Case Study
Automotive Bluetooth Transmitter
Challenges

• Highest quality standards for automotive project
• Scope not completely defined in the beginning of the project
• Innovative solution with four Bluetooth modules in a single device
• Project divided into software and hardware modules developed by different companies
• Timeline and scope changes during the project
Project Scope

- System architecture, Bluetooth firmware design, MCU to Bluetooth module protocol design
- **Implementation of transmitter Bluetooth module** software in line with transmitter release plan. Software update over MCU, UART protocol for MCU/DSP implementation, audio/DSP configuration, Bluetooth state machine, AVRCP support, test modes
- 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**
Project Scope

- **Complete QA.** Unit testing (full coverage), sanity testing, performance and stress testing, functional testing, protocol testing, interoperability testing
- Continuous integration system and tests automation
- SonarQube for testing MISRA standard compliance
- **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 caused by HW delays
Project Plan

BT: base configuration (for a specific board)
BT: development - base implementation (BT state machine)
MCU SIMULATOR on PC: mock of Transmitter MCU UART comm
BT: TEST Transmitter configuration
BT: HW integration (HW version 1,2,3), production test tools
BT: CSR dev board setup, I2S source for testing setup
BT: Audio / Kalimba configuration
BT: Fixing errors/improvements
BT: UART protocol for MCU/DSP control - implementation
BT: AVRCP commands to UART - implementation
BT: software update over MCU
BT: sleep mode configuration
BT: Approbation, Validation and Factory tests implementation
BT: finalizing production test tools and test modes
BT: Coding Standard compliance/verification
BT: OEM’s requirements compliance/verification
BT: Documentation
BT: BT SIG certification support (including internal PTS test)
Remote Support - 3 months, max 4 man-weeks

QA
Automatic tests environment setup
Test scenarios development
Test documentation (templates)
General QA (all other than IOP - test modes, MCU/DSP comm etc)
IOP QA (10 HS models)
Project Metrics – Tasks in Jira

- Tasks in JIRA: 491
  - Development tasks (sub-tasks not included)

- Tasks in JIRA for IOP testing: 689
  - Project included: 11 test plans, 70 test case templates (about 50 as core tests).

  689 is a sum of test plans, test case templates and test case executed with devices from the market.
Project Metrics – Source Code Complexity, Unit Tests, Statical Analysis

Reliability - Issues in this domain mark code where behavior other than expected is possible.

Security - Issues in this domain mark potential weaknesses to hackers.
Automated Test Setup

- **80 keywords** – a keyword is like a function or block and it is used to build a more complex test case.

- **98 test cases** – tests are categorized in 20 groups depending on tested functionality.

- Test run needs **1.5 hours**. Locally, it is possible to run a whole group of tests or one specific test.
Result

✓ Comarch’s partner accepted final delivery
✓ All expected and unexpected challenges that Comarch and its partner had to face have been resolved
✓ Comarch developed high-performance software compliant with automotive standards
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Developing the future