty Holder. All of this information is available within the Central WIMO. With a Distributed WIMO/Pointer File approach, a complex set of enquiries and searches (especially for Consignment Information) would be required, thus adding to costs and response time issues.

In Summary;

The benefits of utilising a Central versus Distributed WIMOs are as follows:-

- Lower Development/Implementation and Operating costs in the range of 5 to 10 times.

- A significant reduction in the risks inherent in the implementation of a project of this magnitude.

- A major reduction in implementation time – up to four years – thus speeding up the implementation of Interoperability and Safety initiatives.

- Providing greater flexibility, thus lowering the barriers to entry when additional Passenger or Freight RUs, and Keeper/ECM actors become involved in European Rail Operations.

- Enabling the rapid implementation of new/revised Functional Requirements which will occur as the needs of the European Rail industry evolves

- Reducing the complexity of Data Security procedures which are of great concern to many stakeholders.

Chapter VI: Functional Requirements: Other TSIs & Related Initiatives:

Since the TAF TSI was completed, approximately 15 other Interoperability and Safety TSIs and related initiatives (that involve Rolling Stock) have been completed or are in various stages of development. This number excludes the six TSIs related to High Speed Passenger. (See Recommendations Chapter IX)

Although data requirements and architecture are not addressed in detail, some of these TSIs and related initiatives have strong dependencies on the TAF TSI.

The purpose of this Chapter is to highlight the functional requirements of these TSIs and other initiatives that could be supported by the TAF TSI WIMO Data and/or Architecture.

1. The Safety Directive(s):

In Article 14 of 2004/49EC (The existing Safety Directive) the principle of Rolling Stock Maintenance "Programme(s)" was established along with "procedures to assure compliance with the standards…throughout the lifecycle of equipment and operations".

The revised Safety Directive (2006/0272: 7 Oct 2008) expands on this Maintenance Programme concept and specifies that the ECM shall ensure that vehicles are maintained in accordance with the maintenance file **for each vehicle**.

Both of these documents stop short of saying clearly that management or monitoring of actual wagon duty profiles (faults, fault repairs, kilometres, tonne kilometres and load types, etc) against a maintenance plan is required. However that is a logical interpretation. The Freight Wagon TSI does specify (4.2.8.1.2) that this maintenance plan management is required. The TSI Operations also states in 4.2.2.5 that; "all vehicles on a train must be currently within their specified maintenance interval and will remain so for the duration (in terms of both time and distance) of the journey being undertaken."

Both Directives refer to the requirement for a National Vehicle Register (which includes identification of a Keeper for each vehicle) and for Common Safety Methods, Targets and Indicators. (See below.)

In summary, the Functional Requirements specified in general terms in the Safety Directives are covered in more detail under Common Safety Measures, the Freight Wagon TSI, the TSI Operations and the NVR headings listed below.

2. Common Safety Methods & Common Safety Indicators:

A search of all of the documents related to CSMs, CSTs and CSIs referenced on the ERA web site indicates that, to date, these initiatives have not addressed vehicle maintenance management. E.g. faults and fault repairs. The one exception to this statement appears to be an Invitation to Tender No.ERA/2006/SAF/OP/01 which calls for an analysis to determine if the apportionment of safety targets between sub systems covered by TSIs is feasible. The target date for completion of this analysis was early 2007; however no further information is available.

It would seem logical that WIMO Functional Capabilities focused on vehicle Faults and Fault Repairs enquiries would provide an excellent Common Safety Indicator/Method. e.g. Enquiries that highlight Fault Types/Repairs by vehicle type, by Manufacturer, by ECM, by Component etc. Since vehicles and vehicle components are manufactured and distributed across all of Europe; this **proactive** approach to Safety would be best applied to ALL vehicles in the Central WIMO.

3. TSI Traffic Management & Operations: (2006/920/EC)

In 4.2.2.5, this TSI states that the Train Composition must take into account the vehicles on the train and that they must be currently within their specified maintenance interval and will remain so within the time and **distance** of the journey being undertaken. In addition, this TSI states that the combination of vehicles forming the train must comply with the technical constraints of the route concerned and be within the maximum length permissible for forwarding and receiving terminals. Information about gross train weight, axle loads and maximum train speed against maximum wagon speed is also required.

These Functional Requirements could be addressed by the TAF Central WIMO except for traction units and any conventional passenger carriages. These issues are addressed below.

4. TSI Freight Wagons:(2006/861/EC)

In 4.2.8, this TSI states that processes (Functional Capabilities) must be in place to manage the maintenance and operational integrity of the Rolling Stock, including:-

- Records of all Maintenance Undertaken and Due on the Rolling Stock.
- Procedures for the receipt and processing of specific information arising from Operational or Maintenance Incidents (i.e. Fault and Fault Repair Reporting) that have a potential to affect the safety integrity of the Rolling Stock.
- Operational duty profiles of Rolling Stock. (Including, but not limited to Tonne Kilometres and Total Kilometres.)
- Processes for the protection and validation of such systems. (This can be assumed to mean databases plus systems to update and assess the data – through enquiries.)

Although this TSI does not explicitly state that a Maintenance File is required **for each vehicle,** the Functional Requirements described above imply that this capability is required.

The TAF WIMO (including the recommendations contained in Chapter IX) has this Functional Capability for freight wagons.

5. TSI Locomotives, Powered Units (Traction Units) & Passenger RST:

The scope of this TSI (In Draft Form Dated 27/08/2008) includes traction vehicles intended for freight and/or passenger transport. See 6. below for Passenger RST)

In 4.2.12.2 (General Documentation) the description is similar to the TAF TSI Freight Wagon Design Parameters such as length over buffers (General Drawings), axle loads and spacing of axles.

There is no mention of Administrative Data. However the Safety Directive clearly states that each vehicle must be registered in the NVR which is the primary repository of Administrative data.

In 4.2.12.3 the requirement for a Maintenance File is outlined in general terms however there is no specific reference to the requirement for time or distance based maintenance parameters or the requirement for a maintenance file for each vehicle as called for in the Safety Directive. Given this requirement and the Train Composition requirement (4.2.2.5) in the TSI Operations, it is clear that a maintenance file for each traction vehicle will be required and that maintenance criteria such as time and distance travelled (at least for bogies, bearings and wheel sets etc.) will be applicable.

Assuming that these Functional Requirements are applicable, the TAF WIMO (Including the Recommendations in Chapter IX) capabilities could meet these requirements if locomotive data were included.

Note: Some of this data (e.g. Locomotive length and weight) is essential for train composition specified in the TAF TSI and the TSI Operations.

6. TSI Passenger Carriages: (Draft Scheduled for Aug 2008)

There is a reference to a separate TSI for Passenger Carriages on the ERA web site but no information beyond that shown in 5. above and 7 below was found.

Passenger Carriages (“and other related cars”) are included in the draft TSI Locomotives (traction units) and Passenger RST described in 5. above. The general reference to Design data is the same as for Locomotives (Traction Units). Similarly, there is no reference to Administrative data, however, as with Locomotives (Traction Units), the NVR requirements clearly apply.

The Safety Directive stipulates that a maintenance file for each vehicle (Passenger Carriage) will be required and the TSI Operations indicates that maintenance criteria such as time and distance travelled (at least for bogies, bearings and wheel sets etc) will be applicable for all trains.

With the input of safety related fault and fault repair data for passenger carriages the TAF Central WIMO could provide the necessary Functionality. If Passenger Carriage events were reported to the TAF WIMO in a similar fashion to freight wagons, then the WIMO functionality described in Chapter II could calculate carriage kms. This approach would require Passenger RUs to develop the capability of translating Train Events into carriage events as currently performed by Freight RUs. This would require most Passenger RUs to modify their existing systems. A simpler approach would be to enhance the Central WIMO capability to process Passenger Train Composition lists to calculate Carriage and Locomotive kms for each passenger train run. This Composition list processing could also generate a WIMO departure and arrival message for each carriage and locomotive. (Note that this approach would not work for freight wagons since they accumulate significant kms involving movements that do not carry a train designation that requires a Train Composition list.).

7. TAP TSI (Telematic Application for Passengers):

In 4.2.2.44 a draft version of this TSI (dated 25/06/2008) refers to Rolling Stock Reference Databases (including maintenance data), Design data and to the concept of a Keeper although the definition of these Functional Capabilities may be more appropriate in the Traction Unit and Passenger Carriage TSIs .

As outlined in 6. above; the input of key passenger carriage data would allow the TAF Central WIMO to provide the necessary Functional Capability.

In addition to 4.2.2.44, this draft TSI refers (in 4.2.2.27, 4.2.2.34 & 4.2.2.35) to Train Composition Data in conjunction with RU/IM dialogues about train paths.

The TAF WIMO can support these Tran Path dialogues assuming the input of Passenger Carriage and Locomotive Administration and Design data.

8. National Vehicle Register: (NVR: 2007/756/EC)

This Commission Decision specifies that databases administered by each Member State are required to capture (and make accessible) Administrative Data for each Vehicle (Freight Wagons, Locomotives (Traction Units) and Passenger Carriages) in service in Europe. This Functional Requirement applies to all Member States however non EU COTIF States have tentatively agreed to this requirement as well.

In addition to Administrative Data for each vehicle the NVR also contains some operational data i.e. vehicle restrictions, and the suspension of authorisation.
This NVR data is important source information for the TAF Central WIMO as shown in the Architectural diagram in Appendix 8.

9. Memorandum of Understanding (MoU): re Mutual Recognition of ECMs for Freight Wagons:

Annex B of this draft MoU (dated 28 July 2008) does not add any new Functional Requirements beyond what has been described above, however it does reinforce the need for ECMs to have the TAF Central WIMO Capabilities specified above in #2. (CSMs & CSIs) and #4 (TSI Freight Wagons). i.e. "The ECM needs to ensure that there are appropriate processes in place for the collation, receipt, processing and management of and secure access rights to all information relative to the management processes for the maintenance and operational integrity of the rolling stock."

10. The General Contract of Use – Freight Wagons: (GCU):

This initiative (dated 12/05/2006) also reinforces the TAF Central WIMO requirements described above – specifically in the areas of; wagon interchange (Acceptance & Handover – Article 1.4), NVR Authorisation (Technically Admitted Article 7.1), wagon information to Keeper for operation & maintenance (Article 15) and wagon information to RU re compliance with maintenance regulations (Article 7.2).

The only Functional Requirement that the GCU adds to the TAF Central WIMO is the ability to indicate if a wagon Keeper is a signatory to the GCU.

11. TSI 1520/1524 mm Track Gauge:

According to the ERA web site, the objective of this TSI (no draft found) appears to be to determine the relationships between the 1435 mm ("standard" track gauge) and the 1520/1524 mm track gauge systems. This involves the non EU Member States such as Ukraine and the EU Member Baltic States.

Clearly any wagons that have the capability of operating on the 1435mm track gauge as well as the 1520/1524 track gauges through replacement of wheel sets, replacement of bogies, and application of gauge variable wheel sets should be registered in an NVR and therefore in the TAF Central WIMO. All updates to data for these wagons (including wagon events inside and outside the EU) should be subject to the 1 hour rule.

In addition this TSI reinforces the need for the TAF Central WIMO Functional Capabilities of tracking shipments by ILU and Consignment numbers.

12. TSI Energy: (Conventional Rail)

References to this TSI indicated that a Final Draft was scheduled to be completed for June 2008 however the draft material was not found.
Several documents relating to Energy Metering and Energy Billing were found which indicated that a link between Energy consumption and Train Gross Tonne Kms would be desirable from an Energy Management point of view.
With the Data and Functional Capabilities described above, the TAF Central WIMO could be used as a source for calculating Train Gross Tonne Kms between specific points.

13. TSI Rolling Stock Noise:
(23 Dec 2005)

In 4.8.2 this TSI states that the following information must be included in the Rolling Stock Register (For each vehicle).

- pass-by noise

- stationary noise

- starting noise

- interior noise in driver's cab

This information is not covered in the NVR however it can be input into the WIMO as part of the Design Data for each vehicle. No additional Functionality would be required. In 7.6.1 it is stated that if a freight wagon is equipped with Composite Brake Blocks, it is assumed that the pass-by noise threshold is below the established limits. Although it could be considered redundant to the requirements of 4.8.2, it would seem logical that if a wagon is equipped with Composite Blocks, that information should be part of the Design Data.

14. TSI Conventional Infrastructure:

The ERA website indicates that this TSI is under development, however no draft document was found.

It is assumed that the TAF TSI Functionality related to Train Paths and Train Composition described in Chapter II - 2 and the WIMO Enquiry Capabilities described Chapter II – 3 will meet the Rolling Stock needs of this TSI.

15. TSI Command Control & Signalling (Conventional Rail):

26 March 2006

Annex C of this TSI indicates that the Rolling Stock Register must contain Administrative and Design Data for each vehicle. It is assumed that the Administrative Data will reside in the NVR and that the Design Data will be input into the Rolling Stock section of the WIMO.

Analysis Summary:

For a summary of these "Other" Functional Requirements against TAF Central WIMO capabilities; see Appendix 9.

In general, there appears to be a lack of harmonisation among some of these TSIs and related Initiatives. Also, there is a lack of specific references as to where and how the required data will be accessed when required. With close to one million vehicles in circulation on the European network on a 24x7 basis, the mechanics of timely and accurate data availability are critical to the successful implementation of Interoperability and Safety initiatives.These issues are addressed in subsequent chapters.

Chapter VII: Systems Architecture – TAF TSI Plus Other TSIs and Related Initiatives:

When the Functional Requirements of the TAF TSI plus the other TSIs and Related Initiatives (addressed in Chapter VI above) are taken into account; the Central TAF WIMO Systems Architecture specified in Chapter III can be easily enhanced to support the Rolling Stock related requirements for the:

1. Safety Directives
2. Common Safety Indicators
3. TSI Traffic Management & Operations
4. TSI Freight Wagons
5. TSI Locomotives (Traction Units) & Passenger RST
6. TSI Passenger Carriages
7. TSI Passenger
8. NVR
9. MoU re Cross Acceptance of Freight Wagon ECMs
10. The General Contract of Use for Freight Wagons
11. TSI 1520/1524mm Gauge Railways
13. TSI Rolling Stock Noise
14. TSI Infrastructure
15. TSI Control Command & Signalling

The required enhancements to the Central WIMO are as follows:

1. Batch (1 hour rule) for inputs to the WIMO from the NVRs
2. Locomotive, Powered Unit and Passenger Carriage Safety Related Fault and Fault Repair inputs (Batch) into the WIMO
3. Locomotive, Powered Unit and Passenger Carriage Administrative, Design and Operational inputs from Keepers/ECMs.
4. Locomotive, Powered Unit and Passenger Carriage km calculation capability based on Train Composition Lists.

Chapter VIII: Impacts of Adding Other TSIs and Related Initiatives to the WIMO Architecture:

1. The enhancements required to add the Functionality required to support the Rolling Stock aspects of the Other TSIs and Related Initiatives can be added to the Central WIMO at very low incremental cost. This cost would be a fraction of what would be required to develop stand alone systems

   Costs aside, there would be a major problem of synchronising common data among stand alone systems. Since data relating to safety are involved, the potential for conflicting information is an issue to be avoided.

   A summary matrix of this additional Functionality against the enhanced Central WIMO (ERVID) is shown in Appendix 10.

2. Passenger RUs would need to develop the capability of generating and batching safety related Fault and Fault Repair events to the WIMO. This could be done with a low end PC (Internet device equipped with a web browser and common-interface plug-in).

3. Keepers/ECMs of Passenger Carriages and Locomotives (Traction Units) would need to develop the capability of updating selected Rolling Stock Design and maintenance related Operational Data in the WIMO. This capability could be Internet based with only the requirement for a low end PC (or internet device), a browser and an Internet connection.

4. NSAs would need the capability of batching NVR updates to the WIMO. As with 3. above, this could be done at modest cost.

Note that the savings identified in 1. above would far outweigh the costs involved with items 2, 3 & 4.

With the enhanced architecture described in Chapter VII, (and shown in Appendix 8) the Central WIMO enquiry capabilities described in Chapter II – 3 would apply to ALL Rolling Stock – Freight Wagons, Passenger Carriages and Locomotives (Traction Units).

These capabilities would support Interoperability, improve Safety, the Quality of Service and Productivity as called for in Directive 16.

Chapter IX: Recommendations – TAF TSI, Plus Other TSIs and Related Initiatives:

1. **A Central WIMO Approach to TAF TSI Implementation Should be Adopted:**

   When costs (both one time development/implementation & ongoing), risks, time to implement and flexibility are considered; it is clear that a Central WIMO approach is far superior to a Distributed architecture. **On a NPV basis, the Distributed approach is estimated to be between five and ten times more expensive.**

   In addition, the Central WIMO's capabilities should be enhanced to encompass ALL Rolling Stock. i.e. passenger carriages and traction units. In order to accomplish this enhancement, a Harmonising, Vehicle Data Interoperability Project encompassing the 16 TSIs and Related Initiatives will be required. The focus of this project should be on Vehicle related data requirements.

   Given these enhanced capabilities; the Central WIMO should be re-named the European Rail Vehicle Information Database **(i.e. the ERVID**)

2. **Within the ERVID Approach, Passenger & Freight RUs & All Rolling Stock Keepers/ECMs Should Have the Option of Operating Local WIMOs & RSRDs.**

   This will allow existing systems to be utilised, thus reducing costs, risks and implementation time. Local WIMOs & RSRDs must be interfaced with the ERVID.

3. **All Vehicles moving in Local & Interchange service should be covered by the ERVID.**

   The main reasons for this recommendation are the calculation of Vehicle kms, (plus gross ton & net tonne kms) and the fault counter functionality. (See Recommendation #4 & #5) Additional reasons are tracking and systems complexity.

4. **The ERVID should have Vehicle Km Calculation Capability based upon: Freight Wagon Event Reporting, Train Composition Data for Passenger Trains, Geo Mapping and GPS Data (When Available.)**

   Most existing RU systems do not have vehicle km capability. This is a critical success factor for Interoperability & Safety and this **ERVID** approach is much faster and lower cost than having 100+ RUs modify/upgrade their existing systems. In addition to calculating Vehicle kms, the **ERVID** should have the capability of calculating Gross Tonne and Net Ton Kms for freight wagons.

   After a vehicle is overhauled, the Maintenance Plan for the Vehicle must indicate the maximum time and distance that the vehicle can travel before the next overhaul. Based on this input from the Vehicle Keeper/ECM, the **ERVID** should have the

capability of calculating and displaying the maximum kms and days until the next overhaul. See Appendix 11 for a more detailed description of this capability.

5. **Vehicle Fault Counters In The ERVID Current File Should Display ALL Safety Related Fault & Repair Details Between Overhauls.**

TAF TSI 4.2.11 & SEDP Deliverable 2 state that the Fault record should be archived when it has been repaired. This recommendation to delay the Fault and Fault Repair data archiving process until vehicle overhaul will make the **ERVID** more user friendly and enhance safety.

6. **The ERVID Should Have Freight Wagon Trip Capability**.

As mentioned in many locations in this report; wagon trips are a key concept supporting many enquiries especially service quality.

Also note that Keepers/ECMs can use this trip capability to monitor duty cycles (e.g. commodities handled) for individual Freight Wagons against the applicable Maintenance Plan.

7. **Freight Wagon Status Should Reside in Enquiry Logic *NOT* in the ERVID:**

This clarifies an open point in SEDP Deliverable 2. This capability gives users far more flexibility when making enquiries.

8. **The ERVID Should Provide Rapid Response Times on ALL Data Elements in the Database. (Estimated at 300**)

This provides for greater flexibility as the systems and user needs evolve. e.g. Wagon Faults and Repairs.

9. **The ERVID Implementation should be targeted for 2010 versus 2014 shown in the SEDP.**

The ability to deliver ***Safety,*** Quality of Service and Productivity benefits four years earlier than the SEDP timetable at a fraction of the cost makes the Business Case for the **ERVID, compelling.**

10. **Enhance the ERVID to Perform Safety Edits on Rolling Stock Interchange Notices & Train Composition Lists for Passenger & Freight RUs:**

This enhancement would improve safety by automatically highlighting any vehicle information that could indicate a potential safety problem. e.g. Unit close to (or past) planned Overhaul date and/or kms, suspended NSA authorisation, Safety related Fault reported but not reported as repaired, ECM Safety Certification suspended, etc. See Appendix 11 for more detail.

11. Enhance the ERVID to Automatically trigger Safety Alerts to Vehicle Keepers/ECMs.

These alerts could be triggered by situations such as; repetitive Fault reports on an individual vehicle (or group of vehicles) within a set period of time, Rolling Stock Units approaching Overhaul time or km limit, etc...

12. Explore the Use of the ERVID Concept to High Speed TSIs:

Although the High Speed Rolling Stock is different from Conventional Rolling Stock in many ways, the concept of a Maintenance File and Maintenance File Management for each high speed unit is probably valid.

13. Access to the ERVID for Authorised Stakeholders Should be Equitable.

No sub group of Stakeholders should have exclusive access to **ERVID** data nor should they control the price of access.

14. Funding of the ERVID Development & Operating Costs:

Initial costs to Stakeholders and barriers to entry for new actors represent significant challenges to the successful implementation of a project of this magnitude. These challenges could be mitigated by adopting a turnkey/ongoing operation approach where a vendor would finance the development and recover these (and ongoing) costs through the application of user charges. Equitable methods for calculation of these charges could be train kilometres (as part of track access fees charged by the I.M.s) and/or volume of enquiries.

It is recommended that this funding issue be addressed as a part of the Rail Vehicle Data Safety & Interoperability Project – European Rail Vehicle Information Database.

15. Introduction & Operation of the ERVID:

A Task Force made up of representatives of relevant Safety authorities and other stakeholders should be set up to oversee the introduction of the ERVID platform and operation of the ongoing service.

Appendix 1: Data Inputs:

1. Data input into the WIMO:

a. Wagon (Rolling Stock) Data: (Admin., Design & Operational)
For ALL wagons. See Recommendations Chapter IX.

- This is a wide range of Data input by Keepers/ECMs and RUs that handle the Wagon.
- Administrative and Design Data will be input by the Keepers for each Wagon.
- Operational Data will be input by the Keeper/ECM and the RUs handling the wagon.
- The Input Functionality is described in TAF TSI 4.2.11.3 and 4.2.11.4. It is also described in more detail in SEDP Deliverable 2 – Appendix b -2.6 & 2.8.

b. Wagon Orders: (Selected Consignment Note Data)

- This Data is Input by the Lead RU. The Functionality is described in TAF TSI 4.2.1 and in more detail in SEDP Appendix Deliverable 2 – Appendix b – 2.7

c. Wagon Movement & Interchange Events:

- This Data is Input by the RUs that handle the Wagon. The Functionally is described in TAF TSI 4.2.8 & 4.2.9 and in more detail in SEDP Deliverable 2 – Appendix b – 2.6.

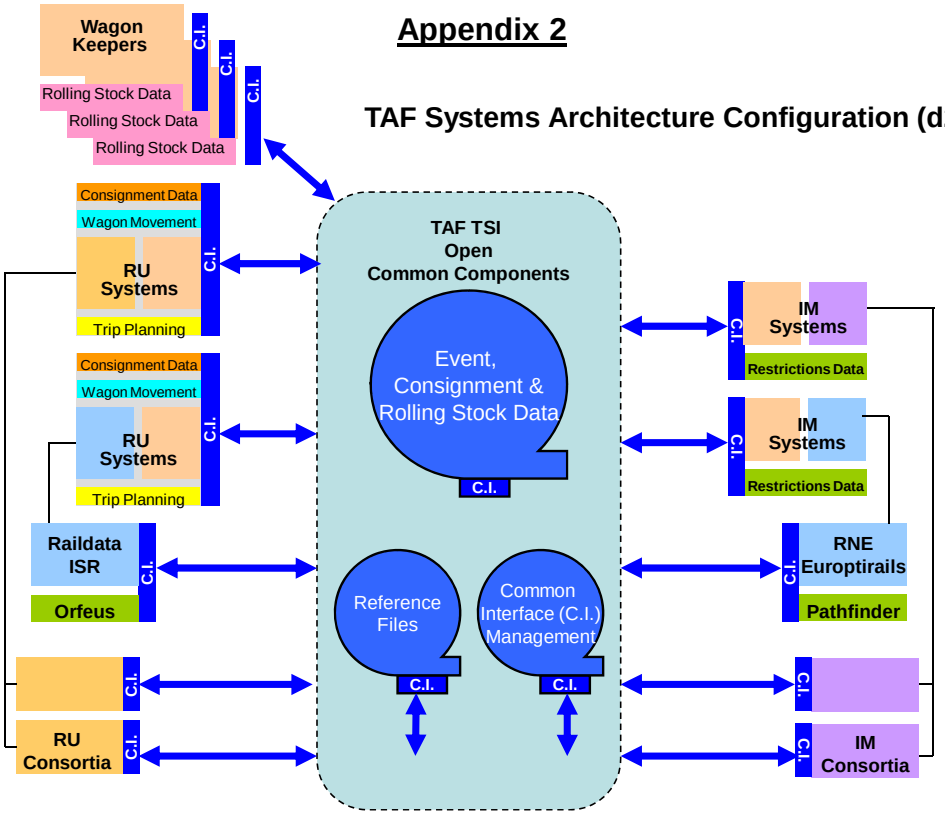
- These Events are shown in a diagram in Appendix 4 of this report.

d. Wagon/Shipment ETIs & ETAs: (At Trip Start & Revised)

- This Data is calculated by the RUs handling the Wagons. It is Input at the start of a Wagon trip as well as when exceptions occur during the trip. The Input Functionally is described in TAF TSI 4.2.7 and in more detail in SEDP Deliverable 2 – Appendix b – 2.6.

Appendix 2

TAF Systems Architecture Configuration (d2)

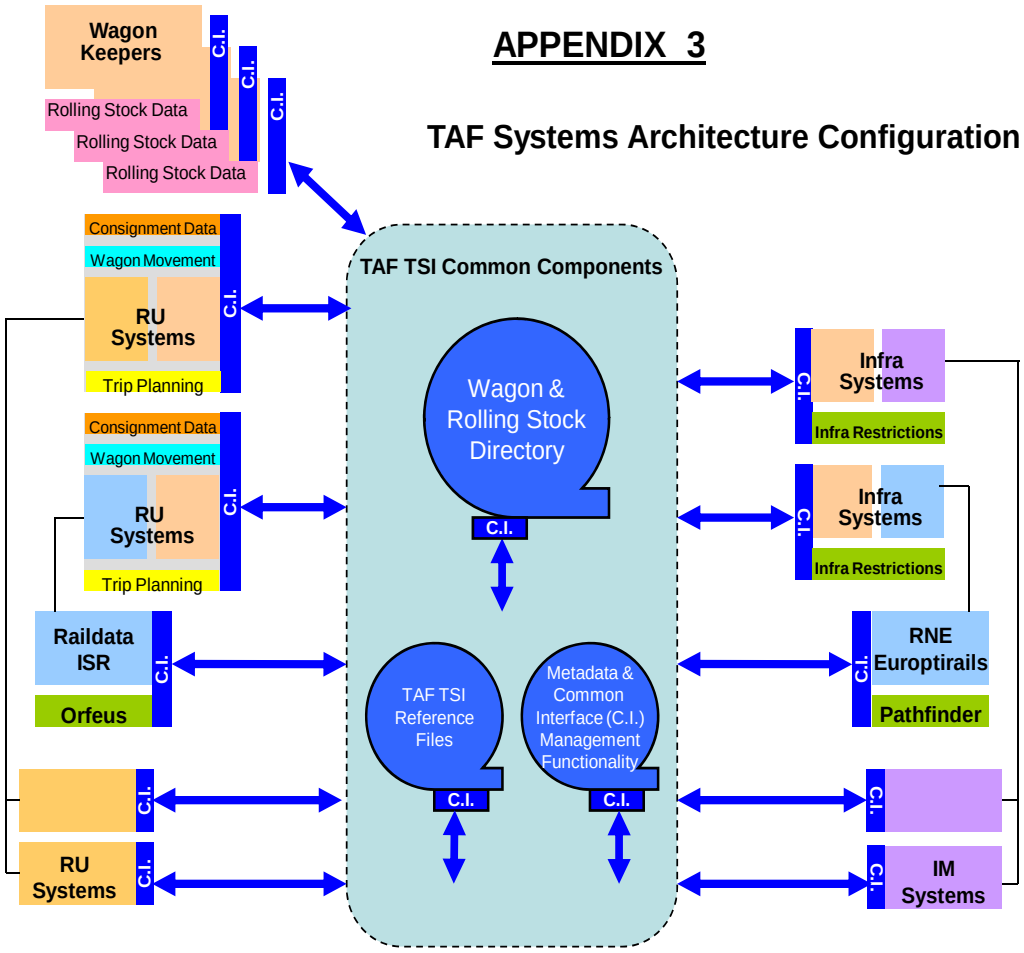


:

Source: SEDP Deliverable 2

APPENDIX 3

TAF Systems Architecture Configuration (d3)



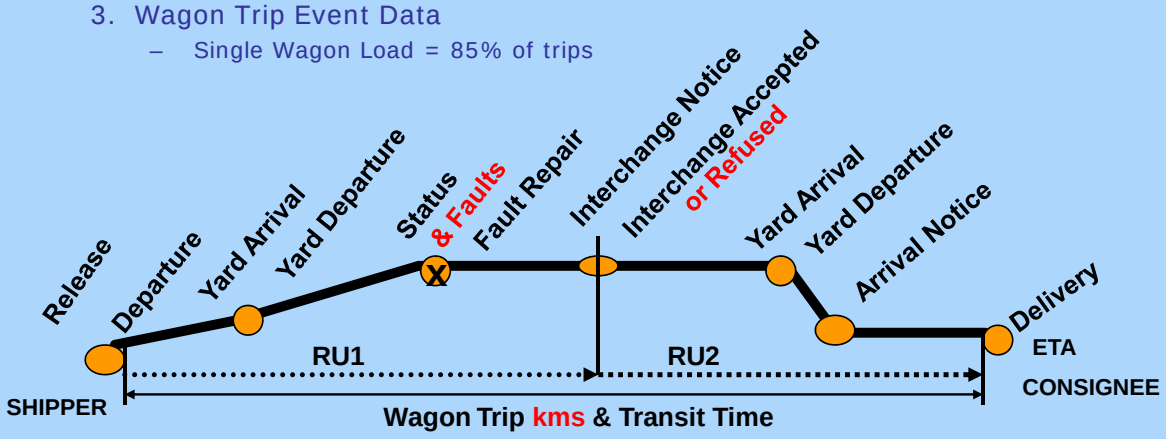
Source: SEDP Deliverable 3

Appendix 4

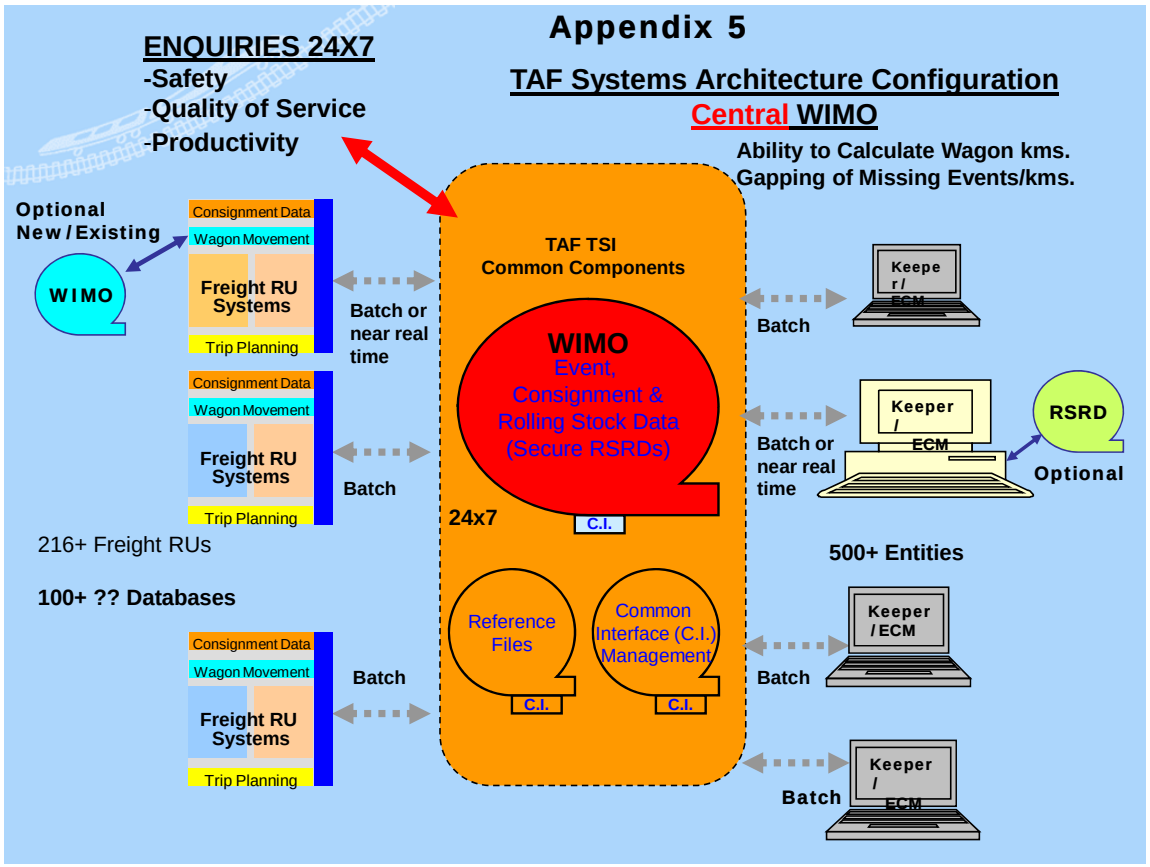
Wagon & Intermodal Unit Operating (WIMO) was created in the TAF TSI

What is 'WIMO' Data? :

1. Rolling Stock Data
   - Admin, Design & Operational data for 750,000 wagons in Europe
2. Consignment Data
   - Loaded or Empty trip data for Each Wagon
3. Wagon Trip Event Data
   - Single Wagon Load = 85% of trips

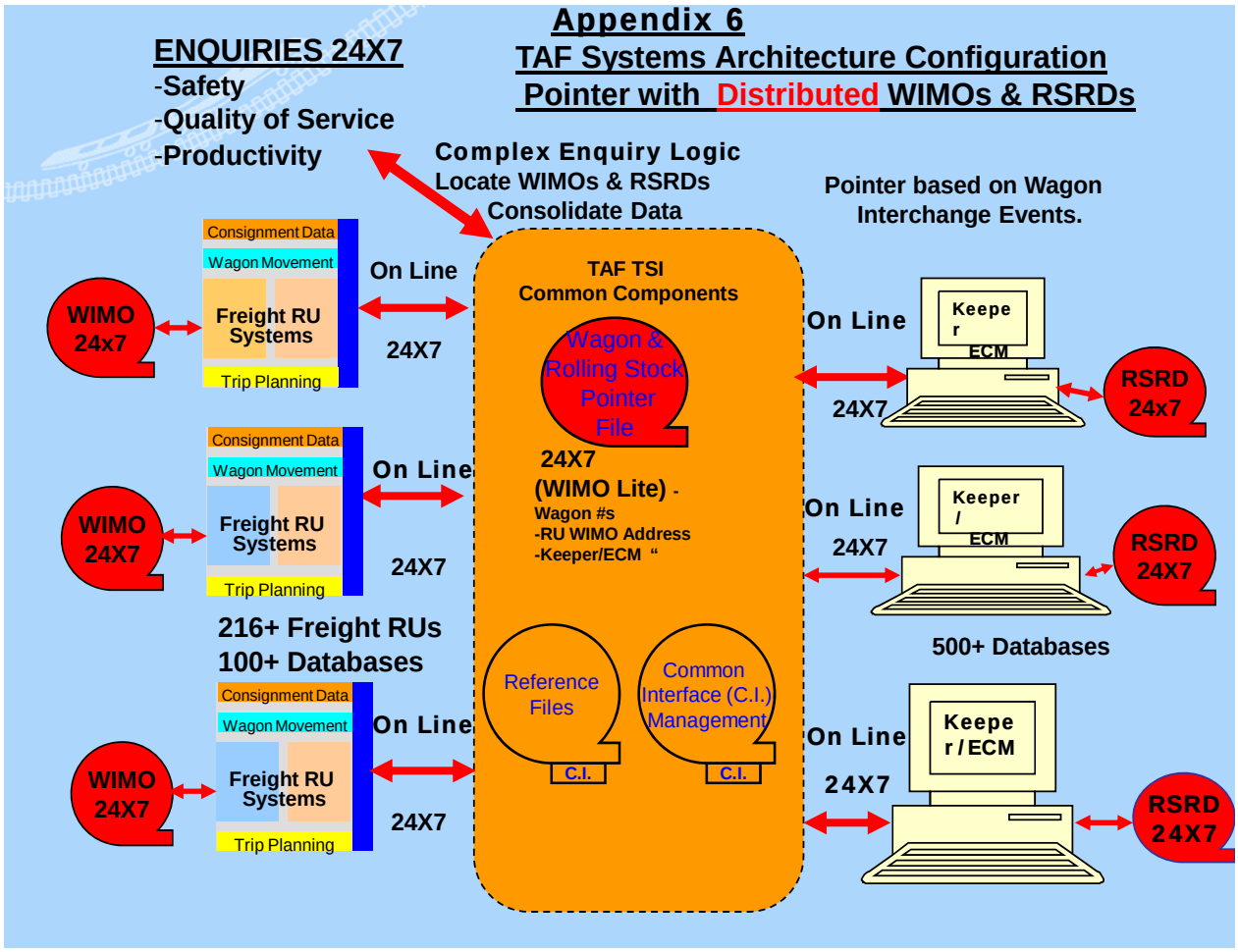


Note: Estimated 3.5 Million Freight Wagon Events Per Day in Europe.



Note 1: See Text Chapter III, page 10.

Note 2: Consignment Data in the WIMO is Operational only – no Commercial Data.



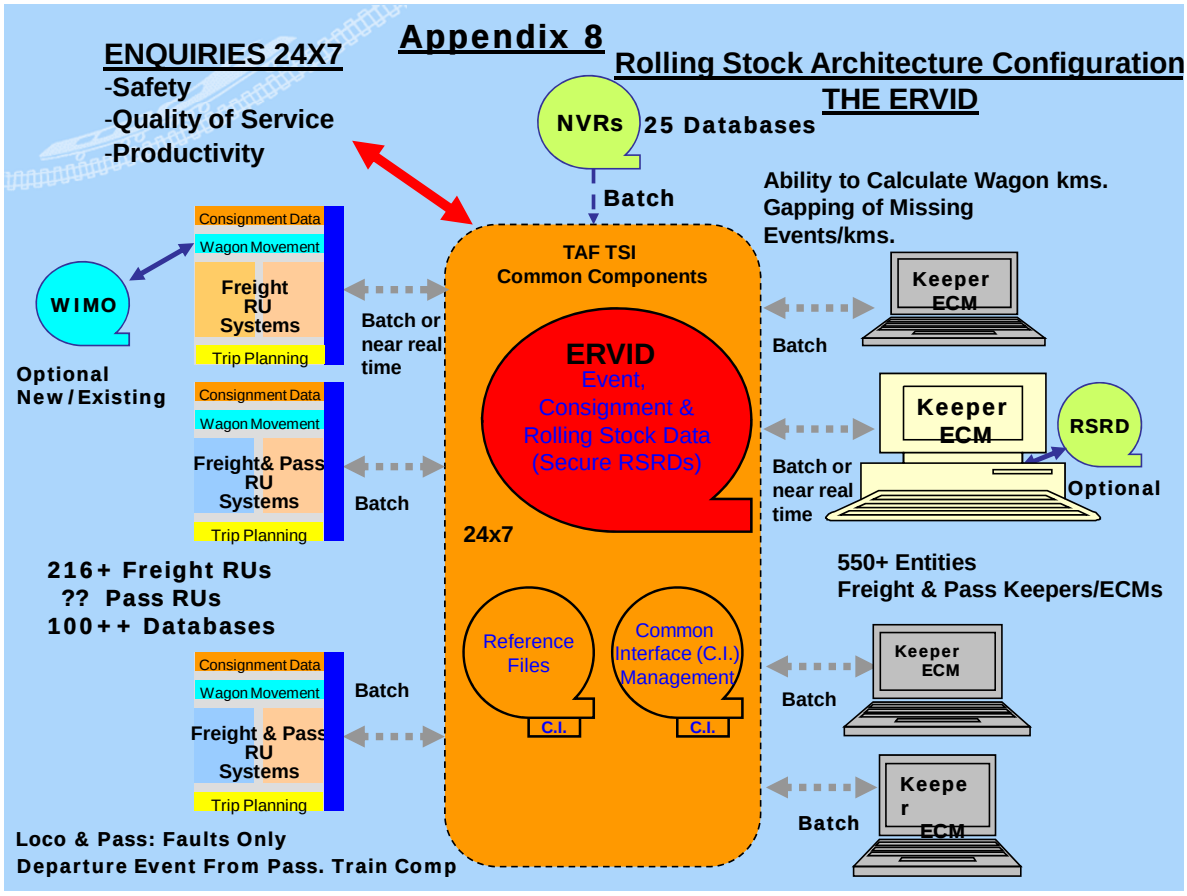
Note: See text Chapter IV, page 14.

Appendix 7

TAF TSI WIMO ARCHITECTURE: COMPLEXITY MATRIX

Initiative	Functional Requirement	Centr	Distr	Remarks
TAF TSI	Wagon Admin Data Repository	L	L	
"	Wagon Design Data Repository	L	L	
"	Wagon kms to Next Overhaul	M	H	Kms not available from RUs
"	Wagon Fault & Repair Records	L	H	Between Overhauls
"	Wagon Event Trip Repository	M	H+	From RU Event Reporting
"	Train Composition List Prep.	L	H	Admin, Design & Mtce Data
"	Interchange Delivery Notice	L	H	" " "
"	Shipment Tracking - Wagon #	L	M	
"	Shipment Tracking - Other	L	H+	ILU#, Consignment#, Dest.
"	Transit Time Reliable Measure	M	H+	Shipper to Consign. Siding
"	Wagon Trips by Wagon Type	M	H+	Major Productivity Measure

H - High M - Medium L - Low



Note 1: See text Chapter VI, page 24

Note 2: Consignment Data in the WIMO is Operational only – no Commercial Data.

Appendix 9

"OTHER" FUNCTIONAL REQUIREMENTS vs WIMO CAPABILITIES:

Initiative	Functional Capabilities	Data	Archit	Remarks
Safety Direct.	Vehicle Admin Data &Mtce File Management	P	Y	Wagon Data Only
CSI	Fault & Fault Repair Analysis	P	Y	" "
TSI Ops	Vehicle Design &Mtce Data for Train Composition	P	Y	" "
TSI Ft Wag	Wagon Maintenance File Management	Y	Y	
TSI Loc&Pas	Loco & Pass Admin, Design & Mtce Data	N	Y	Including Vehicle km Calculation
TAP TSI	Train Composition for Path Confirmation	N	Y	Some Overlap with Loco & Pass
TSI Pass Carriage	Pass Carriage Admin, Design & Mtce Data	N	Y	" " "
NVRs	Admin & Operational Data	P	Y	Vehicle Restriction Capability
MOU re ECM Certif.	Wagon Mtce File Management	Y	Y	
GCU	Wagon Admin & Mtce File Management	Y	Y	Stand Alone Wagon List NOT Required
TSI Energy	Calculation of Gross Ton Kms for Trains	P	Y	Freight Trains Only from Comp Lists
TSI 1520mm	Vehicle Admin, Design & Mtce Data	P	Y	Also Shipment Tracking
TSI Noise	Vehicle Design Data	P	Y	Wagon Data Only
TSI Infra.	Train Composition Processing for Path Confirm.	P	Y	" "
TSI C,C&S	Vehicle Design Data	N	Y	

Y - Yes N - No P - Partial

Appendix 10

"OTHER" FUNCTIONAL REQUIREMENTS vs ERVID CAPABILITIES:

Initiative	Functional Capabilities	Data	Archit	Remarks
Safety Direct.	Vehicle Admin Data &Mtce File Management	Y	Y	
CSI	Fault & Fault Repair Analysis	Y	Y	
TSI Ops	Vehicle Design &Mtce Data for Train Composition	Y	Y	
TSI Ft Wag	Wagon Maintenance File Management	Y	Y	
TSI Loc&Pas	Loco & Pass Admin, Design & Mtce Data	Y	Y	Including Vehicle km Calculation
TAP TSI	Train Composition for Path Confirmation	Y	Y	Some Overlap with Loco & Pass
TSI Pass Carriage	Pass Carriage Admin, Design & Mtce Data	Y	Y	" " "
NVRs	Admin & Operational Data	Y	Y	Vehicle Restriction Capability
MOU re ECM Certif.	Wagon Mtce File Management	Y	Y	
GCU	Wagon Admin & Mtce File Management	Y	Y	Stand Alone Wagon List NOT Required
TSI Energy	Calculation of Gross Ton Kms for Trains	Y	Y	
TSI 1520mm	Vehicle Admin, Design & Mtce Data	Y	Y	Also Shipment Tracking
TSI Noise	Vehicle Design Data	Y	Y	
TSI Infra.	Train Composition Processing for Path Confirm.	Y	Y	
TSI C,C&S	Vehicle Design Data	Y	Y	

Y - Yes

APPENDIX 11:

IMPLEMENTATION of DIRECTIVE 16: (2008/57/EC)

Required Business Processes, Systems &Data – An Example

Introduction:

In addition to the TAF TSI there are fifteen Interoperability and Safety initiatives that apply to the one million European Rail Vehicles- (Freight Wagons, Passenger Carriages & Locomotives/Traction Units). These Vehicles constantly circulate on the tens of thousands of passenger and freight trains that operate on the conventional European Rail network on a 24 hour per day basis.

These fifteen initiatives do not address the substantial Business Processes and Systems (including architecture) required to provide the functional capability required to provide the real time data required for their implementation.

The TSI Operations: (2006/920/EC)

Section 4.2.2.5 (Train Composition) of this TSI provides a good example of these Business Process, Systems and Data needs.

This section states (in part) "…all vehicles on the train must be currently within their specified maintenance interval and will remain so for the duration (in terms of both time and distance) of the journey being undertaken." (1)

To fulfil the distance component of this requirement a robust set of harmonized Business Processes and Systems are needed as outlined below:

1. A Maintenance File (Plan) is required for each vehicle. A key element of this Plan is the maximum distance that a Vehicle can travel between overhauls.

2. When a vehicle is manufactured (and/or after each overhaul) the maximum distance that it can travel must be entered into a "system".

3. When the vehicle (re)enters service and circulates on the European network, a 'system" must automatically keep a cumulative record of the distance that it travels, inside or outside the EU. Currently, most of the 300+ European RUs do not have the capability of calculating the distance that vehicles travel. Modifications to the 300+ RU systems to provide this capability (especially on a cumulative basis) would be time consuming and expensive.

4. A "system" must automatically compare the accumulated distance that a Vehicle has travelled with the maximum distance between overhauls and the

resulting maximum distance to the next overhaul must be calculated and made available to:

a. The passenger or freight RU that is preparing the Train Composition List prior to running the train.

b. The Keeper/ECM.

c. NSAs

5. The maximum distance to next overhaul must be compared with the distance that the Vehicle will travel on the train.

6. If the maximum distance to next overhaul is less than (or close to) the distance that the Vehicle will travel on the train; an automatic alert must be generated.

Summary:

The WIMO Analysis addresses the required Systems architecture, however to make Interoperability & Safety work, other issues must be addressed such as:

- A definition of the Data Requirements of the 15 Initiatives

- The Harmonisation of the Functional Capabilities described in the 15 Initiatives (especially Vehicle maintenance)

- The required Business Processes: (e.g. Who is responsible for data input; when and how is the data entered and updated.)

- A description of the required Functional Capabilities (e.g. how will vehicle distances be calculated.)

(1) Currently the Ops TSI is mandatory for trains on TEN Lines however Vehicles circulate on the complete network. It is understood that revisions to the Ops TSI (scheduled for March 2010) will specify that it will be applicable to the complete European network.