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AEGIS

Advanced Big Data Value Chains for Public Safety and Personal Security

WP5 – AEGIS Data Value Chain
Early Community Demonstrators

D5.4 – Demonstrators Evaluation and Feedback – v2

Version 1.0

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AEGIS KEY FACTS

Topic:	ICT-14-2016 - Big Data PPP: cross-sectorial and cross-lingual data integration and experimentation
Type of Action:	Innovation Action
Project start:	1 January 2017
Duration:	30 months from **01.01.2017** to **30.06.2019** (Article 3 GA)
Project Coordinator:	Fraunhofer
Consortium:	10 organizations from 8 EU member states

AEGIS PARTNERS

Fraunhofer	Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V.
GFT	GFT Italia SRL
KTH	Kungliga Tekniska högskolan
UBITECH	UBITECH Limited
VIF	Kompetenzzentrum - Das virtuelle Fahrzeug , Forschungsgesellschaft-GmbH
NTUA	National Technical University of Athens – NTUA
EPFL	École polytechnique fédérale de Lausanne
SUITE5	SUITE5 Limited
KONKAT	ANONYMOS ETAIREIA KATASKEVON-TECHNIKON ERGON, EMPORIKON, VIOMICHANIKONKAI NAUTILIAKON EPICHEIRISEON KON'KAT
HDIA	HDI Assicurazioni S.P.A

EXECUTIVE SUMMARY

The scope of deliverable D5.4 is to document the efforts undertaken within the context of Tasks 5.2, 5.3, 5.4, 5.5 and 5.6 of WP5. Towards this end, the deliverable builds on top of the work and outcomes of deliverables D5.1, D5.2 and D5.3 in order to report the progress of the AEGIS demonstrators, as well as to perform the evaluation of the AEGIS platform and the AEGIS demonstrators during the second (medium) phase of the AEGIS demonstrators' implementation.

Within the context of the deliverable D5.4, the AEGIS demonstrators' operation and execution during the implementation phase of the second (medium) version of their implementation is documented. In accordance with the AEGIS evaluation framework, the evaluation of both the AEGIS platform and AEGIS demonstrators is performed following both quantitative and qualitative methods.

To meet its goal, D5.4 starts with a detailed description of the evaluators that were defined in the AEGIS evaluation framework, providing details with regards to their technical background and expertise, their role in the project and their involvement in the evaluation. Following the presentation of the evaluators, the results of the holistic evaluation of the AEGIS platform v2.00 are presented. The quantitative evaluation was performed based on the list of KPIs that were defined in deliverable D5.2, while the qualitative evaluation was performed with the help of small focus groups consisting of data scientists and developers that were involved in the implementation process of the second (medium) version of each demonstrator. The results of both methods are presented, followed by a description of the challenges encountered by the demonstrators with respect to the AEGIS platform and a series of recommendations for the enhancement of the AEGIS platform.

Furthermore, deliverable D5.4 provides an overview of the current status of each demonstrator, describing in details the work that was performed during the implementation of the second (medium) version of the demonstrators. Additionally, the results of the scenarios that were executed for each demonstrator are presented with details for each step performed on each scenario. Following the scenarios execution, the results of the two-fold approach of the AEGIS evaluation framework for the evaluation of each demonstrator are presented, providing the results of the quantitative evaluation based on a list of demonstrator-specific KPIs and the qualitative evaluation based on the small focus groups that were conducted by each demonstrator. Finally, the challenges faced during the implementation of each demonstrator and a set of recommendations for the upcoming version of the demonstrators are presented.

In the next steps the outcomes and knowledge extracted from this deliverable will be further analysed by the AEGIS platform developers in order to plan and implement the necessary refinements and updates in the AEGIS platform that will address the demonstrators' and the AEGIS stakeholders' needs. It should be noted that the demonstrator evaluation and feedback is a living process that will last until M30, when the final demonstrator evaluation and feedback (corresponding to D5.5) and the final evaluation, impact assessment and adoption guidelines (corresponding to D5.6) will be delivered.

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ABBREVIATIONS

AAL	Active and Assisted Living
API	Application Programming Interface
CO	Confidential, only for members of the Consortium (including the Commission Services)
CPU	Central Processing Unit
CSP	Care Service Provider
CSV	Comma Separated Values
D	Deliverable
DoW	Description of Work
H2020	Horizon 2020 Programme
GUI	Graphical User Interface
HVAC	Heating Ventilation and Air Conditioning
IT	Information Technology
JSON	JavaScript Object Notation
KPI	Key Performance Indicator
PSPS	Public Safety and Personal Security
R	Report
RTD	Research and Development
SHAL	Smart Home and Assisted Living
UI	User Interface
VOC	Volatile Organic Compounds
XML	Extensible Markup Language
WP	Work Package
Y2	Year 2

1. INTRODUCTION

The scope of the current section is to introduce the deliverable and familiarise the user with its contents. Towards this end, the current section summarises the objective of the current deliverable, its relation with the other work packages and corresponding deliverables and analyses its structure.

1.1. Objective of the deliverable

The scope of deliverable D5.4 is to document the efforts undertaken within the context of Tasks 5.2, 5.3, 5.4, 5.5 and 5.6 of WP5. Within the context of this deliverable, the AEGIS demonstrators' implementation and execution details during their second (medium) version are presented. Furthermore, this document presents the results of the evaluation of the second version of the demonstrators. Besides the demonstrators' evaluation, the scope of this deliverable is to document also the evaluation of the AEGIS platform v2.00.

At first, a detailed description of the profile of the evaluators within the context of the AEGIS evaluation framework is presented. Their presentation is focusing on their technical background and experiences, the role in the project and their involvement in the evaluation process. It should be noted that the description is already covered in deliverable D5.3, however it is included in this deliverable also for coherency reasons.

Following the comprehensive description of the evaluators, the results of the evaluation of the AEGIS platform are presented. The evaluation was performed on the version of the platform that was utilised during the implementation of the second (medium) version of the demonstrators. For the evaluation process both quantitative and qualitative methods were followed. Especially for the case of the qualitative evaluation, small focus groups were conducted by each demonstrator with the involved parties in the implementation activities. The results indicated the challenges faced by each demonstrator with regards to the AEGIS platform, as well as a series of recommendations for the further improvement of the AEGIS platform.

In addition to the platform evaluation, the demonstrators' evaluation is documented. For each demonstrator a detailed overview of the current implementation status is presented, as well as the implementation details for the worked performed for the second (medium) version of each demonstrator. For each scenario that was executed within the context of the second (medium) version of each demonstrator, as documented in deliverable D5.2, the results are presented. More specifically, for each step of the scenarios the execution results along with the corresponding execution details are presented.

Following the execution results of the scenarios, for each demonstrator the evaluation is performed in accordance with the AEGIS evaluation framework. As with the platform evaluation, the demonstrator evaluation is also following both quantitative and qualitative methods and for the qualitative evaluation small focus groups were conducted. The results of the evaluation are presented, followed by a detailed description of the challenges faced during the implementation of the demonstrator and a series of recommendations for the next version of each demonstrator.

1.2. Insights from other tasks and deliverables

The deliverable builds on top of the work reported in WP5. In particular, the previous outcomes of the work performed in WP5, as reported in D5.1, D5.2 and D5.3, provided the AEGIS evaluation framework, as well as the methodology on how to implement the framework during the implementation phase of the three demonstrators of the AEGIS project.

The outcomes of the deliverable D5.2 served as guidance on how the evaluation of both the AEGIS platform and the AEGIS demonstrators will be performed. The AEGIS platform evaluation plan, as well as the scenarios defined for each demonstrator and the documented evaluation plan for each demonstrator have driven the assessment performed during the second (medium) version of the demonstrators.

The outcomes of the deliverable D5.3, where the first (early) versions of the demonstrators were evaluated, guided the implementation of the second (medium) version of the demonstrators. The challenges faced and the recommendations were taken into consideration from the development team of each demonstrator.

1.3. Structure

Deliverable D5.4 is organised in seven main sections as indicated in the table of contents:

- The first section introduces the deliverable. It documents the scope of the deliverable and briefly describes how the document is structured. It also documents the relation of the current deliverable with the other deliverables, and how the outcomes of other deliverables are received as input to the current deliverable.
- Following the introductory section, the second section describes the evaluators involved in the AEGIS evaluation framework, providing information of their technical background and knowledge, how are they related to the project and their involvement in the evaluation.
- The third section documents the results of the evaluation of the AEGIS platform v2.00. In this section both the results of the quantitative and the qualitative evaluation are documented. Additionally, in this section the challenges faced related to the AEGIS platform during the second (medium) version of the demonstrators are documented and a series of recommendations for the enhancement of the platform are presented.
- Following the third section, the upcoming sections are presenting the current status and the evaluation of each one of the three AEGIS demonstrators, section four for the Automotive demonstrator, section five for the Smart Home & Assisted Living demonstrator, and section six for the Insurance demonstrator. At first, for each demonstrator the overview of the demonstrator and the current status is documented. Following the current status description, the results of the scenario(s) execution within the context of the second (medium) version of the demonstrator are documented. Following the scenarios execution, the demonstrator evaluation is presented, providing the results of both the quantitative and qualitative evaluation for each demonstrator. At last, the challenges faced during the implementation of the demonstrator are presented along with a list of recommendations for the upcoming versions of the demonstrator.
- Section 7 concludes the deliverable. It outlines the main findings of the deliverable, which will guide the future research and technological efforts of the consortium.

2. AEGIS EVALUATORS

It should be noted that this section is provided for coherency reasons and there are no changes from the information included in deliverable D5.3.

The AEGIS evaluation framework, as documented in D5.1 and D5.2, is aiming at evaluating the AEGIS platform in terms of how it addresses the requirements and expectations of the AEGIS PSPS stakeholders of the three demonstrators and beyond. The AEGIS evaluation framework is also aiming at performing a holistic evaluation of the platform. As such, the evaluators included in the framework are the main direct beneficiaries of the AEGIS platform, which are the PSPS data scientists from the three different sectors that will develop the data-driven AEGIS PSPS services and the PSPS end users for the corresponding sectors that will consume the developed services. Additionally, the AEGIS platform developers are also involved in the evaluation framework in order to assist in the evaluation focusing mainly on the technical evaluation of the platform.

In the forthcoming subsections, the AEGIS evaluators are described focusing on their profile, role in the project and their involvement in the evaluation.

2.1. PSPS Data Scientists

In general, a data scientist is a professional that collects, analyses and extracts information from large amount of data using a variety of big data analytic tools, in order to extract useful information and insights that will help a business improve operations and gain competitive advantage over rivals or provide the necessary results and advancements in a research program. Data scientists have the experience and proper skills to use advanced analytics technologies that include machine learning and predictive modelling techniques, in order to unveil useful insights beyond statistical analysis. Nowadays, with the data explosion from the voluminous amounts of data produced and collected from various heterogeneous sources the role of the data scientists has become very crucial for the enterprises and organisations towards the aim of maximising the results of the data processing.

In terms of evaluation, the data scientist is one of the most important stakeholders for a Big Data analytics ecosystem. The mix of experience and analytics skills makes the data scientist the most appropriate person to perform the evaluation and identify the deficiencies of the processes and tools of the platform. Through their extended experience and usage skills with a variety of tools and technologies related to big data analysis, data scientists are able to evaluate and propose the best practises in the data collection, data management, data processing and data analysis processes.

In the context of the AEGIS project PSPS data scientists from three different sectors will be involved in the development of the AEGIS PSPS services:

- PSPS data scientists from the automotive sector. In the context of the AEGIS Automotive demonstrator, the PSPS data scientists from VIF will implement the data-driven automotive services that will create data-driven workflows on the AEGIS

platform by exploring the relevant collected vehicle data and other automotive-related sources.

- PSPS data scientists from the smart home and assisted living sector. In the context of the AEGIS Smart Home and Assisted Living demonstrator, data scientists from Konkat, UBITECH and Suite5 will implement a series of data-driven services that will create data-driven workflows on the AEGIS platform by exploring the collected data from smart home devices, wearables and other assisted living devices.
- PSPS data scientists from the insurance sector. In the context of the AEGIS insurance demonstrator, PSPS data scientists from HDI will implement the data-driven Insurance services that will create data-driven workflows on the AEGIS platform by analysing the events detected by the AEGIS tools after exploring data for weather, news and crime open data.

In accordance with the AEGIS Evaluation Framework that is documented in deliverable D5.1, the PSPS data scientists from the three different sectors mentioned above will be involved in the evaluation of the AEGIS platform. More specifically, the AEGIS platform will be evaluated in terms of functionalities offered by the platform and required by the PSPS data scientists in order to implement the PSPS data-driven services through the AEGIS demonstrator-specific evaluation cases. Additionally, the PSPS data scientists will participate in guided interviews that will also evaluate the perceived usefulness and usability of the service design process.

2.2. PSPS End Users

The PSPS end users are experienced professionals from different sectors with different technical and theoretical background. As such, the PSPS end users have different requirements and expectations from the AEGIS platform from the rest of the stakeholders. The PSPS end users are the main consumers of the AEGIS PSPS services that will be developed from the PSPS data scientists. Their expectations vary depending on the requirements of their corresponding sectors but in general, the main goal of the PSPS end user is to exploit the platform and the developed services with the aim of enhancing a process, a product or a service and in some cases introducing new ones.

In terms of evaluation, the end user is an important stakeholder for a Big Data analytics ecosystem. The end user is the most appropriate person to perform the evaluation and identify the deficiencies of the usefulness of the platform in order to fulfil their tasks and gain valuable insights, as well as of the usability, ease of use and quality of the platform. As the consumers of the PSPS data-driven services, the end users are able to evaluate the features of the platform, as well as the added value offered by the services developed by the PSPS data scientists.

In the context of the AEGIS project PSPS end users from three different sectors will consume the AEGIS PSPS services developed by the involved PSPS data scientists:

- PSPS end users from the automotive sector. In the context of the AEGIS Automotive demonstrator, the PSPS end users from VIF will consume the AEGIS PSPS services created by the corresponding PSPS data scientists within the AEGIS Automotive demonstrator. The end users will evaluate the services in terms of gaining valuable insights for safer driving and safer roads by the analysis of the driving styles and driving behaviour.

- PSPS end user from the smart home and assisted living sector. In the context of the AEGIS Smart Home and Assisted Living demonstrator, PSPS end users from Konkat, UBITECH and Suite5 will consume the AEGIS PSPS services created by the corresponding PSPS data scientists within the AEGIS Smart Home and Assisted Living demonstrator. The end users will evaluate the services in terms of efficiency and effectiveness in monitoring at-risk individuals and patients, in case the of care providers or doctors, and in terms of usefulness, usability and non-intrusive behaviour in assisting their everyday lives in the case of at-risk individuals and patients.

- PSPS end users from the insurance sector. In the context of the AEGIS insurance demonstrator PSPS end users from HDI will consume the AEGIS PSPS services created by the corresponding PSPS data scientists within the AEGIS insurance demonstrator. The end users will evaluate the services in terms of benefits achieved by the developed services, the legibility of the produced reports and the customer's feedback depending on their role in the company.

In accordance with the AEGIS Evaluation Framework that is documented in deliverable D5.1, the PSPS end users from the three different sectors mentioned above will be also involved in the evaluation of the AEGIS platform. More specifically, the experiences and satisfaction of the PSPS end users in regards to usefulness, usability and business relevance of the developed PSPS data-driven demonstrator services will be leveraged and will be included in the holistic evaluation of the AEGIS platform with the use of guided interviews.

2.3. AEGIS Platform Developer

The AEGIS platform developer is the experienced professional involved in the development process and production of the platform. The platform developer has extended technological know-how and experience in the Big Data technologies and tools, as well as in the software design and implementation. The platform developer is involved in all the relative phases of the platform development, from the requirements elicitation and the extraction of functional requirements, the design and specification of the platform components and architecture to the implementation and integration of the AEGIS platform. The AEGIS platform developer is aiming at developing and offering novel services and applications that will allow data scientists from the PSPS-related industries to develop advanced and intuitive PSPS data-driven services that will be exploited by the PSPS end users.

In terms of evaluation, the AEGIS platform developer is the most appropriate person in order to assist in the AEGIS platform evaluation in terms of software quality characteristics. The software quality characteristics are measured with the list of technical Key Performance Indicators (KPIs) of the AEGIS platform, as defined in section 2.1 of D5.2, and is related to the quantitative evaluation of the AEGIS platform that will be executed by the AEGIS platform developers.

3. AEGIS PLATFORM EVALUATION

As already described in the previous deliverables of WP5, the AEGIS evaluation framework is aiming at performing a holistic evaluation with a two-fold purpose: a) to capture the satisfaction of the AEGIS PSPS stakeholders with the platform, and b) to provide valuable feedback to the AEGIS platform developers that will drive the enhancements and refinements of the AEGIS platform towards the success of the AEGIS project.

According to the AEGIS evaluation framework, the AEGIS platform evaluation will be performed in three iterations in order to be aligned with the three phases of the demonstrators' implementation. The first iteration was conducted at M18 and the results were documented in deliverable D5.3, the second iteration has been conducted within the context of this deliverable which is delivered at M24, while the final iteration will be conducted at M30 and the results will be documented in deliverable D5.5. On each iteration, the focus is on providing the useful insights on the requirements and expectations of the AEGIS PSPS stakeholders on each corresponding phase.

With regard to the AEGIS platform evaluation, as described in detail in deliverable D5.2, again a two-fold approach is followed. On the one hand, the AEGIS platform is evaluated following the quantitative method that is based on a list of Key Performance Indicators (KPIs), also defined in deliverable D5.2, and on the other hand, the AEGIS platform is also evaluated following the quantitative method via guided interviews or small focus groups with key stakeholders.

The following subsections of the current section present the results of both the quantitative and the qualitative evaluation of AEGIS platform that was conducted during the second (medium) version of the of the demonstrators' implementation. Following the presentations of the evaluation results, a description of the challenges faced during the implementation of the second (medium) version of the AEGIS demonstrators with regard to the AEGIS platform and its offerings. Furthermore, the current section concludes with a set of recommendations from the demonstrator partners for the final version of the platform.

3.1. Quantitative Evaluation of the AEGIS platform

For every technological project in scale, the quality measurement of the developed solution has become increasingly important, especially when different people are involved in the various parts of the developed solution. For this reason, the continuous monitoring and improvement of quality characteristics of the developed solution is very important towards the aim of safeguarding the desired level of quality for the developed solution.

As defined in the AEGIS evaluation framework, the quantitative evaluation of the AEGIS platform aims at the evaluation of the software quality characteristics of the platform in order to perform the technical evaluation. For this purpose, as it was described also in deliverable D5.2, the software quality characteristics and the software product evaluation process model as defined by the ISO/IEC 25010:2011 were used as a guidance in order to generate the list of technical KPIs of the AEGIS platform.

The list of technical KPIs derived from the following software quality characteristics as proposed by ISO/IEC 25010:2011:

- Functional suitability
  - Functional completeness
  - Functional correctness
  - Functional appropriateness
- Performance efficiency
  - Time behaviour
  - Resource utilisation
  - Capacity
- Compatibility
  - Co-existence
  - Interoperability
- Usability
  - Appropriateness recognisability
  - Technical Learnability
  - Ease of Use
  - User error protection
  - User interface aesthetics
  - Technical Accessibility
- Reliability
  - Maturity
  - Availability
  - Fault tolerance
  - Recoverability
- Security
  - Confidentiality
  - Integrity
  - Non-repudiation
  - Accountability
  - Authenticity
- Maintainability
  - Modularity
  - Reusability
  - Analysability
  - Modifiability
  - Testability
- Portability
  - Adaptability
  - Replaceability

Through the list of technical KPIs, the quantitative evaluation of the AEGIS platform is performed towards the aim of providing quality assurance and control in all three versions of the demonstrators. The quantitative evaluation of the platform is performed by the AEGIS platform developers, as well as the developers involved in the implementation of the three demonstrators towards the aim of providing a holistic technical evaluation of the AEGIS platform. The following table presents the results of the evaluation of the AEGIS platform that was utilised in the implementation of the second (medium) version of the demonstrators.

Sub-characteristics	KPIs	Calculation Type	Mandatory / Optional	Value	Comments
Functional suitability					
Functional completeness	Portion of completed User Stories	[Completed User Stories] / [Iteration Cycle of User Stories] * 100%	M	100%	All use cases planned for the second (medium) version were executed.
Functional correctness	Portion of User Stories without reported bugs	[Completed User Stories without bugs] / [Iteration Cycle of User Stories] * 100%	M	93%	A list of bugs was identified however they were successfully addressed.
Functional appropriateness	Straightforward task accomplishment	Are tasks completed without the use of unnecessary steps? [Yes/No]	O	No	Due to the nature of the accomplished tasks, assistance from the respective persons was required.
Performance efficiency					
Time behaviour	Average latency	[Total response time] / [Number of requests]	M	~1.1 sec	Average latency was measured with tools such as Chrome Dev Tools.
	Throughput	[Total Number of Kilobytes] / [Total Time of Operation]	M	~ 300 KB/sec.	Value documented while previewing files and downloading files.
Resource utilisation	Mean CPU Utilisation	[Σ[%CPU utilisation probes]] / [Number of probes]	M	<40%	Based on the resource monitoring tool of the platform
	Mean memory usage	[Σ[RAM Megabytes used in each probe]] /	M	<18%	Based on the resource monitoring tool of the platform

		[Number of probes]			
	Maximum memory usage	Maximum % RAM Memory utilisation recorded	M	40%	Based on the resource monitoring tool of the platform
	Maximum processing power used	Maximum % CPU utilisation recorded	M	90%	As the resource management is performed by YARN (see deliverable D3.4), the appropriate resource allocation is always performed according to the provided configuration.
Capacity	Maximum file size upload	Total number of Kilobytes of files	M	450MB	Note: This is size of the current biggest file available.
	Maximum file system size[1]	Total number of Kilobytes of files	M	89GB	Note: This is the current size of HopsFS that can scale according to the needs of the project.
Compatibility					
Co-existence	Ability to Co-Exist (host in a single environment)	Can the AEGIS platform operate in shared environment? [Yes/No]	O	Yes	
Interoperability	% of APIs coverage	[Number of integrated systems exposing or consuming data through	M	100%	All integrated components / services are integrated through APIs

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[1] AEGIS platform utilises the distributed file system HopsFS. Thus, the database size metric was modified.

		API] / [Total number of integrated systems] * 100%			
	Ability to handle different datasets	Can the AEGIS platform consume datasets from different formats (e.g. CSV, JSON, XML files)? [Yes/No]	M	Yes	No limitations on the file formats HopsFS can store. Files can be processed using the appropriate libraries by the data scientist.
		Can the AEGIS platform provide datasets in various formats (e.g. CSV, JSON, XML files)? [Yes/No]	M	Yes	No limitations on the file formats HopsFS can store and provide.
Usability					
Appropriaten ess recognisabilit y	% Positive feedback on appropriate ness based on the available documentat ion	[Number of positive response] / [Total number of responses] * 100%	O	80%	The initial version of the documentation of the platform is in place (see deliverable D4.3). Although it was well received by the end-users, the documentation can be further enhanced in the next release.
Technical Learnability	% Coverage of features with learning documents	[Unique number of help documents mentioning a feature] / [Total number of features available] * 100%	M	90%	The current version of the documentation is covering 90% of the features of the platform. In the upcoming release all features of the platform will

					be properly documented.
Ease of Use	Dashboard availability	Is there an available dashboard or wizard with easy navigation? [Yes/No/Partially]	O	Partially	The UI of the platform received several improvements from the previous version (see deliverable D4.3). Currently there is an ongoing activity of further improving the UI that will be included in the upcoming release.
User error protection	% Coverage of input fields with error protection methods	[Number of error protected fields] / [Total number of critical input fields] * 100%	M	100%	All input fields in the UI are protected.
User interface aesthetics	% Positive feedback on user interface aesthetics poll	[Number of supported screens] / [Total number of different screens] * 100%	O	85%	Several improvements have been introduced from the previous version. Aesthetics have been improvement and there is an ongoing activity which will introduce further improvements in the upcoming release.

	Responsiveness	[Number of supported screens]/[Total number of different screens] * 100%	M	100%	No inaccessible or malformed screens were identified.
Technical Accessibility	WCAG 2.0 Conformance Level[2]	[None/ A/ AA/ AAA]	M	A	
Reliability					
Maturity	Maximum Concurrent users	Maximum number of concurrent users recorded	M	31	
	Simultaneous requests	Maximum number of simultaneous requests	M	In terms of containers allocated the maximum value recorded was 17, in terms of applications was 9 concurrent application and in terms of requests to filesystem 15 concurrent requests.	Based on the resource monitoring tool of the platform
Availability	% Monthly availability	[1-[Downtime in minutes] / [Total month minutes]] * 100%	M	`~97%	The downtime recorded was due to infrastructure upgrade
	Success rate	[Number of correctly completed requests] / [Total	M	~95%	The problematic requests were successfully

[2] WCAG 2.0: https://www.w3.org/WAI/WCAG20/quickref/

		number of requests]			addressed with bug fixing.
Fault tolerance	% of identified Software problems affecting the platform	[Critical Software Issues] / [Total number of Software faults detected] * 100%	M	~22%	All problems have been identified and fixed.
	% of identified Hardware problems affecting the platform	[Critical Hardware Issues] / [Total number of Hardware faults detected] * 100%	M	100%	Critical hardware issues were identified and fixed in short time.
Recoverability	Mean recovery time from Software problems	[Total recovering time from Software issues] / [Total number of Software issues in need of recovery]	M	~ 1 hour	
	Mean recovery time from Hardware problems	[Total recovering time from Hardware issues] / [Total number of Hardware issues in need of recovery]	M	~ 1 hour	
Security					
Confidentiality	Incidents of ownership changes and accessing prohibited data	Number of recorded incidents	M	None	
Integrity	Incidents of authentication mechanisms breaches	Number of recorded incidents	M	None	

Non-repudiation	% Activities reporting	[Number of log categories] / [Total number of system operations]	M	95%	Logging mechanisms were enhanced
Accountability	User actions traceability	Are usernames included in each activity log entry uniquely? [Yes/No]	M	Yes	Logging mechanisms provide all the appropriate reporting information
Authenticity	Level of User authenticity	Can you identify that a subject is the one it claims to be? [Yes/ No/ Partially]	M	Yes	
Maintainability					
Modularity	% of modularity	[Number of components that can operated individually] / [Total number of components] * 100%	M	100%	
Reusability	% of reusable assets	[Number of assets that can or are reused] / [Total number of assets] * 100%	M	100%	
Analysability	Level of analysability	Can the changes in the performance of the AEGIS platform be efficiently evaluated after each upgrade? [Yes/No]	O	Yes	The system offers monitoring tools with performance indications.
Modifiability	% of update effectiveness	[Number of updates performed without operational issues] / [Total number of updates] * 100%	M	95%	Several updates were performed successfully with minor issues

Testability	Level of testing	Are tests able to probe the behaviour of the AEGIS platform? [Yes/No]	M	Yes	
Portability					
Adaptability	Mean number of errors per hardware change/ upgrade	[Total number of errors recorded] / [Total number of hardware changes]	M	None	
	Mean number of errors per software change/ update	[Total number of errors recorded] / [Total number of software changes]	M	<2%	Minor errors were identified and fixed.
Replaceability	% of software products replaceability within AEGIS platform	[Number of replaceable software components] / [Total number of used software components] * 100%	M	100%	

Table 1: AEGIS Platform quantitative evaluation

3.2. Qualitative Evaluation of the AEGIS platform

In addition to the quantitative evaluation of the AEGIS platform and in accordance with the AEGIS evaluation framework, the qualitative evaluation of the AEGIS platform has been conducted. The qualitative evaluation aims at shedding additional light on aspects such as the usefulness of the platform and the perception of the technical process of implementing second (medium) version of the AEGIS demonstrators. The qualitative evaluation provides valuable feedback that a quantitative evaluation alone would never be able to generate and provides this knowledge back to the platform developers to further improve the AEGIS platform.

To evaluate the usefulness of the AEGIS platform as well as the perception of the technical process of implementing the second version of the AEGIS demonstrators, focus groups were conducted at the sites of the demonstrators. The following section contains the results of these focus groups.

3.2.1. Automotive Demonstrator

To document the perception of the automotive demonstrator, a two-person mini focus group was conducted. Two data scientists were mainly responsible for implementing the second version of the automotive demonstrator, an experienced data scientist, and a junior data scientist

coached by the experienced one. One result of the focus group was that the perception of the platform did not change too much with respect to the experiences made while implementing the first automotive demonstrator on the first prototype of the platform. The look-and-feel of the platform has improved. However, many processes like uploading the raw vehicle data have not been repeated. There were several updates of the platform conducted by the platform development team and (backed-up) datasets have been restored by the platform team after the update was finished successfully. So some of the functionality was not used again during the implementation of the second demonstrator.

One functionality of the platform intensively used by the data scientists is the Visualiser. Thereby the cooperation with the technical team of the visualizer is excellent. Almost all requirements coming from the automotive demonstrator were implemented (or are going to be implemented) in an agile way without much delays. There has even a new visualisation type – a heatmap – being implemented timely. Furthermore, enhancements to marker visualisations such as different colours for markers as well as visualising meta information while clicking on a marker are going to be implemented.

One major advantage of the platform update (which was perceived to be very useful) was the configuration of Jupyter. Thereby certain options like adding execution memory to a project can be more easily accessed, which makes the technical administration of a data science project implemented on the platform much easier. Furthermore, the shift from Zeppelin to Jupyter was perceived to be a good decision as Jupyter seems to run more smoothly.

However, the cooperation between the platform team and the demonstrator developers could be further improved. The demonstrators must meet certain deadlines for implementation and evaluation. If critical platform updates conflict with demonstrator deadlines, the demonstrator development process faces a challenge. This was the case in 11/2018, which challenged the timely completion of the second automotive demonstrator.

Furthermore, the update process of the platform could be improved. In case of an update, demonstrator owners must (re)create their user accounts on the platform, create the project, and the datasets (folders). Then, they must add user accounts to projects (once again) and give them the required permissions to access datasets. Then all data (files) can be restored into the correct datasets (folders) by the platform team. Hence every platform update creates workload for the demonstrator partners, as the process so far cannot be automated.

3.2.2. Smart Home and Assisted Living Demonstrator

Under the scope of the qualitative evaluation of the AEGIS platform and in order to document the perception of the Smart Home and Assisted Living demonstrator, a focus group was conducted with participants from all three involved partners from this demonstrator. More specifically, the focus group consisted of six participants in total, one data scientist and one developer from each partner, that they were all involved in the design and implementation of the second version of the demonstrator. It should be noted that all participants were involved also in the implementation of the first version of the demonstrator, thus they were able to follow the evolvement of the platform and they can provide valuable feedback to the platform developers towards the aim of further improving the AEGIS platform in the upcoming versions.

With regard to the perception of the current version of platform that was utilised during the implementation of the second version of the demonstrator, the participants acknowledged the improvement of the platform in terms of comfortability and usability of the platform, as well as usefulness of the platform for performing the tasks required for the implementation of the demonstrator. The offerings of the platform were significantly improved with the list of predefined tools such as the Query Builder, the Visualiser and the Algorithm Execution Container. Although these tools were also available during the implementation of the first version of the demonstrator, in the current version of the platform these tools are more mature and enriched with several functionalities that are facilitating the execution of data exploration and analysis. However, these predefined tools are not available by default to a project and some manual steps that are described in the documentation have to be executed in order to make them available in a project. This process could be potentially automated and the user could get access to these tools more easily.

The participants also acknowledged that the services offered by the platform, especially the support of various programming languages and the support for the Jupyter notebook development environment enable the development of data-driven applications. Given the nature of the platform and the current platform version and functionalities offered, the participants believe that the platform has great potential that have not been fully exploited yet, especially in the area of algorithmic procedures, but they are confident that will be explored in the upcoming versions of the platform.

Especially for Jupyter, the participants noted that the usability of this tool has been significantly improved with the latest updates of the platform and the data scientists are now able to further explore the capabilities of this notebook development environment more conveniently and efficiently. However, the access of data stored in the platform through Jupyter can be further improved or better documented.

The navigation within the platform and the exploration of the various services and functionalities of the platform has been improved, however there is still room for improvement especially for the case of non-experienced users. The participants noted that the user interface of the platform, although it is stable, it requires some additional steps, which in some cases are not clear, in order to perform the required action. The current version of the documentation of platform is very helpful, especially for the users that are not comfortable with platforms focused on the data science sector.

The participants also noted that the upgrade process of the platform should be further improved as with the current implementation the projects of the users, and the relevant datasets included in the projects, are not unaffected by the upgrade process. The users are requested, in collaboration with the platform developers, to execute various steps that include the recreation of the projects and the relevant datasets after the upgrade process is finished. Ideally, the upgrade process should not affect the user and their project, besides the reasonable downtime of the platform, and any step performed after the upgrade should be automated.

3.2.3. Insurance Demonstrator

In the scope of the second (medium) demonstrator activities evaluation, an internal focus group has been organised at the HDI premises, involving two data scientists and three developers of the demonstrator, both from HDI and GFT, together for many iterations over the test cases. The

objective was to provide a feedback about the perceived usefulness of the AEGIS platform, as well as the perception of the technical process of implementing the demonstrator itself.

Two data scientists and three developers were mainly involved in the implementation of the second (medium) demonstrator. Regarding the first point (i.e. perceived usefulness of the AEGIS platform), the main feedback provided during the focus group was of a general improvement of the graphical user interface of the platform. The assets (e.g. datasets) visualised in the main page are now clickable and it is possible to access them directly. However, the navigation within the platform and the different functionalities can be further improved, because in the case of non-experienced users some actions are not immediately evident.

In addition, it is worth remarking that during the evaluation phase the AEGIS platform was under a process of back-end upgrading, so some of the functionalities could not be tested at their full extent for the entire period of evaluation. Query Builder and Visualiser tools have been proved reliable and useful, correlating the features of the event with the in-house dataset regarding the customers' policies and location, as well as having a fast overview of the interested customers on a map. However, the above notebooks are not available by default when creating a new project and the user is required to install them manually following a detailed procedure available in the platform documentation.

The availability of full documentation about the different components of the platform is, by the way, considered an added value. One possible improvement would be the automatization of this process. A major difference with respect to the previous version of the platform was the decision to discard Zeppelin and focus on the notebooks' deployment on Jupyter, enabling the easier technical administration of a data science project implemented on the platform.

One remark to be considered in the next release of the platform, is the requirement of having the Event Detection Tool integrated within the platform, in order to allow its notifications to be delivered directly to the AEGIS users' personal area (which also should be improved). Finally, the cooperation between the platform team and the demonstrator developers was good, although some respective deadlines were not met causing some issues in the Demonstrator's processes. A closer coordination between the teams should be considered for the next release of the platform and Demonstrators, possibly addressing also the automatization of the process of account/datasets restoration following a platform upgrade.

3.3. Challenges and recommendations

From the conducted focus groups of all three demonstrators and the analysis of the discussions performed within these groups, a series of recommendations can be derived that consist valuable feedback for the platform developers in the course of development of the upcoming versions of the platform.

The three main recommendation of the Automotive demonstrator are:

- Better align the update process of the platform/testbed with the milestones of demonstrator development.
- Improve the update process of the platform, so that it reduces the workload for demonstrators (create users, projects, folders).

- Fine-tune the platform's user interface so that it becomes even more appealing to the data scientists.

The three main recommendations of the Smart Home and Assisted Living demonstrators are:

- Enabling the Query Builder, Visualiser and Algorithm Execution Container tools within a project should be automated for the users.
- Accessing and processing the available datasets from the Jupyter notebook could be improved or better documented in order to facilitate the users.
- Navigating through the various functionalities and services offered by the platform could be further improved and simplified especially if unnecessary steps are involved.

The three main recommendations of the Insurance demonstrator are:

- Simplify the graphical user interface, especially to make it easier for the non-technical users;
- Automate the process of restoring user accounts/datasets following a platform upgrade;
- Automate the import of the AEGIS notebooks (Query Builder, Visualiser and Algorithm Execution Container) when creating a new project.

4. AEGIS AUTOMOTIVE DEMONSTRATOR

4.1. Pilot overview and current status

The automotive demonstrator is developed according to three different scenarios, (1) broken road indicator, (2) safe driving indicator, and (3) regional driving safety risk estimator. The first two scenarios, broken road indicator, and safe driving indicator have been successfully implemented. In particular, the safe driving indicator is reported in this deliverable in what follows.

Vehicle movement data is acquired by using a data logging device developed at VIF, based on a BeagleBone Black[3] single plate computer connected to the vehicle's on-board diagnostics interface. The data logger can easily be installed in the vehicle by the drivers themselves, without the need of technical assistance. The device turns on automatically at the vehicle's start and starts recording data. Likewise, it shuts down and turns off automatically if the vehicle's engine is turned off. Vehicle data from multiple drivers covering multiple trips is manually uploaded to the platforming to the Automotive Demonstrator project[4]. Then a data-analysis pipeline is executed.

- In a first step raw data files of the individual sensors of each vehicle are merged and all trips contained in the data are extracted. A "trip" is defined as the data collected between engine start and engine stop. All extracted trips are resampled to a fixed, regular-spaced time grid of 10Hz and written to a separate dataset.
- Next, the coordinate system of the sensors is aligned with the coordinate system of the vehicle for each of these trips and the data is written into another dataset. This is especially relevant as the position of the data logger in respect to the vehicle is unknown and additionally can change between trips.
- All trips prepared in this way will be loaded to infer three types of safe driving events, harsh acceleration, harsh braking, and harsh cornering. All safety-relevant events are detected by using the following general procedure, compute an artificial "event-signal, detect events when the "event-signal" exceeds a certain threshold, and store the event together with associated information
- The influence of safety-critical events is inter alia influenced by weather information (third-party data source). A corresponding risk score based on statistical is calculated for all trips as well as for all drivers.

A series of Jupyter scripts have been developed for scenario 1 to process from raw data to save driving data. The script which have been used for data preparation are also relevant for scenario 2. The following figure shows the connection between executed scripts and created datasets and visualizes the data analytics pipeline for the first and second demonstrator scenario.

---

[3] BeagleBone Black: https://beagleboard.org/black

[4] Automotive Demonstrator Project: http://bbc6.sics.se:8080/hopsworks/#!/project/1056
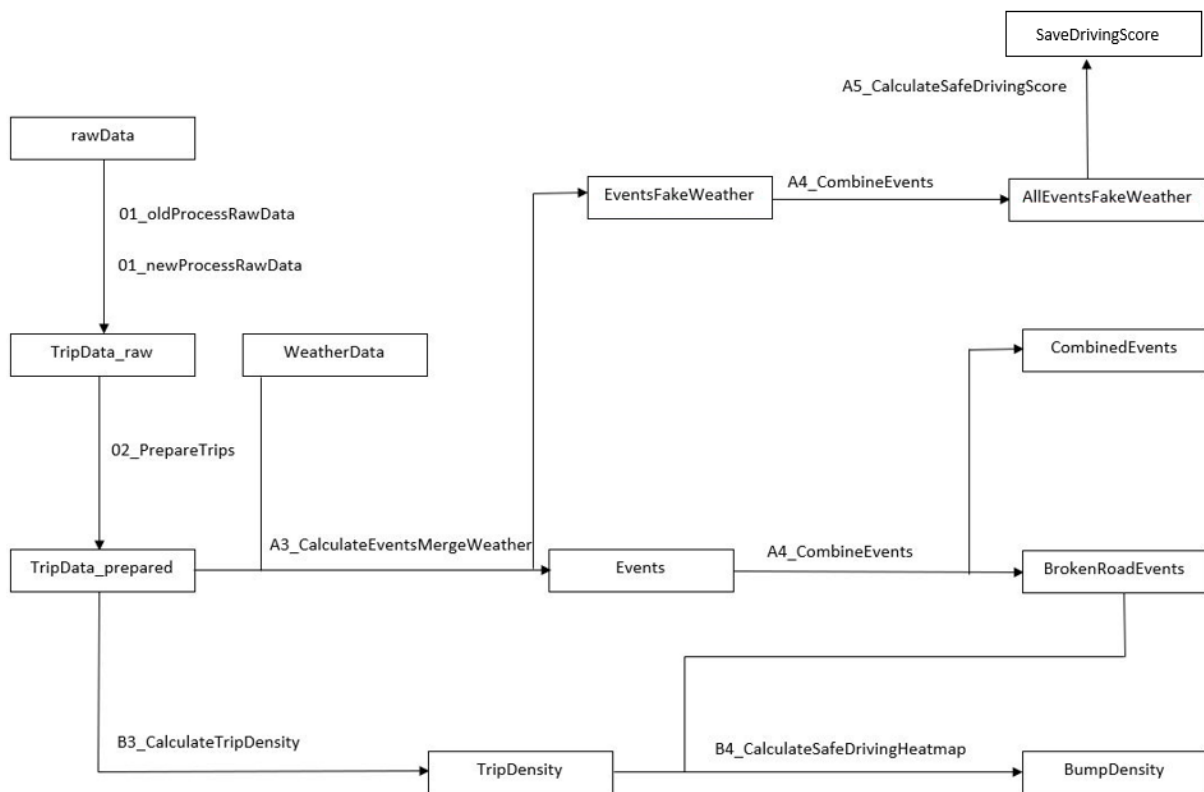
Figure 1: Automotive demonstrator data processing pipeline

Trip-specific safety-relevant events (harsh acceleration, harsh braking, harsh cornering) are visualised using markers. The risk score ('safe driving score') is provided as a %-value in a table for all trips of a particular driver as well as a total score for this driver. As weather data is not available for all times and locations, a fictional weather dataset ("FakeWeather") is computed with random weather information, too.

4.2. Scenario execution

The **second scenario** "safe driving indicator" includes executing <u>three additional test cases</u> to scenario 1, broken road indicator, (1) identify safe driving events and save results, (2) assess driving risk and save results, and (3) provide visualisation of save driving events. The results of the first test cases are provided in D5.3. and will not be repeated in D5.4.

4.2.1. Test Case 1 for "Identify safe driving events and save results"

Actors:	PSPS data scientist from VIF
Pre-conditions:	1. Transformed vehicle data is available on the platform 2. Corresponding weather data is available on the platform
Post-conditions:	1. Save driving data is computed. 2. A new dataset named "save driving data" is created on the platform.

Normal Flow	1. The data scientist queries all trip.csv files generated in the project for trips of a certain driver by using R code or the query builder (trip-selector).
	2. The data scientist executes R-code on the platform using the result of the query as input to detect safety critical events (e.g. harsh acceleration).
	3. The data scientist queries the weather data for environmental conditions during the safety critical events.
	4. The detected events are saved on the platform in a new dataset (safe driving data). The corresponding weather information in the location of the detected event is saved together with the events, too.
Pass Metrics	1. Safe driving dataset is available for the project.
Fail Metrics	1. The event detection has not been successful and an error message is provided.
Notes and Issues:	Safety critical events include harsh braking, harsh acceleration and harsh curving.
Execution Results	Whenever new raw data from measurements is manually uploaded to the AEGIS platform, a series of Jupyter scripts is executed.

As the format of measurements has changed recently (due to a software update of the data logger), the script 01_NewProcess_Raw_Data must be executed first. This converts CSV files to the pandas data frame, interpolates missing values and transforms trip data to fixed time intervals and saves them in the folder TripData_raw.

Second, signals are processed and prepared. In a next step, the script 02_PrepareTrips must be executed and rotates IMU data to be aligned with vehicle coordinate system. Furthermore, it adds artificial events signal (bumps signal, speed change score, curve score) as further table columns. This creates parquet files of trips in the folder TripData_prepared.

In a third step, prepared trip data is correlated with weather data. The script A3_CalculateEventsMergeWeather infers the save driving events in the prepared trip data and merges them with the corresponding weather information (from the WeatherData dataset) at the time and position of the event. The result is a table with events (harsh brake, harsh acceleration, harsh cornering) is saved into the Events folder for all drivers and trips. |

	In a fourth step the script A4_CombineEvents is executed. The script is used to create CSV files for the visualizer. The CSV file stored in the CombinedEvents dataset can contain events for one or more drivers. The data scientist can specify in the script A4_CombineEvents the driver(s), vehicle(s), trip(s), and event types.
	Weather data is harvested on the platform using the OpenWeatherMap service for locations, where most of the trips have been conducted.

All (save driving) events are detected using the following general procedure:

1. Compute an artificial "event-signal". This involves, pointwise unary or binary operations on signals, and "windowed" operations like moving average or any FIR filter

2. Detect events when the "event-signal" exceeds a certain threshold

3. Store the event together with associated information (Start and end position, start and end time, and additional information that varies by event type as e.g. mean speed during the event, severity of speedbump, …)

4.2.2. Test Case 2 for "Assess driving risk and save results "

Actors:	PSPS data scientist from VIF
Pre-conditions:	1. "Save driving data" dataset is available.
Post-conditions:	1. A risk score is computed per trip. 2. A new dataset named "Risk score data" is available
Normal Flow	1. The data scientist queries the save driving dataset for the safety critical events and the corresponding weather conditions by using R code or the query builder. 2. The data scientist executes R-code on the platform using the result of the query as input to calculate a risk score for every trip. The weather situation influences the risk score. 3. The calculated risk score is saved on the platform in a new dataset (risk score data).
Pass Metrics	1. The risk score is calculated and saved in a dataset for the project.
Fail Metrics	1. No risk score is calculated and an error message is provided.
Notes and Issues:	-

Execution Results	The script "A5_CalculateSafeDrivingScore.ipynb" has calculated a risk score for all trips and saved it in the dataset "SafeDrivingScoreTable".
	To compute a risk score for a driver, the script "A6_calcsafedrivingriskscore.ipynb" is executed. Therefore, the average value of the drivers' last 50 trips is calculated. The trips get exponentially decreasing weights to give more recent trips more weight.
	The table below shows the execution result. Driver 1 has in total 943 trips and a risk score of 0.48 (=48%). The trip score implies the trip-specific save driving score.
	The right column shows the risk score per trip. E.g. Trip_053 has a trip score of 0.358711 (~36%) which means that 36% of all trips of all drivers are worse than this particular trip of driver 1. Trip_44 has a trip score of 0.995628, which means that 99,6 % of all trips are worse than this trip of driver 1 (i.e. this trip is a very safe trip).
	The risk score of the driver is 0,48 (=48%), which is the average value of the risk scores of the last 50 trips. However, the trips get exponentially decreasing weights to give more recent trips more weight for the total risk score of driver 1.

```
In [2]: getSafeDrivingScore(1, 50)

Driver1
weighted sum of tripscores: 8.39
divisor: 17.54
riskscore: 0.48

      driver   vehicle     trip  duration  n_accevents  n_brakeevents  n_curveevents  trip-score
370   Driver1  Vehicle6  Trip_053  1.131111       24.0          27.0            5.0    0.358711
438   Driver1  Vehicle6  Trip_052  0.063000        4.0           2.0            0.0    0.394976
200   Driver1  Vehicle6  Trip_051  0.059000        4.0           3.0            3.0    0.765432
74    Driver1  Vehicle6  Trip_050  0.227778        5.0           4.0            4.0    0.432013
387   Driver1  Vehicle6  Trip_049  0.131167        5.0           5.0            0.0    0.392404
367   Driver1  Vehicle6  Trip_048  0.310333        0.0           4.0            2.0    0.198560
223   Driver1  Vehicle6  Trip_047  0.391167       13.0          14.0            6.0    0.483025
347   Driver1  Vehicle6  Trip_046  0.315889        2.0           4.0            0.0    0.138460
366   Driver1  Vehicle6  Trip_045  0.105056        0.0           1.0            0.0    0.067644
237   Driver1  Vehicle6  Trip_044  0.020000       30.0          18.0            4.0    0.995628
237   Driver1  Vehicle6  Trip_043  0.297556       20.0          15.0            5.0    0.673268
330   Driver1  Vehicle6  Trip_042  0.369500        4.0           3.0            1.0    0.166152
198   Driver1  Vehicle6  Trip_041  0.062667       22.0          12.0            8.0    0.941015
436   Driver1  Vehicle6  Trip_040  0.063056        1.0           4.0            0.0    0.358625
456   Driver1  Vehicle6  Trip_039  1.195444       16.0          15.0            2.0    0.201132
18    Driver1  Vehicle6  Trip_038  0.191167       36.0          36.0           12.0    0.914095
236   Driver1  Vehicle6  Trip_037  0.023056       13.0          12.0            4.0    0.986540
281   Driver1  Vehicle6  Trip_036  1.098278       18.0          13.0            3.0    0.227023
408   Driver1  Vehicle6  Trip_035  0.194778        5.0           6.0            1.0    0.406036
86    Driver1  Vehicle6  Trip_034  0.057833       43.0          26.0            1.0    0.874657
35    Driver1  Vehicle6  Trip_033  0.049722       16.0          12.0            3.0    0.919067
457   Driver1  Vehicle6  Trip_032  0.065833        5.0           5.0            0.0    0.555127
402   Driver1  Vehicle6  Trip_031  0.833722        2.0           2.0            1.0    0.091564
185   Driver1  Vehicle6  Trip_030  0.036556        6.0           4.0            2.0    0.849280
206   Driver1  Vehicle6  Trip_029  0.391889       21.0          19.0            4.0    0.620713
132   Driver1  Vehicle6  Trip_028  0.340333       15.0          13.0            6.0    0.585905
69    Driver1  Vehicle6  Trip_027  0.264556        8.0          11.0            2.0    0.447188
409   Driver1  Vehicle6  Trip_026  0.561778        5.0           6.0            0.0    0.109825
306   Driver1  Vehicle6  Trip_025  0.466500        6.0           2.0            1.0    0.150892
247   Driver1  Vehicle6  Trip_024  0.045333        0.0           2.0            0.0    0.189558
..    ...      ...       ...       ...            ...           ...            ...          ...
```

The **risk score** is based on (statistical) ranks:

1. For each trip and each event type calculate the mean event-rate per time unit e.g.: "This trip has 0.1 hard brakes per hour." (Optional: Use a weighted mean where the weights represent external circumstances. E.g.: hard-brakes in bad weather count double).

2. For each trip and each event type calculate the trip-event-score as the percentage of trips which have a lower event-rate (for the current event-type).

3. The score for one trip (trip-score) is calculated as the mean of all trip-event-scores for that trip. (Optional: Use a weighted mean where the weights represent the importance of the event-types).

4. The score for a driver is the latest value of the exponentially smoothed time series of trip-scores for that driver. (the influence of trip-scores declines exponentially over time)

4.2.3. Test Case 3 for "Provide visualisation of save driving events"

Actors:	PSPS data scientist from VIF
Pre-conditions:	1. "Save driving" dataset is available. 2. "Risk score" dataset is available.
Post-conditions:	1. Save driving events are visualised on a map. 2. Risk score is shown along with the map.
Normal Flow	1. The data scientist selects the visualisation tool from the platform, the save driving dataset, and the risk score dataset generated previously to visualise the detected safe driving events *from a single trip* on a map and to display the risk score. 2. The visualisation is intended for a driver, who wants to access it without having a user account on the platform. 3. The visualisation is made available as a web page for externals.
Pass Metrics	1. A proper visualisation is shown to the user.
Fail Metrics	1. The visualisation is not computed and an error message is provided to the user.
Notes and Issues:	-
Execution Results	To visualise safe driving events of a selected trip (e.g. one from the risk score table) on a map the script "preparetripfornewvisualizer.ipynb" is executed. Therefore, a particular trip (e.g. Driver1/Vehicle6/20170224/Trip_012) has to be selected. In practice, the trip specific risk scores provide a good overview and interesting trips can be chosen from the table for further risk analysis.

The script creates a table as input for the visualiser including latitude and longitude of the detected events a well as a colour-type for each event (i.e. "red" for hard braking, "blue" for hard accelerations, and "black" for hard cornering).

Then the visualizer is started, and the created file is loaded. The visualisation below shows the result in the interactive visualizer. Additional information about the events (e.g. the weather at this time/location) is displayed when the user clicks on the event marker.
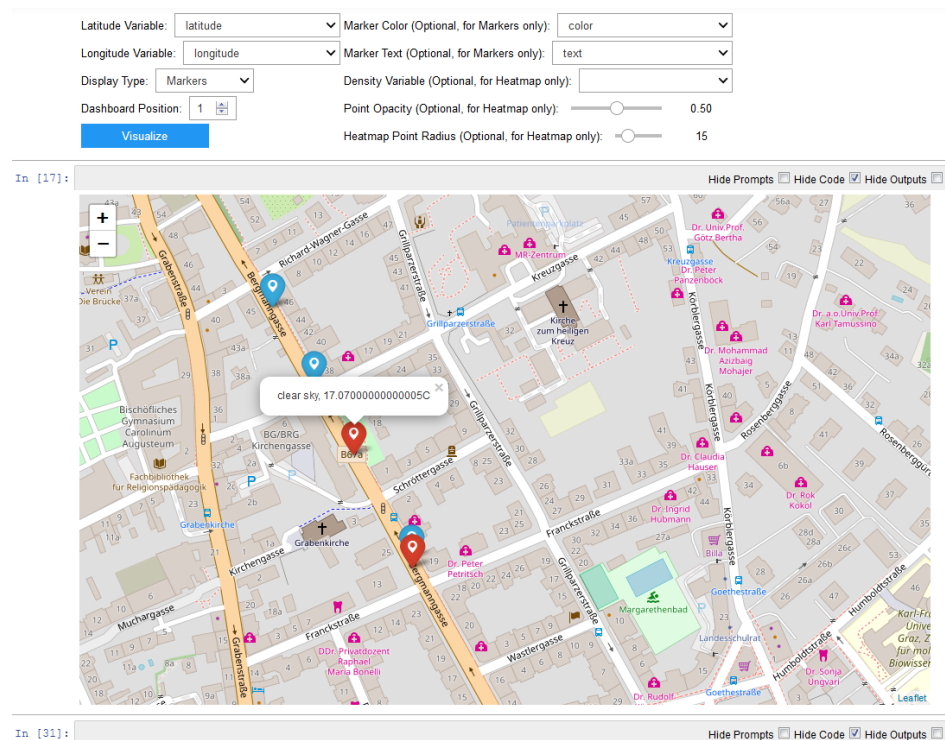
The trip itself is not visualised, yet. This is communicated to the team in charge of visualizer development as a feature request.

4.3. Demonstrator Evaluation

4.3.1. Quantitative Evaluation

The demonstrator-specific quantitative evaluation action focuses on the completeness on the test cases as well as on some demonstrator-related KPIs.

Sub-characteristics	KPIs	Calculation Type	Mandatory / Optional	Means to Verify	Value
Save driving indicator	Number of successfully	[Successfully Completed test cases] /	M	Calculation (0-100%)	100%

functional completeness	completed Test Cases	[No of cases] * 100%			
Include multiple trips in driving data	Number of different Trips	Sum	O	Counting numbers	2163
Include multiple drivers in driving data	Number of different drivers	Sum	O	Counting numbers	15
Demonstrate event detection	Number of detected events in total	Sum	O	Counting numbers	> 2000
Demonstrate braking detection	Number of harsh brakings	Sum	O	Counting numbers	> 500
Demonstrate acceleration detection	Number of detected harsh accelerations	Sum	O	Counting numbers	> 500
Demonstrate cornering detection	Number of detected harsh curving actions	Sum	O	Counting numbers	> 500

Table 2: Automotive demonstrator quantitative evaluation

4.3.2. Qualitative Evaluation

The main source for data-driven services is vehicle movement data. In the scope of the automotive demonstrator version 2, about ten different drivers have provided vehicle movement data. Focus groups are a valuable instrument to gather more in-depth information on perceptions, insights, attitudes, experiences, or beliefs of people. Hence, a three-person focus group with drivers was conducted by the service developers in December. The goal of this focus group was to demonstrate the safe driving indicator service (i.e. the dashboard on the AEGIS platform) and then to generate additional feedback on how the experienced the service. They were furthermore asked for recommendations on how to improve usability, usefulness, and user experience of the service in general and the safe driving dashboard specifically.

To kick-off the focus group, a short presentation of the safe driving indicator was conducted. Thereby the data-scientist in charge explained the concept first and demonstrated the service for making safety-relevant events and the risk scoring transparent for the drivers second. All trips are shown to a driver at a time along with explanations including also an interpretation of the driving style. After this short introduction, all participating drivers were asked if they fully understood the concept of the safe driving indicator presented, how an individual driving-safety coaching is conducted, and what impact this would have on their driving style. In a next step, which was the main purpose of the focus group, individual feedback on the service was requested from each driver. This request for feedback immediately kicked-off a very fruitful discussion on the safe driving service provision as well as requirements and ideas on how to further improve or even extend the service.

Results of the focus groups have shown that in general the information provided to the drivers in the dashboard is perceived to be very useful to better understand and further improve their individual driving strategies. Information shown to drivers consists mainly of three elements, a risk score for each trip driven by a driver, an aggregated risk score for the driver and a visualisation of inferred save driving events on a geographic map to see at what location certain events like harsh braking or harsh acceleration occurred.

Participants noticed that there is only a limited interaction of the risk score visualisation implemented so far. The score is provided with a table, but there is no direct interaction with the trip number in the table and the visualisation of the events. Regarding the implemented visualization of safety-critical events on a map, one participant mentioned that it would be interesting to better understand or even know causes for this event to occur. This could either be achieved by providing further contextual information to drivers (besides map, time/data, and weather data), or by the driver himself when trying to remember the cause for an event after looking at the map (e.g. a pedestrian crossing the road very quickly which caused the driver to break in a harsh manner). Remember past events is only possible for recently driven trips, but not for historical ones. However, the latter one holds a bigger potential as drivers are forced to think more about a past ride and thereby learn what they could improve. Providing more contextual information to drivers would be especially helpful, if drivers drive a route repeatedly to finally improve their driving style.

A warning system using the safe driving data of the platform (e.g. implemented on a mobile app accessing the data in the platform) could even warn drivers in case they approach a location, where many safety-critical events occurred in the past, so they would be nudged to drive more carefully. Such contextual information could be for instance generated by using 360-degree sensors mounted in a vehicle (e.g. radar, lidar) better quantifying the surrounding objects and vehicles on a road. Thereby the context of a detected event could be better explained in historical data.

In the current implementation of the safe driving indicator, only the aggregated data of a driver's own trips is shown to this driver in a coaching-type situation. Information on safety-critical events detected in the trips of other drivers as well as risk scores of other drivers are currently not provided to them during the driver coaching situation. This aspect raised a discussion on the limited feasibility of comparing the own driving style with the driving style of other drivers. Having such a comparison (e.g. by risk score) would create a benchmark-like situation which would even more motivate drivers to improve their ranking (and thereby improve their driving style accordingly). Hence, drivers show interest in better understanding the driving styles of

others. The usefulness of the risk score as a metric for safe driving improves, if risk scores of other drivers are shown, too. These drivers could be taken from a peer group, the same organization/department, or the same fleet to create some competition about driving safety.

Furthermore, it would be very interesting to compare locations where safety-critical events of other drivers occurred with safety-critical events detected in own trips. Thereby two scenarios are relevant: In the first scenario, one driver may cause many safety-critical events in a certain location/area, but other drivers in the same location may not, which could be a stronger indication of risky driving of the first driver. Furthermore (considering a plethora of data from a plethora of drivers is collected), a second – and close to real time – scenario would consider a driver may cause no safety-critical events while other drivers located nearby may cause a lot of such events, which would also indicate a risky situation in which the first driver probably is involved. A warning system correlating such event data could signal a warning information to involved drivers in both cases.

Participants of the focus group were interested in how exactly the risk score was calculated and which data was used for calculating it. Does the risk score only include own trips, or also trips of other drivers? Does the score depend also on trips of other drivers? There are certainly different ways how such a score is calculated. In the current implementation, a simple way was chosen, using the data of all trips (and the corresponding weather at that date/time) for calculation. On driver even raised the interest to parametrize the risk score calculation by differently weighting the risks of certain detected events.

Another interesting discussion was focused on the type of safety-critical events detected – and if they are really an indicator for driving safety. For instance, on an empty street, hard acceleration might not necessarily indicate a real safety risk. Hence, two further events would be relevant to detect to better judge harsh braking and harsh acceleration, speeding (e.g. driving faster than the allowed speed limit) as well as collisions (considering a plethora of drivers and a plethora of vehicles).

Currently the safe driving indicator service provision involves a coach, presenting the safe driving data to the driver along with explanations, interpretations, and suggestions. Another way to coach the driver is by using quantified self-approach and allowing self-coaching and self-tutoring. Thereby drivers are enabled to interact in a visual dashboard in their own Web browser or in a smartphone app, which may generate a totally different user experience for them and may even allow a deeper individual analysis of each trip.

Furthermore, it would be interesting for drivers to specifically show the safest trips as well as their opposites. To better understand the driving strategies of others (e.g. how to brake in front of a curve/protection path/speedbump/… and how to accelerate after a curve) would be interesting for drivers to better judge their driving strategies against the driving strategies of others. In general, the drivers raised their interest to experience, how others are driving. Showing events caused by other drivers in the locations of own trips would be useful for drivers, who want to learn from the behaviour of others. A heatmap as well as a marker visualization for events caused by other drivers to compare with a heatmap and a marker visualization of events caused by the driver to coach is desired.

The visualizations could be improved by providing a legend explaining the most important elements. Concerning the risk score, a graphical presentation would be expected (and not only

a table), i.e. showing how to score changed in time (e.g. in a line graph). Thereby scores, where a driver was in the top 5 or top 10 could be further highlighted in the individual risk score graph. A comparison of the own risk score to the risk scores of other drivers (e.g. a driver is in the top 10/100/1000 in a time span) would be good. Furthermore, a heatmap including all own safety-critical events as well as a visualization showing the most critical areas on a driver would be interesting (e.g. a GPS location and a radius).

Allowing filtering between different vehicles (used by the same driver) would be an interesting feature as the same driver may use different vehicles differently. A better way of comparing own trips could be provided, e.g. grouping and sorting functionality could be very useful (e.g. late trips, early trips, trips to and from work, long trips, short trips, etc.). A sorted list of the best/worst trips in terms of driving safety would be nice.

Another interesting information is fuel consumption. Thereby it would be interesting (in combination with the detected safety-critical events) how to adapt ones driving strategy to be both safe and efficient with respect to fuel consumption. While safe driving depends a lot on other stakeholders (on the road), the level of fuel consumption depends a lot of the individual driving style. Thereby a correlation between safe-driving and low fuel consumption is expected by the participating drivers. Choosing a defensive driving strategy will likely reduce the level of fuel consumption.

4.4. Challenges and recommendations

The workshop provided a series of suggestions from the users of the demonstrator. Some of the suggestions made are already within the roadmap for the third and final version of the automotive demonstrator. Interesting suggestions for a commercial service-type are summarized in the following bullet points:

- One suggestion was to also allow also self-exploration of the data without the necessity to involve a data-scientists using the platform and showing the information in a coaching-type scenario to the driver.
- Another suggestion was to increase interactive elements for data exploration and thus further increase the user experience.
- More options to sort and group trips and then to access the visualisations of events more conveniently would be interesting.
- Providing more contextual information besides geographic location, time, and weather would be interesting.
- Drivers communicated an interest to see also safety-relevant events caused by other drivers in the locations of their own rides.
- Drivers showed interested to benchmark their own driving styles against the driving styles of others to be more motivated about increasing their own driving safety.
- Providing information on driving efficiency and fuel consumption (probable correlating with safe driving) would be very interesting and relevant.
- Detecting speeding as well as collisions are interesting options to judge the safety-relevance of detected events. Especially visualizing speeding events would be highly relevant.
- Parametrizing the risk score calculation would be an interesting option for expert users.

5. AEGIS SMART HOME AND ASSISTED LIVING DEMONSTRATOR

5.1. Pilot overview and current status

The Smart Home and Assisted Living (SHAL) Demonstrator aims to illustrate the added value of the AEGIS big data platform in the area of personal security and safety, through tailored smart home and assisted living services. The encompassing case study is repeated here for completeness: a social care service provider, who desires to exploit big data-driven insights, in order to provide added value services to vulnerable individuals, aspires the creation of services pertaining proactive and reactive security and protection through smart notifications and personalised recommendations, as well as indoor comfort and quality preservation. These services aim at prolonging self-sufficiency and independence of the at-risk individuals, boosting safety, and facilitating informed decision making, either by the individuals themselves, or by their (in)formal carers. The main two services developed within the demonstrator are the following:

- Monitoring and analysis of an individual's well-being conditions, physical activity, positioning and wearable information and external environment data (e.g. weather, crime, news, social media), towards provision of a service for personalised notification and recommendation system for at-risk individuals, including notifications for carers.
- Additional service pertaining monitoring and analysis of weather, indoor environmental conditions, energy and operational device data towards the provision of a smart home application, which can be offered by care providers to at-risk people for increased indoor comfort and welfare.

Each of these services were broken down to early, medium and advanced implementation scenarios, as detailed the Deliverable 5.2. Here, the evaluation process revolves around the two medium stage scenarios, which can be seen in the following table. It needs to be noted, that due to the development stage of the demonstrator, the logical order of work and feedback retrieved from the early version of the demonstrator, certain test cases belonging to Scenario #3 have been replaced by others.

ID	Scenario	Functionalities	Demonstrator Version
3	Notifications and alerts for (at-risk) individuals	More information-rich Personas, definition of medical rules for the notification and alert engine, advanced and non-personalized alerts to (at-risk) individuals, personalised tracking of (at-risk) individuals following their consent and simple notifications to carers	Medium
4	Smart home comfort profiling and notifications	Thermal and Visual Comfort Profiling, notification and alert services for adverse indoor environmental conditions	Medium

Table 3: Smart Home and Assisted Living demonstrator scenarios

The current status of the demonstrator is portrayed vividly in the scenario execution section, where the medium stage scenarios are reiterated and evaluated. In summary, after the successful completion of the early stage demonstrator, the basic infrastructure, data streams and data pre-processing algorithms for the assisted living and smart home services were established. Furthermore, the backbone server and database were up and running and an initial version of the Mobile Apps (iOS and Android) were developed. During the past months, the involved partners concentrated on the development of further features that aim at more personalised recommendations, that in turn make more use of the AEGIS platform as a data processing and algorithm execution environment, in order to derive to a position to deliver the prescribed functionalities of the second (medium) demonstrator, as mentioned in Table 3. Development of the different algorithms and of the datasets which result in actions took place within the AEGIS prototype platform, in order to take advantage and access its capabilities. Finally, improved user interfaces, in both their mobile and web-based versions, were developed. Further details can be found in the following subsection.

The development and evaluation process are interleaved activities, and currently actions are ongoing towards preparing and delivering the final/advanced demonstrator scenarios, which will lead to the full realization of the two demonstrator services. The time plan for the next steps can be found in Deliverable 5.2.

5.2. Scenario execution

5.2.1. *Scenario 3 - Notifications and alerts for* (at-risk) individuals

Scenario 3 deals with the push of notifications to individuals belonging in personas, or to whole personas groups, without compromising the privacy and personal data of each individual (in the latter case). Following the integration of the medical knowledge in the AEGIS back-end for the generation and the validation of the personas, as well as for the automated classification of the individuals into personas, medical rules were defined and formulated in order to be used in the web app's rules engine, so as to: 1) define "personas outliers" and 2) identify outliers and provide (manual and automated) alerts and recommendations.

More specifically, with regards to the definition of the personas outliers, or the design of the "**persona outlier identification model**" as called in the context of the current demonstrator, medical knowledge was translated into machine-understandable language in order to identify and quantify (based upon the information from the wearables and the other data sources) the risk of individuals belonging into persona A (e.g. Hypertensive, Overweight Senior) gliding towards persona B (e.g. At CVD Risk, Hypertensive, Obese Adult) because of e.g. constant increased heart-rate and steady increase of the individual's Body Mass Index[5] (BMI).

In addition to this, with regards to the identification of outliers and the provision of (manual and automated) alerts, notifications and recommendations to at-risk individuals, or the design of the "**outlier notification model**" as called in the context of the current demonstrator the previously designed "persona outlier identification model" was exploited. Based upon this model, and combining it with data coming from the individuals, historical data, as well as additional data from external data sources (e.g. indoor and outdoor environmental conditions

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[5] Body Mass Index: https://en.wikipedia.org/wiki/Body_mass_index

affecting the well-being of at-risk individuals, such as for example increased humidity affecting the well-being of pulmonary patients, correlated with increased heart rate and decreased SpO2[6]) are used for detecting the previously defined outliers and for identifying the deterioration of the well-being of the at-risk individuals and for triggering the necessary notifications. Moreover, this scenario includes also the push of simple notifications to carers.

5.2.1.1. Test Case 3.1 – Design of persona outlier identification model

Actors:	CSP
Pre-conditions:	1. List of medical conditions handled by the demonstrator available in the Web App
Post-conditions:	1. A set of persona outlier identification medical rules per condition or per group of conditions or of combination of conditions facilitating the definition of "personas outliers"
Normal Flow	1. The CSP selects the core medical condition (or the list of conditions in case of comorbid occurrence of more than one medical conditions) in the Web App. In the absence of it, he/she can create a new entry. 2. The CSP views the list of persona outlier identification medical rules associated with the specific core condition (or the combination of conditions). 3. The CSP selects to edit an already stored persona outlier identification medical rule, or to add a new rule following simple "if-then" patterns
Pass Metrics	1. Set of persona outlier identification medical rules available in machine readable format
Fail Metrics	1. No persona outlier identification medical rules are available
Notes and Issues:	-
Execution Results	The CSP selects the medical condition out of the list of available medical conditions. For the selected medical condition, the CSP views the list of persona outlier identification medical rules for this condition and decides to use of one the existing rules. Alternatively, the CSP creates a new rule via the dedicated user interface of the Web App with simple "if-then" patterns and saves the new rule. All steps were executed successfully for both cases.

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[6] Peripheral oxygen saturation : Peripheral oxygen saturation (SpO2) is an estimation of the oxygen saturation level usually measured with a pulse oximeter device.

5.2.1.2. Test Case 3.2 – Design of outlier notification model

Actors:	CSP
Pre-conditions:	1. List of medical conditions handled by the demonstrator are available in the Web App
Post-conditions:	1. A set of outlier notification medical rules per condition or per group of conditions or for combination of conditions facilitating the identification of outliers and the provision of (manual and automated) alerts and recommendations
Normal Flow	1. The CSP selects the core medical condition (or the list of conditions in case of comorbid occurrence of more than one medical conditions) in the Web App. In the absence of it, he/she can create a new entry. 2. The CSP views the list of outlier notification medical rules associated with the specific core condition (or the combination of conditions). 3. The CSP selects to edit an already stored outlier notification medical rule, or to add a new rule following simple "if-then" patterns
Pass Metrics	1. Set of outlier notification medical rules available in machine readable format
Fail Metrics	1. No outlier notification medical rules are available
Notes and Issues:	-
Execution Results	The CSP selects the medical condition out of the list of available medical conditions. For the selected medical condition, the CSP views the list of outlier notification medical rules for this condition and opts for one the existing rules. Alternatively, the CSP creates a new rule via the dedicated user interface of the Web App with simple "if-then" patterns and saves the new rule. All steps were executed successfully for both cases.

5.2.1.3. Test Case 3.3 – Execution of Outlier Notification Model

Actors:	CSP

Pre-conditions:	1. Data from personas 2. Data from wearables 3. Data from external sources 4. Persona outlier identification models available 5. Outlier Notification Models available
Post-conditions:	1. Identification of at-risk individual and/or deterioration of the well-being of the at-risk individuals (based on own data from wearables and data from external data sources)
Normal Flow	1. Data from wearables from individuals are uploaded in the Web App. 2. Data from external sources are uploaded on AEGIS. 3. The Outlier Notification Model periodically runs in order to automatically identify at-risk individuals / outliers. 4. The Outlier Notification Model identifies at-risk individuals / outliers based on the streaming/close-to-real-time batch data the Web App receives from the data sources.
Pass Metrics	1. Data from wearables are uploaded on the Web App 2. Data from external sources are uploaded on AEGIS 3. The Outlier Notification Model runs normally 4. The Outlier Notification Model identifies at-risk individuals / outliers
Fail Metrics	1. Data from wearables are not uploaded on the private repository 2. Data from external sources are not uploaded on AEGIS 3. The Outlier Notification Model fails to run normally
Notes and Issues:	-
Execution Results	Upon the successful execution of the Test cases 3.1 an 3.2 the Persona Outlier Identification Models and the Outlier Notification Models are available with a set of rules for each condition respectively. The Web App receives new data from the defined sources and executes the Outlier Notification Model in a configurable period of time. The model identified at-risk individuals / outliers by processing the new data against the defined rules. All steps were executed successfully for this test case.

5.2.1.4. Test Case 3.4 – Mapping Actions to Notifications for personas of (at-risk) individuals

Actors:	CSP
Pre-conditions:	1. Output of the Outlier Notification Model 2. Medical rules registered 3. (At-risk) individuals registered on the Web App
Post-conditions:	1. Complementing Personas with notifications directed to (at-risk) individuals
Normal Flow	1. The CSP opens the Web App's rule editor 2. For each persona, different medical rule can be selected 3. For each rule, a specific template for a notification for (at-risk) individuals is inserted
Pass Metrics	1. Notifications are successfully mapped to different personas
Fail Metrics	1. No notifications pushed to (at-risk) individuals
Notes and Issues:	-
Execution Results	Template notifications that relate to medical rules have been created and have been linked to the different personas. The templates can be used manually by each CSP by selecting them prior to sending over notifications, and are in the position to be registered to the rules engine for automatic notification issuing (Scenario 5)

5.2.1.5. Test Case 3.5 – Mapping Actions to Notifications for carers

Actors:	CSP
Pre-conditions:	1. Output of the Outlier Notification Model 2. Medical rules registered 3. (At-risk) individuals registered on the Web App 4. Carers registered on the Web App 5. (At-risk) linked with carers
Post-conditions:	1. Complementing Personas with notifications directed to carers
Normal Flow	1. The CSP opens the Web App's rule engine

	2. For each persona, a medical rule is selected
	3. For each rule, a specific notification for carers is inserted
Pass Metrics	1. Notifications are successfully mapped to different personas
	2. (At-risk) individuals belonging to a persona are linked to a carer
Fail Metrics	1. No notifications linked to personas
Notes and Issues:	-
Execution Results	Template notifications that relate to medical rules have been created and have been linked to the different personas, whose members are then also linked to different carers
	The templates can be used manually by each CSP by selecting them prior to sending over notifications, and are in the position to be registered to the rules engine for automatic notification issuing (Scenario 5)

5.2.2. Scenario 4 - Smart home comfort profiling and notifications

Scenario 4 entails the comfort profile model fitting framework and associated notifications to the end users, and constitutes the intermediate level of the Smart Home service of the demonstrator. The profiling process concentrates on the identification of personalized preferences for an at-risk person, based on the monitored environmental conditions and operational status, when he/she is at his/her living premises. Such comfort profiles are subsequently enriched by limits regarding VOC conditions, extracted from respective standards and directives. Given these models, the real-time data are continuously examined, and notifications/alerts, shown to the mobile app of the individual and/or informal carer, are generated, when conditions are recognized as not comfortable or potential detrimental to the person's health. The respective user stories are the following:

- CSP: In order to enable the offering of the envisioned service, the CSP needs to estimate the personal preferences of individuals with respect to indoor living conditions. To that extent, the data scientist, working for the CSP, develops a comfort-profiling algorithm which is periodically trained on the smart home data, after the processing steps described in Scenario 2. The profiling framework is implemented in the AEGIS platform (see section 5.2.2.1), allowing thus scalability of the used algorithmic processes. The model is then employed to continuously predict discomfort/potentially unhealthy indoor conditions, from the incoming data streams, and alert either the individual or the carer, through the mobile app, about the identified risks.
- At-risk individual/Carer: The person and/or his/her informal carer register to the SHAL notification service, which allows them to receive the generated alerts prescribed above.

5.2.2.1. Test Case 4.1 – Software development for comfort profiling and notifications

The methodology for extracting the comfort preferences of the occupants is based on training a naïve Bayes classifier with indoor temperature as the feature (independent) variable and a discrete dependent variable declaring whether the occupant feels comfortable or not.

The most critical aspect of the methodology is the extraction of the training events – pairs of temperature-classification values that allow us to learn the parameters of the system; means and standard deviations of the class distributions.

The basis for the data extraction is the HVAC[7] and occupancy information retrieved from the middleware. In particular, whenever an HVAC signal is recorded, meaning that the user has altered the systems operational status (either ON/OFF, change on setpoint temperature or heating mode) the algorithm classifies the current environmental conditions are uncomfortable for the user. Subsequently, the indoor temperature is monitored in small intervals (2 minutes). When the temperature reaches a stable value (less than 0.25 variation within the last 15 minutes) and the user does not take any further actions, a comfort event is also generated. This data is then utilized to learn the model parameters. Upon successful training, the model is employed to predict the probability of comfort/discomfort in an extended temperature range (10°C – 35°C). The personalized comfort boundaries are extracted as the minimum and maximum indoor temperature in which the probability of feeling comfortable exceeds the one of discomfort.

It must be noted that the process also supports three classes of events – comfort, hot, cold – which is more accurate in modelling terms and allows a more detailed identification of the occupant preferences. Nevertheless, it must be noted that the simpler modelling approach is more robust to a small number of training samples.

The profiling application was developed as a Jupyter notebook in the AEGIS platform. The methodology was tested on data recorded within the established lab premises. The output of the executed notebook, identified events and associated temperatures can be seen below:

```
Retrieving Data

hdfs:///Projects/smart_home_comfort_profiling/smart_home_data/sh_data.pkl

Entries: 9240

HVAC init values:  {'setptemp': 26.0, 'ONOFF': 'OFF', 'MODE': 'COOL', 'FANSP': '4'}

Removing entries with 0 occupancy:  3553

Removing entries during weekends:  915

Final data rows:  4772
```

---

[7] Heating, ventilation, and air conditioning (HVAC) : https://en.wikipedia.org/wiki/HVAC

```
[25.0, 24.1, 25.7, 26.0, 26.2, 26.7, 26.5, 26.1, 26.1, 26.6, 24.9, 25.5, 25.5, 25.0,
25.7, 26.3] ['h', 'ok', 'c', 'ok', 'c', 'ok', 'h', 'ok', 'c', 'ok', 'c', 'ok', 'h',
'ok', 'c', 'ok']

(array([[25.17777778, 25.47777778],

        [ 1.55833086,  1.17168234]]), array([0.5, 0.5])).

Temperature Limits:  (24.499999999999964, 27.299999999999955)
```


Figure 2: Comfort Profiling output – Identified low and high comfort limits.

For further exploration of the underlying procedure, the Visualiser of the AEGIS platform was employed in order to plot the class conditional probability density functions, used in the Bayesian model, as well as the resulted posterior probabilities for the comfort and discomfort classes, as presented in the following figure.
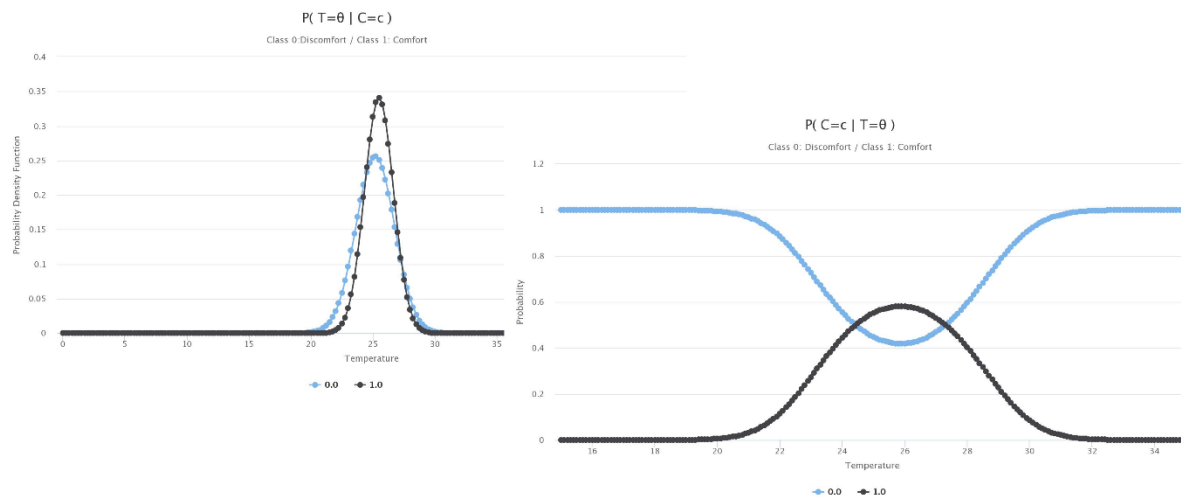
Figure 3: Comfort Profiling output – Bayesian model parameters and posterior results

Actors:	CSP
Pre-conditions:	1. Successful realization of test case 2.1. 2. Successful realization of test case 2.2, to be performed in regular intervals, so as to enable the data and model updating process.
Post-conditions:	1. An API is established in the backbone server, which receives real-time data from the gateway, identifies alerts based on trained comfort model and publishes them to the mobile app.
Normal Flow	1. The data scientist develops the required comfort algorithm in the backbone server. 2. The data scientist develops the notification functionality to be added in the smart home GUI. 3. Environmental and VOC limits are identified. 4. The data scientist implements Test Case 2.2 and retrieves the processed data through the respective API from the AEGIS platform. 5. The comfort models are trained on the data. 6. A web service is operated in the server, which listens for data updates from the smart-home gateway. 7. Alerts are published by the service when the estimated comfort, given current conditions, violates the recognised boundaries.
Pass Metrics	1. The comfort profiling and notification service is in place.

	2. The models are updated in regular intervals based on the monitored data.
Fail Metrics	1. The comfort models cannot be trained due to lack of or bad-quality data. 2. Communication issues between the server and the gateway.
Notes and Issues:	-
Execution Results	The comfort profiling algorithm was created as a Jupyter notebook in the AEGIS platform. The required data-streams were previously established (test case 2.1) and data were cleaned and normalized (test case 2.2). Consequently, the algorithm estimates the required Bayesian classifier model parameters and exports the class conditional posterior probabilities for given temperatures. Through these, the algorithm identified the comfort limits, which are utilized in the following test case to generate warnings on adverse indoor conditions. The test case was successfully completed.

5.2.2.2. Test Case 4.2 – Receive alerts regarding uncomfortable or health-endangering conditions

Following the identification of the comfort limits, a notification process was established within the smart home gateway, which checks in real-time the indoor environmental conditions and posts warning notifications to the SHAL backbone server, upon noticing that these deviate outside the acceptable limits. The web service post message has the following JSON format structure:

```
{

    "sender": "smart_home",

    "key": "home_identifier",

    "title": "Smart Home Notification",

    "message": "…"

}
```

Actors:	At-risk Individual, carer

Pre-conditions:	1. Successful realization of test case 2.1. 2. Successful realization of test case 4.1.
Post-conditions:	1. Alerts are notified to the registered user through the mobile app UI.
Normal Flow	1. The person and/or informal carer are registered for the smart home notification service through the Web App. 2. Smart home data streams are sent from the gateway to the backbone server through a dedicated web service API. 3. The gateway listens for published alerts. 4. When such an alert is generated, a suitable message is notified to the user/s (Examples of alerts: Uncomfortable Conditions: Temperature is very low, consider turning the heating on. Uncomfortable Conditions: Temperature is very high, consider turning the cooling on. Extreme Conditions: Concentration of indoor pollutants exceeds safety limits. Ventilation is required.)
Pass Metrics	1. Useful alerts are generated and notified to the users.
Fail Metrics	1. Alerts do not correspond to actual events, or are not intuitive and thus helpful to the users. 2. Communication issues between the server and the gateway.
Notes and Issues:	-
Execution Results	Following the training process and the identification of the comfort profiles, a service was set up that continuously monitors the indoor conditions and posts warning notifications to the backbone server, which are subsequently pushed to the end-user UI. The test case was successfully completed.

5.3. Demonstrator Evaluation

5.3.1. Quantitative Evaluation

The following table summarizes the quantitative evaluation for the second (medium) version of the SHAL demonstrator.

Sub-characteristics	KPIs	Calculation Type	Mandatory / Optional	Means to Verify	Value

Second (medium) demonstrator functional completeness	Portion of successfully completed medium stage Test Cases	[Successfully Completed test cases] / [No of tested cases] * 100%	M	Calculation (0-100%)	100%
Comfort satisfaction	Average comfort satisfaction rate	[Sum of Comfort probability as learnt by the profiling model] / No of learnt profiles	O	Quantified comfort of users based on control actions.	3
Number of Medical Rules	Medical rules in the Web App	No. of medical Rules	M	Count of medical rules in the web app	10 in total number of medical rules
Number of Notifications per condition	Notifications / Recommendations attached to outlier	No. of notifications defined	O	Count of notifications defined	120 in total, focusing on 4 conditions. For the rest of the conditions the notifications were defined and the execution was simulated

Table 4: SHAL demonstrator quantitative evaluation

5.3.2. Qualitative Evaluation

Further to the quantitative evaluation of the demonstrator, an internal focus group, comprised of six participants, was organized among the data scientists and developers of the demonstrator, so as to perform a further qualitative analysis. Similar to the methodology followed for the platform evaluation, the data scientists were asked to answer a series of questions pertaining the following aspects:

- Perceived Usefulness: The degree to which a data scientist believes that the service, as envisioned and implemented through the AEGIS platform, offers significant advantages.

- Perceived Ease-of-Development: The degree to which a data scientist believes that the development of the service app was easy and with no unexpected problems.
- Service Quality: The level of refinement of the offered service.

In particular, the table below summarizes the questions raised:

Perceived Usefulness	Do you believe that the developed services, utilizing the AEGIS platform offer specific advantages, compared to the case that the platform was not utilized?
Perceived Ease-of-Development	What aspects of the development process did you find good/bad and why? Have you faced any unexpected behaviour during development of the application?
Service Quality	At the current stage of development, do you foresee/expect any potential issues for end-users when using the apps and services? What would you improve to increase the service quality?

Table 5: Questionnaire for qualitative evaluation of the SHAL medium version demonstrator.

A round table discussion with people from the three partners contributing to the demonstrator took place, the answers and comments to the questions were summarized in the following table.

Perceived Usefulness Do you believe that the developed services, utilizing the AEGIS platform offer specific advantages, compared to the case that the platform was not utilized?	• Overall, the utilization of a big data distributed computing platform allows for high scalability of the services offered. • Utilization of predeveloped components, such as the visualizer, helped overcome some difficulties in terms of exploring and visualizing the data. • Although the current algorithmic procedures used do not exploit the full potential of the distributed platform, future exploration of more computationally intensive techniques is possible, due to the modular component architecture.
Perceived Ease-of-Development What aspects of the development process did you find good/bad and why?	• The ability to develop utilizing standard programming languages and development environments (e.g. python through Jupyter) was significantly helpful and eased the introduction to the platform. • Data management within the projects and dataset was intuitive and allowed for the configuration

Have you faced any unexpected behaviour during development of the application?	and role setting of the different developers/data scientists involved. • The demonstrator implementation process has so far been relatively free from unexpected issues, that were difficult to address. • Data uploading to notebooks is somewhat cumbersome obscure. • The utilization of virtualization technologies, HDFS, etc.., poses some specific requirements for accessing data through the notebook environments. The process to do so could be further documented and, if possible, potentially be simplified. • In certain situations, the help of the platform or platform components was needed, in order to solve technical issues related to job management or utilization of these tools.
Service Quality At the current stage of development, do you foresee/expect any potential issues for end-users when using the apps and services? What would you improve to increase the service quality?	• The application workflow seems to be streamlined and stable according to our tests. UI experience is good, with support for both mobile and web interfaces progressing well. • Continuous refinement is of course required. • The documentation targeted to the end users is still in its early stages.

Table 6: Qualitative evaluation of the SHAL medium stage demonstrator – Key points identified through the internal focus group.

5.4. Challenges and recommendations

Through the qualitative and quantitative evaluation of the second (medium) stage demonstrator, and after the organization of the demonstrator internal focus group, a few challenges and associated recommendation for improving the demonstrator functionalities and interfaces, as well as utilization of the AEGIS platform were identified.

In more detail, one of the main challenges was the still somewhat cumbersome and restricting process of data uploading to notebooks for further processing. The manual process followed so far does impose some restrictions in terms of data analysis, for example no automation techniques can be applied. In conjunction to the technical partners, discussions have been made to explore potential better ways for this process.

Related to the above is the strict requirements posed by the platform on how to make data available within the notebook environment. Although this issue is more specific to the platform, the demonstrator partners may also contribute in the enhancement – provision of intuitive modules to make the procedure more intuitive/better understood and documented.

Finally, a third recommendation coming out of those discussion groups referred to issues of identity disclosure to care takers which would be necessary for , and the ability to impose the "right to be forgotten" feature where details of the past are no longer available to care takers in case a patient chooses so (loosing in parallel the personalised notification service)

All of the above challenges have been either initially considered by the demonstrator (and are documented as test cases in D5.2), or came up during the implementation of the demonstrator, and thus are to be amongst the elements for work for the final version of the demonstrator.

6. AEGIS INSURANCE DEMONSTRATOR

6.1. Pilot overview and current status

The insurance demonstrator aims to exploit the AEGIS analytic functionalities in scenarios built following the HDI business needs. On this view, three use cases have been defined, namely Version 1: "Financial impact, customer support and services", Version 2: "Personalised early warning system for asset protection", Version 3: "Business plan and marketing strategy", as shown in Figure 4. The execution and evaluation of the first scenario have been reported in D5.3 (M18), while the execution and evaluation of the third scenario will be reported in D5.5 (M30).
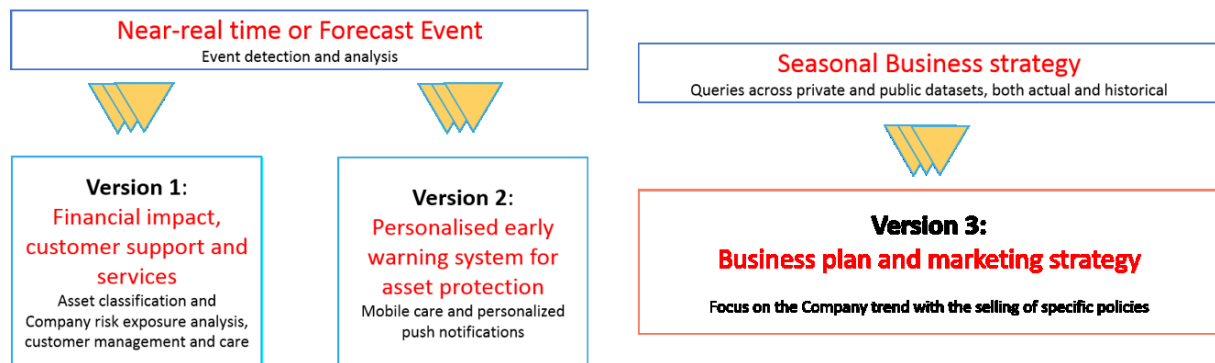
Figure 4: Insurance demonstrator scenarios overview

The following table, which has already been included in the previous deliverables (D5.2 and D5.3), briefly reports the functionalities developed for the first two scenarios as well as the required functionalities for the success of the next scenarios.

ID	Scenario	Functionalities	Demonstrator Version
1	Financial impact, customer support and services	Event Detection tool configuration and training[8] Event Detection notification[9] Create Project Uploading in-house dataset Identification of the possibly involved customers Visualisation Priority list (report) sharing	Early

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[8] At the moment the tool is standalone.

[9] At the moment this service has not yet been implemented.

		Evaluation of the financial impact	
		Customer support and services	
2	Personalised early warning services for asset protection	Additional functionalities required are: Mobile App and geolocation Event Detection tool configuration and training (version 2) Identification of the possibly involved customers (version 2) Personalised offer	Medium
3	Marketing strategy and pricing support services	Additional functionalities required are: Business analysis request Business analysis Visualisation (version 2)	Advanced

Table 7: Insurance demonstrator scenarios and required functionalities overview

The present deliverable reviews the achievements of the second scenario, starting from the description of the test cases: a first definition of the test cases has been provided in D5.2 (paragraph 5.2.1, 5.2.2 and 5.2.3), and despite of what has been reported there, as specified also in D5.3 (paragraph 6.1), the Early and the Medium Demonstrator have been reversed. From this point, the need of some changes in the test cases listed in the following (section 6.2 and sub-paragraphs) raised.

The second scenario of the Insurance Demonstrator is mostly related to the detection of a foreseen event of interest by the Event Detection Tool. The HDI Data Scientists through the AEGIS platform can evaluate the risk exposure of the company by identifying the customers that could be affected by the events and the type of the policy/-ies held by them. Through the analysis of some features, for instance the number of accidents and the number of previous injuries, for each customer a priority value is assigned. The list of customers is then sent to the Web App for further processing by the HDI operators that will contact the customers. The HDI Data Scientist may also send a push notification to the customers that have installed the HDI Mobile App, hence to those that had signed an AEGIS-specific terms and conditions agreement. An example of notification is reported in the Figure 5 showcasing the navigation menu of the Mobile App with options for Notifications ("Notifiche"), Contact Information ("Contatti") and Support Information ("Supporto").

Figure 5: Mobile app menu page

The notification received by the HDI customers, includes details of the event as well as information about further policy/-ies they could subscribe (type of policy, price, duration, restrictions) and contact references of the HDI agent that can support them. For this reason, every time a notification is sent to a customer, a mirroring notification is sent to the HDI Web App workspace of the responsible agent.

The main steps of the second scenario execution are shown in Figure 6.

Figure 6: Insurance Demonstrator scenario 2 - Overview

6.2. Scenario execution

The present section reports the test cases executed in order to evaluate the second scenario of the insurance demonstrator, documenting the issues met and the challenges that during the next period will be the focus of the development team, in order to achieve at the end of the project the proposed KPIs.

6.2.1. Test Case 1 for "Event Detection tool training (version 2)"

Actors:	HDI Developer, HDI Data Scientists

Pre-conditions:	1. The AEGIS Consortium provides the Event Detection tool.
Post-conditions:	1. The Event Detection tool detects events of interest for HDI.

Normal Flow	1. The HDI Expert selects a set of interesting data sources and keywords to be taken into account by the Event Detection tool considering the Italian language.
	
	2. A Python script in an Ubuntu virtual environment streams the tweets that contain the keywords of interest and creates a CSV file to collect them.
	
	3. The Data Scientist manually assigns to each tweet in the CSV file a label from -1 to 1, where:
	    • -1 means that the tweet is not of interest,
	    • 0 means that it is relevant to an event but it is not something that happened recently or it is an opinion about an event,
	    • 1 means that it is exactly the kind of tweet needed.
	
	4. After reaching 5000 labelled records (a number considered sufficient for the training) the text of each tweet is cleaned through a Python script. The result is a CSV file with 3 columns: tweet_id, clean-text and label, and another CSV with just the clean text (1 tweet per line).
	
	5. These files have been then used as the corpus for the TF-IDF algorithm that transforms the dataset to numeric values. The file is ready for the training.

Pass Metrics	1. The Event Detection tool is trained in detecting events of interest for HDI.
Fail Metrics	1. The Event Detection tool is not well trained, does not detect the right events due to wrong keywords setting or misunderstanding on the keywords meaning in the tweet context.

Notes and Issues:	The time necessary for the collection of a significant number of tweets of interest is unpredictable.
	
	Four event types have been identified as 'events of interest':
	    • flood (training completed during the first evaluation),
	    • 'social', for example a strike, a riot, or a high-risk sport-related event (training completed during the second evaluation period),
	    • hailstorm (training completed during the second evaluation period),

	• whirlwind (the training is still ongoing due to the low occurrence rate of the phenomenon). The Python code could be also used almost as-is for the streaming of tweets related to other keywords, languages and further scenarios.
Execution Results	The Event Detection tool has been trained for the second (medium) demonstrator in Italian, with the keywords 'grandine' and 'grandinata' (hailstorm) both in the singular and in the plural forms, 'polizia antisommossa', 'proteste', 'scontri' (respectively riot police, conflict and protest). The number of tweets collected and labelled is around 5000 for each event type (including an enhanced training for the flood event, from 1000 tweets of the first phase to 5000 tweets) and neither retweets nor answers have been considered. The machine-learning algorithm of the Event Detection Tool has been improved.

6.2.2. Test Case 2 for "Event Detection notification configuration"

Actors:	AEGIS partners' developers, HDI Data Scientists
Pre-conditions:	1. The Developer configures and connects the HDI Web App with the Event Detection tool. 2. The Event Detection tool detects events of interest for HDI.
Post-conditions:	1. The HDI Web App provides an alert service that notifies the Data Scientist about the detected foreseen event.
Normal Flow	1. The Developer sets an alert service for the Data Scientist in case of the detection of an interested event.
Pass Metrics	1. The Web App notifies to the Data Scientist that a new event of interest has been detected.
Fail Metrics	1. The Web App is not able to send notification about the detection of an event to the Data Scientist.
Notes and Issues:	-
Execution results	The data scientist will receive the notifications from the EDT in her/his space in the AEGIS platform. Currently this functionality has been simulated.

6.2.3. Test Case 3 for "Event Detection Tool Streaming"

Actors:	HDI Data Scientist
Pre-conditions:	1. The Event Detection tool has been trained with the keywords of interest for HDI.
Post-conditions:	2. The Data Scientist receives an email and a notification on his/her personal area on the AEGIS platform from the EDT and may evaluate the relevance of the event. If he/she considers it as an event that could impact on the HDI customers portfolio, he/she starts the analysis on AEGIS.
Normal Flow	1. The Data Scientist through an email and a notification on the AEGIS platform from the Event Detection Tool is informed that an event that has been detected. 2. The Data Scientist using his/her knowledge (eventually making some research on the internet) evaluates if the event could be of interest for the company. 3. If the event is of interest, the Data Scientist fills a predefined form within the Web App to track the new event.
Pass Metrics	1. The Event Detection Tool API detects events of interest for HDI. 2. The Data Scientist fills the form with details about the event detected and the type of analysis he/she is going to perform.
Fail Metrics	1. The Data Scientist does not fill the form in an exhaustive way.
Notes and Issues:	
Execution Results	The interaction between the HDI Expert with the Event Detection tool and the Web App has been tested many times by different users. When the Expert assigns a new event to a Data Scientist, he/she receives an email on the Web App. The need of sending an email is in order to access the Web App, hence to see the notification, the Data Scientist has to be logged in the Web App. The form that the HDI Expert fills to request a new analysis from the Data Scientist has been jointly defined by them with the aim to drive the analysis that is going to be performed. The fields that should be filled include general information about the event (for instance type and date) and instructions for the analysis and its sharing. When the analysis request is sent, a new event is created and an ID is associated to the event: both the

	Data Scientist and the Expert from the Web App can display the event details and status.

6.2.4. Test Case 4 for "Create Project" and 5 for "Uploading datasets"

These test cases are the same as reported in previous deliverables, and their achievement is the basis of each analysis on the AEGIS platform, since any kind of analysis is dependent on the creation of a project (new or already existing). Every time a new project is created, it is necessary to upload the needed datasets. Please note that, these two steps could be skipped if a project with the datasets of interest has already been placed in AEGIS.

Briefly:

1. The Data Scientist when logged in with his/her AEGIS account creates a "*Personalised early warning system for asset protection*".
2. The Data Scientist through the offline Anonymiser provided by the AEGIS platform and installed on his/her computer, anonymise any sensitive in-house data.
3. The datasets of interest (.csv files) are uploaded and associated with the "Personalised early warning services for asset protection" project. The considered datasets are the customers data (e.g. policy and vehicle/goods details) and further external datasets with scoring values associated to legal entities/physical people.

It is important to mention that following the precise rules disposed by the Consortium's Ethical Advisory Boards, while treating in-house datasets the principle of minimization has been followed, although the data were anonymized and were bounded by the Data Scientist account credentials on the AEGIS platform.

6.2.5. Test Case 6 for "Mobile App data enrichment"

Actors:	HDI Data Scientists
Pre-conditions:	1. The Data Scientist has found an event of interest. 2. The HDI Mobile App has a feature to enable the geolocation of the HDI customer.
Post-conditions:	1. The Data Scientist obtains a dataset with the current location of the customers that have installed the HDI Mobile App. 2. The Data Scientist uploads the .csv file on the AEGIS platform.
Normal Flow	1. The Data Scientist calls from the Web App a function to gain the current location of the HDI customers. 2. The result of the call is a .csv file that associates to each customer his/her location.

	3. The Data Scientist anonymises the file with the Anonymiser and uploads the resultant file on the "*Personalised early warning system for asset protection*" project on the platform.
Pass Metrics	1. The geolocation functionality works correctly and the .csv file contains the expected data (customer reference name, current latitude and longitude).
Fail Metrics	1. The geolocation functionality presents bugs or data in a format unexpected. 2. The HDI customers are not familiar with Mobile Apps or reticent to share their position.
Notes and Issues:	-
Execution Results	Testing about the geolocation from the mobile app was successful and the .csv file was created with the expected data (customer reference name, current latitude and longitude).

6.2.6. Test Case 7 for "Identification and visualisation of the possibly involved customers"

Actors:	HDI Data Scientists
Pre-conditions:	1. All the needed data are available on the "*Personalised early warning system for asset protection*" project on the platform.
Post-conditions:	1. The Data Scientist obtains a dataset about the possibly involved customers; the list of customers depends on the impact area of the foreseen event.
Normal Flow	1. The Data Scientist on the AEGIS platform through the Query Builder correlates the features of the event with the in-house dataset regarding the customers' policies and location. 2. The Data Scientist obtains a .csv file with the list of the customers residents in the area, that have an asset or a real estate with a valid policy coverage in the area, or that are currently located in the area. The file contains the ID of these customers, the type of the valid policy/-ies held and the location of the insured asset(s). 3. To have a fast overview of the customer interested the Data Scientist can visualise them on a map (each customer is represented with a pin).

Pass Metrics	1. The query filters the rows of the file related to the customers that could be involved in the foreseen event. The content of the rows is not changed. 2. The Data Scientist can visualise the customers pointed out from the Query Builder analysis on a map. The customers' location is identified with a marker that evidences the type of policy/-ies held.
Fail Metrics	1. The analysis is not well performed, the dataset was not appropriate or the queries were not properly defined.
Notes and Issues:	-
Execution Results	The Data Scientists have executed this step by using many (anonymised) customer's .csv files from the HDI databases. No issues have been encountered.

6.2.7. Test Case 8 for "Priority list creation"

Actors:	HDI Data Scientists
Pre-conditions:	1. The Data Scientist has identified the customers possibly involved in the event through the Query Builder.
Post-conditions:	1. The Data Scientist obtains a report about the possibly involved customers; that list depends on the area of the foreseen event, on the type of event, on the number and kind of policies held by the customers and on the score values of the customer in the external datasets. 2. A column with a priority value is added to the file resulted from the Query Builder, a new .csv file is created and downloaded by the Data Scientist.
Normal Flow	1. The Data Scientist in the same Jupyter notebook containing the Query Builder and the Visualiser, implements a prioritization algorithm. The priority rules have been defined by the HDI Expert as specified in the form with the analysis instructions. 2. Running the paragraph, a column is added to the dataset. The column contains the priority value associated to each customer. 3. The Data Scientist saves the new dataset, and downloads it in his/her own computer.
Pass Metrics	1. The priority rules are well defined.

	2. The new .csv file includes a column with the priority value associated to each customer. 3. The .csv file resultant from the analysis on the AEGIS platform is saved as new dataset in the project and then downloaded by the Data Scientist.
Fail Metrics	1. The Data Scientist has no knowledge about the priority rules. 2. The Jupyter paragraph is not well implemented, the values are not the right or the column is not added. 3. The Data Scientist is not able to download the file from AEGIS.
Notes and Issues:	-
Execution Result	The Data Scientists performed this test case with different datasets and rules. The execution of this test case has been made easier by the 'Add priorities (HDI)' button although the priority rules should be defined/changed each time following the analysis needs. By pushing the 'Save as Master' button the Data Scientists automatically uploaded the resultant file in a specific dataset folder related to the project. From here, the file is downloaded locally. While executing this test case no issues were encountered.

6.2.8. Test Case 9 for "Priority list (report) deanonymization, sharing and personalised offer"

Actors:	HDI Data Scientists, HDI Operators, HDI Customers
Pre-conditions:	1. The Data Scientist obtains from the analysis executed on AEGIS a report about the possibly involved customers as a priority list.
Post-conditions:	1. The Data Scientist sends a notification with information related to the foreseen event, the reference agent and a personalised offer to the customers on the list that have installed the HDI Mobile App.
Normal Flow	1. The Data Scientist deanonymizes the file resulted from the AEGIS analysis and uploads the file on the HDI Web App. 2. The Data Scientist compiles the notification to send to the Mobile App in a semi-automated way: the Web App indicates the customers that have installed the Mobile App and upon filtering the appropriate entries the text of the notification is composed as follows:

	A *<event type>* is foreseen in *<event area> <day/time of the foreseen event>*. Once the notification is opened, the text will contain also: We would like to suggest you to subscribe *<personalised offer, and details>*. For further information *<agent name, telephone number and email address>* will be glad to support you. 3. Through a click on the "Send" button of the HDI Mobile App sends the notification.
Pass Metrics	1. The HDI Customers receive the notification with correct information.
Fail Metrics	1. The mechanism of automated filling of the form for the notification does not work properly. 2. The mechanism that automatically assigns the personalised offers to the customers does not work properly.
Notes and Issues:	For the identified customers that have not installed the Mobile App, the contacting mechanism is the same as defined for the previous scenario. Briefly: The Data Scientist assigns the (remaining) customers of the list to the designed Operators. The Operators receive a notification on the Web App and an email (with the same indication as the one included in the notification on the Mobile App) to inform them that they have to contact some HDI customers that could be involved in a foreseen event. The customer is contacted by the HDI Operator and receives support.
Execution result	For this round of evaluation, the system has been used by GFT and HDI persons. While executing this test case no issues were encountered.

6.3. Demonstrator Evaluation

6.3.1. Quantitative Evaluation

Most of the KPIs defined in D5.2 are not all applicable to the second (medium) demonstrator since the developed Web App has not been yet integrated with the HDI Systems and GFT/HDI persons have acted as customers. Further KPIs were added to the previous list in order to provide a quantitative evaluation of the second scenario.

The KPIs reported in D5.2 will be evaluated during the next period when the two Apps will be integrated and the real customers will be contacted. The following table summarizes the quantitative evaluation for the second (medium) version of the Insurance demonstrator with corresponding KPIs for this version.

Sub-characteristics	KPIs	Calculation Type	Mandatory / Optional	Value
Second (medium) demonstrator functional completeness	Event Detection Tool reliability	[No of events of interest] / [No of events detected] * 100%	M	88%
Second (medium) demonstrator functional completeness	Event Detection Tool trained events	Sum	M	3
Second (medium) demonstrator functional completeness	Mobile App benefit_1	[No of customers to whom the Mobile App has been proposed]	M	6^{10}
All demonstrators	Number of datasets uploaded	Sum	M	90

Table 8: Insurance demonstrator quantitative evaluation

6.3.2. Qualitative Evaluation

In the scope of the second (medium) demonstrator activities evaluation, an internal focus group has been organised at the HDI premises, involving the two data scientists and three developers of the demonstrator together for many iterations of the test cases. Since the first round of evaluation, data scientists effectively run the Query Builder and Visualiser tools, correlating the features of the event with the in-house dataset regarding the customers' policies and location, and having a fast overview of the interested customers on a map. They are now well trained in the use of the notebooks of the platform.

The Web App that has been developed to allow the information exchange between the three actors involved in the process is working as expected, and the execution flow was tested by different users for each role and no issues were observed. The data scientists' analyses within the AEGIS platform have also succeeded. The problems encountered in the first tests have been fixed in cooperation with the other partners of the consortium.

The general feedback is that the status of the demonstrator, although not yet fully integrated, is on a good direction and the different steps are clearly defined. The Event Detection Tool has been adequately trained for the second (medium) demonstrator in Italian, with the keywords

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[10] This count refers to the number of mobile apps installed on GFT/HDI persons' devices.

'grandine' and 'grandinata' (hailstorm), 'polizia antisommossa', 'proteste', 'scontri' (respectively riot police, conflict and protest). The number of tweets collected and labelled is around 5000 for each event type (including an enhanced training for the flood event, from 1000 tweets of the first phase to 5000 tweets) and neither retweets nor answers have been considered. The machine-learning algorithm of the Event Detection Tool has been improved. Developers highlighted the value of using the Event Detection Tool Python code potentially almost as-is for the streaming of tweets related to other keywords, languages and further scenarios.

A general comment is the need to integrate the notifications from Event Detection Tool within the AEGIS platform personal area of the users, functionality that is foreseen to be implemented in the next period. The use of the Web App by the data scientists has been effective and the tool has been considered clearly structured.

The AEGIS platform was used for creating projects and upload datasets, and the offline Anonymiser was exploited for the management of sensitive in-house data. It is important to mention that following the precise rules disposed by the Consortium's Ethical Advisory Boards, while treating in-house datasets the principle of minimization has been followed, although the data were anonymised and bounded by the data scientist account credentials on the AEGIS platform.

The Mobile App, although in an initial form with a basic set of functionalities, has been used and tested. The geolocation functionality of the Mobile App was tested, as well as the creation of the .csv file with customer reference name, current latitude and longitude, and the achieved results are satisfactory. A remark has been done about potential issues regarding the reluctance of customers to agree sharing their location. Finally, from the workshop a number of suggestions were raised related to the potential new functionalities to be included in the next version of the Mobile App. To be more precise, the workshop suggested: a) the enhanced technical support, b) a magazine updated with useful contents for the healthcare, with periodic polls, information about the traffic and statistics about the usage of the vehicle and GPS location of the nearest affiliated body shop.

6.4. Challenges and recommendations

The main issue related to the second (medium) demonstrator and, in general, to the Insurance demonstrator is the privacy and security regulations. Since the topic is crucial and it needs a deep knowledge and accurate handling, one of the Ethical Advisory Boards has supported HDI for the scenarios' definition. In order to respect the Italian and European Legislation about data treatment, and the Insurance specific policies, the in-house datasets stored in HDI databases are uploaded on the platform after their anonymization. The data are managed and handled only by the HDI employees that are working on the AEGIS project and only the columns of interest for the project evaluation purposes are kept. Additionally, at the end of each analysis the in-house datasets are deleted from the AEGIS platform. More details about security and privacy within the Insurance Demonstrator are available in deliverables D1.3, D9.1 and D9.3.

The security and privacy issues are reflected in the workflow described in the previous paragraph, where there is the need to upload and download data from the HDI databases to the AEGIS platform. A potential issue in the use of the mobile app is represented by the possible reluctance of the customers to give their consent for the geolocation. The challenge for the advanced demonstrator is to avoid these multiple steps while guaranteeing data protection. In general, the second (medium) demonstrator has satisfied all the HDI actors, in terms of usability

of the tools and accuracy of the analysis. Toward this end, the cooperation between the HDI employees and the technical team of the project was fundamental, from the definition of the user stories (D3.1) to the test cases execution.

7. CONCLUSION

The objective of this deliverable was to document the efforts undertaken within the context of Tasks 5.2, 5.3, 5.4, 5.5 and 5.6 of WP5. This deliverable builds on top of the work and outcomes of deliverables D5.1, D5.2 and D5.3 towards the aim of documenting the status of the AEGIS demonstrators and reporting the evaluation results of both the AEGIS platform and the second (medium) version of the AEGIS demonstrators.

At first, the deliverable presents the evaluators involved in the AEGIS evaluation framework by providing a description of their knowledge and technical expertise, their role in the project, as well as their role in the evaluation process.

As documented in deliverable D5.2, the AEGIS evaluation framework aims at performing a holistic evaluation of both the AEGIS platform and the AEGIS demonstrators and it is formed with quantitative and qualitative methods for both cases.

Towards this end, the AEGIS platform v2.00 evaluation was performed incorporating a quantitative evaluation based on the list of KPIs, as defined in D5.2, and a quantitative evaluation based on focus groups that were conducted by each demonstrator. These small focus groups consisted of data scientists and developers involved in the implementation of the second (medium) version of each demonstrator. The results of both methods were documented, followed by a detailed description of the key challenges faced in regards to the AEGIS platform v2.00 during the implementation phase of the second (medium) versions of the demonstrators, as well as a list of recommendations for the enhancement of the platform in the upcoming release.

Following the AEGIS platform evaluation, detailed information for the current status of each demonstrator was documented, presenting the work that was performed during the implementation of the second (medium) version of the demonstrators. The concrete scenarios that were executed in this phase of the demonstrators' implementation were documented, presenting also the results for each step of these scenarios along the relative implementation details. Following the two-fold approach of the AEGIS evaluation framework, for each demonstrator a qualitative evaluation was performed based on a list of demonstrator-specific KPIs and a quantitative evaluation was also performed based on small focus groups. The results of both evaluations were presented and the challenges faced during the implementation are discussed. Finally, a list of recommendations is presented that will guide the implementation of the upcoming version of each demonstrator.

The outcomes and knowledge extracted from this deliverable will serve as valuable feedback for the AEGIS platform developers towards the aim of addressing the demonstrators' and the AEGIS stakeholders' needs in the upcoming version of the AEGIS platform. It should be noted at this point that the demonstrator evaluation and feedback is a living process that will last until M30, when the final demonstrator evaluation and feedback (corresponding to D5.5) and the final evaluation, impact assessment and adoption guidelines (corresponding to D5.6) will be delivered.