SAMANTHA Project

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Safe & Intelligent Fishing Products Traceability Management Throughout the Supply Chain

CO-OPERATIVE RESEARCH PROJECT

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1 Project Execution

The main objective of SAMANTHA is to provide a product which will enable the traceability of fishing goods, not only for big companies but also in SMEs.

From the technical point of view, SAMANTHA has been conceived as a complete **HW-SW architecture with two parts well different between them**. The first one relates to the **RFID architecture**, which enables SAMANTHA to get all the necessary information from the fishery products in order to perform a suitable traceability.

The second part of SAMANTHA is composed of **main components of the TIS** (Traceability Information System). The result of this SW approach is a **configurable platform composed of a workflow basis that will act as internal engine to support the business logic of the applications.** These applications allows the monitoring and control of the traceability value chain, but furthermore, they are defined for taking maximum benefit of all the information obtained through the interfaces with the RFID infrastructure deployed in field.

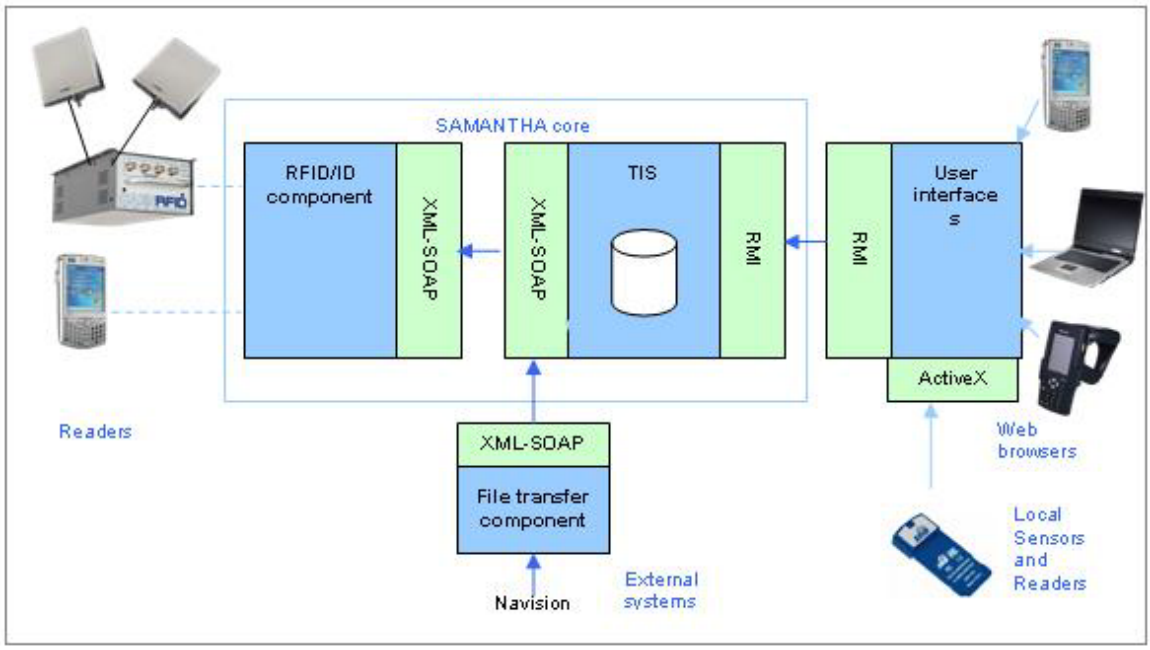

FIG 1: SAMANTHA solution architecture

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Three features will characterize this application perspective of the project:

1. The business definition has being made according to the user requirements and the functional knowledge coming from current methods of work as a starting point for defining new collaborative work methods.
2. **Applications were firstly developed in beta version during the first year of the project and they have been customizable** during this year by applying a design based on parameters with initial values that could be changed depending on the requirements and specific needs of SMEs
3. With the aim of providing more dynamism to these activities performed in-field (fish markets, fisheries, etc), two kind of access have been achieved: **PC-based and handheld-based** (in this case PDAs have been chosen as the most suitable device).

As a successful objective, Samantha has worked with the last techniques and technologies in RFID tags identification with food goods where there is not much experience. Last technologies in portable RFID readers, kind of tags are being used. Samantha is a pioneer project in this sector and many of the found problems are related to the unavailability of devices and tags with the required features.

Samantha is a distributed system where users can manage the information from everywhere, the devices that get, print or show information can be distributed. Samantha uses grid and distributed software technologies to achieve a global complete system composes by several joined nodes. In this way is possible to share information from an organization to another obtaining the complete information about a fishing product and the processes where it has been involved.

Samantha consortium has matched the technology possibilities and the features needed by fishery sector companies. Several and generic scenarios has been detected and the individual use cases have been used to develop the features and needs for the final product creating a complete HW-SW architecture that enables SAMANTHA to get all the necessary information from the fishery products in order to perform a suitable traceability.

Moreover, during the first year of the project, the first prototypes were built; these prototypes have no connection between them but allow checking the possibilities of the different technologies used in the project. We have to remark the work in the RFID prototypes where several developments have been done with the aim to test different technologies and tags. In this prototypes have been tested the distances, tag positions and environment status (humidity, temperature, ice

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presence, water effects) of the readings. The information obtained has been used to define the technologies and devices to be used in the project.

The main objective of the TIS (Traceability Information System) is to achieve the traceability of all the process suffered by the products in a concrete organization. Taking this as principal aim, it has been developed the System Architecture and all its functionalities are aimed to this goal.

Firstly, it has to be considered the different actors that have the domain model:

- Users: different users can use the application (for instance, operators, clients, providers, and so on…). Each one can access to different functionalities.
- RFID System: it is in charge of management of all requests to the RFID writers and readers. Due to this, it is isolated the business logic related to the management of RFID systems, as the writing/reading of tags and the creation of labels.
- External Systems: the organizations also have external systems that can connect to the TIS, for instance: a weigh machine.
- TIS: it will centralize all the requests of each previous actor, and it will be the responsible for the management of all the functionalities of the system.

The TIS Architecture is composed by the following modules:

- Traceability management: this module is responsible for administrating the traceability in the whole production chain of an organization. This module it is divided into three different sub-modules:
  - Processes: responsible of what data enter in a process, how is this process realized, and what data go out this process. For example: a identification process which needs the specie and produces a new label.
  - Reports: management of all the report creation which can be realized by a user of the system.
  - Configuration: this module configures the system, providing feed for the other two modules.
- User management: responsible for registration of new users, in order to these users can realize actions in the system.
- TIS management: allows the communication among different TIS of the net.

The system will have a security framework, allowing secure communications between all its entities.

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Furthermore, to make transparent for all the entities the realization of requests and queries with different formats, the platform provides diverse Input API's, process and output data.

The RFID system administrates all the requests realized to/by the TIS about the writing/reading RFID systems. Due to this fact, they are separated the both business logics, obtaining a platform highly adaptable.

For the communication between the TIS and the RFID, it has been used Web Services, which allows the interoperability among different systems, and improves widely their scalability.

After a big number of tests, described in the deliverable D.2.3.1, the chosen technology for the RFID system, related to HW systems, has been UHF, which has demonstrated that it is the most suitable, owing to the characteristics of the scenarios of the SAMANTHA project given. Through these tests, it has been decided also that the tags used in the system will be passive tags.

To realize the massive tag writing and reading without problems, it will be defined in first place the areas where the tags are residing. From here, the anti-collision protocols as ALOHA, allow realize actions with the tags.

The RFID System contains the following modules:

- RFID Manager: provides the global intelligence of the system, being responsible for the tag management, the zones and the communication with the TIS.
- RFID Fixed Reader middle-ware: this module administrates all the operations with the RFID writers/readers to read tags, write tags, and create new labels.
- RFID Mobile Reader middle-ware: this module consists of an embedded application in the manual reader device, and it will communicate with the RFID Manager to produce all the operations. Due to this, when a user reads a tag with the mobile device, it will be communicated with the system through web services.

In this way, all the scenarios proposed have been covered in the different deliverables. A user can read a tag with its mobile device, it will communicate to the RFID System, and this one, will communicate with the TIS. The TIS also can communicate with the RFID System to print a new label and the last one will communicate with the proper tag writer.

So, the achieved results could be summarising as follows: it has been realized the design and implementation of the SW modules that are the core and the bases of the Traceability Information System (TIS) and its derived applications completed. Besides that, it has been completed the integration of the RFID

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infrastructure with the SW-side of the system, as well it has been finished the deployment and testing within real scenarios. Below, there's a graphical summary of the four pilots and their architecture:

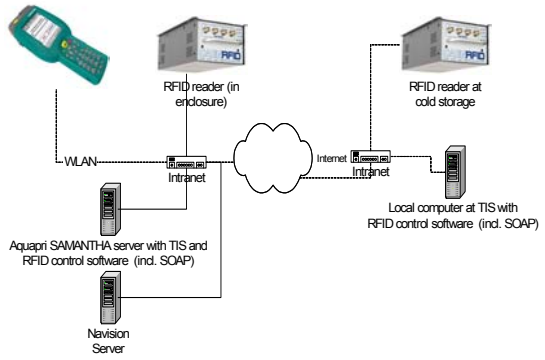

FIG 2: AquaPri's pilot

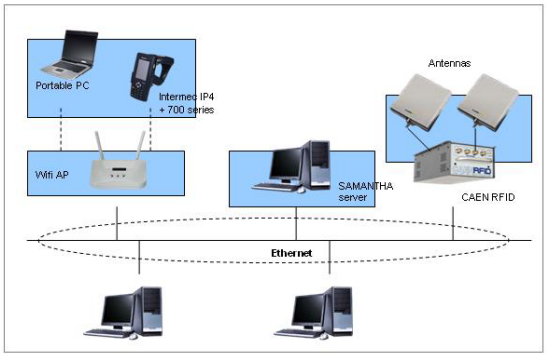

FIG 3: Grupo CIE's pilot

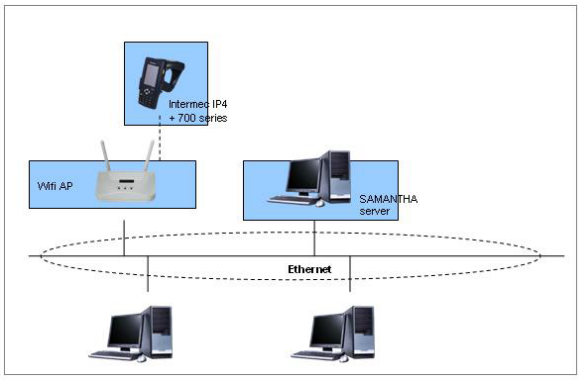

FIG 4: TraceAll's pilot

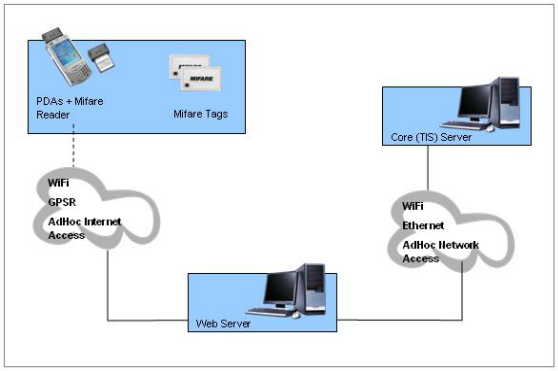

FIG 5: Scitum's pilot

The impact of the SAMANTHA project on the fish industry (or fish sector) - which is extraordinarily diverse; at one extreme we may distinguish large, multinational joint ventures and at the other side the industry relies on small and medium sized fisheries, which do not have enough resources to invest on reliable traceability systems, facing an increasing risk (for both themselves and final customers) whether they are not able to certify their goods, - could be summarised as follows.

The results from SAMANTHA aim at releasing the problem of fishery products traceability within small and medium sized enterprises, approaching new technologies to those companies not having a minimal internal IT capability to automate internal processes that optimize resources and costs.

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Thanks to these results, potential customers will be benefited directly by means of an information network system that can be used by each actor in the food chain to record and manage their own traceability data and to exchange relevant information between supply chain partners. These results let to control the conformity of practices to defined standards and the conformity of products quality to defined specifications. With these results, small and medium sized fisheries certify the origin of their products and set a collaborative framework in order to prevent black market which affects them and satisfy European directives concerning food quality and safety and citizen's health.

Regarding assessment and evaluation activities, all the works have been completed, all the dissemination and exploitation strategies have been finalised for the period included in the life time of the project, but future strategies have been defined thanks to the last version of the Plan for using and disseminating knowledge. As a sample of the dissemination efforts done in this project, below it could be found SAMANTHA's brochure

FIG 6: SAMANTHA Front Brochure

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FIG 7: SAMANTHA Back Brochure

During the project's period, the SAMANTHA consortium has tried to divulge it to all the target audience identified since the early stages of the project.

SAMANTHA has contributed with introducing the traceability concept to traditional sectors, as the fishing industry, which didn't even know or misinterpret the new legislation. For other sectors, as the food industry that have already introduced the traceability to improve their productivity, the project has been also a point of reference for them to know the mechanisms and the technology to assure their products' traceability.

From the beginning of the project, public institutions have been very interested in participating and contributing in the project with their expertise and experience. SAMANTHA provided public institutions with tools and scenarios improve the capacity of their reaction to face food crisis or sanitary alerts. The fishing sector is very affected by many black market activities which are definitely a threat for the appliance of the European directives concerning food quality and safety and citizen's health. Therefore, SAMANTHA has been a good point to set the basis to avoid the black market since provides a means to identify uniquely all the relevant data related to a batches of fishery products with no fraud possibilities.

On the other hand, a lot of contacts have been established with IT providers. The medium and small enterprises in the fish sector are asking for automatic systems to manage their stocks and to control the traceability of their products. SAMANTHA turned into a reference for them to create new projects and new

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business opportunities. The SAMANTHA Consortium contacted with standards developers what has been very useful for the RTD partners to achieve the project and to face new challenges and new projects.

Thanks to the fairs, workshops or other events devoted to the fish sector in which the project has been involved, the Consortium accessed to this sector in all the links within the production chain. The European regulations imposes to auction centres (producers) to have the indispensable computer systems to obtain and transmit to government the data of the transactions that take place in the auction centre in order to control them statistically. The first sale is the starting point of the control of traceability of fishery products where the first labelling of batches takes place. SAMANTHA has been a reference to these companies which manage the first sale since its labelling system lets them manage the auctions or their production systems without being in touch with the products to identify them. Besides, the wholesalers or distributors who buy in an auction centre or in a fishing farm ask these companies for labelling systems that ease their work. The wholesalers, distributors and processors use to be medium or small enterprises that sell directly to great retail supermarkets and some of them are already demanding to their providers RFID tags in their pallets. In its turn they are demanding to their providers, identification tags that let them manage their own labelling system. Therefore, these companies have been very interested in SAMANTHA since the project should contribute to integrate information systems to control the traceability of fishery products in their facilities. Great retail supermarkets more and more are asking for an automated system to maintain an optimum stock level while keeping a balance between product availability in the retail store, and minimize the risk of having excess stock. On the other hand, they must gain the confidence of their clients, guaranteeing and certifying the quality of their products. For that, it's necessary to guarantee the visibility of their products along the supply chain and SAMANTHA fixes the mechanisms to carry it out.

Consumers are worried about the quality of food they are about to consume. SAMANTHA has aimed to offer the mechanisms to put all the information about those products at the final consumer's service.

Regarding the consortium, the technical weight of the SAMANTHA project was in the hands of RTDs companies which are **MOVIQUITY** (coordinator), specialist in mobile applications and software development, **ARIADNA, TRAGSATEC** and **VTT**, specialist in RFID technologies.

The complete system is being exploited from a commercial point of view by at least three SMEs within the consortium: **SMEs** placed in Spain (**GRUPO CIE**), Estonia (**PER SCITUM**) and United Kingdom (**TRACEALL**) are IT providers for the fishing Industry in their respective countries, thus being SAMANTHA a new powerful business opportunity for them. On the other hand, some services will be derived from the system itself, such as the ones related to configuring and customizing the system for their customers and some others that could appear

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through this opportunity. By the way, some of these SMEs also provide maintenance services to fisheries, fish markets, fishermen associations, etc, opening a possibility for these SMEs to provide an advanced traceability control from their own control centers following the so called ASP model (Application Service Provider).

From the point of view of further results, other customers of the solution (such as the one represented by **AQUAPRI**, SME fishing farm from Denmark) are benefited directly by means of an advanced and mobile evolutionary information network system that can be used by each actor (in any place and any moment) in the food chain (producer/grower, processor, distributor, wholesaler, retailer) to record and manage their own traceability data and to exchange relevant information between supply chain partners; control the conformity of his practices to defined standards and the conformity of products quality to defined specifications, and improve their own practices for better quality and food safety.

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2 Dissemination and use

This section provides a publishable summary of each exploitable result of the project has generated. **SMEs which are the companies which have the complete ownership of these results, have jointly agreed that the way to protect the project's results (Intellectual Property Rights protection measures) is through a Joint Ownership Agreement.**

The main final results of the project are:

- **The SAMANTHA solution** will be composed of different software modules interacting to assure the traceability of fish products inside a fish company or an auction centre:
    - **The SAMANTHA platform:** The SAMANTHA core is composed of the TIS (Traceability Information System) and RFID/ID component. User interfaces use the SAMANTHA core functionalities. Different SAMANTHA connected modules will be exploited as a whole.

      The SAMANTHA solution architecture is composed of the RFID/ID Component, the TIS and the user interfaces. Web browsers (IE or similar) query the server to get the HTML pages provided by the web applications that comprise the UI. These UI query the TIS through RMI (Java Remote Method Invocation) to access data from database or from the RFID/ID component. The TIS queries the RFID/ID component through web services (XML-SOAP) to get data from readers.

      Data can be entered into the TIS through two other methods:

        - By file transfer from external applications, using the File Transfer component.
        - By direct communication of the web user interface with an RFID reader, integrated into or connected to the user's device.

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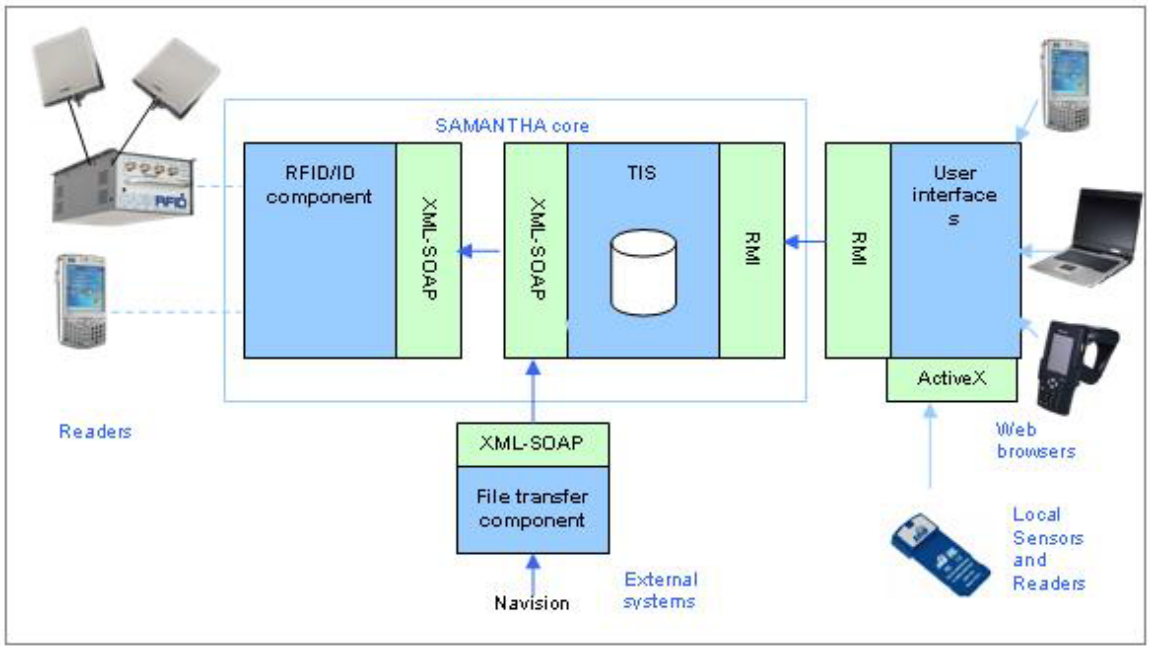

FIG 8: The Samantha Core

- **RFID components**. Software source codes, architecture designs will be obtained from the development of interfaces between the RFID system (readers and tags) and the TIS system. Starting from commercial products, products designed for the fish industry (e.g. tags to be attached to boxes used in fish industry, antennas for fish industry) will be developed. The system will use standardized technology in order to improve marketing possibilities and to provide a cost-effective solution to customers. The RFID component configures and manages the different RFID or ID (barcodes) readers. The RFID/ID component is composed of the following subcomponents:

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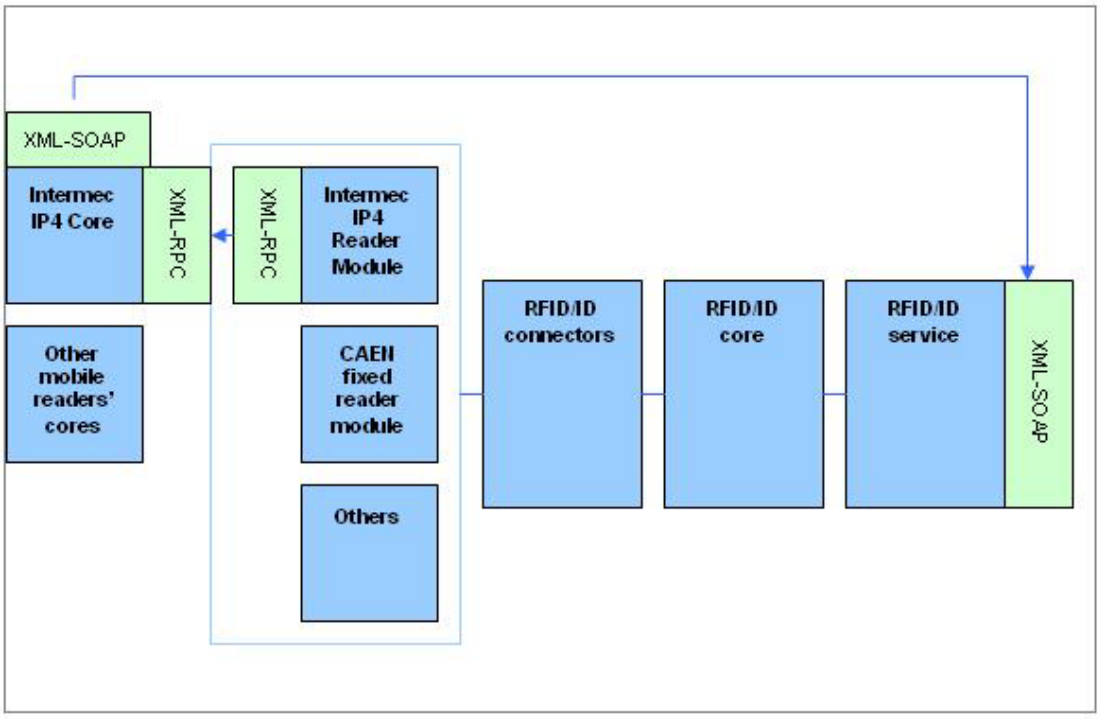

FIG 9: RFID subcomponents

- RFID/ID Service: Publishes the RFID/ID core functionalities. Software modules can ask this service for the following operations:
  - TIS to service (XML-SOAP):
    - To read a RFID tag
    - To write a RFID tag
    - To know is a tag is available or present in the reading area
    - To synchronize a read/write operation between mobile readers and TIS
    - To start/stop the continuous reading of fixed readers
    - To configure on runtime the logging system
    - To shutdown the RFID/ID software component
  - Mobile Readers to service (XML-RPC):
    - To subscribe/unsubscribe mobile readers on runtime
    - To assign operations to a reader on runtime
    - To receive ID events from mobile readers

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- RFID Core: are the main modules of the RFID/ID component
  - Loads the system configuration
  - Creates, activates and manages connectors and readers
  - Launches communication servers
  - Provides the logging system
  - Manages received external events
- RFID/ID Connectors: provide an abstraction layer to access Reader Model Specific Modules in a common way.
- Reader Model Specific Modules
  - Intermec IP4 Reader Module
  - CAEN fixed Reader Module
  - Others
- Intermec IP4 core

- **TIS (Traceability Information System) platform and middleware components.** Source codes and architecture designs will be generated from this system that interacts with the RFID components and the middleware components. New applications will be developed to adapt TIS to each use case to integrate with the pre-existing systems in each use case. TIS is formed by the next modules:
  - **Users**: users management (create, delete …)
  - **Communications**:
    - **Web**: RMI
    - **RFID**: Web Services
  - **Security**:
    - External Systems: communications with EFIS
  - **Configuration**: load XML config. files
  - **Incoming**: input interface in TIS
  - **Session**: join the Web and RFID request
  - **Operations**: execute the operations to save the data in the data base.
  - **Data Base**: in charge of communicate with the data base to save, search and delete the data.

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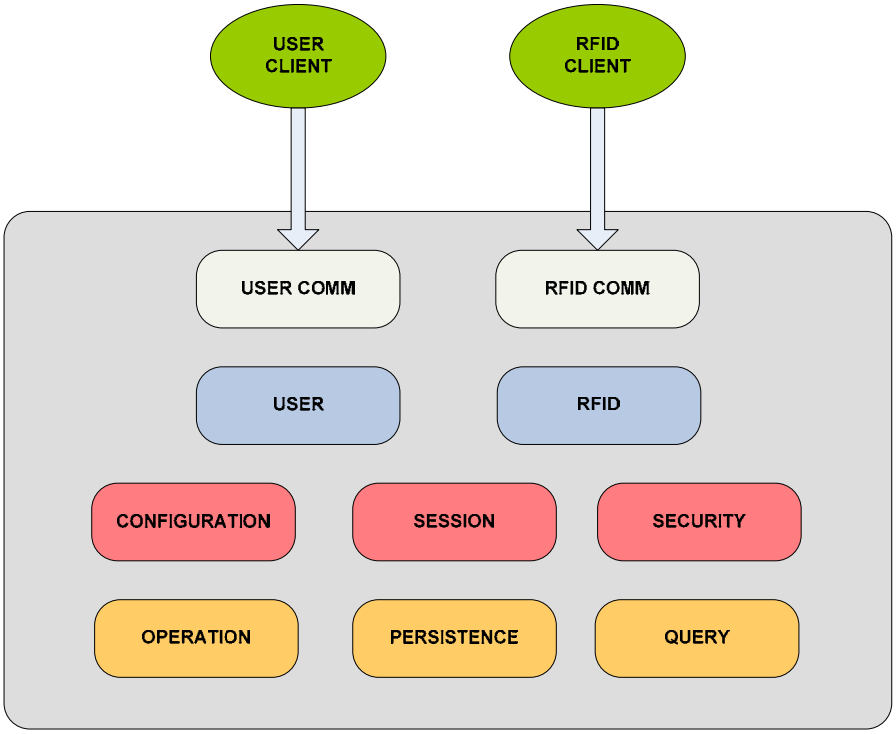

FIG 10: SAMANTHA TIS architecture

- TIS filters and joins the requests of Web and RFID System:
  - What scenario?
    - Trace All
    - CIE
    - Scitum
    - AquaPri
  - What operation?
    - Save Pallet
    - Read Batch
    - …
- TIS sequence:
  1. A request from Web enters in TIS.

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2. The TIS (Traceability Information System) compares the Web request with the XML configuration file.
3. The Web request needs data from RFID. Then TIS waits a request from RFID.
4. A request from RFID enters in TIS.
5. The TIS joins the Web and RFID requests.
6. All data are saved in the data base.

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