TrustedFirmware.org Overview

**Trusted Firmware** provides a reference implementation of secure software for, but not limited to, Armv8-A, Armv9-A and Armv8-M architectures. It provides SoC developers and OEMs with a reference trusted code base complying with the relevant Arm specifications.

- Provides the preferred software implementation of the Arm specifications allowing quick and easy porting to modern chips and platforms.

- Forms the foundations of a Trusted Execution Environment (TEE) on application processors, or the Secure Processing Environment (SPE) of microcontrollers.
Collaborative Security

Complexity solved once for all

Reference Secure Software

Governing bodies: Board & TSC

Shared Ownership

Security at Scale

Open Governance Community Project
Member Benefits: Highlights

- Governing Board seat driving strategic direction and investments
  (Budget, Marketing Initiatives, explore new investment areas)

- Part of Technical Steering Committee driving technical direction of project
  (Define Release process, Security Incident Handling process, Roadmaps reviews & influence)

- Add and maintain platforms in Open CI (Refer to the “Open CI Summary” section below)

- Opportunity for close engineering collaboration with other members

- Refer to “Membership Structure & Benefits” slide below for more details
10yrs of growing collaboration in building security

- 150+ platforms
- 5000+ yearly code contributions
- Hundreds of collaborators
For all market segments

Devices
IoT/Mobile/Auto/Laptop

Embedded Edge

Cloud Server
Trusted Firmware Security Center

TrustedFirmware.org security incident handling and vulnerability disclosure process.


- Found a security vulnerability in Trusted Firmware?
  - Report it here: security@lists.trustedfirmware.org

- Coordinated disclosure with Trusted Stakeholders and ESS

- Per-project security email aliases
<table>
<thead>
<tr>
<th></th>
<th>Diamond</th>
<th>Platinum</th>
<th>General</th>
<th>Community (Uni/Non-profit)</th>
<th>Individual (invite only)</th>
<th>Non-Member</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code Access, Review Participation</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Technical Forums</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Logo and marketing recognition (scaled per tier)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>No</td>
</tr>
<tr>
<td>Technical Steering Committee (TSC) seat+vote</td>
<td>Yes (2 votes each)</td>
<td>Yes (1 vote each)</td>
<td>Yes (1 vote every 5)</td>
<td>Yes (1 vote every 5)</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Governing Board seat + vote</td>
<td>Yes (2 votes each)</td>
<td>Yes (1 vote each)</td>
<td>Yes* (1 vote every 5)*</td>
<td>Yes (1 vote every 5)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Platforms in Open CI</td>
<td>1 (D1) or 2 (D2) new / year</td>
<td>1 new / year</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
| Fees                   | D1: $100k  
D2: $120k | $60k     | G1: $3K  
G2: $12K  
G3: $30K | $3K           | $600         | No          |

*: Only for G2 & G3 General members
G1: $3K (0 to 50 empl. only)
G2: $12k (0-499)
G3: $30k (500+)
Current members

Diamond Members
- arm
- Google

Platinum Members
- Linaro
- NXP
- Renesas
- ST

General Members
- Futurewei Technologies
- Nordic Semiconductor
- ProvenRun

Partners
- bugSeng

TrustedFirmware.org
Open CI Summary
Open CI Summary

The Trusted Firmware Open CI (Continuous Integration) is a cloud-based CI infrastructure that leverages multiple components including Git, Gerrit, Jenkins, TuxSuite, and LAVA to create a comprehensive end-to-end development, integration, test, and release infrastructure.

- Validates TrustedFirmware.org builds on Member hardware located in a centralized hardware lab
- Integrated ECLAIR MISRA test suites / Static Analysis tooling assuring high-quality codebases and providing formal compliance jumpstarts
- Currently leveraged by TF-M, TF-A, Mbed TLS and Hafnium, with additional TrustedFirmware supported projects planned
Additional features of Open CI:

• Integrates different System Specifications, interfaces, architectures
• Supports a Trusted Boot Chain composed of a multi-stage boot process
• Supports TrustZone and the isolation of critical security functions such as secure boot code and cryptographic operations
• Provides facilities for Secure Debugging
• Facilitates the foundation for Security Certifications as required in the marketplace
• Support for multiple Arm Architectures and multiple toolchains

All the above, while providing an efficient software development and validation environment that supports a community centric software development environment
Open CI Additional Features cont’d

Additional features of Open CI:

• Hardware validation lab additional details:
  • Leverages LAVA for validation of software updates on member hardware
    • Code update regression testing/validation prior to final review and merge
  • Validates code updates on multiple toolchains and hundreds of unique configurations
  • Arm Fixed Virtual Platform (FVP) software emulators leveraged for enhanced validation and test configurations
  • Includes Mbed TLS unit tests validated on multiple OS’s

All the above, while providing an efficient software development and validation environment utilizing a community centric software development environment
Open CI & Board Farm

**Gerrit**
review.trustedfirmware.org

**Jenkins**
ci.trustedfirmware.org

**LAVA**
tf.validation.org

**Git**
git.trustedfirmware.org

**Push**
1

**Trigger**
2

**Artifacts**

**Build Slaves**

**Result**
+1

**Board Farm**

**MPS2**

**Juno**

**Member boards**

https://tf.validation.linaro.org/scheduler/device_types
Adopt Trusted Firmware to build your next secure platform

- **250+** Unique Contributors
- **40+** Companies contributing
- **15+** Number of Major Releases
- **8** Number of Member Platforms in Open CI
- **12** LOC Deltas
- **5M+** Open CI Tests per Year
- **+300K-100K+** LOC Deltas
- **FY23 results**
TrustedFirmware.org Projects Summaries
Trusted Firmware-A


Secure world reference software for all Arm Cortex-A & Neoverse processors across all market segments.

Trusted boot flow and runtime firmware providing standard implementation of Arm specifications:

- SMC CC (Secure Monitor Call Calling Convention)
- TBBR (Trusted Board Boot Requirements)
- PSCI (Power State Coordination Interface)
- SCMI (System Control & Management Interface)
- FF-A (Firmware Framework for A-Profile)
TF-RMM (Arm CCA)

Reference implementation of the Arm Realm Management Monitor (RMM) specification for the Arm Confidential Compute Architecture (Arm CCA)

- Enhanced security isolation
- Flexible workload isolation
- Reduced attack surface
TF-A-Tests

https://trustedfirmware-a-tests.readthedocs.io/en/latest/

A suite of bare-metal functional tests to exercise TF-A features from the Normal World, without dependencies on a Rich OS

Provides a strong basis for TF-A developers to validate their own platform ports and add their own test cases, interacting with TF-A through its SMC interface

Features currently tested include:

- SMC Calling Convention
- Power State Coordination Interface (PSCI)
- Software Delegated Exception Interface (SDEI)
- Performance Measurement Framework (PMF)
- Trusted Board Boot Requirements (TBBR)
- Secure Partition Manager (SPM)
- ... and more!
Trusted Firmware-M

Implements the Secure Processing Environment (SPE) for Armv8-M, Armv8.1-M architectures. It is the platform security architecture reference implementation aligning with PSA Certified guidelines.

Consists of Secure Boot and a set of Secure Services such as Secure Storage, Crypto, Attestation, Firmware update for Applications accessible via PSA Functional APIs.
OP-TEE

A reference implementation of the Open Portable Trusted Execution Environment (OP-TEE) designed as companion to a non-secure Linux kernel running on Arm Cortex-A cores using the TrustZone technology.

Implements TEE Internal Core API and TEE Client API as defined in the GlobalPlatform API specifications.
Mbed TLS

- Portable, highly modular, easy-to-use TLS and X.509 library
- Extensively used in various market segments
- Distributed under Apache2.0 License
- Components –
  - Cryptography
  - Protocol (TLS, DTLS)
  - Certificates (X.509, PKI)
- PSA Crypto (Mbed Crypto), derived from Mbed TLS library, brings together Crypto primitives and makes them available via PSA Crypto APIs
- PSA Crypto also support driver interfaces to integrate with Secure Elements and Crypto Accelerators
Trusted Services

- Framework to develop Security related Services for enhanced device security and a standardize security approach across platforms

- Deployable over a range of Isolated Processing Environments (e.g., Secure EL0 Partitions under OP-TEE, Secure Partition under Hafnium.)

- Applications access Trusted Services for Security Operations via standardized service layer

- Includes Platform Security Architecture (PSA) Trusted Services for Cryptography, Storage and Attestation and other Secure Services
MCUBoot

- Secure bootloader for 32 bit microcontrollers
- Widely deployed secure boot solution
- Define a common infrastructure for the bootloader, system flash layout on microcontroller systems
- Enables simple software upgrades
- Used as BL2 bootloader in TF-M
- MCUboot is operating system and hardware independent and provides a hardware abstraction layer.
Thank you

Visit www.TrustedFirmware.org or email enquiries@trustedfirmware.org for more information