TagItSmart!

Smart Tags driven service platform for enabling ecosystems of connected objects

Grant agreement 688061

Open Call Announcement

Grant Agreement number:	688061
Project acronym:	TagItSmart!
Project title:	Smart Tags driven service platform for enabling ecosystems of connected objects
Project website address:	http://tagitsmart.eu/
Start Date of the Project:	1 January 2016
Duration:	36 Months

1 Introduction

I think the message to the IoT community is the key – as with adoption of ICT, the adoption of circular principles will be done by each sector in its own way, but it is the IoT industry that spans the entire value chain and can therefore make a systemic contribution. So, if the IoT community starts to design for a circular economy, rather than the old "linear" economy, then it can be a game-changer for all the industries involved. - Monika Schroeder, DG Connect.

We are in a Digital Transition. You feel it whatever business you are in. This transition is fuelled by the Internet of Things; the horizontal drivers mashing up hardware, software, cloud storage and analytics with monitoring capabilities.

In a world moving as fast as technological innovation allows, we cannot aim to keep practices and operations stable. Retailers, as well as mass good producers need to build strong relations with end users. Online shopping will grow and create delivery and transport issues. Consumers are more vocal and demand much more information about products. Social media makes it easy to share customer experiences. Giving consumers insight into the full product process at every step can create strong Customer Support Journeys.

This way of creating transparency in the value chain should lead to a win-win for producers, distributors, retailers, online shops, brands, and customers. All these positions will change and become fluid. New business models will shift value in between the traditional stakeholders, destroy revenue for some and create value for newcomers.

We encourage you to join our LinkedIn Group: https://www.linkedin.com/groups/8486104

1.1 What is TagItSmart?

A Smart Tags driven service platform for enabling ecosystems of connected objects.
Watch our video.

There is one category of goods that seems to escape this tendency towards full individuating at item level and that are fast moving consumer goods (FMCG). The barcode identifies types of products, but not the individual items. NFC (Near Field Communication) and RFID solutions are used throughout the value chain, but are somehow complex and expensive when compared to the cost of the FMCG items. Therefore, we are looking to the use of dynamic QR codes, i.e. QR codes that are printed on the FMCG items and that change according to the selected environmental parameters (temperature, humidity, intensity of lights), potentially enhanced with printed NFC tags and sensors. These codes can become part of any household item. Using these codes we could create a value model that allows all stakeholders, from farm to fork, from factory to recycling, from producer to individual customer to not only track and trace any item in the process, but also to provide additional information about the item that can be of use for other stakeholders, to give individual feedback to a producer, to request a new product based on individual taste, to alert retailers and producers that an item is close to its best before date or that is being disposed of (in a recycling bin) as it should etc.

We are anticipating the full effect of all FMCG being individually addressable.

We are interested in building a large ecosystem, spanning a diverse set of sectors and application domains. We will have running implementations of our internal pilots which will be available as the basis for the open call pilots. This will involve backend services (user administration, product management, business workflows) as well as *frontend* components like creation of smart tags using a combination of inks, contextual scanning of smart tags with a connection to backend services. Some of the user authentication mechanisms will be available as well.

We want to test our developed infrastructure and framework in pilots, ensure it is robust in-life, together with options for consumer / user engagement, all with currently available technology (e.g. barcodes) and develop these elements in parallel to the development of the functional ink tags. For that we need to involve: third party businesses to confirm/comment our findings and implementations and focus on the balance of gaining intelligence from the tag and from the actual involvement and engagement of end users, as well as the environment envisioned in the scenario (home, supermarket or street). One of our key themes will be *Co-opetition* as we envisage convening multiple suppliers of complimentary industries.[i]

Roles of individuals, companies, city, government, EU are becoming more fluid. This leads to innovation but also to insecurities, especially on funding capabilities and Return On Investment (ROI). New business models and new regulatory models should be co-created with the different actors; EU, NGO, city, SMEs, individuals and large service providers. The European Commission published a new *EU Circular Economy Package*[ii] in December 2015, with an action plan addressing the 'full circle' from production and consumption to waste management and the market for secondary raw materials, to create the circular flow of materials necessary for a regenerative economic system. There are also sector-specific measures on plastics, food waste, critical raw materials, construction, and bio-based products. The proposed actions will contribute to "closing the loop" of product lifecycles through greater re-use, remanufacturing and re-cycling, and bring benefits for both the environment and the collaborative economy, enabling increased sharing of products.

The Internet of Things (IoT) is the key enabler: IoT and circular economy are both about a complete system reinvention, and they are both about smart, informed management of assets. Pioneer companies used circular design already before the digital era but now with the use of IoT technology the game changes entirely: it creates the data- and feedback-rich systems that allow circular designs and business models to thrive.

- What ecology are you working with that can benefit from our smart tags?
- Do you already have an ecosystem that needs these kinds of solutions?

The TagItSmart! project offers a number of innovations that will move existing testbeds beyond the state of the art for interoperability testing. It is therefore critically important that these innovations are tested and validated in terms of their added value and user acceptance. It is also important that the project make every effort to ensure the TagItSmart! platform is adopted and commercially exploited by a wide range of SMEs and large enterprises. In order to achieve this, the project allocated a dedicated budget to support a number of measures in order to select SMEs and web entrepreneurs to develop innovative applications based on the TagItSmart! framework, as well as to support complementary activities.

Our focus is on all stakeholders: producers, consumers, logistics and supply chain, retail and innovators (over the top players), technology and platform providers and SME and large industrial companies.

2 Focus of the Second Open Call

We have 2 rounds of Open Calls during the project, of which the second one is being launched now. The main objectives of the second call are

- To run pilots leveraging available enablers, with specific focus on Industry 4.0, Blockchain, Artificial Intelligence, Augmented Reality and use of context information for service customization.
- To develop extension modules for the existing platform providing new functionalities.

We are looking for the applicants interested in and capable of executing one or more of the following activities:

1. Category A: New use cases (Pilots) up to 9 Months: applicants that want to test and include TIS solutions in their products or services and particularly those with an existing business need, relevant product and infrastructure.
2. Category B: New extensions (Modules) up to 5 Months: applicants with information, databases, tools or applications for the whole supply chain of products (packaging, production, manufacturing, transportation, retail, consumer and recycling), that want to standardize, adapt and include TIS enablers and/or add new components that extend and improve functionality addressing preferably data privacy, security, Big Data, analytics and consumer engagement.

Both in new pilots and modules, we encourage implementation of technologies like Industry 4.0, Blockchain, Artificial Intelligence, Augmented Reality and context detection for service customization.

We are looking for new domains where to execute these activities or, in case they are in a similar application domain of the existing TagItSmart use cases or modules, we are looking doe solutions that offer substantial additional features. Please note that detailed documentation regarding existing project use cases and developed modules will be released by the end of September 2017, so please remember to check back for more details. These are the existing TagItSmart Use Cases and Open Call 1 introduced Modules:

- **TIS Use Case 1 - Digital product**: This use case extends a base use case for fast-moving consumer goods (FMCG) that want to become “smart” via SmartTAG and TagItSmart. It combines novel solutions, and enabling technologies and tools to create smart solutions for the whole value chain; manufacturer, transportation, retail, consumer and recycling. To implement the use case, a real FMCG has been chosen. In this use case, the beer and beer bottles are followed from the manufacturer until recycling the bottle at the end of the value chain. We are talking about “Digital beer” that can be modified to meet use case requirements which also can be used in piloting during TagItSmart project.
- **TIS Use Case 2 - Lifecycle management**: The idea of this use case is to implement a system/technology that allows the lifecycle management of every fast-moving consumer good (FMCG), or consumer packaged good (CPG), that motivates and helps companies and citizens recycle their waste items, overcoming and solving current limitations and problems.

- **TIS Use Case 3 - Brand protection**: The brand protection use case aims at providing brands and consumers with a mechanism to test authenticity of their products and reduce counterfeiting. SmartTags and their capabilities to change based on environmental conditions (such as light, temperature) are used to first identify uniquely the item at hand and second to provide means to avoid fake or misplaced products, by enabling contextual scanning.
- **TIS Use Case 4 - Dynamic pricing**: Manufacturing first provide general information about the products (ingredients, recycling information, best before, consumable before, etc.) as well as reference thresholds for the type of the product. Then the SmartTag (ID) is encoded and SmartTag is printed and attached to the product package. As a part of internal process control, the manufacturer scans SmartTag while the product is still in the factory (meat processing plant). Then the product is ready for transport to the retailer. Afterwards, the transport provider scans SmartTag as a part of the process control. In retail, retailer provides additional information about the products to support consumers (recipes, how to use etc.). Availability of information defined: general or when scanned at selected locations only (in their shops). Then the retailer scans SmartTags a part of "supply chain control process ". Scanning results (pack ID and result) are forwarded to platform and dynamic price calculation process is invoked. Consumer scans SmartTags using a smartphone application and obtains information about the product (best before, price, recycling, recipes and other info approved by retailers). The retrieved information depends on the location and time of scanning.
- **TIS Use Case 5 - Home services**: A good usage of the heating equipment (e.g. a boiler and an associated filtering station) is one means to provide comfort and a healthy living at home. This implies proper 1) maintenance, 2) repair, 3) replenishment, and 4) monitoring. This use case will test different services to the customer all along the life of the equipment at home. Some of the services will leverage access to information related to the product, its environment and its use; and some will provide specialized services (installation, maintenance, repair, etc.).
- **TIS Use Case 6 - Matisse**: Will focus on creating market grounds for IoT in healthcare and the environment of error-free medical services, bringing new business models for healthcare providers, and exploitation of eHealth apps and open innovation across hospital value chain along with EHR interoperability.
- **TIS** Open Call 1 **Module AffectUs**: identifies and disseminates product oriented predicted events across affected verticals. It aims at developing extensions for the platform that will be able to harvest the acquired product data and external data sources, and proactively identify and semantically correlate events with products, for automated event distribution at the affected entities/applications.
- **TIS** Open Call 1 **Module Qualytics**: Enables, through the use of dynamic QR codes, a closed-loop information chain in the home appliances domain, connecting and correlating the data from supplier/delivery, manufacturing/testing, utilization and maintenance to improving customer satisfaction/experience.
- **TIS** Open Call 1 **Module BehavAuth**: Focuses on replacing old-fashioned password based authentication for IoT devices including smartphones with passive authentication of the user with the device by learning users' behavioural patterns.
- **TIS** Open Call 1 **Module FreshTag**: Enhances the functionality of the TagItSmart ecosystem by predicting the product shelf-life will be implemented. It is based on the

unit-individual tracking possibilities and the thermo sensitivity of the SmartTags, the senso time resolved temperature data and intelligent food modeling.

From value chain to value model

One of TagItSmart's bottlenecks is the quantity, quality and granularity of data shared among all stakeholders, public, private and personal.[iii] In *Data sharing and analytics drive success with IoT. Creating Business Value With the Internet of Things*, Stephanie Jernigan, Sam Ransbotham, and David Kiron, state "We found that obtaining business value using the connections the IoT creates between an organization and its customers, suppliers, and competitors depends on companies' willingness to share data with other organizations."`

This leads the European Environmental Bureau (EEB) in their text Circular Economy Package 2.0. Some ideas to complete the circle (March 2015) to the conclusion: "*Inadequate information passed on from one business to another on what resources a product contains and how it can be repaired or recycled is hindering efforts to improve resource efficiency. To tackle this barrier, the use of a 'product passport' should be explored*." In 2013 The European Resource Efficiency Platform, a high-level group comprised of business, government, consumer and environmental representatives, that was not continued, issued recommendations saying that product passports would improve resource efficiency, encourage innovation and generate jobs across Europe: "*This passport will, if adopted, be a key building block in the institutional infrastructure of a sustainable society*" said John Burton, a former Irish prime minister and EU ambassador to Washington who chaired.[1] EU waste legislation that is currently being reviewed is envisaged to include an obligation for the Member states to "*incentivize the extension of the life span of products and support the setting up of systems promoting repair, re-use, remanufacturing and reconditioning activities of products…*", furthermore Member states shall..."*reduce waste generation in processes related to industrial production, manufacturing, extraction of minerals, construction and demolition, including means such as pre-demolition audits and building passports, to commerce and services, taking into account best available techniques and best practices*".

The logical step towards leasing instead of owning products in Internet of Things (upgrades are already build in), and selling services (clean water instead of pulps, Grundfos) instead of products, align with the proposition that in a circular economy, products would "ideally never become waste". *"This would mean that products would always remain the property of the company that makes them. The company would take back obsolete products and remake them into new ones. Companies are increasingly experimenting with sharing or "product service utility" business models – for example BMW with electric car sharing, and Philips with its "pay per lux" lighting scheme. Product passports might be useful in some contexts, such as fast-moving consumer goods that are difficult for manufacturers to retain control of."*[iv]

Working on shared data propositions throughout a value chain along the lines of a product passport might be a strong enabler for helping companies to explore and adopt new business models.

[1] http://www.euractiv.com/section/sustainable-dev/news/eu-group-says-a-product-passport-would-open-doors-to-eco-innovation/

"We need a new business logic. More circular business models must replace the linear economy, featuring the following practices: multi-storey buildings built of wood; electronics designed for longer life and for components to be used again; car plants following the example of Renault, and taking back old engines, renovating them and using them in new vehicles; tyre manufacturers, like Michelin, offering tyres for lease, charging per km of use; clothing companies, like Mud Jeans and Houdini offering clothing for rent and lighting companies, like Philips, providing lighting as a service."[v]

Smart Tags

We envisage value chains, for example retailers as a group to collaboratively invest in infrastructure, schedule update and version management, share security and trust mechanisms and *compete* on services through an added layer consisting of API's to the different retailers from the shared retail platform.

In our scenarios, we bring data into the chain through all stakeholders; producers provide information, retailers will add information – consumers can also add information… *Business rules* decide will be getting what; -sharing data is thus a major issue. Components will enable you to build, scan, print and add information in the chain. We are looking for gaps in our enablers like anonymization, security, and/or new services, pilots, like recall and re-order in the case of retail.

Dynamic pricing can be a key functionality. Retail is not the only candidate: banks, telco's, Google, Social Media and Amazon Home services: "*We have 85 million Amazon customers who have shopped for products this past year that often require a service afterwards*" said Peter Faricy, vice president for Amazon Marketplace. "*Things like TVs, toilets, and sinks." Today, the company is launching a new section in the US, Home Services, where customers can shop for professional help. It's launching with 700 different services, from the ordinary to the esoteric, everything from installing a garbage disposal to renting you a goat herd that will graze away the unwanted vegetation on your property*"[vi].

TagItSmart takes the bigger picture of what IoT is doing in the retail business into account. The future of retailers will switch to service providers in 5 - 10 years. The business models change with that paradigm shift. Customers will lease a full set of services across domains (home, work, en route…) and subscribe to services for sale or rent. The commercial battle will be in all domains and points of action. It is more about services after the shopping process, so the question then becomes *can you reach the customer at home at any time, or in the car, or at work?*

- We are looking for proposals that reflect on and propose what kind of capabilities should be developed by stakeholders such as retailers?
- What kinds of incentives for end-users can lead to building loyalty to brands as well as retailers and what kind of specific context-aware applications and levels of rewards (points for products) can create commitment?
- What kind of services can we expect based on dynamic pricing and what are the consequences of such a practice through the entire value chain. What kind of disruptive new companies (Over The Top) are likely to emerge?
- We are looking for disruptors to work with our solutions.

Open Data or Linked data projects facilitate smart city projects. TagItSmart is also looking for proposals that can map the electronic waste flows in a city context and use the TIS functionalities of all stakeholders (including end-users) to contribute data, as a way to build datamarkets and monetizing incentives. What actionable standardization of open data formats on waste management, recycling can be quickly implemented?

Implementing TIS means that every stakeholder in the value chain should be educated into the process of becoming a value model and sharing data to the highest level of granularity leads to a greater share in a common data market. This educational trajectory should also include questions like:

- How I can we add Smart Tags to our products?
- What IT challenges do we have and how can we solve them in order to join TIS?

Proposals on the creation of new components should include program of co-creation workshops, seminars and lectures for every stakeholder in the ecology.

The basic mechanism of the security platform is a light-induced colour switch of inkjet-printed textures within the functional QR code; the colour switch is initiated by the readout using a smartphone. What we might see as essential systemic security features can become an issue. There are three main issues:

- ✓ Investigations into visual crypto, security/access control embedded in a layer of transparent paper. Issues of standardization could be set here.
- ✓ Security potentially adding complexity and cost to the process when convenience is paramount. This relates to the hierarchy of stakeholders in the use cases: companies (counterfeit), consumers (gaming), lifecycle management (the value chain).
- ✓ A key attack point in IoT security is mismanaging version management. Updating numerous devices at the same time is extremely complex.

Proposals on the creation of new components should address the security issues above.

Finally, we are also looking for innovative solutions using smart contracts. If a smart contract is (more or less) a contract written in code, must it be implemented on a blockchain or can it also be implemented in “traditional” IoT systems? For example, if my smart fridge is set to automatically order yoghurt when I take the last one, is that transaction (the order/purchase of new yoghurts) already a smart contract?

Smart contracts have come into the spotlight specifically in the context of the, hence I wonder whether they are conceptually dependent on this distributed technology.

So, for example, instead of being dependent on benevolent action from the consumer to dispose of their waste responsibly, the discarded objects could "trade themselves" into a reuse/secondary material platform etc.

Open data, domain knowledge and privacy

> *"Who could imagine being wowed by a garbage can? In our age of technological whiz-bang, not much floors us anymore. But I confess, I couldn't stop thinking about the lowly garbage can. Embedded with smart sensors, it alerts city workers when it's ready to be emptied, which slashes fuel costs and avoids unnecessary garbage pickups. That may not sound so impressive — at least compared to driverless cars or sending regular folk into space — but when the dumbest of items gains intelligence, we need to pay attention. We are entering a phase in the cleantech revolution where we are reaping efficiency value from even the most mundane items."*[vii]

The General Data Protection Regulation [GDPR] will go into effect in May of 2018. Although not yet in effect, TagItSmart! Open Calls should attempt to model their plan assuming that the GDPR is in effect. The two key factors that responses should address are data protection and consent. Responses must demonstrate that they have the capability to protect data that they collect through the use of secure communication, strong authentication for access to data, careful management of the separation of consumer identity from data associated with the proposed solution.

In "How Smart, Connected Products Are Transforming Competition", Harvard Business Review, November 2014, Michael Porter and James Heppelmann argued that, because products will be linked in real time to the manufacturer's operations, to other products, and to third party service providers, "IoT may change the power of rivals, substitutes, new entrants, suppliers and buyers in existing industries." According to them there will be "a potentially dramatic transition of power to data analytics intermediaries that will conduct "data-facturing."[viii]"

The challenge is to look beyond solutions for any single sector (manufacturers, retailers or recyclers) and to think about the entire value chain. For instance, in the study *Growth Within: A Circular Economy Vision for a Competitive Europe*[ix], one key recommendation for Europe is to develop a **"**material backbone" – a system to optimize the circulation of materials[x] and minimise the need for virgin resources – to strengthen its competitiveness. How can TagItSmart play a role in achieving such a systemic goal?

We are looking for innovative ways to reach consumers with apps, video, storytelling, visual narratives, storytelling by the objects themselves creating a narrative in daily situations with objects, emotional and affect scripting as what happens after the scan should be meaningful and exciting. As items can now speak individually, can this be a Facebook for things? Proposals should address gamification strategies and the act of "'scanning' itself. Are there cultural issues, gender balances, age issues? Is QR code scanning seen as 'uncool', if so why? Are QR Codes Dead?[xi] We need statistics of usage rates of QR codes.

We need generation X, clearly interested in circular, not simply engaged but ready to strongly participate with providing feedback on products and services Proposals could look into the approach of HereHere and Precious[xii] Plastic[xiii]: "HereHere's goals are to study how characterization can be a tool for data engagement. At the same time, researchers want to understand what sort of light, daily rituals are effective for connecting people to hyperlocal issues, as well as how to create compelling stories with data that can engage larger communities."

We are also interested in proposals that address either/or/and*:*

- *Recycling information about products:* Many entities own and/or manage product databases. We look for entities that want to work on a **standard way of sharing its data** in the TIS ecosystem and to standardize the information these databases contain to include information about its recyclability (parts or components, materials, type of packaging, weight, colour, ...) or other type of information that other partners find useful for their UC. The idea that underpins the product passport is as well information that can be used to repair the product, to upgrade, to remanufacture etc., not only recycle at the end of its life. We focus on the end of life processes as well as the earlier steps of the waste hierarchy.
- *Smart bins or waste management:* Some companies in EU have automatic systems that control and manage waste. Some of them use beacons placed in bins that control the waste they have, and upload this data to their cloud. Other use another type of systems that control, not only the bins or containers but the place or the container itself. There are also reverse vending machines that give money, rewards or discounts if you put waste items on them (beer bottles or plastic bottles) by reading its barcodes.

  We are looking for proposals to work on the interoperability of these systems and technologies with wider our ecosystem and its potential use.

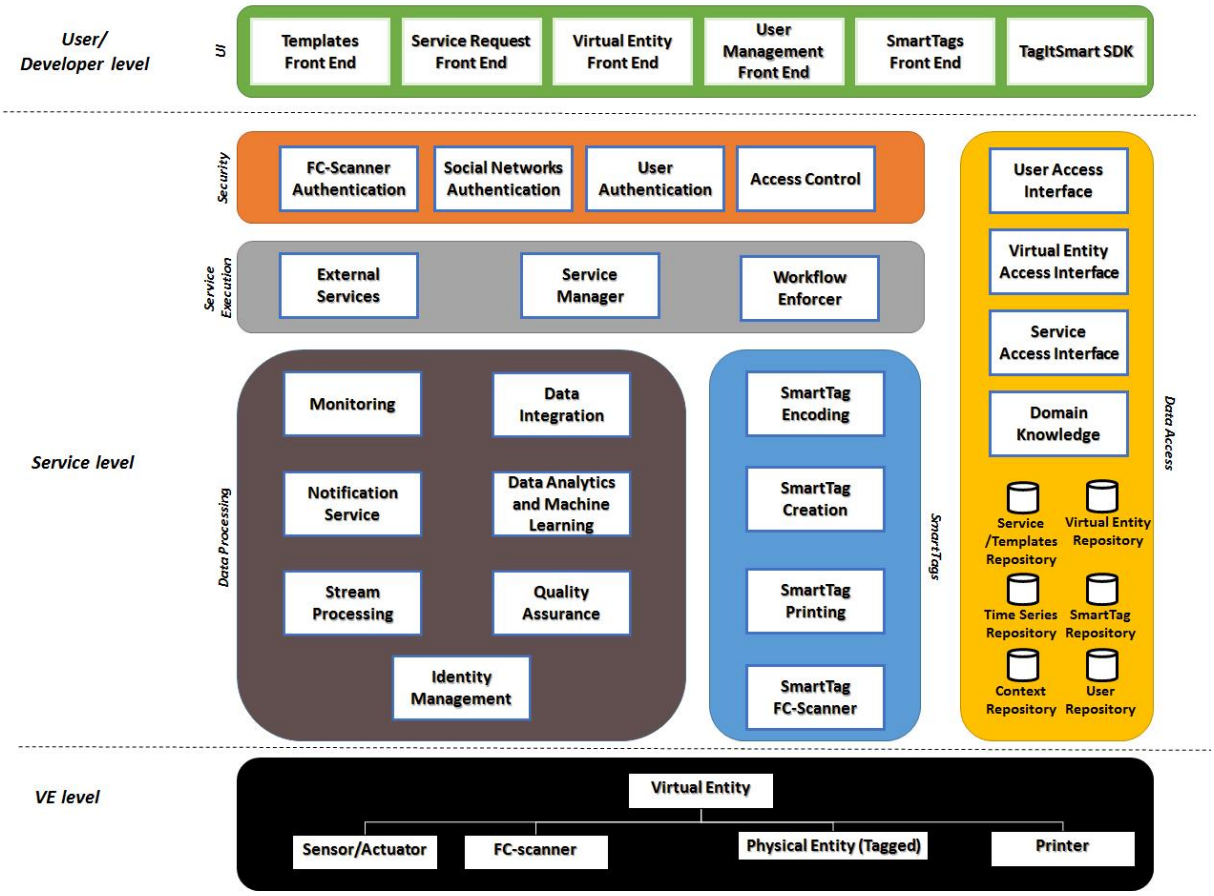
As there will be more and more data, more and more services, the consumer needs usable tools to manage the numerous links between them, i.e. which data for which stakeholder, for which use (service), for how much time and with what granularity.

- Tools to understand who is the stakeholder and what is the service
- Tools to specify the links data vs service: visual data management
- Tools to monitor: dashboards + insights + datavizualisation

3 TagItSmart platform

The TagItSmart! platform from the functional point of view is composed from **User/Developer level** that provides front end for the different components**, Service level** for provisioning of the services and related functionalities and **Virtual Entity level** which is actual representations of the objects and provides access to the data and defined actions based on the semantic models.

From the current reference Architecture model defined, the SmartTag (blue box), the Data Access (orange box) and the User/Developer environment (green box) are planned to be released as separate open source modules. In this manner, anyone should be able to use its own platform and or/modules and plug on top of it components (Table 1) developed by TagItSmart!.



Interoperable platforms:

TagItSmart! enablers are designed to work on the following platforms: EVRYTHNG's IoT Smart Products Platform and Azure. All have a comprehensive interactive development environment. TagItSmart is not building its own platform, but a horizontal layer through existing platforms. The primary functionality that can be expected, is an example app to scan a QR or barcode, collect some contextual data (e.g. data requiring consent and data protection), and storing that data along with the code scanned in a secure data engine. Example applications that support the extraction of this information from the data engine will also be provided.

Printing and Scanning:

- SmartTag module (creation, scanning, decoding). Web provisioning, security
- Web based SmartTag module
- NFC Opensense, SpeedTap, Temperature labels
- Printing of inks and information about the availability
- Printing of thermochromic and photochromic inks. Partners also free to print at other places. Recommendations on where to find suitable commercial inks.
- CMYK inkjet printing of tags with standard ink set using "Roh" printer series. R&D on functional inkjet inks (focus: thermochromic and photochromic inks)

Consult and Domain Knowledge:

Consult on how to utilize tags in their process, as well as core expertise on scanning and reading technology. Co-creation activities to ensure that the demonstration project can evolve into a sustainable full-scale solution.

- Product materials recyclability API (Europe)
- Recycling locations API (on demand)
- Co-creation and scenario writing support

Each component will provide its functionalities leveraging an Open API. The reference implementation will be provided for the core components directly related to the SmartTags and services on the beginning of the second open call (1st February); while others will be taken/integrated from already existing **platforms**. The full list of components available for the Open Call is provided in the table below:

Table 1 TagItSmart components available for the Open Call

Component	Description
SmartTag Encoding, Creation and FC-Scanner (Javascript Web based SKD) for EVRYTHNG platform.	Web based components that enables the development of web applications that use SmartTags (functional inks and NFC) (Javascript SDK).
Virtual Entity Access Interface	API endpoints to create Virtual Entities that have SmartTags associated. EVRYTHNG will provide backend support with free access to their IoT Smart Products Platform. Documentation can be found here: https://developers.evrythng.com/docs/
Stream Processing	Ability to process the SmartTags information in real time and send events. EVRYTHNG will provide backend support with free access to their IoT Smart Products Platform. Documentation can be found here: https://developers.evrythng.com/docs/
WorkFlow Enforcer	Open Call participants can choose to implement their business logic by utilising the TagItSmart Workflow Enforcer integrated in the EVRYTHNG Platform. This component enables the creation of templates of services based on application defined business logic workflows that can be deployed on demand and scale automatically. Documentation about the EVRYTHNG WFE (called Reactor) can be found here: https://developers.evrythng.com/docs/
Identity Management	Ability to create unique Web Identities of Virtual Entities to be used with the SmartTags. EVRYTHNG will provide backend support with free access to their IoT Smart Products Platform. Documentation can be found here: https://developers.evrythng.com/docs/
Service Manager, Templates Front End and Service Request Front-end	Ability to create generic service workflows that are then resolved and executed by the workflow enforcer to allow for reusability and adaptability based on the specific scenario and context. In that way the same workflow can be customized and executed multiple times without requiring manual programming and configuration of endpoints and parameters.
User Management/Authentication/Access Control	Ability to capture interactions from the applications and the SmartTags and define custom analytics that can be used in applications. EVRYTHNG will provide backend

Component	Description
	support with free access to their IoT Smart Products Platform. Documentation can be found here: https://developers.evrythng.com/docs/
Data Analytics	Ability to capture interactions from the applications and the SmartTags and define custom analytics that can be used in applications. EVRYTHNG will provide backend support with free access to their IoT Smart Products Platform. Documentation can be found here: https://developers.evrythng.com/docs/
SmartTag Encoding, Creation and FC-Scanner (Xamarin Mobile based SKD and ASP.NET MVC Web based SDK).	QR code SmartTag Scanner SDK is component that takes QR code as an input and gives alphanumeric string as an output. SmartTag QR code building SDK is component that supports generation of the QR code by enabling its customized creation based on input alphanumeric (SmartTag value) string and number of sensors. As an output SDK will generate QR code with embedded alphanumeric value and sensor positioned in defined space. Web Provisioning tool is a SDK developed as a web application with following functionalities: • access control and user management (CRUD - username, pass, phone, email, gender, age); • product creation (with QR code building module: number of sensors (printed ink parts), product specification, price, "how to use manual", description, etc.); • retail accounts management, product management, etc. • create batch QR codes for selected product
Smart Tag Design service	The design of a QR code that can be read by standard QR code readers in two different ways (before and after exposure to an environmental influence) requires a complicated technical process. Based on a root URL (e.g. www.example.com/product002/) we will generate on request two URLs and corresponding QR codes. We will provide example codes for both the before and after states and the mask that would need to be printed in reactive ink. For example:

Component	Description
	
SmartTag module (creation, scanning, decoding)	Code creation (VE's). Scanning FC (DM) codes in mobile
Android based user authentication using location	An android application that is able to authenticate in the background a user who is using an android phone to scan a SmartTag so as to prevent unauthorized people from getting information about products linked to the authorized user. This is done based on the user's current location and their location history. This is called continuous authentication and does not require an input from the user.
NFC SpeedTap (Make physical products digital), NFC Opensense (Identify a packages seales of opened status), and NFC Temperature labels	NFC SpeedTap™ tags make instant, authentic product connections possible. NFC SpeedTap tags are revolutionary wireless tags that combine the instant interactivity of Near Field Communication (NFC) with the advantages of printed electronics technology. By effortlessly connecting the physical and digital worlds, NFC SpeedTap tags allow smartphones to communicate with everyday objects, offering you key advantages in both brand management and supply chain management. NFC OpenSense™ Tags. With the tap of a mobile phone, OpenSense smart tags connect your products directly to consumers and trusted partners. Tag sensors identify a product's or packages sealed or opened status, letting you deliver personalized and contextually relevant messages. Opensense is suited for use in the wine, spirits, and craft beer, Pharmaceuticals and over-the-counter medication, Specialty foods, Health and beauty products, Medical devices and others. The Smart Label for Temperature Threshold Detection enables low-cost safety and security for temperature sensitive shipments. From fresh food to pharmaceuticals, proper handling and transportation can have a direct impact on quality, usability, safety, and customer satisfaction. There are also profitability implications for retailers, distributors, and logistics providers working with temperature-sensitive products. Cold-chain and controlled

Component	Description
	temperature logistics systems are expanding to distribute insulin, vaccines, and other products to new geographies far from the point of manufacture. Thinfilm's printed electronics technology enables additional functionality and simplified reading compared to many conventional solutions.
Inkjet printing of tags	(1) CMYK inkjet printing of tags with standard ink set using Durst "Roh" printer series (Lienz) on customer substrates; if customer substrates are not available, then f.e. standard R2R self-adhesive tag materials or flatbed media (PVC, PP, PS) is recommended (2) R&D on functional inkjet inks (focus: thermochromic and photochromic inks); if available then inkjet printing of those using the Durst Rho printer series
Key-stroke based user authentication for mobile devices (only Android)	A biometric mechanism to accurately authenticate users typing on mobile devices using their typing behaviour. This application will implicitly authenticate a user while she is typing a password to unlock their mobile device or the FC-scanner app. The key idea is to combine the traditional timing based characterization adopted in keystroke dynamics with movement sensors information that reflects the unique typing behavior of each user
Product materials recyclability API (Europe) and Recycling locations API (on demand)	API Endpoints to obtain recycling information and disposal locations based on materials of products in Europe.
Printing of inks and information about the availability	Analog printing (flexography) of reversible thermochromic and photochromic inks. Irreversible thermochromic inks available only for high temperatures (>+50oC). 10s to 100s of tags per project depending on required specifications. Partners also free to print at other places. Recommendations on where to find suitable commercial inks.

4 Support during the Open Call process

For further information on the Open call, please contact the TagItSmart! team: *helpdesk@tagitsmart.eu*

For further information on the TagItSmart! Project visit our website: *http://www.tagitsmart.eu/opencall*

There will be periodic clinics and information moments during the Open Call. To be informed about these activities, please visit TagItSmart! Website (*http://www.tagitsmart.eu*) or join our LinkedIn project Group (*https://www.linkedin.com/groups/8486104*) where announcements will be made.

We will also provide Telco's on request with project partners. Please ask for it by sending an email to *ecosystem@tagitsmart.eu*.

5 Type of new third parties

Eligible third parties of the TagItSmart! open calls program includes the following:

- Single European mid-caps, SMEs and Micro SMEs as defined in EU law: EU recommendation 2003/361
- Web entrepreneurs and individual sole-traders;
- European secondary and higher education establishments, research institutes and other not-for-profit research organisations;
- Standards bodies such as ETSI, IETF, ITU, IEEE and W3C, BSI.

Each of these must be established in a EU Member State, in an Associated Country or in a country that contributes substantially to the financing of TagItSmart! research project. To avoid conflicts of interest, applications will not be accepted from persons or organisations who are partners in the TagItSmart! consortium or who are formally linked in any way to partners of the consortium. All applicants will be required to declare that they know of no such potential conflicts of interest that would prevent them from applying. Because successful applicants will not be required to join the TagItSmart! consortium, there will be no request for applicants to exhibit possession of a PIC number.

The following categories of third parties are envisioned to participate to the application process:

- Single institution for Type A (subcontracting is allowed but must be justified in proposal)
- Single institution for Type B (no subcontracting)

6 Task of new third parties

New third parties will be requested joining the technical activities and quantitatively assessing and documenting their results into deliverables. In addition, new third parties are expected to contribute to TagItSmart! dissemination and engagement activities and are strongly encouraged to contribute to TagItSmart! open data and open source repositories.

Furthermore, to maximise impact, projects posing the basis for strong results' exploitation, and which can significantly empower TagItSmart! infrastructures, will be strongly encouraged.

It is the responsibility of the new third parties to identify a viable business model allowing them to sustain their activity beyond the project scope.

Proposals generated by Eastern Europe countries are particularly welcomed.

7 Obligations of new third parties

New third parties will be requested to sign the standard contract to protect IPR and identify responsibilities. Proposed solutions must comply with the TagItSmart! architecture and interfaces, as well as with additional technical requirements for integration with TagItSmart! modules and enablers available as part of the TagItSmart! Open Call technical documentation.

We strongly encourage that each developed module is released as an open source code made available without restriction to the TagItSmart! platform and partners as well as to the community.

The final version of the documentation on TagItSmart! architecture and interfaces and re-deployable modules will be made available at least one month prior to the submission deadline.

8 Application process

Proposals for selection as additional third parties in the TagItSmart! project are submitted in a single stage, through the preparation of a complete proposal application, prepared according to the guidelines and the templates provided in the Guide for Applicants.

Duration of expected projects lies between 5 and 9 months. The different type of projects selected will have the following maximum expected duration:

- Category A: New extension use cases (Pilots) up to 9 Months.
- Category B: New extensions (Modules) up to 5 Months.

Details about the maximum contribution recommended for each of the project types encompassed by the call are as following:

- Category A: 150K€ per third parties;
- Category B: 50K€ per third parties.

Deadline for submission of proposals (by sending it to *ecosystem@tagitsmart.eu*)

17:00 CET 1st of November 2017

Notification of selected applicants:

15th of December 2017

Projects start:

1st of February 2018

For further information on the call:

Web site (full call text, guidelines, project details): *http://www.tagitsmart.eu/opencall*

Email address for further information: *helpdesk@tagitsmart.eu*

[i] http://www.sciencedirect.com/science/article/pii/S0048733311000187
[ii] Communication: *http://eur-lex.europa.eu/resource.html?uri=cellar:8a8ef5e8-99a0-11e5-b3b7-01aa75ed71a1.0012.02/DOC_1&format=PDF* List of actions: *http://eur-lex.europa.eu/resource.html?uri=cellar:8a8ef5e8-99a0-11e5-b3b7-01aa75ed71a1.0012.02/DOC_2&format=PDF*
[iii] See also: Data sharing and analytics drive success with IoT. Creating Business Value With the Internet of Things September 08, 2016, by: Stephanie Jernigan, Sam Ransbotham, and David Kiron: "We found that obtaining business value using the connections the IoT creates between an organization and its customers, suppliers, and competitors depends on companies' willingness to share data with other organizations."
http://sloanreview.mit.edu/projects/data-sharing-and-analytics-drive-success-with-internet-of-things/?utm_source=twitter&utm_medium=social&utm_campaign=sm-direct
[iv] http://innovation-forum.co.uk/analysis.php?s=product-passports-pros-and-cons

[v] http://www.euractiv.com/section/sustainable-dev/news/eu-group-says-a-product-passport-would-open-doors-to-eco-innovation/
[vi] http://www.theverge.com/2015/3/30/8309573/amazon-launches-home-services
[vii] Jake Rozmaryn: The sweep of the Internet of Things, garbage cans and all
http://techcrunch.com/2016/05/27/the-sweep-of-the-internet-of-things-garbage-cans-and-all/
[viii] 'Data-Facturing' in the Internet of Things — a Shakeup Ahead?
http://www.theinternetofthings.eu/'data-facturing'-internet-things-—-shakeup-ahead
[ix] *http://www.ellenmacarthurfoundation.org/news/circular-economy-would-increase-european-competitiveness-and-deliver-better-societal-outcomes-new-study-reveals*
[x] See also: The Flanders Materials Programme (FMP):

1. A long term vision: Plan C is the circular economy hub in Flanders, created by OVAM to encourage a change in mind-set from waste to resources and to accelerate the move towards a circular economy
2. Policy-relevant scientific research: SuMMa (Policy Research Centre for Sustainable Materials Management) brings together a broad spectrum of researchers and investigates which economic, policy and social conditions need to be fulfilled in order to realise the transition towards a circular economy.
3. Actions and projects in the field: Agenda 2020 is a list of 45 concrete projects with active partners and a clear time schedule.

http://www.ellenmacarthurfoundation.org/case-studies/belgium-flanders-materials-programme
[xi] Are QR Codes Dead?
"You should answer those meaningful questions in any promotional material that uses a QR code. Appropriately used, QR codes can call your audience to action on postcards, door hangers, flyers, nature notes and more. Have you thought of using QR codes for downloads? Does your company have a lawn care or pest control page to direct people to download information? How about an order or contact form? Perhaps you've developed a cool app? Offered up in the right way, a QR code is just the thing to make access quick, easy and failsafe."
https://www.realgreen.com/community/our-blog/are-qr-codes-dead
[xii] http://preciousplastic.com
[xiii] http://herehere.co: