

## The Contest

Within the Mbed development environment STMicroelectronics proposes an embedded application contest for single developers or small teams with the aim of stimulating the creativity and the innovation through the usage of ST platforms.

The participants could develop their project within the proposed themes in the given timeframe.

In order to facilitate the teams a set of ST kit, some for each field of applications, will be provided by the company for free. The number of available kit is limited, so they will be assigned chronologically following the projects registration order. The assigned kits will be distributed to the enrolled participants presents at the end of the AST Day. The participation to the AST Day Conference is mandatory for the enrolled teams to be eligible for the free kit.

During the award ceremony the contest winner will receives an Apple iPad as a prize.

## The MBED Development Environment

A brief introduction

MBED (<https://www.mbed.com/en/>) is an initiative driven by ARM proposing an Open Source System Development Environment (aka SDK) for embedded devices.

Many partner companies participating to this initiative provides a large set of development boards and expansion boards adding sensors, communication interfaces and other capabilities, covering a broad range of needs.

Thanks to a predefined hardware designs, a set of Hardware Abstraction Layers (HAL) and Board Support Packages (BSP) was created for various vendor platform lowering the initial system setup barrier.

A comprehensive set of “Hello World” and a lot of example applications are also provided simplifying and speeding up the embedded applications development phase, so, allowing makers and students to create their applications and also companies to shorten and make cheaper the project prototyping phase.

Is possible to develop MBED applications in two flavors:

- **MBED classic**, meant for applications that do not needs RTOS support. Typically this kind of applications do not need connection to cloud services and have a limited amount of parallel activities to handle.
- **MBED-OS** including the RTOS (RTX) support, meant for IoT applications development including the MBED Cloud Client. Typically IoT embedded applications needs to post data on the Cloud and have to handle various activities exploiting the threading support of the subtending RTOS.

Within this context the ST proposal include many development boards for various needs, ranging from ultra-low power to high performance (eg. Nucleo family) and also many expansion boards for various sensors family ranging from motion sensors (gyroscope, accelerometers, magnetometer) environmental sensors (temperature, humidity, pressure) and communications interfaces (Bluetooth, WiFi, etc.).

The developer skills normally required to quickly start an effective embedded application development are:

- C/C++ good competence
- Basic RTOS knowledge in case of MBED-OS usage
- Basic competence on version control tools such as GIT and MercurialHG

As the cross compilation could take place on-line through a normal browser, the only tools required are just a PC with internet connection and the ST Nucleo drivers including STLink [http://www.st.com/content/st\\_com/en/products/embedded-software/development-tool-software/stsw-li nk009.html](http://www.st.com/content/st_com/en/products/embedded-software/development-tool-software/stsw-li nk009.html) installed on it in order to allow flashing the application executable file on the Nucleo board.

## The Submission

The participants should submit their outcomes pertaining to one of the below themes within the due date and including also a leaflet illustrating:

- The needs/issue addressed by their proposal (eg. “people often lose their keys”)
- The proposed solution to meet the above need (eg. “a GPS connected keyring”)
- The real or potential benefit of the proposed solution (eg. “people can recover their key everywhere”)
- The architecture of the proposed solution (eg. a UML like use cases and sequence diagrams)
- A commented video illustrating the prototype functionalities and features at work.

The whole project in source code should be available on the indicated Mercurial Mbed repository.

## The Themes

- **Automotive:** the application developed within this area could cover several automotive field of interest ranging from “in vehicle infotainment” to “dashboard interaction” to “engine/traction control” and “car sharing” or “sustainable mobility”.
- **Home Automation/Advanced Man Machine Interaction:** the application developed within this area could address some of the several aspect defining a Smart Home. As no exhaustive example: “presence detection”, “indoor navigation”, “smart lock”, “heating/cooling/lights/appliances/energy management”.
- **Internet of Things systems:** the application developed within this area could address the IoT cloud technology proposing novel solution exploiting the cloud services in terms of data collections/elaboration and inference capabilities. The broad range of possibilities within this context is not limited to “Home” application but ranges from “industrial” to “personal devices”. Given the higher complexity of this kind of application and of their MBED development environment a specific consideration will be given in the evaluation process.
- **Wearable:** the applications developed within this area should propose a wearable device use cases, even if the prototype form factor is of course far from a real device, this will not affect the judgement.

For all the above themes the applications are not required to adhere to any standard or local regulations.

## The Implementation Levels

The chosen theme can be developed and implemented at three levels of complexity:

- **Proof of Concept:** this is the minimum acceptance level for the submission. This is a basic and incomplete implementation of the idea, maybe missing some parts or interfaces but understandable and clearly showing the core concept even if affected by serious stability issues.
- **Core Module:** at this intermediate acceptance level the submission should implement all the core functionalities of the core idea but maybe missing some interfaces or simulating some of the data or user interaction. Some long term stability issues could be accepted.
- **Prototype:** this is the most complete level of development, including the core idea, all the interfaces and working in a stable manner. Of course it is a prototype, so far from a real product, but a certain level of accuracy and completeness in the implementation is expected.

## The Rules

The participants must follow the below rules:

1. Enroll to the contest within the given timeframe following the indications provided and providing all the required informations. The participants must be graduated or close to graduation.
2. Submit the project in source code and the leaflet on the indicated repository
3. Participate to the AST Day conference
4. The participants declare that all submitted material (code, documentation, etc.) do not infringe the intellectual property rights of third parties. Participants will be liable for eventually infringements of third parties rights. The participants must accept the publications according to the rules defined by mbed.org
5. During the winner awards ceremony the first classified team will receive a prize consisting in one Apple iPad.
6. To all the participants to the Contest, will be given by ST Microelectronics a Certificate of Attendance as a recognition.

## The Evaluation Criteria

In the evaluation process of the submitted works the commission - headed by Bruno Murari - (the father of MEMS) and composed by a panel of experts in each field of applications will consider several aspects including, as non exhaustive examples, the listed below:

- Innovation:

A specific evaluation to this aspect will be given, considering the novelty of the proposed solution and/or newer approach to address existing issues with unpublished solution. Also the potential of the idea to extend the silicon usage in new field of applications will be evaluated. The proposal innovation compared to the current “state of the art” of the comparables or similar already existing solutions will be also evaluated.

- Creativity:

This aspect will be evaluated in terms of exploration of new fields of application in a creative manner.

- Usefulness:

In this case the proposed solution usefulness to address with an effective solution a real problem will be considered.

- Complexity:

The overall project complexity in terms of difficulties of the addressed application and uses cases will be taken into account.

- Implementation:

Also the implementation complexity in terms of number of threads, transactions and lines of code will be evaluated.

## Legenda

Contest Registration Start Date: 15 Jan 2018

Contest Registration End Date: 7 March 2018

Contest Registration Required Information: to be provided in the registration form at [www.astday.deib.polimi.it](http://www.astday.deib.polimi.it). The available free kit will be assigned based on the chronological registration order.

Projects repository: [https://developer.mbed.org/teams/AST\\_Day\\_Contest/](https://developer.mbed.org/teams/AST_Day_Contest/)

Contest Documentation: All the submitted project documentation such as presentations, video etc. that could not be uploaded onto the Mbed Mercurial repository should be uploaded to a shared google drive.

Contest Start Date: the 22 Feb 2018 at the end of the AST Day conference Contest End

Date: the 15 Jun 2018

Number of free kit: 24

Free kit description:

(Kit 01) For home automation and Man machine interaction themes, the free kit is composed by:

- Motion and environmental sensors board: X-NUCLEO-IKS01A2
- Bluetooth board: X-NUCLEO-IDB05A1
- Stepper motor driver: X-NUCLEO-IHM02A1
- Proximity and lux sensors board: X-NUCLEO-6180XA1
- MCU: NUCLEO-F401RE

(Kit 02) For IoT system themes, the free kit is composed by:

- Motion and environmental sensors board: X-NUCLEO-IKS01A2
- Tag NFC: X-NUCLEO-NFC02A1
- Wifi: X-NUCLEO-IDW01M1
- MCU: NUCLEO-L476RG

(Kit 03) For wearable themes, the free kit is composed by:

- Tag NFC: X-NUCLEO-NFC02A1
- MCU: STEVAL-STLKT01V1
- MCU/STlink: NUCLEO-F401RE

Contest notifications Date: 1 September 2018

Award Ceremony Date: t.b.d. In September 2018. All the participants are invited to the Award Ceremony, the winners should have a brief presentation of their work and the president Bruno Murari, head of the Evaluation Commission, will make a speech. A little party and a celebration will follow.