Capabilities Overview

Konsulko Group

Over 25 years experience in Embedded Linux and Open Source Software Development

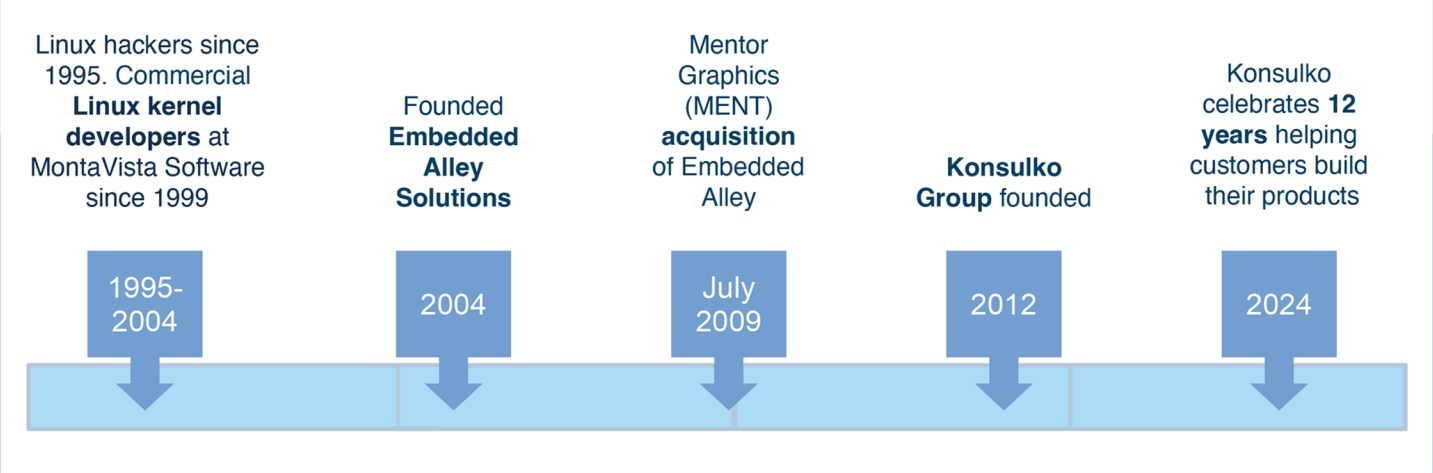
- Embedded Linux Software
- Yocto Project / OpenEmbedded
- Security
- Software Updates
- Automotive Software
- Audio
- RTOS and Bare Metal
- Hardware Design and Integration

Helping companies around the world develop successful products, offering consulting, product engineering, support and capability building at every stage of the engagement.

www.konsulko.com

Konsulko Group

Founded by successful Silicon Valley entrepreneurs with lengthy history in commercial OSS ecosystem and embedded systems markets



Experts in commercial development, committed to Linux and Open Source

Konsulko Group has been privileged to work with outstanding customers, helping them build the software for exciting and essential devices and vehicles.

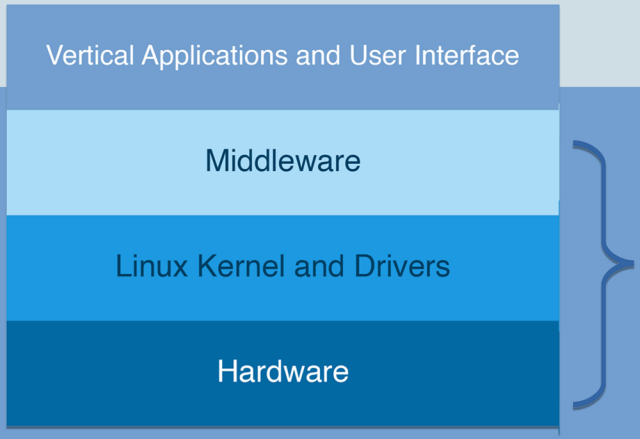
From Level 5 autonomous taxis and open source automotive platforms to innovative consumer devices, from lifesaving medical devices and advanced robotic surgery tools to the high-end networking equipment that powers the Internet, Konsulko has worked on groundbreaking products that impact and shape our lives, now and into the future.

Embedded Linux Hardware and Software services

- Development and porting of bootloader, Linux kernel, Linux device drivers and RTOS or Bare Metal software
- Upstream Linux kernel, Yocto Project, and userspace expertise
- System architecture including split MCU and Linux SoC hardware designs
- Boot time and other performance optimizations
- Security (secure boot, verified boot, encryption, IMA/EVM)
- Debugging complex hardware and software problems in the field
- Remote debug of deployed units
- Hardware design verification and consulting
- Schematics and board layout review
- Selection of components
- New hardware bring-up and debug

Konsulko Group is privately held, headquartered in San Jose, California, with a globally distributed engineering team across the US and Europe

Konsulko Group engineers average 25 years of hands-on experience working in open source community projects and developing commercial products based on embedded Linux.



Konsulko engineers provide particular expertise at the system level

Contributors to OpenEmbedded, Yocto Project, U-Boot, Automotive Grade Linux (AGL) and the Linux kernel

- Konsulko's senior leadership have been contributors in the Linux kernel and other OSS communities since the late 1990s.
- Konsulko team members serve on the OpenEmbedded Board of Directors and the Yocto Project Technical Steering Committee.
- Our engineers have previously served as Yocto Project Architects at Texas Instruments and Intel Corporation. We collectively have worked on hundreds of exacting (and sometimes pioneering) commercial projects in the OpenEmbedded/Yocto Project universe.

Yocto Project/Open Embedded services

- OpenEmbedded Build System configuration and optimization
  - Boot time optimization
  - Image and filesystem optimization for size and resiliency
- Custom integration of key technologies or additional Yocto layers
  - OTA/Software Update (Mender, RAUC, libostree based solutions
  - Secure boot
  - Robot Operating System: meta-ros
  - Systemd, Wayland and/or X11 integrations
  - Integration of 3rd party cloud technologies
- Nvidia L4T migration to Yocto-based solution
  - Elimination of L4T bash scripts, conversion to Yocto best practices
  - Secure boot integration on Nvidia platforms
  - Application developer SDK
- Migration of complex projects to Yocto Project
  - From other build systems
  - From home-grown build systems
- Migration to newer Yocto Project releases
  - Migration
  - Uplift
- Continuous Integration (CI) process
  - Integration
  - Optimization
  - Long-term support
- Virtualization: Construction of OE-based virtualized solutions with containers
- License compliance, SBOM
- Vulnerability Identification: Testing, Tracking
- Custom installers for in-field migration from embedded OS to Linux
  - WinCE to Linux
- Application development
  - SDK
  - Workflow integration
- Quality Assurance
  - QA documentation
  - Testing

Embedded Linux services

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- Boot time and other performance optimizations

Security services

- Chain of trust solutions from power on through applications and software update
- Secure boot (NXP i.MX6/7/8; NVIDIA Tegra K1/X1/X2/Xavier; R-Car3; TPM-based systems)
- U-Boot verified boot support
- dm-verity verified root filesystem support
- dm-crypt and fs-crypt encrypted filesystem support
- dm-integrity integrity support for encrypted volumes
- Hardware Security Manager (HSM) enabled kernel and middleware key management
- Linux Kernel Integrity Measurement Architecture (IMA/EVM)
- Architecture and implementation of end-to-end conditional access systems including:
  - Software implementation of modern crypto algorithms running on smart card or embedded microcontrollers
  - Server side OS hardening and lockdown

Software Update

- Flexible update strategies
  - Traditional A/B update
  - Binary delta incremental updates for performance and bandwidth conservation
  - System only or application only updates
- Flexible update delivery mechanisms
  - OTA (Over The Air) wired or wireless network updates
  - Physical update media (USB, UART, SD/MMC)
- Secure update support
  - Signed and encrypted update payloads
- Build system integration
  - Hardware Security Manager (HSM) key management
- Solutions: Mender, RAUC, swupdate, Aktualizr-lite

Automotive In-Vehicle Infotainment (IVI)

- Full system architecture
- Performance analysis and tuning
- Audio/Video integration and optimization
- Audio/Video Bridging
- Multiple display support
- Connectivity (Bluetooth, Radio, WiFi, 3g/4g)
- Secure Incremental Software Update

Audio

- Support for all three major Linux audio frameworks on projects: ALSA, PulseAudio, PipeWire
- Extensive experience in complex multi-PCM TDM audio systems including 10 channel amplifier systems and 8-12 microphone arrays

Hardware Integration and Design

- **ECG, EEG, Blood Pressure, Pulse Oximetry, and Bioimpedance**
  - Capturing, conditioning and processing
  - Transmission over network
  - Logging, storage, compression
  - Analysis
- **Sensors**
  - MEMS/hall based (accelerometers, gyro, magnetic)
  - Shock, movement, proximity, displacement
  - Particle/spectrum-specific
  - Distance measurement
  - Temperature, humidity
  - Gas sensors
- **Wireless communication**
  - ISM and Mobile spectrum, GPS
  - LoRaWAN, Bluetooth/BLE, Wi-Fi, 3G, LTE, NFC, etc.
  - Integration and developing of proprietary protocols
  - Antenna integration and matching
- **Low power applications**
  - Battery powered
    - with non-replaceable primary battery for the life of the product
    - with chargeable battery
    - with energy harvesting technology
  - Precise low-power timekeeping
  - Accurate battery life estimation
- **System architecture design**
  - Distributed acquisition systems
  - Telemetry, distant monitoring, data collection, tracking and localization of roaming stations
  - Collection, logging, storage, transmission of data
  - Network connectivity: wired and wireless (GSM, Bluetooth, Ethernet, CAN, LIN, power line)
  - Server/Client/Database applications for data collection, storage, management and processing
  - End-user applications (PC or mobile)

RTOS and Bare Metal

- FreeRTOS, NuttX, and Zephyr RTOS
- GCC, LLVM, debugger, and profile/trace tool development
- Jailhouse and Xen virtualization
- Hardware prototyping, design, layout, and manufacturing

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