The 50x Java Dev

Crafting Elegant & Maintainable Code with LLMs

☕ Adam Bien

in/adam-bien, adam-bien.com

airhacks.industries

"It's not work if you like it"
…so I never worked. #java


1000
/@bienadam/shorts

#360 Java, LangChain4J and Enterprise LLMs

Apple Podcasts Spotify YouTube [RSS]

An airhacks.fm conversation with Antonio Goncalves (@agoncal) about:

journey fro
Microsoft f
modern AI
assistance,
abstractior
standards
Entity (BCE
integration
multi-tenar
potentially

#359 From SIMD to CUDA with TornadoVM

[RSS]

An airhack

GPU acc
CPU-bo
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Vector A
hybrid a
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#356 AI/LLM Driven Development

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An airhacks.fm conversation with Jonathan Ellis (@spyced) abou

brokk as a Norse dwarf who forged Thor's hammer, Java Swin

airhacks.live

NEW online, live virtual workshops

Continuous coding, explaining, interacting and sharing with Adam Bien

Live, Virtual Online Workshops, Winter 2026:

> Faster, Better, Cleaner Java Development with Agentic LLMs, 26 February 2026
>
> ...or how to incrementally improve code using best practices and LLMs

Tickets are also available from: airhacks.eventbrite.com and meetup.com/airhacks

by Adam Bien

You don't like live, interactive virtual workshops? Checkout video courses: airhacks.io

airhacks.TV

with the time machine, “100 episodes ago segment”

…any questions left?

&

Total					
	Energy		Time		Mb
(c) C	1.00	(c) C	1.00	(c) Pascal	1.00
(c) Rust	1.03	(c) Rust	1.04	(c) Go	1.05
(c) C++	1.34	(c) C++	1.56	(c) C	1.17
(c) Ada	1.70	(c) Ada	1.85	(c) Fortran	1.24
(v) Java	1.98	(v) Java	1.89	(c) C++	1.34
(c) Pascal	2.14	(c) Chapel	2.14	(c) Ada	1.47
(c) Chapel	2.18	(c) Go	2.83	(c) Rust	1.54
(v) Lisp	2.27	(c) Pascal	3.02	(v) Lisp	1.92
(c) Ocaml	2.40	(c) Ocaml	3.09	(c) Haskell	2.45
(c) Fortran	2.52	(v) C#	3.14	(i) PHP	2.57
(c) Swift	2.79	(v) Lisp	3.40	(c) Swift	2.71
(c) Haskell	3.10	(c) Haskell	3.55	(i) Python	2.80
(v) C#	3.14	(c) Swift	4.20	(c) Ocaml	2.82
(c) Go	3.23	(c) Fortran	4.20	(v) C#	2.85
(i) Dart	3.83	(v) F#	6.30	(i) Hack	3.34
(v) F#	4.13	(i) JavaScript	6.52	(v) Racket	3.52
(i) JavaScript	4.45	(i) Dart	6.67	(i) Ruby	3.97
(v) Racket	7.91	(v) Racket	11.27	(c) Chapel	4.00
(i) TypeScript	21.50	(i) Hack	26.99	(v) F#	4.25
(i) Hack	24.02	(i) PHP	27.64	(i) JavaScript	4.59
(i) PHP	29.30	(v) Erlang	36.71	(i) TypeScript	4.69
(v) Erlang	42.23	(i) Jruby	43.44	(v) Java	6.01
(i) Lua	45.98	(i) TypeScript	46.20	(i) Perl	6.62
(i) Jruby	46.54	(i) Ruby	59.34	(i) Lua	6.72
(i) Ruby	69.91	(i) Perl	65.79	(v) Erlang	7.20
(i) Python	75.88	(i) Python	71.90	(i) Dart	8.64
(i) Perl	79.58	(i) Lua	82.91	(i) Jruby	19.84

GraalVM™

reduces RAM footprint

https://sites.google.com/view/energy-efficiency-languages/results?authuser=0

& LLMs?

	Average	Python	Cpp	Java	JS	Go	Shell	Csharp	Dart	Elixir	Julia	Kotlin	Perl	PHP	Racket	R	Ruby	Rust	Scala	Swift	TS
Count		196	186	188	184	191	188	199	200	198	200	200	200	199	196	198	200	199	199	200	199
Current Upper Bound	*74.8*	*63.3*	*74.7*	*78.7*	*59.2*	*69.1*	*70.7*	*88.4*	*78.0*	*97.5*	*78.0*	*89.5*	*64.5*	*52.8*	*88.3*	*74.2*	*79.5*	*61.3*	*77.4*	*78.0*	*61.3*
Reasoning Mode																					
Claude Opus 4 (20250514)	**52.4**	40.3	44.1	**55.9**	38.6	37.2	**51.6**	74.9	54.0	80.3	**55.5**	72.5	44.5	28.1	**68.9**	**52.5**	61.0	38.7	50.3	50.0	**47.2**
Claude Sonnet 4 (20250514)	51.1	37.2	46.8	52.7	34.8	**41.9**	48.9	72.4	53.5	81.8	49.0	71.5	**45.0**	**34.7**	**68.9**	50.5	54.5	36.2	48.2	48.0	44.2
o3-high (20250416)	51.1	40.8	47.3	53.2	**40.8**	22.0	49.5	68.3	**55.0**	80.8	54.5	72.0	44.0	32.7	53.1	47.5	59.0	**42.2**	51.3	**59.0**	**47.2**
o4-mini (2025-04-16)	50.0	**42.3**	46.8	51.6	40.2	31.4	45.2	68.3	54.0	**82.3**	49.0	**74.0**	44.0	30.2	45.4	43.4	59.0	40.2	50.3	54.0	45.7
Grok-4	50.9	41.2	**48.7**	50.0	37.5	41.4	47.3	72.4	49.5	76.8	**55.0**	70.0	44.0	27.1	63.8	48.5	**61.5**	37.7	**52.8**	51.5	40.7
Gemini2.5 Pro	48.7	40.3	47.5	53.2	37.0	37.2	45.2	70.9	54.0	68.7	54.0	72.0	41.0	29.7	52.6	49.5	56.5	24.6	46.7	49.5	41.7
DeepSeek-R1-0528	50.2	38.8	43.6	52.7	35.9	38.7	46.8	**75.4**	52.5	77.3	52.0	70.0	39.0	28.6	56.1	50.5	58.5	37.2	51.8	55.0	41.2
Seed1.6-enabled (250615)	45.3	39.8	44.6	46.3	28.3	40.8	44.1	60.3	39.5	69.7	51.0	58.0	41.5	25.6	52.6	51.0	52.0	28.6	41.7	47.5	41.2
Seed1.6-Thinking-250715	45.0	40.3	45.2	50.0	33.2	38.2	39.9	67.3	36.5	67.7	51.0	61.0	41.0	26.1	51.0	44.9	55.5	27.6	37.2	46.5	38.7
Seed1.6-Thinking-250615	44.7	38.8	47.0	49.5	38.0	31.4	38.8	62.3	41.0	70.7	45.0	68.0	39.0	25.1	47.5	47.5	50.5	30.7	39.7	41.5	40.2
GLM-4.5-enable	46.6	41.0	43.2	47.9	34.8	37.8	43.9	70.5	42.0	72.5	47.5	66.0	43.5	28.6	50.0	45.0	54.5	31.6	41.0	46.0	42.2
GLM-4.5-Air-enable	40.8	39.3	37.6	39.4	31.0	39.8	36.7	66.3	38.0	61.5	42.0	53.0	40.5	27.1	40.3	39.0	47.0	25.1	30.5	38.5	42.7
ERNIE-X1-Turbo-32K	39.6	39.4	17.8	33.2	32.6	37.4	33.9	46.0	33.0	68.9	54.0	49.5	39.5	23.9	45.3	44.3	48.0	20.8	40.4	44.0	37.7
Qwen3-235B-A22B-Thinking-2507	47.7	37.8	41.9	48.4	39.7	39.8	45.2	71.9	46.0	79.8	48.5	58.0	40.5	29.1	56.6	49.0	55.0	35.7	40.4	46.0	44.2
Qwen3-235B-A22B	45.9	36.7	43.5	47.3	36.4	37.7	42.0	70.9	45.5	68.7	46.0	60.0	39.0	29.1	52.0	47.0	56.5	31.7	43.7	41.5	41.7
Qwen3-32B	41.7	37.8	38.7	39.9	32.6	36.1	39.4	67.8	34.5	65.2	42.5	52.0	40.5	27.6	37.8	44.9	47.0	28.1	37.2	42.0	40.2
Qwen3-14B	37.6	37.8	35.5	35.1	30.4	30.4	36.2	60.8	29.0	62.1	34.5	44.5	37.5	23.1	44.9	36.9	43.5	24.6	28.6	36.0	38.7
Qwen3-8B	28.5	28.1	22.6	21.8	28.3	29.3	27.1	52.8	21.0	43.9	29.0	36.0	35.5	18.6	13.3	30.8	37.0	12.6	21.1	22.0	37.7
Qwen3-4B	24.3	27.6	17.7	22.3	25.5	24.1	28.2	42.2	13.0	33.3	20.0	29.5	34.5	16.1	11.7	23.7	27.5	8.5	20.1	20.0	39.2
Qwen3-1.7B	11.2	16.8	5.4	4.8	12.5	9.9	11.7	19.6	7.0	20.7	11.0	9.0	19.5	7.5	5.6	9.6	21.0	0.0	2.5	10.0	19.6
Non-Reasoning Mode																					
Claude Opus 4 (20250514)	**50.9**	37.8	45.7	50.0	**38.0**	35.6	47.3	73.9	**57.0**	**82.3**	**55.0**	**75.5**	43.0	26.6	**64.8**	47.0	**54.0**	**38.2**	**46.7**	**51.5**	**46.7**
Claude Sonnet 4 (20250514)	49.3	35.7	47.3	**52.7**	**38.0**	**37.7**	**47.9**	72.9	51.0	74.2	51.0	72.0	44.0	**30.7**	63.8	44.4	51.5	35.2	45.2	45.5	44.2
GPT4.1 (2025-04-14)	48.0	37.2	46.8	48.9	34.8	37.2	36.7	74.4	46.5	76.8	50.0	72.0	43.5	29.2	50.5	42.4	**54.0**	37.2	44.2	49.5	46.2
GPT-4o (2024-11-20)	41.1	33.7	37.1	45.2	34.8	30.9	29.3	65.5	43.5	62.6	36.0	67.0	43.0	26.6	37.2	32.8	45.0	29.6	38.2	45.0	39.2
Gemini2.5 Flash	45.7	39.3	44.1	50.0	33.2	33.0	37.8	68.3	49.5	64.0	47.5	70.0	39.5	24.1	38.3	**51.5**	53.0	36.2	44.2	46.5	41.2
DeepSeek-V3-0324	48.1	36.7	**48.4**	**52.7**	31.5	34.6	37.8	72.9	48.0	75.8	49.0	69.0	42.5	28.1	59.2	45.0	52.5	37.2	**46.7**	48.0	43.7
DeepSeek-Coder-V2	37.7	29.1	34.9	34.0	27.7	29.8	31.4	63.8	33.5	60.6	37.5	58.5	35.5	25.1	41.8	35.4	45.0	22.6	33.2	38.0	35.7
DeepSeek-Coder-33B-Instruct	28.5	25.0	24.2	29.3	24.5	29.8	22.3	54.8	17.5	67.7	14.5	52.0	29.5	19.1	28.1	18.7	33.0	8.0	24.1	18.0	29.1
DeepSeek-Coder-6.7B-Instruct	20.5	18.9	12.9	19.7	19.6	21.5	16.0	44.2	11.5	47.5	15.5	45.5	21.5	10.6	15.3	13.1	27.5	6.0	11.1	8.0	23.6
Kimi-K2-0711-Preview	47.8	38.8	42.5	47.9	37.5	31.4	40.4	**75.9**	50.0	80.3	52.0	68.0	41.5	28.1	57.1	40.4	52.5	36.7	42.7	47.0	42.2
Hunyuan-TurboS-20250716	43.8	34.2	34.9	47.9	32.6	34.6	38.3	64.8	44.5	70.7	47.0	62.0	42.0	30.2	45.9	39.9	53.0	30.7	39.2	39.5	42.2
Hunyuan-Coder-7B-Preview	33.4	25.5	26.9	34.0	27.2	21.5	29.3	54.8	36.0	60.1	30.5	57.0	34.0	22.2	37.8	27.3	40.5	11.1	31.2	27.6	31.2
Seed1.6-disabled (250615)	42.9	35.2	40.3	46.8	32.6	34.6	35.1	70.9	42.5	69.7	45.0	62.0	39.5	23.1	49.5	40.4	46.5	28.1	32.7	40.0	42.7
Seed-Coder-8B-Instruct	32.3	23.5	23.7	33.5	28.8	22.5	20.7	54.8	30.5	57.1	33.0	52.5	34.0	25.1	36.7	28.3	35.5	15.6	29.6	28.0	31.2
Qwen3-Coder-480B-A35B-Instruct	44.8	**39.4**	41.1	51.1	27.9	31.4	41.1	63.0	36.5	73.7	49.5	63.1	41.0	27.2	56.3	42.7	51.5	25.4	42.1	47.5	41.9
Qwen3-235B-A22B-Instruct-2507	43.1	35.7	38.2	49.5	29.3	33.5	40.4	67.3	39.5	59.1	46.0	59.5	**44.5**	26.1	49.5	44.0	46.5	24.6	37.7	46.0	43.2
Qwen3-32B	31.0	26.5	21.5	29.5	28.0	25.5	24.0	59.3	27.5	52.0	28.0	45.0	34.5	21.6	28.6	22.7	36.5	16.1	26.6	30.0	35.2
Qwen3-14B	28.6	24.5	22.6	32.4	27.2	16.8	23.9	50.8	21.0	42.4	22.5	42.0	34.5	24.6	28.1	26.3	33.5	17.1	20.6	26.5	32.7
Qwen3-8B	23.3	22.4	11.3	25.0	22.8	18.3	22.3	42.2	17.0	41.4	18.5	36.0	29.5	18.1	23.5	16.2	27.0	7.5	19.1	17.5	29.1
Qwen3-1.7B	7.9	8.7	1.1	2.7	8.2	3.7	11.7	9.5	3.5	17.2	6.0	11.5	15.5	7.5	4.6	7.6	14.5	0.5	3.0	6.0	14.6
Qwen2.5-Coder-32B	35.8	29.6	27.4	33.0	29.9	23.0	29.3	58.3	34.5	59.6	35.5	56.0	38.5	26.1	35.7	31.3	40.0	23.1	29.6	39.0	35.2
Qwen2.5-72B	34.3	33.2	24.7	31.9	28.8	19.9	31.9	54.3	34.0	65.7	30.5	50.5	30.0	22.6	39.3	27.3	42.0	23.1	32.7	29.5	33.2
Qwen2.5-Coder-7B	22.5	19.9	8.6	22.3	21.2	12.6	21.3	38.7	18.5	47.0	18.0	39.0	27.5	15.1	24.0	17.7	29.5	7.0	19.1	17.0	24.6
Qwen2.5-Coder-1.5B	10.3	12.2	2.7	4.8	12.0	7.3	14.4	17.6	6.5	35.4	4.0	16.5	15.0	5.0	7.1	7.6	15.5	1.0	4.5	5.0	11.1
OpenCoder-8B	19.3	14.3	9.7	19.1	12.5	17.3	21.3	33.2	15.5	34.3	15.5	30.0	26.5	14.6	15.8	17.2	29.5	6.0	17.1	15.0	21.1

Table 4: Pass@1 (%) performance of different models for AutoCodeBench. ***Current Upper Bound*** represents the Pass@1 value calculated by taking the union of problems correctly solved by all models.

https://github.com/Tencent-Hunyuan/AutoCodeBenchmark/tree/main

Why Java?

1998

Java Community Process

JCP Formation

- Formalized specification process
- JSR (Java Specification Request)
- Expert Groups
- Public participation

2006

OpenJDK Launch

Open Source Transition

- GPL v2 license
- Source code availability
- Community contributions
- Multiple implementations

Open Source Transition

Sun released Java under GPL, making it truly open source.
Enabled alternative JVM implementations and broader ecosystem participation.

Java's Unique Position

Only Java Offers

- Public normative specifications
- API/SPI separation
- Multiple certified implementations
- Open source ecosystem
- 25+ years of stability

Specifications as Ground Truth

Jakarta EE & MicroProfile

- JAX-RS, JPA, CDI specifications
- RFC 2119 normative language
- Technology Compatibility Kits
- Public documentation
- Consistent implementations

Java Community Process

Established 1998

- Open specification development
- Multi-vendor participation
- Public review process
- Reference implementations

Java Community Process

Established 1998

The JCP provided a formal mechanism for developing Java technology specifications through Java Specification Requests (JSRs). Any organization or individual could participate.

JSR: Java Specification Request

Collaborative Standards

- Specification document
- Reference implementation
- Technology Compatibility Kit (TCK)

JSR: Java Specification Request

Each JSR produces three deliverables. The specification defines the API and behavior. The reference implementation proves feasibility. The TCK ensures compatibility across vendors.

Technology Compatibility Kit

TCK Purpose

- Validates specification compliance
- Enables multiple implementations
- Protects ecosystem compatibility
- Licensed to implementors

API/SPI Separation

```
// API - what developers write
@PersistenceContext
EntityManager em;

var speaker = em.find(Speaker.class, id);

// SPI - provider implementation (hidden)
// Hibernate, EclipseLink, OpenJPA
```

Annotations as Semantic Metadata

```
@Path("/speakers")
@Produces(MediaType.APPLICATION_JSON)
@ApplicationScoped
public class SpeakersResource {

    @GET
    @Transactional
    public List<Speaker> all() {
        return speakers.all();
    }
}
```

Strong Static Typing

```
public Optional<Speaker> findById(Long id) {
    return repository.findById(id);
}

// Type information explicit
// Return type: Optional<Speaker>
// Parameter type: Long
```

Building Maintainable Java Applications

Origins

Ivar Jacobson

- Object-Oriented Software Engineering (1992)
- Robustness Analysis
- Use Case Driven Development

Origins

The BCE pattern originated from Ivar Jacobson's work on use case driven development in the early 1990s.

Jacobson introduced this as part of robustness analysis, a technique to bridge the gap between use cases and detailed design.

BCE Architecture

Boundary Control Entity

- Boundary → External interactions
- Control → Business logic
- Entity → Domain state

Boundary Layer

```
@Path("/speakers")
@Produces(MediaType.APPLICATION_JSON)
public class SpeakersResource {

    @Inject
    Speakers speakers;

    @GET
    public Response all() {
        return Response.ok(speakers.all()).build();
    }
}
```

Control Layer

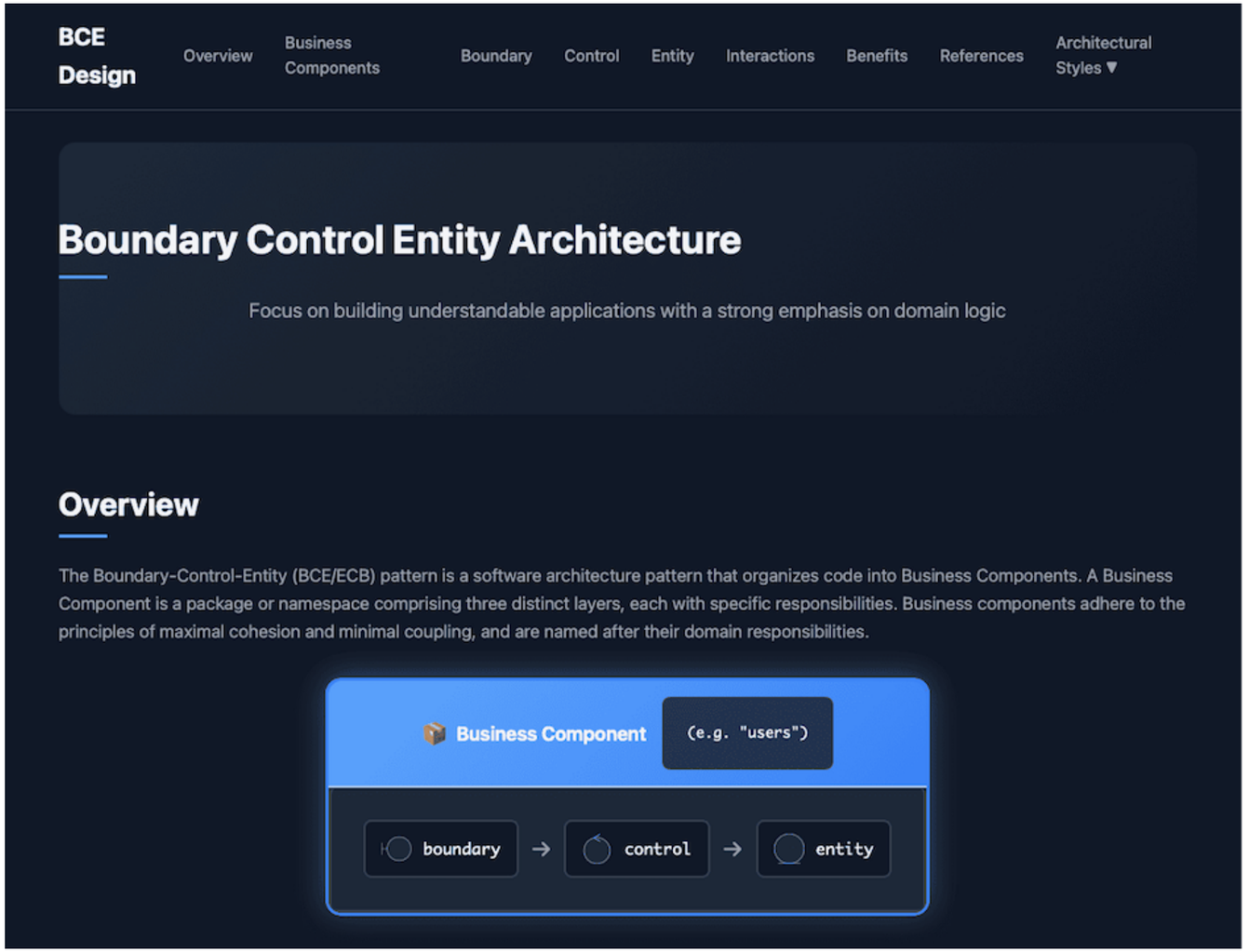
```
@ApplicationScoped
public class Speakers {

    @Inject
    SpeakerRepository repository;

    public List<Speaker> all() {
        return repository.findAll();
    }
}
```

Entity Layer

```
public record Speaker(
    String name,
    String topic,
    LocalDateTime slot
) {
    public JsonObject toJSON() {
        return Json.createObjectBuilder()
            .add("name", name)
            .add("topic", topic)
            .build();
    }
}
```

Package Structure

```
airhacks.conference
├── boundary
│   └── SpeakersResource.java
├── control
│   └── Speakers.java
└── entity
    └── Speaker.java
```


BCE Design
Overview
Business Components
Boundary
Control
Entity
Interactions
Benefits
References
Architectural Styles
Boundary Control Entity Architecture
Focus on building understandable applications with a strong emphasis on domain logic
Overview
The Boundary-Control-Entity (BCE/ECB) pattern is a software architecture pattern that organizes code into Business Components. A Business Component is a package or namespace comprising three distinct layers, each with specific responsibilities. Business components adhere to the principles of maximal cohesion and minimal coupling, and are named after their domain responsibilities.
Business Component
(e.g. "users")
boundary
control
entity

👉bce.design

BCE as LLM Context

- Business components = bounded context for LLMs
- "speakers BC" → airhacks.speakers package
- Cohesive packages reduce ambiguity
- LLMs place code in correct layer

AI Reasons in Meaning

- LLMs understand semantics, not syntax
- @Path, @Transactional → explicit intent
- "boundary", "control" → meaningful names
- Specifications → shared vocabulary

Using LLMs to Write Better Code Faster

Prompt Engineering for Java

Effective Prompts

- "create speakers BC"
- "speaker has presentations"
- "implement speaker JPA entity with validation"
- "add health check"
- "generate REST client interface"
- "implement ST"

Iterative Refinement

Workflow

1. Use Domain Specific Prompt to generate code
2. Review, understand and refine
3. Validate with tests
4. Update rules, steerings, skills or powers
5. (Share)

Hyperproductivity with Standards

Minimal Hallucinations

Standards Prevent

- Invented APIs
- Non-existent annotations
- Incorrect patterns
- Framework-specific quirks

Cut-Off Date Irrelevance

Standards-Based Development

- Jakarta EE 8 (2019) still valid
- JAX-RS 2.1 patterns unchanged
- CDI 2.0 fundamentals stable
- Specifications evolve slowly

Lean Code

```
// LLM generates minimal solution
@Path("/speakers")
public class SpeakersResource {

    @Inject
    Speakers speakers;

    @GET
    public List<Speaker> all() {
        return speakers.all();
    }
}
```

Lean Code

- No unnecessary interfaces
- No abstract classes
- Direct field injection

Understandable Code

```
// Self-documenting through annotations
@GET
@Path("/{id}")
@Produces(MediaType.APPLICATION_JSON)
public Response find(@PathParam("id") String id) {
    return speakers.find(id)
        .map(Response::ok)
        .orElse(Response.status(NOT_FOUND))
        .build();
}
```

Writing Better JavaDoc

Intent Over Implementation

- Document why and what, not how
- Explain purpose and constraints
- Avoid restating implementation
- LLMs generate meaningful docs

Package Documentation

```java
/**
 * REST API for conference speaker management.
 *
 * Exposes CRUD operations for speakers.
 *
 * @see airhacks.speakers.control.Speakers
 */
package airhacks.speakers.boundary;
```

Design Decisions

```
/**
 * Speaker management component.
 *
 * Design Decisions:
 * - Uses optimistic locking via @Version
 * - Implements soft delete pattern
 * - Caches speaker list for 5 minutes
 */
package airhacks.speakers;
```

Automated Code Reviews

LLM as Reviewer

Review Checklist

- Follows BCE architecture?
- Uses appropriate annotations?
- Handles errors correctly?
- Includes validation?
- Has tests?

Architectural Rules

Capturing Rules

```
# Architecture Rules

## Boundary Layer
- JAX-RS resources only
- @Transactional allowed
- Delegate to control layer
- No business logic

## Control Layer
- Business logic only
- Stateless operations
- No protocol handling
```

Testing with LLMs

System Tests

```
@RegisterRestClient(configKey = "speakers_api")
@Path("/speakers")
interface SpeakersClient {

    @GET
    List<Speaker> all();

    @POST
    Response create(Speaker speaker);
}

class SpeakersSystemIT {

    @Inject
    SpeakersClient client;

    @Test
    void createsViRestApi() {
        var response = client.create(
            new Speaker("Venkat", "Functional", now())
        );
        assertThat(response.getStatus()).isEqualTo(201);
    }
}
```

Key Takeaways

Java's Advantages

- Public specifications
- API/SPI separation
- Strong typing
- Annotation metadata
- Open source ecosystem

Standards Enable AI

- Normative specifications prevent hallucinations
- Consistent patterns improve generation
- Public documentation trains LLMs
- Multiple implementations prove portability

Maintainability Matters

- Simple over complex
- Consistent over clever
- Documented over implicit
- Tested over assumed

Tools Complement Skills

- LLMs accelerate development
- Humans ensure quality
- Standards guide both
- Tests validate results

The 50x Developer

Combines

- Deep Java knowledge
- Architectural discipline
- Effective prompting
- Tool mastery
- Standards adherence

Resources

constructions.cloud
bce.design
jakarta.ee
microprofile.io

Questions?