

Achieving FACE™ Conformance with LDRA

LDRA is a member and contributor to the Future Airborne Capability Environment (FACE™) Consortium, supporting the development of the FACE Technical Standard and other key documents including the FACE Conformance Verification Matrix (CVM). This expertise is now reflected in the LDRA tool suite which has been enriched with a FACE conformance workflow management framework, giving software suppliers the ability to leverage the FACE characteristics of Affordability, Agility, Speed and Excellence, and deliver conformant portable software units.

As an increasing number of programs embrace the interoperability promoted by this standard, economical and scalable conformance and verification practices are required for suppliers to be competitive.

The adoption of any new standard is a challenge, with questions surrounding how best to get started, how to roll it efficiently out across the team, and how to minimize the impact on existing working practices. It's likely that other standards (perhaps DO-178C) are already followed, so there's the additional challenge of augmenting familiar objectives with those of the FACE Technical Standard as seamlessly as possible.

Then there is the hurdle of verification. Preparation is very important if a first-time pass by the Verification Authority (VA) is to be achieved. The consequence of poor planning is usually the highly undesirable overhead associated with an extended verification phase. Acquiring a proper understanding of the required artifacts, the need for testing, inspection or both, and the presentation formats acceptable to the VA, can be very daunting task.

The LDRA tool suite helps address these concerns by providing an intuitive, feature rich infrastructure, designed to ease the FACE adoption process by providing guidance throughout a successful verification experience.



Key Benefits

- helps to achieve product delivery with agility, conformance, affordability, speed and excellence
- unifies FACE conformance efforts across multiple stakeholders
- minimizes FACE adoption overhead, and reduces Time-to-Market
- checks adherence to FACE coding standard and to detailed FACE requirements
- can easily be adapted to demonstrate compliance to standards like DO-178B/C, expanding market reach
- integrates MISRA, CERT, JSF and other coding standards into development environments that require evidential artifacts relating to safety and security standards
- identifies conformance gaps prior to submission to the verification authority
- is underpinned by LDRA's ISO 9001:2015 certified Quality Management System, and the LDRA tool suite's TÜV SÜD and SGS-TÜV Saar certification

Solution Details

- enhances and simplifies efforts in achieving verification and conformance
- imports FACE CVM into the LDRA tool suite
- leverages illustrative objectives or requirements to be fulfilled, based on the relevant FACE architectural segment
- provides guidance using placeholders to represent expected deliverables
- expedites progress by leveraging sample template documents
- confirms adherence to FACE coding rules using LDRA static analysis
- collates test results prior to VA submission by invoking the FACE CTS from within the tool suite
- generates reports, tables, pie charts and metrics reflecting the progress of each objective
- establishes and maintains traceability from requirements to conformance artifacts
- enables artifacts to be exported to the originating FACE CVM spread sheet

Future Airborne Capability Environment (FACE™)

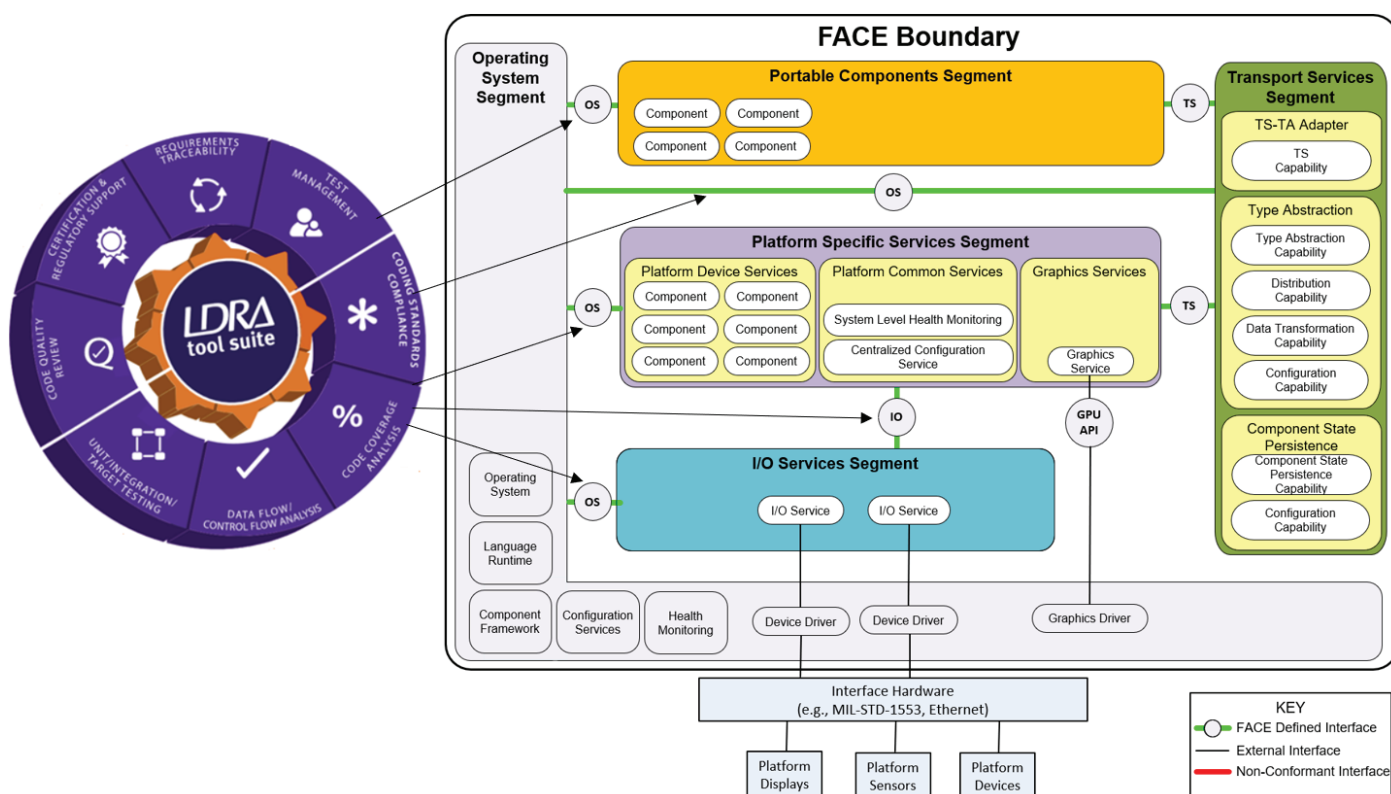
The FACE Technical Standard was created to define a software development environment that enables the repurposing of applications from one DoD aircraft or war-fighting platform on another with minimal software revision.

Called the FACE Reference Architecture, this environment embraces design principles that enhance software portability – for example, by providing a common set of interfaces to each portable FACE application. Both edition 2.1.1 and the current edition 3.0 of the FACE Technical Standard are supported by LDRA.

The FACE Reference Architecture is comprised of five layered segments in which a FACE portable capability or Unit of Portability (UoPs) may reside:

- Operating System Segment (OSS)
- Portable Components Segment (PCS)
- Transport Services Segment (TSS)
- Platform-Specific Services Segment (PSSS)
- I/O Services Segment (IOSS)

To manage variance and deliver portability, a common set of standardized interfaces providing the connections between the FACE architectural segments has been defined.



The LDRA tool suite, the FACE Conformance Test Suite, and the FACE 3.0 Architecture

The FACE Technical Standard is a robust document containing all the requirements a software unit needs to fulfil in order to be certified. It is complemented by the FACE Conformance Program which supports the UoP lifecycle of verification, certification and registration with associated conformance criteria, processes, and policies. The Conformance Verification Matrix (CVM) summarizes the conformance requirements outlined by the FACE Technical Standard, providing the product standard that each UoP must meet.

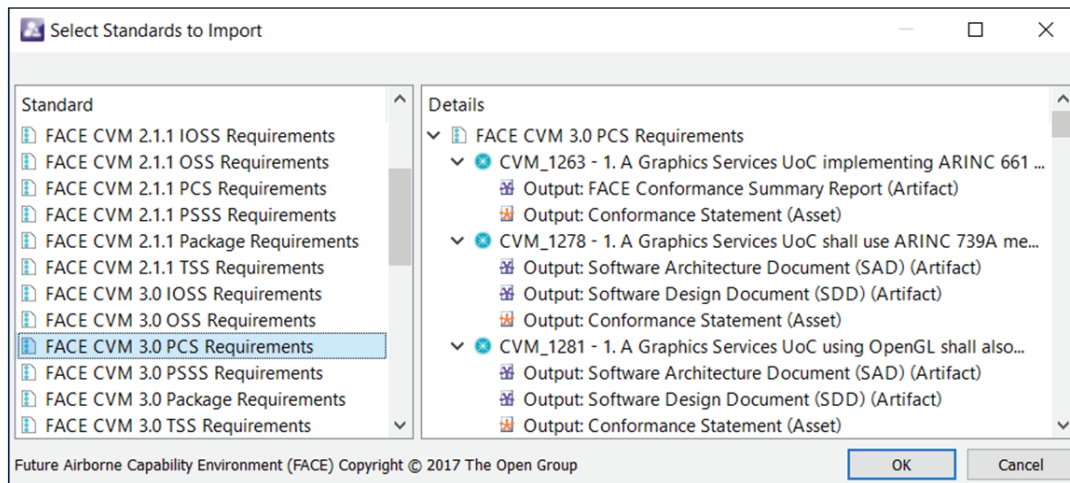
The FACE Conformance Test Suite (CTS) is used to test software functionality, and verify adherence to the FACE Technical Standard. The CTS is also leveraged by FACE Verification Authorities (VA), entities sanctioned by the Steering Committee to conduct or witness for-the-record verification testing and verify adherence. Test summary results are captured and documented for the UoP, along with the pass/fail verdict rendered by the CTS. They include details of each test case result, test configuration settings, the version of the CTS used, the date and time of each test run, the edition of the FACE Technical Standard applied, and more.

Once the VA completes its verification process and the UoP has received a pass verdict, the software supplier may submit the Verification Results Package to the Certification Authority (CA). The CA then assesses the Verification Results Package, manages legal agreements, and issues a FACE certificate of conformance.

The final step is registration. The software supplier submits the FACE certificate of conformance, the UoP description, and metadata to the FACE Library Administrator for review and registration of the certificate. The resulting Units of Conformance (UoC) will maintain certification as long as the software product remains the same as defined by the Conformance Statement and all legal agreements are met. The Library Administrator then updates the FACE Registry with the UoC description, metadata, and FACE Conformance Certificate ID. Government stakeholders can then search the FACE Library for FACE Certified Products to procure.

The LDRA FACE Solution

The LDRA tool suite has been developed to be used to verify and validate UoPs in accordance with the FACE Technical Standard Editions 2.1.1 and 3.0. The TBmanager component of the LDRA tool suite facilitates the import of any of the FACE architectural segments (IOSS, OSS, PCS, PSSS, or TSS) for either edition.

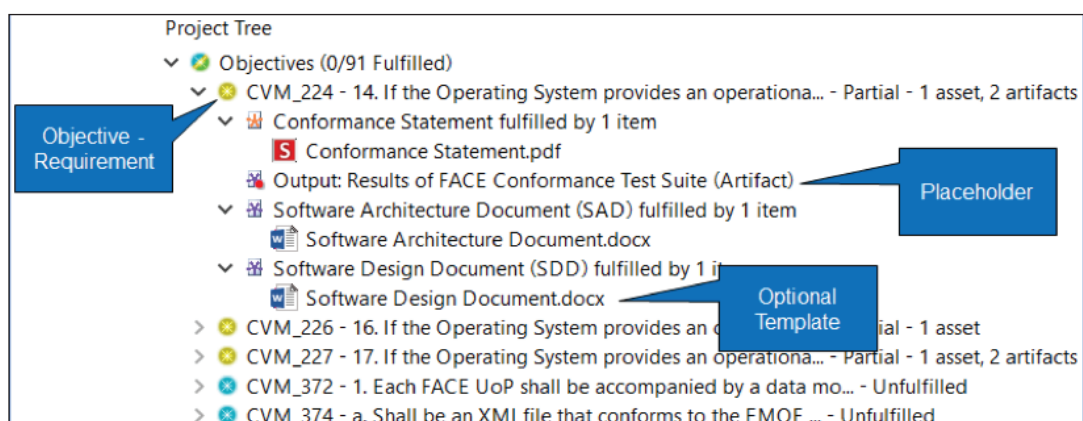


Importing FACE requirements into the TBmanager component of the LDRA tool suite

Importing a segment initiates the creation of a TBmanager project and tree containing a complete set of objectives, each correlating to the requirement that is defined in the FACE technical standard for the selected FACE segment. The objectives contain only the requirements from the FACE CVM that are marked “Y” in the “Verification Needed” column, aligning with FACE VA expectations throughout the development lifecycle and providing invaluable guidance for the successful adoption of the FACE Technical Standard.

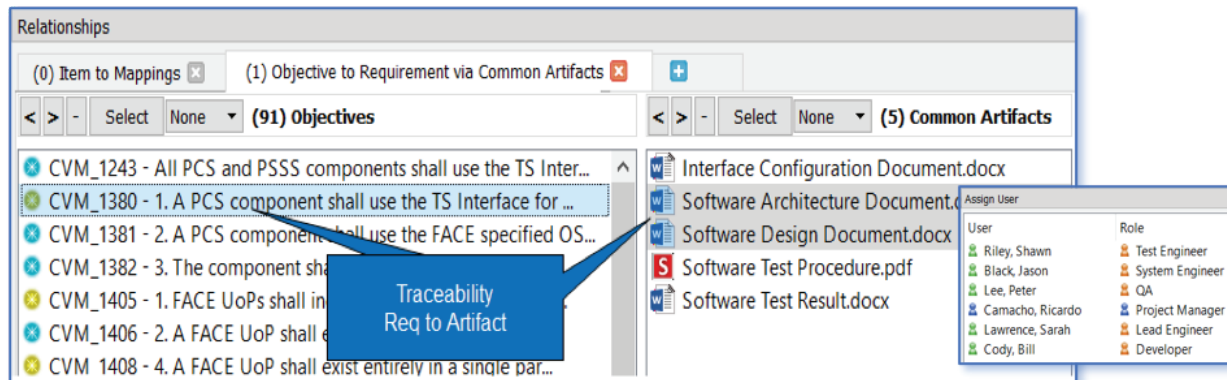
The newly created TBmanager project will include only those requirements from the FACE CVM that are relevant to the selected FACE segment, supplemented by “Software Supplier Artifact – Cross Reference” placeholders for the artifacts that must be generated for proof of conformance. The net result user is a very clear indication of the artifacts, analyses and/or tests that must be performed for each objective. These can be complemented by leveraging one or more template artifacts:

- Interface Control Document (ICD)
- Interface Design Description (IDD)
- Interface Requirements Specification (IRS)
- Software Architecture Description (SAD)
- Software Design Description (SDD)
- Software Product Specification (SPS)
- Software Requirements Specification (SRS)
- Software Test Plan (STP)
- Software Test Report (STR)
- Software User Manual (SUM)



FACE Requirements are represented as “Objectives” in the LDRA tool suite

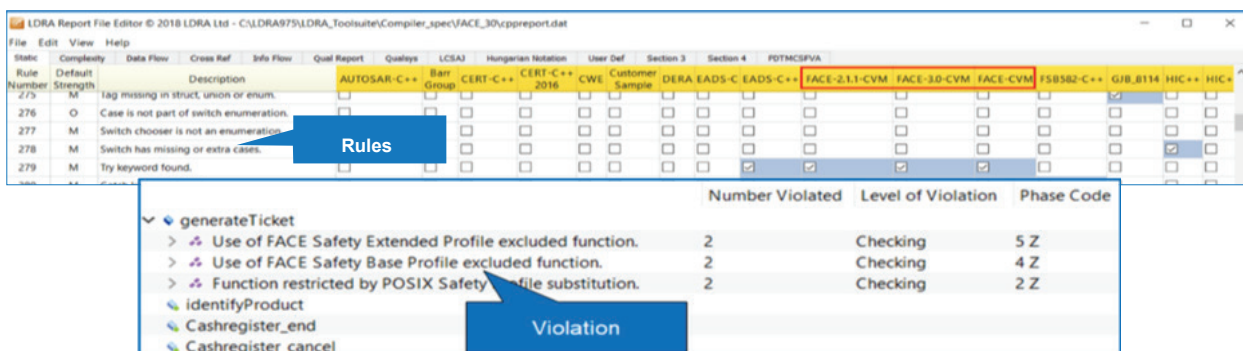
TBmanager provides context to each FACE Requirement by providing traceability to the collated artifact and asset documents associated with its objective. Customizable TBmanager perspectives allow for easy visualization and analysis of objectives, and user roles can be tuned to ensure that only the information relevant to each team member is accessible or modifiable. This privilege-based feature is designed to ensure that information critical to the workflow is protected, and that data is not accidentally spoiled.



Artifact traceability and user roles in TBmanager

The FACE Technical Standard restricts the use of certain API calls while requiring others. Non-conformant calls listed in the FACE Technical Standard and other FACE coding violations can be detected statically by the LDRA tool suite's TBvision component. For example, the checks for adherence to specific sections of the POSIX API, ensures that the UoP function signatures are syntactically correct, enforcing proper use of certain language constructs. The FACE coding standard can be applied in isolation, or alongside others - perhaps from MISRA or CERT.

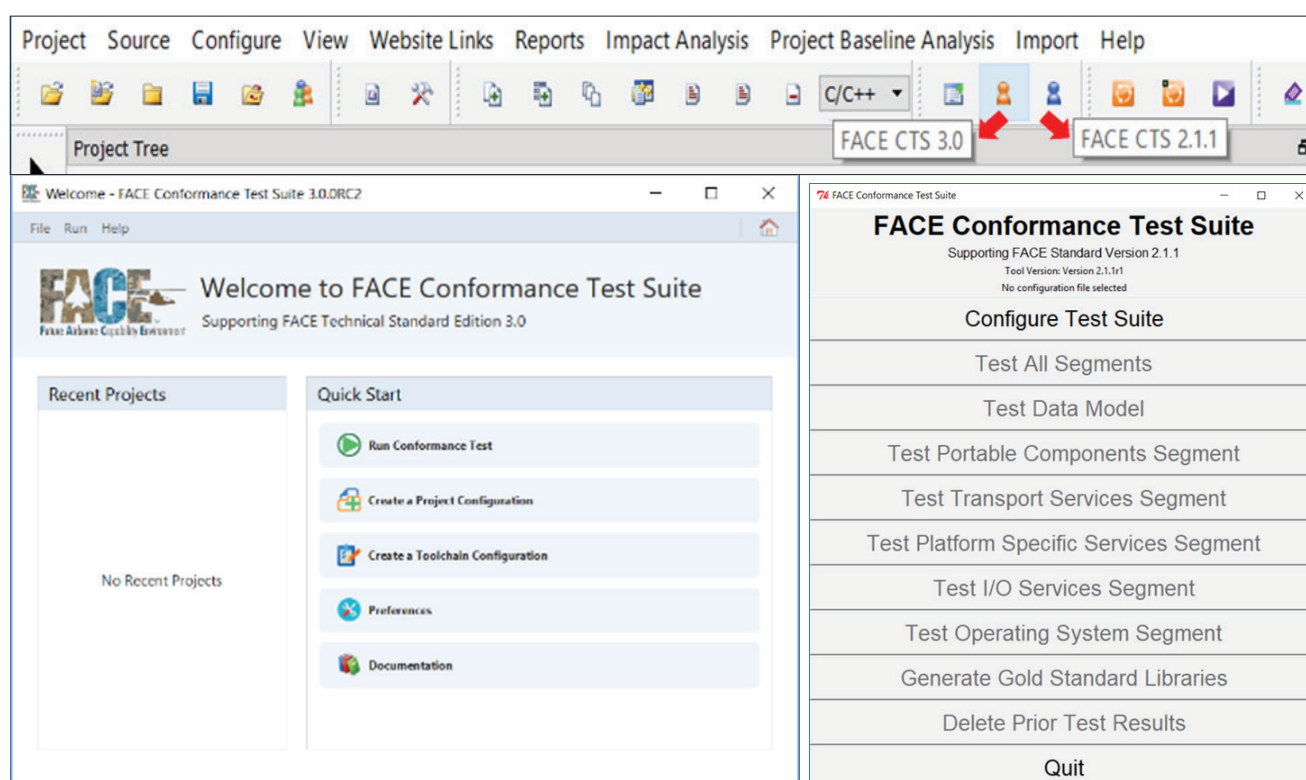
TBvision complements the static analysis element of CTS by being part of the day-to-day development lifecycle, finding violations early at the developer's desktop and at a time of their choosing - prior to compilation of the code, or during the build phase.



FACE Coding Rules and Exposed Violations

By then analyzing the code using the official FACE CTS conformance utility prior to submission to the VA, it can be confirmed that non-conformances have been dealt with during the development phase.

The FACE Conformance Test Suite 2.1.1 and 3.0 can be configured and invoked from TBmanager which in turn will also establish traceability and facilitate regression testing. The association of TBmanager objectives with the obligatory FACE CTS evidential artifacts exposes any verification gaps and allows them to be addressed.



TBmanager – Invoking FACE CTS Versions 3.0 and 2.1.1

Conclusion

LDRA has an unmatched pedigree in aerospace, avionics, and defense application development and verification. The company is committed to working closely with industry and contributing to standards organizations including The Open Group Future Airborne Capability Environment (FACE) Consortium with the aim of optimizing labor-intensive and error-prone elements of the lifecycle, while reducing cost and streamlining the development process, ensuring delivery of safe secure, and reliable portable software units of conformance.

The LDRA tool suite helps software suppliers achieve FACE™ conformance through automation, coding standards compliance, traceability, and artifact generation. From an airworthiness perspective, the LDRA Tool Suite supports DO-178B/C certification up to and including Design Assurance Level A.

LDRA's level of experience and expertise is unsurpassed, and while the powerful LDRA tool suite is not only the most complete software verification and validation solution for avionics software, it also remains cost-effective, nimble, and flexible enough to accommodate less demanding applications.



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