

ANDROID THINGS AND VOICE ASSISTANT

CHEN XINYU
20, APR, 2017



PUBLIC



SECURE CONNECTIONS
FOR A SMARTER WORLD

Agenda

- Android Things Overview
- Android Things RoadMap
- NXP Android Things Solution
- NXP Voice Assistant Solution

ANDROID THINGS OVERVIEW





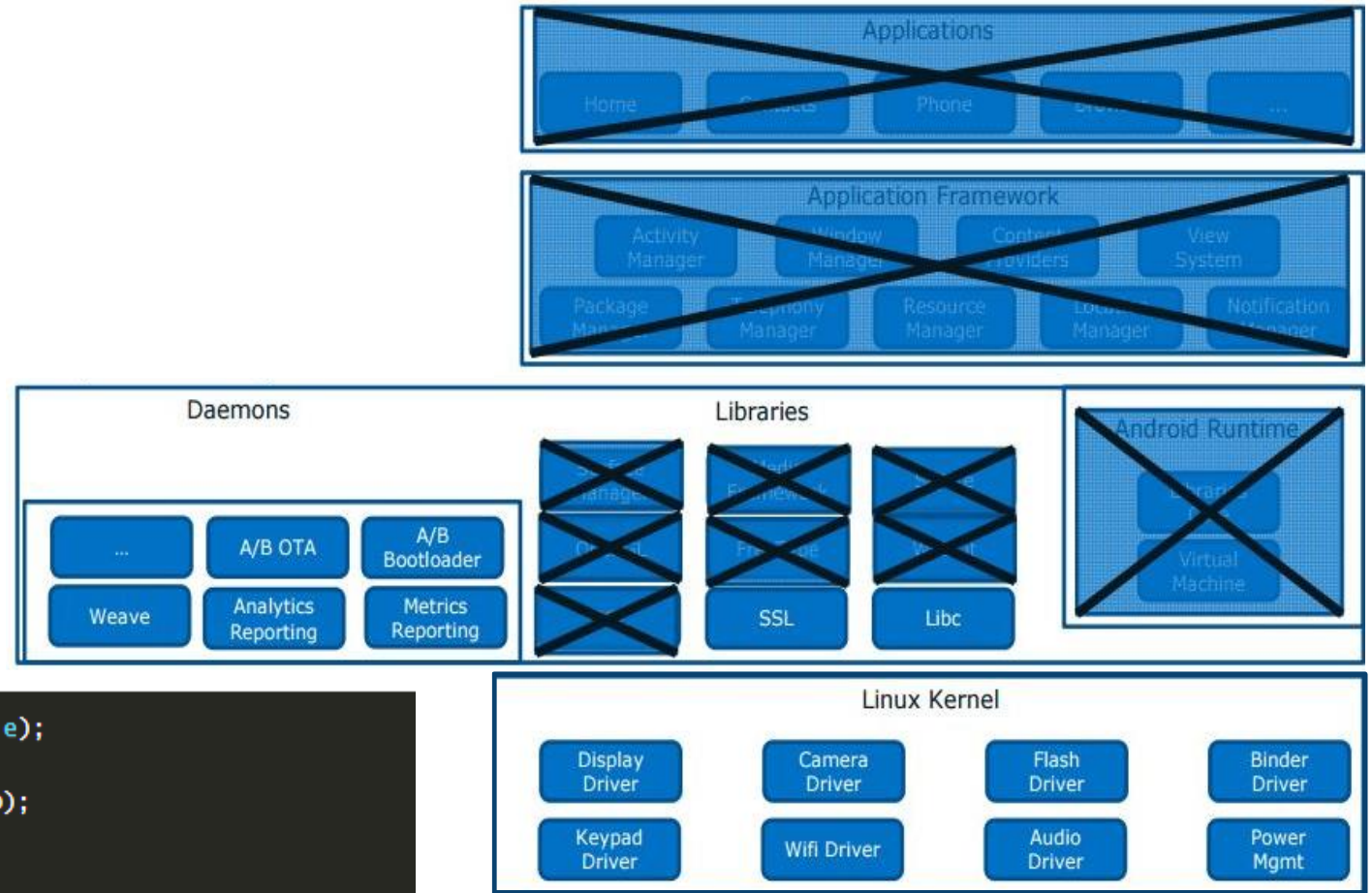
Brillo 1.0

- **Is** an embedded OS based on Android for the IoT market
- **Has** a small memory footprint that makes it ideal for smart connected devices (32MB of RAM minimum)
- **Targets** home and office devices such as Thermostats, fire alarms, connected camera, smart lighting systems (Google OnHub)
- **Core Services** provide the ability to manage and monitor devices in the field (WEAVE, OTA, Metrics/Crash Reporting)



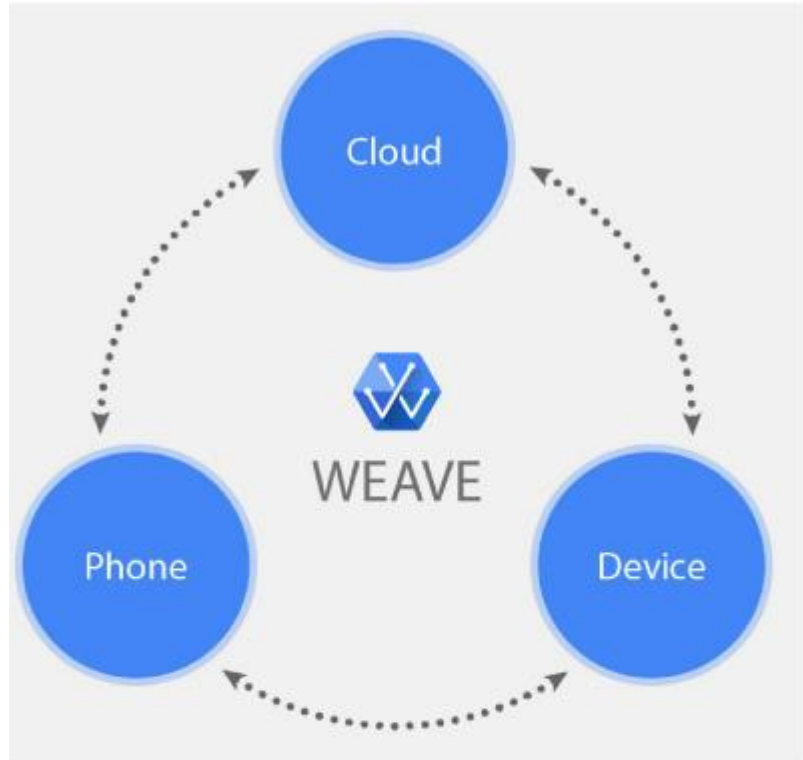
Brillo 1.0

- C/C++ Environment
- Binder IPC
- **No Java Application, Framework or Runtime**
- No Graphics
- 32 or 64 Memory Footprint (minimum)
- Development Application like writing **Device HAL** in Android



```
1 int ret = hw_get_module(LIGHTS_HARDWARE_MODULE_ID, &module);
2 if (ret || !module)
3     err(1, "Failed to load %s", LIGHTS_HARDWARE_MODULE_ID);
4 ret = module->methods->open(module,
5                             LIGHT_ID_NOTIFICATIONS,
6                             reinterpret_cast<struct hw_device_t**>(&light_device));
7 if (ret || !light_device)
8     err(1, "Failed to open %s", LIGHT_ID_NOTIFICATIONS);
```

What is Weave



- A communications platform for IoT devices
- Device setup, phone-to-device-to-cloud communication
- User interaction from mobile devices and the web
- Transports: 802.15.4 (zigbee, threads), BLE, WiFi, Ethernet, Others possible
- Schema Driven (json) Associates Weave XMPP requests with application function invocations
- Web apps may be written with Google API support
- OAuth 2.0 Authentication, Google as AS





android
things

Android Things (Brillo 2.0)

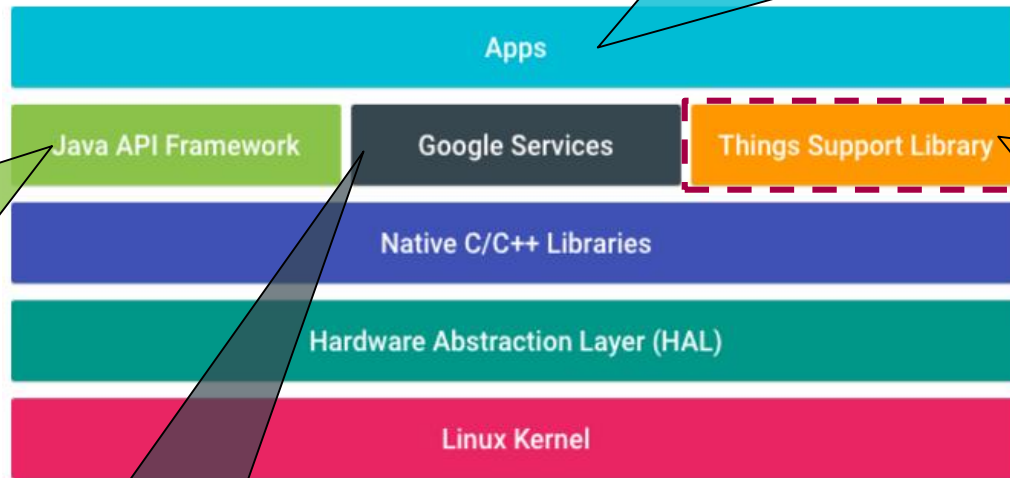
- **Based on Nougat 7.0**
 - Totally different vs Brillo 1.0
 - Java Framework, Runtime, App has been kept.
- **The Android ecosystem**
 - Leverage existing Android development tools, APIs, resources, and a thriving developer community.
- **New APIs for IoT devices**
 - Develop with new Android framework APIs that provide low level I/O and libraries for common components like temperature sensors, display controllers, and more.
- **Trusted security**
 - Take advantage of regular best-in-class security updates by building on top of the Android OS.



Android Things (vs Android)

Remove some standard suite of system apps and content providers: `CalendarContract`, `ContactsContract`, `DocumentsManager`, `DownloadManager`, `MediaStore`, `Settings`, `Telephony`, `UserDictionary`, `VoicemailContract`

- Displays are optional (no status or navigation bar)
- Home activity support (auto launch on boot)



- **Peripheral I/O API**
 - The Peripheral I/O APIs let your apps communicate with sensors and actuators using industry standard protocols and interfaces. The following interfaces are supported: GPIO, PWM, I2C, SPI, UART.
- **User Driver API**
 - User drivers extend existing Android framework services and allow apps to inject hardware events into the framework that other apps can access using the standard Android APIs. E.g, GPS, HID, Sensors.

Supports a subset of the [Google APIs for Android](#)



Android Things API's & services

Hardware

- Camera
- Microphone
- Audio
- Touchpad
- Peripheral IO
- Accelerometer
- Temperature
- Compass
- Gyroscope
- Light
- Pressure
- Humidity
- Infrared

Networking

- Bluetooth
- WiFi
- WiFi Direct
- NFC
- Cellular

Interaction

- Step counter/detector
- Tilt/orientation detector
- Glance, pick-up, wake-up gesture detector
- Magnetic field sensor
- Heart rate sensor
- Media playback/encode
- Text-to-speech translator
- Proximity detector

GCore*

- Account/Login
- Location/Places
- Activity Recognition
- Mobile Vision
- Nearby
- Analytics
- Cloud Messaging
- Drive
- Firebase
- Google Fit
- Wear

Everything on Android and some more

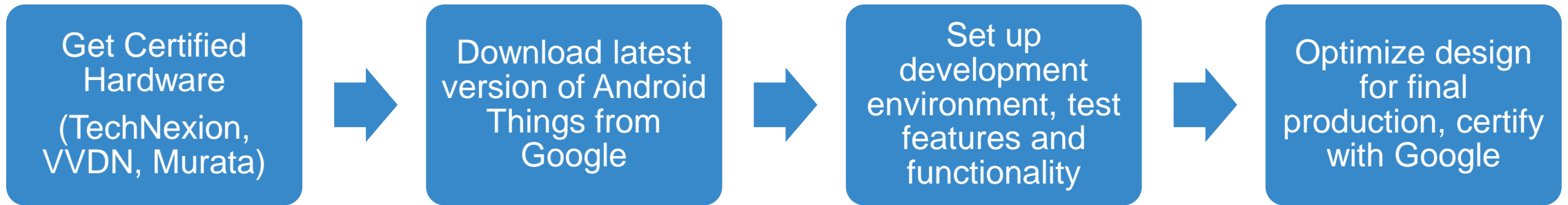
Android Things

- **Faster Time to Market**
 - Write code once, runs on all devices
 - Tap rich Android ecosystem & services
- **Predicable Scaling Costs**
 - Certified hardware
 - Production ready HW & SW
 - Buffered from security issues & upgrade cycles
- **Security at Scale**
 - Google managed updates
 - Verified boot & hardened platform
 - Analytics of crash

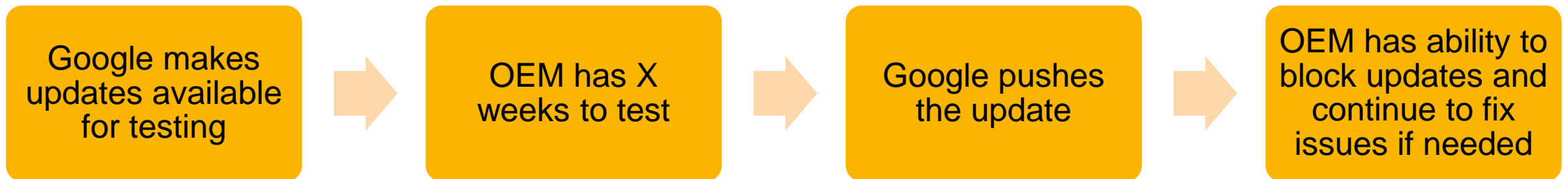
Android Things makes building devices as easy as creating Android Apps

Engagement Model

- **Development**



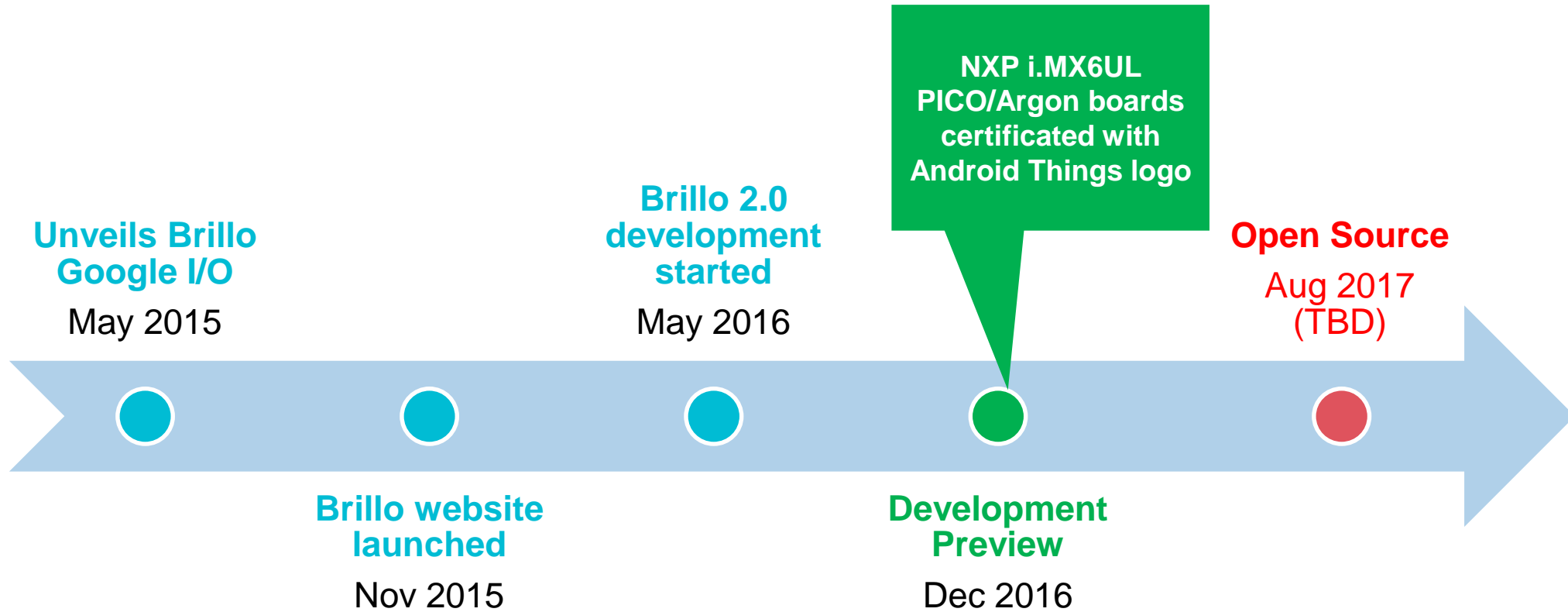
- **Management**



ANDROID THINGS ROADMAP



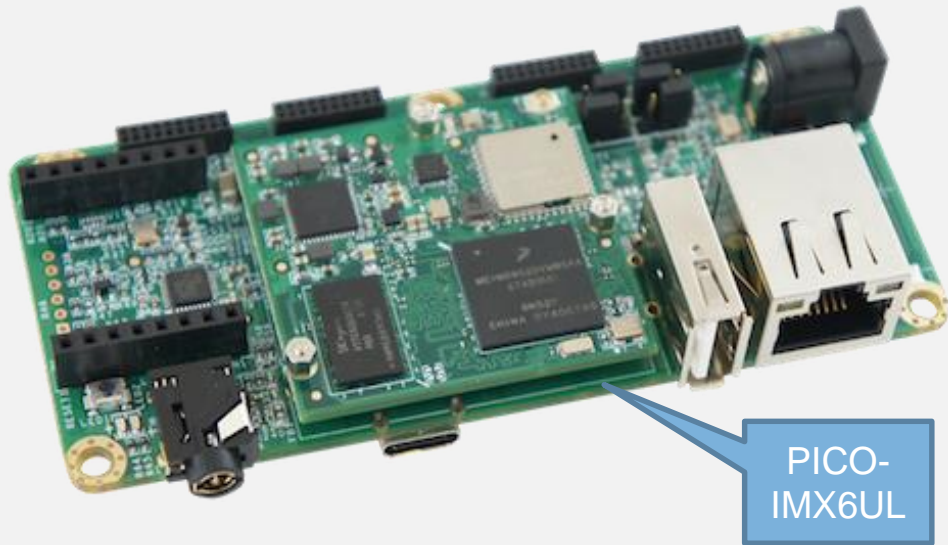
Android things Roadmap



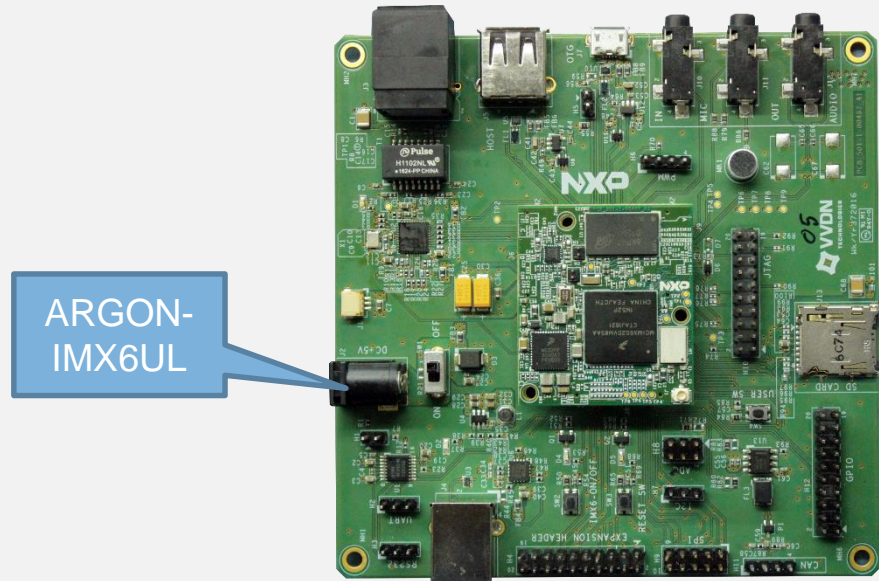
NXP ANDROID THINGS SOLUTION



NXP Android Things



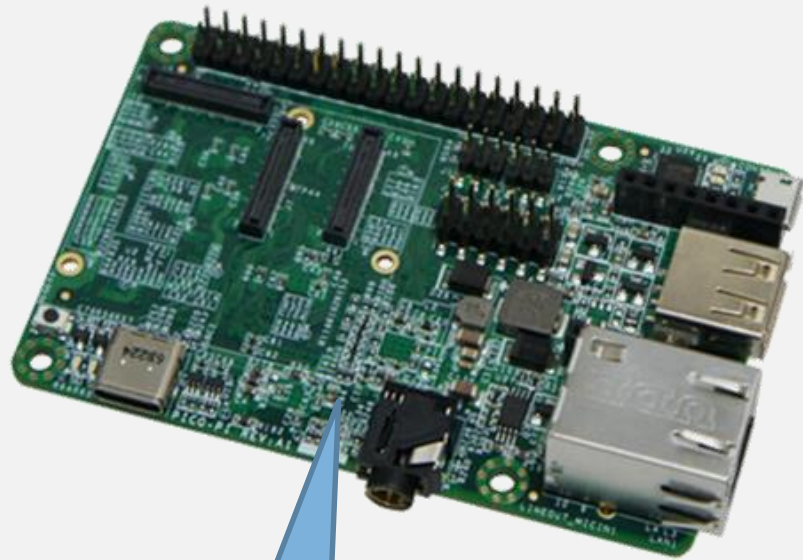
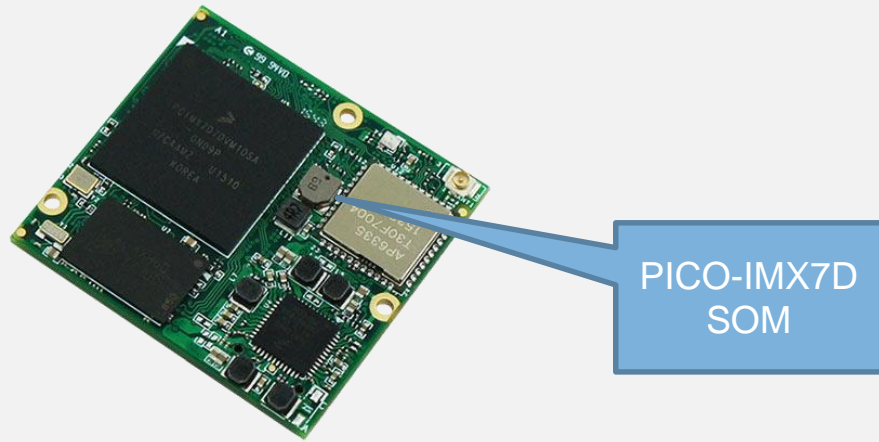
- NXP one of the lead SoC partners
- Two NXP partner boards are approved and carry the Android Things logo:
 - PICO-IMX6UL (Made by TechNexion)
 - ARGON-IMX6UL (Make by VVDN Technologies)



- Launch
 - Google launched with Blog on main Android page and dedicated Android Things community.
<https://developer.android.com/things/preview/download.html>
 - NXP Blog, press release and launch Android Things landing page on NXP.com.
<http://www.nxp.com/AndroidThings>

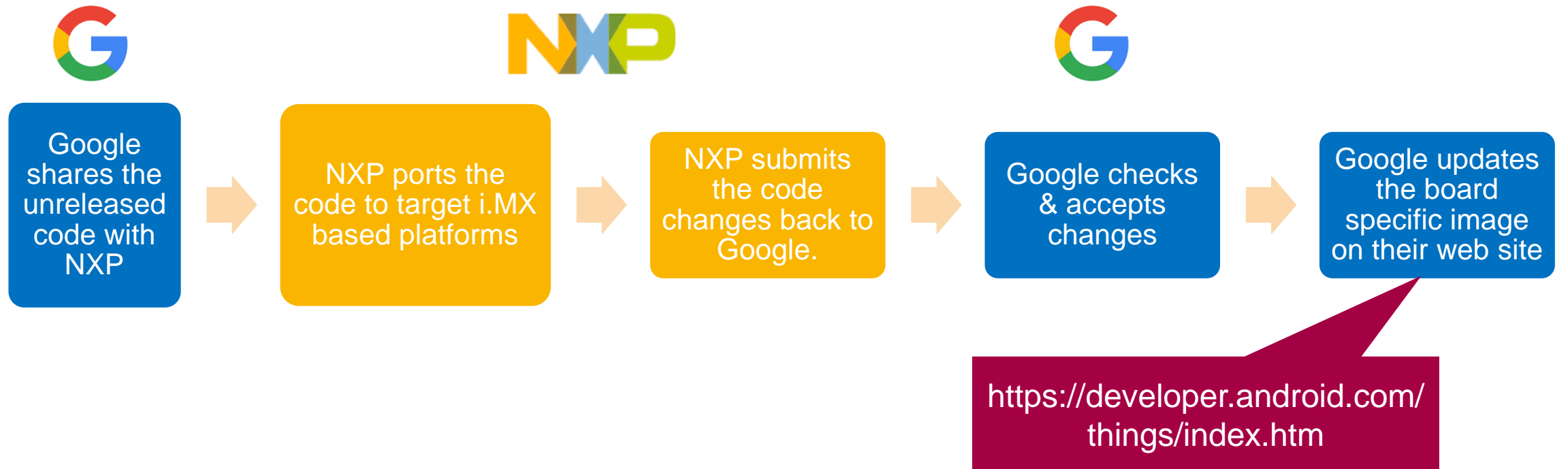


NXP Android Things



- PICO-IMX7D board would be available by end of April, certificated by Google. It features:
 - i.MX7D. Dual ARM Cortex-A7 (up to 1.2GHz) + Cortex-M4 (Heterogeneous Multicore Processing architecture)
 - 2G DDR3L, 4G eMMC
 - BCM4339 Wifi+BT combo
 - Raspberry PI compatible General Purpose I/O header

NXP Android Things (Workflow)



NXP Android Things (FAQ)

Q: How do I gain access to the to the developer kit and console ?

A: <https://developer.android.com/things/index.htm>

Q: Where do I get support:

A: Level 1: via the Android Things G+ community at g.co/iotdev

Level 2: NXP will support customers using the i.MXCommunity.com

Level 3: FAE's and apps engineers for targeted projects

Level 4: Professional services and support

Q: Is there any licensing or certification associated with Android Things:

A: Android Things source code posted to the AOSP will follows the same license structure as Android. There is a certification process for devices that want to go to production. This requires meeting the parameters of the Compatibility Test Suite, similar to the current Android certification model.

VOICE ASSISTANT SOLUTIONS



Voice Ecosystem Choices

amazon alexa

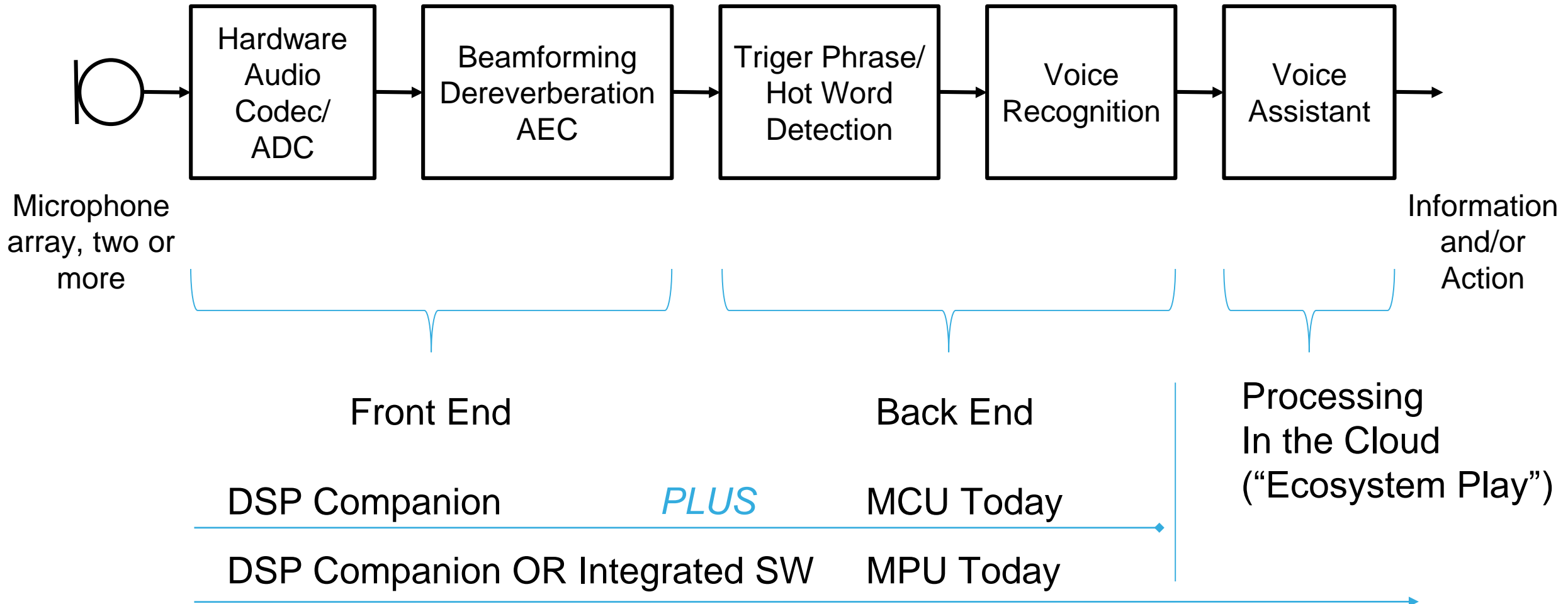


Hi, how can I help?

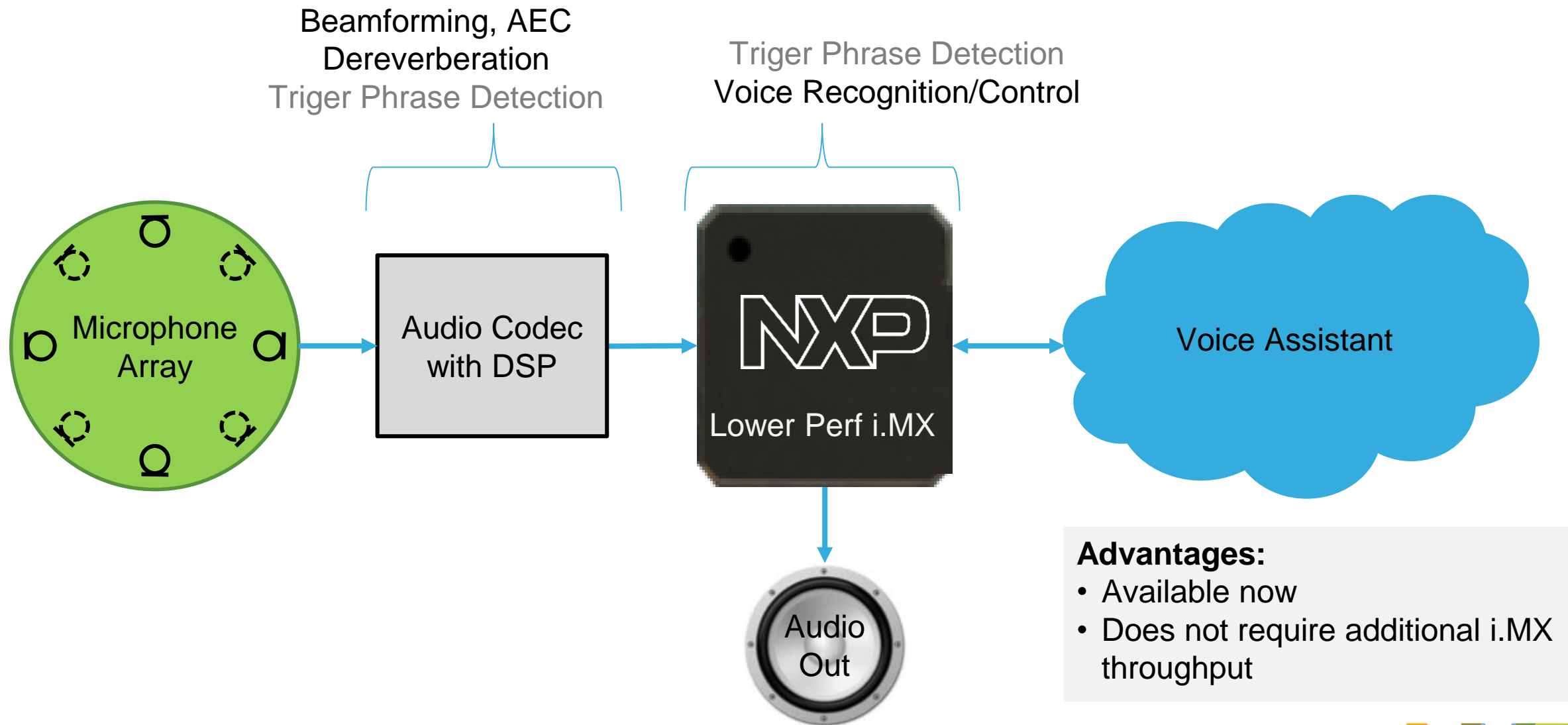


Hi, I'm Cortana.

Breakdown of the Voice Control Technology

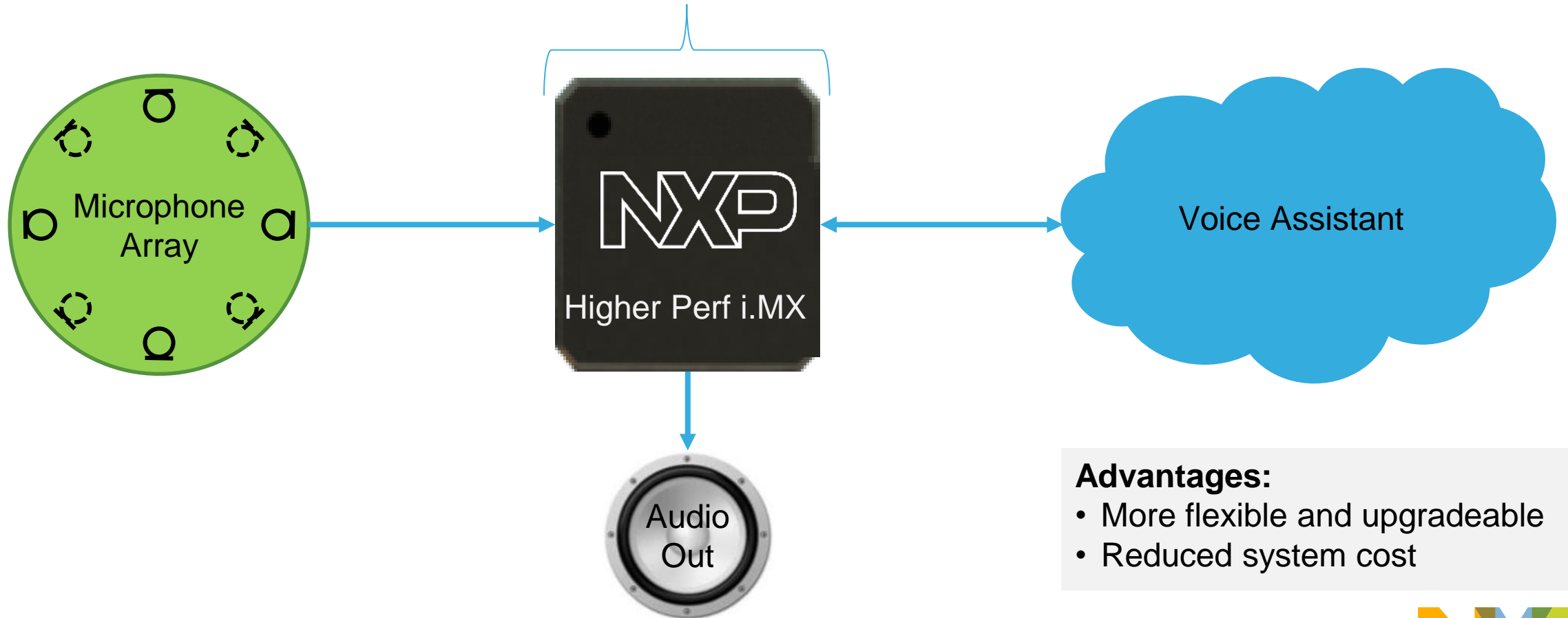


Voice System with Hardware Front End

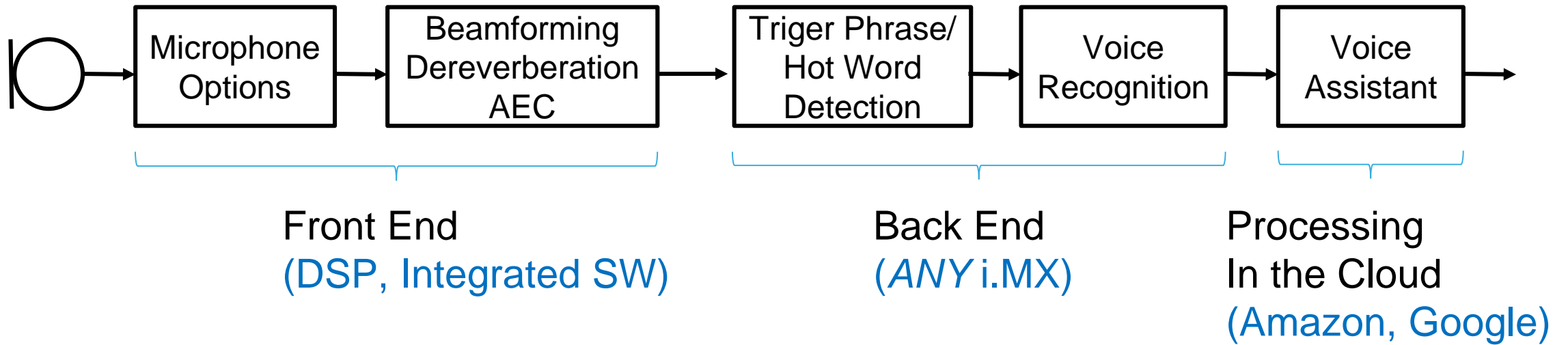


Voice System with Software Front End

Beamforming, Dereverberation, AEC
Triger Phrase Detection
Voice Recognition/Control



i.MX Solution Details



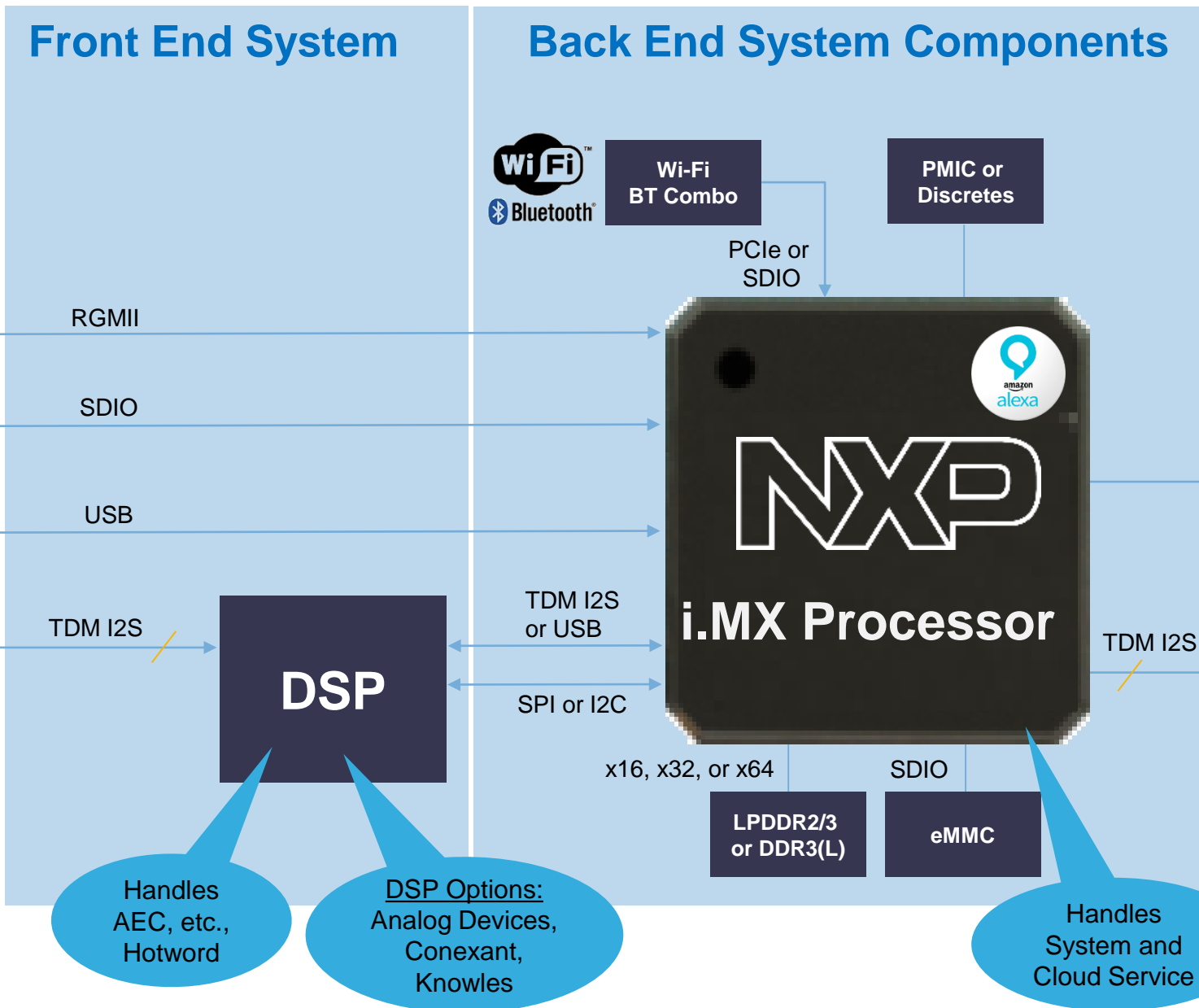
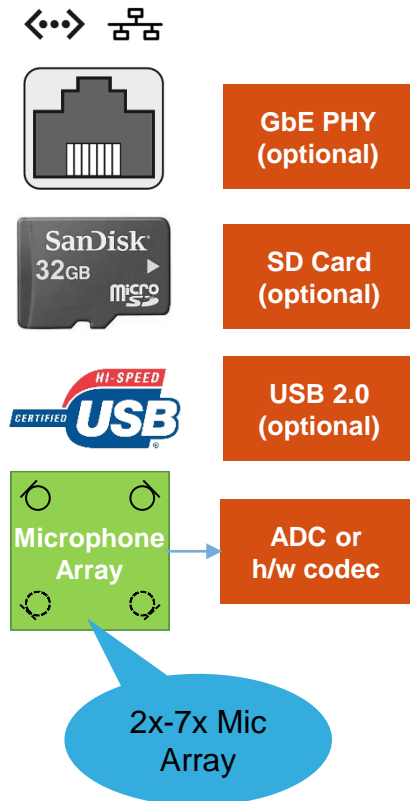
NXP Options	#Mics	Local Acoustic Processing (DSP Chip, Algorithm)	Trigger Phrase/Hotword	Cloud Service/Assistant
Amazon Solution	7	DSP (ADI, Amazon) **AMZ Reference**	Amazon or 3rd Party	Amazon Alexa
	2	DSP (Conexant, Conexant)		
	2-3	DSP (Knowles, Knowles)	Amazon or 3rd Party	Amazon Alexa
	2-8	SW (N/A, Limes Audio)		
Google Solution	2	N/A (Cloud) **Google Reference**	Google (w/ or w/o 3rd Party)	Google Assistant

AMAZON ALEXA OPTIONS

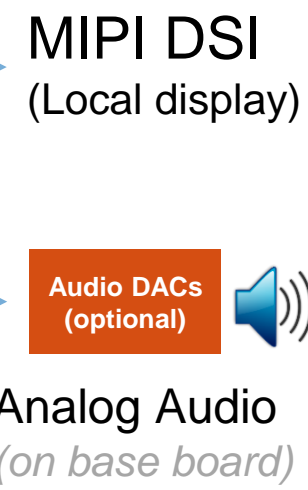


DSP Front End + i.MX Backend System Block Diagram

Audio Sources



Output Paths

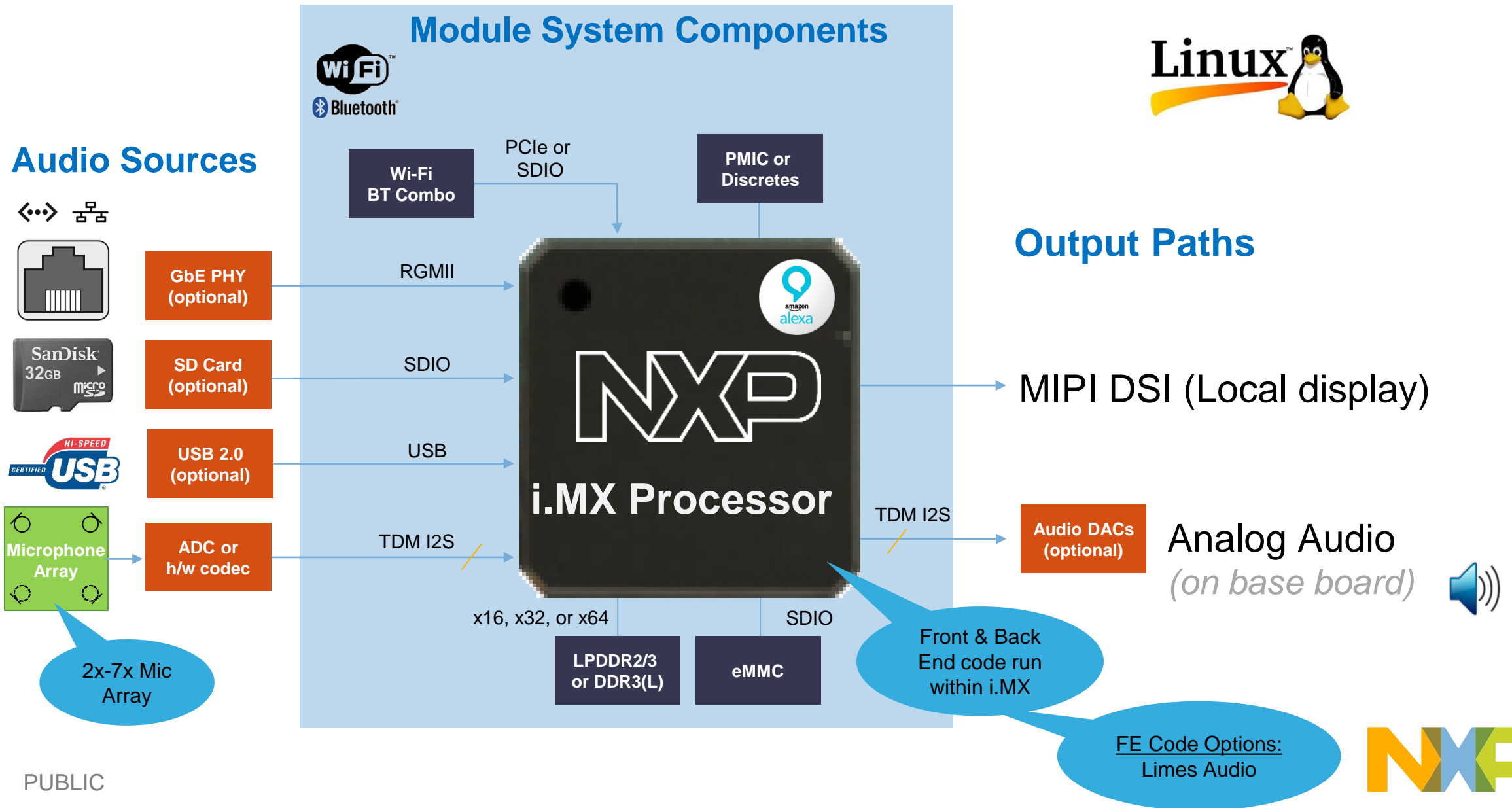


Handles AEC, etc., Hotword
 DSP Options: Analog Devices, Conexant, Knowles

Handles System and Cloud Service

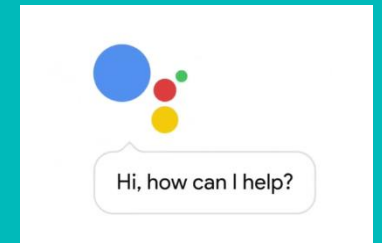


Software Front End + Back End System Block Diagram (using i.MX)



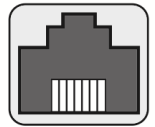


GOOGLE CAST & GOOGLE ASSISTANT OPTIONS



Google Cast System Block Diagram (Audio Playback Only)

Audio Sources



GbE PHY
(optional)

SD Card
(optional)

USB 2.0
(optional)



Output Paths

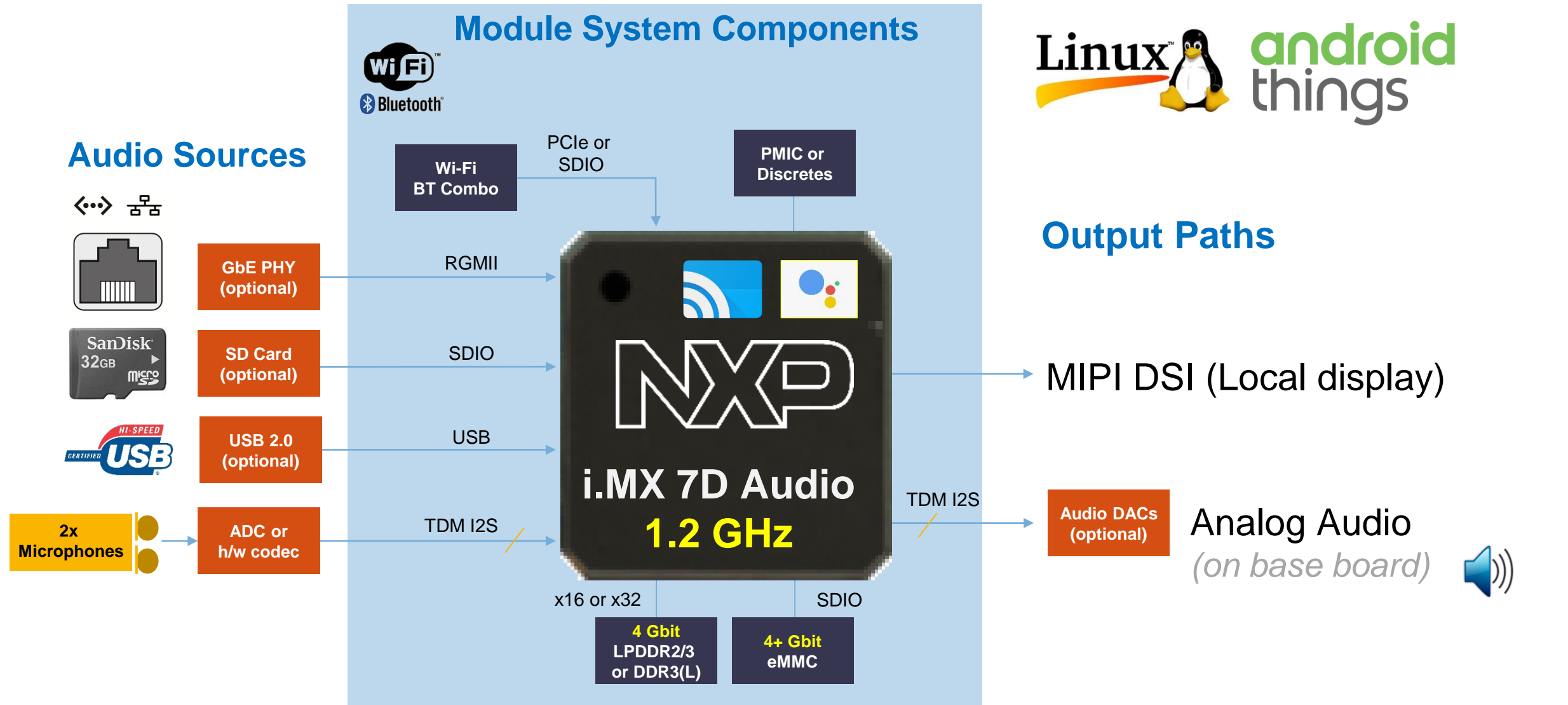
MIPI DSI (Local display)

Audio DACs
(optional)

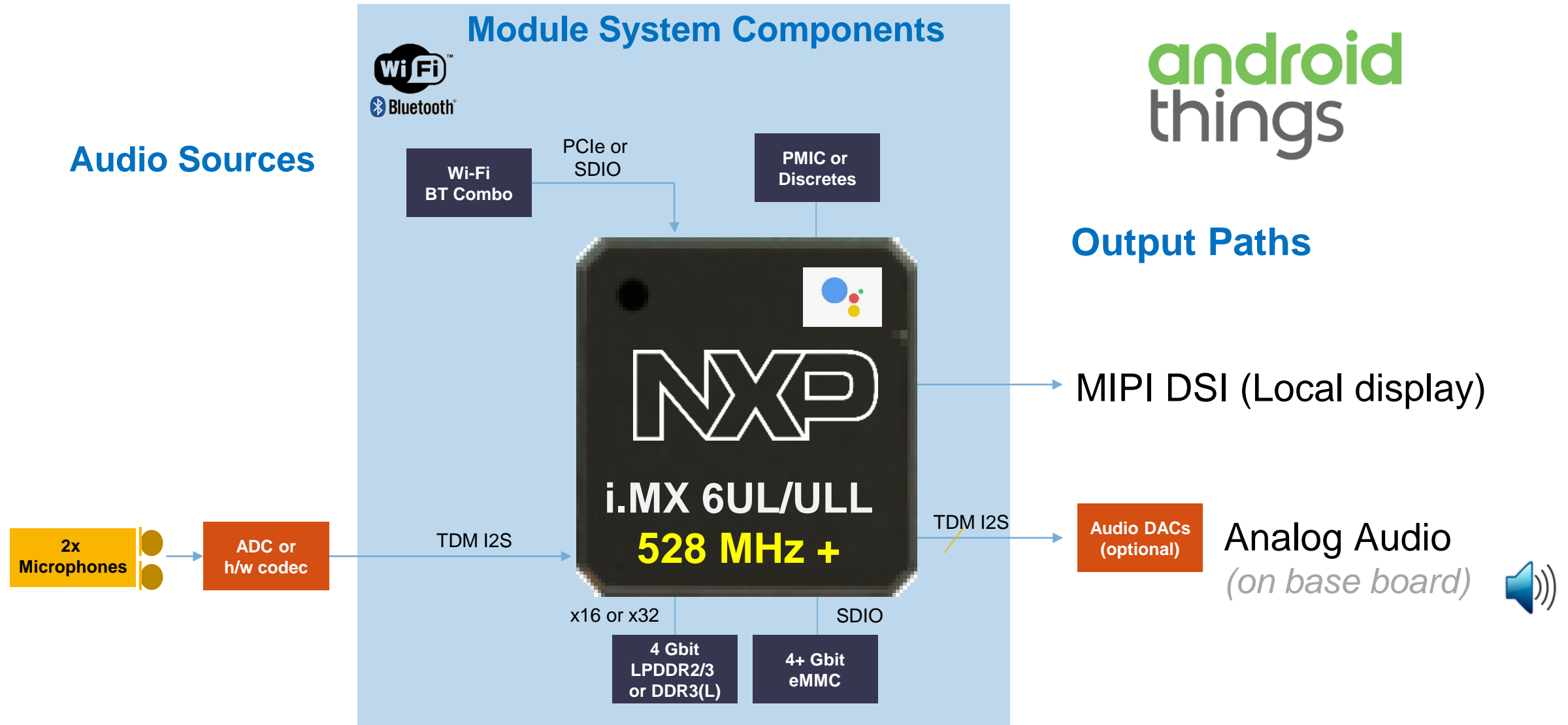
Analog Audio
(on base board)



Google Cast + Google "Home" System Block Diagram



Google "Home" System Block Diagram

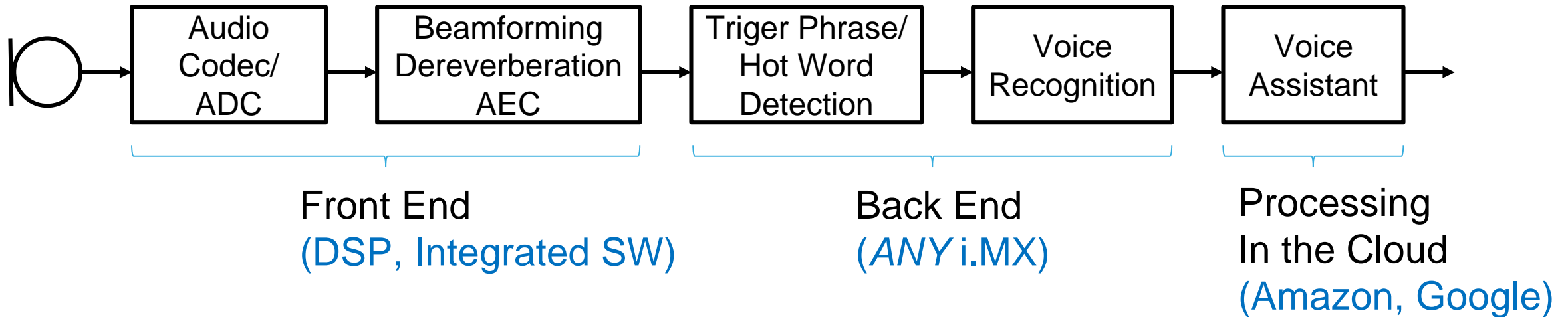


Google Cast Systems Resource Comparison

Component	Google Cast only	Google Cast + Google Assistant	Google Assistant only
i.MX Processor	i.MX 7D @ 1.0 GHz	i.MX 7D @ 1.2 GHz	i.MX 6UL/ULL @ 528MHz +
LPDDR2/3 or DDR3	2 Gbit	4 Gbit	4 Gbit
eMMC	2 Gbit	4 Gbit	4 Gbit
Microphones (qty)	No	Yes (2)	Yes (2)
Local Music Media/Interfaces	Yes	Yes	None (simple?)
Audio Output System	Mono or multi-channel	Mono or multi-channel	Mono only
Operating System	Linux	Linux/Android Things	Android Things



NXP Solutions



DSP-based Options: (all use i.MX 7D Sabre Board)

- 1) “Amazon Reference Platform”: Mics + DSP (ADI) + i.MX
- 2) i.MX DSP Platform 2: Mics + DSP (Conexant) + i.MX
- 3) i.MX DSP Platform 3: Knowles (Mics + DSP) + i.MX

Integrated Software Options: (all use i.MX 7D Sabre Board)

- 4) “Google Reference Platform”: Mics + i.MX



SECURE CONNECTIONS
FOR A SMARTER WORLD