Brochure

USB armory by WithSecure™ Foundry

WITH secure

WithSecure™ Foundry

We live in a physical as well as digital world.

WithSecure™ Foundry mission is to secure embedded products from conception to completion with world-class testing, engineering, and implementation.

We are breakers and makers, testing and building software and hardware products from the ground up since 2005.

This has given us a pragmatic engineering mindset that makes those products not only effective and secure, but practical to implement in your organization.

The USB armory is WithSecure™ Foundry own creation, built from the ground up, to showcase its capabilities and enable innovative security applications.

USB armory Mk II

The USB armory is the world smallest secure computer. It can safeguard data and run trusted applications, preventing unauthorized access or execution. Minimal attack surface, vast performance and capabilities.

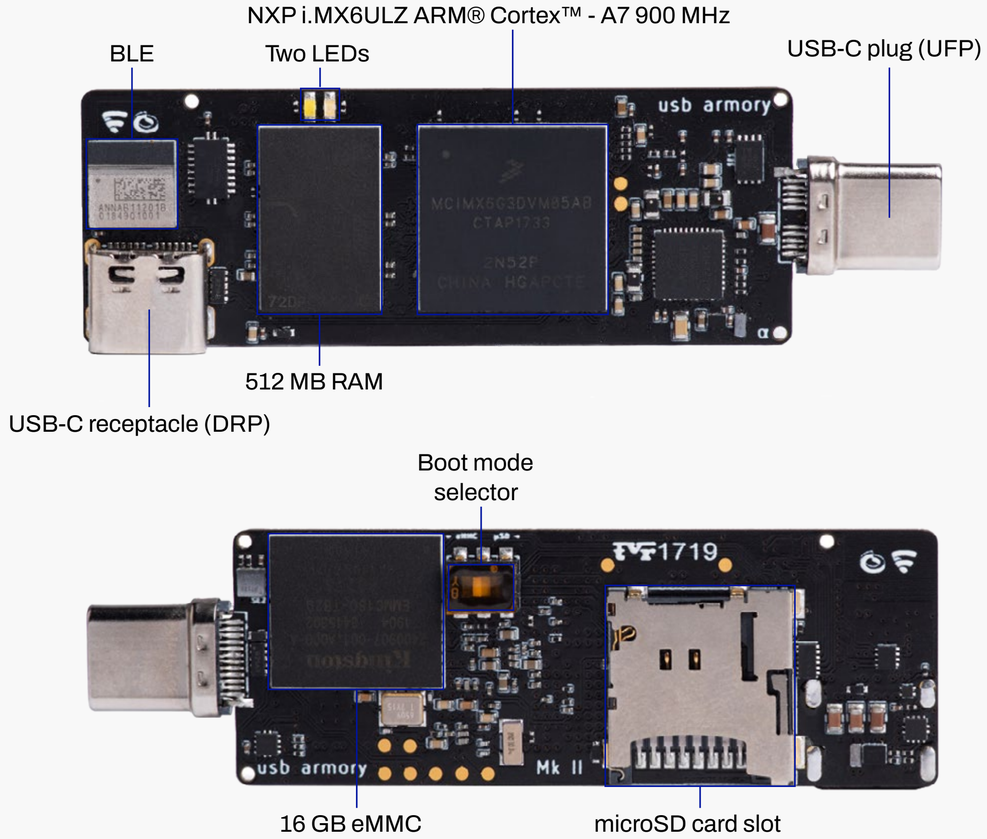
Compact. Customizable. Secure.

Fits right in your pocket, your laptop, your servers.

Introduction

The compact USB powered device is a Single Board Computer which provides a platform for developing and running a variety of applications, thanks to its capabilities and unique form factor.

The features of the USB armory System-on-a-Chip (SoC) and security elements empower developers and users with a fully customizable USB trusted device for innovative applications.



Applications

The capability of implementing arbitrary USB devices in combination with the USB armory speed, the security features and the flexible and customizable operating environments, makes the USB armory the ideal platform for all kinds of personal security applications.

The USB armory is a prime platform for the following applications:

- Encrypted storage solutions
- Hardware Security Module (HSM)
- Enhanced smart cards
- Electronic vaults (e.g. cryptocurrency wallets)
- Key escrow services
- Authentication, provisioning, licensing tokens
- USB firewall

Specifications

- NXP ARM Cortex™-A7 SoC: i.MX6ULZ 900 MHz or i.MX6UL 528 MHz
- RAM: 512 MB or 1 GB DDR3
- Flash memory: 16 GB eMMC
- USB 2.0 over USB-C: DRP receptacle (host/device), UFP plug (device)
- microSD card slot
- Bluetooth module: u-blox ANNA-B112 BLE
- Debug accessory support for CAN (i.MX6UL only), UART, GPIO, SPI, I^2C
- Supported by standard Linux kernels and distributions
- Supported by TamaGo for bare metal Go applications
- Open Hardware & Software

Bespoke transparency

The USB armory has been developed entirely in-house by WithSecure™ Foundry and is manufactured in Italy.

The schematics and layout are open to the public as well as its core software, drivers and tools.

This gives unparalleled transparency to all customers

open hardware

open source initiative

Security Features

The USB armory incorporates a vast number of features that can support a wide variety of security architectures. Its capabilities allow the safe storage of data as well as the trusted execution of operating environments and their applications, natively on the device itself.

Beyond simple smartcards or security tokens, **the USB armory is a personal, self-contained, secure server.** With standard TCP/IP over USB or Bluetooth connectivity the USB armory can be easily interfaced with.

Feature	Use	Variants
HABv4	Secure Boot	all
RNGB	TRNG	only i.MX6ULZ
DCP	Cryptographic acceleration	only i.MX6ULZ
CAAM	Cryptographic acceleration, TRNG	only i.MX6UL
SNVS	Secure Non-Volatile Storage	all
BEE	On-the-fly external RAM encryption	only i.MX6UL
TZ ARM	TrustZone	all
SE050	External cryptographic co-processor	all
RPMB	Protected flash memory region	all

The **HAB** feature enables on-chip internal Boot ROM authentication of initial bootloader (i.e. Secure Boot) with a digital signature, establishing the first trust anchor for code authentication.

The **CAAM** (i.MX6UL) and **RNGB** (i.MX6ULZ) provide true random number generation for cryptographic operations.

The **CAAM** (i.MX6UL) and **DCP** (i.MX6ULZ) provide cryptographic acceleration for encryption and hashing functions.

The built-in **Bluetooth** (BLE) module and the external **microSD** slot, in combination with the security features, allow secure wireless communication and storage expansion.

WithSecure™ Foundry provides drivers and tools for all USB armory security features and use cases. Our **consulting services** enable porting existing customer applications on the USB armory secure environment as well as the bespoke design and implementation of innovative applications.

The **SNVS** (Secure Non-Volatile Storage) enables encrypted storage of arbitrary data using unique keys. A device specific random 256-bit OTPMK key is fused in each SoC at manufacturing time, this key is unreadable and can only be used by the CAAM (i.MX6UL) or DCP (i.MX6ULZ) for AES encryption/decryption of user data. Combined with Secure Boot (HAB) this allows complete lockdown of data through a trusted application.

The **BEE** is included only in boards mounting the i.MX6UL SoC, it supports on-the-fly (OTF) AES-128 (ECB or CTR) encryption/decryption on the AXI bus, allowing OTF DRAM encryption.

The NXP **SE050** features hardware acceleration for elliptic-curve cryptography as well as hardware based key storage.

The eMMC **RPMB** features allows replay protected authenticated access to flash memory partition areas, using a shared secret between the host and the eMMC.

Applications

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The transparency of the open and minimal design for the USB armory hardware facilitates auditability and greatly limits the opportunity and scope of supply chain attacks.

The built-in Bluetooth (BLE) capability enables communication outside the USB ports, allowing authentication and interaction with mobile devices.

The USB armory breaks the conventional models of encrypted drives or security tokens, by providing a **self-contained secure computer.**

The execution of cryptographic and security operations, sensitive data and keys, remain on the device itself which can interact securely with its connected hosts or clients.

The USB armory does not merely take part in security operations, such as conventional smartcards or security elements, but rather **executes and contain all of them within its core.**

Opposed to traditional USB devices, the USB armory **can authenticate peers on its own** and refuse untrusted connections.

Consumer

- Encrypted storage solutions
- Cryptocurrency wallet
- Authentication token
- Secure password manager

Enterprise

- Hardware Security Module
- Secure document store/sharing
- Enterprise authentication token
- Trusted Execution Environment

OEM

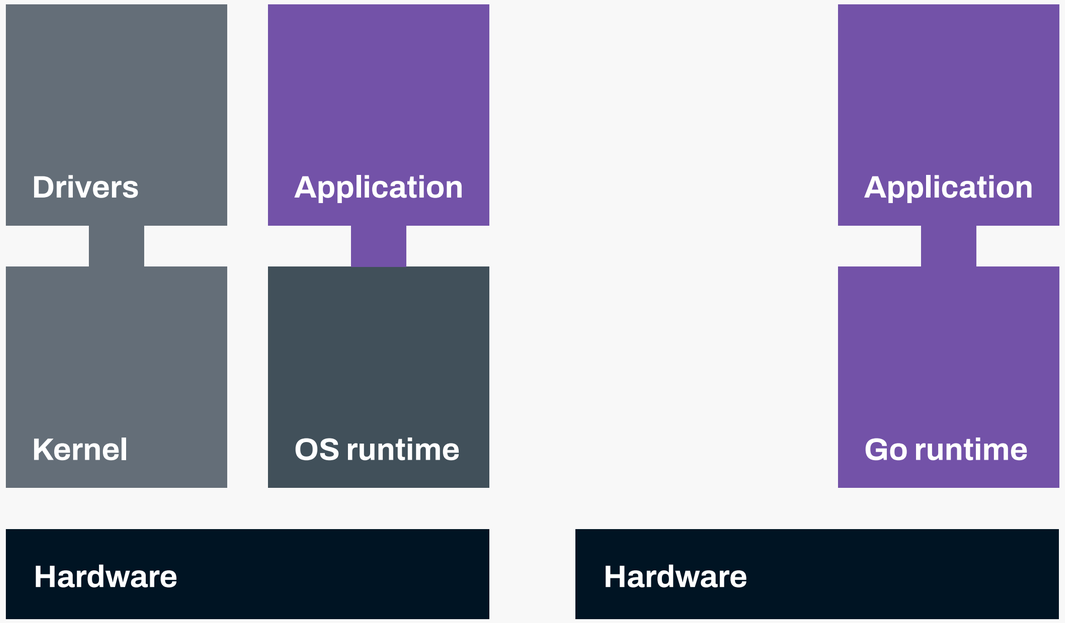
- Licensing server
- Secure device provisioning
- PKI / CA services

Research

- Low level USB testing
- Red Teaming implant
- Embedded development

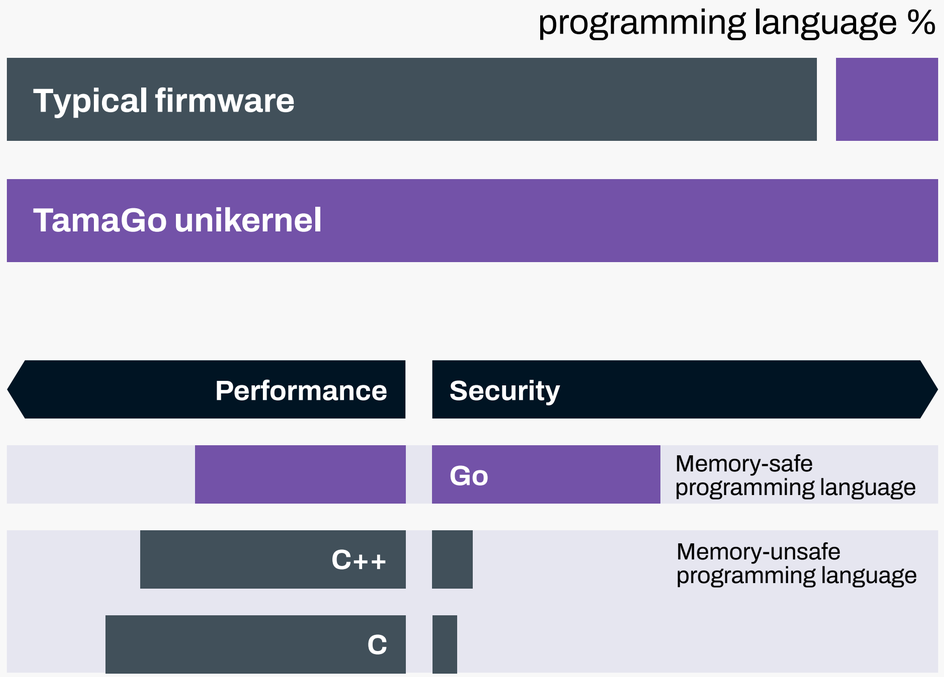
TamaGo

In addition to native support for standard operating environments, such as Linux distributions, the USB armory is directly supported by TamaGo, an WithSecure™ Foundry developed framework that provides **execution of unencumbered Go applications on bare metal** ARM System-on-Chip (SoC) processors.



Traditional OS **TamaGo unikernel**

TamaGo allows a dramatic reduction of the attack surface by removing any dependency on memory-unsafe languages (e.g. C), Operating Systems and third party libraries.



Project page: https://github.com/f-secure-foundry/tamago

GoKey

The GoKey application implements a USB smartcard with innovative properties. Featuring an SSH based management interface, the card provides a dramatically improved security model over traditional smartcards. By leveraging on the TamaGo framework, GoKey is written and executed with only high-level code, minimal dependencies and a memory-safe environment.

	Trust anchor	Data protection	Runtime	Application	Requires tamper proofing	Encryption at rest
Traditional smartcard	! flash protection	! flash protection	JCOP	JCOP applets	! Yes	! No
USB armory with GoKey	✓ secure boot	✓ SoC security element	TamaGo	Go application	✓ No	✓ Yes

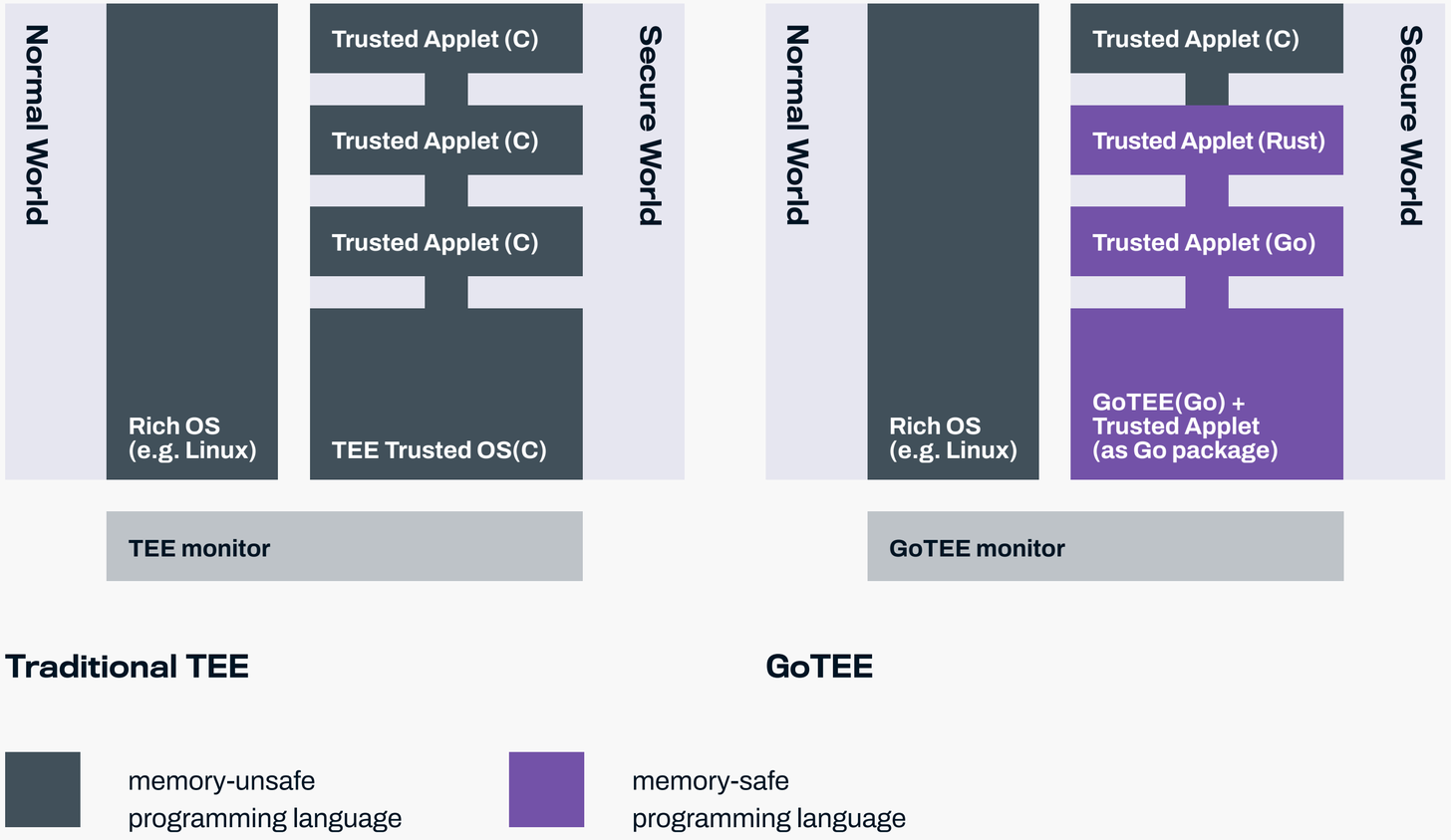
Project page: https://github.com/f-secure-foundry/gokey

GoTEE

The **GoTEE** framework implements a **Trusted Execution Environment** (TEE) bringing Go memory safety, convenience and capabilities to bare metal execution within **ARM® TrustZone®** Secure World.

GoTEE allows concurrent instantiation of **bare metal trusted applets** (whether written as **TamaGo** unikernels or freestanding programs such as Rust or C ones) along side an isolated OS such as Linux.

An OP-TEE **compatibility layer** for Trusted Applets API and Normal World kernel driver is available.



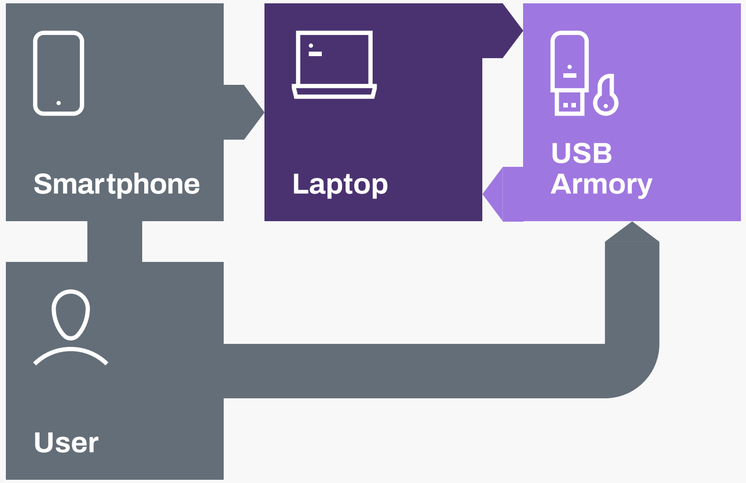
Project page: https://github.com/f-secure-foundry/GoTEE

Example use cases

Armory Drive

The USB armory performs transparent encryption/decryption of the user microSD card. Authorization happens over Bluetooth to ensure safe operation even on untrusted laptops.

Project page: https://github.com/f-secure-foundry/armory-drive



Remote Hardware Security Module

When hosting facilities cannot be trusted, the USB armory, plugged on a server, complements its potentially unsafe environment withself-contained, tamper proof, HSM services.

Remote peers can authenticate the USB armory and use it, while the server remains an unprivileged party.

The server itself can also use the USB armory HSM services for CA/PKI or any other cryptographic purpose, without having access to protected keys.

The USB armory advantage

No other platform combines so many security features, performance, expandability, customization, and transparency in the tiniest of form factors. The USB armory is uniquely placed in the market.

Its security architecture outperforms traditional smartcards, HSMs, tokens and other secure devices.

	Trust anchor	Versioning anchor	Data protection	Runtime	Applications	Performance
Smartcard	! flash protection	! none	! flash protection	JCOP	JCOP applets	! poor
Traditional HSM	vendor dependent	vendor dependent	! flash protection	unknown	Java/C (typ.)	✓ good
FPGA based devices	! bitstream encryption	N/A	N/A	N/A	RTL	✓ good
Traditional security token	! flash protection	✓ eMMC/NAND/ crypto acc.	! flash protection	RTOS	low level C/ C++ code	medium
Traditional encrypted drive	! none	! none	! MCU crypto acc.	N/A	N/A	medium
USB armory	✓ secure boot	✓ eMMC/NAND/ crypto acc.	✓ SoC crypto acc.	✓ any	✓ any language	✓ good

Ordering information

Standard orders

UA-MKII-ULZ-512M	USB armory Mk II • i.MX6ULZ 900 MHz • 512 MB RAM • enclosure
UA-MKII-DA	Debug accessory for the USB armory Mk II

Custom/bulk orders

UA-MKII-UL-512M	USB armory Mk II • i.MX6UL 528 MHz • 512 MB RAM
UA-MKII-UL-1G	USB armory Mk II • i.MX6UL 528 MHz • 1 GB RAM
UA-MKII-ULZ-1G	USB armory Mk II • i.MX6ULZ 900 MHz • 1 GB RAM
UA-MKII-ENC	Enclosure for the USB armory Mk II

Resellers: https://github.com/f-secure-foundry/usbarmory/wiki/Ordering-information
Custom/bulk orders, support inquires: usbarmory@withsecure.com

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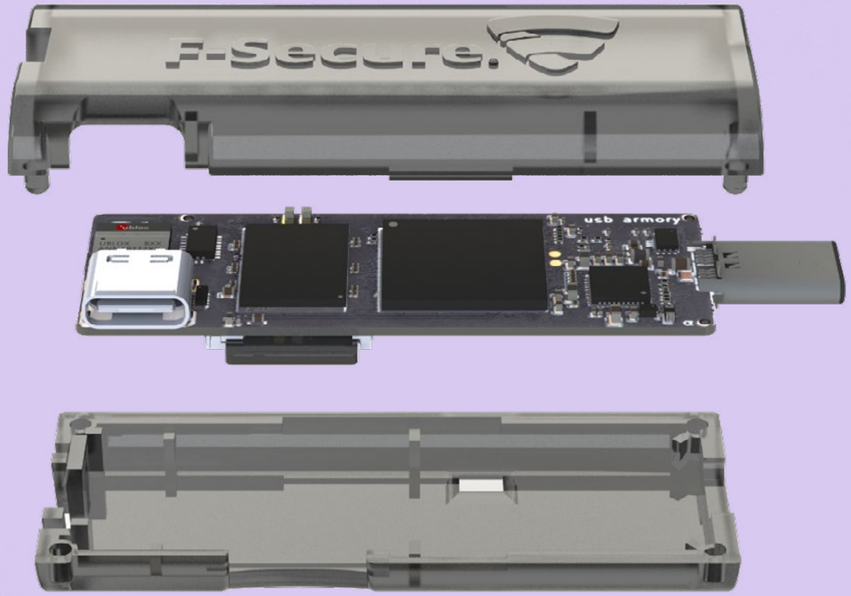
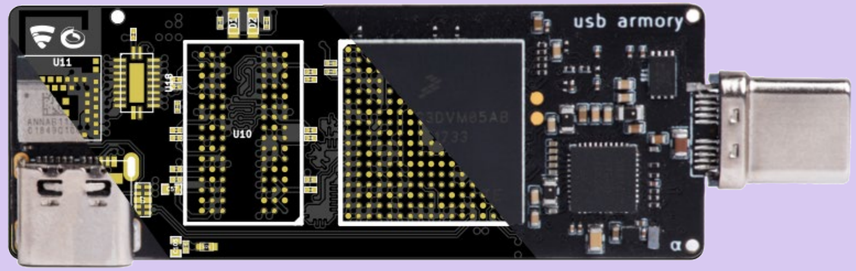


Resources

Documentation:
https://github.com/f-secure-foundry/usbarmory/wiki

Product page:
https://www.withsecure.com/en/solutions/innovative-security-hardware/usb-armory



Who We Are

WithSecure™ is cyber security's reliable partner. IT service providers, MSSPs and businesses along with the largest financial institutions, manufacturers, and thousands of the world's most advanced communications and technology providers trust us for outcome-based cyber security that protects and enables their operations. Our AI-driven protection secures endpoints and cloud collaboration, and our intelligent detection & response is powered by experts who identify business risks by proactively hunting for threats and confronting live attacks. Our consultants partner with enterprises and tech challengers to build resilience through evidence-based security advice. With more than 30 years of experience in building technology that meets business objectives, we've built our portfolio to grow with our partners through flexible commercial models.

WithSecure™ is part of F-Secure Corporation, founded in 1988, and listed on the NASDAQ OMX Helsinki Ltd.

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