

## CASE STUDY

## Comarch Experience in Bluetooth



## The Bluetooth Phenomenon

Effective and smooth connectivity plays a crucial role in the fast-changing, digitized reality. Bluetooth technology has been a part of our lives for decades – from the earliest, basic, very limited 1.0 version to today's advanced specifications and popular gadgets such as smartwatches, earbuds, and other wearables. Among the essential innovations proposed to work using Bluetooth in recent years are True Wireless Stereo and Low Energy Audio.

# Comarch Competencies

**Comarch is ready to provide services in the following areas:**

- Firmware development:
  - Bluetooth Classic and Bluetooth Low Energy (also BLE Mesh)
  - Integration of various sensors into wearable audio devices, for example, touch sensors with gesture recognitions, proximity sensors, accelerometers.
  - Active noise cancelling implementation
- Companion apps development
- Quality assurance as an integral part of other services
- Interoperability testing
- On-site production line support
- Hardware development consultancy

## Tier 1 Customer (Consumer Audio)

**Bluetooth 4.2 Headset** (A2DP, HFP, AVRCP, proprietary profile)

- Firmware development
  - CSR8675
  - Cypress DSP chip (other functionalities)
- Development of additional non-standard functionalities
- Integration of libraries from different suppliers
- Codecs integration and external codecs optimization
- Quality assurance
- Manufacturing test tools development
- Production line support

**Bluetooth 5.0 Headset with telemetric** (A2DP, HFP, AVRCP, proprietary profile)

- Firmware development
  - CSR8675
- Quality assurance
- Manufacturing test tools development
- Production line support
- Companion application development for PC and mobile
  - Firmware upgrade
  - Headset configuration
  - Telemetric acquisition

**Bluetooth 5.0 Ear buds** (A2DP, HFP, AVRCP, proprietary profile)

- Bluetooth connection between each ear bud for stereo audio
  - Qualcomm family chip
- Integration of various sensors
  - touch sensors
  - proximity sensor
  - accelerometer
- Over the air update
- Charging case SW developed from end to end
- Non-standard communication between charging case and ear buds





# Hearing Aid Platform Development

Creation of the platform for development and testing of hearing aid devices for one of the top medical devices manufacturers (agile approach, Scrum).

## Technologies:

- Bluetooth,
- RTOS,
- C++,
- Python
- ARM,
- Telemetry,
- Battery management.

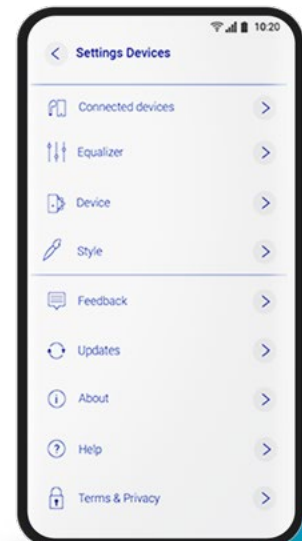
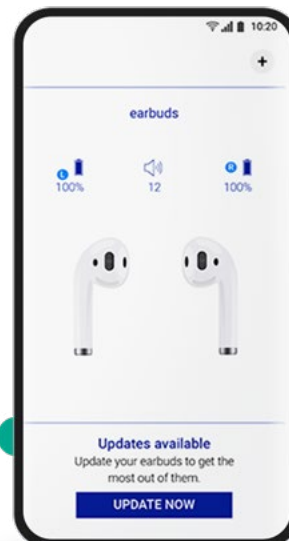
# Automotive Bluetooth Transmitter

## Project scope:

- **System architecture, Bluetooth firmware design, MCU to Bluetooth module protocol design**
- **Implementation of Bluetooth transmitter module**
- Deliverables: binaries, software release notes, software code, software documentation, test results, error reports
- **Transmitter MCU mock simulator** (UART communication for testing)
- Complete and **independent project management** including setting up development environment for Comarch tasks
- **Hardware review and HW issues resolving support**
- **Complete QA**
- **BT SIG certification support** (including internal PTS test).
- **Delivering documentation** for implemented SW and related processes
- **Onsite workshops**, Hardware prototypes bring-ups (four HW versions)
- Project started with **incomplete scope**, flexible approach to delays in the project due to HW delays

# Companion Apps

- Companion apps delivered for leading consumer electronics and premium audio OEM's
  - Including mobile apps development takeover from other provider
- Mobile and desktop applications for device management
- Reference applications for connectivity modules manufacturer, for example: HomeKit implementation, BLE Mesh



# Cooperation Between Dialog Semiconductor and Comarch

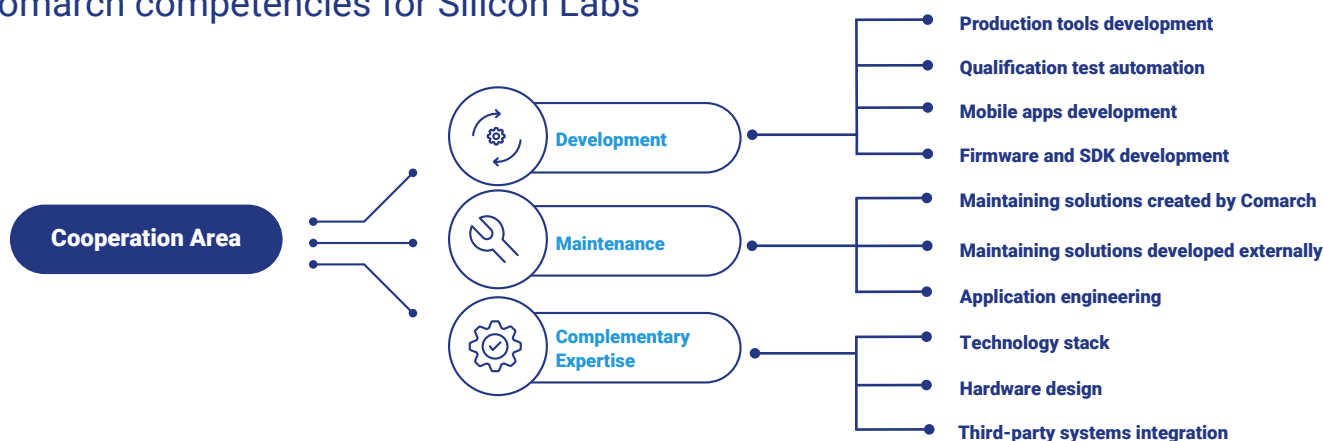


Dialog Semiconductor is an international manufacturer of semiconductor-based solutions. Founded in 1985, Dialog now has almost 40 years of hands-on experience regarding matters such as integrated circuits, mobile and Internet of Things devices, and smart home applications. Comarch's cooperation with Dialog Semiconductors began in the middle of 2021. As part of the cooperation, Dialog and Comarch decided to work together to further develop and improve the TWS-based chip solution. Comarch provided a **hands-on experienced team of engineers**, members of which were specialized in software development, especially in **audio technologies**, such as True Wireless Stereo and wireless connectivity using Bluetooth Low Energy and Bluetooth Classic.

## Comarch and Silicon Labs Cooperation



### Comarch competencies for Silicon Labs



## Firmware Development and Maintenance for Wireless Connectivity Modules - Bluetooth Classic, BLE, Dual Mode

### Project tasks:

- Design and implementation of various features for wireless modules
- Fixing reported bugs and provide technical feedback and support for developed functionalities
- HomeKit integration with BLE and OpenThread stacks
- Testing and verifying current implementation against vulnerabilities reported for BT LE, BR/EDR
- Automation of tests against BT SIG qualification tool for BT Mesh devices

