D6.3
Virtual Factory Experimentation Report

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VERSION HISTORY

VERSION	DATE	NOTES AND COMMENTS
0.1	10/07/2014	DRAFT TABLE OF CONTENT AND RESPONSABILITIES
0.2	30/07/2014	ToC TO SYNCH WITH D5.2 (INNOVALIA)
0.3	11/12/2014	FINAL TABLE OF CONTENT ALIGNED WITH D7.1 AND D13.2
0.31	10/02/2015	UPDATED VERSION CIRCULATED TO PARTNERS
0.32	09/07/2015	PEER REVIEW - WITH MINOR COMMENTS (PTIN)
0.33	27/07/2015	CLEARED COMMENTS AND ANSWERED REVIEW ISSUES (TANet)
1.0	30/07/2015	EXECUTIVE SUMMARY ADDED (CU) – FINAL VERSION

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Acronyms and Abbreviations

BP	Business Process
BS	Business Scenario
DF	Digital Factory
GE	Generic Enabler
GUI	Graphic User Interface
KPI	Key Performance Indicator
MR	Machine Repository
PI	Performance Indicator
SE	Specific Enabler
SF	Smart Factory
TI	Technical Indicator
TSC	Trial Specific Component
VF	Virtual Factory
V&V	Validation & Verification

Executive Summary

This report summarises the three Virtual Factories trials of the FITMAN project, including objectives of the trials, a record of activities therein, and the conclusions which may be drawn from them both as individual trials, and overall. The three WP6 trials were conducted in the Virtual Factory facilities provided by the three manufacturing enterprises:

- APR (plastic), supported by University of Lyon 2;
- TANet (manufacturing resource management), supported by Coventry University;
- COMPlus (led lighting), supported by Fraunhofer IPK.

These three trials are reported to reflect a commonality of structure, though necessarily they are very different a detail level, as the virtual factory issues addressed differ considerably, as do the starting points: the pre-existing software systems in use at the start of the trials. However all trials begin by identifying the business process to be addressed and providing comprehensive documentation of these.

In the case of APR six inter-related, complex business process are selected, and experimentation proceeds from selection and implementation of FITMAN specific enablers (SEs) and FI-WARE generic enablers (GAs), through a test on a set of basic use-cases proving functionality, to hands on user scenario testing to gain insight into end-user appreciation. This is monitored against a defined set of performance indicators for each business process.

The objective of the TANet trial was to transfer implementation of pre-existing collaborative software system to operation widely incorporating FITMAN SEs and FI-WARE GEs, with minimal perceivable change from the end-user point of view. The four defined business process of which the first three are closely related whilst the fourth is more aligned with the Smart Factory concept. Nevertheless all are delivered to clients through the same pre-existing system. Experimental development and implementation of FITMAN and FI-WARE components is described for each business process, and separate scenarios developed for the Virtual and Smart Factory processes. Again this is monitored against defined performance indicators.

In the COMPLUS trial three business processes are considered, the first two relating to supplier network transparency and communication, and the third relating to sharing of best practices on business processes and tools. The experimentation plan proceeds through three phases of implementation: one each for network transparency and best practice coordination processes and a third final implementation of a common entry point for these. Scenario testing with users is similarly focused.

In all cases the components used are reported including the rationale behind selection of FITMAN SEs, FI-WARE GEs, and Trial Specific Components (TSCs) developed to provide problem-able specific functionality not otherwise available through GEs and SEs. In the case to the TANet trial considerable use is also made of SEs developed as a result of the open call for proposals to develop SEs issued by FITMAN.

In conclusion all the Virtual Factory trials reported here have satisfactorily integrated and tested their GE's, SE's and TSC that were appropriate to the end user partners, delivering the required functionality, and satisfying potential or actual end-users of the viability of the solutions achieved. Not all of the available SEs and GAs have been implemented since not all were of relevance to Virtual Factory contexts. Varying degrees of difficulty were encountered in the in deployment of GEs and SEs, but these are largely related to the prototype nature of the available implementations, and inexperience of both component suppliers and trial developers in their application, and a methodology and approach to accelerate successful deployment has emerged and is described elsewhere. In consequence it is believed that the

approach can be extended to other SMEs and web entrepreneurs (not previously involved in FITMAN) to support a wide range of software support for manufacturing.

1. INTRODUCTION

This deliverable includes the history of the Virtual Trials experimentations and monitors the continuous evolution of the four systems as Task 6.3 will be in charge of performing the various trials at the different sites. It is also responsible of coordinating the trial execution and gathering of best practices and lessons learned. The trials have been performed in various phases that will be coordinated with the agile delivery of instantiations of FITMAN SE. This task should also ensure that knowledge is timely spread among the testing sites, so that experimentation ramp-up phases are reduced to a minimum. In this task, various user groups are involved in the experimentation of FI-WARE platform at the various sites.

The three WP6 trials have been conducted in the Virtual Factory facilities provided by the three manufacturing enterprises: APR (plastic), TANet (Manufacturing Resources Management) COMPlus (led lighting). Other four main beneficiaries, one per trial namely University of Lyon 2 (supporting APR), Coventry (supporting TANet) and Fraunhofer IPK (supporting COMPlus) are heavily involved with the aim of scientific/technical support. TXT is the responsible for transferring results from other WPs to WP6 and for the overall technical coordination of the Virtual Factory trials.

The document is composed by several chapters:

Chapter 2. Covers the “PLASTIC TRIAL” carried out by APR – LYON2

Chapter 3. Covers “MANUFACTURING RESOURCES MANAGEMENT” with TANet as the lead and COVENTRY supporting

Chapter 4. Is the “LED LIGHTING TRIAL” headed by COMPLUS and supported by IPK

Each of the chapters cover:

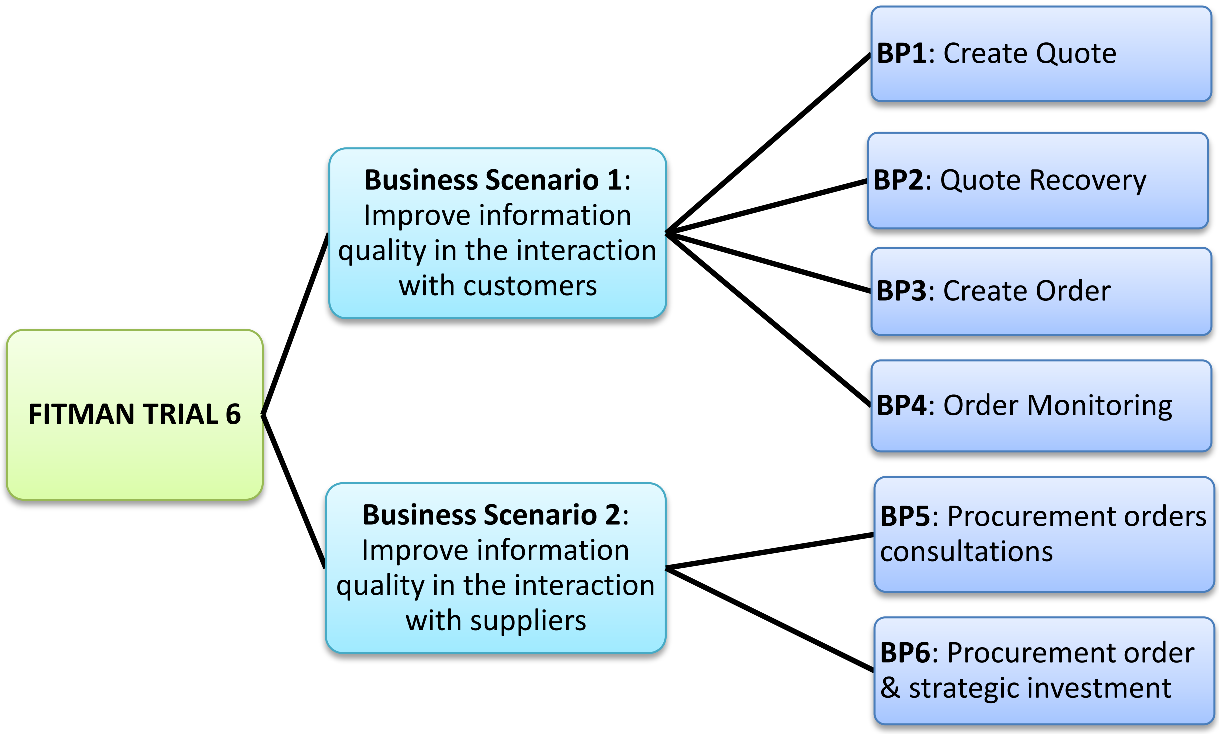
- Final Business Processes
- Experimentation Plan
- Data Gathering and Analysis

Chapter 5. Completes the document with the conclusions drawn from the experiments.

2. Plastic Trial. APR – LYON2

2.1. Final Business Processes

As this trial was not selected to support the open calls, the final release of the Business Processes present some enhancements at the implementation level using the same selected enablers.



APR trial's objectives are related to the improvement of information quality around production information system through the adoption of FI-Ware technologies. We are proposing two business scenario: enhancing the quality of interaction with customers and suppliers through personalized business processes.

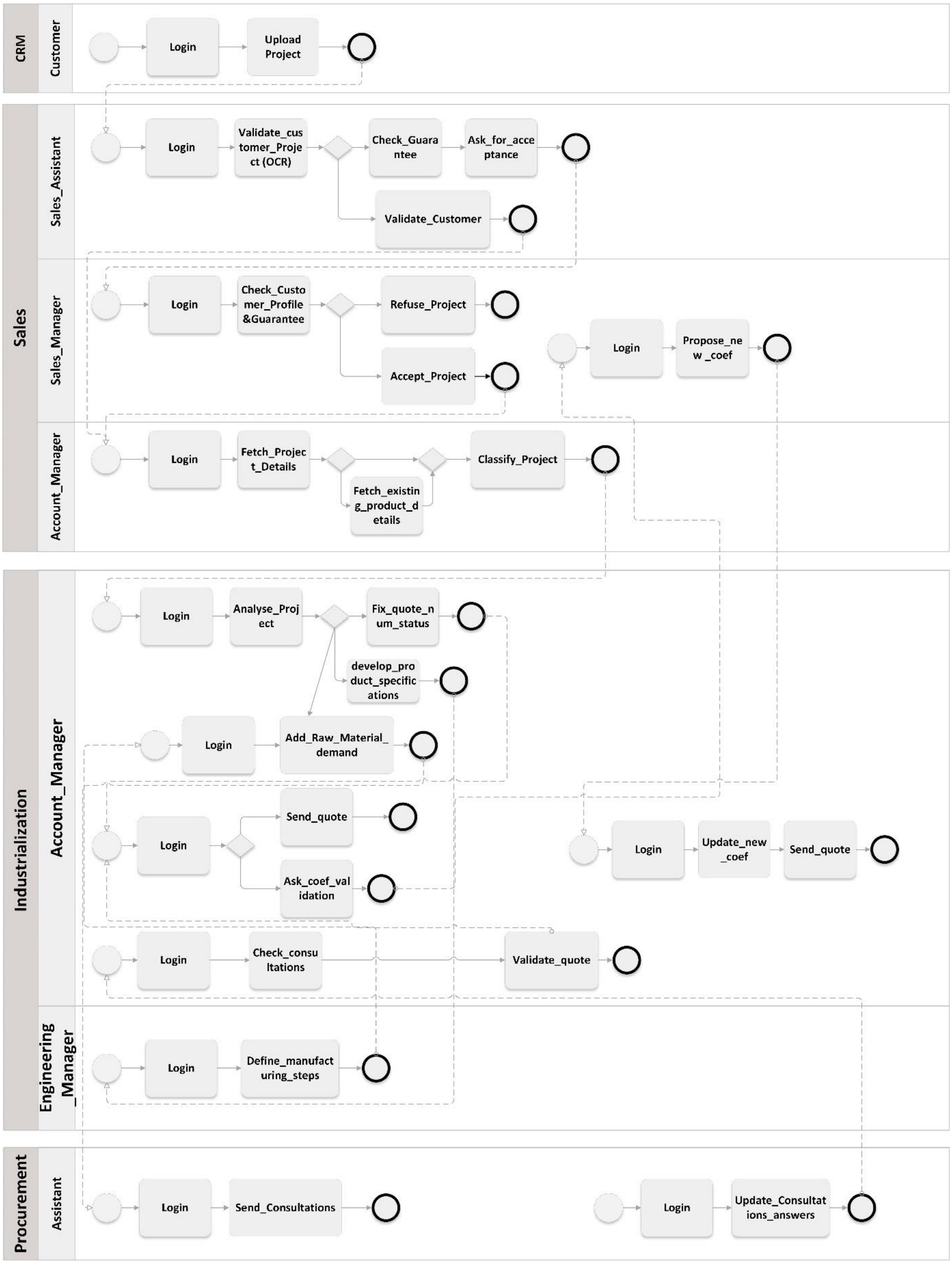
2..1.1. Business Process 1: Create Quote

2..1.1.1 Workflow Diagram BP1

Workflow Description

The motivation of this business process is the impact of data quality problems in the sustainability of business collaboration when ingesting customer's projects for new product development. It aims to setup quality assurance mechanism helping to structure all customers' interaction for new product development through the federation of new IT capabilities.

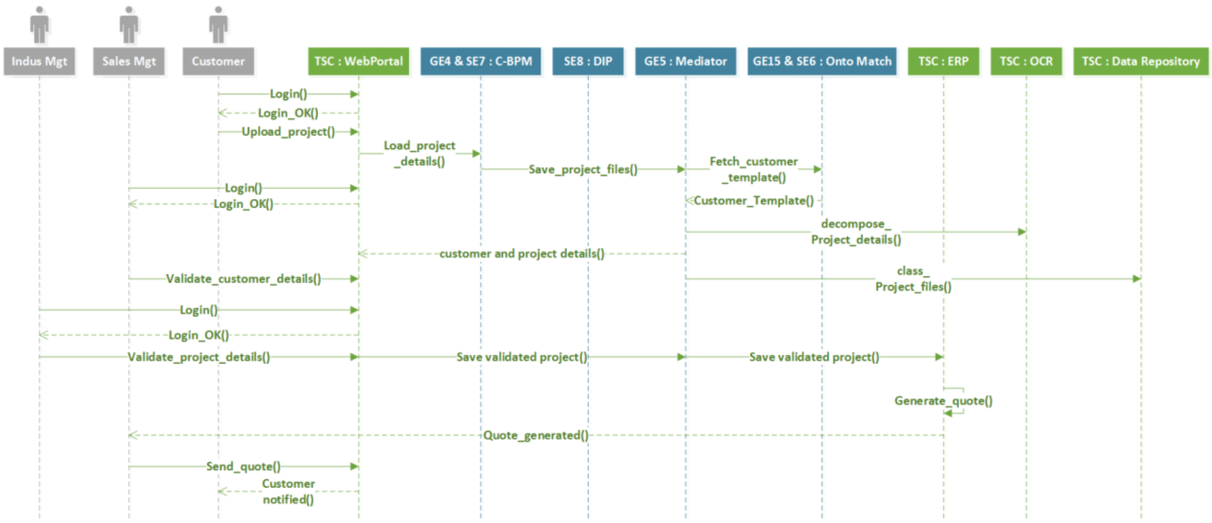
Through the collaboration platform, and after login-in, the customer provides some contact details and uploads project documents for the new product to be produced by APR. When the sales manager receives a notification, he logins the platform in order to validation the customer project. This validation is based on the product specificities, the history of collaboration for this family of products and the customer's profile. When the industrialization manager receives the notification, he analyses the project in order to complete product specifications to be adapted to local manufacturing facilities. In fact, the specifications given by the client (always CAD documents) only concern the product definition. In that way, additional engineering steps are required to adapt the product shape (i.e. as example) to different transformations steps. When product is validated from the production perspective, industrialization manager creates technical data in the ERP system and generates the quote. This quote is validated by the sales manager (delivery date, price, specific accounting facilities, etc.) before being available for customer profile in the collaborative platform.



2..1.1.2 Sequence Diagram BP1

<u>Dynamic sequence description</u>

By quote structuring and automation, APR aims to enhance the collaboration infrastructure with customers in order to enhance communication flows when initiating collaboration. The main objective targets to acceleration answer (quote) for customer projects.
When customer project is uploaded and the analysed through OCR, industrialisation manager is notified. If the product or similar release are manufactured before; the industrialization staff upload previous product data to accelerate the definition of new production data.
The quote is defined with inputs form industrialisation, production, and sales staffs. After validation, the quote is communicated to the customer and stored in the quote database.

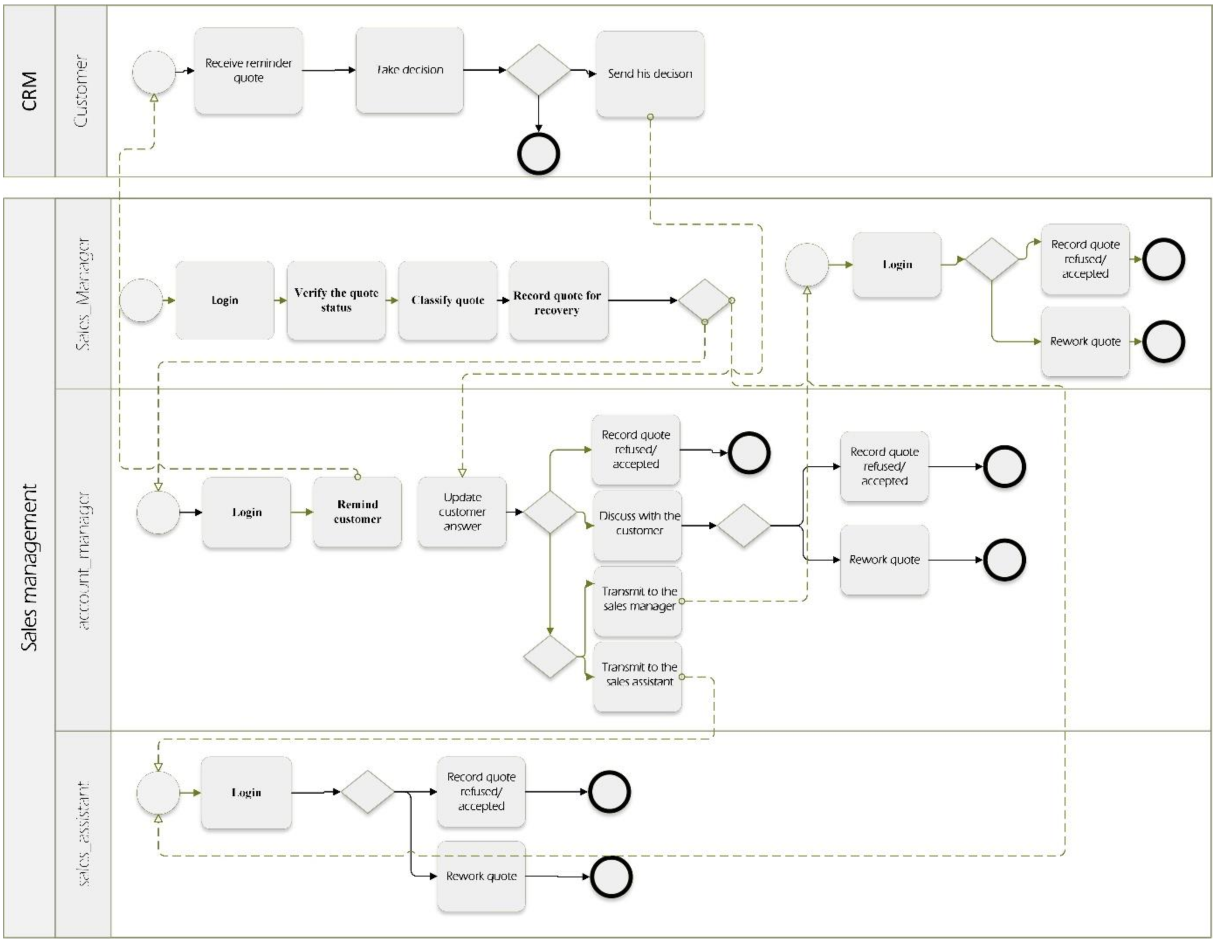


2..1.2. Business Process 2: Quote recovery

2..1.2.1 Workflow Diagram BP2

<u>Workflow Description</u>

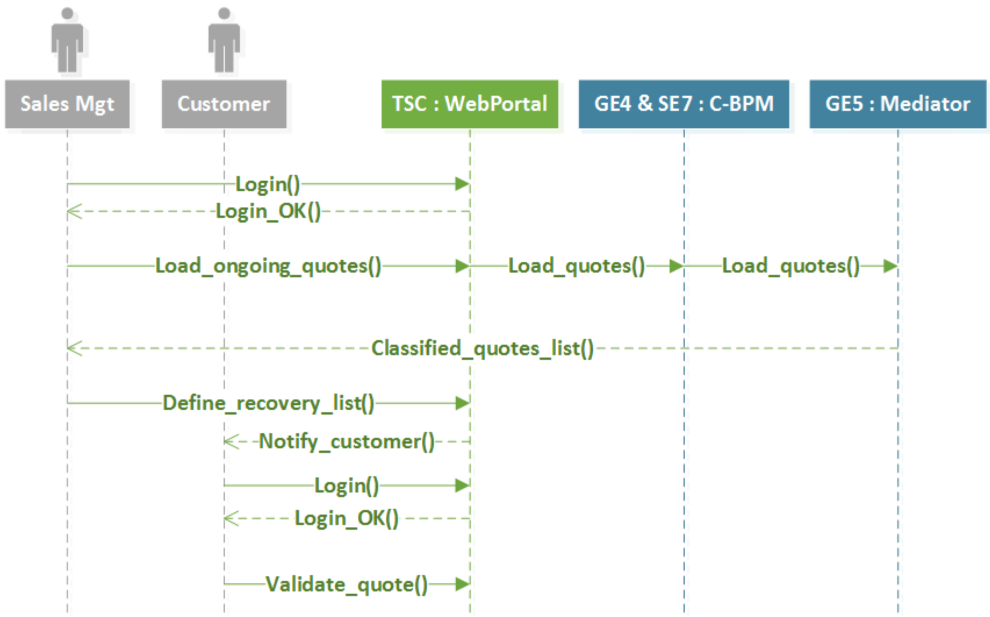
The motivation of this business process is to increase personalized tracking facilities for customers' projects. It aims to provide recovery mechanism for ongoing quotes.
After login-in the collaboration platform, the sales manager can perceive the list of ongoing quotes not-yet validated by customers. According each quote specification and customer's profile, sales manager can decide if it's suitable to generate a reminder for the concerned quote. In fact, several regular customers ingest many projects and don't ensure enough traceability for them. If the commitment conditions in the quote have to be updated (production delay compared to delivery date), the customer should be updated about these information in order to be reactive and fix decision for the quote.



2..1.2.2 Sequence Diagram BP2

Dynamic sequence description

Every day, sales manager analyse quote repository and classify un-retained quotes in order to define if recovery actions have to be applied. Purge action is done in the quote database and traceability database is updated.



2..1.3. Business Process 3: Create order

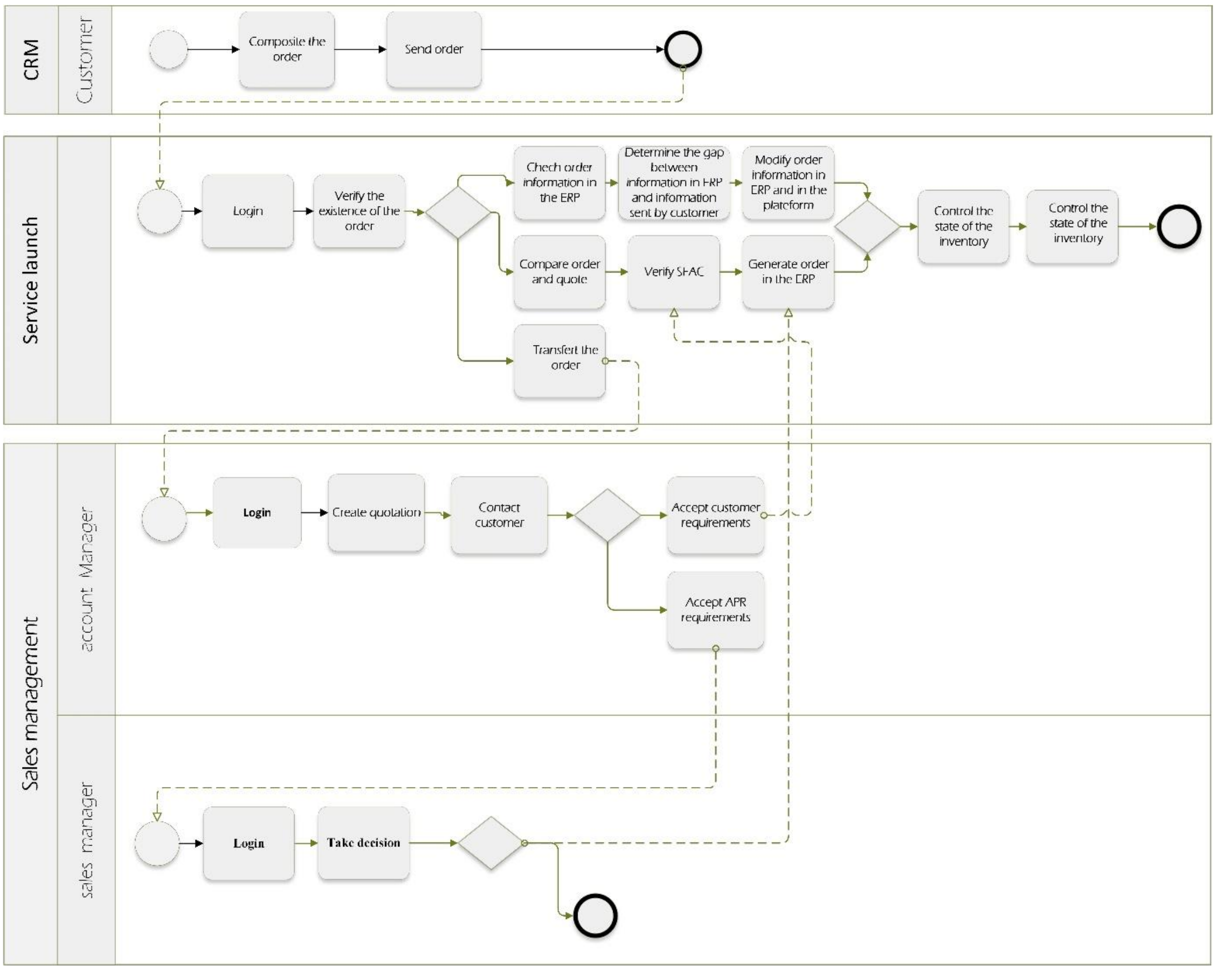
2..1.3.1 Workflow Diagram BP3

Workflow Description

The motivation of this business process is to decrease several orders collection gateways in one reliable system. It aims to federate personalized process for customers' orders collection.

In order to submit orders, customers are invited to login in the collaborative platform and upload their orders. When the sales manager receives notification, he checks each order and compares it with the correspondent quote, if it exists. Several situations have to be managed by the collaboration platform:

- If the quote exists and the order is conform to the quote details, the order can be injected directly in the production system by sales manager
- If the quote exists, but the order's details are different (quantity, delay), the production manager validate the order and ask sales manager to inject data in the production system.
- If the quote doesn't exists but the order concerns regular product (already defined in the ERP system), the production manager validate the product and ask sales manager to inject order.
- If the quote doesn't exist and there is no history for previous similar product, the industrial manager analyse customer request and can ask for additional project details. When product data is defined and internal quote (skeleton) is generated, the sales manager is validating the quote and decide if the APR Company accept the order or reject it.



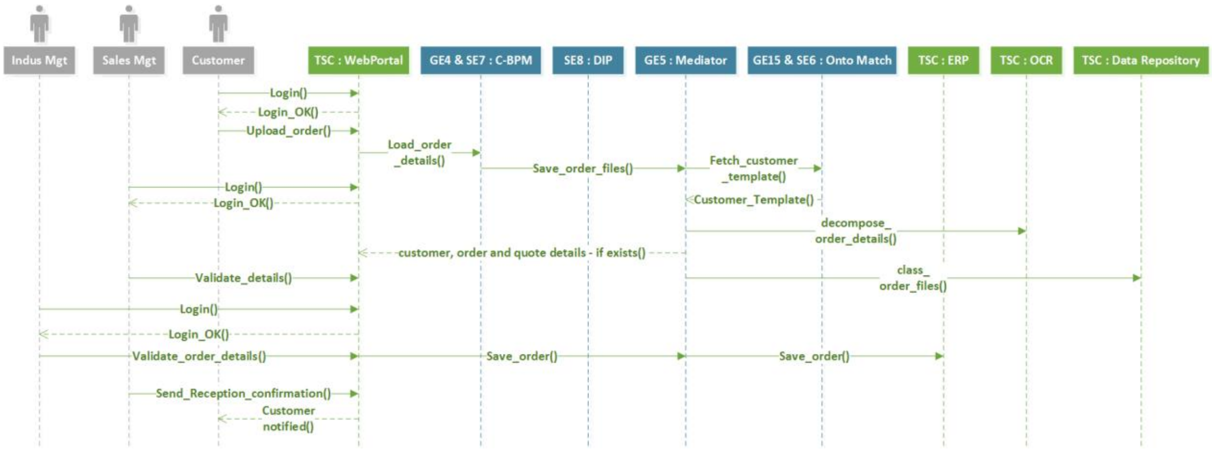
2..1.3.2 Sequence Diagram BP3

Dynamic sequence description

APR customer orders can be classified in three categories:

1. "Market orders": the same order coming permanently from the same customer
2. Negotiated order conform to one registered quote.
3. Negotiated order, but different form the registered quote. In this case, customer can modify quantity, the delivery date, some logistic conditions, some modifications in the raw material, etc.

After the identification of each order data through OCR, customer order in the first case can be quickly validated when the collaboration contract is still valid. The messaging service will sent a notification to the customer.
In the second case, the system will identify the existing quote, create the customer order and update the quote database. A notification is sent to the customer.
In the last case, the order is decomposed through OCR, the quote is identified and the both are sent to the industrialization service for validation. After a negotiation step with the sales manager, a new order is validated in the ERP system and the customer receive the notification.



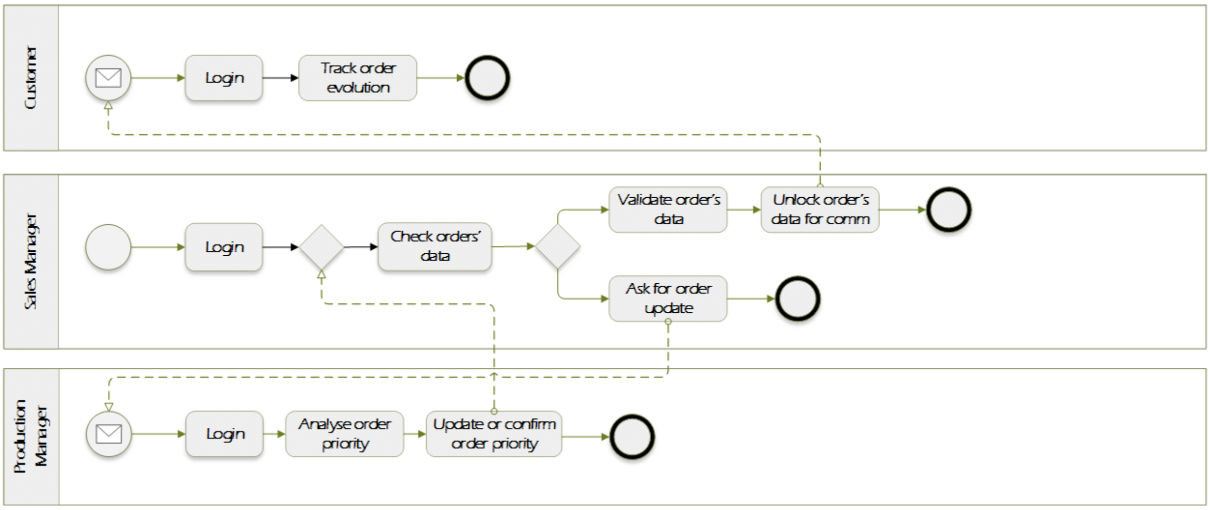
2..1.4. Business Process 4: Order monitoring

2..1.4.1 Workflow Diagram BP4

Workflow Description

The motivation of this business process is to better answer to customer specific requirement for order monitoring. It aims to create customer personalized communication facilities for order production tracking.

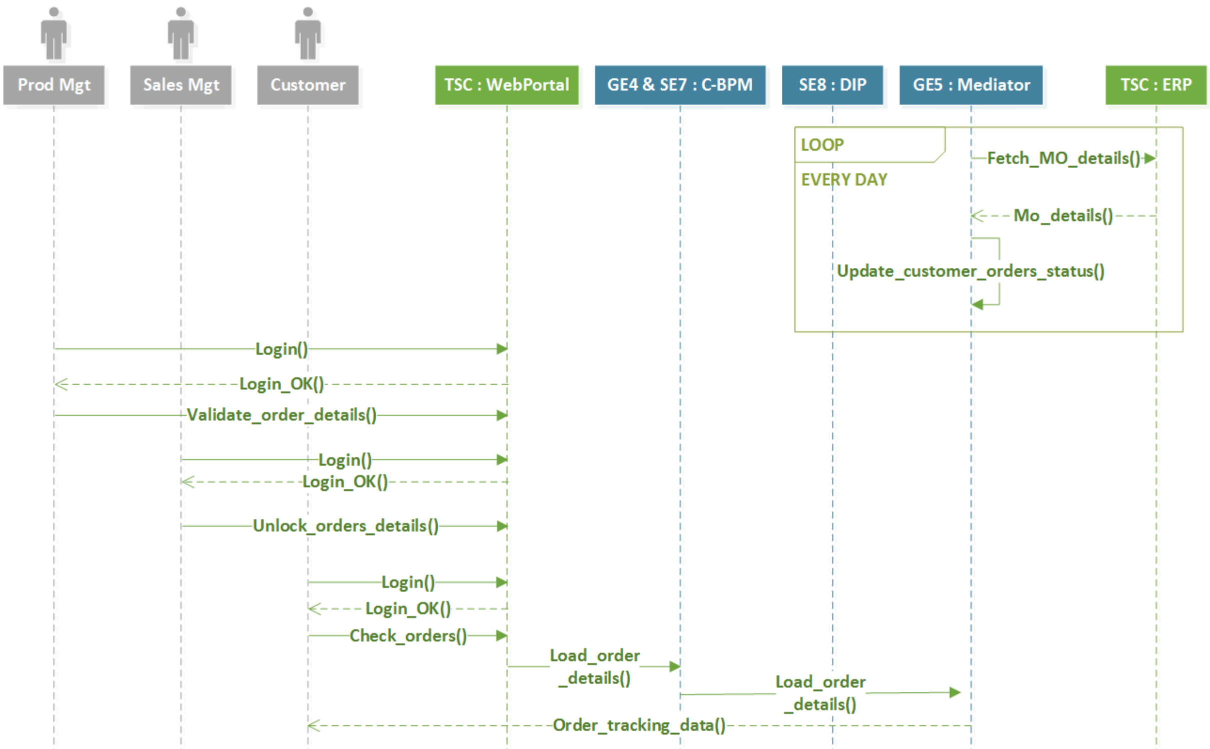
The sales manager is invited regularly to initiate order tracking process by assigning a selected order with the adequate customer template. He has also the responsibility to verify the coherence between order data from production and the different commitments (contracting facilities, quote details, etc.) already engaged with the customer. If all related data is valid, information become open to the customer, otherwise, production services are solicited to cover the identified consistency problem. With this monitoring process, APR aims to reinforce quality assurance by anticipating unconformity problems and enhance the rate of customer commitment respect (more than 96%). From the monitoring perspective, the presentation of order information is dynamically adapted to the density of available information for the customer order.



2..1.4.2 Sequence Diagram BP4

Dynamic sequence description

As one of the contracted conditions, each APR customer needs some personalised monitoring information about his orders. These information should be adapted to the customer profile and the manufacturing situation in the shop-floor. Therefore, all APR customers are classified (A=VIP, B, C) and some personalised templates should be created to define order status to be considered in the communication process and validation steps with sales and production managers. When committed, any order treated by APR should be respected and the customer satisfaction should be higher than 98%. The order monitoring business process concerns only the density and granularity of order information to be shared with customer.



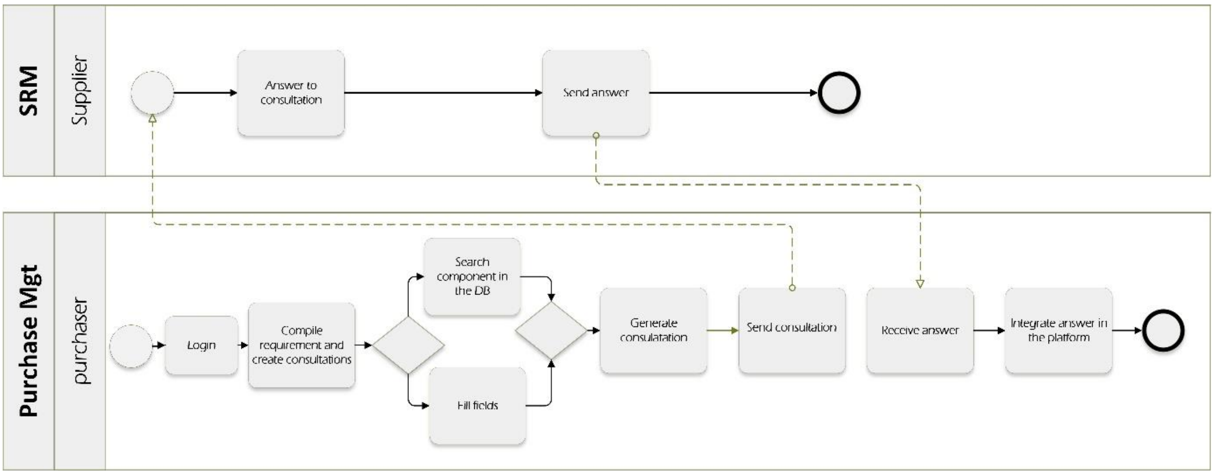
2..1.5. Business Process 5: Create consultations

2..1.5.1 Workflow Diagram BP5

Workflow Description

The motivation of this business process is to Raw material cost is changing frequently and can vary in more than 25%. It aims to update as much as possible supplier catalogue pricing and delivery delays.

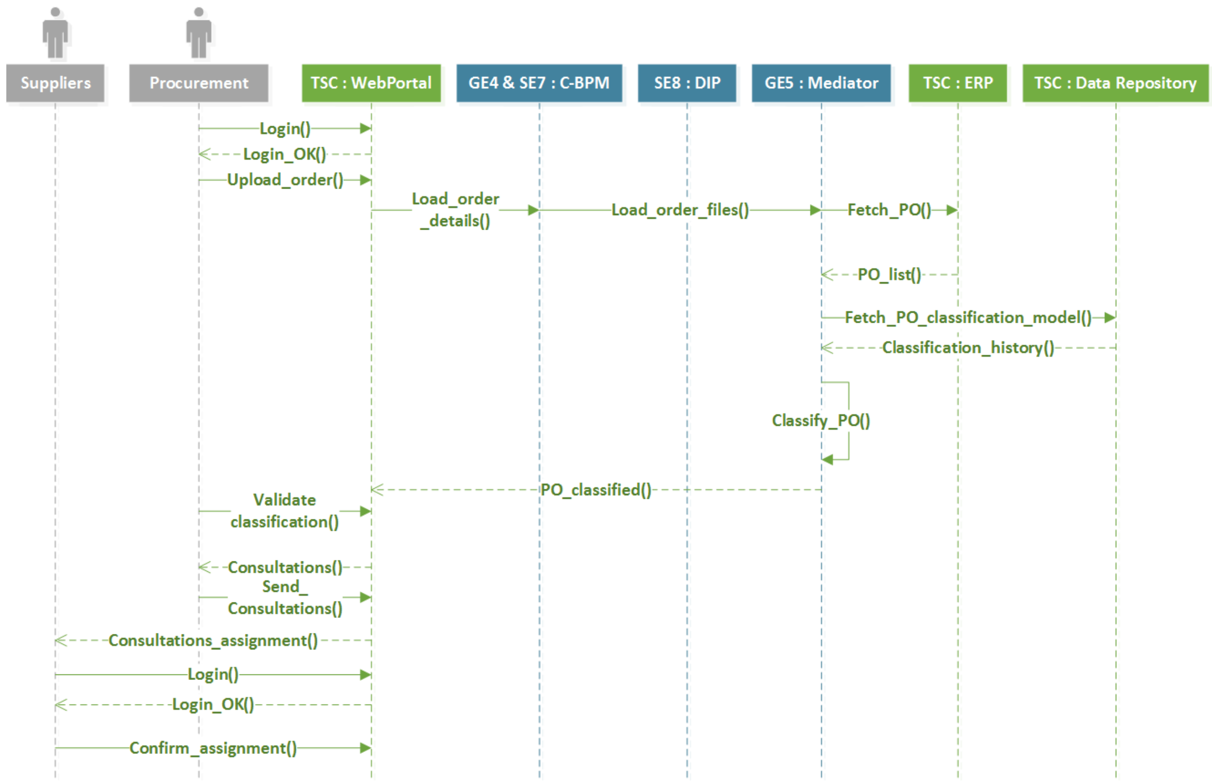
After login-in the collaboration platform, procurement manager load procurement orders (not yet confirmed) and apply some classifications using mining concepts in order to select the list of suppliers or raw material producers to be contacted. Consultations are sent in order to update APR catalogue and partners are invited to upload in the platform their pricing offers.



2..1.5.2 Sequence Diagram BP5

<u>Dynamic sequence description</u>

Through the production planning process, where the inventory level is low, the MRP generates a set of procurement orders defined by their delivery dates, quantity and a default supplier. These orders are proposed to the procurement manager for confirmation.
The definition of suppliers' catalogues in the ERP system needs to be permanently updated (every 15 days) due to the evolution of raw material cost. Therefore, the application of mining concepts aims to analyse the history of each concerned supplier or producer to identify the best/most likely classes of partners to target for consultations.



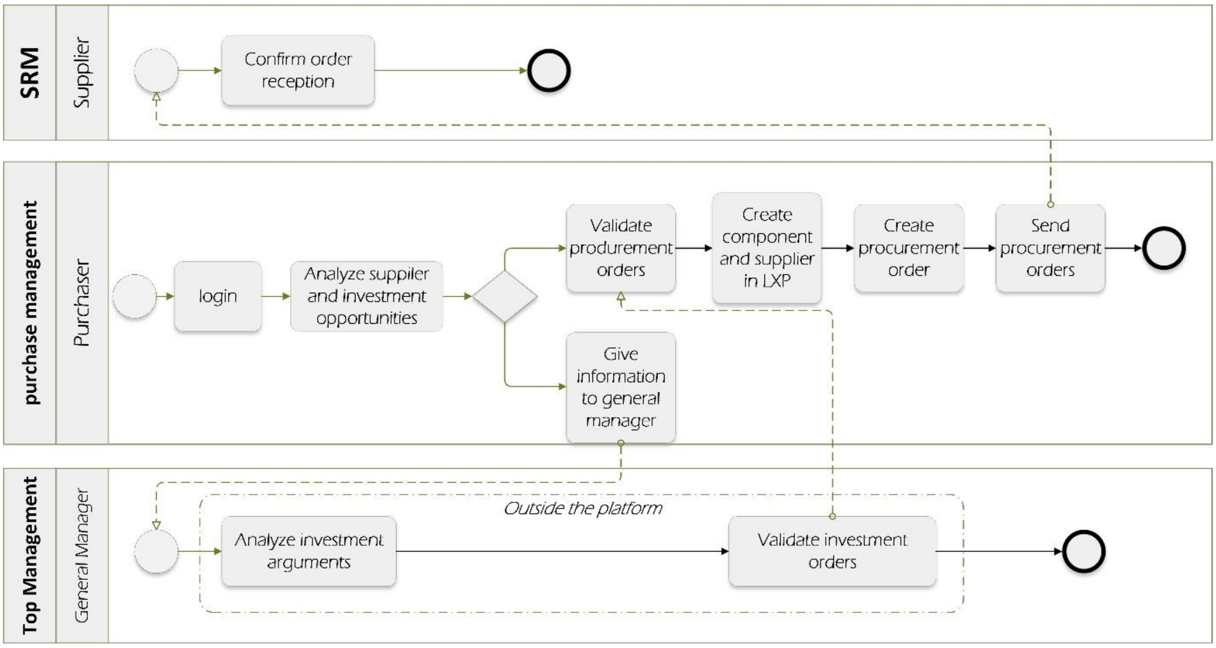
2..1.6. Business Process 6: procurement & strategic investment

2..1.6.1 Workflow Diagram BP6

Workflow Description

The motivation of this business process is matching several procurement schema and scenario coming from the history of APR commitments and collaboration contracts. The objective is the standardization of the procurement process.

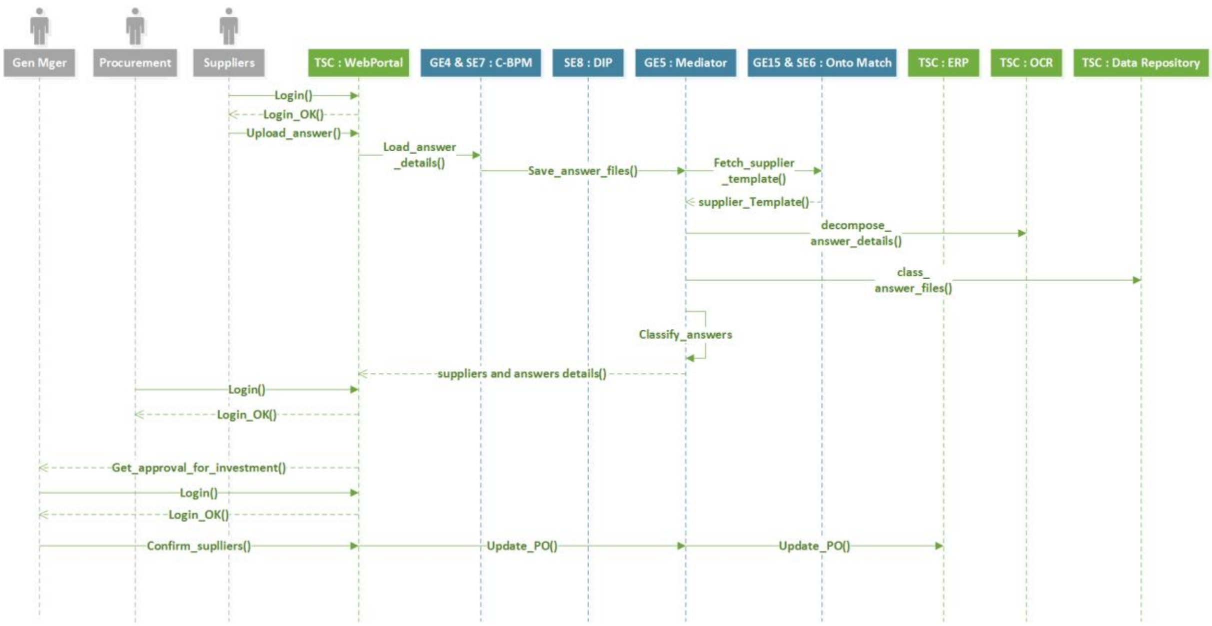
Procurement manager is invited regularly to analyse suppliers and producers answers in order to confirm orders. According to the volume of answers, the criticality of concerned orders and the opportunity for relevant massive investment (increase the inventory level), the general manager can be invited to approve some investment tasks. When partner's data are not enough relevant to make procurement decision, procurement manager can send a reminder for the concerned package of consultations.



2..1.6.2 Sequence Diagram BP6

Dynamic sequence description

The collection of consultation feedbacks, from suppliers and producers, are analysed through the TSC OCR. After that, the result is mined in order to find the best procurement schema: existing collaboration contracts, composition, insurance, delivery delay, correlation between quantity and payment conditions, etc. If the procurement orders financial value is higher than the procurement manager decision accreditation, the general manager validate the transaction. This consultation is done only in strategic investment case, when APR purchase raw material for stock in extra than the procurement orders requirements.



2.2. Experimentation Plan

The experimentation environment of APR plastic is defined with a selection of customers and suppliers accepting to test the new collaborative platform.

2..2.1. Basic use-cases

The first experimentation stage concerns some **basic use-cases** helping to verify the following validation points:

- The relevance of the business rules implemented inside the business processes
- The reliability of the information treatment flow.
- The horizontal scalability. For example, at the first business process, we upload several projects for the same customer in order to analyse the data repositories structures, the incidence in terms of information treatment at each actor, the new bottlenecks related to new project configurations, etc.
- The vertical scalability. This objective is related to the integration of new partners inside the collaboration platform. More than the capacity problems, the main interest of this validation points concerns the ability of APR actors to differentiate ongoing projects identified by partners according to their criticality, the regulatory commitments, etc.

The detailed validation points are parts of the business process implementation and integration protocol developed between Lyon 2 as IT provider, APR as industrial partner, LM Realisation as selected customer, and NetShape as a selected supplier.

2..2.2. Usage scenarios

The second experimentation stage concerns the development of some **usage scenarios** with a selection of representative customers and suppliers. At this stage, we develop and integrate some partner specific services for patterns treatment: upload partner profiles, patterns to parse and transform documents with OCR, etc. The integration feasibility illustrates the scalability of the collaboration platform to support specific extensions and adaptations in the future.

In addition to the validation points proposed at the use-cases subsection, we evaluate the business and technical impact of the new platform through the selected sets of business and technical indicators. This evaluation prove the business added value for APR industry.

2.3. Data Gathering and Analysis

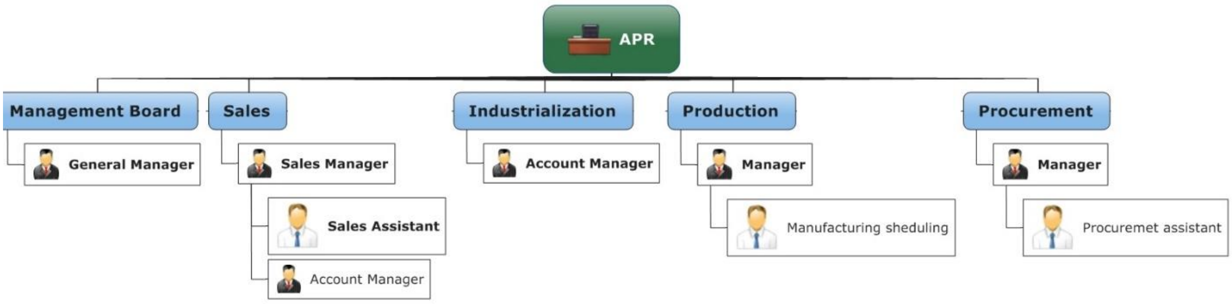
The APR trial in plastic industry concerns 6 collaborative business processes. In order to validate the business relevance of these collaboration capabilities, we propose the following set of business indicators:

TRIAL 6 APR	Name of the BPI	Why this PI's is important (comment 4)in comparison with market and competitors	Why this AS IS	Why this AS IS	Plan of measurement	Organization of the measurement	What measures can be done automatically and what manually? How automatically	Which data are you going to collect and how? How manually
BP_1	Time limit for responding to quotes demand (current/new product) **after / before the DV/AV implementation during a period***	The reactivity of the quotation process allows to validate with customer the criticality of the demand.	**Current (2 days) New (4 days)**	**Current (1 day) new (2 day)**	Treatment of the information flows is automatically with the traceability of answers	Definition of the tasks of everyone	BPI is evaluated from the payload	Time between the date of reception confirmed by the customer and the date of customer quotation request (automatically)
	% of the unsuccessful quotes due to high price after / before the **DV/AV** implementation during a period*	The reactivity of the quotation response validates with the customer the best transformation solution to meet his requirement	**60%**	**30%**	Treatment of the information flows is automatically with the traceability of answers	Definition of the tasks of everyone	BI is evaluated from the customer answer	% Number of unsuccessful quotes due to high price/Total number of quotes processed (automatically)
BP_2	% of time for analysis and control of customer recovery after / before the **DV/AV** implementation during a period*	The analysis of customer information allows a better understanding of his needs.	10%	40%	Automation of the seized tasks	Replacement of the task of seizure by a task of analysis	BI is evaluated at the level of analysis and discussion with customer	% Total time for analysis and control of customer recovery / Total processing time of customer recovery (automatically)

	Average time of customer recovery after / before the **DV/AV** implementation during a period*	When the time of customer recovery is short, we can know quickly customer needs.	7-14 days	7 days	Treatment of the information flows is automatically with the traceability of answers	Definition of the tasks of everyone	BI is evaluated from the time of customer recovery	Time between the date of customer recovery and the Sending date of commercial proposal (automatically)
BP_3	Average time to confirm the order with acknowledgement of receipt (with/ without quote) after / before the **DV/AV** implementation during a period*	Customer delivery time is becoming shorter. Therefore, the time of administrative treatment should be shorten in order to respect committed production delay.	4 days	48 h	Treatment of the information flows is automatically with the traceability of answers	Definition of the tasks of everyone	BI is evaluated at customer delivery time	Time between the date order acknowledgment to the client (client confirmation) and date of sending the order confirmation (automatically)
	% of time for analysis and control of orders after / before the **DV/AV** implementation during a period*	The analysis of customer orders should allow a good quality of treatment, and anticipate administrative gaps.	20%	50%	Automation of the seized tasks	Replacement of the task of seizure by a task of analysis	BI is evaluated from the verification and discussion with customer about order information	% Total time for analysis and control of orders / Total processing time of customer orders (automatically)
BP_4	% Customer service rate after / before the **DV/AV** implementation during a period*	Quality of service allows us to maintain our margins compared to the competitors.	93%	96%	Treatment of the information flows is automatically with the traceability of answers	Steering of production data	BI is evaluated at the time of delivery orders	% Number of orders not delivered out delay/Total number of orders delivered (automatically)

	Number of products received back due to faults after / before the **DV/AV** implementation during a period*	We lose market opportunities when producing non-quality products.	10	7	Automation of the seized tasks	Replacement of the task of seizure by a task of analysis	BI is evaluated at the reception time of the order	Number of products received back due to faults (automatically)
BP_5	% Internal Stockout rate after / before the **DV/AV** implementation during a period*	Customer delivery time is becoming shorter, so we must have the best material at the right time.	20%	5%	Automation of the seized tasks of consultations	Analysis of consultations	Bi is evaluated before sending a consultation to supplier	number of disruptions of internal stock per year (automatically)
	% External Stockout rate after / before the **DV/AV** implementation during a period*	Development of partnership with our suppliers must allow a good partnership to optimize the material supply.	5%	1%	gathering of needs	Replacement of orders tasks by tasks of managements delivery	Bi is evaluated from supplier answer	number of disruptions of external stock per year (automatically)
BP_6	Value of stock at the end of last period after / before the DV/AV implementation during a period*	The cost of stock directly impact our cost, so the less it is important the more we will be competitive.	230 K euros	180 K euros	Define more precisely the need of material	analysis of consultations and grouped orders	BI is evaluated from the analysis of investment	Value of stock at the end of last period in terms of material costs only (automatically)

To support the collaborative business processes, APR stakeholders and partners are identified with their access and functionalities profiles. The following figure provides an overview of the impacted business divisions.



People involved within BP1-2-3-4 implementation:

- Account management (2 people)
- Sales management (2 people)
- IT Service (2 people)

People involved within BP5-6 implementation:

- Procurement management (4 people)
- IT Service (2 people)

All these actors are involving in the appreciation of the new collaborative processes and the assessment of the proposed business indicators. In addition, the execution platform provides traces information to support the calculation of time based indicators. The following table provide the results of indicators analysis by months 18 and 21. The next evaluation is scheduled for M27.

BS	BPs	AS-IS		Target		TO-BE	M18			M21		
		BI1	BI2	BI1	BI2		Progress (Previous)	BI1	BI2	Progress (estimated)	BI1	BI2
BS1	BP1: create quote	Current (2 days) New (4 days)	60%	Current (1 day) New (2 days)	30%	To-be_1	100% (Pilot)	Current (1 day) New (2 days)	36%	100% (Pilot)	Current (1 day) New (2 days)	36%
						To-be_2					Current (1 day) New (2 days)	32%
						To-be_3						
	BP2:Quote recovery	10%	7-14 days	40%	7 days	To-be_1	90%			100% (Pilot)	17%	7 days
						To-be_2					22%	7 days
						To-be_3						
	BP3: Create order	4 days	20%	48h	50%	To-be_1	80%			90%	72h	30%
						To-be_2						
						To-be_3						
	BP4: Order monitoring	93%	10	96%	7	To-be_1	80%			95%(Pilot)	94%	8
						To-be_2						
						To-be_3						
BS2	BP5: Send consultation	20%	5%	5%	1%	To-be_1	75%			100% (Pilot)	20%	5%
						To-be_2					15%	4%
						To-be_3						
	BP6: Procurement Order and strategic investment	230 K euros		180 K euros		To-be_1	75%			90%	230	
						To-be_2						
						To-be_3						
						Moyenne	83%			95,83%		

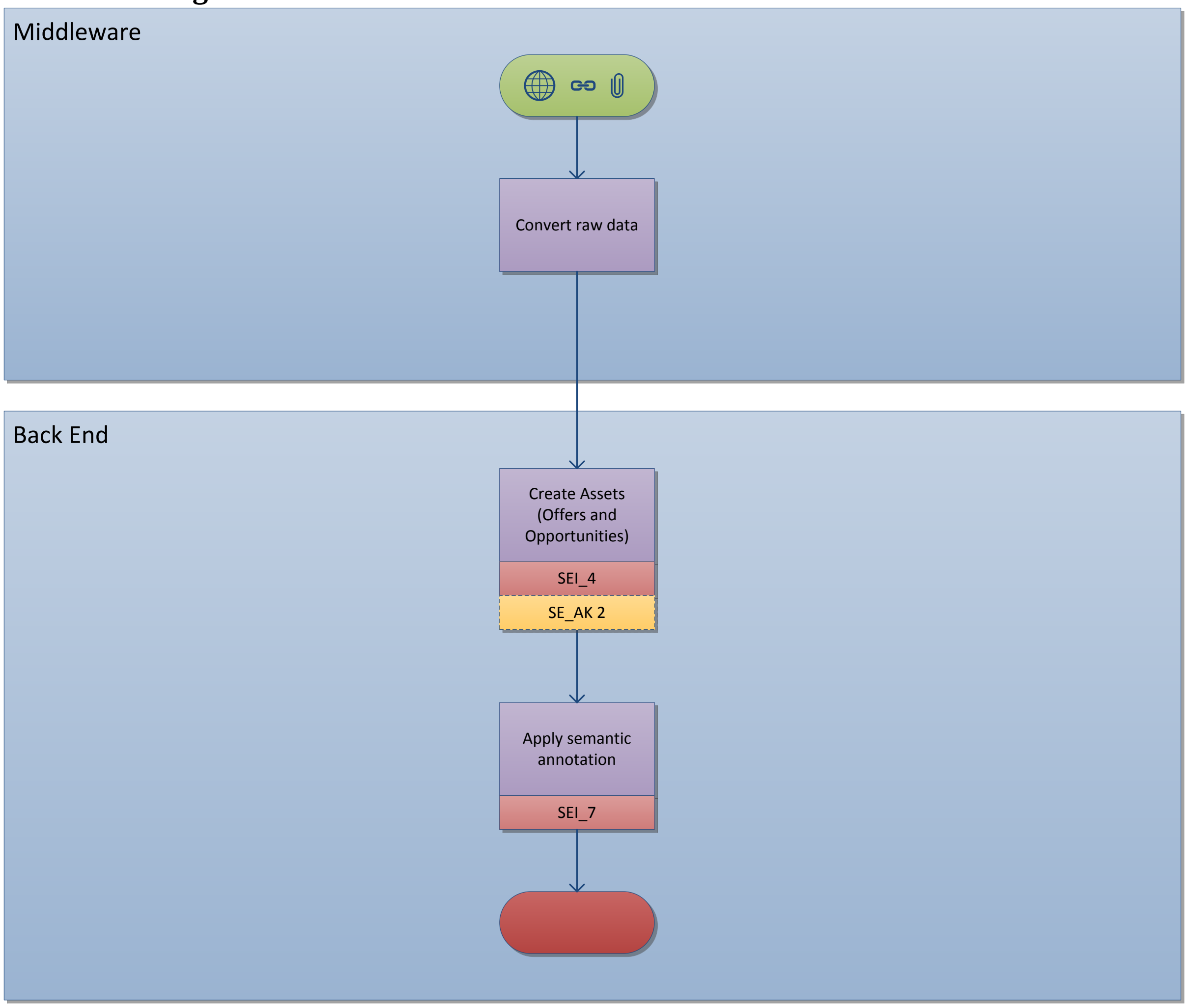
3. Manufacturing Resources Management TANet – Coventry

3.1. Final Business Processes

The following diagrams and accompanying text describe the final BP implementation of the TANet trial. The workflows describe how the business processes incorporate the additions of the SE's used from the open call partners DITF namely the advanced Management of Virtualized Assets (MoVA) which intuitively generates, composes, and transforms virtual representations of in-/tangible assets (VAaaS) through a user-centric graphical interface for dynamic discovery and flexible composition of Virtualized in-/tangible Assets (as a Service). The other SE from STI which is the Generation and Transformation of Virtualized Assets (GeToVA). Which supports semi-automatic generation and clustering of Virtualized intangible Assets (VAaaS) from real-world semi-structured enterprise and network resources. GeToVA and MoVA are described in more detail in WP14. In this report they are collectively referred to as the "ASSET-KIT"

3..1.1. Business Process 1

Workflow Diagram BP1

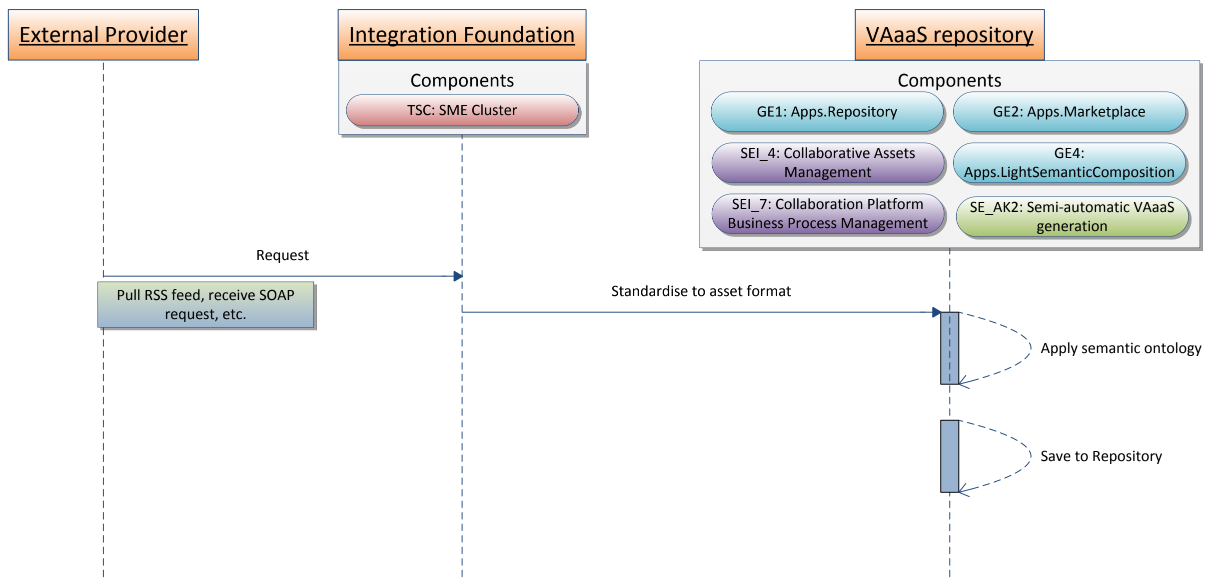


The first step in creating a cluster is to absorb tender opportunities and service offers into the system. The trial middleware acts as a communication layer which can receive information from various sources, and in various different formats, and translate this into usable information. We envisage the Unstructured and Social Data SE doing much of the translation work here.

The next step is to take the data and record it as an intangible asset. Our aim here is to have as little human interaction as possible; the ideal scenario requiring no human interaction to create the asset. Here, the ASSET-KIT SE_AK 2: Semi-autonomous generation of VAaaS should be used, in conjunction with the Collaborative Assets Management SE to store the asset in a hierarchy.

Finally, we need to apply a semantic ontology to each offer and opportunity, to enable the Synergy Search engine to more easily match them when producing clusters.

3..1.2. Sequence Diagram BP1

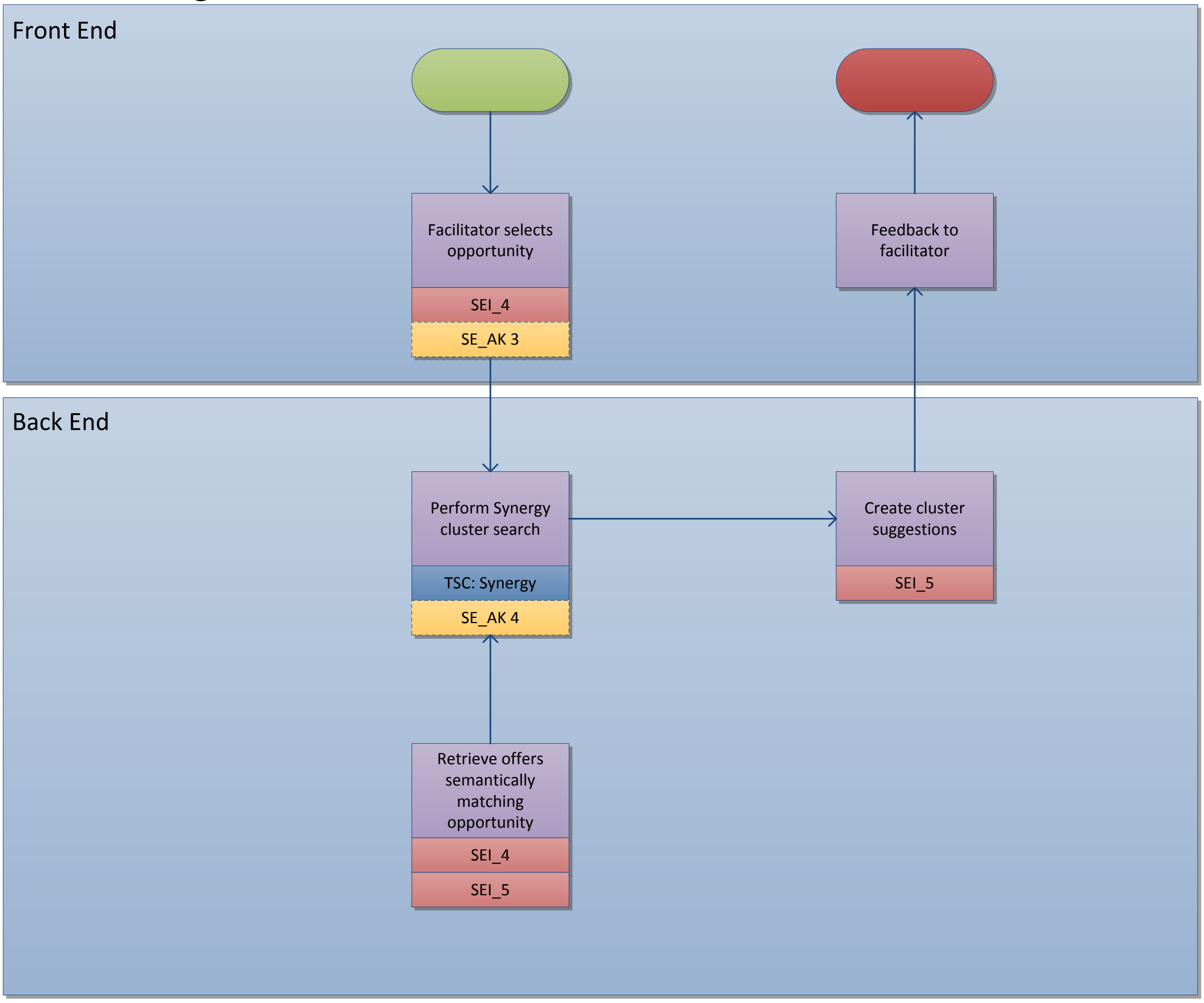


Offers and opportunities may be pulled from a variety of sources, to widen the applicability of the SME Cluster service. The sequence in which assets are created aims to most logically approach the generation of assets from sourced data.

- Raw data is received from an external provider, and analysed for the information we will use to create a virtual asset. This will use the Unstructured and Social Data Analysis SE and/or parts of SME Cluster's communications layer, the integration foundation, to extrapolate an asset from the input data.
- The virtual asset will then be passed to the virtual platform, where the trial will use the ASSET-KIT Semi-autonomous VAaaS generation SE and the Collaboration BP Management SE to create and semantically annotate the asset.
- Once the asset has been finalised, it will be stored to the repository using the Collaborative Assets Management SE.

3..1.3. Business Process 2

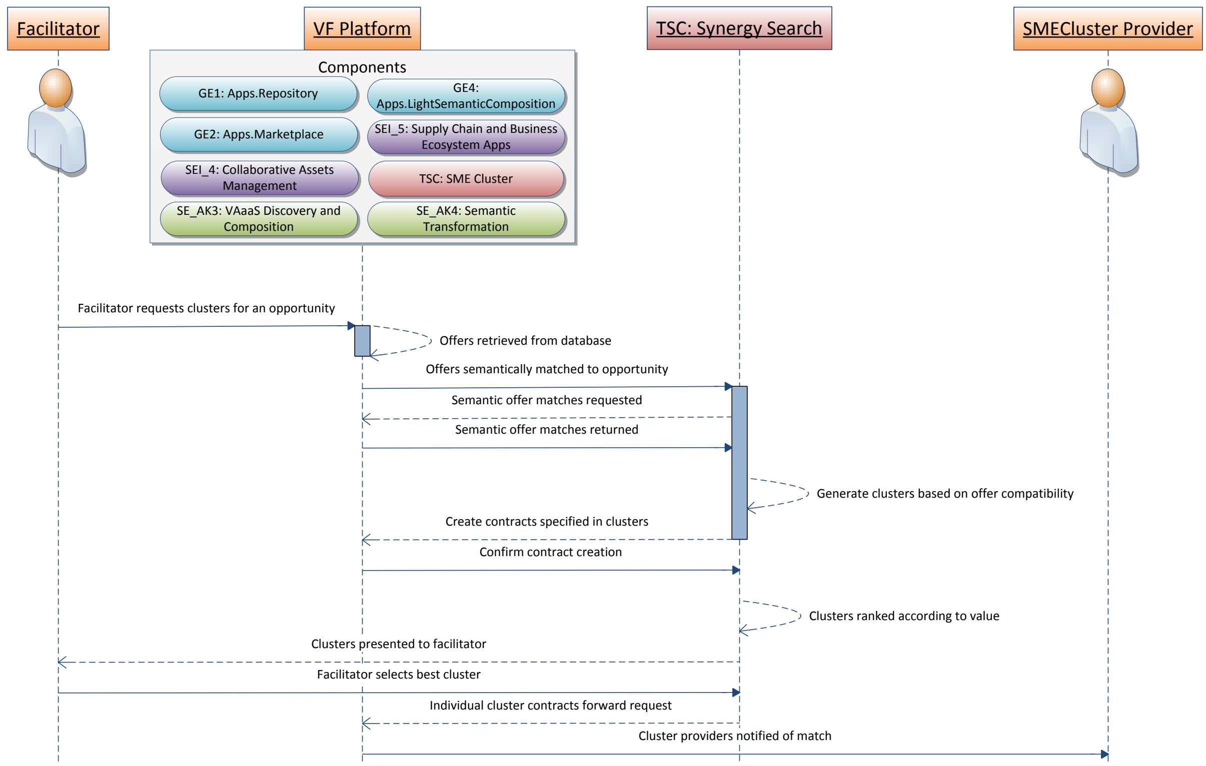
Workflow Diagram BP2



The facilitator's purpose within SME Cluster is currently to create clusters using their business knowledge and experience, and to notify recommended partners of the cluster and the tender opportunity provider of a contract option. However, feedback from facilitators recommends that there is opportunity for automation in this aspect; that they would benefit from automatic cluster generation, and they could then use their knowledge to select the most appropriate cluster or modify a suggested cluster.

The existing Synergy Search engine uses semantic ontology for creating cluster matches; we envisage using the ASSET-KIT VAaaS Discovery and Composition SE and Semantic Transformation SE to assist in enhancing the search capabilities of Synergy in creating appropriate matches. For each match in a cluster, a new contract offer will be made using the Supply Chain and Business Ecosystem Apps SE.

Sequence Diagram BP2

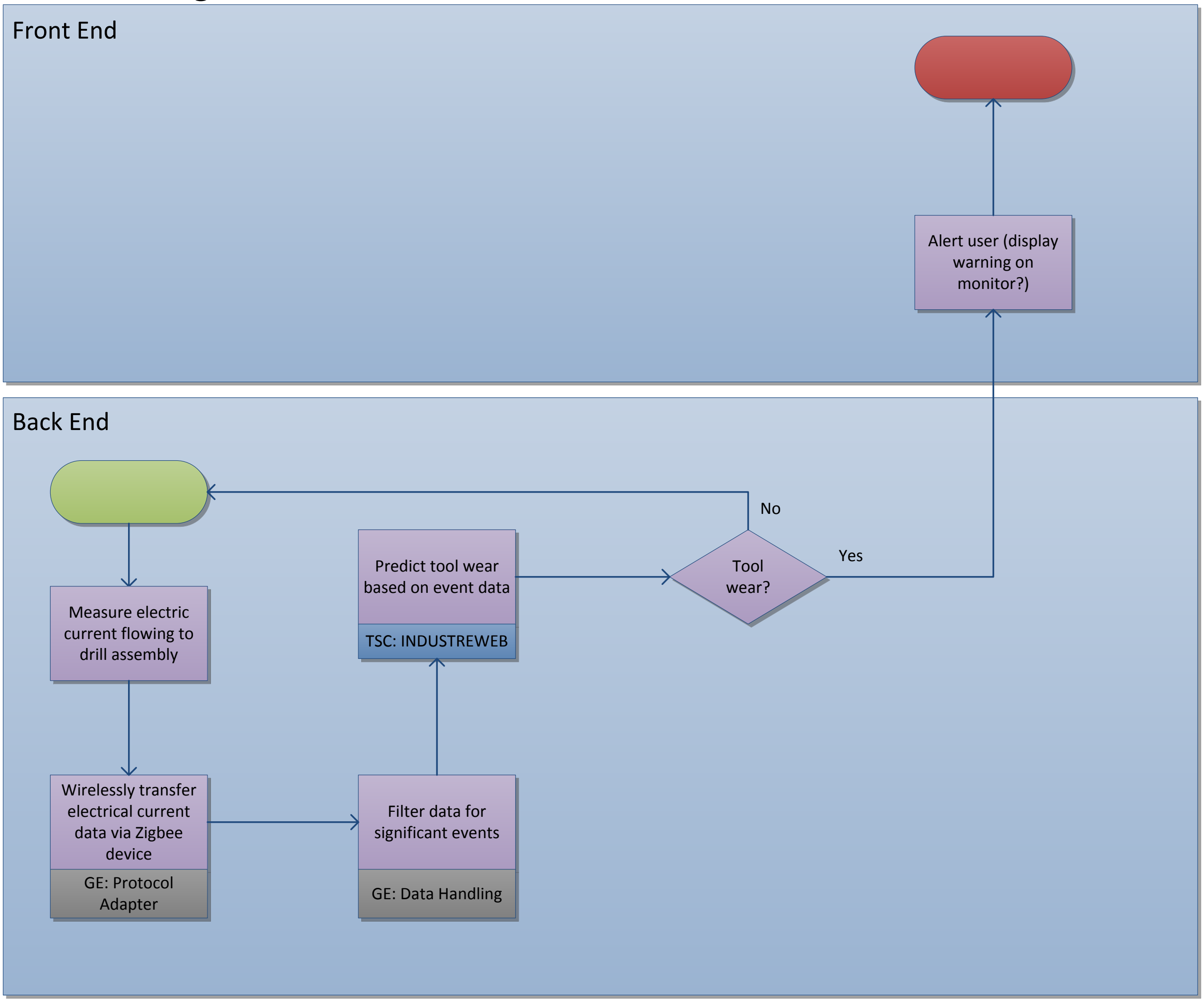


The facilitator begins the sequence by selecting an opportunity to create clusters for. The Synergy Search engine will utilise the functionality offered by the Semantic Transformation SE and the Supply Chain and Business Ecosystem Apps SE to create contracts for each individual cluster offer provider.

- The facilitator chooses a tender opportunity and requests a clustering operation.
- The VF Platform retrieves offers which could provide potential matches based on semantic annotation, which are then passed to Synergy
- Synergy clusters offers to fulfil offering requirements, assigning each cluster a score based on its approximate viability
- The facilitator is notified of the clusters, and may make adjustments at this point
- Once the facilitator confirms a cluster, Synergy will create contracts for each offer provider, and use the Supply Chain and Business Ecosystem Apps SE to notify the opportunity provider and the offer providers.

3..1.4. Business Process 3

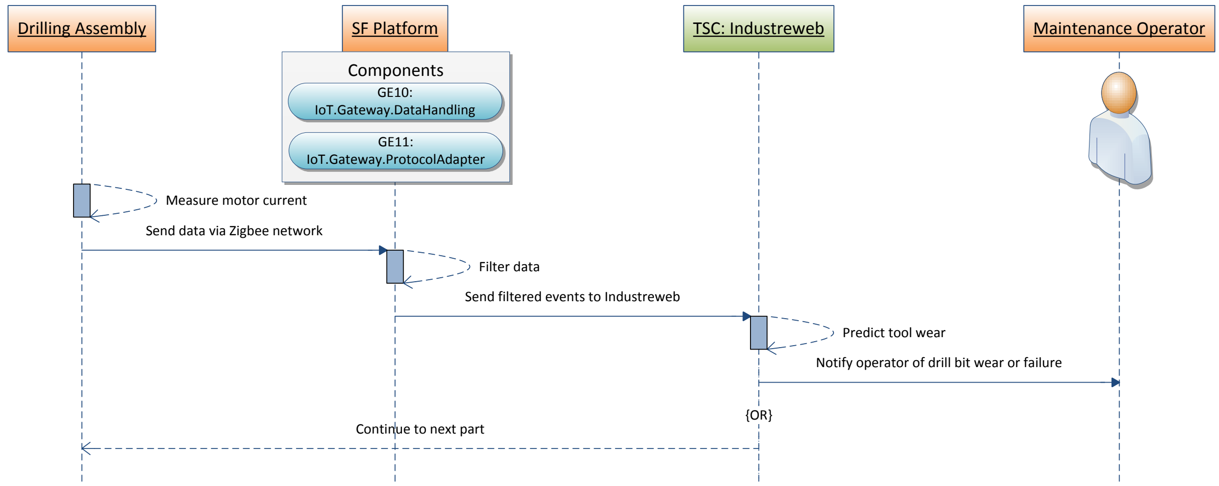
Workflow Diagram BP3



Predicting tool wear is important to a number of small manufacturers, as knowing in advance whether an assembly line is at risk of being disrupted is vital in a small business environment. This knowledge can then be used to plan to minimise disruption, or even to avoid it entirely.

In our trial's proof of concept drilling assembly, measuring the current drawn while the drill works on a part is an effective way of gauging its lifespan. The current drawn should be fairly consistent, and deviation from this predictable value indicates wear or damage to the drill bit. Therefore by measuring and filtering for values outside the predicted range, we can use this data to predict tool wear. These events can also be passed to a front end display to notify a user.

Sequence Diagram BP3

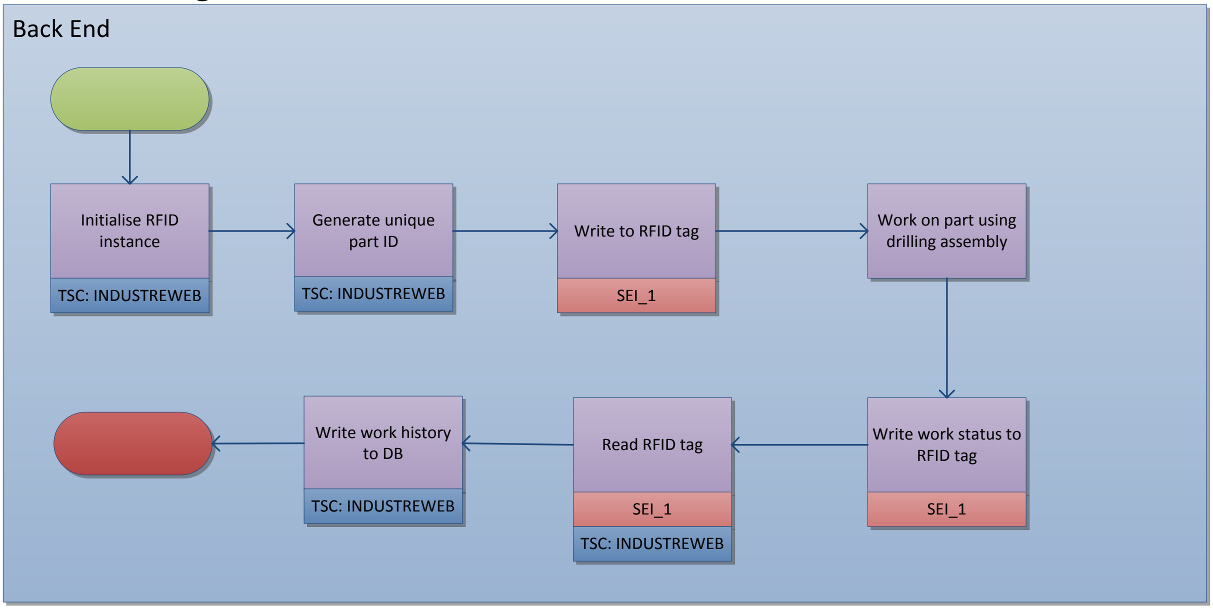


The drilling assembly draws an electrical current when working, whose value can be predicted. This value can then be used to identify the state of the drill bit, and to predict when it is approaching the end of its life, or a point at which it could produce sub-optimal results on the part it is working on.

- A sensor registered with the Protocol Adapter GE measures the current drawn when the drill is in use.
- This data is passed to the Data Handling GE, which will have rules in place to filter data and look for deviations from the predicted range of values.
- Our Industreweb TSC will then receive these filtered values and predict the current state of the drill and its intended lifespan.
- If the state predicted by Industreweb indicates an imminent or active event, the maintenance operator will be notified via a front-end interface.

3..1.5. Business Process 4

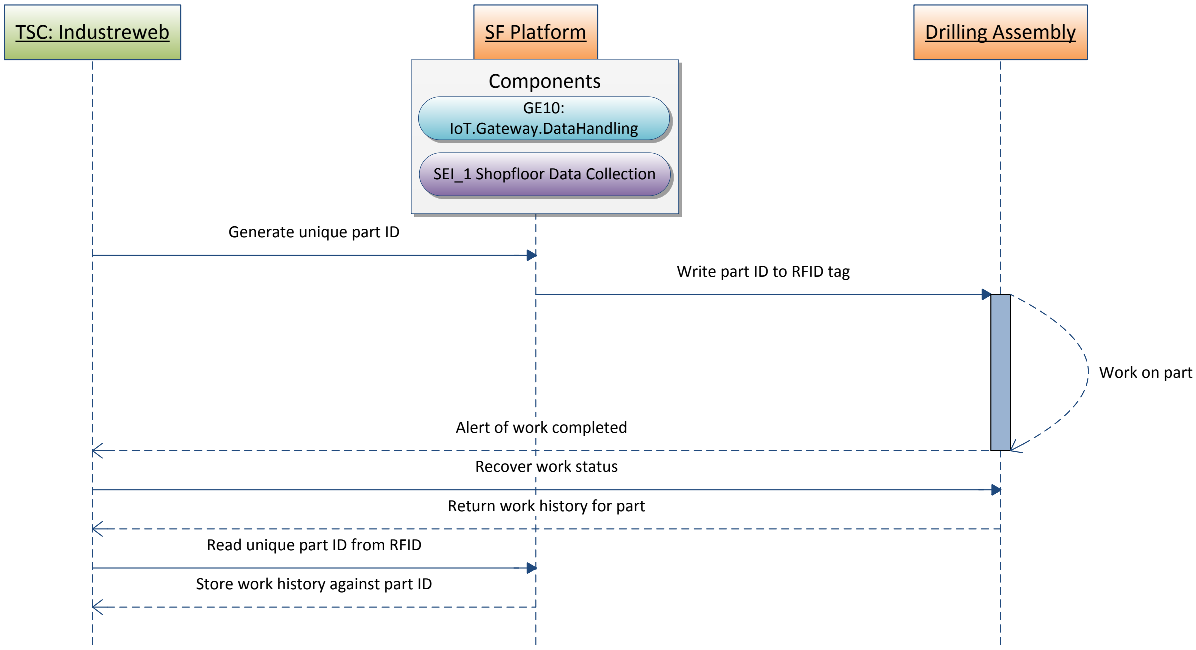
Workflow Diagram BP4



Accountability and service history can be an important part of manufacturing. The ability to retrieve the work history of a component can indicate reasons for its failure, or suggest ways to improve future work on it.

Our trial suggests using an RFID tag to store the work history of a part throughout the assembly line, using the Shopfloor Data Collection SE to simplify interactions reading from and writing to the RFID tag, and using our Industreweb TSC to store the history of the part.

Sequence Diagram BP4



The RFID tag will be used to store a minimum of data, while Industreweb will store the work history of the part being worked on. Once the part's work is complete, the history will be combined with the part ID and stored to database.

- Industreweb will generate a unique ID for the part, which will then be written to the part's RFID tag using the Shopfloor Data Collection SE.
- Once the part is worked on by the drilling assembly, the status of the worked part (success/failure/warning etc.) will be recorded by Industreweb.

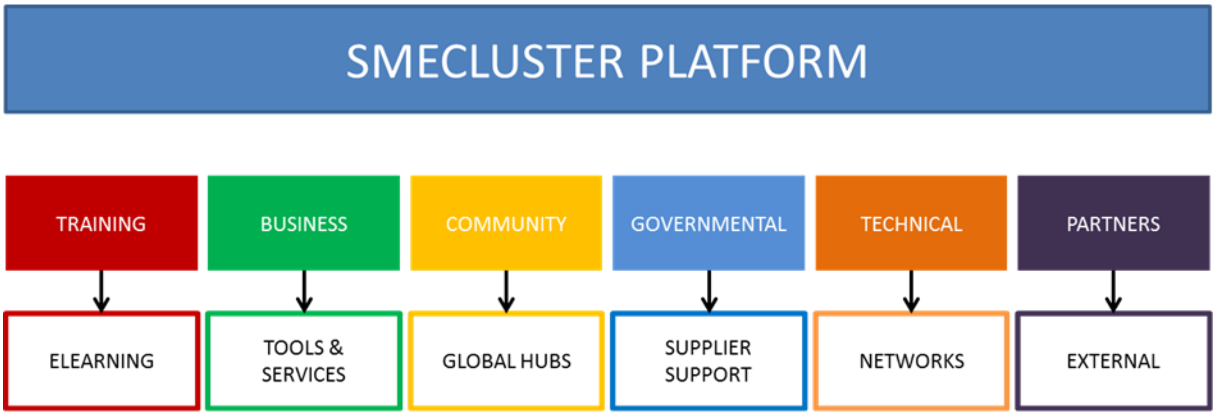
Finally the part ID will be retrieved at the end of the assembly, and the ID along with the work history written to database by Industreweb.

3.2. Experimentation Plan

3..2.1.1 Starting Point

SMECluster is a privately owned network cluster of like-minded SME companies (referred to as member companies or just members) that want to share resource and ideas to reduce costs and increase profits. The business model enables the member companies to bring together the skills and capacity of the smaller businesses in the UK which, when clustered, can tender for larger contracts.

SMECluster enables the member companies to inter-trade and share products at special partner rates so that there are benefits of lowered costs for the members and gives motivation to join the SMECluster. There is a wide portfolio of services as follows:



Although SMECluster exists and is active, it is still not performing the role that it was set up to do. It is meant to enable the member SME's to concentrate on their core offerings without worrying about the bureaucratic nightmare of filling in numerous repetitive forms and business to meet the criteria that larger private companies and public bodies demand from business today. Since there are no automated services available currently, members are no better off by joining SMECluster as they are still required to do repetitive paperwork.

The aim of the Trial is to leave the ways in which the IT appears to and is used by end-users and Sematronix unchanged, as far as is possible, whilst re-structuring the underlying system architecture as depicted below to exploit the FI-WARE architecture in general, and selected GEs in particular.

3..2.2. Trial Plan and Roadmap

3..2.3. VF Scenario (Call for Tender Opportunities)

The aim of the trial is to establish systems which support streamlining of data aggregation, and provide functionality to match suppliers to tender opportunities. Our implementation roadmap focused first on delivery of core systems, followed by key functionality, and finalising with supporting features.

Phase 1: Delivery of core systems

- SE 4 – Collaborative Assets Management
- SE 5 – Supply Chain and Business Ecosystem Apps (SCAPP)
- TSC – SMECluster Platform
- Allow manual addition of suppliers and opportunities to the system
- Allow adding of keywords to opportunities

The Collaborative Assets Management SE (CAM) provides a data store which, combined with SCAPP, allows supplier data to be handled in a format which is easily integrated with SCAPP's functions. SCAPP was chosen for its collaboration support between supplier and facilitator.

Phase 2: Implementation of functionality

- SE 3 – Anlzer
- SE 7 – Collaborative Business Process Management
- TSC – Synergy
- Allow adding of keywords to suppliers
- Cluster searching – match appropriate groups of suppliers to tenders

The Collaborative Business Process Management SE (CBPM) is used by the facilitator to aid in selecting supplier clusters suitable for an opportunity. Synergy is required to provide cluster options to facilitators.

Phase 3: Supporting features

- AK 3 – MoVA
- AK 24 – GeToVA
- Trend identification amongst tenders
- Automate input of tenders and suppliers

MoVA and GeToVA will be used to complement the functionality of CAM, and further support the ability to automate input of data into SMECluster.

3..2.4. SF Scenario (Industreweb PoC Platform)

The Industreweb PoC Platform is used to demonstrate Industreweb software and win business. The implementation focused on first collection, then analysis of data from the platform.

Phase 1: Data collection

- SE 1 – Shopfloor Data Collection (SDC)

SDC allows simplified communication between RFID sensors and the Industreweb platform.

Phase 2: Data analysis

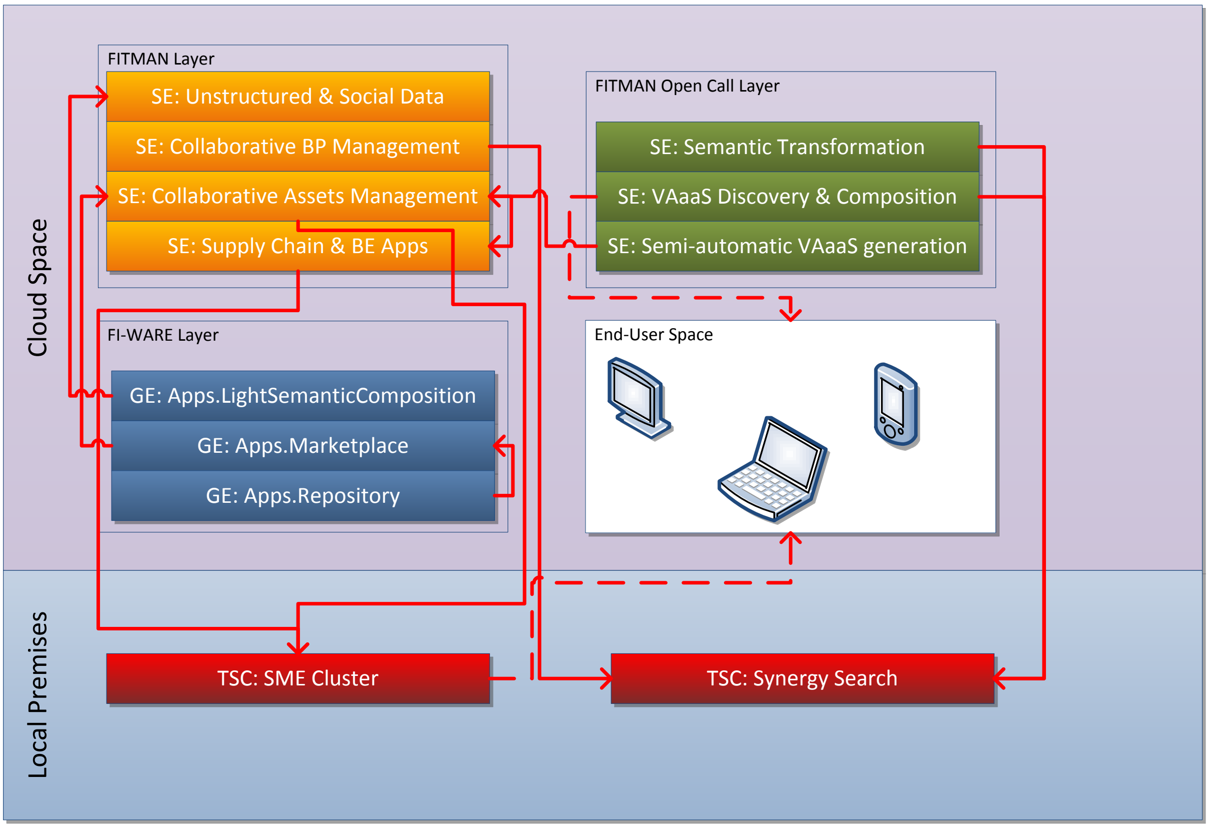
- IoT.Gateway.ProtocolAdapter – Zigbee Protocol Adapter (ZPA)
- IoT.Gateway.DataHandling – Complex Event Processing (CEP)

ZPA simplifies communication between the wireless networks connecting the drilling rig and sensors, and the server hosting Industreweb, while CEP filters out non-event data.

3..2.5. Virtual Factory Experimentation

Complete list of SE's/GE's to implement:
SEI_3 – Unstructured and Social Data
SEI_4 – Collaborative Assets Management
SEI_5 – Supply Chain and Business Ecosystem Apps
SEI_7 – Collaborative Business Process Management
SEI_8 – Data Interoperability Platform Services

Complete list of actors:
Facilitator
Service Provider(s)



Once a facilitator has created an account with SMECluster, they will be able to register suppliers, adding some basic information about their company and detailed information relating to their production, adding assets which represent the services a supplier offers, which will be gathered into SEI 4: Collaborative Assets Management. They may also design a workflow diagram for the supplier to support future decisions, which will be created using SEI 7: Collaborative Business Process Management.

Facilitators will be able to enter tenders into the system. Facilitators will also be able to identify trends in tenders using SEI 3: Unstructured and Social Data Analytics, such as quantity of tenders in a particular industry area, or rate at which tenders become available over time.

Once opportunities and assets exist within the system, the facilitator can choose an opportunity they wish to fulfil. This will use SEI 5: Supply Chain and Business Ecosystem Apps, consuming data in SEI 4: Collaborative Asset Management. TSC: Synergy will be used to create a number of asset clusters capable of fulfilling the opportunity. The facilitator will then use their experience and business domain knowledge to select the most appropriate cluster formed by the system.

3..2.5.1 First phase of implementation

Include:

- SEI_4 (Collaborative Assets Management) - CAM
- SEI_5 (Supply Chain and Business Ecosystem Apps) - SCApp
- Facilitator
- Service Provider(s)

First phase will include use of CAM and SCApp to capture services provided and tenders entered into the system.

Implementation will allow:

- Manual addition of a service to the system (Service Provider; CAM)
- Manual addition of an opportunity to the system (Facilitator)
- Manual semantic annotation of opportunities (Facilitator)
- Manual semantic annotation of services (Facilitator/Service Provider)
- Manual creation of ‘rooms’ to negotiate contracts between opportunities and service providers (SCApp)

3..2.5.2 Second phase of implementation

Additionally include:

- SEI_7 (Collaborative Business Process Management) – CBPM
- SEI_8 (Data Interoperability Platform Services) - DIPS
- Proprietary Synergy system - Synergy

Second phase will use CBPM to automate semantic annotation of assets, and aim to automate the process of matching tender opportunities to services.

Implementation will allow:

- Automated semantic annotation of opportunities and services added to system (CBPM) Automated matching of services to tenders (SCApp; Synergy)
- Automated clustering of matches to fulfil tenders (Synergy)
- Manual selection of best cluster (Facilitator)
- Automated creation of ‘rooms’ for service providers to agree to cluster (SCApp)
- Manual confirmation of acceptance by service providers

In addition, addressing feedback arising from experimentation.

3..2.5.3 Final implementation

Additionally include:

- SEI_3 (Unstructured and Social Data) – Anlzer

Final phase will use Anlzer to automate contract acquisition, and expand the facilitator's role by allowing them to edit suggestions by the Synergy engine, as well as looking to work with more complex opportunities effectively.

Implementation will allow:

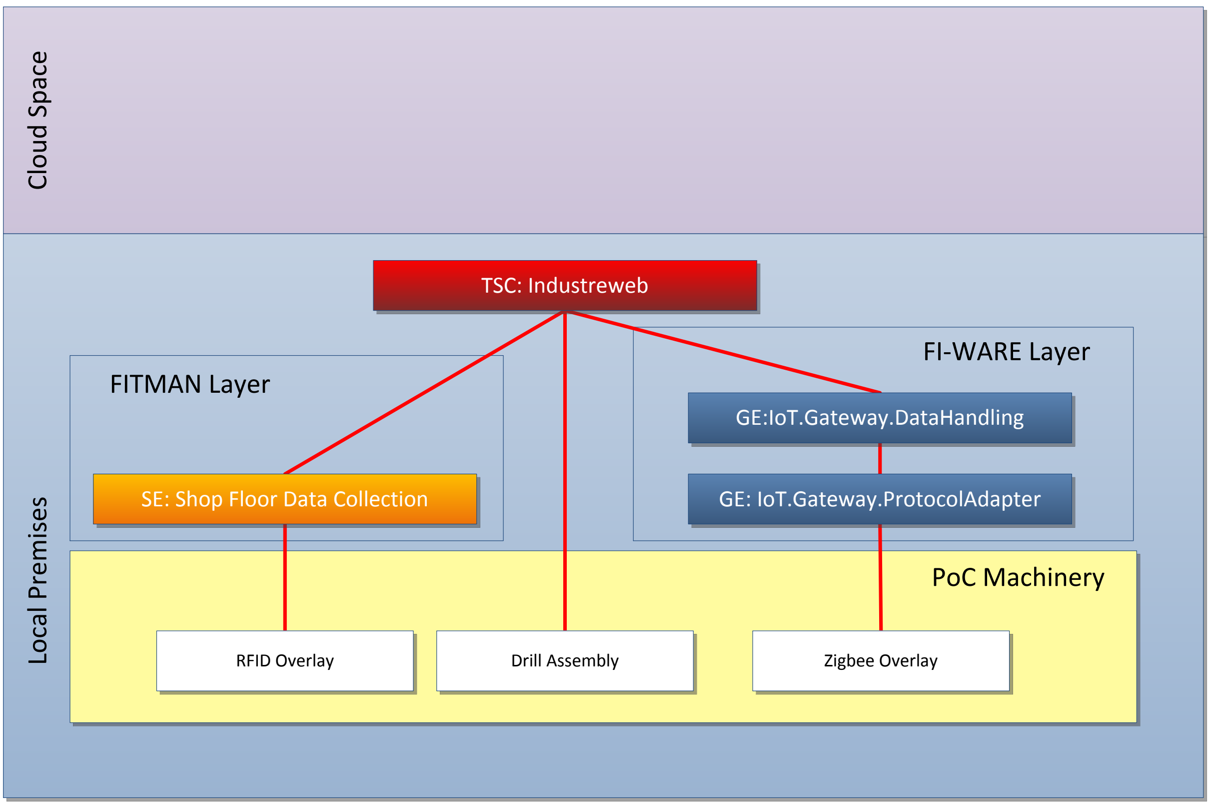
- Automated capture of opportunities (Anlzer)
- Ability to edit/create more complex clusters (Facilitator)

In addition, address feedback arising from experimentation, and consider further exploiting SE functionality.

3..2.6. Smart Factory Experimentation

Complete list of SE's/GE's to implement:
SEI_1 (Shopfloor Data Collection)
IoT.Gateway.ProtocolAdapter (Telecom Italia)
IoT.Gateway.DataHandling (Orange)

Complete list of actors:
Operator
Maintenance Engineer
Quality Manager



Once a facilitator has created an account with SMECluster, they will be able to register suppliers, adding some basic information about their company and detailed information relating to their production. SE_AK 24: Semi-automatic VAaaS generation will assist by allowing supplier profiles to be generated from unstructured data. The facilitator will also add assets which represent the services a supplier offers, which will be designed using SE_AK3: VAaaS Discovery and Composition, and gathered into SEI 4: Collaborative Assets Management. They may also design a workflow diagram for the supplier to support future decisions, which will be created using SEI 7: Collaborative Business Process Management.

Facilitators will be able to enter tenders into the system. Facilitators will also be able to identify trends in tenders using SEI 3: Unstructured and Social Data Analytics, such as quantity of tenders in a particular industry area, or rate at which tenders become available over time.

Once opportunities and assets exist within the system, the facilitator can choose an opportunity they wish to fulfil. This will use SEI 5: Supply Chain and Business Ecosystem Apps and SE_AK 24: Semantic Transformation, consuming data in SEI 4: Collaborative Asset Management. TSC: Synergy will be used to create a number of asset clusters capable of fulfilling the opportunity. The facilitator will then use their experience and business domain knowledge to select the most appropriate cluster formed by the system.

3..2.6.1 First phase of implementation

Include:

- SEI_1 (Shopfloor Data Collection) – SDC

The first stage of implementation will be used to test the ability of SDC to simplify communication between RFID sensors and the Industreweb platform. Additionally, components will, at this stage, be installed on a rig, but used simply to test the setup of the system, and the ability to track the movement of an RFID tag.

Implementation will allow:

- RFID Reader to locate and read RFID tag
- RFID sensor to communicate with SDC (SDC)
- SDC to communicate with Industreweb with only identification information (SDC)

3..2.6.2 Second phase of implementation

Additionally include:

- IoT.Gateway.ProtocolAdapter – ZPA
- IoT.Gateway.DataHandling – CEP

The second phase will concentrate on the capture of data from the drill assembly over a Zigbee network, and the use of data returned via the SDC to make predictions regarding tool wear, and for locating the source of defects in machined parts.

Implementation will allow:

- Wireless transfer of sensor data via Zigbee network (ZPA)
- Translation of data into events (CEP)
- Prediction of tool wear, requiring replacement (Industreweb, Operator)

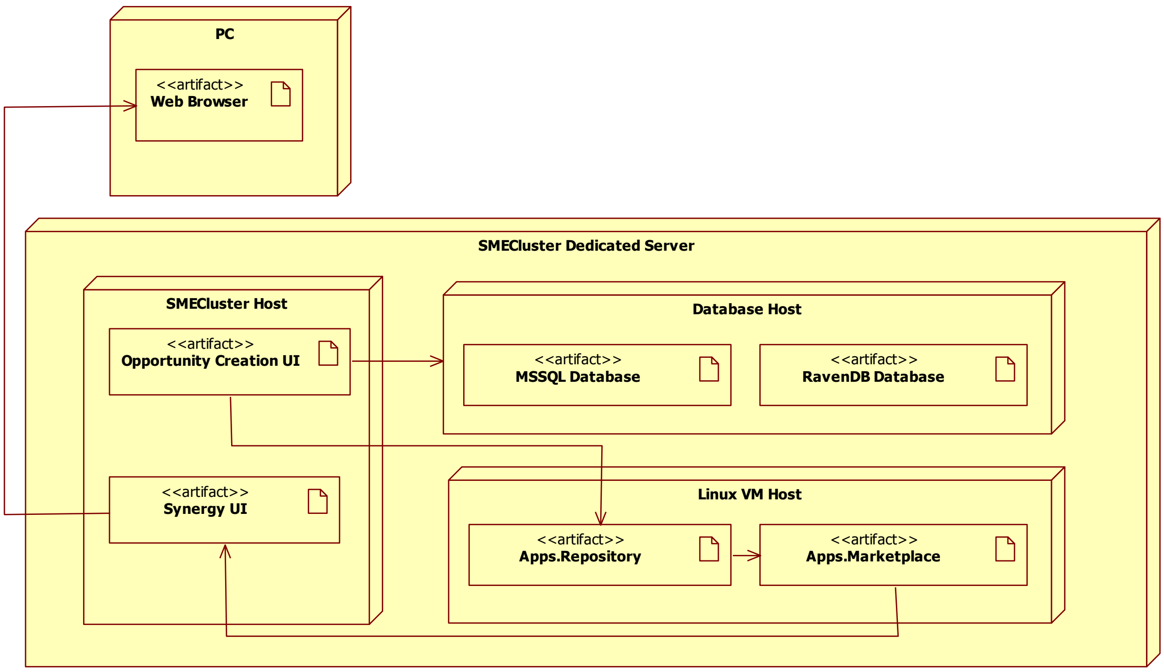
3..2.6.3 Final implementation

The final stage will focus on improving the usability of the final software by implementing an advanced interface to the GE/SEs and pulling the data in to understandable screens for use with shop floor staff.

- Industreweb using events to flag issues to shop floor (Maintenance Engineer, Industreweb)
- Tracing of defective machined parts to source (Quality Manager; SDC, Industreweb)

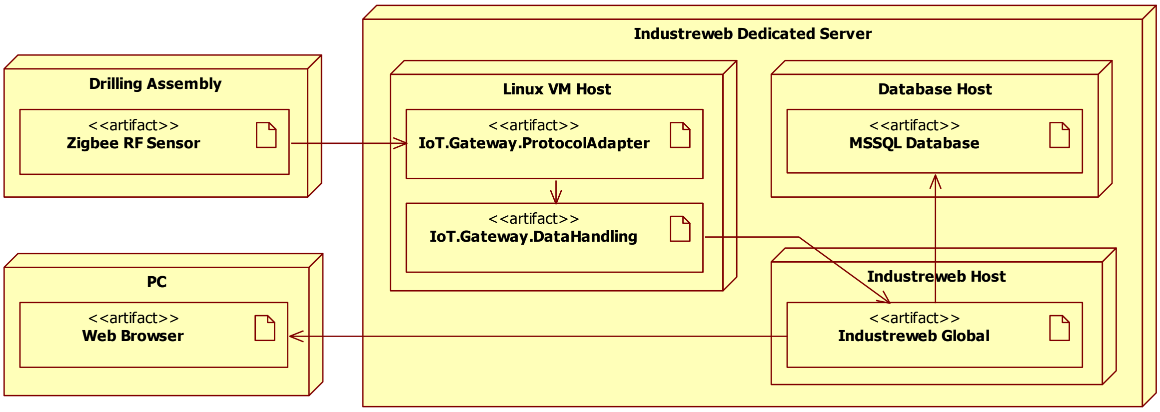
3..2.6.4 People, Infrastructures, Processes *(1 page)*

Company	People allocated to implementation and instantiation	A short description of how they will interact with the trial	Owner
Sematronix	3	Administration of platform	Gash Bhullar
WAF	4	Gathering tenders, creation of opportunities and approval of clusters	Tim Williams
Control 2K	3	Developing the platform	Simon Osborne
Coventry	2	Providing technical assistance	Keith Popplewell



The network infrastructure is based on two development servers configured on a 100Mbps network located at the Control 2K headquarters at Waterton Centre. The network is TCP/IP based on IPv4 addressing using Dynamic Host Configuration Protocol. Server one will run

SMECluster which will interface with the Server two hosting the underlying database for the platform. Server one will interface mainly to the FITMAN platform.



SMECluster which will interface with the Server two hosting the underlying database for the platform. Server one will interface mainly to the FITMAN platform.

In addition to the servers a PC connected via 100Mbps switch will run the ZPA GE run on a PC located in Systems Development room where a production test machine will be modelling a production environment. Control systems on this production test machine are both PC & PLC based and will be connected via a 100Mbps switch to the same network to enable production related data to be retrieved in real-time.

The IT infrastructure that will be used will be minimally invasive in respect of the normal production. The main point of interface will be via the Zigbee Smart Object sensor network, which is recording relevant events coming from production test machine.

3..2.6.5 Results at M18 and Future Expectations

Number	**Indicators** *List the indicators that will help measuring the results of the living lab*	**DESCRIPTION** *Give a detailed description of the indicators*	**Unit***	**Current value**	**Future expected value**
1	Tenders accrued monthly	Quantity of tenders entered into system	Qty	3-10	15-20
2	Active facilitators	Number of facilitators logging on monthly	People	2	3
3	Registered service providers	Number of providers offering services on platform	Organis-ations	102	80-115
4	End-to-end clustering	Reducing man-hours involved in creating and managing clusters	Hours per tender	5	2
5	Automation of tender input	Collection of tenders by automated systems	Minutes per tender input	30	<1

- **Tenders accrued monthly**: Tenders accrued monthly have increased due to increased number of facilitators and increased engagement of facilitators. Platform redesign may also have affected its usage.
- **Active facilitators**: An additional facilitator has registered on the SMECluster Tendering Platform. Tim Williams of the Welsh Automotive Forum is utilising the platform and providing user feedback.
- **Registered service providers:** The Welsh Automotive Forum has a directory of suppliers who are their members. These suppliers have been imported onto the platform allowing them to fulfil their service provider role.
- **End to end clustering**: A small reduction in overall end-to-end clustering time has been achieved using SCAPP to handle negotiation. However, our desired benefit of automating data input could not be achieved without the inclusion of the Open Call SE's.
- **Automation of tender input**: As above, we have not yet implemented Open Call SE's and therefore have not affected this KPI.

Number	**Indicators** *List the indicators that will help measuring the results of the living lab*	**DESCRIPTION** *Give a detailed description of the indicators*	Unit*	Current value	Future expected value	Expected date of achievement**
1	Reduced downtime	Amount of time lost due to breakdown in system	Hours per month per line	6	1	Before 24 months after implementation
2	Reduced waste of material due to failures	Damage caused to material by broken or worn tools	% per month per line	0.15	0.04	Before 24 months after implementation
3	Root cause analysis	Use of track and trace to identify root cause of defect in batch	Hours	30	12	After 24 months after implementation

Results will be available after disseminating the proof of concept platform to industrial partners within SMECluster. This will occur after the second development Sprint.

3.3. Data Gathering and Analysis

3..3.1. Misunderstanding in the intended functionality of GE/SEs

While we have had some experience with varied generic enablers we have not had the opportunity to explore the functionality of all Generic Enablers and Specific Enablers. This could be a potential bottleneck as a misunderstanding could affect all layers of the implementation from hardware to application layer.

3..3.2. Open source requirement

The open source nature of the FI-WARE enablers allowed us to derive functionality and intended use from GE/SEs even where a clear explanation was not provided.

3..3.3. Hardware incompatibility with GE/SE

Although the generic enablers support open standards the existing hardware which exists on the legacy PoC Machinery may not support these standards. This could have delayed trial implementation.

3..3.4. GE uses industrial standards

Our selected generic enablers used hardware standards which were widely supported by many OEMs such as Zigbee Gateway Device and LLRP. Despite our existing hardware being incompatible with some of these standards, it was easy to procure new hardware which matched these standards due to them being widely adopted.

3..3.5. Real tender data availability at time of instantiation.

The throughput of tendering of work can be an unpredictable business, with seasonal changes and business fluctuations real tender data could not be available at the time of testing. This could therefore have halted the operation of the trial. However, plenty of data was available at the time of trial experimentation, which helped support the business case for the trial, showing that our expectations of available data were lower than actually existed.

3..3.6. ZPA issue

When initially trying to use the ZPA, we encountered problems with retrieving data from the GE, as it did not support the querying of data. After contacting the GE owner, an updated version was released.

3..3.7. Benefits

The IoT smart factory platform is well-conceived and uses the NGSI protocol to easily integrate several disparate components from several vendors without the complexities of separately integrating each component.
Each SE and GE are open source by definition. This means it is possible to get an in-depth understanding of the software, and it is also possible to make modifications to suit your specific scenario without needing to contact the vendor.

3..3.8. Pitfalls

Be aware that many of the implementations lack API support; invisible integration into existing systems is not always possible. Enablers without APIs tend to have well-designed user interfaces which can be directly integrated; however this means several user interfaces being directed at users which could be confusing for potential customers.
Many of the implementations of the GE's are future-facing; support for legacy hardware is less prevalent. While it is simple enough to find hardware which will integrate with them, this is an additional cost which needs to be offset against potential savings from integrating FI-WARE technology.
It is quite difficult to set up many of the SE's/GE's from scratch, technical experience is a must. This should be a consideration for when planning, as we tended to find our timescales were extended by setup requirements.

3..3.9. Observations

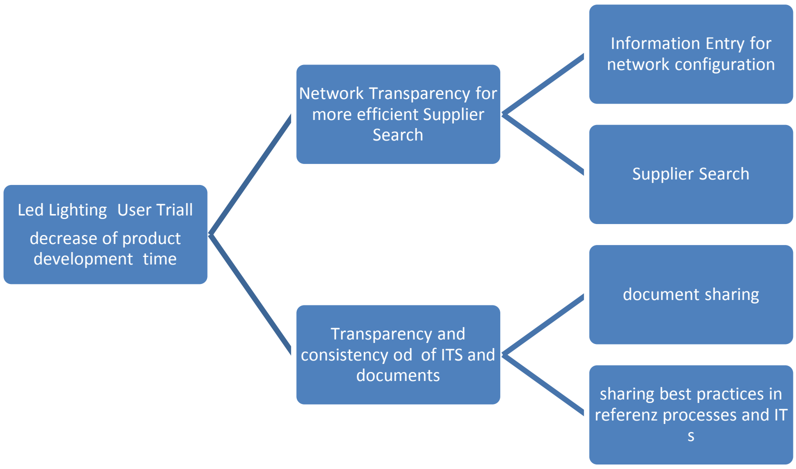
Many SE's and GE's were provided pre-installed on a VM. This made getting up and running easier in most situations, but in some situations made customisation of the running of an SE/GE more difficult.
Many of the SE's act as wrappers for existing open source software, while integrating GE's. Therefore there is usually documentation available online for these tools; however, utilising the SE's in this manner is complicated by accumulating a learning debt.

4. Led Lighting Trial COMPlus - IPK

4.1. Final Business Processes

The final Business processes from this trial are focused on two business scenarios.

- Network Transparency for a more efficient Supplier Network Configuration
- Communication Platform for a better transparency and coordination for sharing of best practices on business processes and used IT Tools.



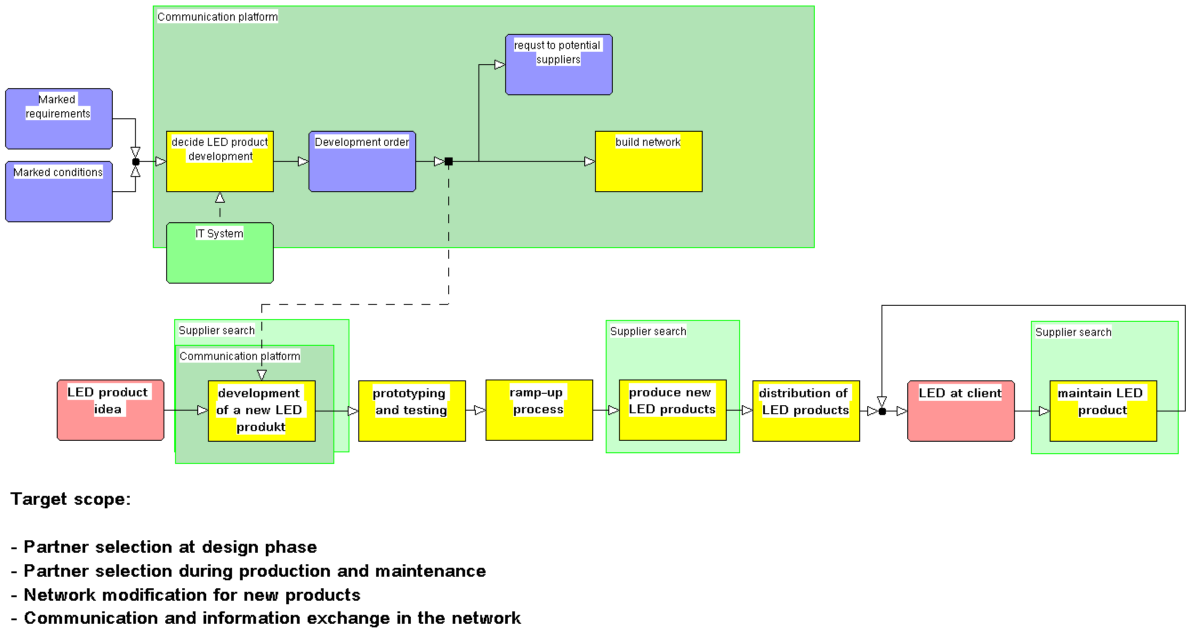
4..1.1. Business Scenario 1: Supply Network Transparency and Network Configuration

This Business Scenario covers two business processes, (1) information entry for configuration and transparency and (2) supplier search.

Currently, the LED Network acquires, plans and implements a LED Lighting System involving a number of interdisciplinary suppliers. At the present moment, the development of concept and setting a production network takes a long time, as all planning operations are performed on ad-hoc, using verbal communication with pure capabilities or synchronize information and data regarding requirements, business processes, possible supplier and their role in the supply network as well as variety of business processes and IT Tools. Triggered from both own ideas and customer orders, the network configuration and searching for companies with the corresponding capabilities are continuously performed in the following phases:

- At the design phase,
- During the production phase
- During the modification of the network for new products
- During the service providing for maintenance of the LED-Lighting Systems

The main aspect of the future business process is to enable the networked companies to access a collaborative environment in order to share knowledge about technological capabilities and best practices in an early design phase. Both business processes covered with this scenario are shown in the diagram bellow.



4..1.2. Business Scenario 2: Transparency and sharing of best practices on business processes and used IT Tools

The “Best Practice Service” supports an enterprise network like the LED network with information about tools and processes in terms of practices applied in the network. This comes with an evaluation service for the tools and processes. In this way the tools and processes used in the network can convert to a standard way of working. This will allow an easier sharing of documents and design descriptions but it will also simplify the extension and evolution of the network. New network partners will have an easy way to understand tools, formats and processes applied in the network and therefore they will have a better chance to be conforming to the network practices.

4.2. Experimentation Plan

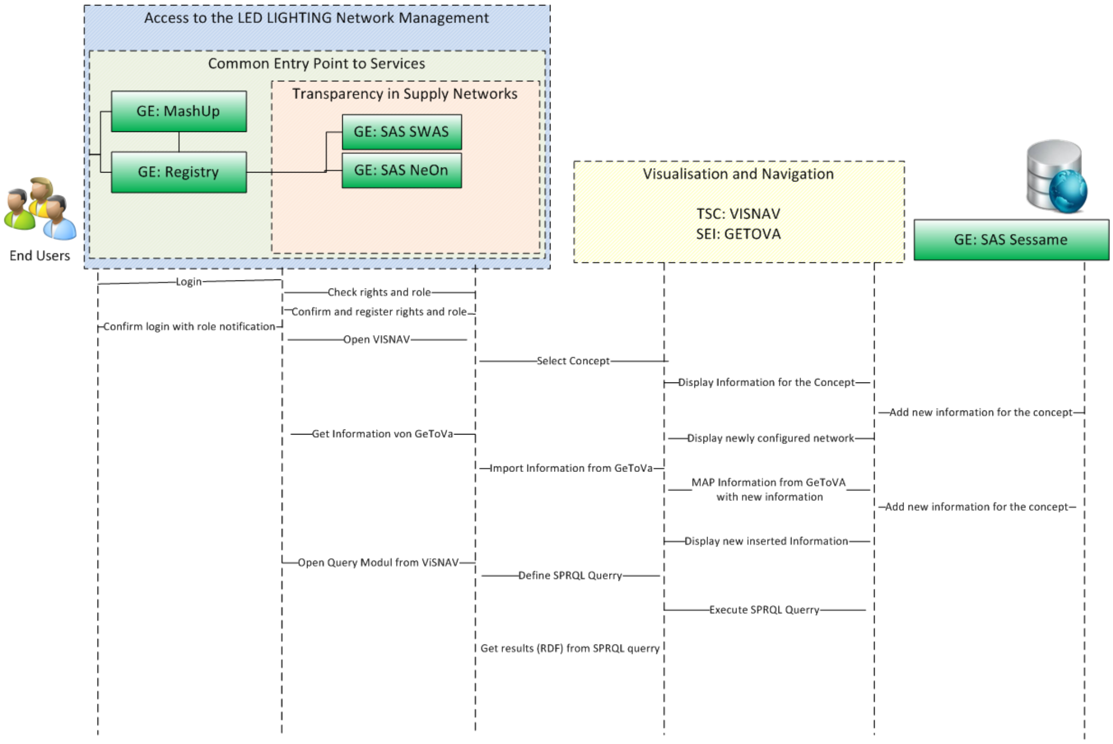
The experimentation plan leans on the development plan consequently. Each of the implementation phases was completed with the verification of the components involving primarily the network manager of the LED Lighting network. The implementation phases are as the following:

- First phase of implementation – Implementation of the business scenario for Network Transparency for a more efficient Supplier Network Configuration
- Second phase of implementation – Implementation of the Communication Platform for a better transparency and coordination for sharing of best practices on business processes and used IT Tools.
- Final Implementation – Implementation of the common entry point as an user interface for accessing the implementation in the previous implementation phases

4..2.1. First Implementation Phase

The first phase is the foundation phase to provide functionalities needed by the business scenario of the supply network visualization and supplier search, as well as a set of SEIs needed to support the collaborative work and interoperability within the supply network.

This process is illustrated with the following sequence diagram, where the user get an access to the system and activates the VisNAv Application. Using the edit space of the solution, new data can be entered and interlinked with the existing network. In addition to this, the user can import information processed from the external sources like company profiles.
Using the VisNav component, the user can search for information using the Query space of the VisNav solution.



In this implementation phase, the LED - Trial uses the GE- Semantic Application Support, presenting a set of tools for creating, importing, publishing of ontologies, as well as creation and management of user workplaces, in this case the workplace of the Supply Network Manager.

The Semantic Application Support GE will be used to support the under the Business Scenario for "Network Transparency for more efficient Supply Network Configuration". Based on the existing ontology for Supply Networks, this GE will mainly test the ability to manage multiple ontologies. This GE supports the semantic applications with the infrastructure to develop storage and use of ontologies, which helps the users to efficiently manage their knowledge base. The Semantic Application Support GE is a set of tools to facilitate the development of Semantic Web Applications, composed of:

- Creating and Import of Ontologies using the NeOn Toolkit
- Ontology Registry – used for ontology storage, versioning and publication of ontologies SESAME
- Using of the TSC VisNav – Visualisation and Navigation of Supply Networks

The initial creation, modification and import of ontologies are performed using the baseline asset NeOn Toolkit. The NeOn Toolkit is a state-of-the-art, eclipse based, open source multi-platform ontology engineering environment, which provides comprehensive support for the ontology engineering life-cycle. This GE will be upgraded with the Trial Specific Component for visualisation and navigation of the supply networks. This will enable the Network

Manager as an end user to use this solution as a web service independent from the IT specialist.
The backbone of this trial is the LEDNetwork Ontology (LEDSupplyNetwork.owl) based on the generic SupplyNetworkSchema, a generic ontology for creation of customized ontologies describing concrete supply networks.

The Collaborative work within the Supply Network will be supported using the following SEIs:

- SEI_7 Collaboration Platform BP Mgmt
  - Collaborative business processes calling transformation services
- SEI_6 Metadata Ontologies Semantic Matching
  - Generation of the XSLT starting from Transformation generation
  - Automatic registration in SEI_8
- SEI_8 Data Interoperability Platform Services
  - Store transformation services

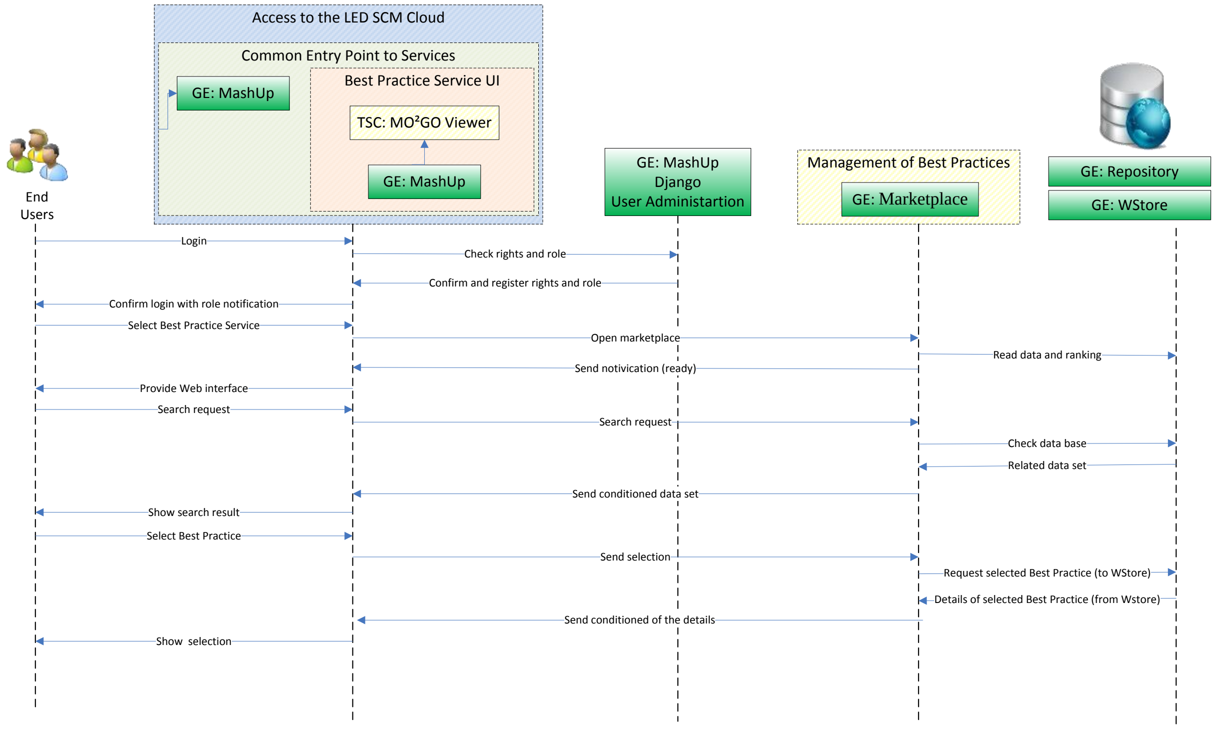
4..2.2. Second phase of implementation

The second business scenario "Transparency and Consistency of the ITs and Business Processes", will be implemented during the second phase.

The user tries to understand what the best practices are in the supply chain network in terms of IT solutions and processes. This implies the FI-ware marketplace GE which is used to manage the best practices of tools and processes. These best practices are previously entered by an administrator which is usually the enterprise network manager. The user now checked the potential solution as well as the related evaluations and selects the most suitable versions to work in the enterprise network. The tools and processes are provided via the data stored in the best practice service data repository represented by the FI-ware repository and WStore GE. For reading the best practice process structure a process viewer is used depending on the format. This can be realized by WEB browser and SVG, JAVA MO²GO Process Viewer. After some time of usage of the selected best practices the user comes back to the platform and provides an evaluation of the used tools and services. This supports a continuous improvement of the best practices because the network administrator can now provide improved best practices based on the experiences of the users.

The sequence diagram represents the part of searching and selecting best practices from the workflow described before.

Sequence of Personalized Dashboard:
1) User login into the cloud. User will receive the authorisation if the evaluation of the user rights were successful.
2) The authorisation will be registered for the session.
3) The selected the "Best Practice Service" from a list of possible services.
4) The user gets a web interface of the marketplace.
5) The user insert a request via search service and gets a list of potential best practices
6) The user selects a best practice to get more details about it.



4..2.3. Final implementation

At the third implementation phase, the LED Trial platform includes the implementation of the Fi Ware components needed to support the business processes which are defined within the LED Lighting scenario.

The LED LightingTrial emphasised a private cloud infrastructure hosted and maintained by COMplus. This was supposed to give the opportunity to the Network Manager to use the functionalities and the trusted environment of a dedicated Private Cloud hosted exclusively for the LED Supply Network. For this reason, and Open Stack cloud is being used enriched with the GEs from the FI WARE Cloud Chapter. This however, proved to require resources beyond the capabilities of COMplus, and therefore, this implementation of this trial is offered via a common entry point to the LED Lighting Web Platform

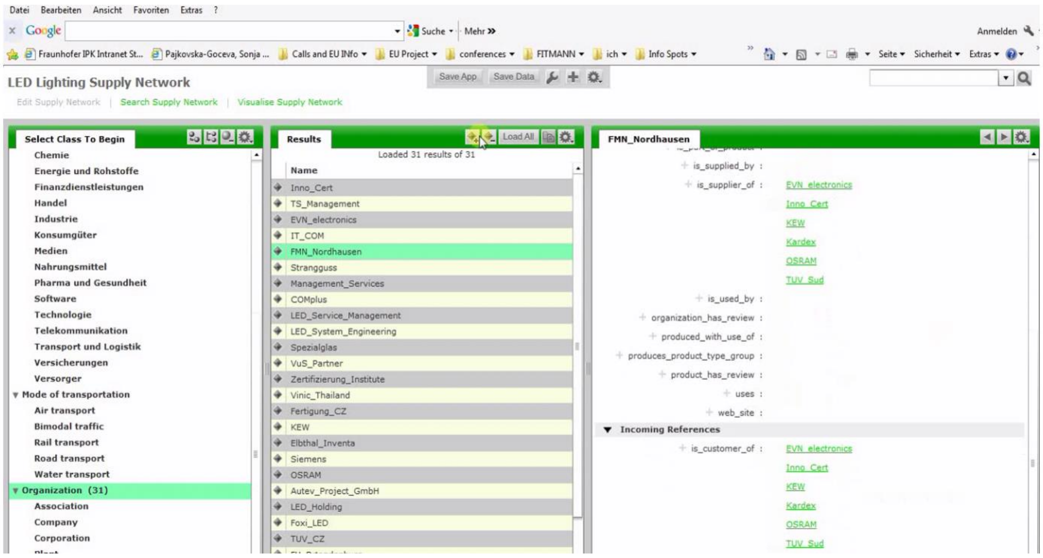
During the last final phase, the LED trial solution matured in all scenarios of the defined business processes.

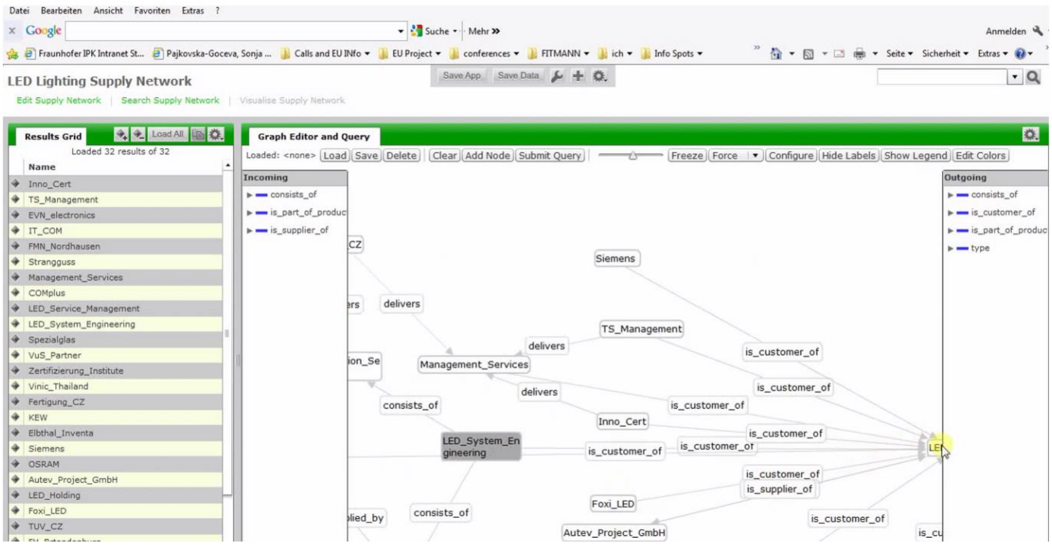
- Network Transparency for a more efficient Supplier Network Configuration
  - Information base for Network Configuration
  - Supplier Search
- Communication Platform for a better transparency and coordination for an improved transparency of used IT Tools and best practices business processes
  - Document sharing
  - Best Practices on business processes and IT Tools sharing

The main improvement on this phase was focused on the development of the Web Based user interfaces.

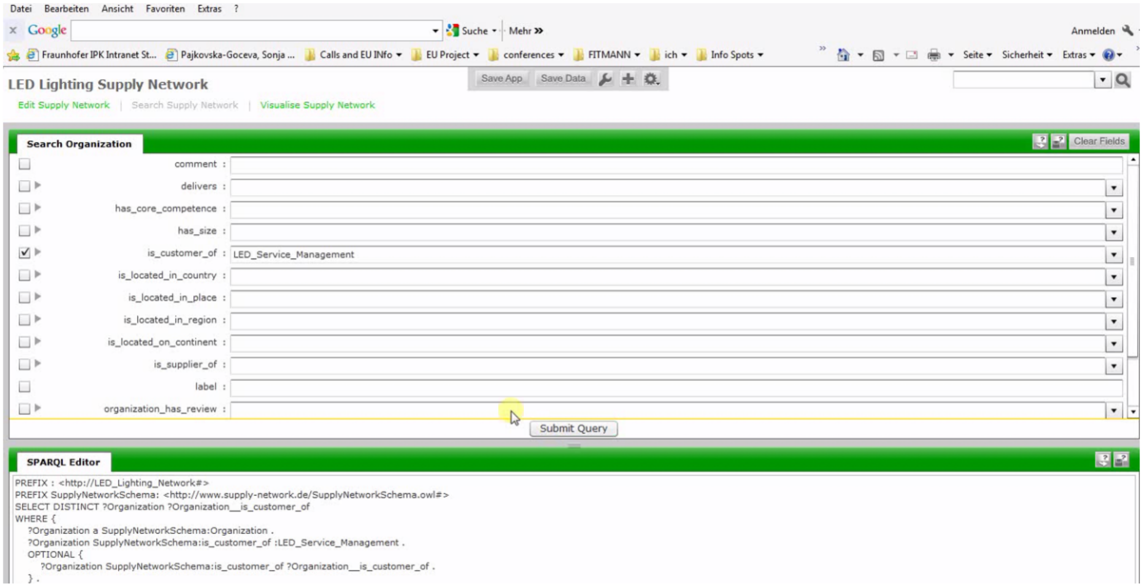
4..2.3.1 Scenario 1 Supplier Network transparency and configuration

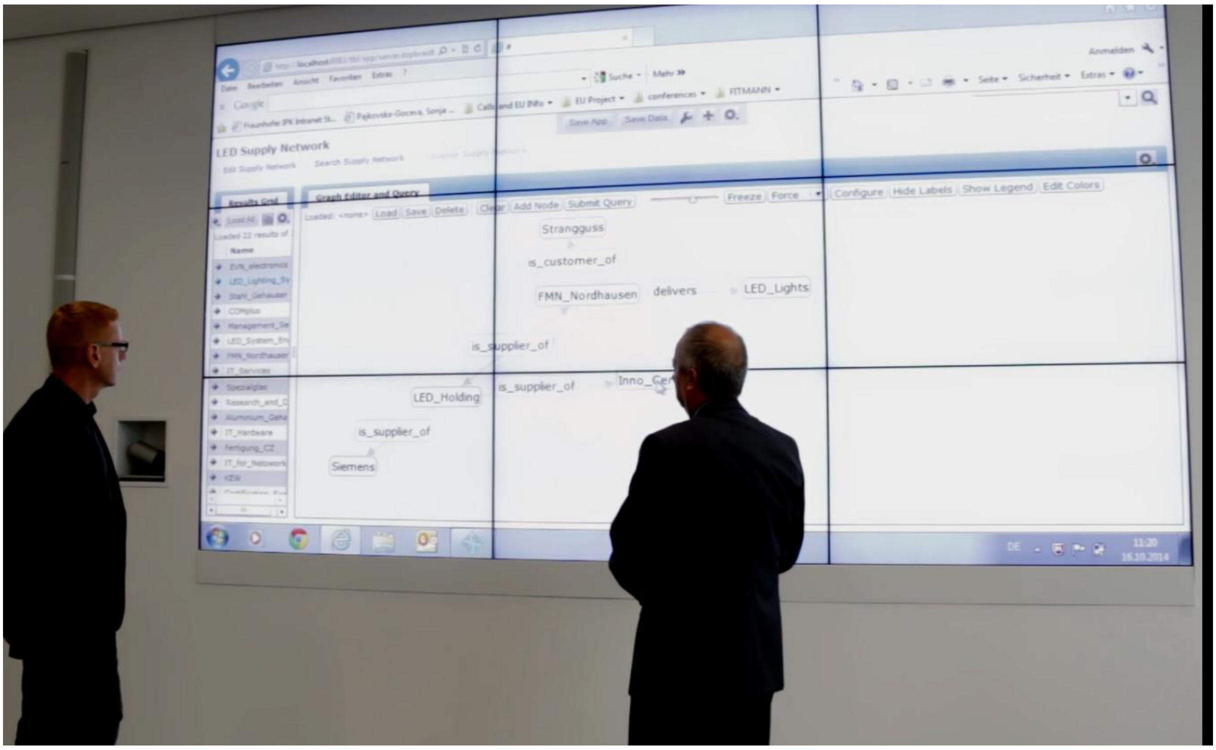
The user is accessing the platform via a Common Entry Point to the environment, provided as a web services or a private cloud infrastructure and have an access to the provided Services. Using the UI of the TSC VisNav – Visualisation and Navigation, the user can have a holistic view on his Supply Network.





The user can navigate through the network by selection of elements and dependencies of interest, and create customized views on the multi-tier network or specify and execute semantic queries for information retrieval from the network. Furthermore, the user can use this TSC to maintain the Network Knowledge Base by entering new information relevant to the supply network.

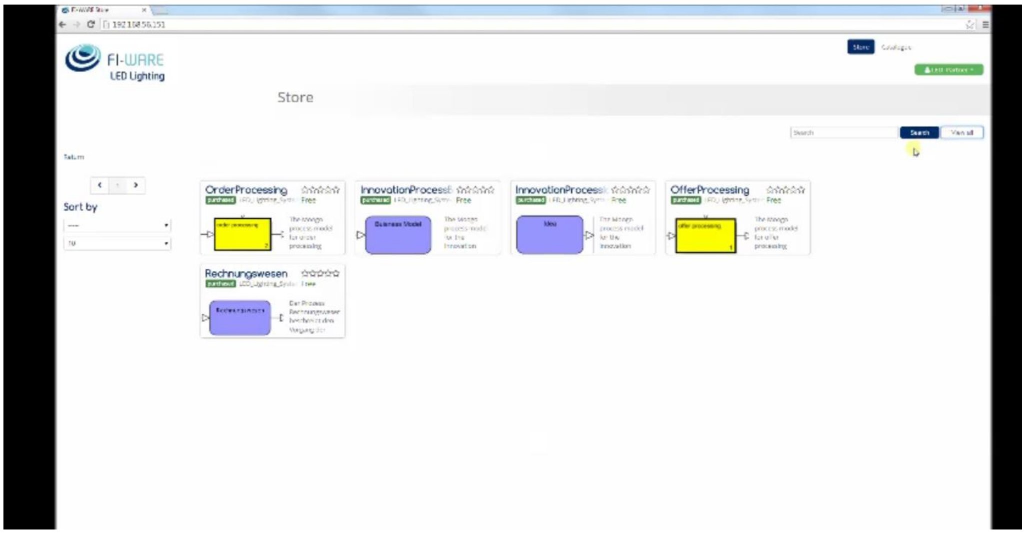




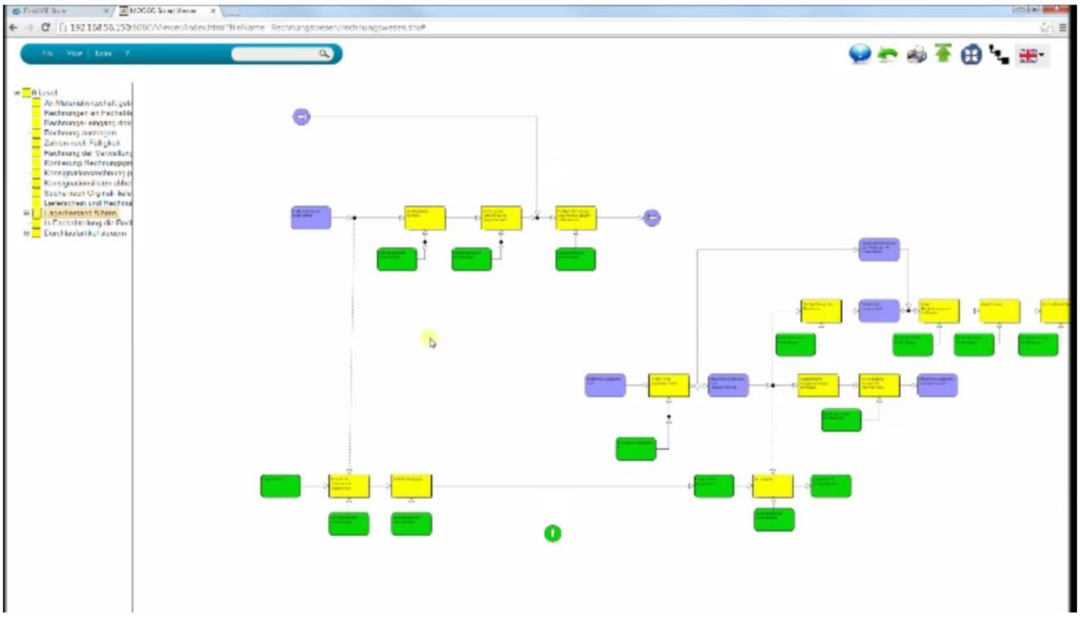
4..2.3.2 Scenario 2 Best practices and IT solutions inventory

The user tries to understand what the best practices are in the supply chain network in terms of IT solutions and processes. Therefore the user starts the best practise service of the network to check the practises applied within the network. The user intends to do it on a business trip and will use a PTA to access the LED supply chain cloud of the network. After the login the user reaches the common entry page which provides the accessible web services.

Now the user starts the best practise service to search for potential solutions for the company of the end user. This implies the FI-ware marketplace GE which is used to manage the best practises of tools and processes. These best practises are previously entered by an administrator which is usually the enterprise network manager. The user now checked the potential solution as well as the related evaluations and selects the most suitable versions to work in the enterprise network. The tools and processes are provided via the data stored in the best practise service data repository represented by the FI-ware repository and WStore GE. For reading the best practise process structure a process viewer is used depending on the format. This can be realised by WEB browser and SVG, JAVA MO²GO viewer, the Compel BPMN representation or other process viewers.



After some time of usage of the selected best practices the user comes back to the platform and provides an evaluation of the used tools and services. This supports a continuous improvement of the best practices because the network administrator can now provide improved best practices based on the experiences of the users.



4.3. Data Gathering and Analysis

On behalf of COMPlus, two members of the Trial team have posted their responses to the Community-based Survey.
The two team members agree that it is easy to start to use the solution and learn its functionalities and that it is attractive to the average user. However, - from a technical point of view – focusing on the fulfilment of the requirements and on the efficiency of the solution, one of the two members has objections, believing that the solution should be more efficient and that some of the requirements are not fulfilled in the way it was expected.

Technical Indicator	Responses		Average
	1	2	
Fulfilment of requirements	I agree	I disagree	I agree (50%) + I disagree (50%)
Learnability	I agree	I agree	I agree (100%)
Understandability	I agree	I agree	I agree (100%)
User's attraction level	I agree	I agree	I agree (100%)
Efficiency	I agree	I disagree	I agree (50%) + I disagree (50%)

Table 1 : Trial Solution Technical Indicators by COMPLUS

The trial experimentation process is performed based on the following functionalities and actions as following:

Conclusions
Based on the present test it is shown that the given GEs deliver limited functionalities and possibility to interlink and integrate within the platform. This impacts the creation of a fully fiunctional platform.

- GE Semantic Application Support – provides services for management of ontologies, including entering of new data for enrichment of the knowledge base. The first implementation and test show that part of this GE related to the NEON Ontology Management tools gives the functionalities for ontology management. However, this is a single user application and does not this GE does not deliver a User Interface, which makes it difficult for the end user
- The implementation of the GE- Mashup Wirecloud, GE marketplace , GE WStare, GE Repository resulted with difficulties of wiring the tool chains. After analyzing the source code of the WStore we found out that in order to connect Marketplace and WStore, a specific user/ password needs to be present in the database of the marketplace and the marketplace application has to be renamed so that it is accessible under a specific name
- GE Wirecloud Mashup – additional adjustments to the database were needed as the accessibility to the database was not possible.
- During the user trial, efforts have been made to use the GEs from the cloud chapter in order to provide a private cloud infrastructure for the networked enterprises. Further efforts were made to use the Open Stack Cloud, which faced difficulties as OpenStack requires a pool of public IP addresses to access the virtual machines.

Bottlenecks
Based on the present test it is shown that the given GEs shows the following bottlenecks:

- GE Semantic Application Support – provides services for management of ontologies, including entering of new data for enrichment of the knowledge base. The first implementation and test show that this GE does not deliver a User Interface, which makes it difficult for the end user.
- A specific challenge is the compatibility and robustness of the required tool chains. GE marketplace, GE WStare, GE Repository and the GE Mashup has to work together. It is not easy to install them and also the documentation is fragmented. The marketplace is configured via WStore in USDL. The option to create the USDL via LinkedUSDL is difficult because the consistence is not checked and created files are not readable by WStore. Only the graphical interface of WStore can be used to create the USDL in WStore. This can affect the completeness and usability of the best practice service. The mashup and the WStore requires in the trial separate access.
- SE "collaborative asset management" is also experienced in the trial instead of the original marketplace approach. The challenge is that it requires a specific predefined ontology which has to be provided by experts. Also it is difficult to access the service externally and not in the same way as the other GEs.

5. CONCLUSION

The Virtual factory trials have satisfactorily integrated and tested their GE's, SE's and TSC that were appropriate to the end user partners. The Harmonize development of the experimentations, share experiences and the general approach to this deliverable resulted in a common output format by each of the trials specifying their own requirements and needs of their end users.

The continuous adaptation of the *FITMAN System* for the three FITMAN Virtual Factory Trials based on the *FITMAN Virtual Factory System for Trials* described in document D6.1 is documented accompanying the technical prototype of the M18 trial. Similarly to D6.1 the document collects not only the different components that composes the Virtual Factory Platform (GEs, SEs and TSCs of each virtual trial), but also the workflows showing the relation between all these components. In this version the Specific Enablers coming from the Open calls, namely MoVA (Management of Virtual Assets) and GeToVa (Generation and Transformation of Virtualized Assets) are introduced in the architecture and will be instantiated in trials in coming months. The new SEs are duly described in deliverable D14.1.

By conducting the trails in the different contexts meant that the generic Virtual factory platform could be aligned to a wider audience of manufacturing companies to give them a methodology and approach for integrating the components from the FIWARE catalogue relevant to their own needs. This approach can be further expanded to other SME's and Web Entrepreneurs potentially in the next call for SME participation.