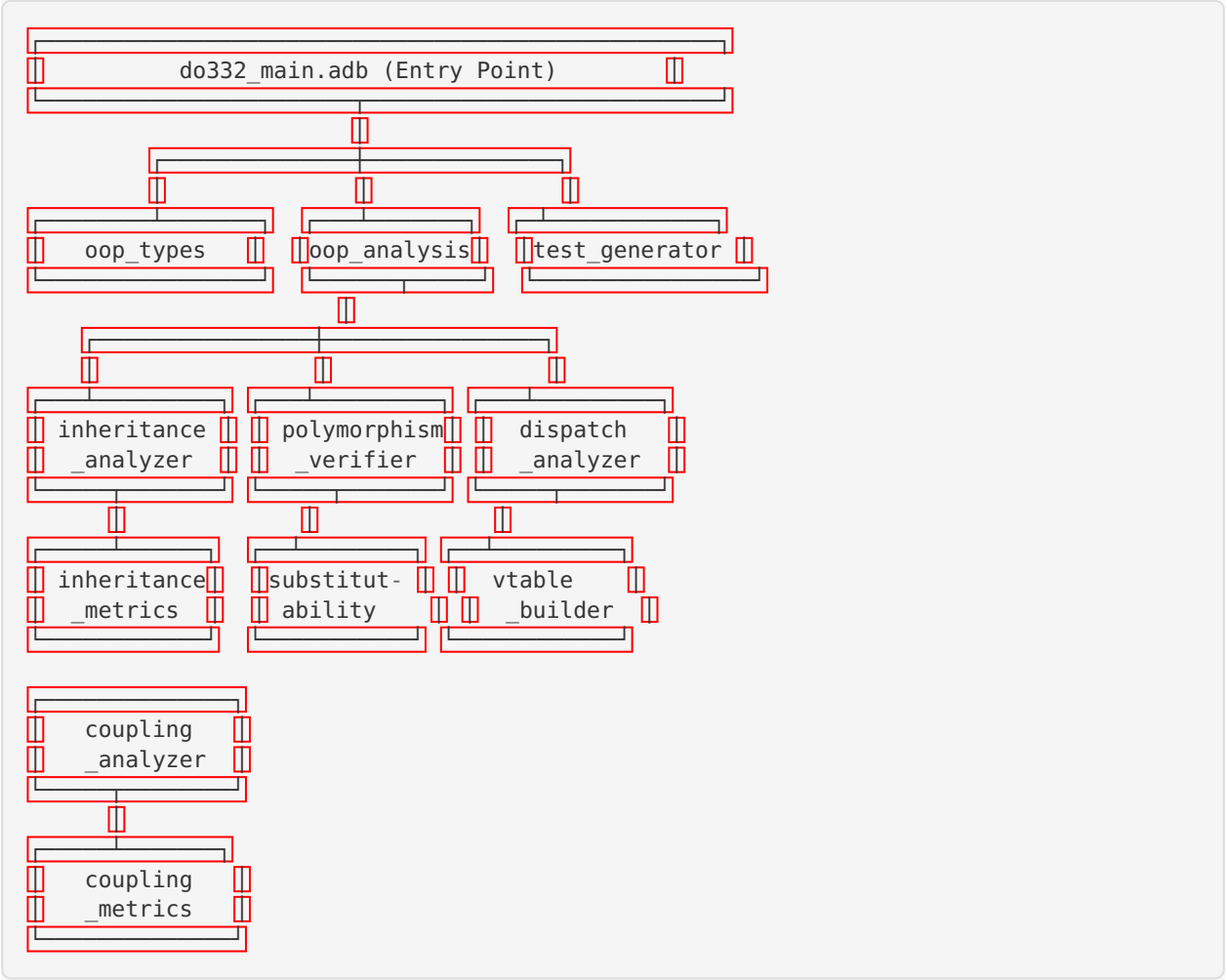
DO-332 OOP Verification Architecture

Component Overview



Package Descriptions

oop_types

Core type definitions for OOP constructs:
- Class_Info, Method_Info, Field_Info
- Inheritance_Link, Dependency
- VTable_Entry
- DAL requirements

oop_analysis

Main analysis framework:
- Class hierarchy container
- Analysis configuration
- Result types
- Orchestration functions

inheritance_analyzer

DO-332 OO.1 implementation:
- Depth calculation
- Diamond detection
- Circular detection
- Override verification
- Ancestor tracking

polymorphism_verifier

DO-332 OO.2 implementation:
- Virtual method scanning
- Type counting
- LSP verification
- Covariance/contravariance

dispatch_analyzer

DO-332 OO.3 implementation:
- Target resolution
- Site analysis
- Devirtualization
- Bounded dispatch proof

coupling_analyzer

DO-332 OO.4 implementation:
- Dependency graph
- CBO, RFC, LCOM metrics
- Circular dependency detection
- Threshold checking

test_generator

Test case generation:
- Per-objective tests
- Coverage point tracking
- Template-based generation

Data Flow

```
IR Input → Parse → Build Hierarchy → Analyze → Generate Reports
                          │
                          ├─→ Inheritance Analysis
                          ├─→ Polymorphism Verification
                          ├─→ Dispatch Analysis
                          ├─→ Coupling Analysis
                          └─→ Test Generation
```

SPARK Contracts

All analysis functions include SPARK contracts:
- Preconditions validate inputs

- Postconditions guarantee properties
- Type invariants ensure consistency