

# EMBEDDED SOFTWARE ENGINEERING



## IBV – YOUR DEVELOPMENT PARTNER

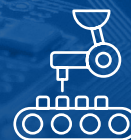
IBV provides software engineering services for embedded systems and real-time applications. Our team of software experts with different skills will accompany you from the product idea, through the design and implementation of the embedded software, to the launch of your product on the market.



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## IBV – SOFTWARE EXPERTISE IN TECHNICAL INDUSTRIES

IBV offers services and products across all industries. Due to our long-time project experience we are able to bring in a special industry know-how for some target markets. For example, we are familiar with the technologies, applicable norms and standards. This enables us to react to inquiries from these markets in a targeted manner and to create optimal software solutions.



**INDUSTRIAL  
AUTOMATION**



**MEDICAL  
TECHNOLOGY**



**IOT  
SMART HOME  
SMART ENERGY**



**MEASUREMENT  
TECHNOLOGY**

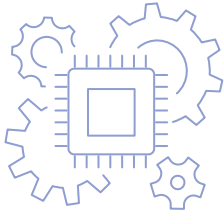


**TELECOMMUNI-  
CATIONS**

# IBV – ENGINEERING SERVICES

As a development partner, we design and implement customer-specific software on modern micro-controllers and embedded processors. Our team of experts offers a wide range of experience to transform the requirements and challenges of your project into modular and robust future-proof software with efficiency.

## Embedded Operating Systems

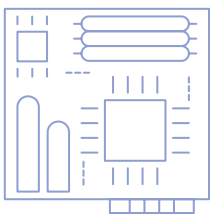


- Selection, integration and customization of embedded operating systems
- Development of boot loaders and board support packages (BSPs)
- Porting of existing applications to other operating systems
- Single-core and multi-core solutions
- Hypervisor technologies
- Analyses of performance and real-time behaviour, implementation of optimizations

### OPERATING SYSTEMS

- Embedded Linux, Linux Preempt-RT (Yocto, Buildroot, PTXdist, ...)
- Xenomai
- QNX Neutrino RTOS
- FreeRTOS
- RTOS-32, ...

## Hardware-related Software



- Consulting for the selection of processors and boards
- Driver and BSP development
- Performance analyses and optimizations
- Integration of hardware and software, support for bring-up of custom boards

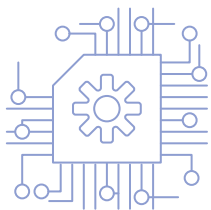
### PROCESSORS AND SOCS

- ARM Cortex-A (NXP i.MX, Xilinx Zynq, TI Sitara, TI Jacinto, ...)
- Heterogeneous systems with ARM Cortex-M/-R processors
- Intel x86, ...

### INTERFACES

- Ethernet, WLAN, Bluetooth, PCIe, USB
- SPI, I<sup>2</sup>C, UART, CAN
- SD Card, eMMC, SATA, NOR, NAND
- Memory, DMA, Graphics, ...

## Software for Microcontrollers



- Consulting on the selection of microcontrollers
- Development of startup code, boot loaders and drivers
- Integration of operating system, network stack, file system, connectivity
- Implementation of firmware update functionality
- Application development

### MICROCONTROLLERS

- ARM Cortex-M (STM32, NXP i.MX RT, NXP LPC, ...)
- ARM Cortex-R (Sitara AM243x)
- Microchip PIC32, Espressif ESP32, Infineon XMC, ...

### OPERATING SYSTEMS AND FRAMEWORKS

- FreeRTOS
- TI-RTOS
- lwIP
- SEGGER embOS, ...

## Firmware development for FPGAs

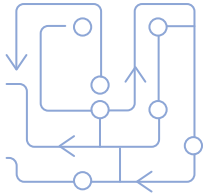


- Consulting for the selection of FPGA technology
- Implementation of the logic in VHDL and Verilog
- Integration of IP cores and soft cores
- Interfacing of FPGAs to CPUs
- Performing timing analyses

### FPGA TECHNOLOGIES

- AMD Xilinx (Zynq, Artix, Spartan, MicroBlaze), Vivado Design Suite
- Intel (Cyclone, MAX, Nios), Quartus Prime
- Lattice (ECP5, ...), Lattice Diamond
- ...

## Fieldbus Integration



- Consulting for the selection of the communication technology
- Integration of protocol stacks
- Implementation of master and slave systems
- Configuration of networks
- Solutions for time synchronization of network devices
- Support with conformance tests

### FIELDBUS TECHNOLOGIES

- EtherCAT MainDevice (Master)
- EtherCAT SubDevice (Slave)
- CAN, CANopen
- TSN (IEEE 802.1Qbv, IEEE 802.1AS)
- OPC UA, open62541
- PROFINET
- Modbus TCP, Modbus RTU
- ETHERNET POWERLINK MN, CN

## Embedded Security

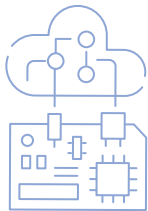


- Support for implementing secure embedded systems according to IEC 62443
- Support for risk assessments based on threat analyses
- Identification and evaluation of protective measures
- Implementation of security features

### TOPICS

- Secure Boot for embedded processors and microcontrollers (verified boot, measured boot)
- Certificates und certificate management
- Encryption
- Integration with TPM, OP-TEE, ...
- Access control and rights management
- Security patch management
- Secure firmware update

## Connectivity



- Connecting embedded systems to the internet and cloud
- Development of communication protocols
- Integration of web servers
- Software update over-the-air
- Implementation of applications for IoT gateways

### TECHNOLOGIES

- Wi-Fi, Bluetooth, BLE, Ethernet
- TLS, HTTPS, MQTT, AMQP, REST, ...
- XML, JSON, ...
- Microsoft Azure
- nginx, lighttpd, Apache, Node.js, ...

## User Interfaces



- Development of user interfaces for microcontrollers, embedded systems and desktop applications
- Development of browser applications
- Development of prototypes for usability testing
- Solutions for internationalization and multilingualism

### GRAPHIC FRAMEWORKS AND TECHNOLOGIES

- Qt, QML
- Microsoft WPF, Windows Forms
- HTML 5, Angular
- Vue.js
- SEGGER emWin
- Embedded Wizard
- QNX Photon
- Crank Storyboard

## Application Development



- Technology consulting for the selection of hardware and software platforms
- Implementation of feasibility studies
- Support with software requirements analysis
- Creation of software architectures and software designs
- Porting of existing applications to other operating systems or a different hardware platform
- Development of complete embedded applications



## ETHERCAT MASTER STACK

IBV offers software solutions for industrial communication under the brand icNET which are especially designed for the use on embedded systems. With the icNET software solutions from IBV you can integrate a tested implementation into your product and bring it faster and cheaper to market.

### Our services



**Technology consulting, analyses, proof of concepts**



**Requirements engineering and software design**



**Software implementation of single modules or complete applications**



**Test and documentation of the software**



**Integration of hardware, software, third-party components**



**Maintenance and support**



**including project management for the development at IBV**

**icECAT.**  
EtherCAT Master Stack  
for Embedded Systems

- Optimal performance
- Small footprint
- Royalty-free

**icECAT.**  
Configuration Library

Library supporting the EtherCAT network configuration suitable for integration in a custom engineering tool

### Our principles

#### 1. We offer more than just "manpower"

IBV performs the complete project handling of the software development, including project management.

#### 2. The best solution for the customer

... is always in the focus at IBV. We offer services independent of products and technologies.

#### 3. Reliable software investment

A good software architecture ensures long-term investment security for the development. Therefore, we develop the software modular and, if desired, portable.

#### 4. IBV as part of the customer project

If desired, we adapt the development process, tooling and documentation formats of our customers.

#### 5. Working with transparency

We maintain proactive communication and regularly report the status of the project. We deliver all source codes.

## IBV – CONTACT

Our experts are available to talk about your project and take your inquiry:

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