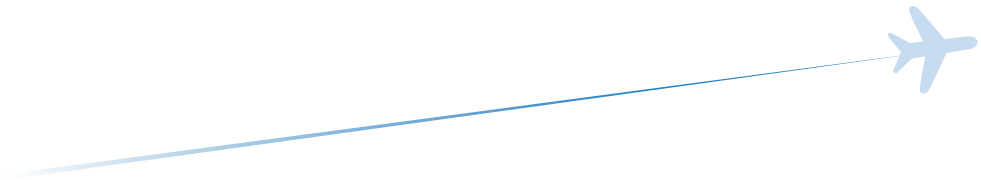

The Stakeholder View

D4.1

BEST

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ACHIEVING THE BENEFITS OF SWIM BY MAKING SMART USE OF SEMANTIC TECHNOLOGIES

Founding Members

EUROPEAN UNION EUROCONTROL

SESAR JOINT UNDERTAKING

Authoring & Approval

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Rejected By - Representatives of beneficiaries involved in the project

Name/Beneficiary	Position/Title	Date

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00.60	16/04/18	External proposed	Reza Mirhossein	Add feedbacks from reference group meetings and presentations
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BEST

ACHIEVING THE BENEFITS OF SWIM BY MAKING SMART USE OF SEMANTIC TECHNOLOGIES

This deliverable is part of a project that has received funding from the SESAR Joint Undertaking under grant agreement No 699298 under the European Union's Horizon 2020 research and innovation programme.

Executive Summary

Project promotion in BEST is based on an integrated approach combining Dissemination (making results available), Communication (making sure that potential stakeholders are aware of the project and its results and establishing dialogue with some of them), and Exploitation Planning (planning of measures to encourage use of results after project completion).

This deliverable reports on work done to establish a "Reference Group" of external experts, and on the feedback obtained from the Reference Group using various means like survey, workshop or meetings. The feedback forms the basis for the stakeholder view and provides a valuable guidance on evaluating the project results from different points of view. Reference group members are potentially the main users of project results and have an absolute understanding about the potential benefits and deployment barriers of such solution. Also these feedbacks might affect the direction of the project applications in the future and maturing the idea for real use cases.

BEST reference group consists of carefully selected experts in aviation and ontology IT fields. The details of selection criteria is defined in D4.2 in order to capture their own point of view by holding several meetings, interactive workshops and through a comprehensive survey method.

The type of technology addressed by BEST is somewhat complex. Even in case of the carefully selected survey participants (aviation researchers, ICT experts, AIRM group members), knowledge of semantic technologies and ontologies is limited. Consequently, the role of project communication is more highlighted to maximise the impacts of selected reference group view on the future benefits of the semantic technology.

Founding Members
EUROPEAN UNION EUROCONTROL

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List of abbreviations

Abbreviation	Description
AAA	Amsterdam Advanced Air Traffic Control System
AI	Artificial Intelligence
AIRM	ATM Information Reference Model
ANSP	Air Navigation Service Provider
ATM	Air Traffic Management
ATS	Air Traffic Services
CA	Consortium Agreement
CCB	Change Control Board
DoA	Description of Action
EFB	Electronic Flight Bag
FAQ	Frequented Asked Questions
GA	Grant Agreement
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IPR	Intellectual Property Rights
IT	Information Technology
ICT	Information & Communication Technology
KPI	Key Progress Indicators
NATO	North Atlantic Treaty Organisation
NOTAM	Notice to Airmen
OWL	Web Ontology Language

REST	Representational State Transfer
RG	Reference Group
SESAR	Single European Sky ATM Research
SWIM	System Wide Information Management
TRL	Technology Readiness Level
UML	Unified Modelling Language
WP	Work Package

1 Introduction: About this document[1]

1.1 Purpose of this document

The Grant Agreement describes the content of this deliverable as follows:

> *Report describing the views of key- stakeholders about the kind of support they expect semantic technologies could provide.*

The consortium chose to use various means of obtaining the views of stakeholders. At the beginning of the project the consortium organised an online survey. At the relative end of the project the consortium used various ways to obtain the feedback like Stakeholder Workshop, informal meeting or presentation on SESAR event.

To organise the survey, the consortium had to perform a range of activities like selecting the survey method and establishing the reference group. The Reference Group become a dynamic group of people due to the fact that not everybody was always available and because of the changing needs of the project.

This document describes the methods used to select the members of the reference group, how the survey was conducted, reports on the organised Stakeholder Workshop and other events and the results, the stakeholders' view, arising from them.

1.2 Intended Readership

The document is aimed primarily at project participants. It may also be useful for the SJU staff and independent reviewers, to assist in assessment of dissemination and exploitation strategies.

1.3 Relationship to other deliverables

Deliverable	Relationship
D4.2 Dissemination, communication and project promotion plan	It describes the target audiences and communication channels for the project promotion activities, including identification of targeted journals, other publications, conferences etc. Moreover, it defines some selection criteria for reference groups and provides refinement of the communication plan included in the project management plan

[1] The opinions expressed herein reflect the author's view only. Under no circumstances shall the SESAR Joint Undertaking be responsible for any use that may be made of the information contained herein.

D4.5	Dissemination and project promotion report	This deliverable will be delivered just before the end of the project, and will report on the activities that actually took place during the project regarding dissemination and exploitation. It will therefore provide documentation of the extent to which measures defined in this document were followed during the project, and the outcomes of that work.

2 Stakeholders' view

The original plan was to have one survey during the project, however the consortium decided that the project needs the feedback from the stakeholders to evaluate the progress made by the project and also use the outside of the project view that the stakeholders can provide. Therefore, beside the survey other occasions were created to communicate with the stakeholders and receive feedback. The following chapters will provide the overview of the feedbacks obtained. The detailed reports on the survey and other events are located at the Annex of the present deliverable.

2.1 The Survey

The following conclusions can be drawn from the results of the survey.

- Some of the respondents had some previous knowledge about the semantic technologies. However, the majority (50%) was not so sure. The knowledge about ontologies was even less pronounced.
- The survey participants have expressed that to understand better the project's goals and work they would need some more real life examples and some written introductory materials.
- The survey participants saw difficulties of implementation, not in technical sense, rather in lack of knowledge and in a fact that the benefits are not that obvious as in some other cases. Another issue they pointed out is that it is rare for an expert have knowledge in the application domain and the semantic technologies.
- Despite the previously elaborated difficulties, the survey participants also saw the potential in application of the semantic technologies. They considered that the application of the semantic technologies would have **positive affect on situational awareness** and result in **clearer and more transparent aviation related information**.
- The survey participants also had to evaluate the proposed use case scenarios. There was **a positive evaluation of the scenarios that were related to normal operations** like Electronic Flight Bag (EFB) and Runway Management Scenario and Aeronautical and Weather Data Container for a Remote Tower Scenario, while emergency related scenarios like Landing Gear not Down or Large Animal on Manoeuvring Area were considered less fit for semantic containers.
- The survey participants were reluctant to propose other scenarios mainly due to the limited knowledge of semantic technologies.
- Most of the survey participants considered that the semantic technologies could be used to **solve some existing issues in aviation IT**. The have also agreed that the BEST project's results will support the implementation of SWIM.
- It became more apparent that the topic of the research and the expected benefits is very hard to explain especially to the wider public and that needs an extra effort. In order to highlight the benefits of the research the consortium should produce more examples of actual implementation of the research results to make obvious how and to what extent the expected results will deliver benefits to the aviation especially to the implementation of SWIM in ATM system. Otherwise, **the ATM community might be reluctant to consider implementation of said results merely due to the complexity of the topic**.

- The results of the survey were used as input into the further work in WP2 and WP3 and it made clear that more attention should be paid to the better explanation of the project work.

The detailed report on the survey can be found at the Annex of the present document.

2.2 Reference group meeting – Budapest

The goal of the meeting was to provide the participants with information on the BEST project itself and to present the achieved result and their possible implementation. Furthermore, the project considered important to obtain feedback on the project results, their intelligibility, their relevancy and usefulness.

The following conclusions can be drawn from the outcome of the meeting.

- The project has not taken into consideration the cost of data. As ATM and airports are businesses the information they are dealing with also should be considered as business information and handled as such. The methodology to deal with business information also could be used outside of the aviation domain. It was also mentioned that if the information were considered as commodity it would lead to competitive business environment for delivering the best quality data at the lowest price.
- This was followed by couple of remarks on the performance measuring and the questions on how exactly the ontologies work. This made us realise that we should provide more information on the Compliance Validator, difference between the OWL and UML and some other areas to be able to show the benefits of the approach the project took.
- The presentation on the semantic containers was followed with a several technical questions regarding the source of the information, the provenance of the information and the method how the semantic container can be created and used.
- The presentation of use case scenarios had a positive impact on how the participants understand the result of the project. Although it was said that the technical details are very difficult to understand the use case scenarios helped them to see through them and realise the benefits.
- The participants agreed that the project's results **would enable implementation of SWIM and the use of artificial intelligentsia in the future for building more user-friendly applications**. It is also was mentioned that the project's results could **introduce structure and possibility for standardisation of information**.
- Modularization and Governance topic received less interest from the participants, probably because this topic was again a bit academic for them; however, they have mentioned the question about maintaining the dependencies and compliance.
- In the final discussion part, the participants expressed some of their ideas about the project and the delivered presentations. There was a remark asking for clarification of what could be done using the project's results with existing technologies. It was also said the end-users do not need to understand how the ontologies and the semantic containers work just enjoy the benefits. The software developers on the other hand should be aware of the benefits of this approach.
- There were a couple of negative remarks about SWIM during the workshop and maybe some more information on that topic would be useful. However, it was concluded that the success of SWIM is not just about technology, it is also about organisational issues and how decisions

are made regarding "standardisation". BEST contributions to governance could be useful here.

The detailed report on the workshop can be found at the Annex of the present document.

2.3 SESAR PJ19.03 plenary meeting, INDRA Premises, Madrid

The presentation was made at a plenary meeting PJ19.03. PJ19 is the SESAR project responsible for "Content Integration" in SESAR (acting as a kind of integrator for other SESAR projects), and PJ19.03 is the work package within PJ19 responsible for "ATM Systems and Services". Clearly, the participants had an interest in BEST ideas about information management.

BEST project members had a presentation, with room for discussion, of BEST. On the original agenda, this was allocated 60 minutes. But the slot was at the end of the day, and over-runs from earlier sessions meant that the total duration was about 40 minutes.

The following conclusions can be drawn from the outcome of the meeting.

- It was clear that some people had never even heard the term "ontology", let alone have any understanding of what it meant. W maybe need to explain a little more on the slides what ontologies are. BUT: in some cases, depending on the audience/context, it may be better not to present ontologies at all.
- People liked the idea of **Semantic Containers strengthening the benefits of SWIM services**. (The slide on "Benefits" was of particular interest to many).
- People made the observation (as in Budapest) that **"Artificial Intelligence" seems a relevant technology** for containers.
- From the preceding presentation on SWIM Governance, there had been some discussion about the idea of several competing services being able to realise a single "Service Definition". People saw the Container concept as offering ways to promote "competing" services.
- People wanted to know more about whether the Container concept has been used in other domains, and whether it has been successful.
- People wondered whether there was business potential in the container concept.
- The role of the **compliance validator in providing a report on validation (showing what was and was not compliant, or forms of compliance) was appreciated**.
- Questions were raised about how "automated" transformations and compliance testing could be validated/calibrated. Could we really trust it?
- From a governance point of view, there was some interest in the potential offered by modularisation, especially with respect to the opportunities offered for CCB composition (higher proportion of experts on the domain).

- Leader of the SWIM Governance project mentioned that it could be a lighter way instead of always writing a service definition. Service provider will write their descriptions and then maybe link only to a container instead of to a service definition.

The detailed report on the presentation and the discussion afterwards can be found at the Annex of the present document.

2.4 BEST informal EUROCONTROL meeting, Brussels

The meeting was organised with the aim to provide the participants with the overall structure and goals of the BEST project, to present the achieved results and the foreseen application of them And, consequently, to obtain feedback from the participants on intelligibility, relevancy of the project results.

- The following conclusions can be drawn from the outcome of the meeting. It seems that the BEST **approach is - fundamentally - *cross-domain,* since this "Information sharing" approach can involve any type of information**. However, the use cases demonstrated in WP3 results do not cover any cross-domain case.

- There was discussion about whether it matters that operational experts are in most cases unfamiliar with ontologies and languages such as OWL. One view to take on that is that OWL is for computers to read and process, not humans.

- The American company MarkLogic propose an approach to information management that seems similar to what you are trying to do. They sell the idea by the motto **"It's about seeing [the information] you could not see before"** (i.e. a kind of data discovery/mining point of view).

- The **idea of using AI/BigData techniques** is also related to the previous point; could be interesting to investigate further.

- The basic **idea of enriching data with metadata, using ontologies, was well received**. The idea of adding BUSINESS data as another kind of metadata was discussed. The idea has not been used in BEST, but was proposed as the Budapest meeting. Participants at this meeting liked the idea and felt that maybe starting with business data to drive things could revolutionise how we approach information management.

- The importance of relating information to *services* was emphasised. This had not received the attention it should have in the earlier stages of the project.

The next presentation was about the ontologies and it resulted the following responses:

- The two different example ontologies differ fundamentally: the first one refers to *instances* (specific places, specific people) while the second one refers to *general concepts* (e.g. aircraft). This distinction between concept/class/type and instance has not received enough attention in the project: maybe being more explicit about it would aid understandability.

- A specific clarification is that the Semantic Containers work at the instance level.

- To "sell" the compliance validator tool you need to clarify that it can be used to check *any* ontology against the AIRM ontology. The presentation can leave people with the impression that it can only be used for ontologies developed in BEST.

- The **transformation tools and validator tool are "good news"** since they demonstrate the feasibility of making use of semantic technologies for real cases.

The third presentation was about semantic containers and resulted the following reactions:

- The idea of containers providing a "caching" mechanism met with considerable scepticism. Its usefulness depends on the results of a query being something that does not vary much over time. In ATM there are plenty of examples where that is definitely *not* the case. There are no doubt some examples where it does apply – but is there any big advantage of caching?

- It was not entirely clear where in the overall architecture of providing services the containers would fit. Participants were able to speculate about various possible alternatives.

- It would be interesting to explore the idea about providing metadata about the services themselves (as an ontology), and using that to find smart ways to compose/select/filter data from existing services.

- Further clarity needs to be provided about the "Membership Condition" part of containers. It can look as if it something the user provides directly to indicate the information that is needed. In fact the "Membership Condition" is produced by some kind of translation of the "query" from the user, and can be narrower/wider than the query. This process needs to be explained more clearly.

- The idea of supporting "data quality" as metadata was considered interesting and potentially useful. It would require more precise definition of what "quality" means. While the project has defined it as part of the approach, no direct work was done on making data quality assessments for any real data.

- If performance is to be a possible advantage, then the issue of scalability would be crucial. The project made some progress on scalability assessment, but it was far from conclusive.

- Participants felt that the advantage for the data consumer was not very clearly explained: it seemed that these things could be done by other means, and the "unique selling point" did not come across.

- When asked if participants could see any "blocking issues" with the approach, one participant said that the picture explaining the approach was a kind of blocking issue because it does not explain things clearly enough.

The next presentation was about the modularisation and resulted the following responses:

- Rather than basing **modularisation on topics, it might be more useful to base it on the structure of SWIM services**.

- Participants felt that BEST had managed well to show that the technology for doing modularisation works, making modularisation feasible as an approach. However, BEST had not managed to go to the next level: providing advice about how best to make use of the technology (e.g. criteria for when to modularise and when not to modularise, what to modularise etc).

The final presentation was about the governance and resulted the following responses:

- It would surely be necessary to model some information in more than one module.
- The costs of ensuring consistency could be considerable.
- There would be "political" sensitivities in adopting a radical approach.

The presentations were followed by an open discussion and it resulted the following responses:

- In the current climate, the discussion about implications for governance might cause a lot of confusion, as many people will not have understood/thought through the various issues. It might be strategically best, at this stage, to not give a lot or prominence to this.
- The **"container" concept is appealing, in the sense of putting together a kind of "family of related datasets".**
- Some of the underlying ideas from BEST seem to point in the direction of adopting the RESTful approach to web applications.
- Possible topics for inclusion in a follow-up project [in addition to things already mentioned above] would be:
    - Some unified approach to dealing with the plethora of formats that currently out there.
    - The idea of "smart services" to help you find the information you really want.
- The approaches used here for ATM could easily be widened to cover other domains as well. This is particularly relevant given increasing focus on multi-domain transport.
- If considering a new project, it might be better to cover fewer topics than in BEST – but investigate them more deeply.

The detailed report on the informal meeting held in EUROCONTROL can be found at the Annex of the present document.

2.5 Conclusion

The BEST project is a TRL1 research project and as such provides a new approach/solution to an existing problem. Besides that, it deals with abstract concept that makes it even more difficult to explain. It is obvious that the theoretical part is difficult to grasp on first look. However, during the lifetime of the project the project partners managed to come up with more and more understandable explanations, more close to real life examples and better use case scenarios, so that the targeted audience could understand the project goals, the archived results and the real life

application that will result benefits more clearly. From the reference group perspective, the most promising three parts of the project were; the approach of utilizing ontologies in order to enriching data with metadata, sense of putting together a series of related dataset and the role of compliance validator in providing reports on validation and forms of compliance.

The feedback received shows that the Reference Group members understand the basics of the use of semantic technologies in SWIM, see the potential application and the resulting benefits. An especially interesting idea coming from the Reference Group was to consider the business aspect of the BEST approach and consider the information that was subject of the proposed solution as a commodity. That approach would bring a completely new dynamic into the information management and result in competition for the best quality and price of the information.

There were various suggestions around the scope of the BEST project and suggestions to widen the application area of the project results outside of the aviation domain through a more comprehensive approach which can consist of business information within the transportation industry rather than focusing on ATM data. Furthermore, there was a wide held belief about the integration possibilities in to the AI and big data analytic domain. Obvious benefits in analytic and prediction features could supplement information management subject.

On the other hand, a series of concerns regarding future application were highlighted during the meetings and surveys. A majority of experts believed that a careful consideration should be taken in to account to minimize the adaption barriers such as compatibility with conventional working cultures and risk of information overflow. Particularly, it turned out that the implementation in SWIM environment needs a rational long-term plan to foresee all necessity such as adequate collaboration between IT and lines of business and sufficient staff training prior implementation.

The communication with the Reference Group provided the BEST project with a clear view on required improvements in their communication. It became obvious that it is difficult to explain the project's results especially the ontology related topic. Accordingly, the consortium partners should use more real life examples and carefully selected use cases to explain the results and to show the achievable by implementation benefits. Moreover, the provided material in communication with stakeholder's or future users should be more explicit to cover all aspects of the project results and avoid further confusion.

Clearly, the overall acceptance of the project results was positive in terms of the Reference Group contribution to the surveys and meetings. The majority of comments about the project idea and concepts were appealing and the vital outcome of this interaction was the rational guidance on finding the most suitable approach for future steps and refine the communication materials and inputs accordingly.

3 References

As stated in section 1.3, this deliverable is indirectly related to all technical project deliverables in the project, as these are all subject to the Dissemination measures described in this project and/or may be influenced by the results of this work. However, there is no direct dependency between them in terms of content or structure. Therefore, there are no specific references provided to them.

In the Appendix "**Error! Reference source not found.**" in chapter **Error! Reference source not found.**, extensive use was made of external sources, all of them from internet:

- https://explorable.com/research-population
- https://explorable.com/population-sampling
- https://en.wikipedia.org/wiki/Survey_sampling

No other references sources were used in the document.

4 Annex A - Surveys and Reference group meetings

4.1 Reference Group Membership

Experts invited to the Reference group meetings	
Organisation	No of members
R&SZ INFO	1
JKU	1
ANSP	1
DSNA	3
Brussels Airlines	1
Romanian Air Traffic Services Administration	1
Thales	2
ENAV	2
MIL	5
Riga Airport	1
BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS	1
University of Belgrade	4
PildoLabs	2
College Ruy Barbosa, Brazil	1
ISDEFE	1
Lufthansa	2
AV ETAT	2
Wizz Air Hungary Ltd.	1
FAA	2
Johannes Kepler University Linz	2
EUROCONTROL	10
Minienm	2
MOBILIT FGOV	5
Deutsche Flugsicherung	2
Ministry of National Development	1
SkyGuide	3
Budapest Airport	1
Vilnius Airport	2
Leonardo	1
AVIATIOO-CIVILE Gov	1

Experts invited to the Reference group meetings	
Organisation	No of members
AT-One	2
Faculdade Farias Brito, Brazil	1
National Aerospace Laboratory	3
BAZL	2
Bulgarian Air Traffic Services Authority	1
CroatiaControl	2
Czech Airlines	1
Institute for Economic Research	1
PANSA	5
ENAIRE	1
INECO	2
German Aerospace Center	4
Bundeswehr	3
BAF BUND	2
German Airline Pilots' Association (Vereinigung Cockpit)	1
AustroControl	3
MINDEF	1
AVIATION-CIVILE Gov	3
ANS CR	2
INTRADEF Gov	2
LFV	3
IATA	1
VTG	2
m-click.aero GmbH	1
FlightAware	1
mit-c.com	1
LPS SR	2
ROMATSA	1
Naviair/COOPANS	1
M-NAV	1
BHANSA	1
DFS	3
Belgocontrol	1
Centro Italiano Ricerche Aerospaziali	1
Katowice Airport	1
ASBU for Future	1
Civil Aviation Authority of NZ	1

Experts invited to the Reference group meetings	
Organisation	No of members
FullBit Ltd.	1
NASA	1
Delft University of Technology	1
Schipol Amsterdam Airport	1
National Air Traffic Services Ltd.	1
Air Berlin	1
Heathrow Airport	1
Flughafen Zurich	1
Fly Aeolus	1
Swiss Air Force	1
Universita Degli Studi Di Trieste	1
Valstybés Imoné Oro Navigacija	2
Oro Navigacija	2
BULATSA	1
Swiss International Air Lines Ltd.	1
Sloveniacontrol	1

Table 1 Reference Group

4.2 Purpose of the survey

The BEST Consortium contacted outstanding experts in aviation and/or ICT domain called Reference Group and the Consortium believed that their skills could help to evaluate the project results. By the end of October 2016, almost 100 Reference Group membership invitations had been sent out to experts. Reference group members were invited to give feedbacks on the project results via different channels: survey, interview, webinars and workshops.

The aim of the BEST survey was to analyse the different viewpoints of the stakeholders about BEST which is a SESAR Exploratory Research project focusing on a new way of data handling. By creating new data classification methodologies, it will enable the application of System Wide Information Management (SWIM) one of the main results of SESAR.

4.3 Overview of the methods applied

The methods on which we based our survey are described in the Annex in this document providing explanations to this section. The following section reports the actual work done based on the methods selected.

4.4 How did the Consortium identify the people to be included in the BEST survey?

Members of the BEST Consortium had long experience working in the field of information technologies, specifically areas related to ontology and semantic technologies. Furthermore, some consortium partners had good knowledge and expertise in ATM and airport related areas. This resulted in considerable network of personal connections to the experts in above mentioned areas.

The consortium had established good relations with the AIRM group and wished to utilize it further, and involve the participating Reference Group into the BEST's project work.

This collection of experts was the base of the target population of the research processes, especially the survey.

4.5 How did Consortium select the respondents?

The project work had a very specific target therefore the survey participants had to be selected carefully so that they response would add to the project efforts. The main criteria of selection were:

- Expertise in the field
- Accessibility and flexibility

Expertise in the field means that the selected person should have either appropriate expertise in aviation related field (for example: ANSP, Airline, Airport, Regulatory/Government, aviation related Research) or expertise in IT and some knowledge in aviation.

Accessibility and flexibility means that the selected person should be available for the completion of the survey, however it is possible that he should participate in multiple surveys (depending on the project's needs) or even be able to participate on workshops or face-to-face interviews.

The consortium partners have a long work history in their corresponding field of activities and therefore have a substantial net of connections in the field of aviation and IT research and development. Based on the personal connections of the consortium partners a substantial list of possible candidates for survey was created and the persons on the list were invited to participate in the survey.

4.6 How did the Consortium collect the data?

4.6.1 Personalized electronic invitation letters

The consortium created a database in the project's web-based cooperation platform (eRoom), and issued personalised invitation letters to the experts selected.

The electronic invitation letters had multiple purposes:

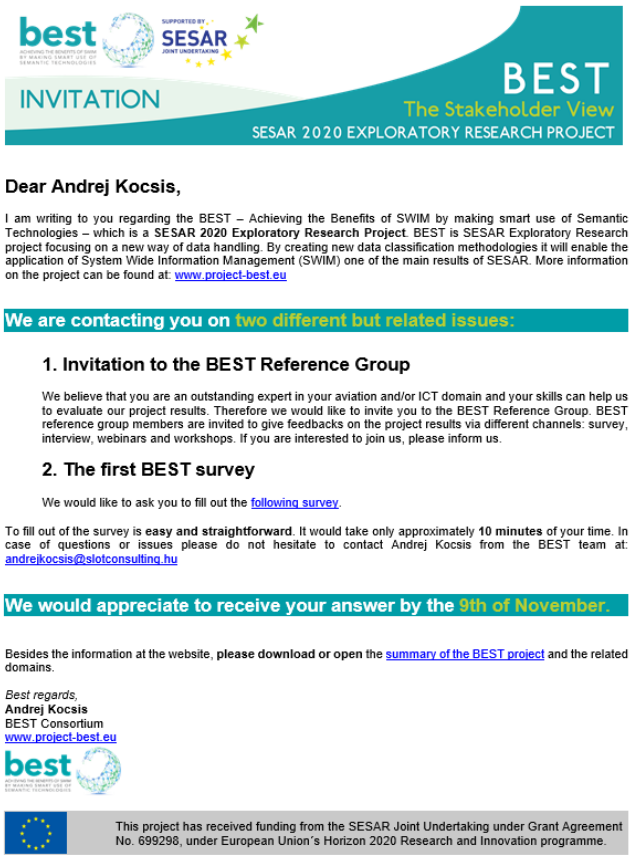
First, they contained some short information on the project to familiarise the invitees with the project. They also contained links to the website to provide further information.

Besides that, the selected experts were invited to participate in the Reference Group. The participation in the Reference Group means that the members receive further information on the project work periodically and that they are invited to the workshops and events that will be held during the project. Also they could be invited to face-to-face meeting or interviews.

Furthermore, the invitation contained a request to fill in the online survey set up for this occasion and provided a link to do so.

In case it would be more convenient for some of the invitees, a download link for the project summary was provided. The summary described the current state of the project making clear the goals and the path selected to reach them.

The list of experts is available in Annex II in chapter **Error! Reference source not found.**.



INVITATION

BEST
The Stakeholder View
SESAR 2020 EXPLORATORY RESEARCH PROJECT

Dear Andrej Kocsis,

I am writing to you regarding the BEST – Achieving the Benefits of SWIM by making smart use of Semantic Technologies – which is a **SESAR 2020 Exploratory Research Project**. BEST is SESAR Exploratory Research project focusing on a new way of data handling. By creating new data classification methodologies it will enable the application of System Wide Information Management (SWIM) one of the main results of SESAR. More information on the project can be found at: www.project-best.eu

We are contacting you on two different but related issues:

1. Invitation to the BEST Reference Group

We believe that you are an outstanding expert in your aviation and/or ICT domain and your skills can help us to evaluate our project results. Therefore we would like to invite you to the BEST Reference Group. BEST reference group members are invited to give feedbacks on the project results via different channels: survey, interview, webinars and workshops. If you are interested to join us, please inform us.

2. The first BEST survey

We would like to ask you to fill out the following survey.

To fill out of the survey is **easy and straightforward**. It would take only approximately **10 minutes** of your time. In case of questions or issues please do not hesitate to contact Andrej Kocsis from the BEST team at: andrejkocsis@slotconsulting.hu

We would appreciate to receive your answer by the 9th of November.

Besides the information at the website, **please download or open** the summary of the BEST project and the related domains.

Best regards,
Andrej Kocsis
BEST Consortium
www.project-best.eu

This project has received funding from the SESAR Joint Undertaking under Grant Agreement No. 699298, under European Union's Horizon 2020 Research and Innovation programme.

Figure 1: Electronic invitation letter

4.6.2 Online survey

The survey was conducted by using Google Online Form services. The survey was administered by the consortium. Google was hosting the survey on their websites and collected the responses that were submitted to the consortium. The survey was located at the following link:

https://goo.gl/forms/GXFHImLf6dbAucYG3

The survey was published with the following legal announcement:

"Both BEST Consortium and Google don't sell responses to third parties, don't sell or share survey responses with third party advertisers or marketers in any conditions. Google merely acts as a custodian on behalf of the survey creator who controls data. Please be ensured that all information provided to us:

- will be handled in a confidential manner
- will only be used for exploratory research purposes
- will not be disclosed to any external partners

All information in public reports will be presented in anonymized way ensuring that none of the inputs/views can be traced directly to a person or entity."

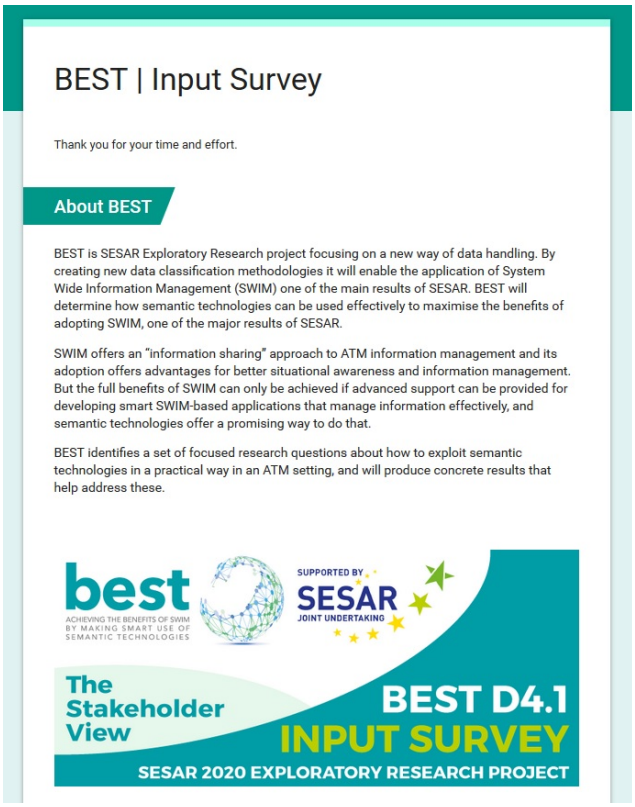


Figure 2: Survey look

4.7 Timing of the survey

The project needed a feedback from the experts involved in IT or aviation or both to reflect on the envisaged work and maybe provide a different perspective.

It was also important for the project to map the general understanding of the project topic in order to be able to communicate better the work of the consortium and the expected results.

It was obvious from the beginning of the project that the topic of the project is difficult to understand for the wider audience. Therefore, the consortium has to make an effort to convey the highly sophisticated information in more understandable format for those who are not so close to the high-level IT concepts.

On the other hand, the results of the project should be widely used in ATM as they will boost the practical implementation of SWIM in the aviation. Therefore, it is vital that the aviation community is aware of the achieved results and the possible practical implementation and its benefits.

The current survey was a one-time survey with the clearly stated deadline (November 11th 2016), therefore the period of data collection was from October 30 till November 16 2016.

4.8 Introduction & Personal Details

In this section the respondents had to provide their names, organisation they are currently employed at and their e-mail addresses for further contact and to enable BEST project to contact them again if needed.

From a total of 148 invited experts, eighteen accepted the invitation to participate in the survey (reply percentage: 12%). Since our request was to accept membership in the Reference Group and to participate in the survey we considered that those who participated in the survey have accepted the invitation to be a member of the Reference Group as well.

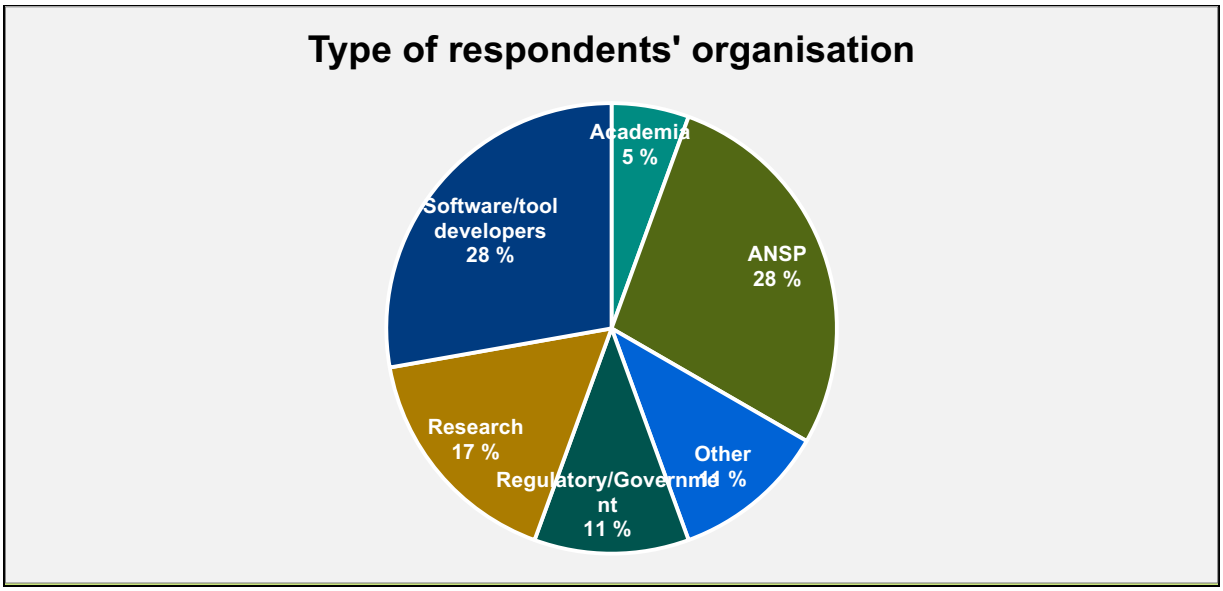
Consortium members should certainly work further on the issue and try to involve a larger number of experts into the group and consequently in the upcoming survey(s) or interviews, as the project needs their opinion and has to measure the results of dissemination related efforts.

4.8.1 Type of organisation

Generally speaking, the information is a key element in any work related to aviation, so one might say it doesn't matter in which field someone works - the topic is equally important. However, the consortium has decided that in order to have a clear picture of what is the perception in different fields related to aviation of ontology and the semantic technologies, the survey should cover different areas like ANSP, Airline, Airport, Regulatory/Government, Research, Software/tool developers and others.

Row Labels	Number of Responses
Academia	1
ANSP	5
Regulatory/Government	2
Research	3
Software/tool developers	5
Other	2
Grand Total	**18**

The responses to the survey were coming from different areas related to aviation and the graph below shows the distribution of respondents according the field they working in.



4.9 Results and Evaluation

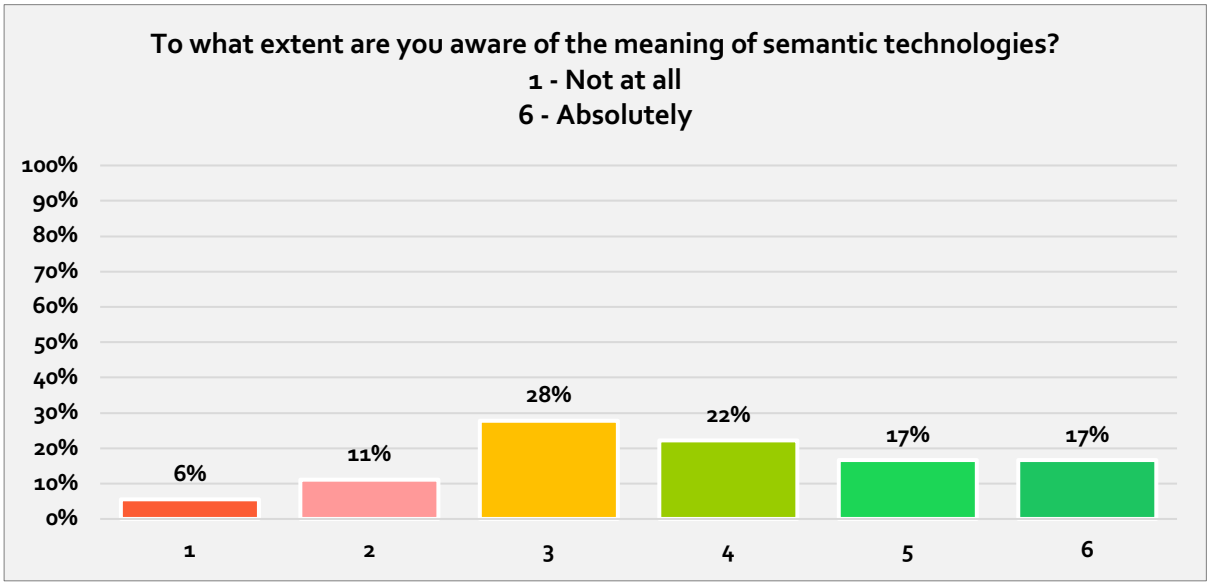
4.9.1 Section one – Questions on ontology and semantic technologies

To what extent are you aware of the meaning of semantic technologies?

The question was related to the general knowledge about the semantic technologies. The respondents had to evaluate the level of their knowledge about semantic technologies from before they have get familiar with the BEST project short description. The respondents had to evaluate their knowledge and provide answer on the scale from 1 to 6 where 1 meant not at all and 6 meant absolutely.

Row Labels	Number of Reponses	Percentage
1	1	6%
2	2	11%
3	5	28%
4	4	22%
5	3	17%
6	3	17%
Grand Total	**18**	**100%**

As it can be seen from the answers the majority of the respondents had some previous knowledge about the semantic technologies. However, the biggest response rate had the value 3 and 4 which means that despite of encouraging response values of 34% of values 5 and 6 the majority (50%) wasn't so sure and responded accordingly.



The graph shows that the majority of the respondents answered rather positively and the most negative answers (1 and 2) reached only 17%.

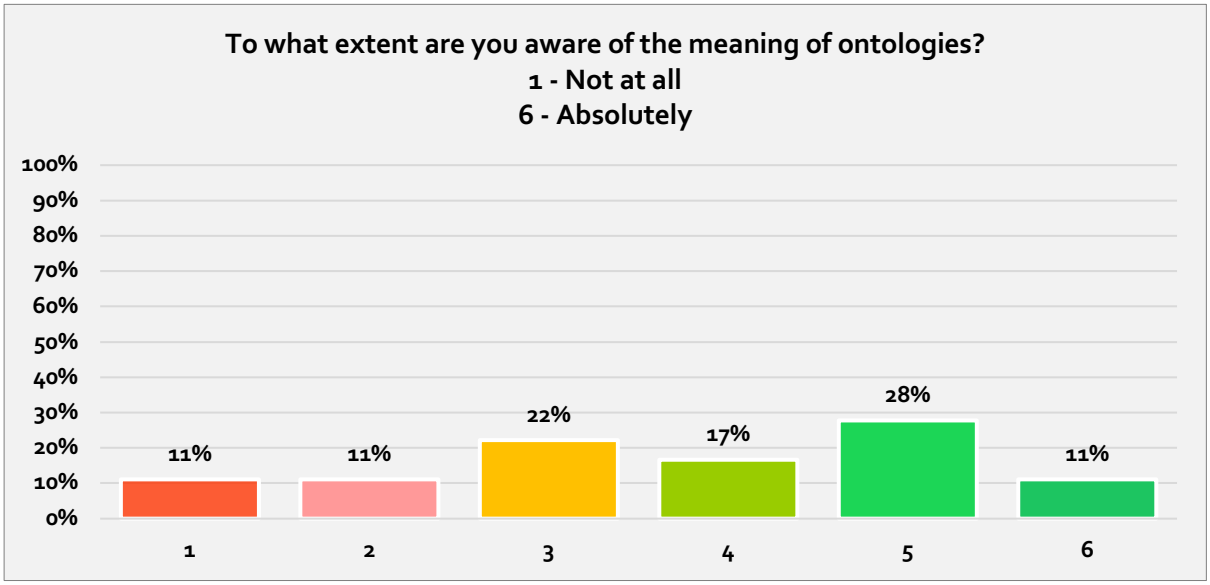
To what extent are you aware of the meaning of ontologies?

The question was related to the general knowledge about the ontologies. The respondents had to evaluate the level of their knowledge about ontologies before reading the BEST project short

description. The respondents had to evaluate their knowledge and provide answer on the scale from 1 to 6 where 1 meant not at all and 6 meant absolutely.

Row Labels	Number of Responses	Percentage
1	2	11%
2	2	11%
3	4	22%
4	3	17%
5	5	28%
6	2	11%
Grand Total	**18**	**100%**

As it can be seen from the answers the majority of the respondents had some previous knowledge about ontologies. Although the majority of respondents (56%) had answered positively (values 4, 5 and 6), 44% answered rather negatively (values 1, 2 and 3).



However, taking into account that only half of the respondents have scientific or software related background it is still encouraging.

What kind of support you would need to understand it better?

For this question the respondents had a possibility to answer in free text.

Responds	What kind of support you would need to understand it better?
Response 1	N/A
Response 2	Clarification what exactly this project means by “semantic technology”
Response 3	More description in a 1-2-page format. Illustrative examples.
Response 4	Understanding the context and the relation to the professional environment. Use cases and examples in daily life or in ATM specific applications
Response 5	Both
Response 6	Workshop
Response 7	N/A
Response 8	N/A

Responds	What kind of support you would need to understand it better?
Response 9	N/A
Response 10	N/A
Response 11	References to documentation where I could read about it in a form written not for scientists.
Response 12	N/A
Response 13	N/A
Response 14	Some online training.
Response 15	Concrete examples of semantic technologies usage within a business domain, illustrating at high-level the type of engineering / modelling activities that are involved and showing the business value that these technologies can deliver.
Response 16	N/A
Response 17	N/A
Response 18	N/A

The respondents mainly asked for further clarification, however the question of the practical implementation and request to show the business value of the application of the semantic technologies also appeared.

4.9.2 Section two – Questions on applying semantic technologies in an aviation SWIM environment

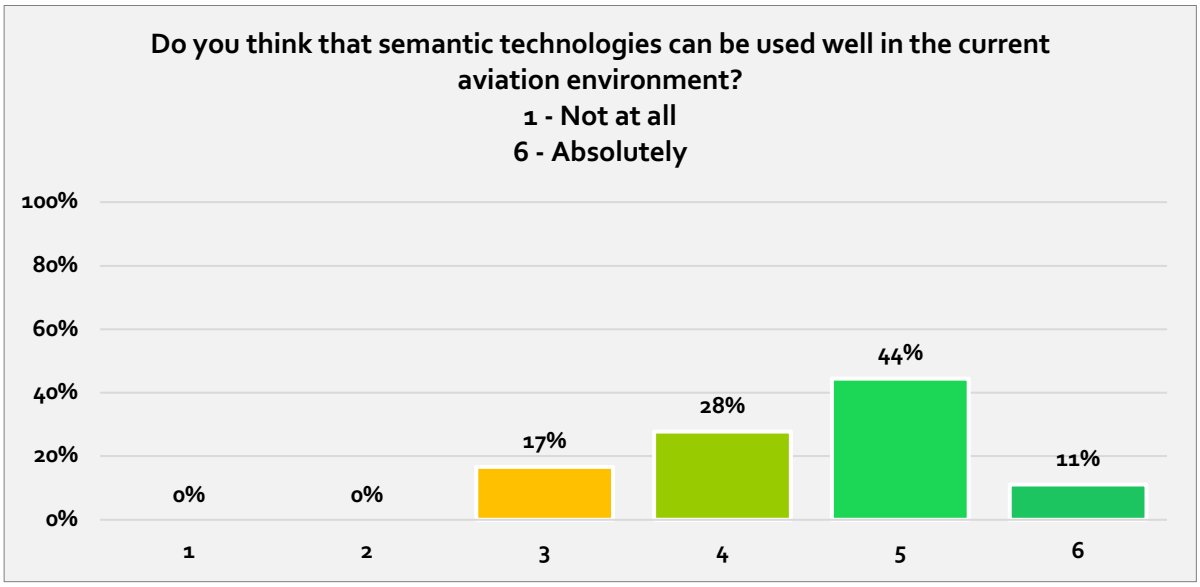
The BEST project is dealing with the application of semantic technologies and otology in an aviation context, therefor this topic is of central importance.

Do you think that semantic technologies can be used well in the current aviation environment?

After reading of the short introduction to the project and explanation of the term semantic technologies, the respondents were more comfortable answering the questions. This question was aimed at application of the semantic technologies at current aviation environment. The respondents had to evaluate applicability of the semantic technologies and provide answer on the scale from 1 to 6 where 1 meant not at all and 6 meant absolutely.

Row Labels	Number of Responses	Percentage
1	0	0%
2	0	0%
3	3	17%
4	5	28%
5	8	44%
6	2	11%
Grand Total	**18**	**100%**

The majority (83%) of the respondents answered the question positively while none of them answered entirely negatively and only 17% answered slightly negatively.



The graph shows that only 11% percent of respondents were sure of the applicability of semantic technologies in current aviation environment and the majority (44%) left some margin of uncertainty and answered with 5, yet none of them answered with 1 or 2. This may be due to the fact that they are not really experts to the topic, so they were a bit cautious in their answer.

What kind of obstacles do you foresee?

For this question the respondents had a possibility to answer in free text. They had to provide their opinion on obstacles that can prevent or make harder the introduction of semantic technologies in the current aviation environment.

Responds	What kind of obstacles do you foresee?
Response 1	The culture and spirit of decision makers. Air traffic controllers.
Response 2	By design of ATM all critical data needs are already covered by standards& regulations. i.e. there is no serious “information gap” that only semantic technologies can fill. In times of market consolidation, it will therefore be difficult to make the (business) case for introducing a new technology paradigm.
Response 3	N/A
Response 4	The willingness of separating data from support & the perceived risk of orientation towards standardisation
Response 5	N/A
Response 6	Lack of knowledge

Responds	What kind of obstacles do you foresee?
Response 7	1) In my experience, development and extension of ontologies (e.g. defining concepts, relations and mapping them onto e.g. an RDF graph) is a rather tedious data engineering task which requires experts familiar with both the application domain and semantic technologies. Experts who are willing to learn both sides are generally hard to come by. 2) Formalizing "common sense" is a notoriously hard problem. It is mostly still unsolved. There was some progress on this front primarily in the field of Artificial Intelligence (see e.g. IBM Watson which utilized semantic technologies). 3) Although, in theory, querying such databases is mostly solved, however, the hardware requirements can quickly get out of hand. 4) I do not know if reasoning in semantic databases will be a part of this project. This is also mostly unsolved. There are deductive (e.g. formal logic-based) and inductive (e.g. deep learning) approaches for this but nothing ground-breaking yet.
Response 8	N/A
Response 9	Provide a good interface to the user
Response 10	N/A
Response 11	not a lot of data in my field is "interpretable" – it is more "hard data" – call sign, FL etc.
Response 12	Put semantic technologies into operational context
Response 13	N/A
Response 14	Quite low level of understanding of the topic.
Response 15	Lack of buy-in from management if benefits are not obvious.
Response 16	performance (processing time, reasoning time etc.), uniform knowledge extraction and definition
Response 17	Scalability, efficiency
Response 18	Performance; potential need (and unwillingness) to change/adapt operational procedures to fully utilize potential benefits; unreasonable expectations in terms of implementation costs

The answers were of three basic types. One type would be concerned with the usual human nature based approach to any innovation. The second type would worry that if the benefits of the introduction of the semantic technologies are obvious enough. The third type was based on the deeper knowledge of the semantic technologies and or deeper knowledge of aviation related data and have more practical concerns. All approaches had their valid points and the project partners should consider answering them in the course of the project to have more successful outcome of the project.

What are the possibilities in your opinion?

For this question the respondents had a possibility to answer in free text. They had to provide their opinion on possibilities that the use of semantic technologies would provide in the current aviation environment.

Responds	What are the possibilities in your opinion?
Response 1	Improved information exchange, planning and situation awareness
Response 2	What comes to my mind is that semantic technology could be useful in detecting "weak signals" of potential future system degradation, e.g. by trawling the web with an ontology containing key words indicative of preparation for industrial action, low-level seismic activity.
Response 3	N/A
Response 4	This would be the door opener to a totally new aeronautical management scheme
Response 5	N/A
Response 6	Training

Responds	What are the possibilities in your opinion?
Response 7	This sounds like a huge opportunity if you can get enough industrial partners on board. In my primary research field (drug discovery), an unprecedented cooperation was formed between big pharmaceutical companies who were willing to disclose some of their private measurements (mostly for "shelved" products and failed molecules). The project, called Open PHACTS, was completed in 2016. Companies shared and integrated their data with publicly available databases in a huge semantic network and created a vast, curated, publicly available knowledge base. Nowadays, it is pretty much the starting point if you want to do drug discovery and pharmacological research if you are not a big pharmaceutical company. If you could pull this off in the current aviation environment, it could become a standard just as it happened in drug research.
Response 8	N/A
Response 9	Rest
Response 10	N/A
Response 11	Safety assessment
Response 12	N/A
Response 13	N/A
Response 14	Education
Response 15	Not sure I understand the question, but overcoming the obstacles above will require to demonstrate the value that the semantic technologies can deliver to ATM / Aviation.
Response 16	Filtering of irrelevant information depending on business concepts and rules, determination of relevant information sets based on given inputs, avoiding misunderstandings due to different concept understandings, ease organization wide communication and understanding, increase situation awareness
Response 17	NOTAM filtering, Semantic Web Services, Data set description
Response 18	Information exchange between different aviation personnel; detailed and personalized information provisioning; simplification/streamlining of aeronautical procedures and regulations; improved interoperability of aeronautical services

Despite of the seemingly different answers they were basically predicting that with the application of the semantic technologies the current bit foggy distorted information world of the aviation could be transformed into a clearer and more transparent system providing better situational awareness and more reliable data.

4.9.3 Section three – Questions on possible use case scenarios for BEST

The respondents were offered a number of use case scenarios that could be used during the project work to test the created ontology and semantic technology solutions. The respondents had to evaluate them and provide their opinion on the usability of the offered use case scenarios.

Multiple-choice grid of possible use case scenarios

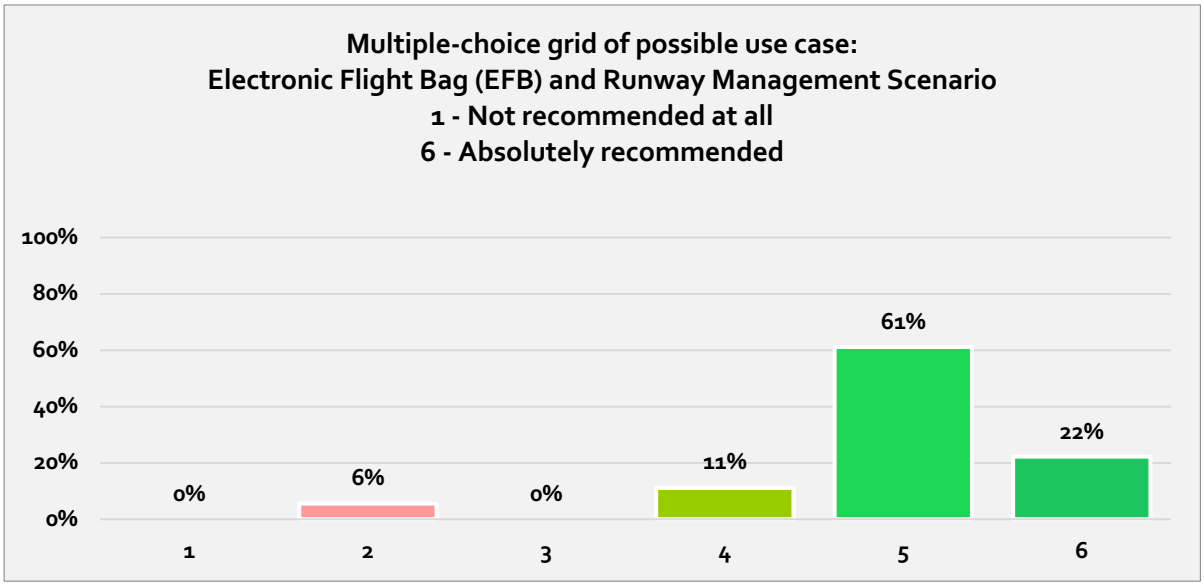
The respondents had to evaluate the offered scenarios and provide an answer on the scale from 1 to 6 where 1 means "Not recommended at all" and 6 means "Absolutely recommended".

Electronic Flight Bag (EFB) and Runway Management Scenario

The respondents had to evaluate the offer for consideration Electronic Flight Bag (EFB) and Runway Management Scenario and provide answer on the scale from 1 to 6 where 1 meant that the offered scenario is not recommended at all and 6 meant absolutely recommended.

Row Labels	Number of Responses	Percentage
1	0	0%
2	1	6%
3	0	0%
4	2	11%
5	11	61%
6	4	22%
Grand Total	**18**	**100%**

This scenario was evaluated positively (except one answer which also wasn't so sure). The majority of respondents evaluated the scenario with 5 leaving a small room for error, but some of them were rather confident with it and evaluated the scenario with 6.



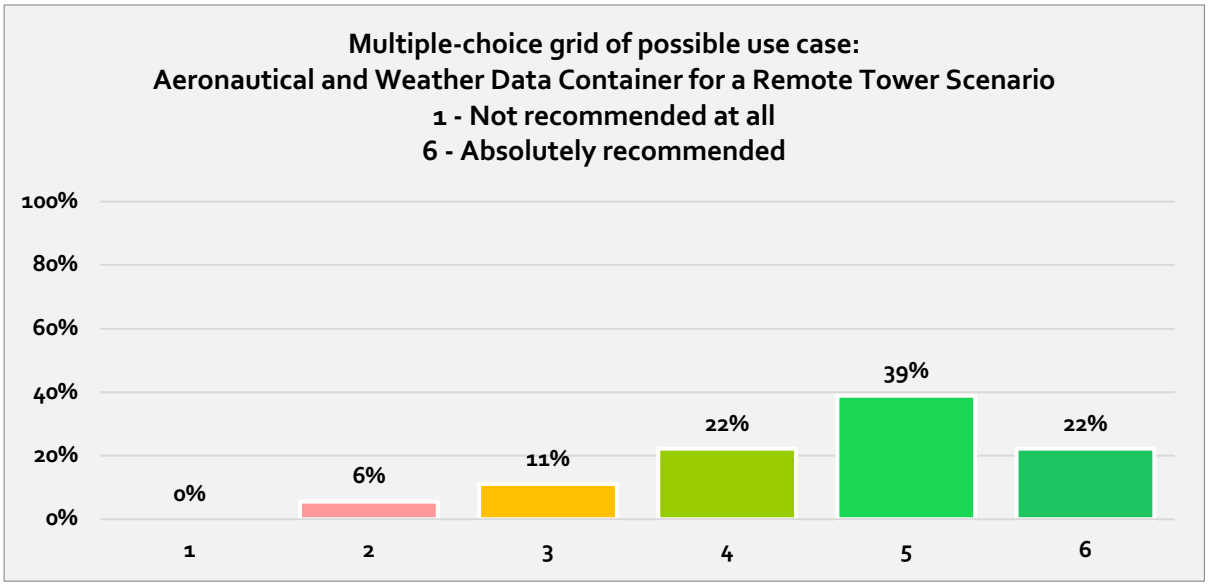
The graph shows that the respondents were rather in favour of the scenario and evaluated it positively. Majority of voters evaluated it with 5 and some of them with 6. Altogether the 83% of respondents voted positively 11% were not so sure, but still voted positively and only 6% voted negatively.

Aeronautical and Weather Data Container for a Remote Tower Scenario

The respondents had to evaluate the offer for consideration Aeronautical and Weather Data Container for a Remote Tower Scenario and provide answer on the scale from 1 to 6 where 1 meant that the offered scenario is not recommended at all and 6 meant absolutely recommended.

Row Labels	Number of Responses	Percentage
1	0	0%
2	1	6%
3	2	11%
4	4	22%
5	7	39%
6	4	22%
Grand Total	**18**	**100%**

Altogether the scenario was evaluated as fit for the purposes of BEST project. Majority of the respondents have been voting rather positively. The answers provided are more widely spread then in the previous case, but still positive.



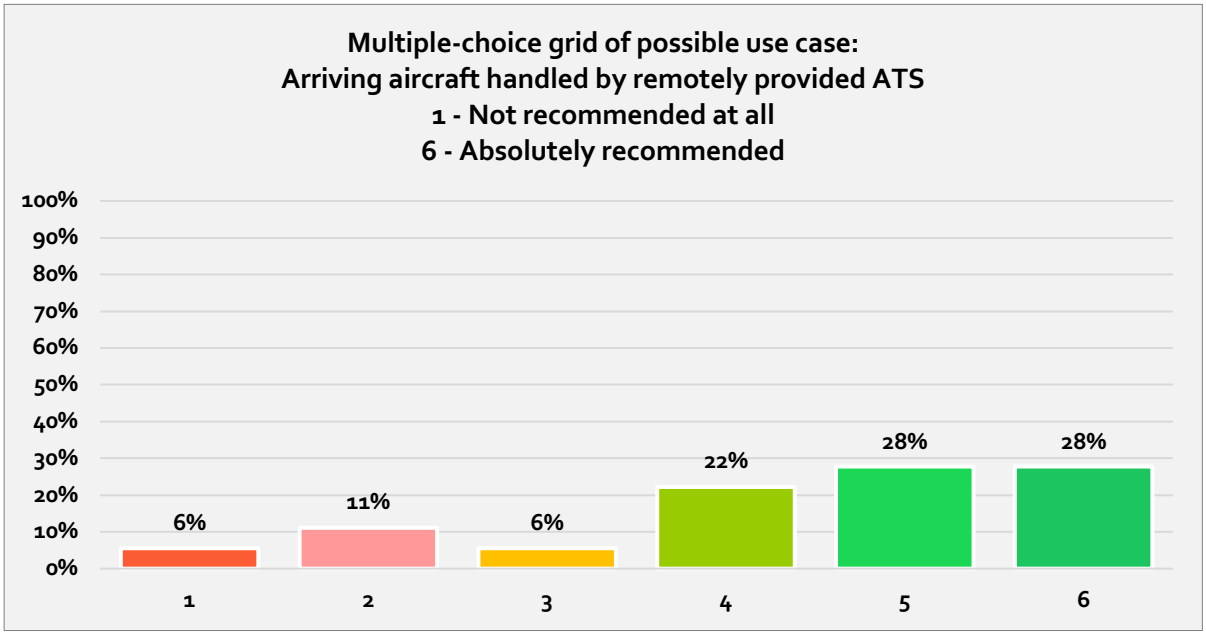
The graph shows that the answers were appropriately spread the balance is however towards the positive side. 83% of the votes were positive that is the respondents considered the scenario appropriate for the BEST project.

Arriving aircraft handled by remotely provided ATS

The respondents had to evaluate the offer for consideration Arriving aircraft handled by remotely provided ATS scenario and provide answer on the scale from 1 to 6 where 1 meant that the offered scenario is not recommended at all and 6 meant absolutely recommended.

Row Labels	Number of Responses	Percentage
1	1	6%
2	2	11%
3	1	6%
4	4	22%
5	5	28%
6	5	28%
Grand Total	**18**	**100%**

78% of respondents were in favour of this scenario and only 22% voted against it. According to this result the respondents considered this scenario as appropriate to be used in BEST project.



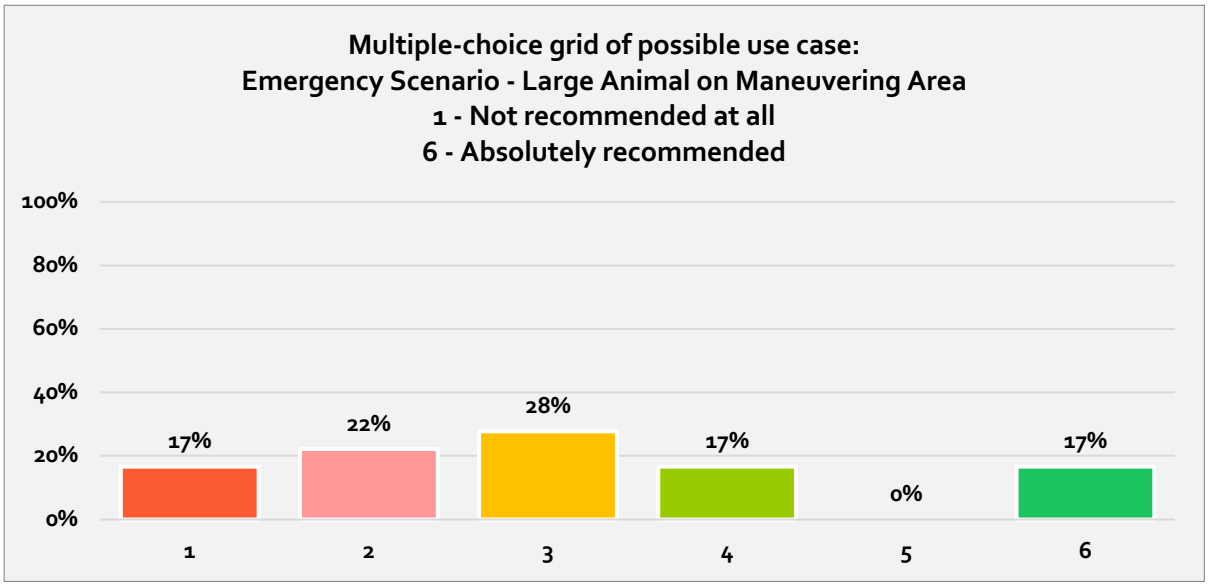
The graph shows that the respondents considered the scenario as rather adequate for the BEST project as 78% of them considered it as recommended to various degrees (answered with 4-6) and only 22% answered negatively to various degrees.

Emergency Scenario – Large Animal on Manoeuvring Area

The respondents had to evaluate the offer for consideration Emergency Scenario – Large Animal on Manoeuvring Area and provide answer on the scale from 1 to 6 where 1 meant that the offered scenario is not recommended at all and 6 meant absolutely recommended.

Row Labels	Number of Responses	Percentage
1	3	17%
2	4	22%
3	5	28%
4	3	17%
5	0	0%
6	3	17%
Grand Total	**18**	**100%**

Only 34% of respondents were in favour of this scenario and the majority (66%) voted against it. According to this result the respondents didn't consider this scenario as appropriate to be used in BEST project.



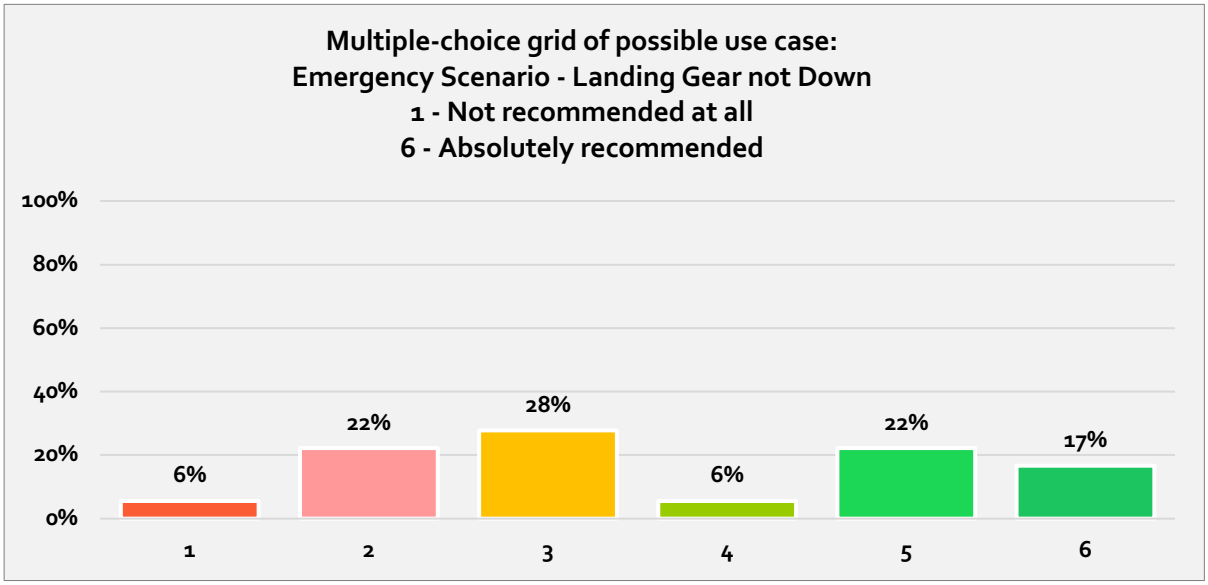
The graph shows that the respondents evaluated the scenario as rather inadequate for the BEST project as 66% of them considered it as not recommended to various degrees (answered with 1-3) and only 17% answered absolutely positively (6) and the rest of the positive answers (17%) had the lowest positive value of 4.

Emergency Scenario – Landing Gear not Down

The respondents had to evaluate the offer for consideration Emergency Scenario – Landing Gear not Down and provide answer on the scale from 1 to 6 where 1 meant that the offered scenario is not recommended at all and 6 meant absolutely recommended.

Row Labels	Number of Responses	Percentage
1	1	6%
2	4	22%
3	5	28%
4	1	6%
5	4	22%
6	3	17%
Grand Total	**18**	**100%**

Based on the results the respondents were not really certain if the scenario should be recommended or not for the use case scenario although the result is against the scenario in 55%-45% rate.



The graph shows that the answers are very well spread and that the respondents voted almost as much for it as against it, however the "Not recommended" has won the result was not conclusive.

Any other use case scenario?

In this part the respondents had a possibility to recommend another scenario(s) in free text form that can be used during the project work. The question was: "If you see any other possible use case scenario for BEST, please specify your opinion here:".

Responds	Any other use case scenario?
Response 1	Assume, there is more, but need to understand the concept better
Response 2	See answer to previous question. I do not understand what semantic technology could contribute to any of the above, but please see my remark on understanding of the term "semantic technology". All the above have to be covered by structured information and R/T (but please note that I consider speech recognition in ATC not scope of BEST research – this has already be researched and trialled).
Response 3	N/A

Responds	Any other use case scenario?
Response 4	N/A
Response 5	ATM and airspace capacity planning
Response 6	NOTAM filtering
Response 7	N/A
Response 8	N/A
Response 9	N/A
Response 10	N/A
Response 11	N/A
Response 12	N/A
Response 13	N/A
Response 14	N/A
Response 15	N/A
Response 16	N/A
Response 17	N/A
Response 18	Technical Problem Scenario – Possible Reasons/Effects of defect equipment; Maintenance scheduling – Optimized maintenance based on executed/planned operations

The respondents were mostly reluctant to name further scenarios for the use case scenarios. This was probably due to lack of deep knowledge of the project's work and lack of time to think through it appropriately.

4.9.4 Section four – Questions on the BEST project

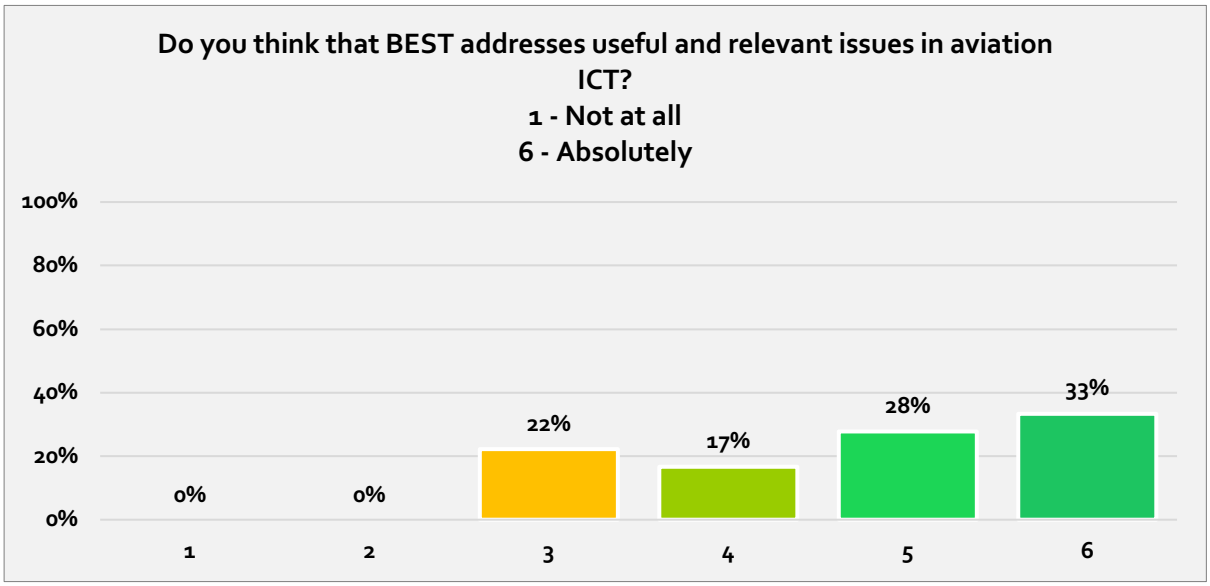
This section deals with the overall work of the BEST project and the expected results.

Do you think that BEST addresses useful and relevant issues in aviation ICT?

The respondents were asked if they think that that BEST addresses useful and relevant issues in aviation ICT and to express their opinion on the scale from 1 to 6 where 1 meant that the BEST doesn't addresses useful and relevant issues in aviation ICT at all and 6 meant the BEST addresses useful and relevant issues in aviation ICT absolutely.

Row Labels	Number of Responses	Percentage
1	0	0%
2	0	0%
3	4	22%
4	3	17%
5	5	28%
6	6	33%
Grand Total	**18**	**100%**

Most of the respondents (78%) provided positive answer and only 22% was somewhat reluctant about it. Their opinion might be based on the lack of deeper understanding of the real life application of the expected project results and this is something that we should better address in our dissemination activities.



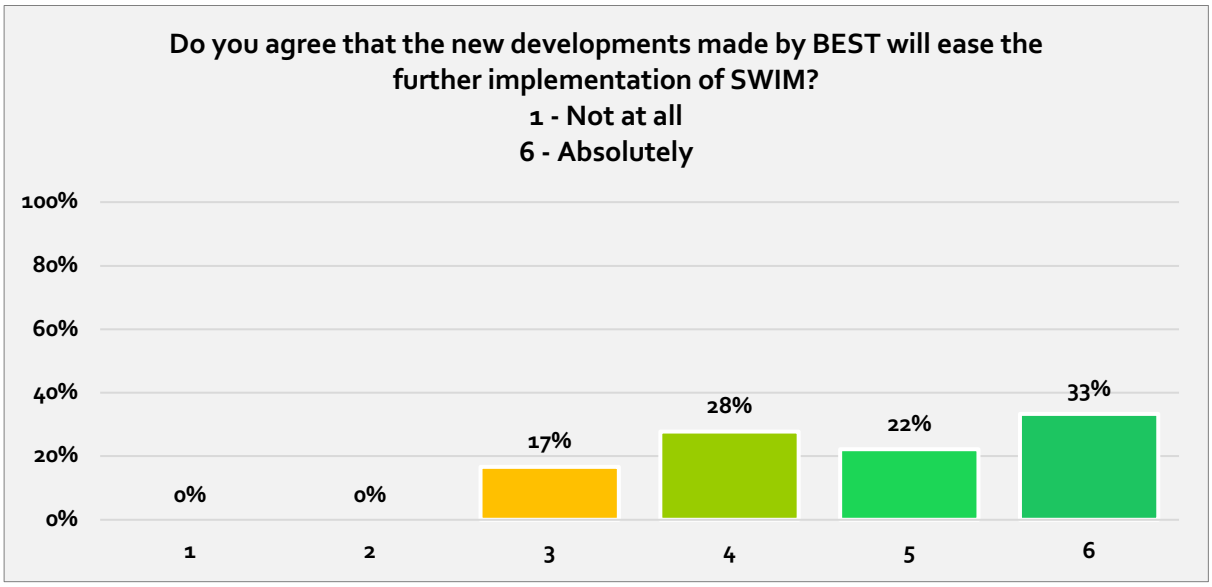
The graph shows that the majority of the respondents were convinced that the BEST project addresses useful and relevant issues in aviation ICT as 61% answered the question by 5 and 6 and only 17% provided the lower yet still positive 4. The rest of the respondents provided 3 as answer which was not that awfully negative rather expresses that they were not really sure about the answer.

Do you agree that the new developments made by BEST will ease the further implementation of SWIM?

The respondents were asked if they think that the new developments made by BEST will ease the further implementation of SWIM and to express their opinion on the scale from 1 to 6 where 1 meant that they do not agree that the new developments made by BEST will ease the further implementation of SWIM at all and 6 meant that they do agree that the new developments made by BEST will ease the further implementation of SWIM absolutely.

Row Labels	Number of Responses	Percentage
1	0	0%
2	0	0%
3	3	17%
4	5	28%
5	4	22%
6	6	33%
Grand Total	**18**	**100%**

Most of the respondents (83%) provided positive answer and only 17% were somewhat reluctant about it. Their opinion might be based on the lack of deeper understanding of the SWIM related issues and how they will affect the SWIM implementation and this is something that we should better address in our dissemination activities.



The graph shows that the majority of the respondents were convinced that the BEST project results will ease the further implementation of SWIM as 55% answered the question by 5 and 6 and only 28% provided the lower yet still positive 4. The rest of the respondents provided 3 as answer which was not that awfully negative rather expresses that they were not really sure about the answer.

What other directions you would recommend for the BEST project?

In this part the respondents had a possibility to recommend other direction(s) for the BEST project in free text form. The question was: "What other directions you would recommend for the BEST project?".

Responds	What other directions you would recommend for the BEST project?
Response 1	Directions?
Response 2	See above
Response 3	N/A
Response 4	N/A
Response 5	N/A
Response 6	N/A
Response 7	N/A
Response 8	N/A
Respond 9	N/A
Response 10	N/A
Response 11	The technologies seem well suited for other items than just SWIM – as I just mentioned safety assessment – incident investigation. The derived tasks of an ANSP so to speak
Response 12	N/A
Response 13	N/A
Response 14	N/A
Response 15	N/A
Response 16	N/A
Response 17	N/A

Responds	What other directions you would recommend for the BEST project?
Response 18	N/A

The respondents were mostly reluctant to recommend other direction(s) for the BEST project. This is probably due to lack of deep knowledge of the project's work and lack of time to think through it appropriately.

4.10 Conclusion and feedback on the survey

The survey has produced valuable inputs for dissemination activities of the BEST project as well as project's research work.

It became more apparent that the topic of the research and the expected benefits is very hard to explain especially to the wider public and that needs an extra effort. In order to highlight the benefits of the research the consortium should produce more examples of actual implementation of the research results to make obvious how and to what extent the expected results will deliver benefits to the aviation especially to the implementation of SWIM in ATM system. Otherwise the ATM community might be reluctant to consider implementation of said results merely due to the complexity of the topic.

The consortium also had a valuable input on the use cases that were proposed to the respondents; this should be used to move the currently on-going work in WP2 and WP3 in the right direction.

Below table is to elucidate the overall feedback from surveys and reference group meetings:

Chapters	Surveys	Reference group meetings
Ontologies	More than half of the respondents were aware of the ontologies basics but did not know how it can be applied in aviation	Limited experience and knowledge about ontologies, need to explain more but depending on audience it also can be eliminated,
	Suggest training, workshops, illustrative examples and probably use cases to perceive the concept	More details about how compliance validator exactly works (Check any ontology against AIRM ontology)
		Require more explanation about the ontology in the background rather than its academic reputations
Semantic technologies	Almost 35% of the respondents had previous knowledge, though the biggest portion of them was not sure about the concept and idea	More clear explanation about how to store membership and content in XML

Chapters	Surveys	Reference group meetings
	More clarification was suggested about the project means and elaborate the context through use cases and application in ATM and general semantic technology examples	Possibility to include the cost of the data should be considered as well
		Need a clearer information about the rules that shows what contains in the semantic container and at which stage it happens
	Suggested to provide concrete examples of semantic technologies usage within a business domain, illustrating at high-level the type of engineering / modelling activities that are involved and showing the business value that these technologies can deliver.	Advantages of semantic containers to filter and extract NOTAMS over conventional method
		AI seems relevant to be used in semantic container
		Semantic container could be introduced as a competing service and if it can be business potential in containers
		Further clarification is needed for "membership condition" part of the containers
		The "data quality" as metadata was considered interesting, while they claimed that the advantages of data consumers are not clearly defined
Apply semantic technologies in SWIM environment	Majority of the respondents were positive about the future application in SWIM	Can address the "information overflow" objection in adoption of SWIM
	However, a lot of obstacles were foreseen; such as adaption culture, quite	Apply composite container in case of multiple sources in SWIM

Chapters	Surveys	Reference group meetings
	hard to make business case for new paradigm , lack of knowledge and appropriate skilled staff in the area and unwillingness to change operational procedure to utilize potential benefits	The capability of semantic container to call multiple services to get all required information was discussed
	Suggest possibilities of the semantic containers such as; revolutionise aeronautical management scheme, improve information exchange and enhance situational awareness, an opportunity to involve industrial partners onboard, assist safety assessment issues and NOTAM filtering	
Use case scenarios	More than 80% of the respondents believed it can be beneficial in EFB and runway management application	Even though, non-experts could not understand the technical parts, managed to "see through" that and understand the benefits.
	Slightly fewer than EFB, but still majority of the respondents voted positively for "Aeronautical and weather data container for a remote tower scenario"	Audience found the provided ATM use cases (NOTAM distribution) useful to perceive real application in ATM
	78% were in favour of utilizing in "Arriving aircraft handled by remotely provided ATS"	The semantic container as a basic layer for future AI application to handle structured data
	Majority of the respondents were against these(Emergency scenario – large animal on manoeuvring area & landing gear not down) scenario for BEST application	
	Respondents suggested; NOTAM filtering and optimised maintenance scheduling as technical problem scenario	

Chapters	Surveys	Reference group meetings
Modularization & governance		Concerning about pros and cons of AIRM modularization; enhance decision quality over complexity due to dependencies.
		The cost of ensuring consistency and political sensitivities in adoption should be considered as well
BEST project	Most of the respondents(78%) were positive about the usefulness of the BEST and relevant issues in aviation ICT	The idea of "smart services" to assist in finding the intended information as a follow up topic
	83% believed that the project would ease up further implementation of the SWIM	The project approach can easily expanded to other domains and scopes as well
	The project can be well suited for safety related issues in aviation such as incident investigation	The idea of Big data/AI techniques was suggested as well as relating data to "services" as possible future work in the project

5 Annex B - Budapest reference group meeting

Below is the detail report from reference group meeting with focus on stakeholder view

5.1 Meeting goal

- To provide participants with:
    - A summary of the overall structure and goals of BEST
    - Details related to specific results: what they are and what they can be used for.
- Obtain feedback from Reference Group members regarding BEST concepts and results with respect to:
    - Are they easy to understand?
    - Are they relevant/useful within your domain/role/field of work?
    - Do you have suggestions for changes in scope or approach, or for further work?
- The meeting will be considered a success if:
    - Participants leave with a good understanding of the potential of semantic technologies in SWIM.
    - The project receives feedback on the strengths of weaknesses of what we are doing.
- The meeting will be considered a failure if:
    - We fail to have an open, interactive dialogue

5.2 Participants

Names withheld for privacy reasons

Participant Type	Organisation	Role
Reference Group	BluSky	Independent consultant in ATM issues, one of the originators of the SWIM concept. He was originally an air traffic controller with ratings in aerodrome, approach and area control, including radar, instructor and examiner. He later obtained a computer programmers diploma. He joined the Paris office of ICAO as a technical officer, and then moved on to Amsterdam to work as a process specialist building the AAA air traffic control system. Subsequently, he joined IATA's office in Brussels as an assistant director, infrastructure and safety. Steve established BluSky Services nine years ago where he is director of the air traffic management operations division and CEO of the BluSky Services Group. http://www.bluskyservices.com/

Participant Type	Organisation	Role
	Hungarocontrol	Air Traffic Controller. HungaroControl, the Hungarian air navigation service provider (ANSP), provides air navigation services in Hungarian airspace and - on a NATO assignment – in the upper airspace over Kosovo, trains air traffic control personnel and conducts air navigation research and development. In recent years, we have been making ground-breaking efforts in leading and supporting innovation to improve flight safety, increase capacity, reduce airline costs, and enhance environmental protection. Introducing Hungarian Free-Route Airspace, implementing Controller Pilot Data-Link Communication, demonstrating a unique Remote Tower solution and providing ATC services in the upper airspace over Kosovo, are just some of our key achievements. Besides forming partnership with ANSPs, universities and technology providers, as a member of the Frequentis SESAR Partners consortium, we participate in the industrial research, validation and demonstration activities of SESAR 2020 as well. The consortium of Atos, HungaroControl and Frequentis aims to enhance cross-industry innovation by integrating different stakeholders in the ATM value chain. As an ANSP, we can provide essential support to industry partners working on innovative solutions. Our support includes ATM-centric expertise, real-life operating experience and the provision of simulation facilities. http://en.hungarocontrol.hu/about-us
	WizzAir	Active pilot.
	B-AIR	A former MALEV pilot who is mainly active in aviation related R&D for example participated a VALORIE (Clean Sky) project and other related activities. He has his own company, B-AIR Ltd. It is a private company founded in 1996. We are experienced entrepreneurs in various fields of transportation with a focus on air transport industry. Aircraft engineers, aviation experts, economists and IT people can be found in our staff as well as senior airline crew. http://b-air.hu/
Project Consortium	SINTEF	Project coordination. Work on ontology transformations, modularisation, governance, scalability.
	Frequentis	Development of scenarios, simple prototypes.
	University of Linz	Development of the Semantic Container concept.

Participant Type	Organisation	Role
	Slot	Responsible for establishing and coordinating the Reference Group. Project Dissemination and Exploitation Manager.

5.3 Location & date

The meeting was organised by Slot Consulting in its office (Koer street 2/a Budapest, Hungary, H-1103) on 16th February 2018.

5.4 Agenda

Time	Programme	Responsible
09:00-09:10	Round table introductions	SLOT
09:10-09:40	Welcome and introduction; Project Overview	SINTEF
09:40-10:10	Ontologies	SINTEF
10:10-10:30	B R E A K	
10:30-10:55	Semantic containers	UNIV LINZ
10:55-11:45	Use case scenarios and Prototypes	FREQUENTIS
11:45-12:20	Modularisation and Governance	SINTEF
12:20-12:40	B R E A K	
12:40-13:10	Open Discussion/Overflow from earlier sessions	All

13:10-13:30	Final feedback from Reference Group + Conclusions	All

5.5 Summary of the feedback

Note: This document is not intended as "minutes" in the style used for formal meetings, indicating who said what, actions points and agreements. It is rather intended as a document to capture the feedback we received at this meeting, in some cases trying to draw conclusions from it. While we have identified the names of all participants, we have deliberately not identified the source of each item of feedback. That is in support of the open/interactive style we tried to create: people should feel free to express their opinion openly and honestly, without fear of being "quoted" on it, if some should consider the views controversial.

Welcome and introduction:

The chairman welcomed everyone to the meeting and extended a special thanks to Reference Group members for taking the time to attend the meeting. He presented the goals of the meeting and encouraged all present to feel free to be frank, open and raise any issues they felt relevant.

The chairman presented the agenda and explained that timings were indicative and could be adjusted dynamically depending on the level of interest in different topics. The "Open Discussion/Overflow" session could be used to bring up other topics, or to re-visit topics from earlier sessions if needed.

The chairman explained that each session would include a set of simple questions from the consortium to Reference Group members, raising issues where we felt particular need for feedback but that all present were free to raise other issues as needed. The detailed record below shows the pre-prepared questions, the responses to them, and other issues raised by participants.

Project overview:

Project member presented an overview of BEST: its goals and main results. He explained its role as an "exploratory research" project, and the meaning in the SESAR context of "TRL 1".

He provided a brief overview of SWIM, emphasising the point that it replaces "point to point messaging" (where the *sender* has to decide to whom information must be sent) with an "information sharing" approach in which *recipients* of information need to have a clear idea about what information they require. This implies that recipients need support in ensuring they receive information that best matches their needs.

He explained that BEST does not *replace* SWIM, it is *complementary* to it. We will use semantic technologies to improve SWIM services by making them more precise.

Also he provided an overview of AIRM, explaining that it provides precise descriptions of what things mean, and that it is a very large model.

Ontologies:

Question	Answers/ comments from participants	Observations by BEST team (during or after event)
Responses to specific questions prepared before event (and shown on slides/shared by email etc.)		
Does anyone have any experience with ontologies? If so, from what domain?		
	Some present had limited experience.	
Do you think that ATM is a good domain for using ontologies?		
	You at no point discuss the *cost* of data, or what pricing models might apply to its distribution (via SWIM or otherwise). That is something that might also be handled using ontologies. You are limiting the discussion specifically to ATM – perhaps you should extend it to "business information". Moreover, ATM and airports are businesses: the information they are dealing with should be considered as business information and the methodology that deals with such business information can be applied in much wider area outside of aviation domain.	This was a very useful input – to consider extending the scope to "business" aspects, not just the pure ATM domain. This could perhaps be a topic for further research.
Do you have experience with any ontology tools, such as Protégé, Pool Party, NeOn, TopBraid Composer?		
	No	
Other remarks arising during/after presentation, not based on questions prepared before the meeting		
	Does BEST do a comparison of with/without BEST regarding effectiveness?	Would be useful, but outside scope.
	One of the claims you make in project documents is that SWIM is one of biggest achievements of SESAR. Some outside the project would not agree with that claim.	As "SESAR" members we tend to take for granted that everyone agrees that SWIM is a major achievement. Clearly, that idea has not been "sold" to everyone; we should remember that when addressing external audiences.

Question	Answers/ comments from participants	Observations by BEST team (during or after event)
	Compliance validator: participants wanted more details about exactly how it works, and wondered whether we have any performance indicators regarding its accuracy etc.	We are working on producing such measures. → Must remember to include in presentation material when available.
	Is the compliance validator purely syntactic, or also semantic?	It's both. → We need to clarify this in presentation material.
	Are ontologies maybe used more widely than I realise, "in the background" in implementations – without me realising it?	Yes, they are. → Maybe we should "sell" ontologies more by making this clear in presentations, help to reduce their "academic" reputation.
	How is OWL more expressive than UML?	Our answer to this was along the lines of "UML more for visualization (though you can generate code), OWL lets you add all sorts of 'rules'. It becomes 'machine readable' once you have transformed to OWL.". → We need to work on this, and provide a clearer response on this issue.

Semantic container:

Question	Answers/ comments from participants	Observations by BEST team (during or after event)
Responses to specific questions prepared before event (and shown on slides/shared by email etc.)		
Specific questions for this presentation were raised in the session on use case scenarios (below) as the two presentations are linked.		
Other remarks arising during/after presentation, not based on questions prepared before the meeting		
	Do you store the membership and the content in parallel, in XML?	Our reply on this was a little unclear; we need to provide a clearer explanation of this.

Question	Answers/ comments from participants	Observations by BEST team (during or after event)
	If you have multiple sources, would you have a separate SWIM service for each one of them?	We can store provenance information (to show where the information came from) and can use composite containers.
	How do you classify the different possible sources?	This is up to the provider of the data.
	Could you include the COST of the data (see questions on ontologies)?	We don't now, but we could.
	Might a semantic container have to call multiple services to get all the information it needs?	Yes.
	Am I right in saying that the rules that define what containers will contain need to be done "Up front" when designing the containers – not done on a day-to-day operational basis?	Basically yes. → We need to provide clearer information about WHEN (i.e. at what stage in development/operation) information is defined and gathered.
	How does this differ from what we already do when we request NOTAMS?	With the "container" layer, we add the possibility of filtering and structuring. It makes it easier to find the data more easily. → Above is something we need to illustrate much more clearly in our presentation, probably at an early stage --- show where the "containers" fit in the architecture, and when they get populated etc.

Use Case scenarios and prototypes:

The table below includes overall questions related to the Semantic Container concept, from the previous conversation.

Question	Answers/ comments from participants	Observations by BEST team (during or after event)
Responses to specific questions prepared before event (and shown on slides/shared by email etc.)		
Did you understand the Semantic Container concept?		
	Different replies: • I understood it very well, and am happy to see that this can contribute to making benefits of SWIM more easily achievable. • Sort of basically kind of 50%. • I don't understand the technical stuff at all. But I do understand the underlying issue of information overload and the idea of getting everything from a "data pool". • It was a good presentation, and you managed to answer what I asked about. I was not paying much attention to the technical details, but understood that it helps us get the information we need.	Perhaps not surprisingly, we can learn from this that non-experts are unlikely to understand the technical details about subsumption hierarchies etc. etc. But it is encouraging to see that they manage to "see through" that and appreciate the underlying goals and advantages. *BUT*: they perhaps managed this partly because we were able to have a highly interactive session where things could be explained in detail when questions arose. For the future, we should improve presentations to highlight the advantages that this audience perceived.
Do you agree with the presented benefits?		
	(Answers to that were implicit in answers to other questions, and in general discussion).	
Do you see benefits other than those presented?		
	None were mentioned by participants.	

Question	Answers/ comments from participants	Observations by BEST team (during or after event)
Does the use of semantic containers in SWIM increase your confidence in that SWIM will provide you with the information you need – and only that?		
	Yes, I think this will act as an enabler. Longer term we need to use AI techniques etc – and this "semantic container" idea maybe provide a basic layer. (For the future it seems very likely that that will be needed). You are providing something that can a structured/standardized way to handle the data.	
Do you think that the use of the semantic container concept will make it easier for developers?		
	This was not discussed much; the discussions were more on advantages for data consumers.	One of the reasons it was not discussed much is maybe because we did not refer often to "developers" in presentations. We should perhaps be more explicit about that.
Is there a better way of ensuring efficient information exchange in SWIM?		
	No one suggested any.	
Other remarks arising during/after presentation, not based on questions prepared before the meeting		
	If a service is for some reason, do we still have the "latest" data cached in the container?	Yes – with associated temporal information showing how recent it is.
	It's clear that this approach can have a *business/market* impact, and can lead to a more competitive business environment for delivering "best" data. It encourages the idea of viewing data as a sellable "commodity".	Again, the "business" dimension is mentioned. Clearly something on which we can build.
	"Information overflow" is something I have heard raised as an objection/obstacle to the adoption of SWIM. Perhaps BEST can help address that potential problem, and so help SWIM. Longer-term, it seems likely that some Artificial Intelligence approach may be needed.	Encouraging to see that BEST can be viewed as having a possible SWIM enabler role. The idea of applying AI could be an area of further research.

Question	Answers/ comments from participants	Observations by BEST team (during or after event)
	There has been a tendency in ATM to get too hung up on the *sources* of data – we should instead focus on its *quality*.	Semantic container metadata supports this; maybe we should emphasise it a bit more.
	Would be useful to provide several potential use cases based on real experiences of the project in ATM environment to eliminate inefficient flow of information such as distribution of NOTAMs.	

Modularization and Governance:

Question	Answers/ comments from participants	Observations by BEST team (during or after event)
Responses to specific questions prepared before event (and shown on slides/shared by email etc.)		
Does anyone have any experience with modularisation, either within the domain of ontology engineering or ”traditional” software engineering?		
	One participant had limited experience.	
Which modularisation approach (partitioning or extraction) do you think made more sense?		
	The extraction one is clearly best. Contributes well to understanding.	
Do you see other approaches that could be applied?		
	No participants made any suggestions.	
Do you think the modularisation of AIRM makes life easier or more complex for governance?		
	Advantages and disadvantages. Good for quality of decisions about change requests. But introduces complexities of maintaining dependencies.	
	Maybe the question should be: Should modularization be mandatory? We are talking about life-critical information, so there should be emphasis on quality of the models AND the decision making processes around it. So probably you are making a contribution there.	This is good feedback about the relevance of our work.

Question	Answers/ comments from participants	Observations by BEST team (during or after event)
Other remarks arising during/after presentation, not based on questions prepared before the meeting		
	You presented a "partitioning" approach and an "extraction" one. Is some middle way possible?	Yes. But we have not had resources to do that in the project.
	How do you manage dependencies?	It's based on ontology matching and hard to explain the details. →Maybe we should have one slide summarising this?
	How do you test whether the modules you generate are compliant with the source (AIRM)?	It is done using ontology matching. → Maybe we should emphasise this on slides.

Final open discussion:

Question	Answers/ comments from participants	Observations by BEST team (during or after event)
Responses to specific questions prepared before event (and shown on slides/shared by email etc.)		
As we asked at the start: How does this relate to your domain?		
	There were no explicit responses on this.	
Which areas are of most of interest to you?		
	As a software developer: I think about what is feasible with existing technologies. For example, with AI: do we have technologies there that could be applied? The concept is clear - but what are the next steps?	This is important feedback: we are describing what we have done, but not saying wat needs done next-
What was particularly interesting or relevant for you?		
	There were no explicit responses on this.	
Did you find any parts especially difficult to understand?		

Question	Answers/ comments from participants	Observations by BEST team (during or after event)
	Semantic containers (several people). Especially when you get to the bit where you make composite containers.	This comes as no surprise. Still, we need to think about making things clearer in presentations.
	I did manage to understand (most of) it. But that will not be the case for everyone! So be careful to make it clear that end users do not need to know about ontologies and containers! Fine to say that semantic containers help SWIM work more effectively. Fine to say that it is not necessary for end user of information request to know about it the semantic container concept.	Good advice!
Were there parts that seemed of no relevance to you?		
	☺ The coffee break.	
Do you see potential for future cooperation or developments?		
	Today ATM is no longer the centre of the universe. It is not "aviation". You have developed a method that could be of much wider scope, including business information. That would be a nice follow-up project.	Interesting idea.
	SWIM is more than just a technical competence, it is also organisational and institutional i.e. "SWIM Governance". Until all that is solved, then the real benefits will never come.	This provides an affirmation that our work on governance is relevant.
Other remarks arising during/after presentation, not based on questions prepared before the meeting		

5.6 Conclusion and main feedback

At the end of the meeting, the project team thanked the Reference Group for their attentiveness, spirited interaction and very useful feedback.

When reviewing the goals of the meeting, we considered that the participants had received the overviews that were promised, and that the consortium had received the desired feedback on strengths, weakness and feedback. The meeting was considered a success.

Based on the detailed feedback provided above, we have identified the following as the most crucial elements of the feedback:

- The audience was able to perceive benefits from all of the presentations we made.
- There is no doubt that some of the material can be difficult to understand for people without specialist knowledge. BUT: it is possible to communicate the BEST approach to a willing audience in such a way that they can see the main benefits without having to understand all the technical details.
- Despite the above point, there are aspects of the presentations that can be improved to further improve clarity – especially for events where there may be less opportunity for detailed interactions to explain things.
- The success of SWIM is not just about technology, it is also about organisational issues and how decisions are made regarding "standardisation". BEST contributions to governance could be useful here.
- Concerning possible future work:
    - We need to include some details in our presentations about what we see as the "next steps" to lead on from our work;
    - Ontologies offer the opportunity for extending the scope beyond pure ATM, to include wider "business" data;
    - Application of Artificial Intelligence techniques for filtering and matching information needs with information provided.
- Things to remember:
    - People in the audience are not necessarily SESAR/SWIM "believers" – it may be helpful to provide a little more information on that, and the possible role of BEST as an "enabler" of the goals of SWIM.

6 Aneex C - SESAR PJ19.03 plenary meeting, INDRA Premises, Madrid

6.1 Meeting goals

The presentation was made at a plenary meeting PJ19.03. PJ19 is the SESAR project responsible for “Content Integration” in SESAR (acting as a kind of integrator for other SESAR projects), and PJ19.03 is the work package within PJ19 responsible for “ATM Systems and Services”. One of the tasks in PJ19.03 is about “Information Architecture”. This group therefore brings together people in SESAR actively involved in development of strategies for information management. Clearly, they would have an interest in BEST ideas about information management.

The goals of the two-day plenary meeting were related to internal business of PJ19.03, but slots were included on the agenda for:

- A presentation by the SWIM Governance project leader about the status of work on SWIM Governance. This was allocated 30 minutes, but discussions lengthened it to 45 minutes.

- A presentation, with room for discussion, of BEST. On the original agenda, this was allocated 60 minutes. But the slot was at the end of the day, and over-runs from earlier sessions meant that the total duration was about 40 minutes.

From the point of view of PJ19.03, the goal of both sessions was simply to keep project members informed of developments.

From the point of view of BEST, the goals were:

- To present as much as possible about the project in a short period of time, to learn what has to be emphasised in such cases.

- To gain feedback about how the BEST approach is perceived from SWIM Governance and by project members actively involved in information and service management.

To assess how easy it is for people to understand BEST when it is presented in a very compressed way. (One of the experiences from the Budapest Reference Group meeting was that people gave mostly positive feedback about ability to understand – but there was scope there for detailed dialogues to explain things).

6.2 Participants

Names withheld for privacy reasons

Participant Type	Organisation
From the "SWIM Governance" project	DFS
From the BEST project consortium	SINTEF
	Frequentis
From the PJ19.03 team	Approximately 16 people, all active project participants. (The two BEST team members are also PJ19.03 members).

6.3 What was presented

Following the meeting in Budapest, a revised "Project Presentation" was created, based on the slides presented in Budapest. These were gathered into a single presentation, with different sub-sections on different topics. They were later refined and slightly extended, producing an extensive set. Severe time constraints at this meeting meant that it was impossible to present all of these, but we were able to present some slides from all sections. Specifically (referring to eRoom version 11 of file "BEST Project Presentation.pptx", we presented:

- **Project Scope:** Slides 4-9 (emphasising TRL1 role and relationship to SWIM "information sharing")
- **Objectives and Results:** all slides.
- **Ontologies:** Slides 25-29 (emphasising the transformation tools and compliance validator tool).
- **Semantic Containers:** Slides 34-38 (introducing the core idea of the concept).
- **Prototypes/Use Cases:** Slides 55-59 (emphasising composition and filtering), slide 64 (summary of benefits)
- **Modularisation:** Slides 67-72, emphasising goals and types of modularisation.
- **Governance:** All slides.

Most questions/comments arose during the presentations. There was also some discussion at the end, but it was unfortunate that the session came at the end of a busy meeting, and people were tired.

6.4 Summary of feedback

Due to the short time available, it was not feasible to do things the way we did in Budapest and ask for explicit feedback on specific issues in which we were specifically interested. So, the feedback was less structured. Points that arose:

- It was clear that some people had never even heard the term “ontology”, let alone have any understanding of what it meant. We maybe need to explain a little more on the slides what ontologies are. BUT: in some cases, depending on the audience/context, it may be better not to present ontologies at all.
- People liked the idea of Semantic Containers strengthening the benefits of SWIM services. (The slide on “Benefits” was of particular interest to many).
- People made the observation (as in Budapest) that “Artificial Intelligence” seems a relevant technology for containers.
- From the preceding presentation on SWIM Governance, there had been some discussion about the idea of several competing services being able to realise a single “Service Definition”. People saw the Container concept as offering ways to promote “competing” services.
- People wanted to know more about whether the Container concept has been used in other domains, and whether it has been successful.
- People wondered whether there was business potential in the container concept.
- The role of the compliance validator in providing a report on validation (showing what was and was not compliant, or forms of compliance) was appreciated.
- Questions were raised about how “automated” transformations and compliance testing could be validated/calibrated. Could we really trust it?
- From a governance point of view, there was some interest in the potential offered by modularisation, especially with respect to the opportunities offered for CCB composition (higher proportion of experts on the domain).
- The leader of the SWIM Goverenance project mentioned that it could be a lighter way instead of always writing a service definition. Service provider will write their descriptions and then maybe link only to a container instead of to a service definition.

One participant sent some feedback by email after the meeting, saying “Please don’t forget the safety assurance aspects of what you are evolving.”

7 Annex D - BEST informal EUROCONTROL meeting, Brussels

7.1 Meeting goals

- To provide participants with:
    - A summary of the overall structure and goals of BEST
    - Details related to specific results: what they are and what they can be used for.
- Obtain feedback from Reference Group members regarding BEST concepts and results with respect to:
    - Are they easy to understand?
    - Are they relevant/useful within your domain/role/field of work?
    - Do you have suggestions for changes in scope or approach, or for further work?
- The meeting will be considered a success if:
    - Participants leave with a good understanding of the potential of semantic technologies in SWIM.
    - The project receives feedback on the strengths of weaknesses of what we are doing.
- The meeting will be considered a failure if:
    - We fail to have an open, interactive dialogue.

7.2 Participants

Names withheld for privacy reasons

Participant Type	Organisation	Role
Reference Group[2]	EUROCONTROL	SWIM expert at EUROCONTROL and lead author of information related sections in the upcoming revision to the SWIM Concept at ICAO.
	EUROCONTROL	Service expert, lead in the development of the SWIM Specification for Service Definitions.
	EUROCONTROL	Flight information expert and modeller. FIXM CCB co-chairman.
	EUROCONTROL	Flight information expert and AIRM CCB secretary, supporting the development of the AIRM.
Project Consortium	EUROCONTROL	Quality Assurance role in the project, including internal review of most technical deliverables. Made all presentations at today's meeting.
	SINTEF	Project coordinator.

7.3 Location & Date

The meeting was organised by EURCONTROL at is headquarters in Brussels, on 16th April 2018.

7.4 Agenda

The meeting lasted 2.5 hours. The agenda was very simple:

1. Presentation of main elements of BEST, with interactive discussions:
    a. Overall project objectives, role as a TRL1 project.
    b. What are semantic technologies?
    c. What are ontologies and how could they be used in ATM?

[2] Only Sam Van Der Stricht is formally a member of the Reference Group. The other experts from EUROCONTROL were included due to their highly relevant experience and expertise.

d. Semantic infrastructure developed in BEST (transformations, compliance validator).
e. The “Semantic Container” concepts and its relationship to SWIM
f. Modularization
g. Governance

2. Final discussion on overall impressions and possible future work

For point (1), the standard overall project presentation was used (essentially the same slides as used at the previous two meetings, in Budapest and Madrid, but with some minor improvements produced since then).

7.5 Summary of feedback

This report is not intended to provide complete “Minutes” of the meeting, but rather to record the main feedback received from the participants. It is structured according to the presentations that were made.

Welcome and Introduction:

Joe explained about the role of the “Reference Group”: how it was originally intended to gather viewpoints to influence the work, but evolved into a way of gathering feedback from expert stakeholders about what had actually been produced, and its potential for further developments.

Project Overview:

Consortium member presented an overview of BEST: its goals and main results. He explained its role as an “exploratory research” project, and the meaning in the SESAR context of “TRL 1”.

He provided a brief overview of SWIM, emphasising the point that it replaces “point to point messaging” (where the *sender* has to decide to whom information must be sent) with an “information sharing” approach in which *recipients* of information need to have a clear idea about what information they require. This implies that recipients need support in ensuring they receive information that best matches their needs.

He explained that BEST does not *replace* SWIM, it is *complementary* to it.

Feedback rising from this:

- It seems that the BEST approach is - fundamentally - *cross-domain,* since this “Information sharing” approach can involve any type of information. However, the use cases demonstrated in WP3 results do not cover any cross-domain case.
- There was discussion about whether it matters that operational experts are in most cases unfamiliar with ontologies and languages such as OWL. One view to take on that is that OWL is for computers to read and process, not humans.
- The American company MarkLogic propose an approach to information management that seems similar to what you are trying to do. They sell the idea by the motto “It’s about seeing

[the information] you could not see before" (i.e. a kind of data discovery/mining point of view).

- The idea of using AI/BigData techniques is also related to the previous point; could be interesting to investigate further.
- The basic idea of enriching data with metadata, using ontologies, was well received. The idea of adding BUSINESS data as another kind of metadata was discussed. The idea has not been used in BEST, but was proposed as the Budapest meeting. Participants at this meeting liked the idea and felt that maybe starting with business data to drive things could revolutionise how we approach information management.
- The importance of relating information to *services* was emphasised. This had not received the attention it should have in the earlier stages of the project.

Ontologies:

Presenter provided an English-language definition of "ontologies" which everyone felt was helpful in explaining their role. He presented a simple "example" ontology defining names and places, who was born where etc. , and followed this with an ontology illustrating concepts in the ATM domain. Scott explained the transformation tools and the validator tool.

Feedback arising:

- The two different example ontologies differ fundamentally: the first one refers to *instances* (specific places, specific people) while the second one refers to *general concepts* (e.g. aircraft). This distinction between concept/class/type and instance has not received enough attention in the project: maybe being more explicit about it would aid understandability.
- A specific clarification is that the Semantic Containers work at the instance level.
- To "sell" the compliance validator tool you need to clarify that it can be used to check *any* ontology against the AIRM ontology. The presentation can leave people with the impression that it can only be used for ontologies developed in BEST.
- The transformation tools and validator tool are "good news" since they demonstrate the feasibility of making use of semantic technologies for real cases.

Powerpoint update needed: Update the slides about the validator to take account of point (□) above.

Powerpoint update needed: Walter asked about the colour codes on the early diagrams, what do they mean? We should update the slide to explain.

Semantic Containers:

Presenter presented the container concept, emphasising the role of helping find the data you need, and so enhancing existing services.

Feedback arising:

- The idea of containers providing a "caching" mechanism met with considerable scepticism. Its usefulness depends on the results of a query being something that does not vary much over time. In ATM there are plenty of examples where that is definitely *not* the case. There

are no doubt some examples where it does apply – but is there any big advantage of caching?

- It was not entirely clear where in the overall architecture of providing services the containers would fit. Participants were able to speculate about various possible alternatives.
- It would be interesting to explore the idea about providing metadata about the services themselves (as an ontology), and using that to find smart ways to compose/select/filter data from existing services.
- Further clarity needs to be provided about the "Membership Condition" part of containers. It can look as if it something the user provides directly to indicate the information that is needed. In fact the "Membership Condition" is produced by some kind of translation of the "query" from the user, and can be narrower/wider than the query. This process needs to be explained more clearly.
- The idea of supporting "data quality" as metadata was considered interesting and potentially useful. It would require more precise definition of what "quality" means. While the project has defined it as part of the approach, no direct work was done on making data quality assessments for any real data.
- If performance is to be a possible advantage, then the issue of scalability would be crucial. The project made some progress on scalability assessment, but it was far from conclusive.
- Participants felt that the advantage for the data consumer was not very clearly explained: it seemed that these things could be done by other means , and the "unique selling point" did not come across.
- When asked if participants could see any "blocking issues" with the approach, one participant said that the picture explaining the approach was a kind of blocking issue because it does not explain things clearly enough.

Powerpoint update needed: The first slide needs to be updated. It provides too much detail and fails to explain the core idea. The first two sentences can be confusing; some felt that the first line should say the containers take DATA as input, not INFORMATION.

Powerpoint update needed: General feedback is that the presentation leaves various things a bit unclear, and that the "selling point" needs to be made clearer. So the whole set of slide maybe needs to be reviewed.

Modularisation:

Consortium presented the tools for modularisation, explaining the two different approaches (based on module size and based on gathering topics), and mentioned the relevance for governance.

Feedback arising:

- Rather than basing modularisation on topics, it might be more useful to base it on the structure of SWIM services.
- Participants felt that BEST had managed well to show that the technology for doing modularisation works, making modularisation feasible as an approach. But BEST had not

managed to go to the next level: providing advice about how best to make use of the technology (e.g. criteria for when to modularise and when not to modularise, what to modularise etc).

Governance:

Consortium presented some implications for governance, if modularisation is used. It could lead to having more CCBs of a more specialised nature. It could also lead to problems in ensuring consistency.

Feedback arising:

- It would surely be necessary to model some information in more than one module.
- The costs of ensuring consistency could be considerable.
- There would be "political" sensitivities in adopting a radical approach.

Open Final Discussion:

The final session invited participants to provide any general feedback/overall impressions and indicate possible ways forward for further work in new projects. The main points that came up from this were:

- In the current climate, the discussion about implications for governance might cause a lot of confusion, as many people will not have understood/thought through the various issues. It might be strategically best, at this stage, to not give a lot or prominence to this.
- The "container" concept is appealing, in the sense of putting together a kind of "family of related datasets".
- Some of the underlying ideas from BEST seem to point in the direction of adopting the RESTful approach to web applications.
- Possible topics for inclusion in a follow-up project [in addition to things already mentioned above] would be:
    - Some unified approach to dealing with the plethora of formats that currently out there.
    - The idea of "smart services" to help you find the information you really want.
- The approaches used here for ATM could easily be widened to cover other domains as well. This is particularly relevant given increasing focus on multi-domain transport.
- If considering a new project, it might be better to cover fewer topics than in BEST – but investigate them more deeply.

BEST has been very good at showing *capabilities*, and that is very valuable – it forms a good basis for future work. BEST has been less successful at considering *what to do with* the capabilities developed – there is a lot of scope for doing that in more detail in future.