DO-330 Tool Qualification Framework - User Guide

Version: 1.0.0
Date: 2026-01-29
Standard: DO-330 (Software Tool Qualification Considerations)

1. Overview

The STUNIR DO-330 Tool Qualification Framework provides a simplified, template-based approach for generating DO-330 certification packages. It integrates with DO-331/332/333 implementations to collect qualification data and generate required documentation.

Key Features

- **Template-Based Generation**: Pre-defined templates for TOR, TQP, TAS, and other DO-330 artifacts
- **Data Collection**: Automatic collection from DO-331/332/333 outputs
- **Ada SPARK Implementation**: Memory-safe, formally verifiable code
- **Unified Reporting**: Combined qualification data from all supplements

2. Installation

Prerequisites

- GNAT 2024 or later (Ada compiler)
- GNATprove (for SPARK proofs, optional)
- Make (build automation)

Building

```
cd tools/do330
make build
```

This creates the `do330_generator` executable in `bin/`.

Running Tests

```
make test
```

Running SPARK Proofs

```
make prove
```

3. Quick Start

Generate a certification package

```
./bin/do330_generator \
    --tool=verify_build \
    --tql=4 \
    --output=./certification_package
```

Using the shell wrapper

```
./scripts/do330_generate.sh \
    --tool=verify_build \
    --tql=4 \
    --output=./pkg
```

4. Command Line Options

Option	Description	Default
`--tool=<name>`	Tool name to qualify (required)	-
`--version=<ver>`	Tool version	1.0.0
`--tql=<1-5>`	TQL level	5
`--dal=<A-E>`	DAL level	E
`--output=<dir>`	Output directory	./certification_package
`--template=<dir>`	Template directory	./templates
`--include-do331`	Include DO-331 data	Yes
`--include-do332`	Include DO-332 data	Yes
`--include-do333`	Include DO-333 data	Yes
`--validate`	Validate package only	No
`--help`	Show help	-

5. TQL Levels

TQL	Description	Requirements
TQL-1	Most rigorous	All DO-330 data items, 100% coverage
TQL-2	High rigor	Most data items, 90% coverage
TQL-3	Moderate rigor	Standard data items, 80% coverage
TQL-4	Lower rigor	TQP, TOR, tests, TAS
TQL-5	No qualification	None (output verified externally)

6. Generated Artifacts

Core Documents

- **TOR.md** - Tool Operational Requirements
- **TQP.md** - Tool Qualification Plan
- **TAS.md** - Tool Accomplishment Summary

Traceability

- **tor_to_test.json** - TOR to test case mapping
- **do330_objectives.json** - DO-330 objectives mapping

Configuration

- **config_index.json** - Configuration items index

Integration

- **do331_summary.json** - DO-331 model-based integration
- **do332_summary.json** - DO-332 OOP integration
- **do333_summary.json** - DO-333 formal methods integration

7. Template Customization

Template Variables

Templates use `{{VARIABLE}}` syntax:

```
{{TOOL_NAME}}           - Tool identifier
{{TOOL_VERSION}}        - Version string
{{TQL_LEVEL}}           - TQL-1 through TQL-5
{{DAL_LEVEL}}           - DAL A through E
{{QUALIFICATION_DATE}}  - ISO date
{{AUTHOR}}              - Document author
```

Custom Templates

1. Copy template from `templates/` directory
2. Modify as needed
3. Use `--template=<dir>` to specify custom location

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8. Integration with DO-331/332/333

The framework automatically collects data from:

- `tools/do331/output/` - Model coverage, traceability
- `tools/do332/output/` - OOP metrics, class analysis
- `tools/do333/output/` - Proof results, VCs

Data Collection Configuration

```json
{
  "integration": {
    "do331_path": "tools/do331/output/",
    "do332_path": "tools/do332/output/",
    "do333_path": "tools/do333/output/"
  }
}
```

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9. Examples

Example 1: TQL-4 Verification Tool

```
./bin/do330_generator \
    --tool=verify_build \
    --version=1.2.0 \
    --tql=4 \
    --dal=A \
    --output=./pkg/verify_build
```

Example 2: TQL-5 Development Tool

```
./bin/do330_generator \
    --tool=ir_emitter \
    --tql=5 \
    --output=./pkg/ir_emitter
```

Example 3: Validate Existing Package

```
./bin/do330_generator \
    --validate \
    ./pkg/verify_build
```

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10. Troubleshooting

Build Errors

1. Ensure GNAT 2024+ is installed
2. Run `make clean` before rebuilding
3. Check for missing dependencies

Template Processing Errors

1. Verify template file exists
2. Check for missing required variables
3. Ensure output directory is writable

Data Collection Errors

1. Verify DO-331/332/333 output directories exist
2. Check for valid JSON format in source files
3. Run tools with `--verbose` for diagnostics

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11. Support

- **Documentation:** `tools/do330/docs/`
- **Templates:** `tools/do330/templates/`
- **Examples:** `tools/do330/examples/`
