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[Use case name]

This template has been updated to collect the information required to prepare D1.2, D2.2, D4.2 and D10.3 deliverables. The objective is to provide support for the use case baseline analysis (WP1/WP2), the use cases baseline description (WP1), the definition of an improved version of the engineering process (WP2) and the architectural and interoperability aspects (WP4). In the last part we collect information about standards used and/or planned to be used (WP10).

The entire template must be continuously updated according to the evolution of the use case. Periodically we will create a snapshot of the use case that will be included in the deliverables according to the project timeline.
From a timeline perspective, all the sections of this document refer to month 0 (baseline) of the Arrowhead Tools project, while section C includes also information related to the progress after month 0. For the baseline definition check D1.1.

An example of use case, the Smart Boiler System, has been conceived to provide support and simplify the editing of the Survey. The example is described in the external fileT WP12410_survey.docx and WP12410_survey.xlsl: it includes the entire survey and the related tables. The Use Case is just for reference and it is not meant to be exhaustive.

Provide or update the input to the different sections in the placeholders marked by [...].
For each section of the *WP12410_Survey* we highlighted the WP of the project where the information will be used.
The text in angular parenthesis **<...>** gives indication about the information to be provided.

Acronyms:
- **UC-EP**: Use case specific engineering process
- **AHT-EP**: improved and flexible version of the Engineering Process, covering all the UC-EPs.
- **AHT-EPP**: Arrowhead Tools Engineering Process Phase

A. Baseline summary [WP1]

a. General description of the baseline

<Short summary of the use case baseline.>
[…]

b. Initial architecture of the use case as a sequential list of functional blocks

<
- *Illustrate the architecture of the use case and of the engineering solution adopted in use case*
- *Highlight the role/function of the tools/artifacts*
- *Use pictures/blocks diagrams*

>
[…]

B. Baseline analysis [WP1, WP2, WP4, WP10]

Update of the analysis of the engineering process currently adopted in the use case (UC-EP). Provide the following information:

a. Overall description of the UC-EP, highlighting the current coverage of the engineering phases [WP1, WP2]

[…]

b. Description of the adopted toolchain(s)/technologies (if any) and state-of-the-art techniques adopted in the engineering phase of the use-case [WP1, WP4]

[…]

c. Analysis of the licensing model adopted in the toolchain [WP1, WP10].

[…]

d. Analysis of each single engineering phase [WP1, WP2, WP4]:

<This is a baseline, therefore we should provide the tools currently used, not the ones planned to be developed>

   i. ***Engineering activities currently performed in the phase;***

*<Engineering activities currently performed in the phases of the AHT-EP must be described in the external file **WP12410_survey.xlsx**, sheet **B.d.i**.>*
[…]

ii. *Adopted tools;*

*<The toolchains/tools adopted in the phases of the AHT-EP must be described in the external file **WP12410_survey.xlsx**, sheet **B.d.ii**.>*
[…]

iii. *The automation level of the engineering phase (how are the tools used in each phase connected? What is the manual work to adapt the EP sub-phases?*

*<The automation level of toolchains/tools adopted in the phases of the AHT-EP must be described in the external file **WP12410_survey.xlsx**, sheet **B.d.iii**.>*
[…]

e. Toolchain automation [WP1, WP4]:

<For a definition of Tools and Toolchains, please refer to D4.1-O1>

i. *Evaluate the level of integration/automation of the toolchain;*

*<Describe briefly where are the gaps in the automation of the toolchains, expressed in detail in **B.d.iii**, and which of these are going to be filled or tackled during the project. This is more a summary.>*
[…]

ii. *Describe the type of information passed from phase-to-phase and how the information is managed through the engineering process;*

[…]

iii. *Evaluate the level of integration of the toolchain with the Arrowhead Framework (Services consumed/produced);*

[…]

iv. *Evaluate the impact of the tools licensing model on the automation of the toolchain.*

[…]

f. Identify missing tools (for automation and for interoperability between phases and sub-phases) in the current toolchain, inadequate tools or missing functionalities in existing tools [WP4];

<This is important for the gaps you have currently in your engineering process>

> *i.* *Specify tools that partners within the Use Case are potentially able to provide (in short, which tools are currently missing and you plan to integrate/develop);*
>
> [...]

> *ii.* *Specify tools that could be integrated in your toolchain(s) and none of the partners within the Use Case is capable of providing such tools (in short, which tools are currently missing and you look for someone else to help out).*
>
> [...]

g. **Identify tools or parts of the architecture critical/indispensable for your use case [WP1, WP4].**

<This is about the importance of the components, whether they are only mandatory or just supporting the use case.>
[...]

h. **Identify and evaluate the available training material (gap analysis of tools and training material) [WP1].**

[...]

C. Engineering Process [WP2]

a. **State and present which framework, if any, is currently being used to manage the engineering process that supports the life-cycle of the product/service developed in your use case. Provide also a description of the state of the art of life-cycle management frameworks used in your domain, even if you are not using them.**

<The description of actions (DoA) refers to IEC 81346 while RAMI is based on IEC 62890>
[...]

b. **Within your use case engineering process (UC-EP), group the methodologies and tools (existing & new) used throughout the life-cycle of your use case, and match these groups with the phases of the Arrowhead Tools Engineering Process (AHT-EP) [WP2, WP4].**
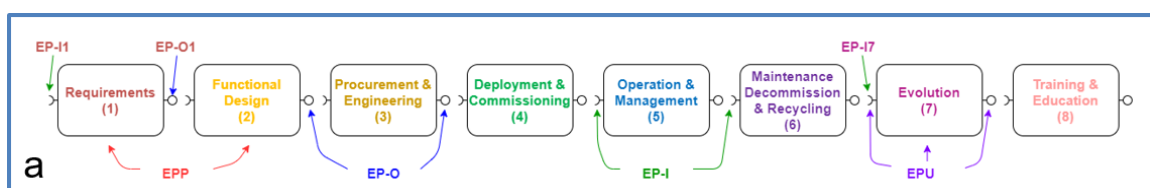
<If your use case's current engineering process (UC-EP) does not match the AHT-EP, an alternative mapping between UC-EP and AHT-EP should be provided (e.g. see UC_03). Input should be provided in tabular format. The figure above illustrates the AHT-EP. See D2.1
*To be provided in the external file **WP12410_survey.xlsx**, sheet **C.b***>
[…]

c. Provide the status of development/integration of the Tools that you are developing in the AHT project (for each of them).

<Descriptive text>
[…]

d. Provide Inputs and Outputs for the above-mentioned tools as well as their compatibility / expected compatibility with the AHF.

<For readability we did not include the description of inputs and outputs in the previous table and we expect to find it here.
*To be provided in the external file **WP12410_survey.xlsx**, sheet **C.d***>
[…]

e. Identify which of the AHT-EP phases are not considered in your specific use case domain and explain why these phases cannot be used in your domain.

<Give a description of all such phases (role in the engineering process as well as its tools and their relation with other phases). Please suggest any possible modifications to the AHT-EP to better support your use case. Provide the main motivations for not using the identified phases and what actions can be done to support them in AHT-EP.>
[…]

f. Report any lack of technology in one or more phases of the AHT-EP.

<For example, a tool whose interface does not support a service oriented architecture (SOA). A serious analysis should be done to identify the lack of tools, features or functionalities, interfaces, etc.>
[…]

g. Provide the AHT-EP of your Use Case.

<We need a schematic representation (a drawing of the AHT-EP graph) of the EP that uses the ontology defined in D2.1 and D4.1 for mapping each used tool on the eight AHT-EP engineering phases.>
[…]

h. **Describe the current scalability level (EP applied to the development of products and by-products recursively) by defining and drawing a set of AHT-EPs for each stakeholder involved in the life-cycle management of the product/service developed in the use case.**

<Specify if the EP can be applied both a component level, product level, system level. Verify also if the WP2 objective related to the multi-stakeholders can be reached>
[…]

i. **Report the Engineering Process standards adopted in your use case.**

<RAMI 4.0, IIRA, IBM Industry 4.0 Architecture, etc.>
[…]

j. **Please, describe how the AHT-EP has been applied to your use case and summarize the differences between your UC-EP before and after the adoption of the AHT-EP.**

[…]

k. **Please, describe how the AHT-EP allows to match the WP2 objectives both at the EP level and in each engineering process phase (EPP) within your use case.**

[…]

WP2 Objective	Planned actions
Obj. 1 - The change from design time to run time engineering	
Obj. 2 - The move from single to integrated multi stakeholder automation and digitalization	
Obj. 3 - Handling of substantially increased number of I/O's due to much more fine grained automation	
Obj. 4 - Address digital learning and training activities as an integral	

part of the engineering cycle	

AHT-EPP	Planned actions for match the objective			
	Obj. 1 - The change from design time to run time engineering	Obj. 2 - The move from single to integrated multi stakeholder automation and digitalization	Obj. 3 - Handling of substantially increased number of I/O's due to much more fine grained automation	Obj. 4 - Address digital learning and training activities as an integral part of the engineering cycle
1 Requirements				
2 Functional Design				
3 Procurement & Engineering				
4 Deployment & Commissioning				
5 Operation & Management				
6 Maintenance Decommissioning & Recycling				
7 Evolution				
8 Training & Education				

I. **Provide any additional comments on the Engineering Process.**

[…]

D. Baseline costs analysis [WP1]

Update/finalization of the engineering costs analysis of the use case at M0 (engineering costs baseline).
<In this section we are focusing on the costs of the adopted engineering process, NOT the costs of the USE CASE or the costs of its development or the partner's costs in the project.>

a. Evaluate the engineering costs of each engineering phase;

<Textual description of the analysis. Fill the table with the costs of each engineering phase. Many partners provided the costs classification, but not a quantification of the costs. To have a baseline we need a numerical reference point. Some examples of quantification: €, effort, normalized value (100 is total of the engineering process…). To be provided in the external file WP12410_survey.xlsx, sheet D.a>
[…]

b. Evaluate the costs of toolchain integration and automation;

<Textual description of the analysis. Fill the table with the costs of each engineering phase.
To be provided in the external file WP12410_survey.xlsx, sheet D.b>
[…]

c. Evaluate how licenses cost impact on the engineering process costs;

<Use real costs or normalised costs. Only for WP7 UC: these costs must be reported in the "Licenses" sheet of the excel file used for engineering process costs calculation.>
[…]

d. Evaluate how standards impact on the engineering process costs;

<Use real costs or normalised costs. Only for WP7 UC: these costs must be reported in the "Standards & certifications" sheet of the excel file used for engineering process costs calculation.>
[…]

e. Evaluate the costs of training material and activities.

<Textual description>
[…]

E. Baseline Reference indicators [WP1]

<TO KEEP UPDATED>

a. Link to baseline indicators table

<In the table headers a note explains the contents of the columns. Use the external excel file shared between all use cases>
[…]

b. Link to training material table

<In the table headers a note explains the contents of the columns. Use the external excel file shared between all use cases>
[…]

F. Baseline plan [WP1, WP4]

Definition of the action plan to reach the project objectives from the use case perspective.

a. **List the actions planned to reach the <u>use case specific objectives</u>; include research activities, implementation, documentation preparation etc.**

   <Descriptive section.>
   […]

b. **Describe the actions planned to reach the <u>project objectives</u>, indicating the current state, the expected improvement and the actions required to reach it.**

   <Fill the table with the objectives.>
   […]

Project Objective	Planned actions
Obj. 1 - Reduction of solution engineering costs by 20-50%	
Obj. 2 - Interoperability for IoT and SoS engineering tools	
Obj. 3 - Interoperability and integration of data from legacy automation engineering tools to the Arrowhead Framework integration platform	
Obj. 4 - Integration platform interoperability with emerging digitalization and automation framework	
Obj. 5 - Flexible, interoperable and manageable security for digitalisation and automation solutions	

Obj. 6 - Training material (HW and SW) for professional engineers	

c. **What modifications are required to the AHT-EP to match the project objectives stated in the baseline plan? How AHT can support this new improved Engineering Process?**

<Answer only if your current engineering process is not the AHT-EP at M0.
To be provided in the external file WP12410_survey.xlsx, sheet F.c>
[…]

d. **Provide a list of engineering tools that will be developed to reach project objectives [WP4].**

<Fundamental, follow the schema and the example provided in the external excel file WP12410_survey.xlsx, sheet C.d. For each of them, please provide an exhaustive description.>
[…]

e. **The improvement of the toolchain(s) (if not already specified in the previous section F.a.).**

[…]

f. **Which training material will be provided (if not already specified in the previous section F.a.)?**

[…]

g. **Describe the evaluation and validation process that will be adopted to verify the objectives' achievement.**

<A description of the evaluation and validation process must be provided. You should clarify how you will monitor the progress towards the objectives. Mentioning the reference indicators you have defined could help.>
[…]

G. Standards [WP10]

a. **Provide the standardisation requirements, indicating the standard available and/or adopted currently (BASELINE) and the standard that will be adopted by the end of the project (FINAL).**

<In the following table, you can find 8 different categories of standards and, for each category, a list of standards as an example. For each category, if applicable, provide

a similar list of standards available and/or adopted currently (BASELINE) and the standard that will be adopted by the end of the project (FINAL). You can start from the examples and remove and/or add standards according to your use case.>

Standardisation Requirements		
Categories of Standards	**Baseline**	**Final**
System and Software	Life Cycle Management, Software life cycle processes , SQuaRE, REST APIs, ERP/MES, Function Blocks	Life Cycle Management, Software life cycle processes , SQuaRE, REST APIs, ERP/MES, Function Blocks
Information and Representation	Product data representation and exchange , Framework for object-oriented information exchange , eCl@ss and Common data Dictionary, G-CODE, Worksite data exchange, Geographical metadata standard, …	Product data representation and exchange , Framework for object-oriented information exchange , eCl@ss and Common data Dictionary, G-CODE, Worksite data exchange, Geographical metadata standard, …
Semantic and Language	XML, JSON, RDF, SPARQL, SysML, UML, HTML/CSS3, Ontologies, LDP 1.0	XML, JSON, RDF, SPARQL, SysML, UML, HTML/CSS3, Ontologies, LDP 1.0
Communication	MT Connect, ETHERCAT, Sercos, Fieldbus, OPC-UA, UMATI, MQTT, M2M, WIFI, RDF and NFC, EAP, COAP, Internet Protocols: HTTP, SSH, FTP, TCP/IP, IPSEC, SMTP, UDP	MT Connect, ETHERCAT, Sercos, Fieldbus, OPC-UA, UMATI, MQTT, M2M, WIFI, RDF and NFC, EAP, COAP, Internet Protocols: HTTP, SSH, FTP, TCP/IP, IPSEC, SMTP, UDP
Cybersecurity and Safety	IEC 62443, ISO 27001, NIST SP 800-82, Encrypted Communication, Encrypted DDBB, Authentication, Network monitoring, Firewall, IEC 61508, OWASP, Road Vehicles safety and cybersecurity, Security for Contactless Devices, Safety for Electrical/programmable electronic	IEC 62443, ISO 27001, NIST SP 800-82, Encrypted Communication, Encrypted DDBB, Authentication, Network monitoring, Firewall, IEC 61508, OWASP, Road Vehicles safety and cybersecurity, Security for Contactless Devices, Safety for Electrical/programmable electronic
Reference Model	RAMI, IIRA, ASS, NIST, Digital Factory	RAMI, IIRA, ASS, NIST, Digital Factory
Domain-Specific	Robotics, Artificial Intelligence, IoT, Digital Twin, Integration Life Cycle, Blockchain, Environmental Management	Robotics, Artificial Intelligence, IoT, Digital Twin, Integration Life Cycle, Blockchain, Environmental Management
Framework Development and Specific Applications for development	Node.JS, Angular JS, JAVA, Javascript, .NET, Eclipse, Node Red, PHP, Python, Haddoop, Spark, MONGO DB…	Node.JS, Angular JS, JAVA, Javascript, .NET, Eclipse, Node Red, PHP, Python, Haddoop, Spark, MONGO DB…

b. Suggested reference indicators related to standards

<The following examples of reference indicators can be adopted to track the improvements related to standards, depending on the specific use case. Add your reference indicators here:
Link to baseline indicators table
In the column, "indicator type" put "standards".>

- **Number of standards to use at the beginning and at the end of the project**
  Choose an element.
- **Asses the improvement of the performance of the use case thanks to the standardization strategy**
  Choose an element.
- **Asses the reduction of the development cost the use case thanks to the standardization strategy**
  Choose an element.
- **Asses the improvement of the defect rate of the use case thanks to the standardization strategy**
  Choose an element.
- **Asses the improvement of the production uptime of the use case thanks to the standardization strategy**
  Choose an element.

H. Comments from the WP leaders and responses from the UC leaders [WP1, WP2, WP4, WP10]

[…]