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# Deliverable D4.1

## Arrowhead Tools toolchain design

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### Abstract

This document constitutes deliverable D4.1 of the Arrowhead Tools project. The main objective of this document is providing a tool chain architecture design and reference definition for WP5, which is devoted to the definition and the implementation of the tools. This is achieved by providing proper definition of the basic concepts, an examination of each use case from the toolchain point of view and an analysis of the semantic concepts that revolve around the project.



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## 1. Introduction

The toolchain reference aims at providing an overview of all parts contributing to the Arrowhead Tools development and maintenance toolchain. The project itself proposes an extension of IEC 81346 automation engineering model, called further the extended automation engineering model (EAEM). The described parts are accommodated within EAEM through appropriate mapping. Within each functional block of the toolchain examples of suitable tools are provided. Further the means of providing a well-integrated toolchain with efficient transfer of engineering data from one tool to another. The toolchain shall be flexible and possible to rearrange in a simple way.

More in detail, the objective of WP4 at large is given by two major points:

- [T4.1] Provide a toolchain architecture that supports:
  - Engineering both in design time and run time
  - Is in-line with the engineering process defined in WP2
- [T4.2] Investigate toolchain architecture and feasibility of tool data semantics like e.g. OSLC and others

This deliverable document addresses such objectives by:

1. Providing a definition of the concepts of tool, toolchain and extended engineering process.
2. Providing the best practices for defining tools within a toolchain and their compatibility with the Arrowhead Framework.
3. Providing an initial definition of the toolchain architecture for each vertical use case in the project.
4. Providing a definition and best practices for semantics within the project.
5. Providing a first analysis of the semantic concepts that are proposed to be used within the project and their purposes.

## 2. Deliverable content

In this section the content of the deliverable is shortly described with appropriate links for specific documents. The content has been divided into definitions, architecture and semantics.

### 2.1 Deliverable content: A definition of Arrowhead toolchains

#### 2.1.1 Objectives

This table shows which objectives that are addressed by this part of the deliverable and how these are supported.

Objective	Contribution
<b>O1:</b> Identifying and explaining core AHT architectural concepts	A document with definitions of Arrowhead tools, toolchains, and design principles

Initial definitions for the Arrowhead Tools design principles

### 2.1.1 Content

The definition of the Arrowhead Tools toolchains basic concepts has been initially carried out during a physical meeting that took place in Gdansk between leaders and co-leaders of WP3, WP4 and WP5 and has been further strengthened by the contributions of leaders of WP1 and WP2.

The content of **O1** is elaborated in Appendix 1.

## 2.2 Deliverable content: Architecture

### 2.2.1 Objectives

This table shows which objectives that are addressed by this part of the deliverable and how these are supported.

Objective	Contribution
<b>O2:</b> Outlining the best practices for defining an Arrowhead tools	This document is a collection of definitions as well as best practices when defining and describing Arrowhead tools
<b>O3:</b> Evaluating the use cases in terms of their toolchains and mapping them to the proposed engineering process	In this document, each use case is analyzed in terms of its tools and their mapping to the proposed engineering process

### 2.2.2 Content

In order to gather information from each and every use case in the project, WP4, together with WP1 and WP2, provided all the AHT partners with a survey that was intended to gather a detailed description of the use cases, in particular:

- The use case baseline
- The engineering process adopted and the modifications needed
- The tools that are currently used in the baseline and the explicit statement of the gaps in the toolchain together with the new declared tools that are intended to cover such gaps.
- The survey can be found in Appendix 6

WP4, with the collaboration of WP2, provided then the document O2, that is intended to facilitate and homogenize the declaration of new tools in the toolchain.

The responses of the Use Case leaders have been hard to obtain on time, and it needed more than one round due to misunderstandings. The results of the analysis of the survey from the WP4 side are reported in O3, which outlines, for each use case, the use case overview, the identified gaps and the definition of the proposed tools according to the best practices proposed in O2.

The contents of **O2** and **O3** are elaborated in Appendices 2 and 3, respectively.

## 2.3 Deliverable content: Semantics

### 2.3.1 Objectives

This table shows which objectives that are addressed by this part of the deliverable and how these are supported.

Objective	Contribution
<b>O4:</b> Evaluating semantic models for interoperability	This document contains an explanation of how different semantic approaches serve as the basis of interoperability in the Arrowhead Tools project
<b>O5:</b> Providing examples of semantic approaches	This document contains a set of representative examples for defining semantic approaches

### 2.3.2 Content

The definition and best practices for semantics in the AHT project have been defined by the WP4 and T4.2 leaders in order to give a guideline to all the partners involved in the semantics definition. The single contributions from T4.2 members are then collected and reported by T4.2 leader in the O5 document, through the help of weekly calls.

The contents of **O4** and **O5** are elaborated in Appendices 4 and 5, respectively.

## 3. Appendices

1. Appendix 1: O1\_ AHT Definitions  
<https://atmospheres.research.ltu.se/owncloud/index.php/f/991334>
2. Appendix 2: O2\_ AHT Best Practices  
<https://atmospheres.research.ltu.se/owncloud/index.php/f/991681>
3. Appendix 3: O3\_ AHT use case analysis  
<https://atmospheres.research.ltu.se/owncloud/index.php/f/1462727>
4. Appendix 4: O4\_ Semantics General Concepts  
<https://atmospheres.research.ltu.se/owncloud/index.php/f/991740>
5. Appendix 5: O5\_ AHT Examples of Semantic Approaches  
<https://atmospheres.research.ltu.se/owncloud/index.php/f/1144387>
6. Appendix 6: AHT\_WP124 Survey  
<https://atmospheres.research.ltu.se/owncloud/index.php/f/1522164>

## 4. References

1. D1.1, an input to this deliverable:  
<https://atmospheres.research.ltu.se/owncloud/index.php/f/1466106>

2. D2.1, an input to this deliverable:  
<https://atmospheres.research.ltu.se/owncloud/index.php/f/1466469>
3. D3.1, an input to this deliverable:  
<https://atmospheres.research.ltu.se/owncloud/index.php/f/1270573>

## 5. Conclusions

The work has progressed slowly and proper contributions have been hard to get in the first place, nonetheless, the deliverable has now reached a satisfactory status and all the use cases are on track and have provided a first definition of their toolchain, a primary goal of this document. The outcome of such difficulties is a slightly delayed delivery, however, the objective of this first milestone has been reached, as now the basic toolchain has been defined for each demonstrator. This does not affect negatively subsequent phases in the delivery process within this project.

## 6. Revision history

### 6.1 Contributing and reviewing partners

Contributions	Reviews	Participants	Representing partner
X		DAC	Marek Tatara
X		IUNET	Federico Montori
X		IQL	Géza Kulcsár
	X	IQL	Ákos Horváth

### 6.2 Amendments

No.	Date	Version	Subject of Amendments	Author
1	2019-10-04	0.1	First draft	Marek Tatara
2	2019-11-08	0.2	Added general description, abstract, intro, conclusions and information acquisition process	Federico Montori, Marek Tatara
3	2019-12-11	1.0	Sanity Check	Federico Montori, Marek Tatara

### 6.3 Quality assurance

No	Date	Version	Approved by
1	2019-12-11	1.0	Jerker Delsing