Hello, and welcome to the presentation of the STM32L476G discovery kit (32L476GDISCOVERY). It covers the main features of the discovery board dedicated to the STM32L4 series. The demos included with the STM32L476G discovery kit will allow you to become more familiar with this new high-performance, low-power microcontroller.
The STM32L476G discovery kit embeds a high precision ammeter for measuring the current consumption of the STM32L476 microcontroller in Run and low-power modes. Other demos within the demonstration firmware include audio recording and playback, a simple LCD display, compass and guitar-tuning applications and more. The discovery kit also embeds a debugger that helps you develop your own applications from the existing examples.
The STM32L476 microcontroller (MCU) features an ARM® Cortex®-M4F core running at up to 80 MHz, 1 Mbyte of Flash memory and 128 Kbytes of RAM. It also features a rich set of peripherals including USB On-The-Go allowing a direct connection with other USB devices without the need for a host computer.

Some other hardware highlights from the discovery board include:
A high precision current ammeter with 4 ranges and auto-calibration, based on an STM32L152 MCU
ST’s own high-performance MEMS motion sensors, including a 3-axis accelerometer, 3-axis magnetometer and 3-axis gyroscope
An ST MEMS-based digital microphone
An audio digital-to-analog converter with a 3.5 mm jack output
A liquid crystal display with 24 segment and 4 common lines
A four-direction joystick to navigate through the demonstration menus
16 Mbytes of Quad-SPI Flash memory to store large data arrays or program code
An embedded ST-LINK/V2-1 debugger/programmer for connecting your favorite development tools.

This board incorporates 3 distinct STM32 devices: the target, the debugger and the MCU used to measure the current.
The discovery kit has two main power supply modes. It can be supplied by USB if you plug in a type-B mini USB cable. For this, make sure:
- The RST and ST-LINK jumpers are set
- The JP5 jumper is set to IDD
- The JP6 jumper is set to 3V3

It can also be supplied by a battery if you insert a CR2032 battery into the socket placed at the back of the board. For this, make sure:
- The RST and ST-LINK jumpers are removed
- The JP5 jumper is set to IDD
- The JP6 jumper is set to BATT
Now, let's look at the demos included in the STM32L476G discovery kit.
The four-direction joystick is used to navigate through the demonstration menus on the LCD screen.

When supplied via USB, the MCU automatically goes into low-power mode after 10 seconds of user inactivity. When supplied by the battery, the MCU will enter low-power mode after 4 seconds of inactivity. The MCU wakes up when the joystick is moved.
The demonstration firmware features 8 applications. This diagram shows the available menus and sub-menus you can browse through.
The IDD application measures and displays the IDD current consumption in different MCU power modes. The VDD application uses the STM32L476’s ADC and internal voltage reference to measure the VDD supply voltage.
The RECORD application provides a 48 kHz audio recording and storage mechanism via the Quad-SPI Flash memory interface.
The PLAYER application plays back in loops any WAV file stored in the internal Flash or Quad-SPI Flash memory after a record sequence. Earphone volume can be adjusted during playback.
The COMPASS application uses the embedded eCOMPASS MEMS device with its 3D magnetometer. It
requires the user to first perform a calibration step and then displays the rotation angle.
The SOUND Meter application uses the on-board MEMS digital microphone and displays the ambient sound level in decibels.
The GUITAR tuning application requires an acoustic guitar to work. First select the string you want to tune and the application will tell you how far from the correct pitch your string is.
Finally, the OPTIONS menu will allow you to select whether low-power mode is entered upon user inactivity and displays various board information.
This menu is used to select the power mode from a subset of the STM32L4 low-power capabilities whose current consumption will be measured. First, use the joystick to select the power mode (Run, Sleep, Low-power run, and the other modes shown here) and the measurement will be displayed on the LCD. Typically, you will observe that the STM32L476 consumes in the range of 1.3 µA in Stop 2 mode and 70 nA in Shutdown mode at 3 V at room temperature. You may want to reuse the demonstration firmware to design your own low-power application.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Run</td>
<td>Run 24 MHz, voltage range 2, PLL off, RTC/LSE off, Flash ART on</td>
</tr>
<tr>
<td>Sleep</td>
<td>Sleep 24 MHz, voltage range 2, PLL off, RTC/LSE off, Flash ART on</td>
</tr>
<tr>
<td>Low-power run</td>
<td>Low Power Run 2 MHz, PLL off, RTC/LSE off, Flash ART on</td>
</tr>
<tr>
<td>Low-power sleep</td>
<td>Low Power Sleep 2 MHz, PLL off, RTC/LSE off, Flash ART on</td>
</tr>
<tr>
<td>Stop 2</td>
<td>RTC/LSE off, Flash ART off</td>
</tr>
<tr>
<td>Standby</td>
<td>RTC/LSE off, Flash ART off, RAM retention off</td>
</tr>
<tr>
<td>Shutdown</td>
<td>RTC/LSE off, Flash ART off</td>
</tr>
</tbody>
</table>
The RECORD application uses the MP34DT01 MEMS digital microphone (LED5 toggling during recording) to store 16-bit audio samples at 48 kHz stored in N25Q128A13 Quad-SPI Flash memory. Push joystick LEFT to exit.

The PLAYER application plays back in loops any WAV file stored in the internal Flash or external Quad-SPI Flash memory. If both memories contain a WAV file, you can select from a sub-menu which one you want to play. It uses a CS43L22 audio codec to output the audio data on the 3.5 mm jack. Earphone volume can be adjusted during playback.
In order to program the WAV file in internal Flash, you can use the STM32 ST-LINK Utility. This tool allows you to get various STM32L476VGT6 device information and program, erase and verify new firmware in internal or external Flash memory. Option bytes can also be set using the ST-LINK Utility.
The COMPASS application uses ST’s LSM303C eCOMPASS MEMS device to sense the earth’s magnetic field. Before using this demo, the user must first calibrate the device by quickly rotating the board 360 degrees in all 3 axes. The user can then select the RUN sub-menu to display the board’s direction in degrees.

The SOUND meter application uses ST’s MP34DT01 digital microphone and displays the ambient sound level in decibels.
The GUITAR tuning application helps the user tune his acoustic guitar. First select the string you want to tune and place the discovery board close to the sound hole. The sound is continuously recorded until valid samples are detected; then the MCU displays on the LCD screen whether the pitch is correct or if the string needs to be tightened or loosened.
For more information on the low-power STM32L476G discovery kit, go to www.st.com/STM32L4-DISCOVERY. You can also watch our videos on our YouTube channel.

Thank you.