



PROPHESY

Platform for rapid deployment of self-configuring and optimized predictive maintenance services



DELIVERABLE

D8.5 – Report on Standardization Activities and Collaboration with Associations v1

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DELIVERABLE

D8.5 – Report on Standardization Activities and Collaboration with Associations v1

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Executive Summary

The present deliverable is the first report on the project's participation and contribution to standardization bodies and EU associations. To this end, the PROPHEsy project members have attended various events linked to standardization or clustering activities. Main achievements for this period and the key meetings attended are presented.

A standardization channel has been made for with international norms mechanical vibration, shock and condition monitoring standards committee, thus enabling feedback from and to the PROPHEsy project.

At the collaboration with associations level, a cluster with other projects working on the same subject has been initiated (ForeSee). Contents of the web meetings and physical meetings are further detailed in the current report, including information on the PROPHEsy Workshop on Predictive Maintenance (organisation, promotion, agenda, discussion).

Other collaborations activities with EFFRA, EU H2020 FAR-EDGE project, Edge4Industry and AIOTI WG11 are also described in the present deliverable.

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Definitions, Acronyms and Abbreviations

Acronym/ Abbreviation	Title
AIOTI	Alliance for IoT Innovation
DoA	Description of Action
EFFRA	European Factories of the Future Research Association
FoF	Factories of the Future
ForeSee	Cluster of FoF-09 projects on predictive maintenance for the factories of the future
IoT	Internet of Things
ISO	International Organization for Standardization
METSTA	Mechanical Engineering and Metals Industry Standardization in Finland
NBN	Belgium National Bureau for Normalization
PdM	Predictive Maintenance
TC	Technical Committee
WG	Working Group
WP	Work Package
M	Month
T	Task

1 Introduction

1.1 Purpose and audience

This deliverable aims at providing a detailed report on the project's participation and contribution to standardization bodies and EU clusters and associations.

The purpose of the document is to describe all activities undertaken during the 1st period of the project (M1-M18), to summarize activities related to standardization and to explain the activities performed by the partners of the PROPHECY project with EU clusters and associations. The purpose of the task is to promote results, standardize results where relevant and ensure a regular communication of the project towards and with other European Funded projects or associations.

1.2 Document scope

In the scope of the reporting period, the project established liaisons and collaborations with various clusters and associations, in-line with the plan listed in the DoA (Description of the Action). In particular, PROPHECY collaborated and contributed to the following clusters and associations:

- The European Factories of the Future Research Association (EFFRA).
- The Alliance for IoT Innovation (AIOTI) and more specifically its 11th Working Group (WG) on IoT in Manufacturing.
- The Cluster of FoF-09 projects (ForeSee) on predictive maintenance for the factories of the future.

The scope of the partners' contributions to these associations, clusters and their initiatives are described in later paragraphs of the deliverable.

1.3 Document structure

The Sections of the deliverable at hand are organised in the following manner.

After the introductory Section 1, Section 2 provides a report on the standardization activities that took place during the first period of the project.

Section 3 provides a report on the collaboration with associations that took place during the first period of the project.

Section 4 draws the conclusions and future outlooks.

2 Report on Standardization Activities

2.1 Standardization bodies and partners

At the beginning of the project, a list of potentially relevant bodies and standards was released. The initial table is given in the DoA. The reviewed table is given in Table 1. This table takes into account the current status of the Standardization bodies for which PROPHECY partners have established a direct link.

Table 1 Standardization bodies potentially relevant to the PROPHECY project

Standard/ Committee	Description	Partner(s)
ISO TC 108/SC 5	ISO/TC 108 (Mechanical vibration, shock and condition monitoring) Committee	ICARE
EFFRA	Contribution to roadmaps, position papers and other documents to be produced/developed by EFFRA – Participation in clustering activities	AIT / INTRA
AOITI WG11	Participation in IoT standards roadmapping initiatives and contribution based on the CPS manufacturing and PdM perspective	AIT

2.2 ISO TC108/SC5 Condition monitoring and diagnostics of machine systems

The International Organization for Standardization (ISO) develops and publish International Standards. 163 national standard bodies participate to ISO.

- ISO requires representations of countries in different technical committees.
- ISO Technical Committee 108 is responsible for Mechanical vibration, shock and condition monitoring standards. It is further divided into 4 Functional Committees:
 - ISO/TC 108/SC 02 "Measurement and evaluation of mechanical vibration and shock as applied to machines, vehicles and structures"
 - ISO/TC 108/SC 04 "Human exposure to mechanical vibration and shock"
 - ISO/TC 108/SC 05 "Condition monitoring and diagnostics of machine systems"
 - ISO/TC 108/SC 06 "Vibration and shock generating systems"
- Each committee is composed of Working Groups (WG). Each WG develops standards on a specific subject.

2.2.1 Attendance of August 2018 Meeting in Helsinki

ICARE attended the meeting on behalf of the NBN. NBN is the National Bureau for Normalization and is responsible for developing, publishing and selling standards in Belgium.

The meeting took place on August 13-17, 2018 – ISO TC 108/SC 5 Condition Monitoring and Diagnostics of Machine Systems, Helsinki, Finland at METSTA Office (Conference Center) in Helsinki, Finland.

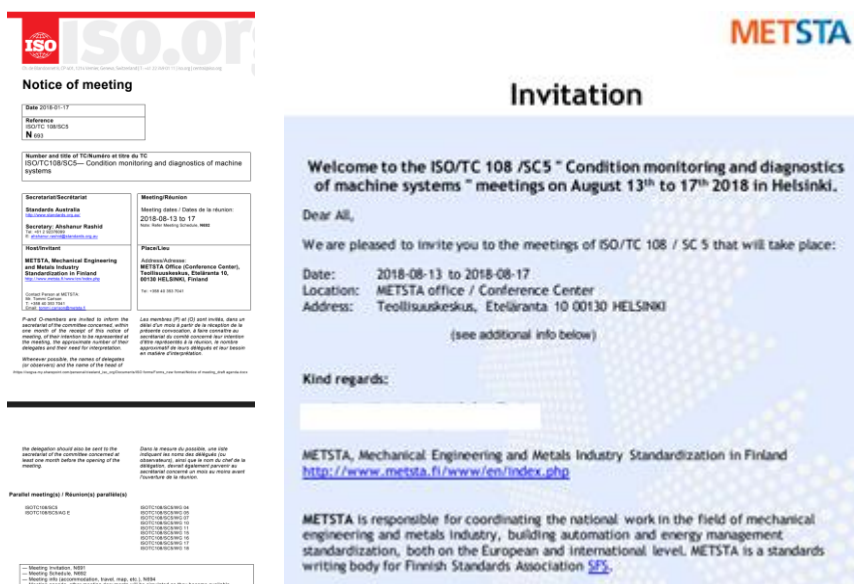


Figure 1 Notice of meeting & invitation to the ISO TC/108 August 2018 meeting

ICARE also attended the following meetings and working groups.

Committee	Title
ISO/TC 108/SC 5/AG E	Strategic planning
ISO/TC 108/SC 5/WG 4	Tribology-based monitoring and diagnostics
ISO/TC 108/SC 5/WG 5	Prognostics
ISO/TC 108/SC 5/WG 7	Training and accreditation in the field of condition monitoring and diagnostics
ISO/TC 108/SC 5/WG 16	Condition monitoring and diagnostics of wind turbines
ISO/TC 108/SC 5/WG 18	Condition monitoring management

2.2.2 Norms discussed, revised or cited

The following list summarizes the norms that were either discussed or commented or used as a reference to highlight the link between some industrial needs and parts of the standards that were potentially covering these needs. For copyright and confidentiality reasons, the details cannot be given in this report.

List of discussed norms:

- ISO 14830-1 Condition monitoring and diagnostics of machine systems -- Tribology-based monitoring and diagnostics -- Part 1: General guidelines

- ISO 13381-1 Condition monitoring and diagnostics of machines -- Prognostics -- Part 1: General guidelines
- ISO 18436-1 Condition monitoring and diagnostics of machines -- Requirements for qualification and assessment of personnel -- Part 1: Requirements for assessment bodies and the assessment process
- ISO/IEC 17024:2012 Conformity assessment -- General requirements for bodies operating certification of persons
- ISO 16079-1 Condition monitoring and diagnostics of wind turbines -- Part 1: General guidelines
- ISO 16079-2 Condition monitoring and diagnostics of wind turbines -- Part 2: Detection of mechanical faults of the drive train
- ISO 10816-21 Mechanical vibration -- Evaluation of machine vibration by measurements on non-rotating parts -- Part 21: Horizontal axis wind turbines with gearbox
- ISO 13373-1 Condition monitoring and diagnostics of machines -- Vibration condition monitoring -- Part 1: General procedures
- ISO 5348 Mechanical vibration and shock -- Mechanical mounting of accelerometers
- ISO 55000 Asset management -- Overview, principles and terminology
- ISO 55001 Asset management -- Management systems -- Guidelines for the application of ISO 55001
- ISO 55002 Asset management -- Management systems -- Guidelines for the application of ISO 55001
- ISO 55010 Guidance on alignment of asset management, finance and accounting

2.2.3 Following of new/reviewed standards from this committee

It has been identified that there's a possible use of ISO norms in the PROPHESY approach for T3.3 & T4.1 & T5.1 & T6.3, some of which do fall under the responsibility of the ISO TC 108/SC5 committee. This ensures that any changes or suggested changes will be notified to the PROPHESY project and that the PROPHESY stakeholders may provide, at least through ICARE, a possible feedback for the ISO norms that are under the ISO/TC 108/SC5 committee.

3 Report on Collaborations and Contributions to Clusters and Associations

3.1 PROPHECY Participation in the FoF-09 Projects Cluster: “ForeSee”

3.1.1 Overview

PROPHECY participates in the cluster of predictive maintenance projects, with other projects working on the same subject with different approaches (<http://prophecy.eu/foresee-cluster>).

This cluster aims at sharing results, strategies, discussing use cases and experience on different topics addressed by the projects, such as algorithms for data analytics, data collection, etc. The idea behind the cluster is to leverage the funding received by all the cluster members in order to go beyond every project’s defined scope. Sharing information between members enables open discussions from an audience composed of field and academic experts working on similar projects, thus fostering business, market information, scientific and technical knowledge collaboration.

The cluster includes the following 6 EU-funded projects:

- PROPHECY (<http://prophecy.eu/> - grant agreement no. 766994)
- PROGRAMS (<https://www.programs-project.eu/> - grant agreement no. 767287)
- SERENA (<https://www.serena-project.eu/> - grant agreement no. 767561)
- PreCoM (<https://www.precom-project.eu/> - grant agreement no. 768575)
- UPTIME (<https://www.uptime-h2020.eu/> - grant agreement no. 768634)
- Z-BRE4K (<https://www.z-bre4k.eu/> - grant agreement no. 768869)

The cluster events list is summarized in Table 2. The next paragraphs describe the contents of the discussions and highlight some of the conclusions.

Table 2: ForeSee Cluster Events List

Cluster Event	Date	Type	Location (if relevant)
Web Meeting 01	11/12/2017	Telco	
Web Meeting 02	26/02/2018	Telco	
Web Meeting 03	04/04/2018	Telco	
Web Meeting 04	31/05/2018	Telco	
1 st Physical Meeting	26/06/2018	Physical meeting	Centre Albert Borschette, Brussels
Web Meeting 05	13/09/2018	Telco	
Web Meeting 06	16/11/2018	Telco	
Web Meeting 07	20/12/2018	Telco	
Workshop (organised by PROPHECY project)	24/01/2019	Physical meeting	Philips, Drachten (NL)

3.1.2 PROPHECY Participation in the 1st ForeSee Web Meeting

The 1st Foresee web meeting took place the 11th of December 2017 via GoToMeeting application and all projects participated. Slides of all projects were prepared according to the proposed agenda. The internal discussions indicated a clear interest to coordinate joint activity.

A number of activities were proposed by each project, on both technical (technology, KPIs, validation aspects) and non-technical (dissemination, commercialization, outreach) aspects of the cluster. More details can be found in the individual projects' presentation and also in the cluster overview presentation.

It was agreed that the mechanism to facilitate the joint activity would be by the means of a joint cluster scope document, addressing technical aspects, non-technical aspects, road mapping activity etc. It was also decided that each project should undertake the lead of specific parts of this scope document that will be discussed in the 2nd conference call.

The tentative title and acronym of the cluster was discussed at this stage. It was also proposed to organize a joint session for the FoF Impact workshop, the next conference call date and a physical meeting for 2018.

3.1.3 PROPHECY Participation in the 2nd ForeSee Web Meeting

The 2nd Foresee web meeting took place the 26th of February 2018 via GoToMeeting application and all projects participated. The main discussion points of the 2nd Foresee web meeting were the access of all projects representatives to the shared folder of the cluster, the needs of individual projects, the upcoming common activities/events and the suggested names for the cluster.

The agenda of the 2nd web meeting can be found on Appendix A.

3.1.4 PROPHECY Participation in the 3rd ForeSee Web Meeting

The 3rd Foresee web meeting took place the 4th of April 2018 via GoToMeeting application and all projects participated. The main discussion points of the 3rd Foresee web meeting were the access of all projects representatives to the shared folder of the cluster, the progress of the cluster name suggestions, the common interests to standardisation activities and aspects.

The agenda of the 3rd web meeting can be found on Appendix A.

3.1.5 PROPHECY Participation in the 4th ForeSee Web Meeting

The 4th Foresee web meeting took place the 31st of May 2018 via GoToMeeting application and all projects participated. The main discussion points of the 4th Foresee web meeting were the progress of the cluster name decision and the progress of each project of the cluster.

The agenda of the 4th web meeting can be found on Appendix A.

3.1.6 PROPHECY Participation in the 1st physical ForeSee Meeting: FoF-09-2017, Predictive Maintenance of Production Systems

The next meeting of the cluster was physical, took place the 26th of June in Brussels and all projects were present.

The discussion elaborated on the idea of creating of a Roadmap for predictive maintenance. This roadmap would document the knowledge acquired by the individual projects. The roadmap should be in the form of a document, approximately 15-20 pages, summarizing the key findings and guiding companies on setting up predictive maintenance approaches.

- Create a new paradigm for introducing predictive maintenance paradigm in the industry
- How to help SMEs adapt such solutions?
- How can the projects differentiate from existing commercial platforms?
- Contribution to the future research agenda
- Contribution towards the development agenda of industrial and technology companies

In order to structure the future activity of the cluster in the long term, a set of Activity areas where proposed and further discussed. While these activity areas would require significant effort to elaborate, it was agreed that they provide a good reference structure to organize the discussion within the cluster. The following activity areas have been listed up to now:

- AA1: Analysis of technology in the market and in the pipeline
- AA2: CLUSTER predictive maintenance concept for the Factory of the Future
- AA3: Trend-setting for the future factory
- AA4: New model for sustainable factories through efficient predictive maintenance
- AA5: Skills building paradigm for predictive maintenance
- AA6: Community building and dissemination
- AA7: Administration-Coordination

Additionally, the following items where discussed and further elaborated over the next web and physical meetings.

- Working on a common cluster presentation
 - Catalogue of platforms enabling technologies
 - Catalogue of Human support techs
 - Catalogue of AI techs
 - Discussion on a sort of Exploitation sandbox idea
 - Data modeling aspects
 - Catalogue of services
- Taxonomy, system terminology
- Potential communication actions
 - Communication in the frame of EFFRA events

- Open access book. Cluster work.
- Technical workshop.
- Conference dedicated session.
- Participation in Euro-maintenance
- Webinar for the outside world
- Cluster name
 - Several good titles were proposed for the cluster as it can be seen in the relevant document in the cluster drive
 - A suitable acronym reflecting the vision of a future predictive maintenance cluster should be identified.
 - Each project has been asked to contribute with potential acronyms and this item will be discussed in the next web meeting

The agenda of the 1st physical meeting can be found on Appendix A.

3.1.7 PROPHECY Participation in the 5th ForeSee Web Meeting

The 5th Foresee web meeting took place the 13th of September 2018 via GoToMeeting application and all projects participated. The main discussion points of the 5th Foresee web meeting were the dissemination activities of the cluster, such as Press Releases, Newsletters, Book on PdM, CMS 2018 session planning, etc.

3.1.8 PROPHECY Participation in the 6th ForeSee Web Meeting

The 6th Foresee web meeting took place the 16th of November 2018 via GoToMeeting application and all projects participated. The cluster name was confirmed as “Foresee” and the main discussion point was the activities/workshops where the cluster will participate.

During this meeting, a roadmap was also presented to define the next steps, goals and duration of this clustering activity. The Initial Community Management and Awareness Creation Plan is given in Figure 2.

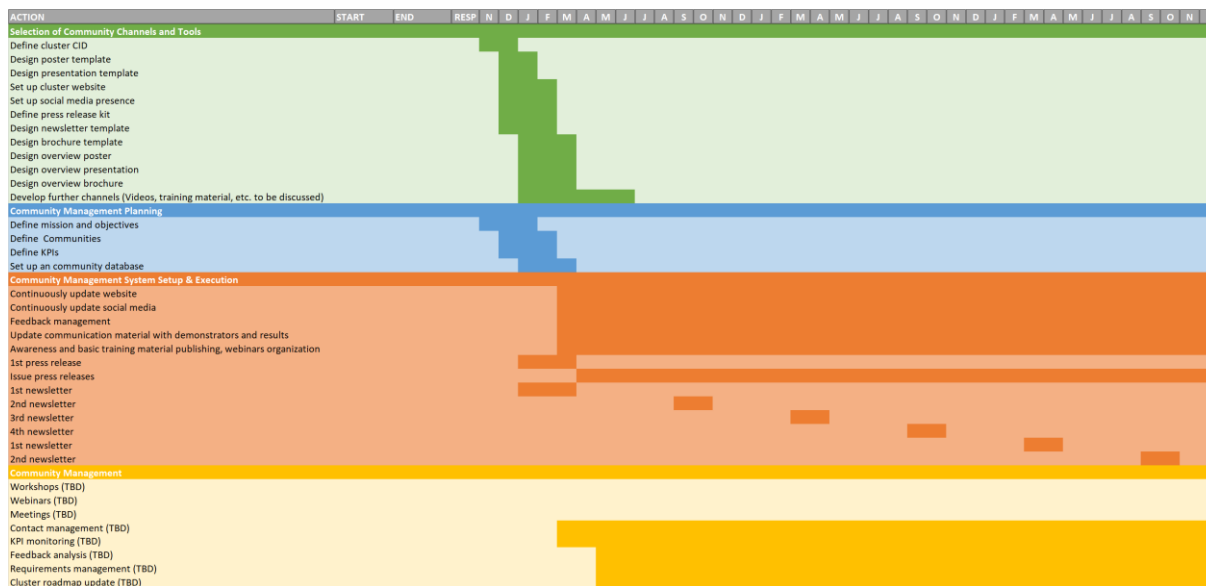


Figure 2: The Initial Community Management and Awareness Creation Plan

The agenda of the 6th web meeting can be found on Appendix A.

3.1.9 PROPHECY Participation in the 7th ForeSee Web Meeting

The 7th Foresee web meeting took place the 18th of December 2018 via GoToMeeting application and all projects participated.

During this meeting, the following tasks were discussed:

- AA1: Analysis of technology in the market and in the pipeline
 - Reference model for compiling existing technology
 - Analysis of existing approaches
- AA2: ForeSee predictive maintenance concept for the Factory of the Future
 - Scientific and technological aspects identification-clustering
 - Common reference model – generalization

The representative of PROPHECY project had a presentation on the AA1 (Analysis of technology in the market and in the pipeline).

3.2 PROPHECY Workshop on Predictive Maintenance solutions and services

The H2020 PROPHECY project organized its 1st workshop on Thursday, January 24, 2019 at PHILIPS premises in Drachten, Netherlands.

The main objective of this workshop was to present the initial results of PROPHECY project to a community of relevant stakeholders and to bring together several EU manufacturing and Predictive Maintenance (PdM) related projects, to assist in the exchange of knowledge, best practices and ideas, and promote inter-project collaboration.

The workshop on Predictive Maintenance solutions and services was organised next to the PROPHECY consortium meeting of January 22-23, 2019 where the first integration of the PROPHECY system at the PHILIPS pilot side was presented and tested – the outcomes of this integration activities and of the first PROPHECY demonstrations are presented in the relevant project deliverables (PHI demo: D7.3, JLR demo: D7.6).



Figure 3: Various pictures from the Workshop in Drachten, Netherlands

3.2.1 Planning and Organisation

3.2.1.1 Planning

INTRASOFT (PROPHECY project coordinator) and PHILIPS (host) were the main organisers of the workshop. PROPHECY partners also participated in the planning, in the technical organization of the workshop, and in the preparation of the PROPHECY presentation.

Initially, a list of candidate attendees and speakers was created, taking into consideration the background and positions of the participants and their involvement on the subject. Two separate invitations were created, one generic (see Appendix) and one for the candidate

speakers. The generic invitation was circulated to the PROPHECY consortium, for the partners to inform the relevant stakeholders.

A dedicated webpage was also created in the PROPHECY website, in which the interested parties could find more information about the workshop: <http://prophecy.eu/WorkshopOnPredictiveMaintenance>.

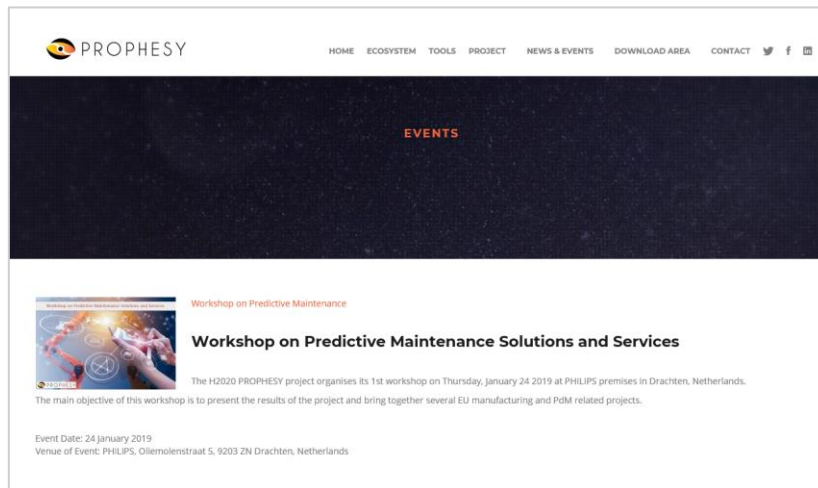


Figure 4: Workshop website (1)

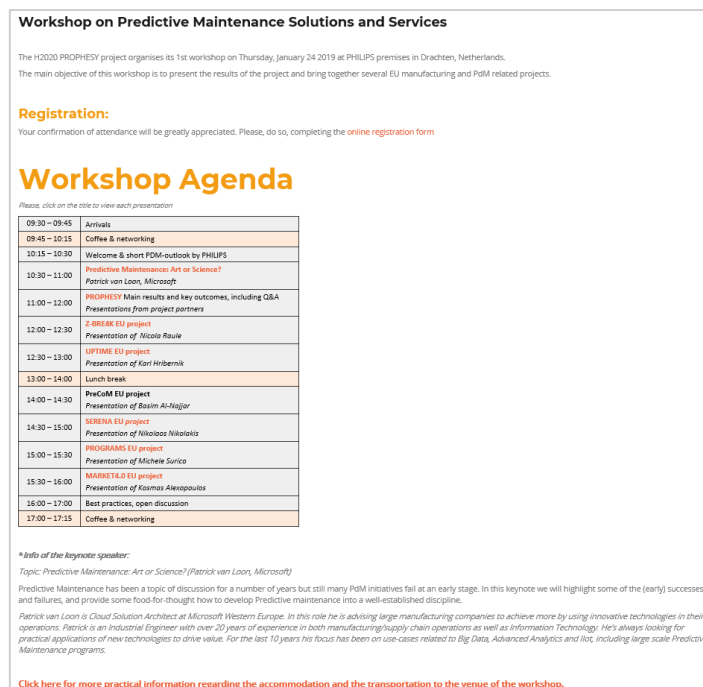


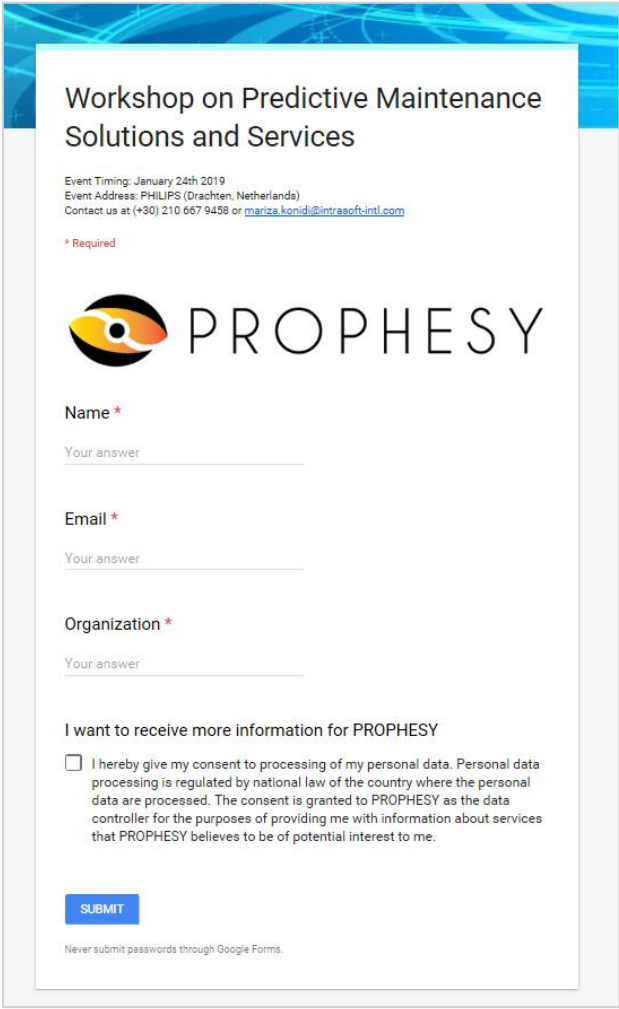
Figure 5: Workshop website (2)

Through this webpage, participants could also find a separate document (see Appendix) with practical information regarding the accommodation and the transportation to the venue of the workshop.

The agenda of the workshop (see section 3.2.3) was finalized, taking into consideration the speakers, the nature of the topics under discussion and the time we had available, and was also uploaded to the workshop webpage.

All the logistics and practical details of the workshop were planned by PHILIPS, who hosted the workshop at their premises. Meeting room monitors and support, facilities for breakout sessions and catering facilities were all well arranged.


Furthermore, an online registration form (<https://goo.gl/forms/ERKd3Zh2a7tqTLvi2>) was created for the participants to confirm their attendance, redirecting from the workshop webpage.



Workshop on Predictive Maintenance
Solutions and Services

Event Timing: January 24th 2019
Event Address: PHILIPS (Drachten, Netherlands)
Contact us at (+30) 210 667 9458 or mariza.konidi@intrasoft-intl.com

* Required

 PROPHESY

Name *

Your answer

Email *

Your answer

Organization *

Your answer

I want to receive more information for PROPHESY

I hereby give my consent to processing of my personal data. Personal data processing is regulated by national law of the country where the personal data are processed. The consent is granted to PROPHESY as the data controller for the purposes of providing me with information about services that PROPHESY believes to be of potential interest to me.

SUBMIT

Never submit passwords through Google Forms.

Figure 6: Online Registration Form

3.2.1.2 Organisation

The workshop was very well organized by the host (PHILIPS), with the use of the main conference room with complete audio-visual capabilities. It was also very well attended. There were 48 attendees in the online registration form, while eventually there were 53 participants in total, as 5 participants came directly on site.



Figure 7: Workshop participation

A front desk was placed outside the meeting room, to welcome the participants, subscribe those who had not fill the online registration form and give them the necessary materials. Posters and banner of PROPHEsy project were also placed at the front desk.



Figure 8: Workshop front desk with poster and banner

All participants received an already printed name-tag, a notepad with the PHILIPS logo and a pen created especially for PROPHESY, in order to make notes or record any ideas. A leaflet of PROPHESY and a printed copy of the workshop agenda was also shared.

With regards to the consent to the audio/visual documentation of the workshop activities, a consent form (see Appendix) was created, shared and signed by all participants.



Figure 9: Pens, leaflets and name tags

During the workshop two coffee breaks, one lunch and a cocktail took place, which were all arranged and very well supported by PHILIPS staff.



Figure 10: Coffee break during the workshop

3.2.2 Digital channels promotion

As mentioned above, a dedicated webpage was created for the workshop and included all the information needed for the participants. This helped the website to have a lot of traffic.

As we can see, from the figures below, taken from Google Analytics Platform, especially the days that the workshop was promoted through social media channels, either from PROPHECY project or from the consortium, this traffic is heavier.

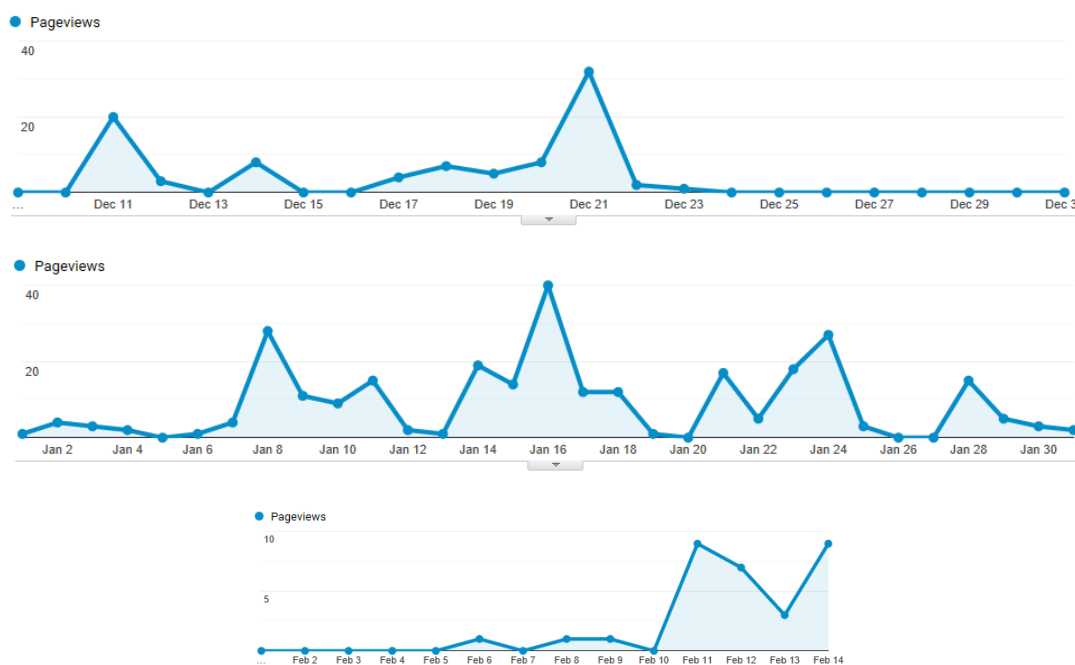


Figure 11: Google Analytics - Pageviews (chart)

From the tables below, we can also observe that the workshop webpage had in total several pageviews, 391 from which the 305 were unique. The average time viewing the page is 7 min and 52 sec.

Almost 64% of these pageviews (248 sessions) were made as landing page, the page through which visitors entered PROPHECY website and almost half of them (118) were first-time users. Workshop webpage as landing page to the PROPHECY website had an average session duration of 2 min and 42 sec.

Page ?	Pageviews ?	Unique Pageviews ?	Avg. Time on Page ?
	391 % of Total: 28.88% (1,354)	305 % of Total: 27.90% (1,093)	00:07:52 Avg for View: 00:02:43 (189.95%)
1. /WorkshopOnPredictiveMaintenance	391(100.00%)	305(100.00%)	00:07:52

Landing Page ?	Acquisition			Behavior		
	Sessions ?	% New Sessions ?	New Users ?	Bounce Rate ?	Pages / Session ?	Avg. Session Duration ?
	248 % of Total: 38.99% (636)	47.58% Avg for View: 55.66% (-14.52%)	118 % of Total: 33.33% (354)	65.73% Avg for View: 53.93% (21.87%)	1.60 Avg for View: 2.14 (-25.03%)	00:02:42 Avg for View: 00:03:09 (-14.36%)
1. /WorkshopOnPredictiveMaintenance	248(100.00%)	47.58%	118(100.00%)	65.73%	1.60	00:02:42

Figure 12: Google Analytics – Pageviews and landing pages (table)

To promote this event, several social media posts were created and shared through the PROPHECY accounts (Twitter, LinkedIn, Facebook and Instagram), but also separately through the consortium and the other cluster projects social media accounts.

Social media posts were shared, before the workshop, in order to inform the stakeholders, the day of the workshop and a few days after, so as to communicate the outcomes and actions that were defined during the event.

As we can see from the Figure 11, taken from Twitter, workshop related posts gained a lot of impressions, an important percentage of engagement and were viewed by several users. This also explains the raise of new followers the same period.

LinkedIn posts achieved a significant number of views and likes, as we can observe from the Figure 12 and were also reshared several times. The most important achievement, though, is that thanks to the posts made for the workshop, the LinkedIn network of PROPHECY grew even more, adding 43 new connections.

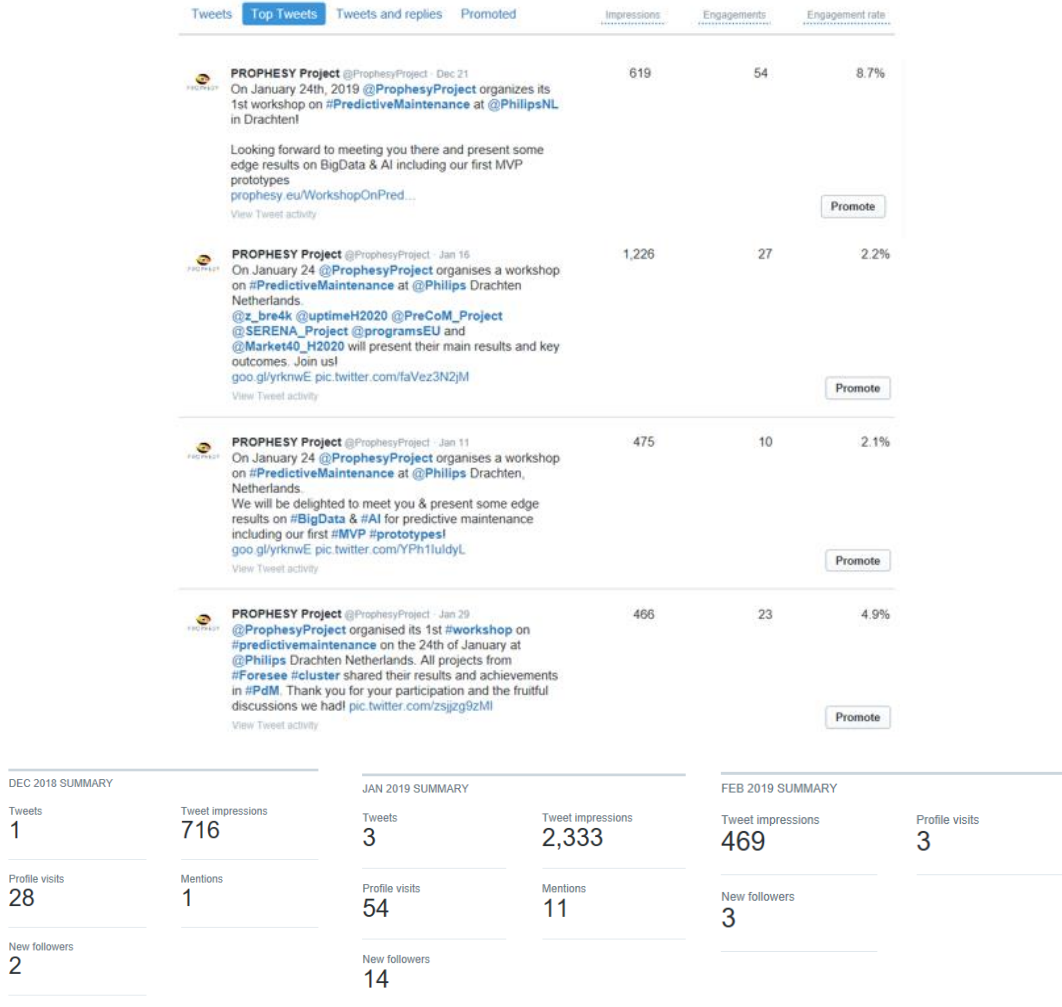


Figure 13: Tweets insights

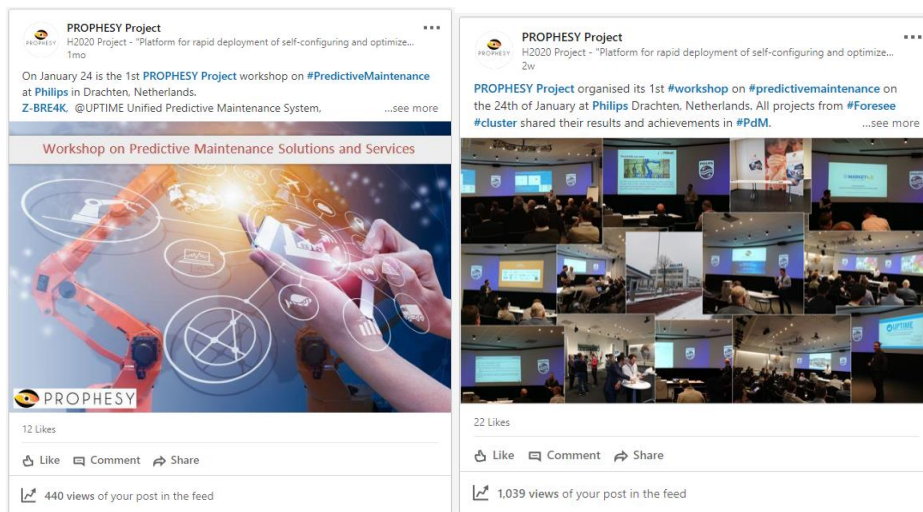


Figure 14: LinkedIn posts

3.2.3 Agenda and presentations

3.2.3.1 Workshop Agenda

The final agenda of the workshop was the following:

09:30 – 09:45	Arrivals
09:45 – 10:15	Coffee & networking
10:15 – 10:30	Welcome & short PDM-outlook by PHILIPS <i>Presentation of Binne Visser</i>
10:30 – 11:00	<u>Predictive Maintenance: Art or Science?</u> <i>Presentation of Patrick van Loon, Microsoft</i>
11:00 – 11:45	<u>PROPHESY Main results and key outcomes, including Q&A</u> <i>Presentations from project partners</i>
11:45 – 12:00	Coffee break
12:00 – 12:30	<u>Z-BRE4K EU project</u> <i>Presentation of Nicola Raule</i>
12:30 – 13:00	<u>UPTIME EU project</u> <i>Presentation of Karl Hribernik</i>
13:00 – 13:45	Lunch break
13:45 – 14:15	PreCoM EU project <i>Presentation of Basim Al-Najjar</i>
14:15 – 14:45	<u>SERENA EU project</u> <i>Presentation of Nikolaos Nikolakis</i>
14:45 – 15:00	Coffee break
15:15 – 15:30	<u>PROGRAMS EU project</u> <i>Presentation of Michele Surico</i>
15:30 – 16:00	<u>MARKET4.0 EU project</u> <i>Presentation of Kosmas Alexopoulos</i>
16:00 – 17:00	Best practices, open discussion
17:00 – 17:15	Cocktail & networking

The presenters provided a public version of their presentation that was posted in the workshop website. The links in the agenda provide direct access to those public presentations.

3.2.3.2 Presentations

After a short introduction for the workshop by Haije Zijlstra from PHILIPS and Andreas Zalonis from INTRASOFT, the workshop started with the presentations as per the agenda. Below, a short summary for each presentation is provided, along with the main discussion points.

Predictive Maintenance outlook by PHILIPS – benefit to Business



Figure 15: Presentation by Binne Visser, PHILIPS

The focus of this presentation was the business benefits of applying the appropriate maintenance techniques and practices on tools and equipment. Specific examples were presented, including the associated cost-benefit analysis for the cost of maintenance versus the benefit in total business cost. Having as a target to improve the cost benefits, PHILIPS is transferring from Condition Based Maintenance to Predictive Maintenance. A specific example of that process was applied in industrial robots, where at the beginning the maintenance was performed by frequent monitoring and inspections, resulting in high repair costs and unexpected down time. By collecting and examining the existing data, related to basic parameters and accuracy of robot arm in time, PHILIPS managed to have a prediction for when the break down occur in the most important robots in place and apply timely repairs during planned production stops. The result was improved maintenance cost, less analytic manpower, less production downtime, extended life time of robots.

Predictive Maintenance: Art or Science?



Figure 16: Presentation of the Keynote speaker: Patrick van Loon, Microsoft

The keynote speaker of the workshop was Mr. Patrick van Loon from Microsoft. Patrick van Loon is Cloud Solution Architect at Microsoft Western Europe. In this role he is advising large

manufacturing companies to achieve more by using innovative technologies in their operations. Patrick is an Industrial Engineer with over 20 years of experience in both manufacturing/supply chain operations as well as Information Technology. He’s always looking for practical applications of new technologies to drive value. For the last 10 years his focus has been on use-cases related to Big Data, Advanced Analytics and IIoT, including large scale Predictive Maintenance programs.

His presentation was concentrated in the PdM challenges in the framework of Industry 4.0. The main challenge that was highlighted in the presentation and in the discussion followed was the **difficulty to scale PdM solutions** when there is exponential growth in data sources, in modelling complexity, and in user requirements and applications. This issue was identified by PROPHESY partners, pointing that one of the objectives of the project is to provide solutions that are scalable and can be applied to different user scenarios and settings. The project partners will investigate the best approach to test and assess the scalability of the system within the framework of the two pilot cases at PHILIPS and JLR factories.

Another important discussion was about the application of the **Digital Feedback Loop** in the PdM process, which is the process of collecting data from IoT devices and sensors, then performing data analysis to gain insights to select the appropriate solutions, and then perform specific actions to apply these solutions. In this process it is important to establish a feedback loop in order to identify modifications in the data collection that will lead to the improvement of the solutions. All project presentations that followed tried to identify which aspects of their developments apply to this Digital Feedback Loop.

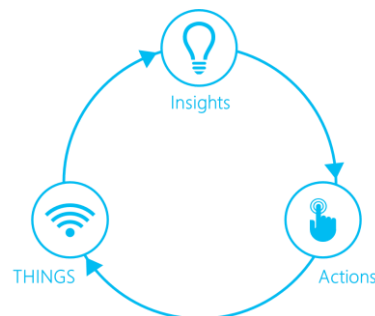


Figure 17: Digital Feedback Loop in the PdM process

Mr van Loon also provided insights and guidelines to the PdM solution developers: to have as a focus only the business problem and not to be carried away by the “fancy” algorithmic trends that may unnecessary increase complexity with minimal results in the end.

The final part of the presentation was about Microsoft’s data analytics research activities and on how the results of those activities are transferred to the business domain (business applications and processes).

PROPHESY EU project



Figure 18: Presentations of Andreas Zalonis (INTRA), Sören Schneickert (FHG), Alessandro Di Bucchianico (TUE) and Haije Zijlstra (PHI)

The presentation of PROPHESY project had the following structure:

- PROPHESY Overview
- Architecture and functionalities
- Data Analytics Techniques for PdM
- Application on production tooling at PHILIPS factory

In the overview of the project, the main components were presented, along with the concept on how these components will be combined and used to provide added value to a manufacturing facility. The implementation plan was also presented, focusing in the two pilot demonstrators at PHILIPS and JLR.

The presentation of the architecture was concentrated in the connection with previous activities and projects (e.g., MANTIS, FAR-EDGE), on how PROPHESY is compliant to the MANTIS Reference Architecture and on the key functionalities. A small technical discussion followed between the participants on specific aspects of the architecture and on how these choices are implemented in the existing system.

In the data analytics part, the focus was on the adopted methodologies for the Remaining Useful Lifetime (RUL) estimation.

The application of PROPHESY technologies on production tooling at PHILIPS factory was the focal point of the PROPHESY presentation. Since the first demonstration was performed on the site just two days ago, the audience had the opportunity to experience first the main outcomes of this effort and to provide comments and remarks. Mr Zijlstra presented in detail the current situation, the challenges and the high-level objectives in this production line. The three Uses Cases were

presented: the RUL prediction cold-forming tool, the RUL prediction 5-fold cut-out tool, and the AR assisted tool maintenance, along with the status of the implemented monitoring system in the relevant machines. The presentation raised a lot of attention from the attendees, asking questions on the difficulty of installations, the time consumed, and on the feedback from the maintenance employees.

All the presenters tried to identify where PROPHECY is compliant with the Digital Feedback Loop and when the feedback based on the actions taken would assist in the improvement of the system. The main conclusion was that in principle the PROPHECY platform is capable to incorporate modifications based on the feedback and the results. These modifications may involve the placement of additional sensors or the application of different algorithms. This is something that the consortium partners will examine during the course of the project.

Z-BRE4K EU project



Figure 19: Presentation of Nicola Raule, CRIT

An overview of Z-BRE4K project was presented, concentrated in the project's main features, the three Use case demos (SACMI – CDS, Plastic compression moulding machinery, PHILIPS, Cutting and bending line for shaving blades manufacturing, GESTAMP, Metal sheet stamping and welding for automotive applications), the general architecture, and the expected added value of the project. After the overview the Z-Bre4k Predictive Modelling status was presented giving emphasis in the Gestamp Use Case. Advanced statistical methods and pattern recognition algorithms have been used to determine events based on outliers and anomalies. The initial results were presented, along with key conclusions identifying the future steps of the project. A dedicated presentation was also performed for the Philips razor blades production line, providing the technical details for the methods used to detect patterns in time series and to detect changes which are not statistically evident. In the end there was some discussion on the general architecture and some clarifications were provided.

UPTIME EU project



Figure 20: Presentation of Karl Hribernik and Stathis Anastasiou

An overview for the UPTIME approach, solution, draft architecture components, and industrial Use Cases was provided by Mr Hribernik. The presentation raised attention and questions from the audience for the functionality of the presented dashboards. The second part of the presentation was about the MAILLIS Use Case. The maintenance data used in this use case was presented, along with a detailed explanation on the sensor types and their placement in the machines. Some initial results were presented, and a discussion followed on the next steps of the project.

PreCoM EU project



Figure 21: Presentation by Basim Al-Najjar, Linnaeus University

The presentation provided an overview of the project and the followed workplan: the communication mechanisms (I/O), the multi-sensor platform, the physical and statistical models used, the production scheduling process, the Augmented Reality (AR) and the Production Line Information Visualization (PLIV) applications, the integration of modules so far, and the performance analysis tools.

SERENA EU project

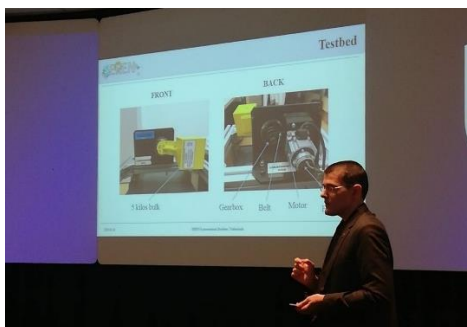


Figure 22: Presentation by Nikolaos Nikolakis, LMS

The concept of SERENA project was presented in detail. The preliminary proof-of-concept for the SERENA system was also presented, which included the: Edge data collection and pre-processing; Cloud infrastructure, data ingestion and storage; the Predictive analytics; and the Maintenance scheduling & visualization. The target is to implement the system on the COMAU Robot Box, so more details were given for the relevant data sources and edge pre-processing. The last part of the presentation was about the cloud infrastructure, and the data ingestion and storage on Infinite testbed (based in Cork, Ireland) and the predictive analytics framework.

As in the previous presentations the audience mainly asked questions for clarifications on the presented technical developments.

PROGRAMS EU project



Figure 23: Presentation by Michele Surico, FIDIA

Overview of the project, including the platform architecture design, the tools (Smart Control System), and the methodology for advanced physical modelling. One of the key issues, that was identified early in the project, was the assumption of the relevant stakeholders that PdM is not going to save them enough money to justify the investment. This assumption was also discussed during the keynote presentation as an important barrier in the adoption of PdM techniques. In this framework, PROGRAMS project aims at integrating PdM into an ICT platform capable of determining when PdM application is profitable.

MARKET4.0 EU project



Figure 24: Presentation by Kosmas Alexopoulos, LMS

MARKET4.0 was the only project outside the FoF-09-2017 cluster. It was included as the last presentation to provide additional insights to the participants for the opportunities in manufacturing business-to-business (B2B) collaboration. The project provides a system for on-line Procurement of Production Equipment and Services, which is basically a peer-to-peer marketplace for manufacturing services. It brings together the production equipment provider, the service provider (application developer), and the manufacturing company. It creates technical and financial trust to prove payment, delivery and anonymized feedback in manufacturing B2B collaboration. The approach and the technology used for the implementation of such ecosystem was presented.

The project started on November 2018 and it is in its initial phases. However, all attendees presented significant interest on the marketplace and asked questions for the project time-plan and the initial availability of the platform. A link between the FoF-09-2017 cluster projects and MARKET4.0 has been established during this meeting and all cluster projects will be constantly informed for the marketplace developments in the forthcoming cluster meetings.

3.2.4 Discussion and conclusions

After the projects presentations there was approximately one hour dedicated to open discussion.

Following the discussion during the presentations, the application of the Digital Feedback Loop in the PdM process was further discussed in the context of the identification of the cost benefits for the interested companies. The keynote speaker pointed out that any PdM solution should be accompanied with a clear cost-benefit analysis. So, in the iterative process proposed in the Digital Feedback Loop one must identify specific financial benefits in some parts of the process.

Another discussion point, that was also mentioned in the previous presentations, was the important challenge on the scalability of the proposed solutions. As it was mentioned by the keynote speaker, the modelling of a single machine is relatively easy when it is compared with the complexity of applying the same solution to different machines.

Another discussion topic was the difficulty to identify the relevant and useful data from a large pool of available data. This is a difficult task and it was raised from almost all participants.

In his concluding remarks the keynote speaker made the following suggestions

- all researchers to adopt a business first mindset when developing algorithms and processes for PdM – to try to be useful and relevant to the business needs
- identify the reference architecture and be adopted by all relevant approaches
- not reinvent the wheel when solutions exist (e.g., security solutions)

In the framework of inter-project collaboration within the FoF-09-2017 cluster, and also based on the projects' presentations, it was clear that there is a variety of Use Cases in the projects. Usually the solutions proposed are driven by these Use Cases, so one specific solution or approach will never be the optimal for all the Use Cases. For that purpose, it was proposed that the cluster projects will initiate a dialogue that will include the different Use Cases of the projects – to identify overlaps and collaboration opportunities.

Also, there was the idea to share results, data formats and KPIs to assist each other in the scaling of their solutions. However, this would probably require the creation of an NDA between the involved parties. The possibility for building a common ecosystem for all FoF-09-2017 cluster projects was also discussed. The feasibility of such an approach will be examined in the forthcoming cluster meetings.

In the end it was clear to everyone that this workshop was an important and necessary step for the progress of the cluster activities. Furthermore, all projects had to organize and present their current status and progress in a relevant audience which included not only project participants, but also other stakeholders and they had to answer to various questions that eventually will assist them in their development efforts. As the projects progresses and produce more results we will have the opportunity to organize more focused events in the future.



Figure 25: Discussions during the workshop (1)



Figure 26: Discussions during the workshop (2)

3.3 PROPHECY Collaboration with EFFRA

3.3.1 Overview

PROPHECY focuses on predictive maintenance solutions for the factories of the future. As such it is a project with clear relevance to the activities of European Factories of the Future Research Association – EFFRA (<https://www.effra.eu/>), the non-for-profit, industry-driven association that promotes the development of new and innovative production technologies. EFFRA is the official representative of the private side in the 'Factories of the Future' public-private partnership. Several of the PROPHECY partners (e.g., INTRA, PHILIPS, MONDRAGON) are members of EFFRA and play an active role in defining and executing EFFRA's activities.

In the H2020 space, EFFRA is coordinating the Connected Factories (<https://www.effra.eu/connectedfactories>) coordination and support action, which explores pathways to the digital integration and interoperability of manufacturing systems and processes and the benefits this will bring.

Since the very beginning of its lifetime, PROPHECY established close links with EFFRA and its ConnectedFactories project with the following objectives:

- **To exchange knowledge with other EFFRA projects** that are supported by ConnectedFactories, notably projects in the area of digital automation. The aim of this knowledge exchange would be to explore how PROPHECY innovations in predictive maintenance techniques (notably BigData analytics for predictive maintenance) could be integrated and used in conjunction with leading edge digital manufacturing platforms.
- **To join efforts and build synergies for ecosystem and community building**, given that results within EFFRA supported projects are addressed to same target groups as the results of PROPHECY. This provided opportunities for streamlining ecosystem and community building efforts, including efforts towards building the PROPHECY solutions and ecosystems and the PROPHECY service bricks catalogue and solution optimization engine.

In following paragraphs, we provide more details regarding concrete synergies between PROPHECY and EFFRA during the reporting period.

3.3.2 PROPHECY's Participation in Connected Factories Workshop, February 6th, 2018

PROPHECY gave an introductory presentation about the project in the scope of a Connected Factories workshop organized by EFFRA in February 2018 in Brussels. The goal of the presentation was to introduce the project and its expected outcomes to EFFRA members. The presentation received significant attention, with EFFRA members asking information about the algorithms to be used/deployed for maintenance data sets processing in the scope of PROPHECY, along with questions about the AR (Augmented Reality) solutions of the project. Almost 200 people participated in the workshop and the key participants were OEMs, SMEs, Industrie4.0 interested companies, EFFRA members and Manufacture members.

Overall, these interactions raised awareness about PROPHESY in the EFFRA community and instigated initial discussions about collaborations with other projects. All the projects of the “ForeSee” cluster were also represented in the workshop.



Figure 27: Connected Factories Workshop, February 6th, 2018

3.3.3 PROPHESY’s Participation in EFFRA General Assembly and EFFRAV2019 community debate, March 19th, 2019

PROPHESY project participated in the General Assembly of EFFRA and the EFFRA Vision Community debate in Brussels. The aim of this debate is to have a thorough discussion on the EFFRA vision for Horizon Europe and the future Manufacturing Partnership.

During the EFFRAV2019, speakers and participants explored EFFRA’s vision for Horizon Europe and discussed the case for the Manufacturing PPP under this new EU framework programme through two panels:

- a) The EFFRA Roadmap for Horizon Europe (2021 – 2027): Making the Case for the Manufacturing Partnership
- b) How the Manufacturing Partnership relates to other European Initiatives & activities

In the event approximately 350 people participated, out of that an amount of about 100 participants can be assumed to be targeted audience with interest in Predictive Maintenance, even though the general topic was broader.

The general feedback from the participation was positive. Predictive Maintenance is a topic that needs continued attention and research activities. Positive feedback also about the FORESEE cluster activity where all related projects from the same call collaborate.



Figure 28: EFFRA General Assembly and EFFRAV2019 community debate, March 19th, 2019

3.4 PROPHECY Collaboration with H2020 FAR-EDGE

PROPHECY has established a close technical collaboration with H2020 FAR-EDGE project (which is part of the FoF-11 cluster of EFFRA/Connected Factories project) on Distributed Data Analytics (DDA). The collaboration has been instigated by common partners of both projects, including AIT, SENSAP and UNPARALLEL and concerned the customization and reuse of FAR-EDGE's distributed data analytics solution in PROPHECY. Note that this solution is open source and made available for reuse based on an open source license. The collaboration has been substantiated based on a number of technical meetings and teleconferences between the joint partners (listed above) and other PROPHECY partners involved in data collection and integration (including INTRA, ICARE and FHG). As a result of these discussions, the FAR-EDGE DDA solution has been customized and use for data integration and consolidation of diverse streams in the PHILIPS and JLR demonstrators. This is a tangible collaboration case, which streamlines the FAR-EDGE exploitation strategy with

the PROPHECY technical development and demonstration activities towards reuse of results and maximization of value for money.

3.5 PROPHECY Collaboration with Edge4Industry.eu

In terms of ecosystem building, PROPHECY collaborates with the Edge4Industry initiative, which has been established by the FAR-EDGE project as well. Edge4Industry.eu consolidates and makes available through a single entry point most of the industrial automation results FAR-EDGE, including software, middleware, solutions brief and blueprints, as well as tutorials and training presentations. Most of these results are based on edge computing solutions for automation, simulation (digital twins) and analytics developed in FAR-EDGE. The community is currently joined by over 100 participants from different organizations in Europe. These participants are within the target audience/groups of the PROPHECY results. Hence, PROPHECY has opted to create synergies with Edge4Industry in terms of community building. The latter synergies are substantiated in the establishment of PdM4Industry a community similar to Edge4Industry, but focused on Predictive Maintenance. This would allow PROPHECY to address directly the participants of the Edge4Industry community, but also to create a wider brand (“4Industry”) for Factories of the Future solutions. The establishment of the PdM4Industry community is an on-going activity in PROPHECY WP6 and WP8.

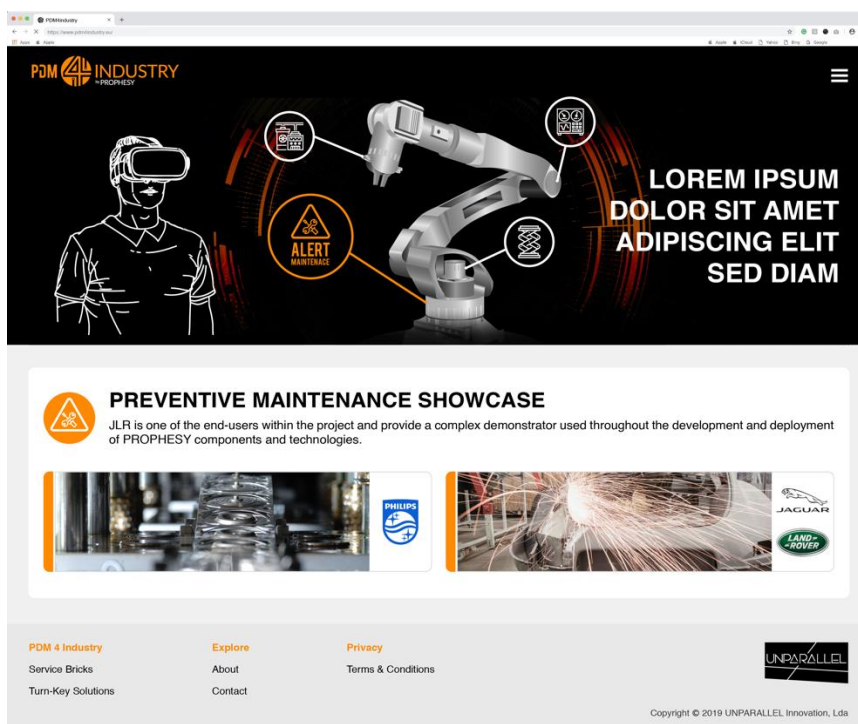


Figure 29: Mock-up of PdM4Industry Ecosystem portal

3.6 PROPHECY Collaboration with AIOTI WG11

3.6.1 Overview

The Alliance for IoT Innovation includes a working group that is devoted to IoT solutions for future manufacturing. There is a prominent link with PROPHECY activities, given that PROPHECY takes advantage of advanced Industrial IoT solutions for data collection and analytics, including algorithms for advanced IIoT analytics. PROPHECY has therefore initiated a dialogue with this working group aiming at knowledge transfer and experience sharing. This has been substantiated so far as listed in the following paragraphs.

3.6.2 PROPHECY Participation in AIOTI WG11 Meetings

PROPHECY has joined the AIOTI WG11 meeting (through AIT) in June 2018, during the IoT Week. It provided inputs to AIOTI and its roadmap for IoT in manufacturing, with emphasis on autonomous systems for collecting and processing data for maintenance.

4 Conclusions and Future Outlooks

This first report (M1-M18), about the project's participation and contribution to standardization bodies and EU associations, shows that several key actions have been performed to ensure that the project is on the track with respect to exploitation and dissemination prospects.

On the standardization part, a link has been created with the ISO Technical Committee responsible for standards related to Mechanical vibration, shock and condition monitoring - Condition monitoring and diagnostics of machine systems.

The clustering collaboration has also been successfully initiated at an early stage of the project and kept up and running through the ForeSee cluster with regular web and physical meetings, including a major workshop on M16, involving at least one representative of each FoF-09-2017 Predictive Maintenance project. This workshop, organized and hosted by PROPHECY partners focused on sharing technical information about the status of the Factories of the Future projects on predictive maintenance, enabling discussions and eventually initiating future collaborations.

Aside from the main ForeSee cluster, partners have been collaborating in EFFRA, at the Connected Factories Workshop, Edge4Industry, and AIOTI WG11.

For the next period, it is expected that the project will link to the above clusters and initiatives as a means of developing content and building a larger base of participants. Clustering will very likely be continued through events and other workshops, attended or hosted by at least one partner of the PROPHECY project. Standardization activities will also continue, keeping an eye on norms and hopefully participating more actively in norms preparations by taking into account the current and future needs of the PROPHECY project.

5 Appendix A

5.1 Agendas of Foresee Custer Meetings

2nd Meeting Agenda
Predictive Maintenance of Production Systems
26/02/2018
GotoMeeting: <https://global.gotomeeting.com/join/705387981>
See also Calendar invitation sent separately.

AGENDA

13:00 – 13:15 Welcome, introductions

- Status of access to the common folder
- Cluster name proposal progress

13:15 – 13:30 Follow-up kick-off meeting activities, all participants

- Conferences, common activities up to now
- Feedback from each project if any

13:30 – 14:15 Discussion on the proposed structure of the cluster

- Introduction-Proposed action, Sotiris
- Feedback from each project

14:15 – 14:30 Round table feedback – next steps

- Next meeting

Projects

- SERENA
- PRECOM
- PROPHECY
- PROGRAMS
- Z-BREA4K
- UPTIME

End of document ■

Figure 30: Agenda of the 2nd ForeSee Cluster Meeting

3rd Meeting Agenda
Predictive Maintenance of Production Systems
04/04/2018
GotoMeeting: <https://global.gotomeeting.com/join/475816301>
See also Calendar invitation sent separately.

AGENDA

14:30 – 14:45 Welcome, introductions

- Status of access to the common folder
- Cluster name proposal progress

14:45 – 15:00 Follow-up kick-off meeting activities, all participants

- Conferences, common activities up to now
- Feedback from each project if any

15:00 – 15:45 Discussion on the cluster activities

- Cluster overview draft, Basim
- Standardisation common interests, Cosmas
- Feedback from each project

15:45 – 16:00 Round table feedback – next steps

- Next meeting

Projects

- SERENA
- PRECOM
- PROPHECY
- PROGRAMS
- Z-BREA4K
- UPTIME

Figure 31: Agenda of the 3rd ForeSee Cluster Meeting

4th Meeting Agenda

Predictive Maintenance of Production Systems

31/05/2018

GotoMeeting: <https://global.gotomeeting.com/join/984473333>

See also Calendar invitation sent separately.

AGENDA

14:30 – 14:45 Welcome, introductions

- Status of access to the common folder
- Cluster name proposal progress

14:45 – 15:15 Follow-up kick-off meeting activities, all participants

- Projects mapping – updates from each project
 - Slides upload in the common folder-web meeting 04
- Feedback from each project

15:15 – 15:30 Round table feedback – next steps

- Next meeting

Projects

- SERENA
- PRECOM
- PROPHESY
- PROGRAMS
- Z-BREA4K
- UPTIME

End of document ■

Figure 32: Agenda of the 4th ForeSee Cluster Meeting

5th Meeting Agenda

FoF-09-2017, Predictive Maintenance of Production Systems

Tuesday 26 June 2018, 11:00 – 16.00

Venue: Centre Albert Borschette, Brussels, Room: AB / 3.10

AGENDA

11:00 – 11:45 Welcome, overview of cluster topics, Sotiris

- Motivation, cluster activity
- Overview of cluster, content and Status
- Overview of all the FoF projects involved
- New ongoing and forthcoming cluster related calls

11:45 – 13:00 Common technical aspects, ALL projects

- Proposed content of presentations
 - Definition of Predictive maintenance goals
 - Scientific/technical goals, approach discussion
 - Impacts substantiation

- Synergies sought
- Technical cross cutting issues
- Non-technical cross-cutting issues
- Discussion

Break

14:00 – 15:30 Round table discussion on the following topics, ALL

- Relevant commercial products and Relevant market
- Future factory vision for predictive maintenance solutions
- Sustainability considerations
- Skills requirements for the future factory
- Community engagement
- Other items of interest

15:30 – 16:00 Wrap up, next meeting, Sotiris, ALL

Projects

Figure 33 Agenda of the 5th ForeSee Cluster Meeting

6th Meeting Agenda

Predictive Maintenance of Production Systems

16/11/2018

GotoMeeting: <https://global.gotomeeting.com/join/561686901>

See also Calendar invitation sent separately.

AGENDA

11:00 – 11:20 Welcome, introductions

- Follow up from previous meeting
- Cluster name
- Cluster events
 - Workshops

11:20 – 11:50 Follow-up activities, all participants

- Projects fields of key contribution
 - PdM roadmap
- Follow up on book proposal

11:50 – 12:00 Round table feedback – next steps

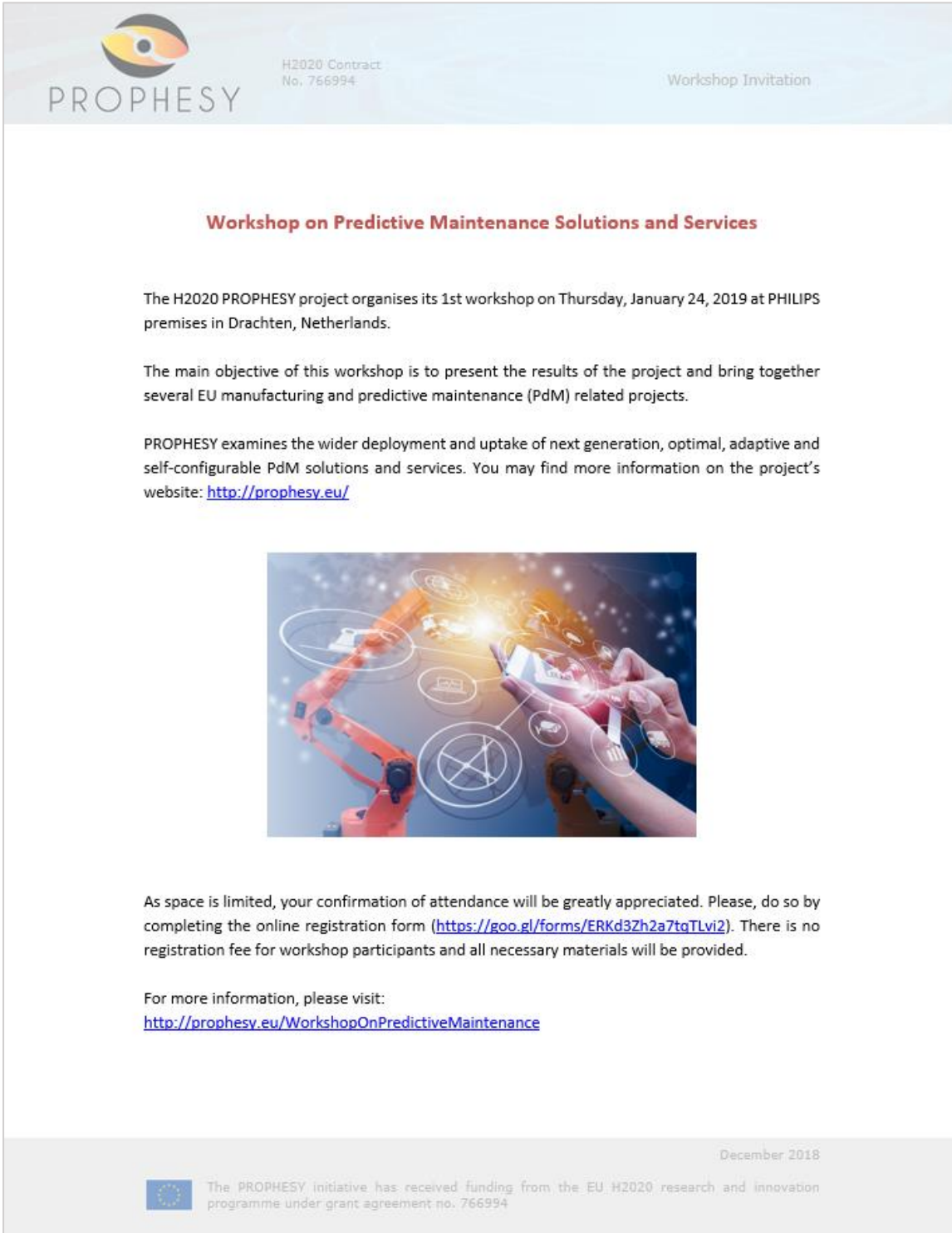
- Next meeting
 - Online
 - Physical

Projects

- SERENA
 - PRECOM
 - PROPHESY
 - PROGRAMS
 - Z-BREA4K
 - UPTIME
-

Figure 34: Agenda of the 6th ForeSee Cluster Meeting

5.2 Workshop material




The image shows a workshop invitation document from the PROPHECY project. The header includes the PROPHECY logo, the contract number 'H2020 Contract No. 766994', and the title 'Workshop Invitation'. The main heading is 'Workshop on Predictive Maintenance Solutions and Services'. The text describes the workshop's purpose, location (Drachten, Netherlands), and objectives. It includes a URL for more information: <http://prophesy.eu/>. A central image depicts a hand holding a smartphone with a futuristic interface, overlaid with a robotic arm and various data icons. The document concludes with a request for attendance confirmation, a registration form link (<https://goo.gl/forms/ERKd3Zh2a7tqTLvi2>), and a final URL for more information: <http://prophesy.eu/WorkshopOnPredictiveMaintenance>. The footer contains the date 'December 2018' and a funding acknowledgment from the EU H2020 programme.

Workshop on Predictive Maintenance Solutions and Services

The H2020 PROPHECY project organises its 1st workshop on Thursday, January 24, 2019 at PHILIPS premises in Drachten, Netherlands.

The main objective of this workshop is to present the results of the project and bring together several EU manufacturing and predictive maintenance (PdM) related projects.

PROPHECY examines the wider deployment and uptake of next generation, optimal, adaptive and self-configurable PdM solutions and services. You may find more information on the project's website: <http://prophesy.eu/>



As space is limited, your confirmation of attendance will be greatly appreciated. Please, do so by completing the online registration form (<https://goo.gl/forms/ERKd3Zh2a7tqTLvi2>). There is no registration fee for workshop participants and all necessary materials will be provided.

For more information, please visit:
<http://prophesy.eu/WorkshopOnPredictiveMaintenance>

December 2018



 The PROPHECY initiative has received funding from the EU H2020 research and innovation programme under grant agreement no. 766994

Figure 35: Workshop invitation



H2020 Contract No.
766994

PdM Workshop – Practical Information

Workshop on Predictive Maintenance

January 24, 2018
Philips Consumer Lifestyle, Drachten, The Netherlands

Practical information

Venue address

Philips Consumer Lifestyle, Oliemolenstraat 5, 9203 ZN Drachten
Meeting room: Conference room AH

At arrival, the participants must report at the security desk at Oliemolenstraat 5 and they will receive instructions for parking and directions to the meeting room.

Hotel recommendations

*** Hotel Het Witte Huis, Olterterp: <https://wittehuisolterterp.nl/en/>
Address: Van Harinxmaweg 20, 9246 TL, Beetsterzwaag (4.5km from venue location)
Rates: ~€ 80 per night, breakfast included.

**** Hotel Van der Valk, Drachten: <https://www.hoteldrachten.nl/en/>
Address: Lavendelheide 4, 9202 PD, Drachten (1.5km from venue location)
Rates: ~€ 130 - € 150 per night, breakfast included.

***** Hotel Bilderberg, Beetsterzwaag: <https://www.bilderberg.nl/en/>
Address: Van Harinxmaweg 10, 9244 CJ Beetsterzwaag (5.4km from venue location)
Rates: ~€ 150 per night, breakfast included.

Transportation

Nearest airport: Schiphol Airport, Amsterdam (160km from Drachten)

Amsterdam-Drachten:

- **Rental car:** most convenient option, approx. 1:45 hr drive.
- **Public transport from Amsterdam:**
 - by **train** to Heerenveen (25km from Drachten)
then by bus or taxi to Drachten
Taxi: less than 30 minutes
Bus: route number 320, duration 28 minutes, departure every 30 minutes (hh:09 + hh:39)
Bus station 'Van Knobelsdorffplein', Drachten (1km from venue, 15 minutes' walk)
For details on bus and train departure times consult <https://9292.nl/en> (this is a general site for public transport in the Netherlands).
 - **Flixbus** from Amsterdam to Drachten (<https://global.flixbus.com/bus-routes/bus-amsterdam-drachten>)

January 24, 2019
Philips Consumer Lifestyle, Drachten, The Netherlands

Figure 36: Practical Information