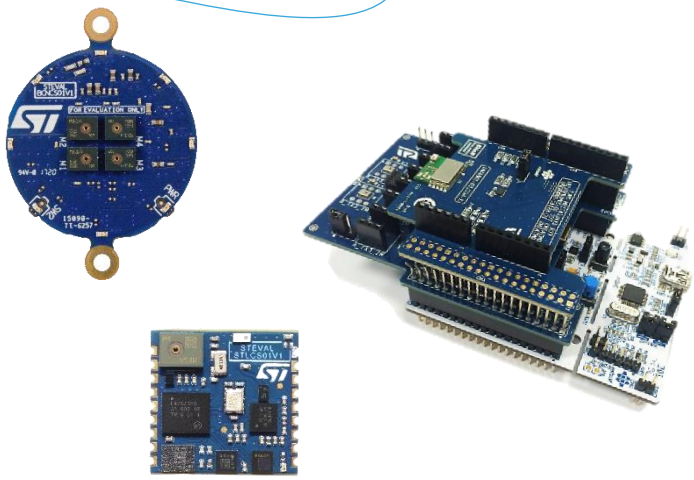
Quick Start Guide

STM32 ODE function pack for half-duplex voice streaming over Bluetooth Low Energy

(FP-AUD-BVLINK1)



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Version 1.0 (June 21, 2017)

Quick Start Guide Contents

FP-AUD-BVLINK1: STM32 ODE function pack for half-duplex voice streaming over Bluetooth Low Energy

Hardware and Software overview

Setup & Demo Examples

Documents & Related Resources

STM32 Open Development Environment: Overview

Bluetooth Low Energy expansion board
Hardware Overview (1/4)

X-NUCLEO-IDB05A1 Hardware Description

- The X-NUCLEO-IDB05A1 is a Bluetooth Low Energy (BLE) evaluation and development board system, designed around ST's SPBTLE-RF Bluetooth Low Energy module based on BlueNRG-MS.
- The BlueNRG-MS processor hosted in the SPBTLE-RF module communicates with the STM32 Nucleo developer board host microcontroller though an SPI link available on the Arduino UNO R3 connector.

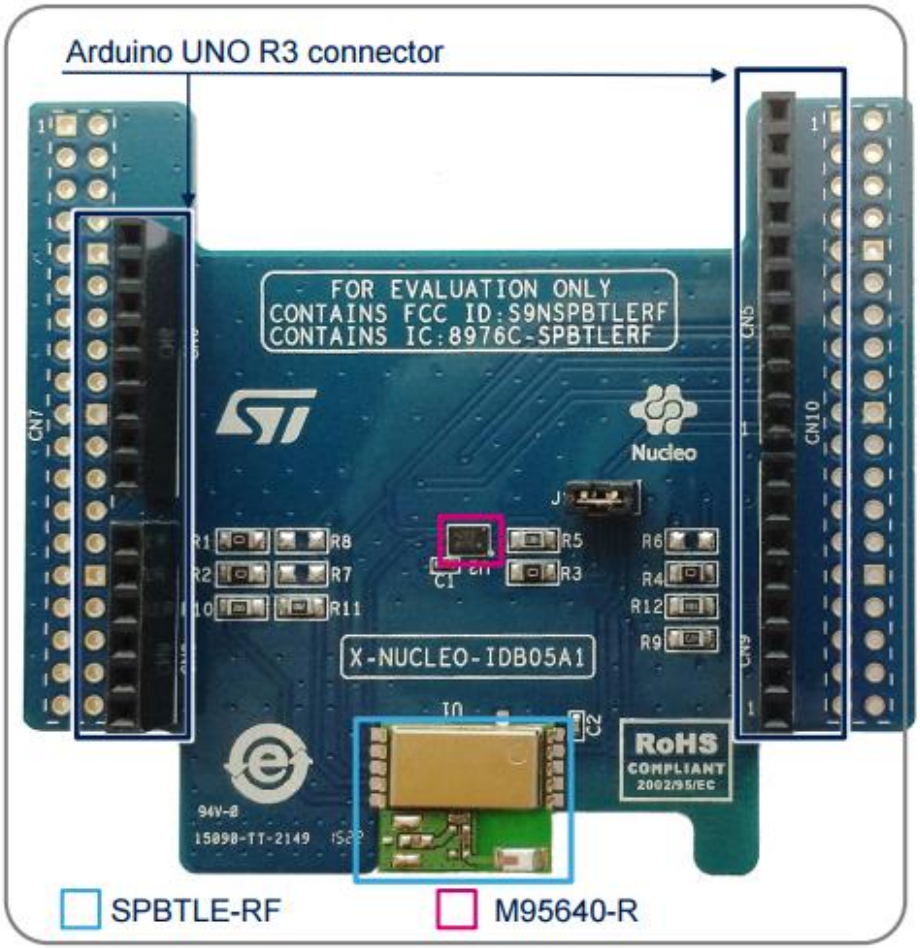
Key Products on board

SPBTLE-RF
Bluetooth Low Energy, FCC and IC certified, module based on Bluetooth® Low Energy wireless network processor BlueNRG-MS, BLE4.1 compliant.

SPBTLE-RF integrates a BALF-NRG-01D3 balun and a chip antenna. It embeds 32 MHz and 32.768 kHz crystal oscillators for the BlueNRG-MS.

M95640-R

64-Kbit serial SPI bus EEPROM with high-speed clock interface



Latest info available at www.st.com
X-NUCLEO-IDB05A1

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MEMS Microphones expansion board

Hardware Overview (2/4)

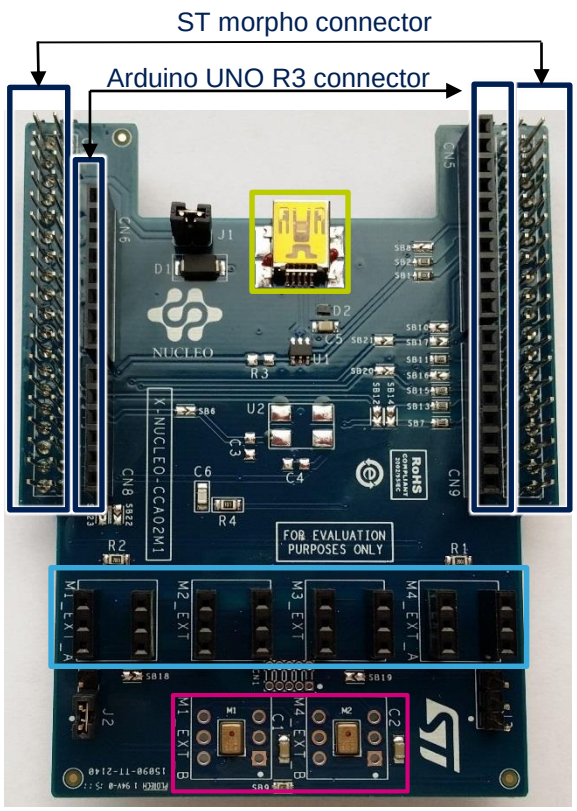
X-NUCLEO-CCA02M1 Hardware Description

- The X-NUCLEO-CCA02M1 is an expansion board based on digital MEMS microphones. It has two MP34DT01–M microphones soldered on board and offers the possibility to plug additional microphones using MP34DT01-based coupon evaluation boards (**STEVAL-MKI129V* or STEVAL-MKI155V***).
- The X-NUCLEO-CCA02M1 enables the acquisition and streaming of up 4 microphones using both I²S and SPI bus available on ST morpho connector.

Key products on board

MP34DT01-M

Ultra-compact, low-power, omnidirectional, digital MEMS microphone built with a capacitive sensing element and an IC interface.



Latest info available at www.st.com
X-NUCLEO-CCA02M1

* is used as a wildcard character for related part number

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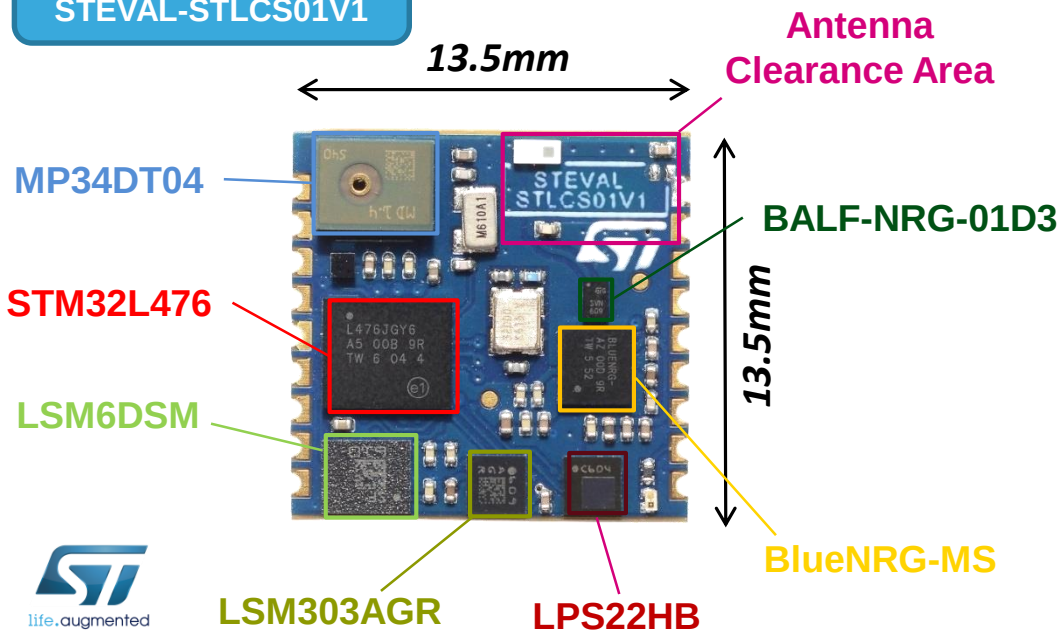
SensorTile Platform
Hardware Overview (3/4)

STEVAL-STLKT01V1 Hardware Description

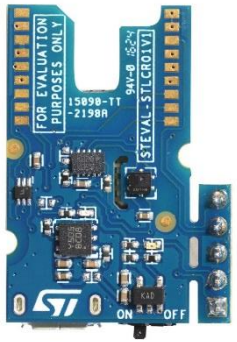
- STEVAL-STLKT01V1 is the development kit for the SensorTile board (STEVAL-STLCS01V1), a highly Integrated Development Platform with a broad range of functionalities aiming to improve system design cycle and accelerate delivery of results
- Two host boards are also provided as part of the kit, both featuring SWD programming interface
  - Cradle eXpansion has a plugin connection for SensorTile Core System and an Arduino interface
  - The Cradle is a small host featuring battery charger and SD card interface that supports on-the-field testing and data acquisition campaigns

SensorTile Core System
STEVAL-STLCS01V1



SensorTile Cradle eXpansion
STEVAL-STLCX01V1

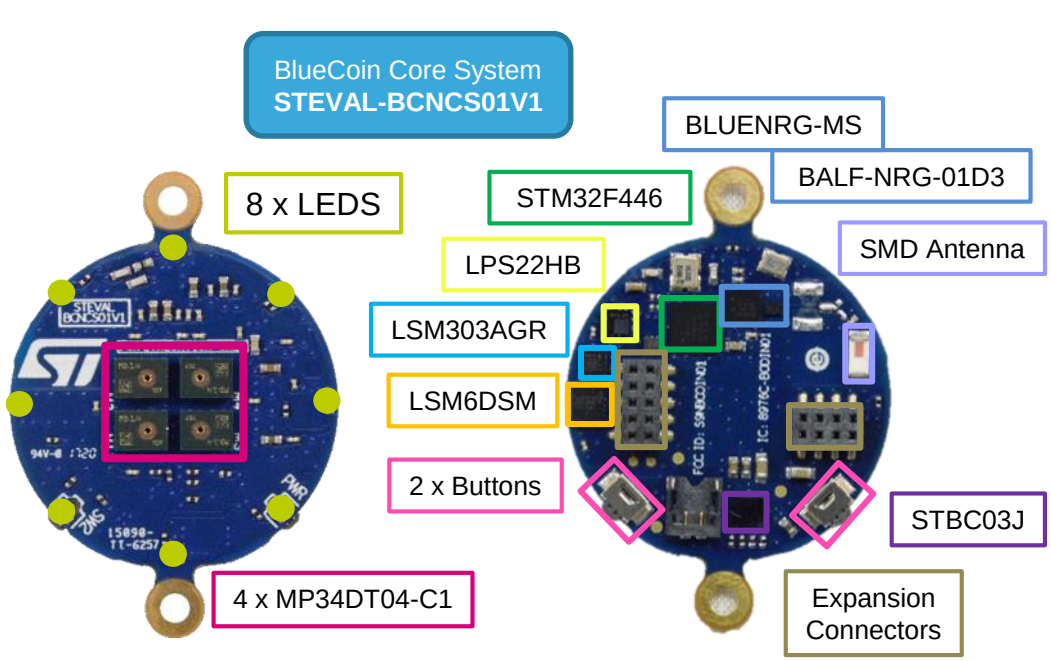
SensorTile Cradle
STEVAL-STLCR01V1

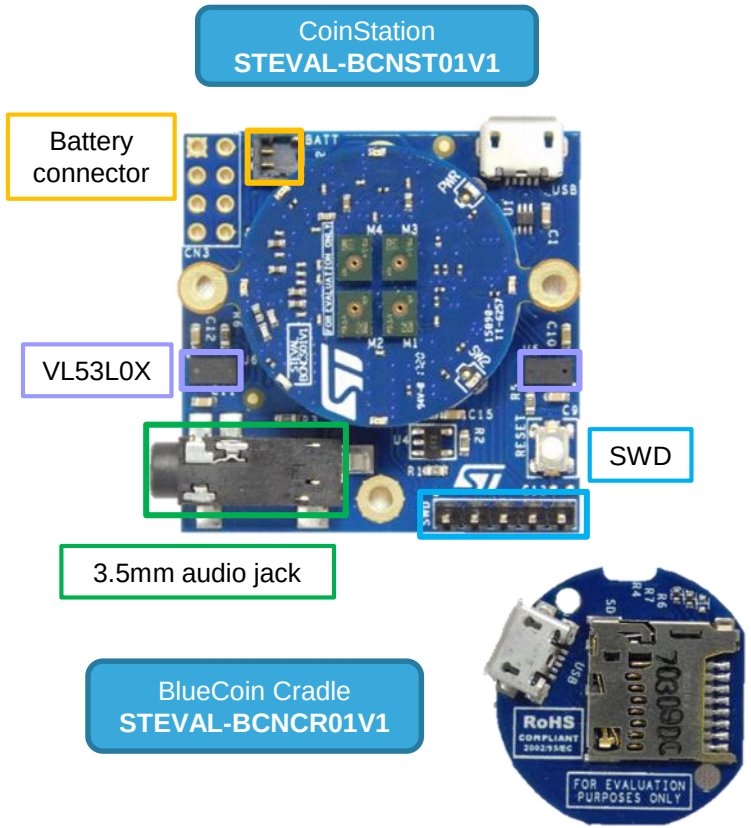


BlueCoin Platform
Hardware Overview (4/4)

STEVAL-BCNKT01V1 Hardware Description

- STEVAL-BCNKT01V1 is the starter kit for the BlueCoin board (STEVAL-BCNCS01V1), a highly Integrated Development and Prototyping Platform for augmented acoustic and motion sensing, aiming to improve system design cycle and accelerate delivery of results
- Two host boards are also provided as part of the kit:
  - The CoinStation provides audio output, battery management and two Time-of-flight ranging sensors.
  - The Cradle is a small host board featuring USB and SD card interfaces, it is useful for on-the-field testing and data acquisition campaigns.





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Half-duplex voice streaming over Bluetooth Low Energy

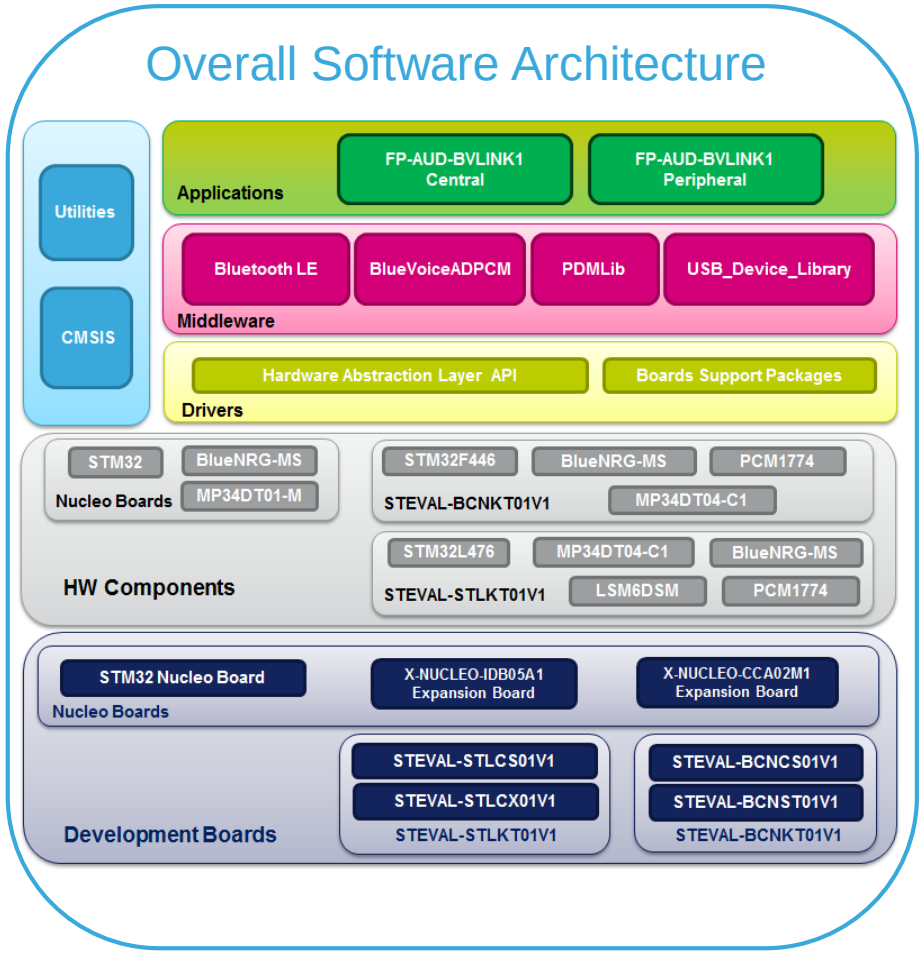
Software Overview

FP-AUD-BVLINK1 Software Description

- FP-AUD-BVLINK1 is an STM32 ODE function pack that performs voice streaming over Bluetooth low energy in a half-duplex configuration. The application runs on the STM32 Nucleo and includes drivers and middleware for Bluetooth Low Energy (BlueNRG-MS) and MP34DT01-M or MP34DT04-C1 digital MEMS microphones.
- The expansion is built on STM32Cube software technology to ease portability across different STM32 microcontrollers. The software comes with sample implementations of the drivers for X-NUCLEO-IDB05A1 plus X-NUCLEO-CCA02M1, when connected to a NUCLEO-F401RE, NUCLEOL476RG or NUCLEO-L053R8 board.
- FP-AUD-BVLINK1 is also compatible with SensorTile (STEVAL-STLKT01V1) and BlueCoin (STEVALBCNKT01V1).

Key features

- BlueVoiceADPCM, half-duplex voice over Bluetooth low energy communication profile.
- Complete middleware to build applications using the BlueNRG-MS network processor and digital MEMS microphone.
- Easy portability across different MCU families thanks to STM32Cube.
- Sample applications that the developer can use to start experimenting with the code.
- Free user-friendly license terms.
- Compatibility with ST BlueMS app (v 3.0.0 or higher), available for Android and iOS.



Latest info available at
FP-AUD-BVLINK1

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Quick Start Guide Contents

FP-AUD-BVLINK1: STM32 ODE function pack for half-duplex voice streaming over Bluetooth Low Energy

Hardware and Software overview

Setup & Demo Examples

Documents & Related Resources

STM32 Open Development Environment: Overview

Setup & Demo Examples

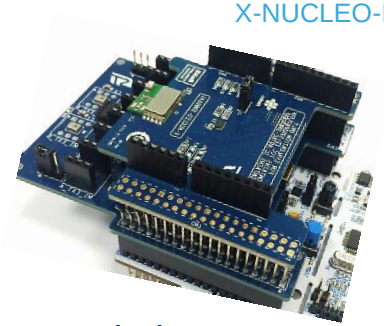
STM32 Nucleo - HW prerequisites

- 2x STM32 Nucleo Bluetooth Low Energy expansion board (**X-NUCLEO-IBD05A1**)
- 2x STM32 Nucleo MEMS Microphones expansion board (**X-NUCLEO-CCA02M1**)
- 2x STM32 Nucleo development board (**NUCLEO-F401RE**, **NUCLEO-L476RG**), for Half-Duplex communication.
- Alternately 1x STM32 Nucleo development board (**NUCLEO-F401RE**, **NUCLEO-L476RG** or **NUCLEO-L053R8**), for simplex communication with a mobile device.
- PC with Windows® 7 or above (for half duplex application)
- Android™ or iOS™ device running ST BlueMS app (for simplex application).
- 1x USB type A to Mini-B USB cable

NUCLEO-F401RE
or NUCLEO-L152RE

X-NUCLEO-CCA02M1

X-NUCLEO-IDB05A1



2x kits needed
(for central and peripheral roles
In half-duplex communication)

Setup & Demo Examples

SW prerequisites

- **STSW-LINK004**:
  - STM32 ST-LINK Utility is a full-featured software interface for programming STM32 microcontrollers. You can use this utility to flash your STM32 Nucleo, SensorTile or BlueCoin board, for a fast demo setup.

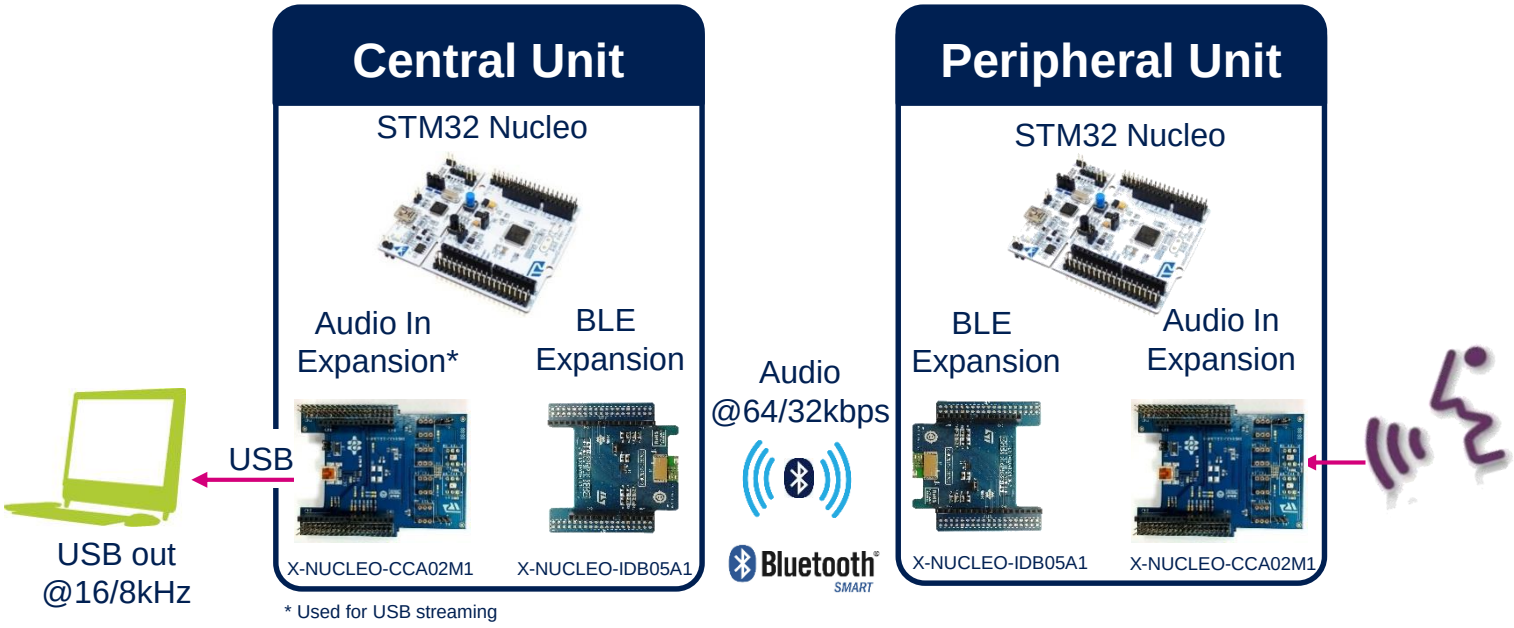
- **FP-AUD-BVLINK1**
  - Copy the .zip file content into a folder on your PC. The package contains source code example (Keil, IAR, System Workbench) based **NUCLEO-F401RE**, **NUCLEO-L476RG, NUCLEO-L053R8, SensorTile or BlueCoin.**

- **BlueMS** Application for **Android**/**iOS** can be downloaded from Google Store / iTunes

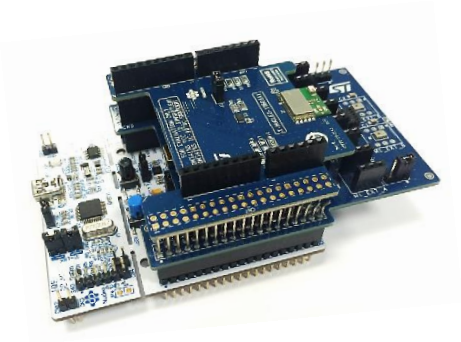
- Third party software for audio acquisition (if you are using STM32Nucleo board)
  - Audacity® is free, open source, cross-platform software for recording and editing sounds.
  - It is available for Windows®, Mac®, GNU/Linux®; and other operating systems.
  - Link: http://audacity.sourceforge.net

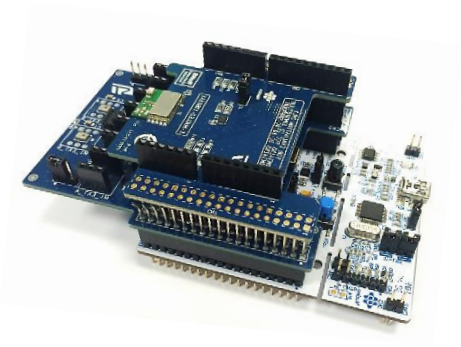
Setup & Demo Examples

STM32 Nucleo - System overview



* Used for USB streaming





FP-AUD-BVLINK1
Voice over BLE software

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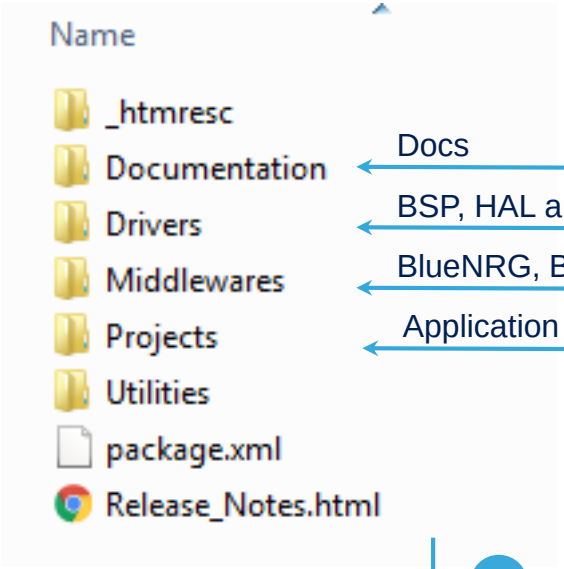
www.st.com

1 www.st.com/stm32ode-fp

2 Select FP-AUD-BVLINK1

3 Download & unpack

FP-AUD-BVLINK1 package structure



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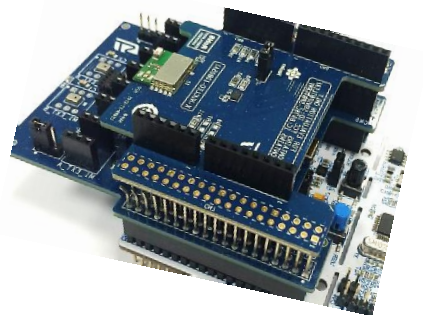

Open project example
"BVLCen" or "BVLPer"

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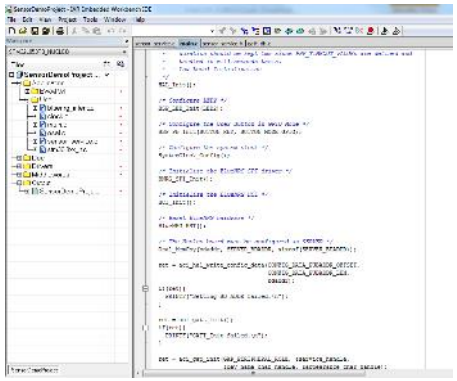
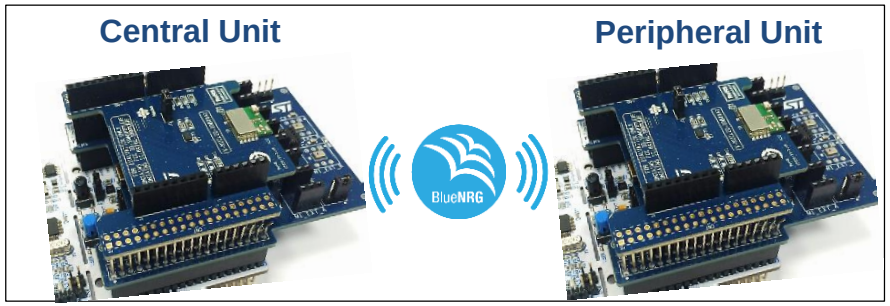
6 Build the application



Setup & Demo Examples

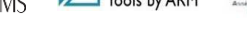
STM32 Nucleo - Demo setup

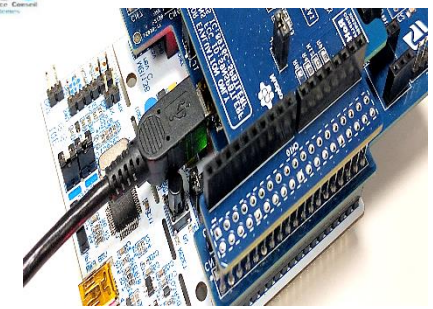


1. Compile and download BVLCen application on one unit and BVLPer application on the other (see previous slide)

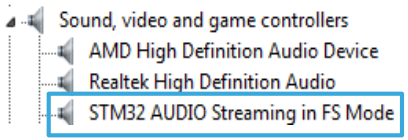
2. Unplug USB cable from STM32 Nucleo board
   Move STM32 Nucleo jumper JP5 to E5V 

   Plug mini USB cable into X-NUCLEO-CCA02M1

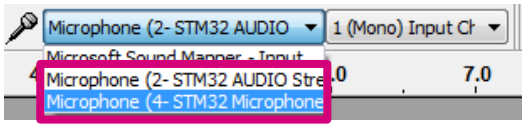




3. Both units are recognized as USB Microphone.

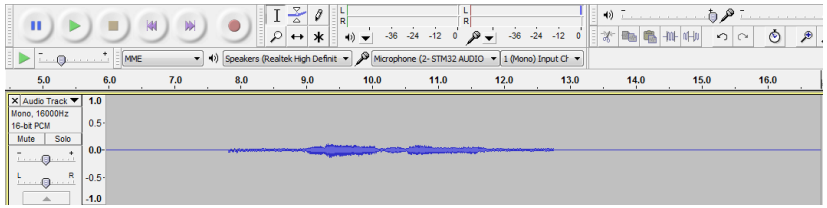


4. Open Audacity, select the peripheral or central unit and click record.



5. Press STM32 Nucleo user button to START streaming, press again to STOP it. Only one unit at time can stream.

6. Audacity records audio coming from the transmitter unit.



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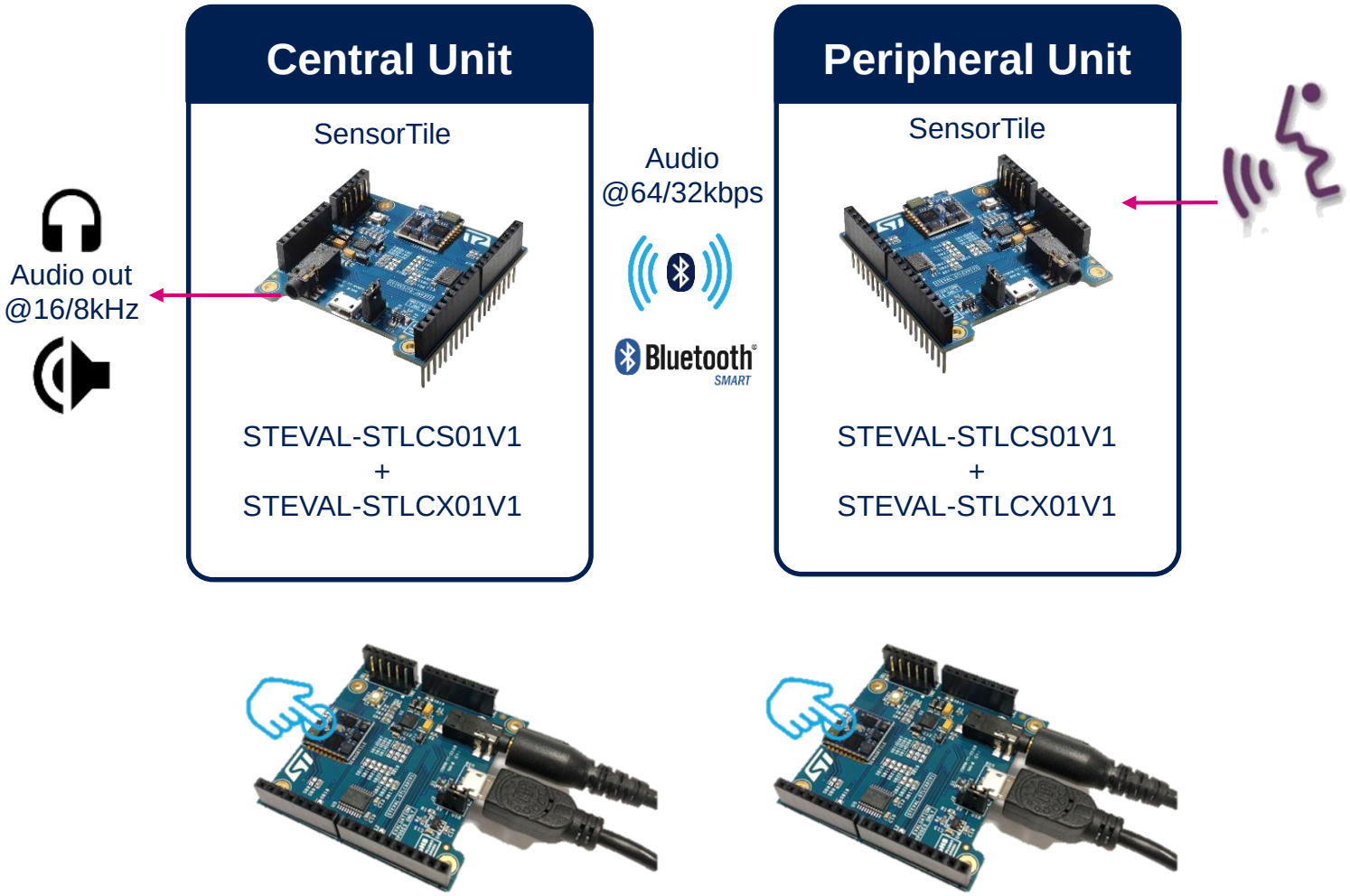
Setup & Demo Examples

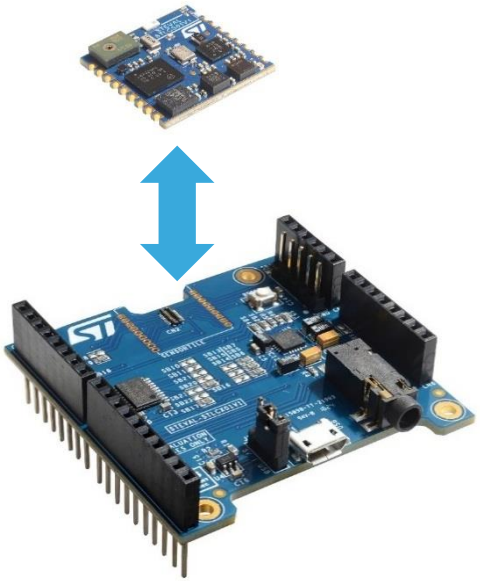
SensorTile - System overview



Setup & Demo Examples

SensorTile - HW prerequisites

- 2x STEVAL-STLKT01V1: STEVAL-STLCS01V1 connected to the STEVAL-STLCX01V1 for Half-Duplex communication.
- Alternately, 1x STEVAL-STLKT01V1: STEVAL-STLCS01V1 connected to the STEVAL-STLCX01V1, for simplex communication with a mobile device.
- Active speaker output: loudspeaker or headset.
- Android™ or iOS™ device running ST BlueMS app.

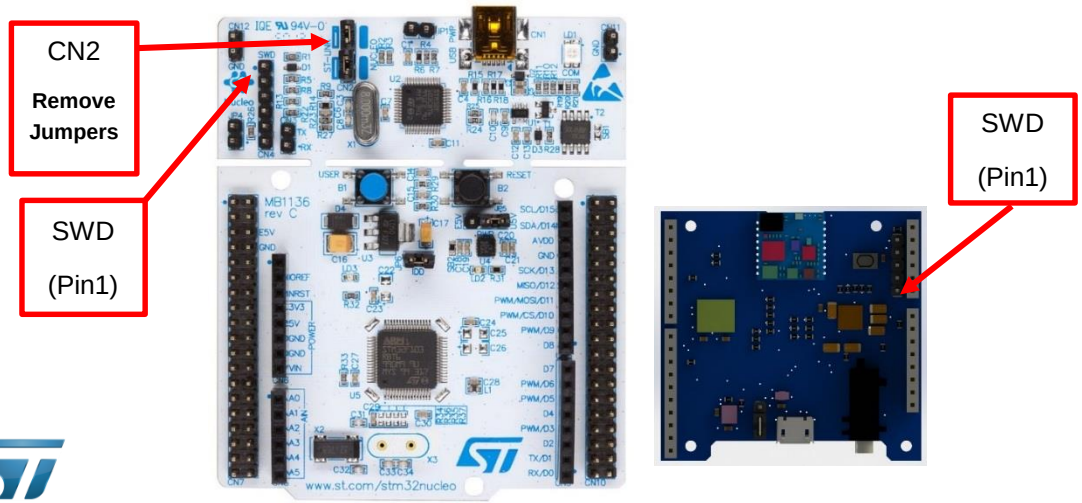


2x kits needed
(for central and peripheral roles)

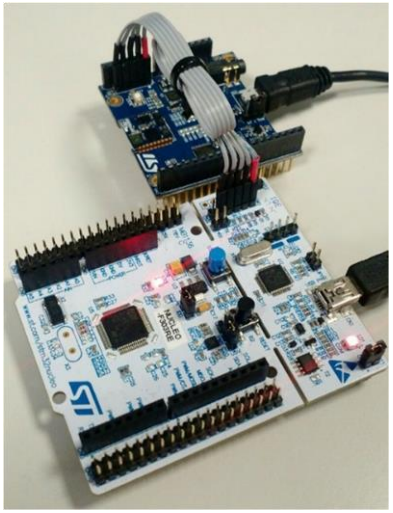
Setup & Demo Examples

SensorTile - HW setup

- In order to program the board you need to connect an external ST-Link to the SWD connector on the cradles, a 5pin flat cable is provided within the SensorTile Kit package.
- The easiest way is to get an STM32-Nucleo board which includes an ST-Link V2.1 programmer.
- Be sure that CN2 Jumpers are OFF and connect your STM32 Nucleo board to the SensorTile Cradle through the provided cable paying attention to the polarity of the connectors. Pin 1 can be identified by a little circle on the PCB silkscreen (STM32 Nucleo board and SensorTile Cradle Expansion).

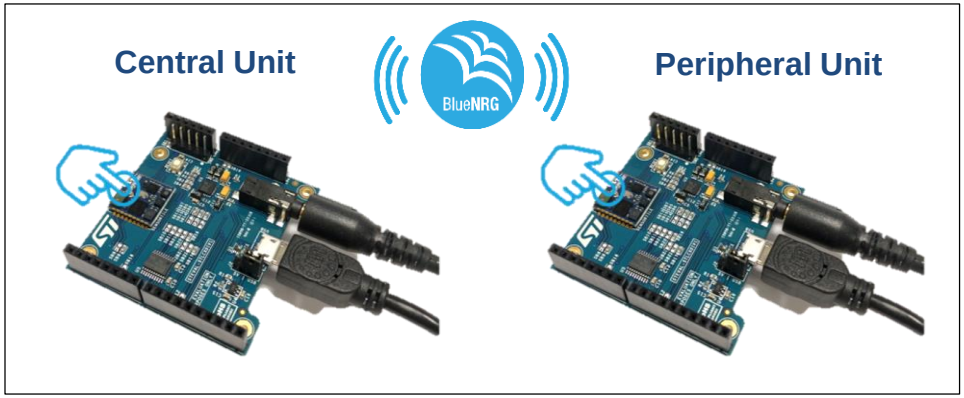


Cradle eXpansion SWD connection



Setup & Demo Examples

SensorTile - Demo setup



1. Compile and download BVLCen application on one SensorTile and BVLPer application on the other.
2. Connect to the jack connector on the Expansion cradle board a loudspeaker or a headset.
3. Double tap on the SensorTile that must act as transmitter, the audio streaming will start.
4. Double tap again on the same unit to stop the streaming.
5. Only one unit at time can stream.

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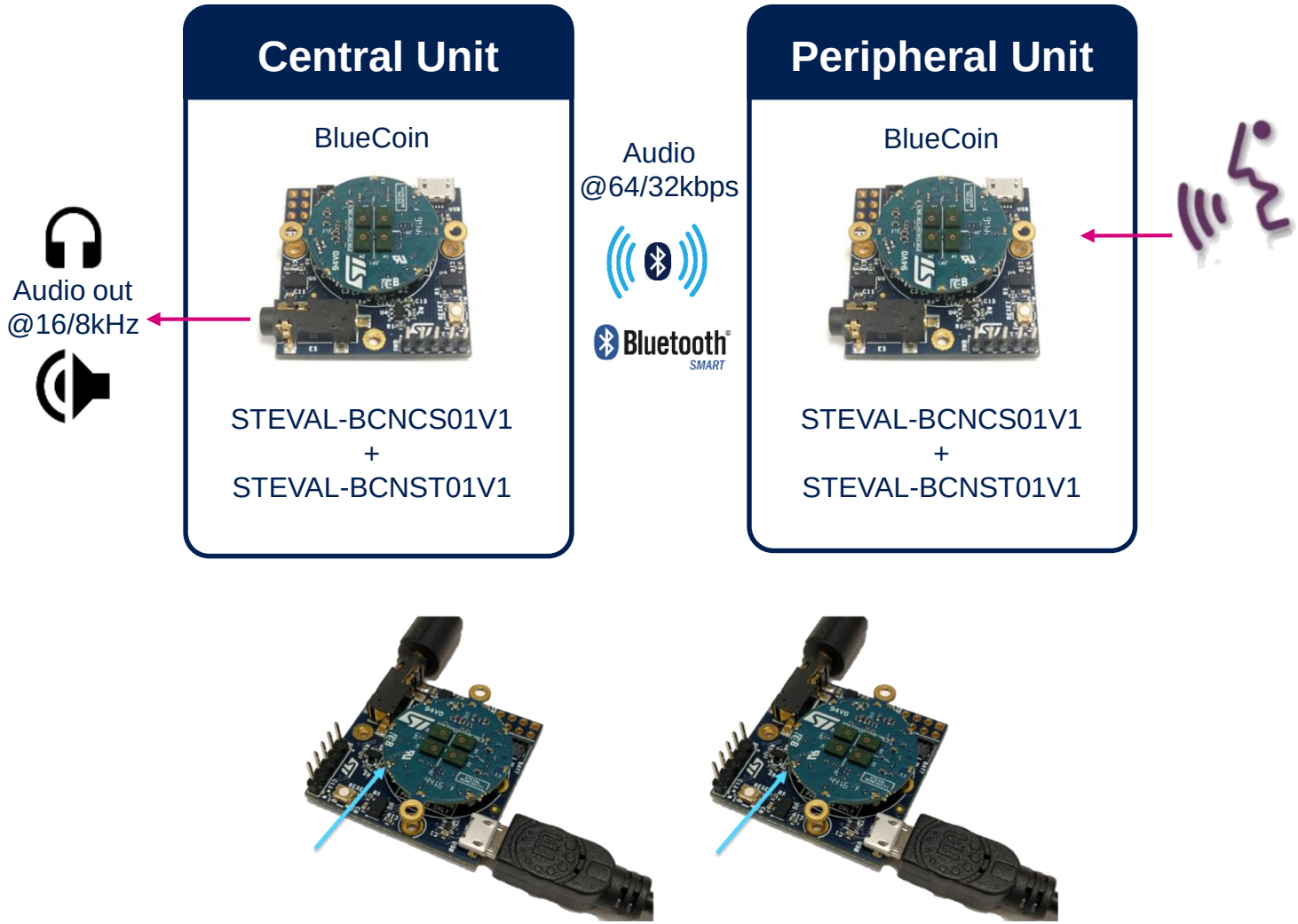
Setup & Demo Examples

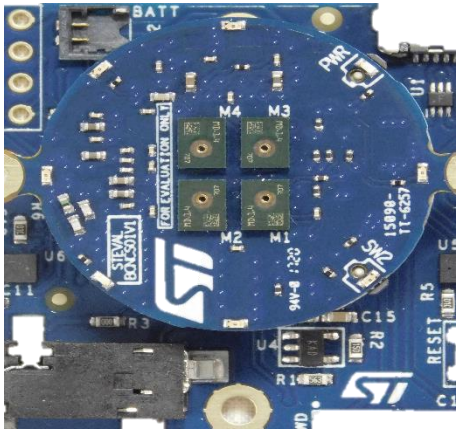
BlueCoin - System overview



Setup & Demo Examples

BlueCoin - HW prerequisites

- 2x STEVAL-BCNKT01V1: STEVAL-BCNCS01V1 connected to the STEVAL-BCNST01V1 for Half-Duplex communication.
- Alternately 1x STEVAL-BCNKT01V1: STEVAL-BCNCS01V1 connected to the STEVAL-BCNST01V1, for simplex communication with a mobile device.
- Active speaker output: loudspeaker or headset.
- Android™ or iOS™ device running ST BlueMS app.



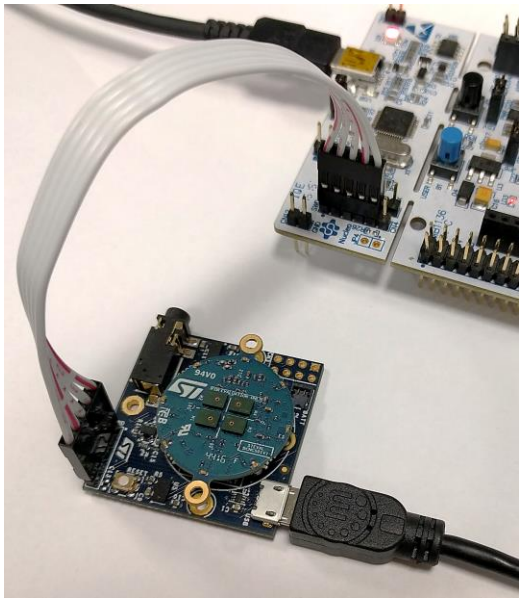
2x kits needed
(for central and peripheral roles)

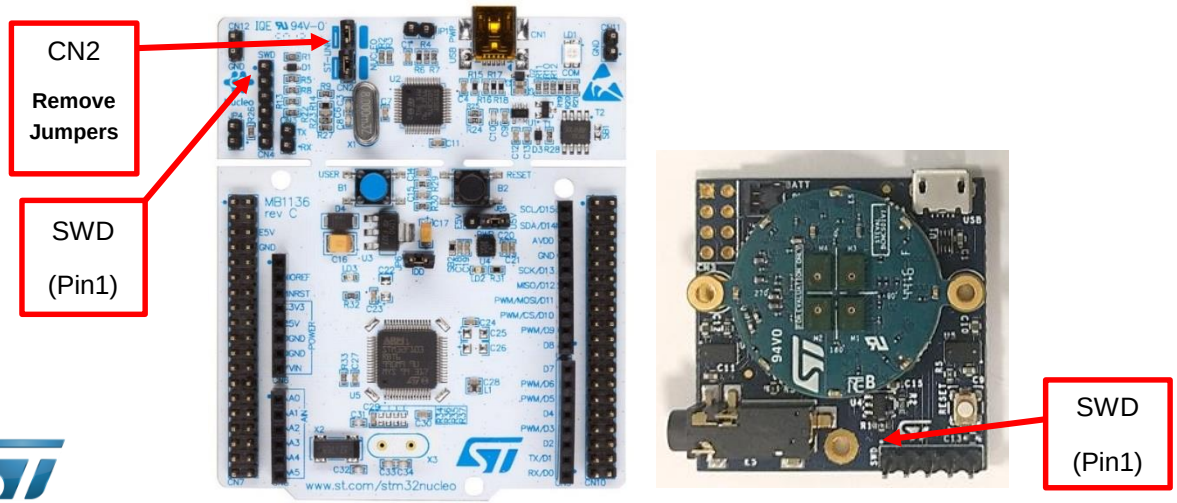
Setup & Demo Examples

BlueCoin - HW setup

- In order to program the board you need to connect an external ST-Link to the SWD connector on the BlueCoin Station, a 5pin flat cable is provided within the BlueCoin Kit package.
- The easiest way is to get an STM32-Nucleo board which includes an ST-Link V2.1 programmer.
- Be sure that CN2 Jumpers are OFF and connect your STM32 Nucleo board to the BlueCoin Station through the provided cable paying attention to the polarity of the connectors. Pin 1 can be identified by a little circle on the PCB silkscreen (STM32 Nucleo board and BlueCoin Station).

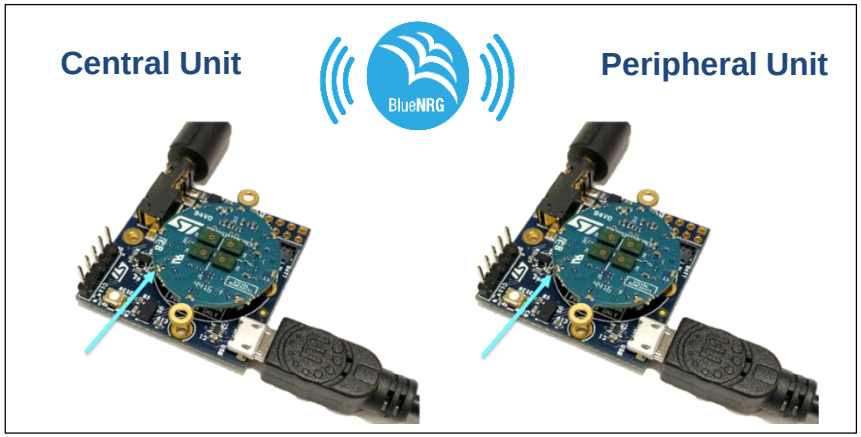
BlueCoin Station SWD connection





Setup & Demo Examples

BlueCoin - Demo setup

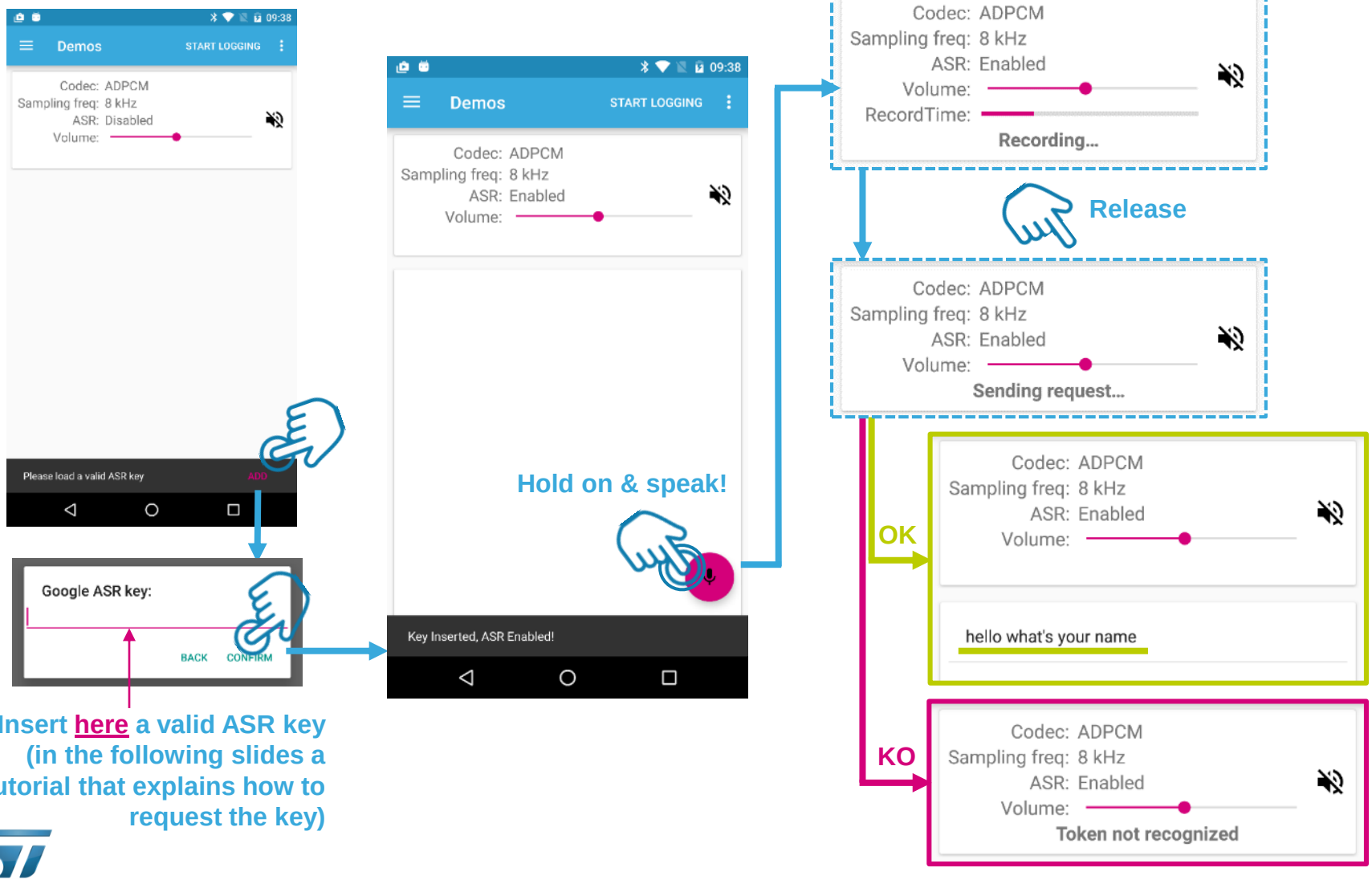


1. Compile and download BVLCen application on one BlueCoin and BVLPer application on the other.
2. Connect to the jack connector on the BlueCoin Station a loudspeaker or a headset.
3. Press the button indicated in the picture above to start the audio streaming from the BlueCoin acting as transmitter.
4. Press again the same button to stop the streaming.
5. Only one unit at time can stream.

Setup & Demo Examples

ST BlueMS app

FP-AUD-BVLINK1-Peripheral FW **must be recompiled with 8kHz** audio sampling frequency configuration.
Press the blue button on the STM32 Nucleo board to enable the audio streaming.



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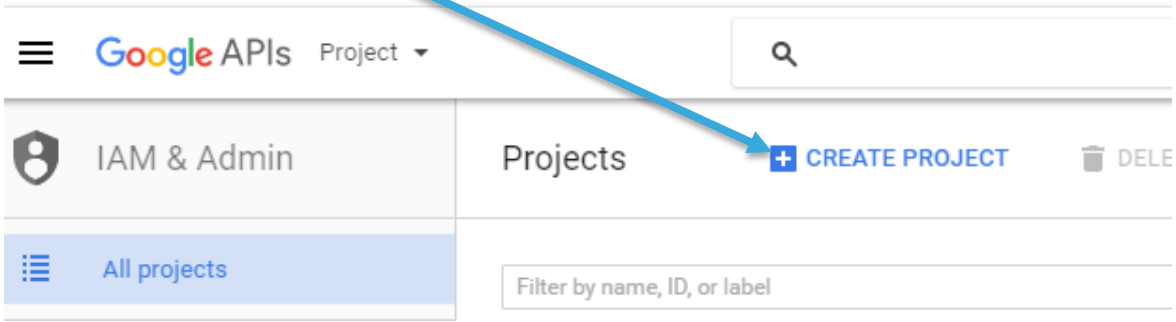
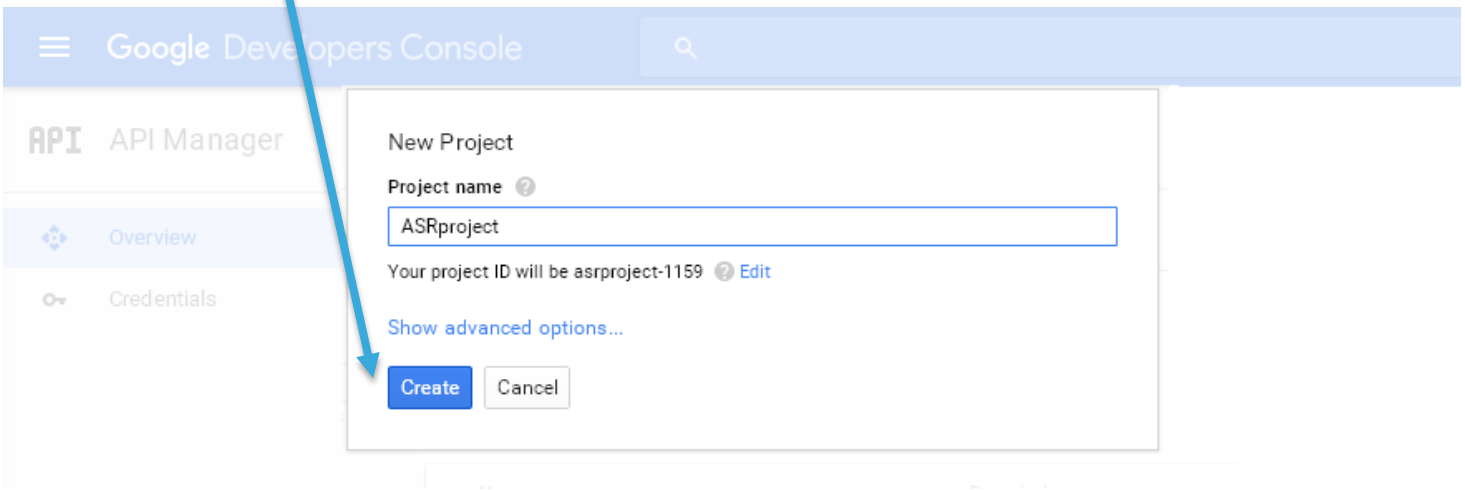
How to generate Google ASR keys (1/4)

- Login with a Gmail Account that you own.
- Make sure you are a member of https://groups.google.com/a/chromium.org/forum/?fromgroups#!forum/chromium-dev
  - (you can just subscribe to chromium-dev and choose not to receive email). The APIs you need are only visible to people subscribed to that group.
- Follow this link https://console.developers.google.com/project
- Click on “Create a project”.



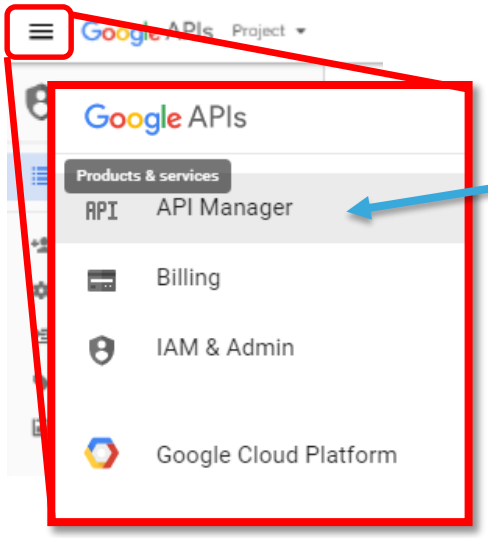
How to generate Google ASR keys (2/4)

- Choose the Project name.
- Click on “Create” button.

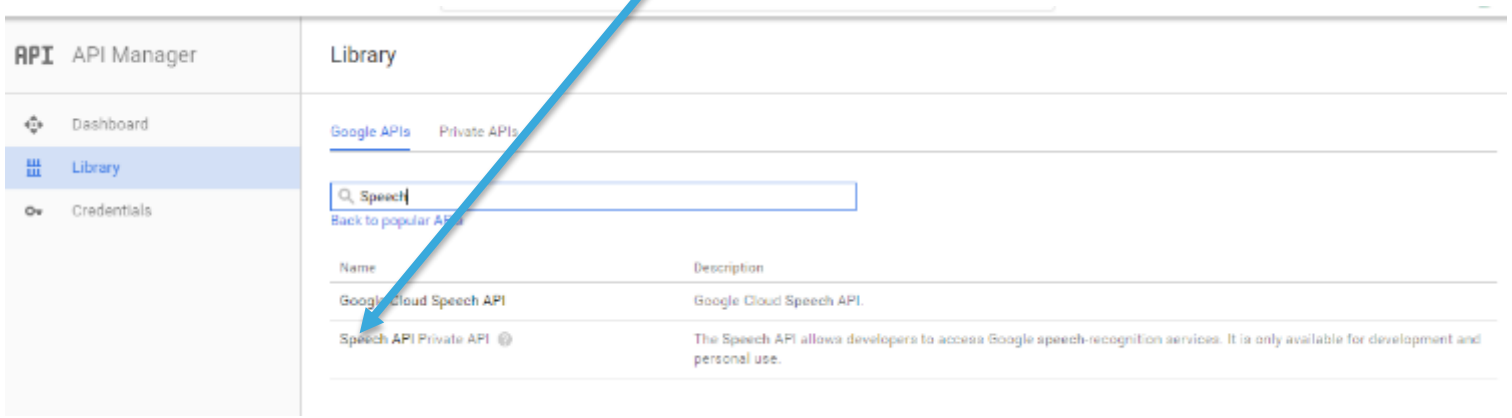


- Open the project you’ve just created

How to generate Google ASR keys (3/4)

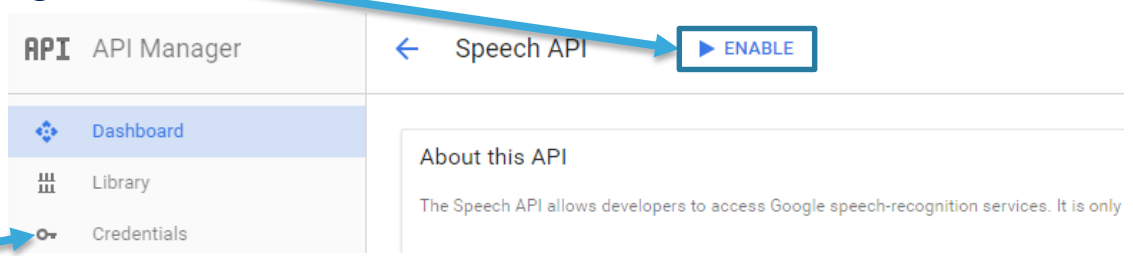


- Open API Manager
- Write “Speech API” in the search box, and select the correct result.



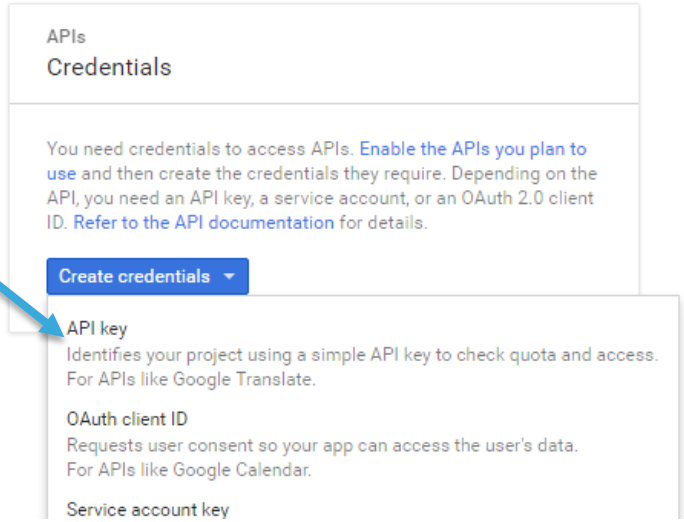
How to generate Google ASR keys (4/4)

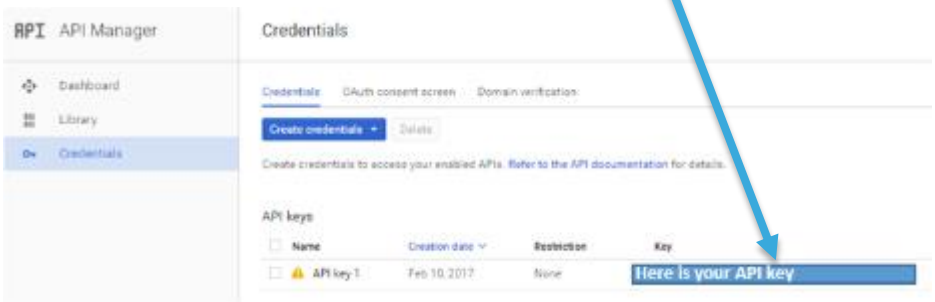
- Enable the Speech API clicking on the blue button.



- Open “Credentials”.

- Move to “Credentials” tab and choose “API Key”, a new key is now available in Credentials





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Documents & Related Resources (1/2)

All documents are available in the DESIGN tab of the related products webpage

FP-AUD-BVLINK1:

- **DB3255**: STM32 ODE Function Pack for half-duplex voice streaming over Bluetooth low energy – **Data brief**
- **UM2196:** Getting started with the FP-AUD-BVLINK1, a software expansion for STM32Cube that performs an Half-Duplex voice streaming over Bluetooth Low Energy – **User Manual**
- Software setup file

X-NUCLEO-CCA02M1

- Gerber files, BOM, Schematics
- **DB2593:** Digital MEMS microphones expansion board based on MP34DT01-M for STM32 Nucleo **– data brief**
- **UM1900:** Getting started with the digital MEMS microphones expansion board based on MP34DT01-M for STM32 Nucleo – **user manual**

X-NUCLEO-IDB05A1

- Gerber files, BOM, Schematic
- **DB2592:** Bluetooth Low Energy expansion board based on SPBTLE-RF module for STM32 Nucleo **– data brief**
- **UM1912:** Getting started with X-NUCLEO-IDB05A1 Bluetooth low energy expansion board based on SPBTLE-RF module for STM32 Nucleo **– user manual**

Consult www.st.com for the complete list

Documents & Related Resources (2/2)

All documents are available in the DESIGN tab of the related products webpage

STEVAL-STLKT01V1

- Gerber files, BOM, Schematic
- **DB2956:** SensorTile development kit **– data brief**
- **UM2101**: Getting started with the STEVAL-STLKT01V1 SensorTile integrated development platform **– user manual**

STEVAL-BCNKT01V1

- Gerber files, BOM, Schematic

- **DB3255:** STM32 ODE function pack for half-duplex voice streaming over Bluetooth low energy **– data brief**
- **UM2196**: Getting started with the FP-AUD-BVLINK1 STM32 ODE function pack based on half-duplex voice streaming over BLE **– user manual**

Consult www.st.com for the complete list

Quick Start Guide Contents

FP-AUD-BVLINK1: STM32 ODE function pack for half-duplex voice streaming over Bluetooth low energy

Hardware and Software overview

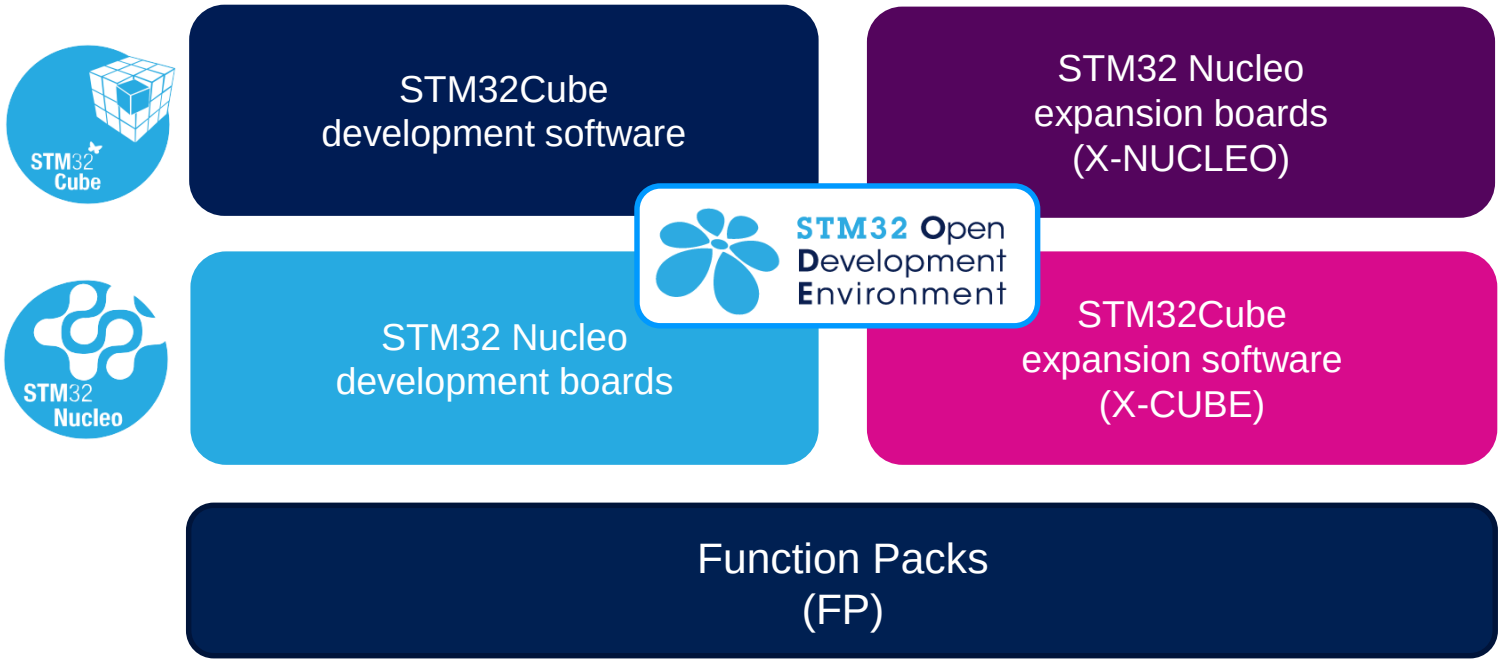
Setup & Demo Examples

Documents & Related Resources

STM32 Open Development Environment: Overview

STM32 Open Development Environment
Fast, affordable Prototyping and Development

- The STM32 Open Development Environment (ODE) consists of a set of stackable boards and a modular open SW environment designed around the STM32 microcontroller family.



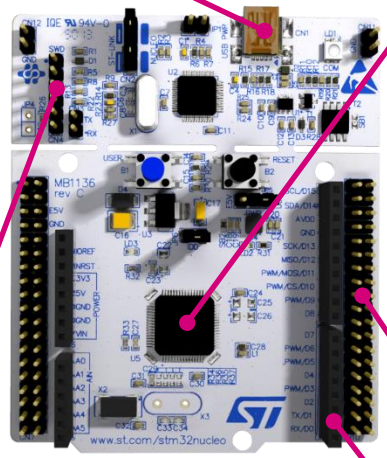
www.st.com/stm32ode

STM32 Nucleo
Development Boards (NUCLEO)

- A comprehensive range of affordable development boards for all the STM32 microcontroller series, with unlimited unified expansion capabilities and integrated debugger/programmer functionality.

Power supply through USB or external source

Integrated debugging and programming ST-LINK probe



STM32 microcontroller

STM32 F0 STM32 F1 STM32 F2 STM32 F3 STM32 F4 STM32 F7

STM32 L0 STM32 L1

Complete product range
from ultra-low power to high-performance

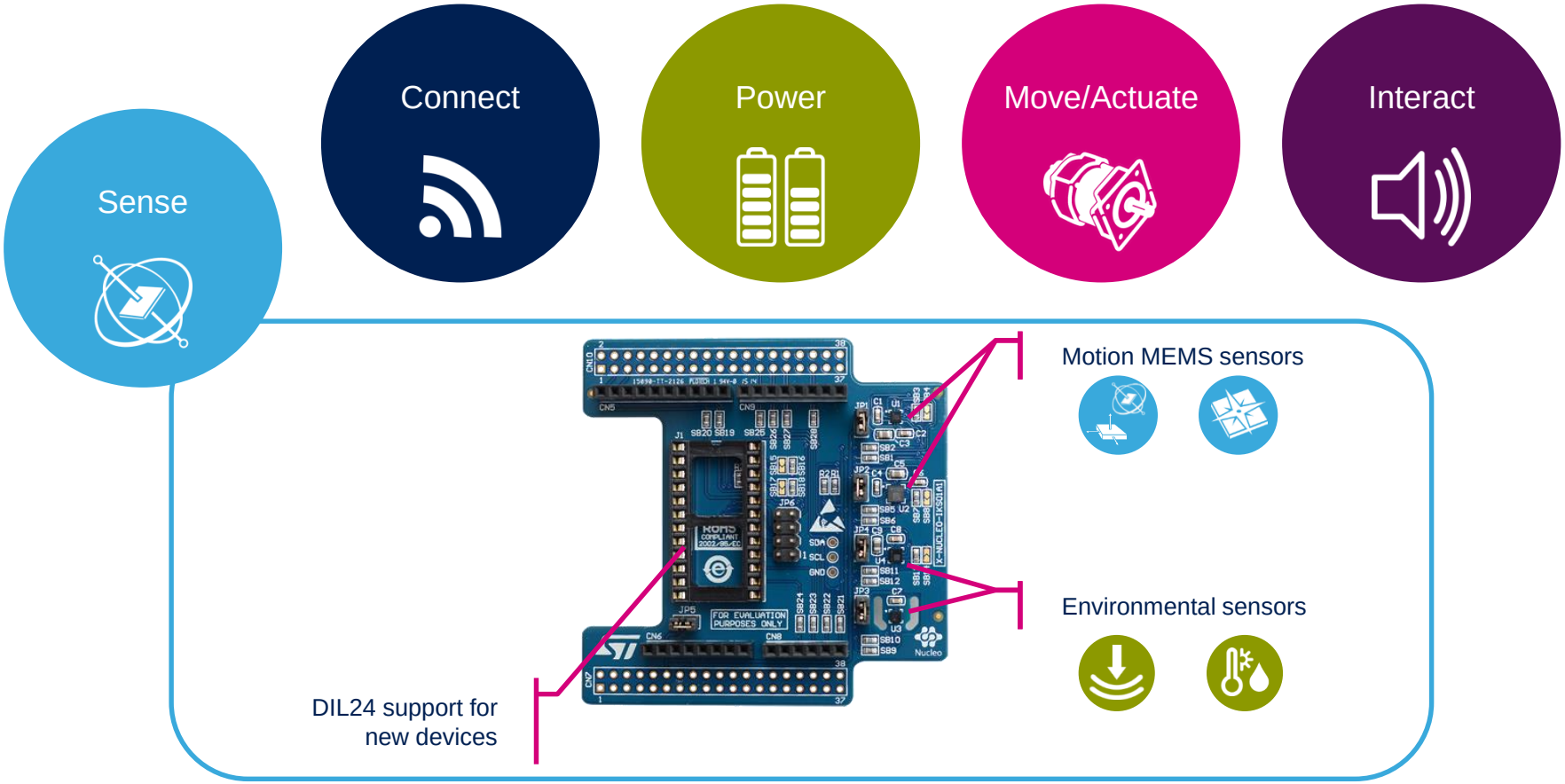
ST morpho extension header

Arduino™ UNO R3 extension headers

STM32 Nucleo

STM32 Nucleo
Expansion Boards (X-NUCLEO)

- Boards with additional functionality that can be plugged directly on top of the STM32 Nucleo development board directly or stacked on another expansion board.



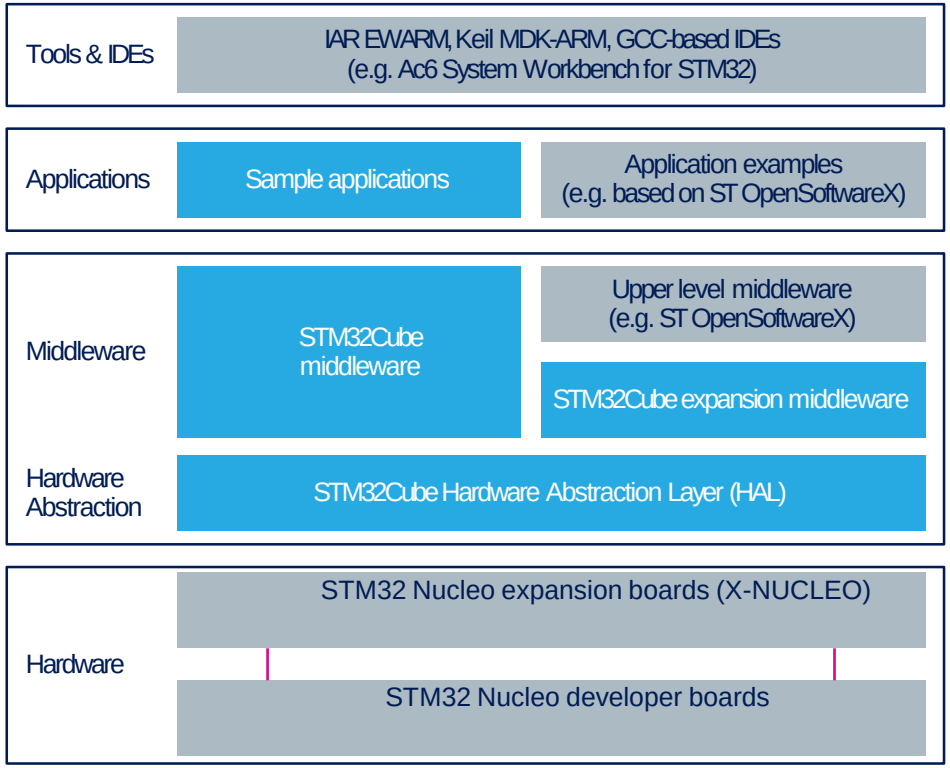
Example of STM32 expansion board (X-NUCLEO-IKS01A1)

STM32 Open Development Environment

Software components

- **STM32Cube software (CUBE)** - A set of free tools and embedded software bricks to enable fast and easy development on the STM32, including a Hardware Abstraction Layer and middleware bricks.

- **STM32Cube expansion software (X-CUBE)** - Expansion software provided free for use with the STM32 Nucleo expansion board and fully compatible with the STM32Cube software framework. It provides abstracted access to expansion board functionality through high-level APIs and sample applications.



- **Compatibility with multiple Development Environments -** The STM32 Open Development Environment is compatible with a number of IDEs including IAR EWARM, Keil MDK, and GCC-based environments. Users can choose from three IDEs from leading vendors, which are free of charge and deployed in close cooperation with ST. These include Eclipse-based IDEs such as Ac6 System Workbench for STM32 and the MDK-ARM environment.

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OPEN LICENSE MODELS: STM32Cube software and sample applications are covered by a mix of fully open source BSD license and ST licenses with very permissive terms.

www.st.com/stm32cube

www.st.com/x-cube

STM32 Open Development Environment
Building block approach

The building blocks	Your need	Our answer

Accelerometer, gyroscope
Inertial modules, magnetometer
Pressure, temperature, humidity
Proximity, microphone

Sense — COLLECT

Bluetooth LE, Sub-GHz radio
NFC, Wi-Fi, GNSS

Connect — TRANSMIT

Audio amplifier
Touch controller
Operation Amplifier

Translate — ACCESS

Stepper motor driver
DC & BLDC motor driver
Industrial input / output

Move / Actuate — CREATE

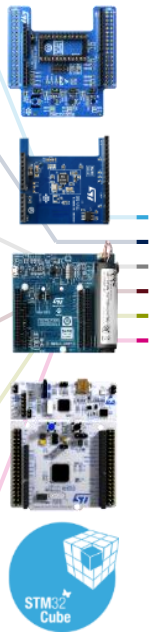
Energy management & battery

Power — POWER

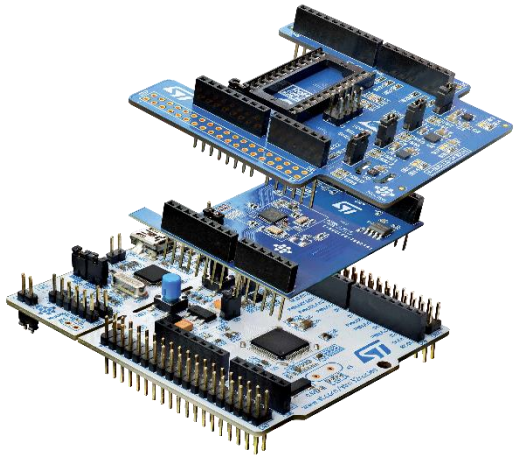
General-purpose microcontrollers
Secure microcontrollers

Process — PROCESS

Software



STM32 Open Development Environment



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