Trustable Software Framework (TSF)

Fundamentals and Practical Application for Automotive Software

A comprehensive approach to software trustworthiness

Graph Model

Requirements

Traceability

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Team04 - DrivaPi

Learning Goals

By the end of this training, participants will be able to:

Understand TSF Fundamentals

Grasp core principles of the Trustable Software Framework and its application to automotive software development

Awareness of Standards

Develop understanding of ISO 26262 and ASPICE as they relate to verification efforts and safety-critical systems

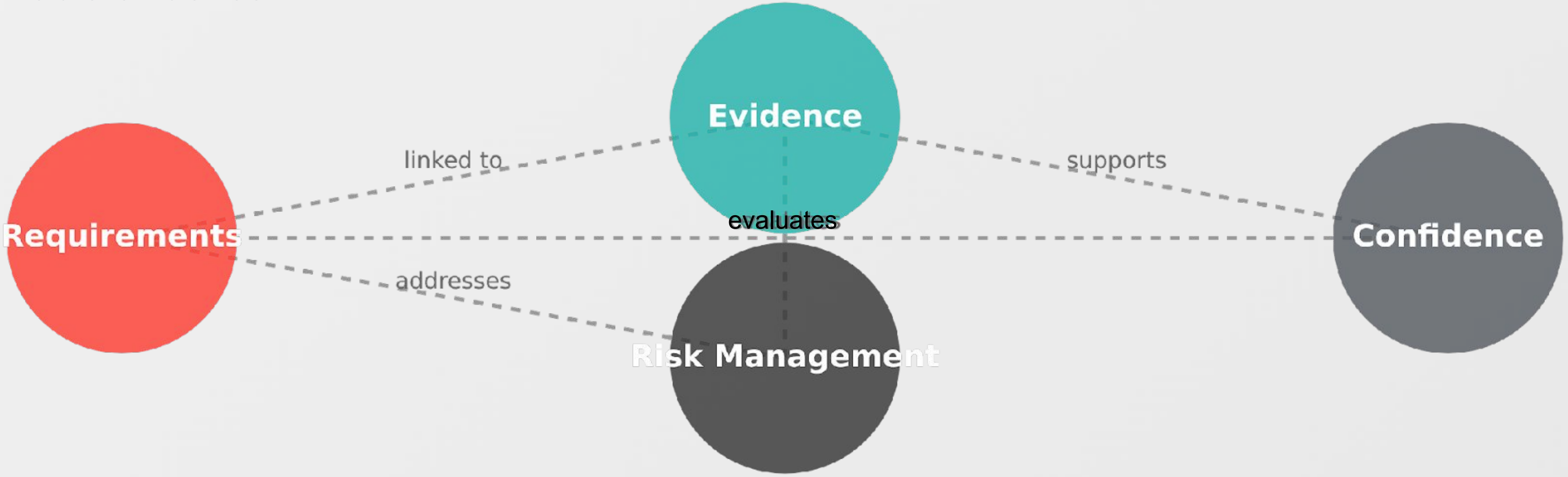
Write Traceable Requirements

Learn to create clear, testable requirements with proper traceability for critical automotive systems

Key Focus: Practical application of TSF principles to automotive software development, including repository layout, workflow implementation, and evidence collection.

Why TSF Matters

"TSF is crucial for managing the increasing complexity of modern software by making claims and requirements explicit and linking them directly to verifiable evidence."



Explicit Requirements

Makes requirements and claims explicit, linking them directly to verifiable evidence

Risk Management

Enables measurement, management, and reduction of risks in complex software releases

Confidence Assessment

Allows assessors to objectively evaluate trustworthiness through evidence-based confidence scoring

Safety-Critical Focus

Essential for safety, security, performance, availability, and reliability in automotive systems

TSF Model and Methodology

Model Components

Statements

Concise, affirmative claims or requirements that form the nodes of the graph, written to support logical reasoning

Links

Define implication relationships between Statements, indicating how one Statement supports or is derived from another

Artifacts

Concrete pieces of evidence such as source code, test results, and documentation that support and validate Statements

TSF Methodology

Setting Expectations

Defining critical functional and non-functional requirements as Expectations (requests without parents)

Providing Evidence

Gathering artifacts to support claims, creating links between Statements and evidence

Documenting Assumptions

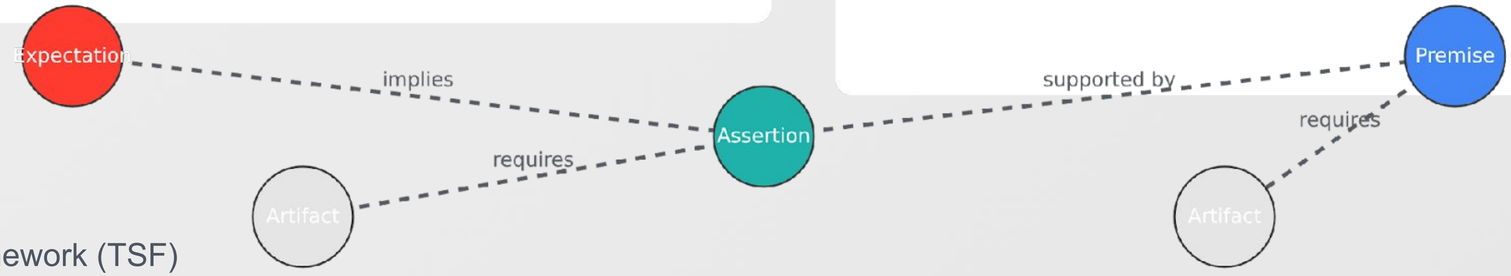
Recording external dependencies as "dangling" Premises (claims without children)

Recording Reasoning

Building logical arguments using Assertions (both requests and claims)

Assessing Confidence

Scoring evidence and recursively calculating confidence for all Statements



Key Evidence Areas

TSF requires evidence collection across these six key areas to establish trustworthiness

Provenance

Origin of software, claims about source and licensing, understanding who produced it

Construction

How software is built and installed, ensuring correctness in these processes

Change

Management of updates and verification to prevent regressions or side effects

Expectations

What software is designed to do and what it must not do, covering functional and non-functional requirements

Results

Actual behavior compared to expectations through testing and performance metrics

Confidence

Overall assessment of software trustworthiness, derived from evaluation of all evidence areas

Requirements and Repository Layout

Repository Structure

- **reqs/**
  Dedicated directory for all requirements
  - **urd/**
    User Requirements (high-level user needs)
  - **srd/**
    System Requirements (system functionalities)
  - **swd/**
    Software Requirements (software behavior)
  - **lltc/**
    Low-Level Test Cases (test verification)

MD Template Fields

- **ref**
  Canonical reference matching file ID
- **header**
  Concise, one-line title for the requirement
- **text**
  Detailed, testable description of the requirement
- **reviewers**
  List of individuals responsible for review
- **reviewed**
  Records provenance of approval (Git SHA)
- **links**
  References to related requirements or artifacts

Authoring and Review Workflow

A systematic approach to requirement authoring with quality and traceability

1. Branch Creation

Create dedicated Git branch

```
git checkout -b feat/REQ-
```

2. Bootstrap

Create new requirement file

```
trudag manage create-item
<TYPE> <NUM> reqs/<type>
```

3. MD Editing

Fill in header, text, links, …

```
Copy template from reqs/templates/
```

4. Linking Reqs

Establish traceability

```
trudag manage create-link
<CHILD> <PARENT>
```

5. Local Linting

Validate requirement format

```
trudag manage lint
```

6. PR Submission

Push branch and open Pull Request

```
git push origin feat/REQ-
```

7. Review & Approval

Reviewers examine and approve

```
trudag manage set-item <path>
```

7. Merged

Changes integrated into main branch

```
git checkout main && git merge
feat/REQ-
```

Key Point: The "reviewed:" field in the MD file records approval provenance as a Git SHA, enabling clear audit trails.

Authoring and Review Workflow - continuation

A systematic approach to requirement authoring with quality and traceability

9. Calculate Score

Determine score trustability

```
trudag score
```

11. Report

Generate report and artifacts that support the evidence

```
trudag publish --output-dir
artifacts/trustable-report
```

12. Baseline

Snapshot of a current state

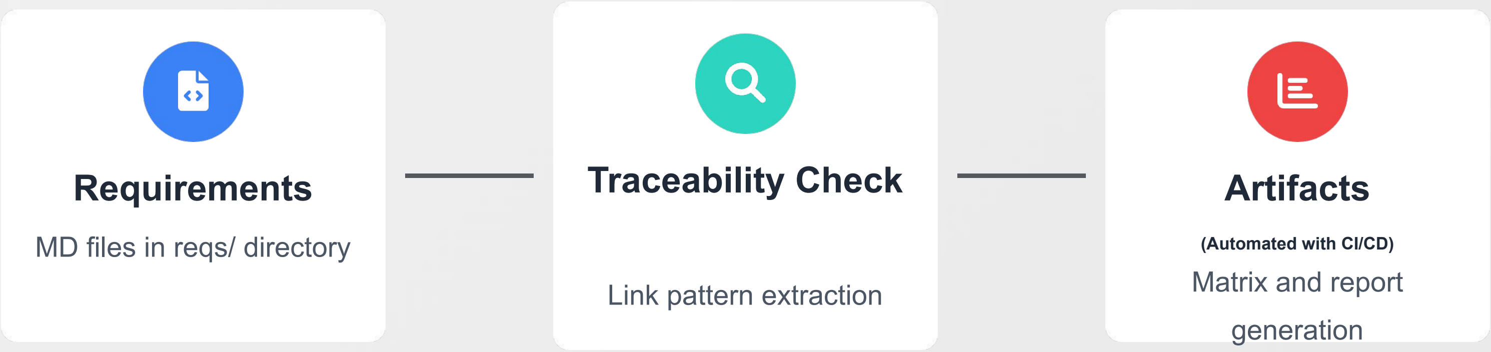
```
git tag -a BASELINE-V1.0 -m
"Sprint 1 baseline"
```

13. Keep record

Save Baseline in folder

```
mkdir -p artifacts/baselines
cp -r artifacts/trustable-report
artifacts/baselines/v1.0-$(date
+%Y%m%d)
```

Traceability and Continuous Integration



Requirements

MD files in reqs/ directory

Traceability Check

Link pattern extraction

Artifacts

(Automated with CI/CD)

Matrix and report generation

Automated Traceability

- ✓ Scans MD files for linking patterns
- ✓ Generates artifacts reports

V&V and ASIL Mapping

Verification and Validation activities scale with ASIL levels to ensure appropriate safety assurance

A ASIL A

- Basic testing
- Single reviewer
- Simple validation

B ASIL B

- Static analysis
- Two reviewers
- Integration tests

C ASIL C

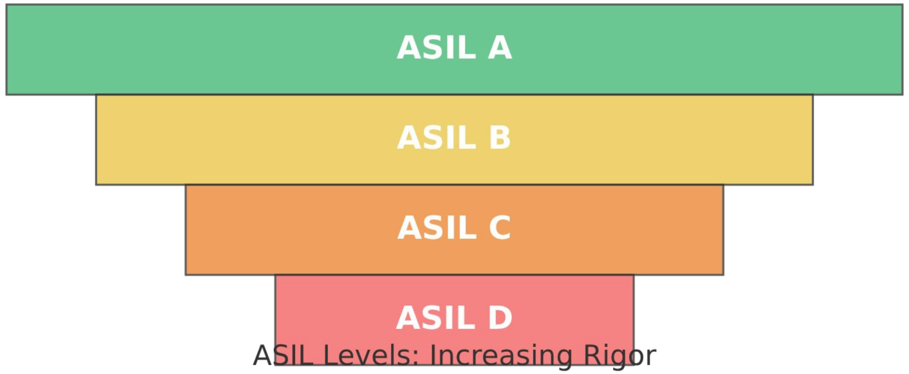
- Formal methods
- Independent review
- Comprehensive testing

D ASIL D

- Highest rigor
- Formal verification
- Independent validation

Key V&V Activities by ASIL Level

- **ASIL B/C/D:** Static analysis mandated to identify potential code defects
- **High-Risk Claims:** Formal methods considered for mathematical proof of correctness



Hands-on Lab and Assessment

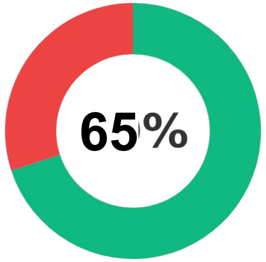
Lab Exercises

- Author a new requirement with proper ref, header, and text
- Link to upstream design and downstream test case
- Run linter to check formatting and structure
- Execute traceability checker and inspect artifacts report

2 session

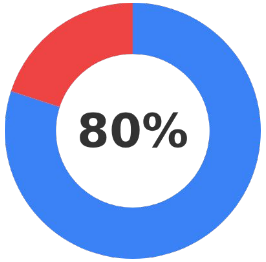
Assessment

Knowledge Quiz



- ✓ 10 questions
- ✓ 65% passing threshold
- ✓ 90% indicates high confidence

Lab Evaluation



- 5 tasks total
- 4 tasks required for passing
- Completion certifies you as a TSF reviewer