



**software framework for runtime-Adaptive and secure
deep Learning On Heterogeneous Architectures**

Project Number 780788

Project Acronym ALOHA

D8.1	Kick-off progress report		
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Brief description:

This deliverable reports on overall progress and achievements of the ALOHA project in the first 6 months, starting from the Kick-Off Meeting held in Cagliari to the regular first meeting in Alghero.



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The ALOHA Consortium is the following:

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1	STMICROELECTRONICS SRL	ST-I	Italy
2	UNIVERSITA' DEGLI STUDI DI CAGLIARI	UNICA	Italy
3	UNIVERSITEIT VAN AMSTERDAM	UVA	Netherlands
4	UNIVERSITEIT LEIDEN	UL	Netherlands
5	EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH	ETHZ	Switzerland
6	UNIVERSITA' DEGLI STUDI DI SASSARI	UNISS	Italy
7	PKE ELECTRONICS AG	PKE	Austria
8	CA TECHNOLOGIES DEVELOPMENT SPAIN SA	CA	Spain
9	SOFTWARE COMPETENCE CENTER HAGENBERG GMBH	SCCH	Austria
10	SANTER REPLY SPA	REPLY	Italy
11	IBM ISRAEL - SCIENCE AND TECHNOLOGY LTD	IBM	Israel
12	SYSTMATA YPOLOGISTIKIS ORASHS IRIDA LABS AE	IL	Greece
13	PLURIBUS ONE SRL	P-ONE	Italy
14	MAXQ ARTIFICIAL INTELLIGENCE, LTD (formerly MEDYMATCH TECHNOLOGY, LTD)	MaxQ-AI (formerly MM)	Israel

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1 Executive Summary

This document provides an overview of the progress and main results achieved by the Consortium in the first six months. It summarizes key outcomes of the Kick-Off Meeting that took place in Cagliari (Italy) on 25th of January 2018, including agreements reached concerning initial collaboration and next steps to be taken.

This document also describes the administrative and technical progress of the project after the Kick-Off Meeting, with an emphasis on decisions taken by the Consortium regarding the implementation of each WP/task till the first regular meeting that took place in Alghero (Italy) from 18 to 20 June 2018.

1.1 Acronyms and abbreviations

Acronym	Meaning
CNN	Convolutional Neural Network
DNN	Deep Neural Networks
DSE	Design Space Exploration
PI	Parsimonious Inference
SDF	Synchronous DataFlow
AOW	Architecture Optimization Workbench
API	Application Programming Interface

2 Kick-Off Meeting

The Kick-Off Meeting of the ALOHA project took place on 25th of January 2018 in Cagliari, Italy. It was hosted and organized by UniCA. All 14 consortium partners were represented, with a total of 31 attendees:

- ST-I: Giulio Urlini, Giuseppe Desoli
- UniCA: Paolo Meloni, Luigi Raffo, Simona Scalas, Daniela Loi, Gianfranco Deriu
- MedyMatch: Ofer Pinhasi, Gilad Weinberg
- UvA: Andy Pimentel, Dolly Sapra
- ETHZ: Francesco Conti, Andrea Giannini
- UniSS: Francesca Palumbo, Luca Pulina
- UL: Todor Stefanov, Svetlana Minakova
- IBM: Micheal Masin
- P-ONE: Battista Biggio, Matteo Mauri, Fabio Roli
- Irida Labs: Nikos Fragoulis
- CA: David Sanchez, Oscar Ripolles, David Solans
- PKE: Werner Klohofer, Adriano Ribeiro
- SCCH: Bernhard Moser, Thomas Hoch
- REPLY: Maurizio Griva, Cristina Chesta

The meeting aimed at introducing project beneficiaries to each other and at consolidating their cooperation, creating synergies for an effective implementation of the project. After a general overview of the ALOHA objectives and challenges, participants reviewed and confirmed the work plan included in the Description of Action. The 9 Work Packages of the project were presented by the respective WP Leaders. All WPs' presentations included: (a) objectives of the tasks, (b) involved partners, (c) methodology and timeline, and (d) required deliverables. Copies of the .ppt presentations were shared and made available on Box just after the event.



Figure 1: ALOHA kick-off meeting, Cagliari

During the meeting, a technical discussion took place about the expected features of the toolflow and the needs and requirements for the three industrial use cases to implement in ALOHA. Participants planned a road-map to produce the first technical results in terms of interfaces definition, use-cases specification, and integration approach. Participants also discussed the practical operational objectives and milestones to be achieved before the interim review, that are:

- Reach a successful specification phase for M6
- Start developing the preliminary code to test the basic features of the ALOHA single components

Before closing the Kick-Off Meeting, participants identified a list of next actions and responsibilities for the coming 6 months:

- Provide a form for use-case description - PKE
- Provide a software repository to store the source code and to collaborate on it - ETHZ
- Provide a document repository to facilitate exchange of information and enhance collaboration between partners - IBM
- Create a mailing list for the Consortium – P-ONE
- Create a template for presentations (.ppt) and deliverables (.doc) – UniCA
- Provide a form for dissemination and communication activities description – UniSS
- Organization of the next face-to-face meeting in Alghero, Italy on 18th and 19th June 2018 – UniSS

3 First regular meeting

The first regular project meeting took place from 18th to 20th of June 2018 in Alghero, Italy. It was hosted and organized by UniSS. All 14 consortium partners were represented, with a total of 25 attendees:

- ST-I: Giulio Urlini, Francesco Papariello
- UniCA: Paolo Meloni, Daniela Loi, Gianfranco Deriu
- MaxQ-AI (formerly MedyMatch): Yaniv Ben Zriham
- UvA: Andy Pimentel, Dolly Sapra
- ETHZ: Francesco Conti, Luca Benini
- UniSS: Francesca Palumbo
- UL: Todor Stefanov, Svetlana Minakova
- IBM: Vladimir Lipets
- P-ONE: Battista Biggio, Matteo Mauri
- Irida Labs: Nikos Fragoulis, Ilias Theodorakopoulos
- CA: Oscar Ripolles, David Solans
- PKE: Werner Klohofer, Adriano Ribeiro
- SCCH: Bernhard Moser, Natalia Shepeleva
- REPLY: Cristina Chesta



Figure 2: ALOHA project meeting, Alghero

The meeting aimed at synchronizing activities across different work packages and at finalizing the first phase of the project related with the specification of the ALOHA toolflow and the use cases. After a general overview of the ALOHA toolflow architecture provided by the Scientific Coordinator, the single components to be developed in WP2, WP3 and WP4 and integrated in WP1 were presented. Operative and technical discussions took place in specific sessions dedicated to understanding the training tools, the hardware platforms and their description format, the system-level design, and the integration mechanism and communication interface in ALOHA. A specific session took place among the Scientific Coordinator, the Use Case providers and the partner CA to discuss on Key Performance Indicators and use-case requirements.

Before closing the meeting, participants identified a list of next actions and responsibilities for the coming 6 months. Copies of the .ppt presentations were shared and made available on Box during the first day of the meeting.

4 Administrative project progress

4.1 General Assembly meetings

The **first General Assembly (GA) meeting** was held jointly with the kick-off meeting in Cagliari on 26th of January 2018. During the first GA, partners approved the nomination of the Work Package Leaders reported in the DoA, and appointed the following figures for the project implementation:

- Innovation Manager – Dr. Oscar Ripolles from CA
- IPR Manager – Dr. Michael Masin from IBM
- Quality Manager – Dr. Daniela Loi from UniCA
- Communication and Dissemination Manager – Dr. Francesca Palumbo from UniSS

The GA had the opportunity to present the project management procedures, clarify leadership skills, and discuss legal and financial issues. Roles and responsibilities of the Project Coordinator, Scientific Coordinator, WP and Tasks leaders were discussed in depth. The Project Coordinator proposes a plan for deliverables and suggests an internal formal review process. Responsible and reviewers for deliverables has be assigned by ST-M. GA face-to-face meetings will be held twice a year to assess the overall project status (technical and administrative) and to align individual work across partners. The Project and Scientific Coordinators will organize plenary online meetings to support the cooperation among partners working in different work packages. Each WP Leader will organize regular conference calls with Task leaders and partners involved in the work package, to monitor performance and progress with respect to the timetables defined in the DoA.

On June 19th, 2018 the **2nd General Assembly meeting** was held at the University of Sassari in Alghero, hosted by UNISS. Giulio Urlini from ST-I provided an update on the general progress of the project based on the deliverables submitted and milestone achieved till month M4. An overview of deliverables due for the end of June 2018 (M6) was provided and deadlines for missing contributions were discussed. The amendment request launched on May 2018 by the Project Coordinator was also discussed. It was explained that the modification of a beneficiary name (in this case MaxQ-AI instead of MedyMatch) does not need an amendment request. Information about the project interim review was provided by ST-I. The interim review of the ALOHA project will be held on December 14th, 2018 in Avenue de Beaulieu 25 (0/S9), 1160 Brussels, Belgium. It will cover the project activities carried out so far during the first reporting period (up to and including month 9). Finally, partners scheduled the next face-to-face meeting for January 2019, after the project review. The meeting will be hosted by CA in Barcelona, Spain.

4.2 Consortium agreement signature

The Consortium Agreement was discussed and elaborated during the first months and signed by all partners on May 2018. Each partner received an original hard copy of the signature pages of the Consortium Agreement during the 2nd General Assembly meeting in Alghero.

4.3 Changes in administrative aspects

On May 10, 2018, the Project Coordinator on behalf of the Consortium started the amendment request process using the Participant Portal (reference number AMD-780788-4). The request of amendment concerned the following items:

- **Addition of a Linked Third Party** – Partner CA Technologies Development Spain required to add CA TECHNOLOGY R&D LIMITED (CA-UK) as Linked Third Party and to transfer them 3 PMs (total budget of 39K euro for Personnel costs) + 4k euro for trips.
- **Increase of person-months** – Partner CA Technologies Development Spain required to add an

extra effort of 26 PMs over the planned 70 PMs, without requiring additional budget.

- **Change of beneficiary name** –Medymatch Technology Ltd required to change its name to MaxQ-Artificial Intelligence (MaxQ-AI).

4.4 Interactions after the Kick-Off Meeting

Regular e-mail contact with the partners has been maintained throughout the reported period and several online meetings have been already organized to discuss the practical aspects of the ALOHA activities. In particular:

- Plenary conference calls have been organized to discuss the work being performed in WP1 and to ensure that specification activities stayed aligned with the other WPs (i.e. 05/04/2018, 03/05/2018, 15/05/2018, 24/05/2018, 11/06/2018).
- Dedicated conference calls have been organized between the Scientific Coordinator and the CA team to discuss interface definition and integration methodology in WP1 (i.e. 02/05/2018, 24/05/2018)
- Dedicated conference calls have been organized between the Scientific Coordinator and partners involved in WP2 to discuss dataset specification and transfer learning task (i.e. 09/05/2018, 11/05/2018)
- Dedicated conference calls have been organized between the Scientific Coordinator and partners involved in WP3 (i.e. 05/04/2018, 01/05/2018, 03/05/2018)
- Dedicated conference calls have been organized between the Innovation Manager and WP leaders to discuss exploitation strategy and to plan next steps in WP6 (i.e. 27/02/2018, 15/03/2018, 04/04/2018)
- Dedicated conference calls have been organized between the Scientific Coordinator and the Use-Case providers (i.e. 14/03/2018, 15/03/2018, 02/05/2018, 09/05/2018)

4.5 Deliverables submitted and milestones achieved

The following deliverables were submitted and milestones achieved in the reported period (from M1 to M6).

Table 1: Deliverables submitted

WP No	Del No	Title	Lead Benef.	Nature	Dissem. level	Est. Del. Date (Annex I)	Submission date
WP7	D7.1	Project digital presence	P-ONE	Demo	Public	28/02/18	27/02/18
WP8	D8.5	Project quality handbook	ST-I	Report	Public	31/03/18	30/03/18
WP9	D9.1	POPD - Requirement No. 1	ST-I	Ethics	Confident	31/03/18	04/04/18
WP9	D9.2	NEC - Requirement No. 2	ST-I	Ethics	Confident	31/03/18	04/04/18
WP6	D6.1	Exploitation plan	CA	Report	Public	30/04/18	30/04/18
WP7	D7.2	Plan for the dissemination and communication	P-ONE	Report	Public	30/04/18	30/04/18
WP1	D1.1	Report on general specifications and interface definition	UNICA	Report	Public	30/06/18	30/06/18
WP1	D1.4	General specification of the surveillance use-case	PKE	Report	Confident	30/06/18	30/06/18
WP1	D1.5	General specification of the smart industry use-case	REPLY	Report	Confident	30/06/18	30/06/18
WP1	D1.6	General specification of the medical application use-case	MM	Report	Confident	30/06/18	30/06/18

WP8	D8.1	Kick-off progress report	UNICA	Report	Public	30/06/18	30/06/18
WP8	D8.6	Open Data Management Plan	UNICA	ORDP: Open Research Data Pilot	Public	30/06/18	30/06/18

Table 2: Milestones achieved

No	Name	Lead Beneficiary	Delivery Date (Annex I)	Delivery Date (actual)
1	Successful kick-off and specification phase	UNICA	01/07/18	30/06/18

5 Scientific/Technical project progress

After the kick-off meeting, project partners successfully started to collaborate and interact with each other to implement the technical activities of the project. During the face-to-face meeting in Alghero, partners had the opportunity to share the first results of the activities carried out on the project till mid-June. A description of the technical progress made by the Consortium with the implementation of the work packages active in the period between M1 and M6, is provided below.

5.1 Progress on WP1

During the Kick-Off Meeting, partners agreed on the idea to implement the ALOHA toolflow using a 3-level structure that reflects the interaction between the activities of work packages WP2, WP3 and WP4. Tasks 1.1 and 1.2 are completed and their activities led, respectively, to the identification of the components of the ALOHA toolflow and the definition of the interaction between them as described in Deliverable 1.1, and to the general specification of the use cases as described in Deliverables 1.4, 1.5 and 1.6. From the integration point of view, even if Task 1.3 has not started yet, the Consortium have agreed on adopting Agile Continuous Integration practice and to use containerized modules to reduce technological dependencies between components. Due to the different nature of the use cases, it was decided to have their specifications in three separate documents. Nevertheless, for the sake of clarity, effort has been made to harmonize the specifications in the deliverables 1.4, 1.5 and 1.6.

5.2 Progress on WP2

In the kick-off meeting, partners agreed on the general structure and scope of the WP2 component on the toolflow, which will be dedicated to the training of topologies optimized for accuracy, security, and performance/energy for a given dataset and target architecture. After the kick-off, activity started in very tight loop with the integration activities of WP1. In the kick-off and the following interactions, the internal sub-components of the WP2 training tool were identified, and work has started on all related tasks. T2.1 has started by setting up the Training Engine and Design Space Exploration (DSE) engines component of WP2. T2.2 has kickstarted its work focusing on the Security Evaluation of a trained network topology. T2.3 has started work on a tool for Algorithm Configuration Refinement for Parsimonious Inference. Finally, T2.4 has started the discussion on the correct level of representation for architectural details in the context of the WP2 tool for training. In addition to that, T2.4 has defined the dataflow application model to represent deep learning algorithms in terms of SDF graphs and has implemented a tool to convert a CNN into a corresponding SDF model.

5.3 Progress on WP3

The WP3 component structure agreed in the kick-off meeting contains a system-level DSE engine, a post-training parsimonious inference (PI) tool and two tools for system level HW/SW co-design – simulation based SESAME and mathematical programming-based AOW. The agreed toolflow is driven by the DSE engine, that may ask the PI tool to provide a shrunked DNN, and may proceed to optimize its partitioning and mapping to the hardware platform. To this aim, it iteratively accesses SESAME and AOW to evaluate design points. In these iterations, AOW enables coarser exploration of large design spaces, while, with SESAME, evaluations are verified and fine-tuned by simulation. Evaluations from SESAME could be used to close the feedback loop to AOW with an adjusted model of the application and hardware architecture based on the detailed simulations. All tasks of WP3 have started with review of the state-of-the-art (SOTA) for system level abstraction and design of deep learning inference on hardware accelerators. As of June 2018, in Tasks 3.1 and 3.3, an initial interface for SESAME and AOW has been defined. In Task 3.2, the core algorithmic part of the underlying refinement process has been finalized, and a prototype has been developed and tested on a variety of reference tasks, spanning from image classification (e.g. ILSVRC2012) to visual object detection (Pascal VOC, COCO etc.); secondary components responsible for tasks such as the

automatic selection of the most demanding nodes of a DNN graph, the temporary modifications of the DNN necessary to facilitate the specialized training process etc. have already been developed in a prototype form, pending the necessary modifications to adopt the internal ALOHA graph representation format and integration specifics. In this task, the main focus of research effort is towards the development of an automatic supervision mechanism for the on-line (during training) handling of the internal hyper-parameters that control the parsimony-accuracy tradeoffs, currently being static and semi-manually defined. The ultimate goal is to fully automate the tool's functionality and at the same time provide the best conditions for delivering a more parsimonious DNN within the given accuracy constraints. Task 3.4 partners have cooperated with activities in WP4 to the analysis and definition of a common set of application building blocks, capable of capturing processing and communication actors needed to compose state-of-the-art DNN algorithms and suitable to be translated in programming primitives exposed by prospective target processing platforms. This analysis has influenced the definition of the ALOHA architecture description format, proposed in WP4, and has built coherent practical link between the abstract actors considered in WP2 and WP3 and the eventual application code that will be customized and generated in WP4.

5.4 Progress on WP4

Work Package 4 is devoted to the automation of target-specific code generation. The utilities in this WP will have to adapt the generic view produced by WP3 to libraries and API exposed to the programmer by the target platforms. The target platforms selected in ALOHA project will be used as first examples. The activities of WP4 started at M4, with the definition of a general description of the hardware platforms in terms of population of computing elements, connectivity, and available operating modes (data types, working frequency and gating conditions). This description will be used in WP2/WP3 as a characterization of the features of the target platforms. It defines a set of "operators" that may be executed/mapped on each processing element, thus defining a set of elementary computing blocks that may be triggered by the code to be generated. The automated generator will have, thus, to implement an adaptation of the generic operator-based information produced by WP3 and the actual platform-specific APIs that should be invoked in the final code. The same kind of adaptation must be implemented for communication tasks and communication primitives exposed by the target platform. Currently, we have started the collection and analysis of the *operators* available in Orlando and NEURAghe and of the corresponding programming mechanism, to better understand the issues involved in the adaptation process.

6 Communication and dissemination activities

Project partners collaborated to produce the first version of the Dissemination and Communication Plan for the ALOHA project at M4. Deliverable D7.2 lists and describes all communication and dissemination activities held within and outside the Consortium in the first 4 months of the project. It also includes a timeline of the already planned activities.

Here follows a small summary of the ALOHA achievements till June 2018:

- Website, social media channels and visual identity of ALOHA have been created.
- Definition of the prospective dissemination and communication strategy, including the list of targets and channels to be used to reach them.
- Different papers have been submitted, and some of them are already accepted (and available on the ALOHA website):
 - W. Zellinger, B. A. Moser, T. Grubinger, E. Lughofer, T. Natschläger, and S. Saminger-Platz “Robust Unsupervised Domain Adaptation for Neural Networks via Moment Alignment”, Machine Learning (<https://arxiv.org/abs/1711.06114v2>).
 - M. Jagielski, A. Oprea, B. Biggio, C. Liu, C. Nita-Rotaru, and B. Li, “Manipulating Machine Learning: Poisoning Attacks and Countermeasures for Regression Learning”, in 39th IEEE Symposium on Security and Privacy, 2018.
 - B. Kolosnjaji, A. Demontis, B. Biggio, D. Maiorca, G. Giacinto, C. Eckert, and F. Roli. “Adversarial malware binaries: Evading deep learning for malware detection in executables”, in 26th European Signal Processing Conference (EUSIPCO), 2018.
 - M. Melis, D. Maiorca, B. Biggio, G. Giacinto, and F. Roli. “Explaining black-box android malware detection”, in 26th European Signal Processing Conference (EUSIPCO), 2018.
- Participation to Conferences, Workshops and other events:
 - HiPEAC event (<https://www.hipeac.net/roadshow/events/10/date-conference-2018/>) at the DATE Conference.
 - Workshop on Design of Low Power Embedded Systems (LP-EMS18), co-located with CF Conference.
 - OpenDays 4 OpenMinds (<http://sites.unica.it/opendays4openminds/>), annual event organized by the University of Cagliari to present its activities to high school students and bachelor students.
 - Security Summit 2018 (<https://www.securitysummit.it/event/Milano-2018>).
 - SCCH Site Visit.
 - A&T, Automation and Testing (www.aetevent.com).
 - Software Research Day at the Austrian Federal Economic Chamber.
- Media coverage as reported in the ALOHA website
<http://www.aloha-h2020.eu/index.php/news-events>

7 Exploitation activities

Exploitation is a very important task of the ALOHA project, being one of the main objectives and risks defined in the Grant Agreement. Moreover, several KPIs were defined around exploitation, which will help the consortium assess the progress on these activities.

The ALOHA consortium has already started the exploitation of the results. In Deliverable D6.1, each partner outlined key exploitable results that may result from the research and development work performed in ALOHA, and also considered how to exploit them individually. An initial market analysis, as well as IPR principles and standards, were also covered in this deliverable, and the information will be updated and completed as the project evolves. This deliverable also describes 3 events related to exploitation and some plans for the rest of 2018.

As for progress in the last two months, we would like to highlight that:

- the work performed in WP1 to clearly define the architecture and the use cases has been very helpful to clarify some aspects of the key exploitable results, and some possible joint exploitations of several results.
- CA Technologies hosted in early June the Built to Change Summit in Santa Clara (California, USA), where tens of journalists were invited to discuss research and, more precisely, research projects such as ALOHA. This event had a great media coverage, and a press release and a booklet were shared during that week to enhance the impact that the research that CA Technologies is doing. A special mention should be made to the booklet, where a clear referral to ALOHA and each partner of the consortium was made. All this impact will help CA Technologies position itself as an industrial innovator and a leader in AI and related topics.
- In June, CA Strategic Research met with Ashok Reddy who is leading four Business Units and is part of the closest team to the CPO. In this meeting they expressed their interest in the results of ALOHA, and further meetings will be organized with them to follow up.