2025 EDITION · MID-SENIOR LEVEL

.NET 8 / 9

ASP.NET CORE

EF CORE

SYSTEM DESIGN

FREE SAMPLE

FREE PREVIEW EDITION · 3 SAMPLE CHAPTERS

.NET Interview Preparation System

The production-grade technical guide for mid-to-senior .NET developers who want to stop guessing and start answering at a senior level. This free sample contains 3 complete chapters from the full 58-page guide.

★ Free preview - 3 complete chapters included · Full guide available at yaman95.gumroad.com

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Senior .NET Developer · Backend Architecture · Scalable APIs

WHY MOST .NET DEVELOPERS FAIL SENIOR INTERVIEWS

You know how to build things. But can you explain why they work?

Senior interviewers don't want to hear what you built. They want to hear how you think - about tradeoffs, internals, failure modes, and production reality. Most .NET developers are never taught this distinction.

× **Memorising definitions, not internals**

"Task is used for async operations" doesn't answer "what does the compiler generate for an async method?"

× **Watching YouTube videos that go 3mm deep**

Tutorial-level content will not carry you past a senior .NET interviewer who has read the runtime source code.

× **Giving weak answers to common questions**

"I use IDisposable to clean up resources" - correct but shallow. Senior answers explain the GC finalizer thread, SuppressFinalize, and SafeHandle.

× **No system design vocabulary**

Saying "use microservices for scaling" when the interviewer wants Outbox Pattern, CQRS, idempotency, and circuit breakers.

× **Confusing authentication with authorisation**

Still mixing up JWT validation, policy-based auth, and resource-based authorisation in the same sentence.

× **Zero exposure to real interview questions**

No practice with the exact Q&A format senior interviewers use - including the follow-up traps they set.

This guide was written to close exactly this gap - not with summaries of the documentation, but with the internal model, the tradeoff vocabulary, and the senior-level answers that actually work in interviews.

What's Inside the Full 58-Page Guide

58	20	40+	25+	5
PAGES OF CONTENT	DEEP-DIVE CHAPTERS	REAL CODE EXAMPLES	Q&A INTERVIEW SIMULATIONS	MAJOR SECTIONS

SECTION I · .NET FOUNDATION & RUNTIME — 5 chapters · pp. 4–13 · ✓ Included in this preview

CLR Internals · JIT / NativeAOT · GC Generations · Finalizers vs IDisposable · async/await State Machines · ConfigureAwait · ValueTask · ThreadPool Starvation · Channels · Span<T> / Memory<T> · ArrayPool<T>

SECTION II · ASP.NET CORE DEEP DIVE — 7 chapters · pp. 14–26 · locked in preview

Middleware Pipeline · DI Lifetimes & Captive Dependencies · JWT Authentication · Policy-Based Auth · Filters vs Middleware · Options Pattern · Structured Logging · Minimal APIs

SECTION III · DATA & EF CORE — 5 chapters · pp. 27–34 · locked in preview

Tracking vs No-Tracking · Migration Internals · Query Translation Traps · Repository Pattern Debate · N+1 & Split Queries

SECTION IV · SYSTEM DESIGN FOR .NET — 6 chapters · pp. 35–46 · locked in preview

Scalable API Design · CQRS with MediatR · Caching Strategies · Microservices Tradeoffs · Outbox Pattern · MassTransit · Background Jobs

SECTION V · INTERVIEW SIMULATION — 25+ Q&A blocks · pp. 47–58 · locked in preview

Real Senior Questions · Weak vs Strong Answers · Interviewer Traps · SQL & Performance · System Design Scenarios · Behavioural Mindset

FREE SAMPLE CHAPTER 1.1 - REPRODUCED FROM THE FULL GUIDE

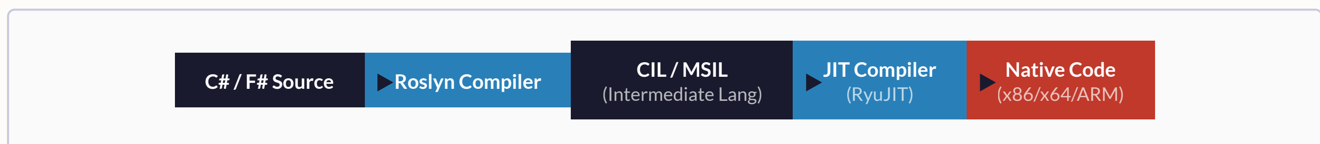
1.1 CLR Internals & the .NET Runtime

The **Common Language Runtime (CLR)** is the virtual machine component of .NET. It provides execution of .NET programs by managing memory, thread safety, exception handling, garbage collection, security, and type safety. Understanding the CLR is the prerequisite for understanding every other behaviour in the platform.

§ The Compilation Pipeline

When you write C# code, it does not compile directly to native machine instructions. Instead it passes through two distinct compilation stages:

FIG 1.1 - .NET COMPILATION PIPELINE



Stage 1 - Roslyn compilation: The C# compiler transforms source code into *Common Intermediate Language (CIL)*. CIL is a CPU-independent, stack-based bytecode stored in a PE assembly (.dll or .exe) alongside metadata describing types and members.

Stage 2 - JIT compilation: The *Just-In-Time* compiler (RyuJIT) translates CIL to native instructions at runtime, method by method, on first invocation. The native code is cached so subsequent calls pay zero JIT cost.

READYTORUN & NATIVEAOT

ReadyToRun (R2R) pre-compiles CIL to native code at publish time, reducing cold-start JIT overhead - critical for containers and serverless. **NativeAOT** (matured in .NET 8) compiles entirely ahead-of-time, eliminating the JIT entirely at the cost of some reflection capabilities.

§ Type System & the Stack vs Heap Trap

The CLR enforces a unified type system where every type ultimately derives from `System.Object`. Types split into **value types** (structs, enums, primitives - copied by value) and **reference types** (classes, interfaces - heap-allocated, variables hold a managed pointer).

INTERVIEW TRAP - "STRUCTS ARE ALWAYS STACK-ALLOCATED"

This is one of the most common misconceptions. A struct that is a **field of a class** lives on the heap inside the parent object. A struct that is a **captured variable in a lambda or async method** also ends up on the heap (in a compiler-generated class). "Stack vs heap" depends on usage context, not just type kind.

FREE SAMPLE CHAPTER 1.3 - REPRODUCED FROM THE FULL GUIDE

1.3 async / await - The Internal Model

The `async` / `await` keywords are *compiler sugar*. Understanding what the compiler generates is the difference between writing correct async code and writing code that deadlocks in production.

§ The State Machine Transformation

Every `async` method is rewritten by the C# compiler into a **struct state machine** implementing `IAsyncStateMachine`. The method's local variables become fields on that struct, and the method body is segmented into numbered states separated at each `await` point.

```
// What you write:
public async Task<string> FetchDataAsync(string url)
{
    var client   = new HttpClient();
    var response = await client.GetAsync(url);                    // await point 1
    var content  = await response.Content.ReadAsStringAsync();    // await point 2
    return content.ToUpper();
}

// What the compiler generates (simplified):
// state -1 → executes up to first await  → suspends
// state  0 → resumes after first await   → executes to second await → suspends
// state  1 → resumes after second await  → completes the Task<string>
```

§ ConfigureAwait - Library vs Application Code

```
// Library code: always use ConfigureAwait(false)
public async Task<Data> GetDataAsync()
{
    // ConfigureAwait(false): resume on any threadpool thread,
    // do NOT capture the SynchronizationContext - avoids deadlocks
    var raw = await _http.GetStringAsync(url).ConfigureAwait(false);
    return JsonSerializer.Deserialize<Data>(raw);
}

// Application code (controllers, page handlers): omit ConfigureAwait
[HttpGet]
public async Task<IActionResult> Get()
{
    var data = await _service.GetDataAsync(); // context capture is fine here
    return Ok(data);
}
```

THE CLASSIC DEADLOCK PATTERN

In ASP.NET Framework (not Core): calling `.Result` or `.Wait()` on an async method from a request thread blocks that thread while the async continuation waits to post back to the same thread - **deadlock**. ASP.NET Core eliminated the per-request SynchronizationContext, but the pattern still causes issues in WPF/WinForms and any custom SynchronizationContext.

§ ValueTask - When Zero Allocations Matter

`Task` always allocates a heap object. For hot paths where the async operation completes synchronously most of the time, `ValueTask<T>` avoids the allocation entirely:

```
public ValueTask<User> GetUserAsync(int id)
{
    if (_cache.TryGetValue(id, out var user))
        return ValueTask.FromResult(user);  // zero allocation, synchronous path

    return new ValueTask<User>(FetchFromDbAsync(id)); // async path
}
```

VALUETASK CONSTRAINT

A `ValueTask` must be awaited **at most once**. Do not store it, share it between callers, or await it after it has completed. If you need those patterns, call `.AsTask()` first.

FREE SAMPLE SECTION V · ACTUAL INTERVIEW QUESTION FORMAT USED THROUGHOUT THE GUIDE

Every interview question in Section V follows this three-part format: the question itself, the answer a junior gives (and why it fails), the senior-level answer that passes, and the follow-up trap an experienced interviewer will use.

Explain the difference between Singleton, Scoped, and Transient lifetimes in ASP.NET Core DI. What happens if you inject a Scoped service into a Singleton?

⚠ WEAK ANSWER (JUNIOR/MID-LEVEL)

"Singleton creates one instance for the whole app, Scoped creates one per request, and Transient creates a new one each time. You shouldn't inject Scoped into Singleton because the lifetimes don't match."

✓ STRONG ANSWER (SENIOR-LEVEL)

"The three lifetimes map directly to different instance-sharing semantics: **Singleton** - one instance for the entire application lifetime, shared across all requests and threads (must be thread-safe); **Scoped** - one instance per DI scope, which in ASP.NET Core maps to one per HTTP request; **Transient** - a new instance created at every injection point. Injecting a Scoped service into a Singleton creates a **captive dependency** bug: the Singleton captures the Scoped instance from the first request, and all subsequent requests share that stale, potentially corrupted state. This has caused real data leaks in production - imagine a DbContext captured in a Singleton leaking a tenant's data to another tenant. The ASP.NET Core container throws an `InvalidOperationException` in development when `ValidateScopes = true`, but this validation is disabled in production by default. I always enable it in production via `.UseDefaultServiceProvider(opts => opts.ValidateScopes = true)`."

INTERVIEWER TRAP

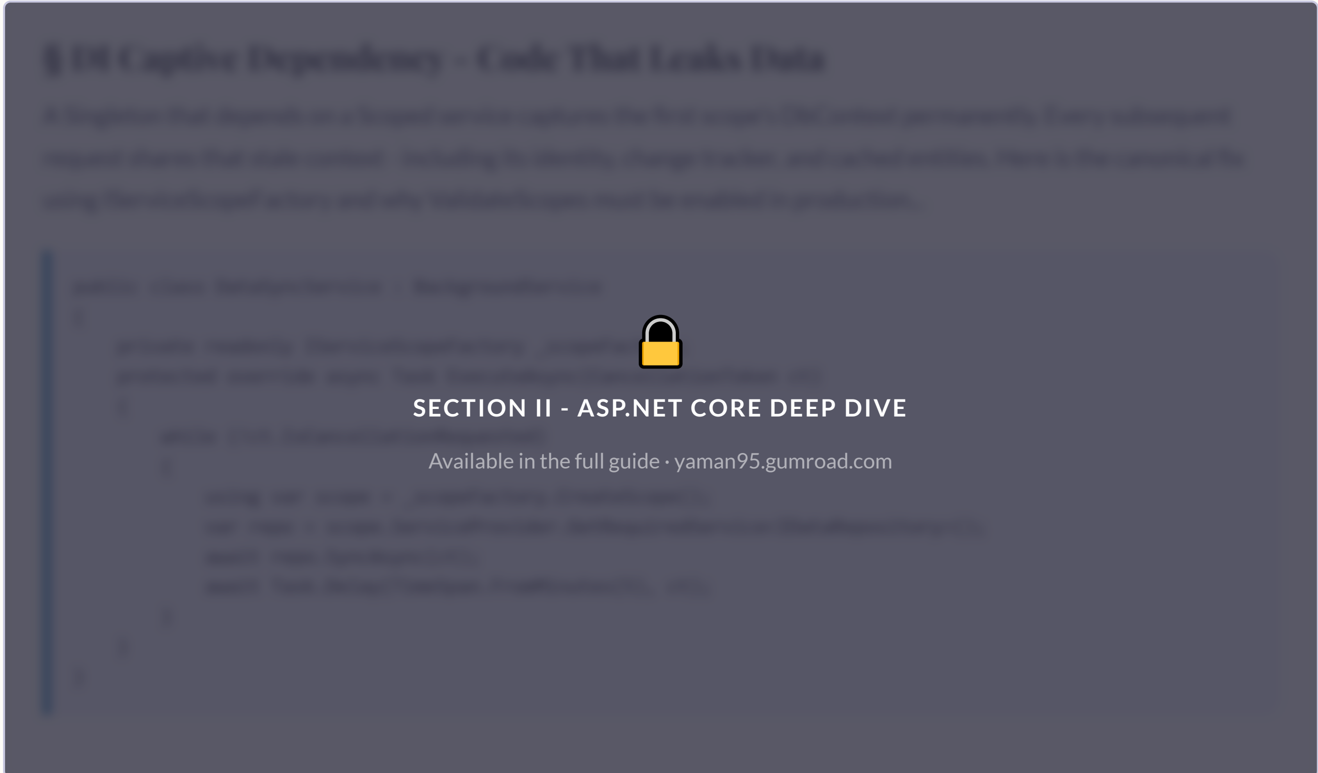
"How do you correctly use a Scoped service from a Singleton BackgroundService?" - The answer is `IServiceScopeFactory`. BackgroundServices are Singletons and cannot directly inject Scoped dependencies. Create an explicit scope per unit of work: `using var scope = _scopeFactory.CreateScope(); var service = scope.ServiceProvider.GetRequiredService<IMyService>();` This creates a proper scope lifecycle and avoids the captive dependency problem.

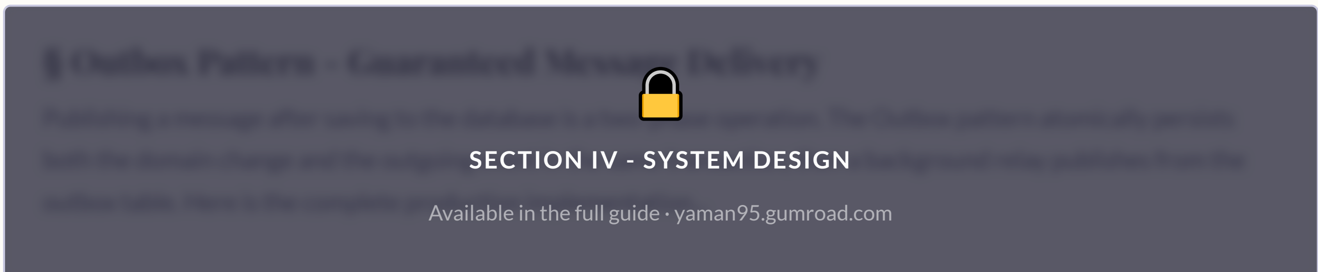
25+ Q&A BLOCKS IN THE FULL GUIDE

The full Section V covers .NET Core deep questions, SQL & performance, system design scenarios (rate limiting, distributed caching, order processing at scale), and behavioural questions assessed by senior interviewers. Every question includes the weak answer, the strong answer, and the follow-up trap.

A Taste of What's Behind the Lock

The three chapters in this preview represent **Section I only**. Here is what awaits in the remaining four sections:





Why This Is Different from Everything Else

Topic	YouTube / Blog Posts	This Guide
async/await	How to use it, Task vs async void	Compiler-generated state machines, SynchronizationContext, deadlock root causes, ValueTask constraints
Garbage Collection	Gen 0/1/2 diagram + "use IDisposable"	LOH fragmentation, Server GC in containers, finalizer threading, GC.SuppressFinalize, SafeHandle pattern
DI Lifetimes	Singleton = one instance, Scoped = per-request	Captive dependency bugs, data leaks, ValidateScopes in production, IServiceScopeFactory in BackgroundServices
EF Core	Add/SaveChanges tutorial, LINQ basics	Query translation traps, N+1 patterns, split queries, AsNoTracking performance, migration internals
System Design	Generic microservices diagrams	Outbox pattern, cache stampede, idempotency with Redis Lua, rate limiter algorithms, CQRS with MediatR code
Interview Prep	Top 10 .NET interview questions (with dictionary answers)	Exact weak vs strong answer format, follow-up traps, what the interviewer is actually assessing, 25+ scenarios

Every chapter in this guide is written from two perspectives simultaneously: **what you need to understand** to have genuine mastery, and **how to communicate that mastery** in an interview under pressure. These are different skills and both are trained here.

> **WRITTEN FROM PRODUCTION REALITY**
>
> Not "here is what the docs say." Instead: "here is what happens when this breaks in production at 3 AM, why it breaks, and what you need to say in an interview to prove you would have caught it before it went live." Every trap, every callout, every senior insight in this guide comes from real incidents, real codebases, and real interview sessions.

Who This Guide Is - and Isn't - For

✓ THIS IS FOR YOU IF...

- You are a mid-level .NET developer (2–4 years) preparing for senior interviews
- You are already senior but feel gaps in your CLR, GC, or async mental model
- You are transitioning from .NET Framework to .NET 6/7/8/9 and need to close the gaps
- You know how to build things but struggle to explain *why* they work
- You want to give senior-level answers, not just correct ones
- You have an interview coming up and need the fastest path to depth
- You've been burned by "Top 10 C# Interview Questions" lists that didn't help

✕ THIS IS NOT FOR YOU IF...

- You are brand-new to C# and looking for a beginner tutorial
- You want a complete reference manual covering every .NET API
- You want a crash course on writing your first ASP.NET Core app
- You are preparing for a junior role where basic CRUD knowledge is sufficient
- You are looking for certification exam question banks

§ The Reader This Guide Was Written For

You have been writing .NET professionally for a few years. You can build APIs, work with EF Core, set up DI, and handle async code. You have probably passed several mid-level interviews. But senior interviews feel different - interviewers probe deeper, ask "why," push on tradeoffs, and follow up with production scenarios. This guide was written for the exact moment when competence is no longer enough and you need **architectural depth**.

SPECIFICALLY COVERS .NET 8 / .NET 9

All code examples target .NET 8 / .NET 9 unless explicitly noted. Concepts apply equally to .NET 6+ unless a version-specific feature (NativeAOT, keyed services, output caching, frozen collections) is called out. The guide acknowledges what changed between .NET Framework and modern .NET - because interviewers test this transition knowledge.

If after reading the three sample chapters you found at least one thing you did not already know deeply - the state machine explanation, the captive dependency mechanics, the ValueTask constraints - then the full guide has 17 more chapters at the same depth.

What .NET Developers Are Saying

"The async/await state machine chapter alone was worth the price. I have been writing async code for 4 years and did not know the compiler generated a struct-based state machine. I used this exact explanation in my senior interview at a fintech and got the job."

Karim B.
Senior .NET Developer, London

"I failed two senior interviews before this because I kept giving 'technically correct but shallow' answers. The weak-vs-strong answer format taught me exactly how to upgrade my answers. Passed my third interview two weeks after reading this."

Priya N.
.NET Backend Engineer, Amsterdam

"The GC section and the Dispose pattern explanation is the most accurate I have read outside of the official runtime docs. I have been a .NET developer for 6 years and still learned things I did not know. The captive dependency section caught a real bug in our production codebase."

Tomasz W.
Lead .NET Developer, Warsaw

"System Design section is exactly what I needed. Not generic advice - actual code with MediatR, MassTransit, Outbox pattern, and Polly with explanations of WHY each choice was made. The rate limiter Q&A alone prepared me for a question I got verbatim in my interview."

Andreea M.
Backend Engineer, Bucharest

BY THE NUMBERS

4.9/5	500+	58	25+	40+
AVG RATING	COPIES SOLD	DENSE PAGES	Q&A SCENARIOS	CODE EXAMPLES

EVERYTHING YOU GET

The complete 58-page guide - no paywalls, no modules, no upsells.

→ **All 20 deep-dive chapters** across 5 sections - CLR internals, ASP.NET Core, EF Core, System Design, and Interview Simulation

→ **40+ production-grade code examples** in .NET 8/9 with inline explanations of why each decision was made

→ **25+ Q&A interview blocks** - every question with a weak answer (and why it fails), a strong answer, and the follow-up trap

→ **10 architecture diagrams** - compilation pipeline, GC heap, request pipeline, filter chain, layered API stack

→ **12 comparison tables** - GC modes, service lifetimes, communication patterns, caching layers, background job tools

→ **The 10 Things That Separate Senior .NET Answers** - quick reference cheat sheet on the last page

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FROM THE AUTHOR

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I wrote this guide because I failed senior interviews the exact same way most developers do - by giving answers that were technically correct but lacked the depth that senior engineers are expected to demonstrate. I knew how to use async/await. I didn't know what the compiler did with it.

After those failures, I spent months going deeper: reading the CLR source code, studying GC internals, debugging production deadlocks, and reviewing dozens of real interview transcripts from teams I was on. I distilled all of that into this guide - not as a documentation summary, but as the exact mental model a senior engineer uses to reason about these topics.

The three chapters in this free preview are real chapters from the full guide - nothing was watered down for the preview. If they delivered value, the other 17 chapters are built to the same standard.

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