Code Refactoring Analysis: Apache Roller Weblogger

Executive Summary

This document analyzes refactoring improvements across three subsystems of Apache Roller Weblogger: **Weblog & Content**, **User & Role Management**, and **Search & Indexing**. The analysis combines design-level metrics (Designite) with implementation-level quality indicators (SonarQube).

Key Improvements

Metric	Before	After	Change	Source
Subsystem LOC	8,150	4,973	↓ 39%	Designite
Complex Methods (CC > 10)	26	9	↓ 65%	Designite
Code Smells	2,300	2,096	↓ 9%	SonarQube
Security Issues	122	5	↓ 96%	SonarQube
God Classes	2	0	↓ 100%	Designite
Average Cyclomatic Complexity	8.7	3.3	↓ 62%	Designite

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1. Weblog & Content Subsystem

Quantitative Improvements

Metric	Before	After	Change
LOC	3,450	2,245	↓ 35%
Complex Methods	12	5	↓ 58%
Magic Numbers	45	18	↓ 60%
Cyclic Dependencies	8	3	↓ 63%
LCOM	0.65	0.40	↓ 38%

Key Refactorings

1.1 God Class Decomposition

- `Weblog.java` reduced from 97 methods to 45 methods
- Extracted search logic to `WeblogEntrySearchCriteria` (Parameter Object Pattern)
- Applied Repository Pattern for data access

1.2 Parameter List Simplification

- Average parameters per method: 5.2 → 1.8
- Applied Parameter Object Pattern
- SonarQube maintainability: C → A

1.3 Cyclic Dependency Breaking

- Introduced Manager layer (Mediator Pattern)
- FANOUT reduced: 14.2 → 5.8
- Applied Dependency Inversion Principle

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2. User & Role Management Subsystem

Quantitative Improvements

Metric	Before	After	Change
LOC	2,850	1,710	↓ 40%
Security Issues	85	3	↓ 96%
Public Mutable Fields (S1104)	15	0	↓ 100%
WMC	112	45	↓ 60%

Key Refactorings

2.1 Security Enhancement

- Eliminated all public mutable fields
- Implemented password hashing
- SonarQube Security Rating: E → A

2.2 God Class Elimination

- `User.java` reduced from 75 to 45 methods
- Extracted permission classes: `WeblogPermission`, `GlobalPermission`
- LCOM improved: 0.72 → 0.32

2.3 Permission Model Centralization

- Reduced duplicate code from 180 LOC to 0
- Applied Template Method Pattern
- Code smell reduction: 75%

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3. Search & Indexing Subsystem

Quantitative Improvements

Metric	Before	After	Change
LOC	1,850	1,018	↓ 45%
Magic Numbers	35	5	↓ 86%
System.out Logging (S106)	24	0	↓ 100%
Broken Hierarchy	4	0	↓ 100%

Key Refactorings

3.1 Constants Consolidation

- Created `FieldConstants.java` with 28 constants
- Reduced magic numbers by 86%
- Maintenance points: 35 → 1

3.2 Logging Modernization

- Replaced System.out with SLF4J
- S106 violations eliminated
- Production-ready logging established

3.3 Hierarchy Correction

- Implemented Template Method Pattern
- Eliminated 180 LOC duplicate code
- Average CC: 8.5 → 3.2

3.4 Dependency Abstraction

- Created `IndexManager` interface

- Direct Lucene dependencies: 15 → 1 class
- FANOUT: 12.5 → 4.2

Cross-Cutting Metrics

Design Pattern Impact

Pattern	Subsystems	Key Improvement
Template Method	All 3	↓ 100% duplicate code
Parameter Object	Weblog	↓ 65% parameters
Dependency Inversion	All 3	↓ 64% coupling
Repository	All 3	Clear layering

SonarQube Quality Gates

Category	Before	After	Status
Reliability	C	B	✅ Improved
Security	E	A	✅ Passed
Maintainability	C	B	✅ Improved
Coverage	45%	72%	✅ Improved

Technical Debt

Type	Before (days)	After (days)	Reduction
Code Smells	45	32	↓ 29%
Reliability	12	5	↓ 58%
Security	8	0.5	↓ 94%
Total	65	37.5	↓ 42%

Design Smell Resolution

Smell Type	Before	After	Reduction
God Classes	2	0	↓ 100%
Broken Hierarchy	6	0	↓ 100%
Cyclic Dependencies	16	5	↓ 69%
Magic Numbers	98	30	↓ 69%
Public Mutable Fields	15	0	↓ 100%
Generic Exceptions	35	8	↓ 77%

Conclusions

Achievements

- **Security:** 96% reduction in vulnerabilities (SonarQube A rating)
- **Complexity:** 62% reduction in average cyclomatic complexity
- **Design Quality:** Eliminated all God Classes and broken hierarchies
- **Codebase:** 39% reduction in LOC while maintaining functionality

Recommendations

Immediate Actions:

1. Apply patterns to remaining subsystems
2. Enforce quality gates: CC < 10, Security A, Coverage > 70%
3. Remove remaining dead code (180 LOC identified)

Long-term Strategy:

1. Integrate quality metrics in CI/CD
2. Allocate 20% sprint capacity for technical debt
3. Create pattern documentation for team