UNIVERSITY OF WESTMINSTER

Enterprise Application Development

Milos Kojic

Aleksandar Kojic

James Deslauriers

Cassim Farook (IIT)

UNIVERSITY OF WESTMINSTER

Announcements

- Lectures will take place online (Blackboard)

- Tutorials will be on campus

- Tutorial slots are listed on your timetable

- Tutorials start next week

Objectives

- Learn how to build modern enterprise applications with C# and .NET
- Understand how to design and model software, considering requirements
- Get practical knowledge on Object Oriented Programming patterns and techniques

Module Outline

- Week 1: The .NET introduction
- Week 2: C# overview
- Week 3: UMLs
- Week 4: .NET application development
- Week 5: Web applications - Blazor
- Week 6: Engagement week
- Week 7: SOLID principles
- Week 8: Working with Databases
- Week 9: Working with APIs
- Week 10: Design patterns
- Week 11: Testing
- Week 12: Cloud computing concepts

Assessment

- Module is coursework based

- Coursework 1 (50%) - Requirements analysis and design
  - due 2/11/2021 1pm

- Coursework 2 (50%) - Implementation of Coursework 1
  - due 14/12/2021 1pm

My expectations of you

- You engage with all lectures and tutorials
  - For any questions use Blackboard Module Discussion Board

- You do all tutorial exercises

- Submit your coursework on time

- Flag any problems you have early

.NET (framework)

What is .NET?

- .NET is an open-source development platform for building different types of apps
  - Development platform: Languages + libraries
- .NET implementations
  - **.NET Framework:** websites, services and apps on Windows
  - **.NET Core:** cross-platform desktop (Windows, Linux and macOS)
  - **Xamarin:** cross-platform mobile (Android and iOS)
  - **Mono:** games programming with Unity3D
  - **.NET standard:** build libraries that can be referenced from any .NET implementations

History of .NET

- The original .NET Framework was first released in early 2002
- After 2002, Microsoft worked to make a version of .NET cross-platform to allow developers to write one code base and use it across macOS, Linux, and Windows operating systems
- .NET Core was introduced around 2014
- Microsoft has maintained the original .NET Framework but new features and improvements were reserved for .NET Core
- *"Core"* was later dropped from the name. The next major versions are .NET 5, .NET 6, .NET 7, and so on

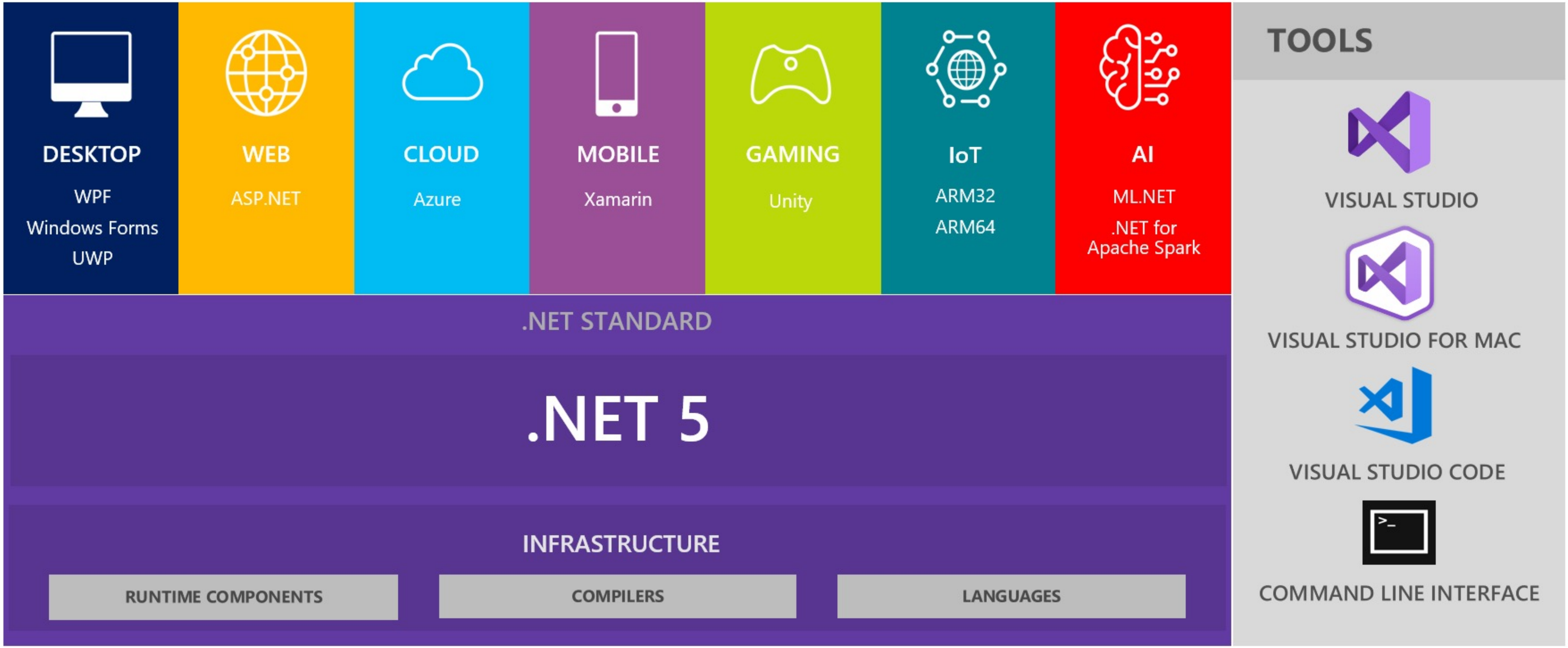
.NET application development

- .NET is an ecosystem for application development (Web, Desktop and Mobile)

App model	Framework	Notes
Web	ASP.NET Core	The framework for building server-side logic.
Web	ASP.NET Core MVC	The framework for building server-side logic for web pages or web APIs.
Web	ASP.NET Core Razor Pages	The framework for building server-generated HTML.
Web client	Blazor	Blazor is a part of ASP.NET Core. It comes with two hosting modes.
Desktop	WinForms	A framework for building "battleship gray" Windows-style applications.
Desktop	Windows Presentation Foundation (WPF)	A framework for building dynamic desktop applications that conform to different form factors.
Mobile	Xamarin	Allows .NET developers to build apps for iOS and Android devices.

- Furthermore, .NET powers Unity3D.

.NET – A unified platform



DESKTOP
WPF
Windows Forms
UWP

WEB
ASP.NET

CLOUD
Azure

MOBILE
Xamarin

GAMING
Unity

IoT
ARM32
ARM64

AI
ML.NET
.NET for Apache Spark

.NET STANDARD

.NET 5

INFRASTRUCTURE

RUNTIME COMPONENTS

COMPILERS

LANGUAGES

TOOLS

VISUAL STUDIO

VISUAL STUDIO FOR MAC

VISUAL STUDIO CODE

COMMAND LINE INTERFACE

When to use .NET

- .NET is a good choice for either large or small projects
  - Offers tools to build any kind of app.
- Choose .NET when productivity matters
  - .NET is a strongly typed system, so it avoids many of the bugs that can arise in loosely typed systems
- Choose .NET for enterprise-scale applications
  - Powerful ecosystem (SDKs, tools and libraries)
  - Easy integration with Azure and on-premise servers

When to use .NET

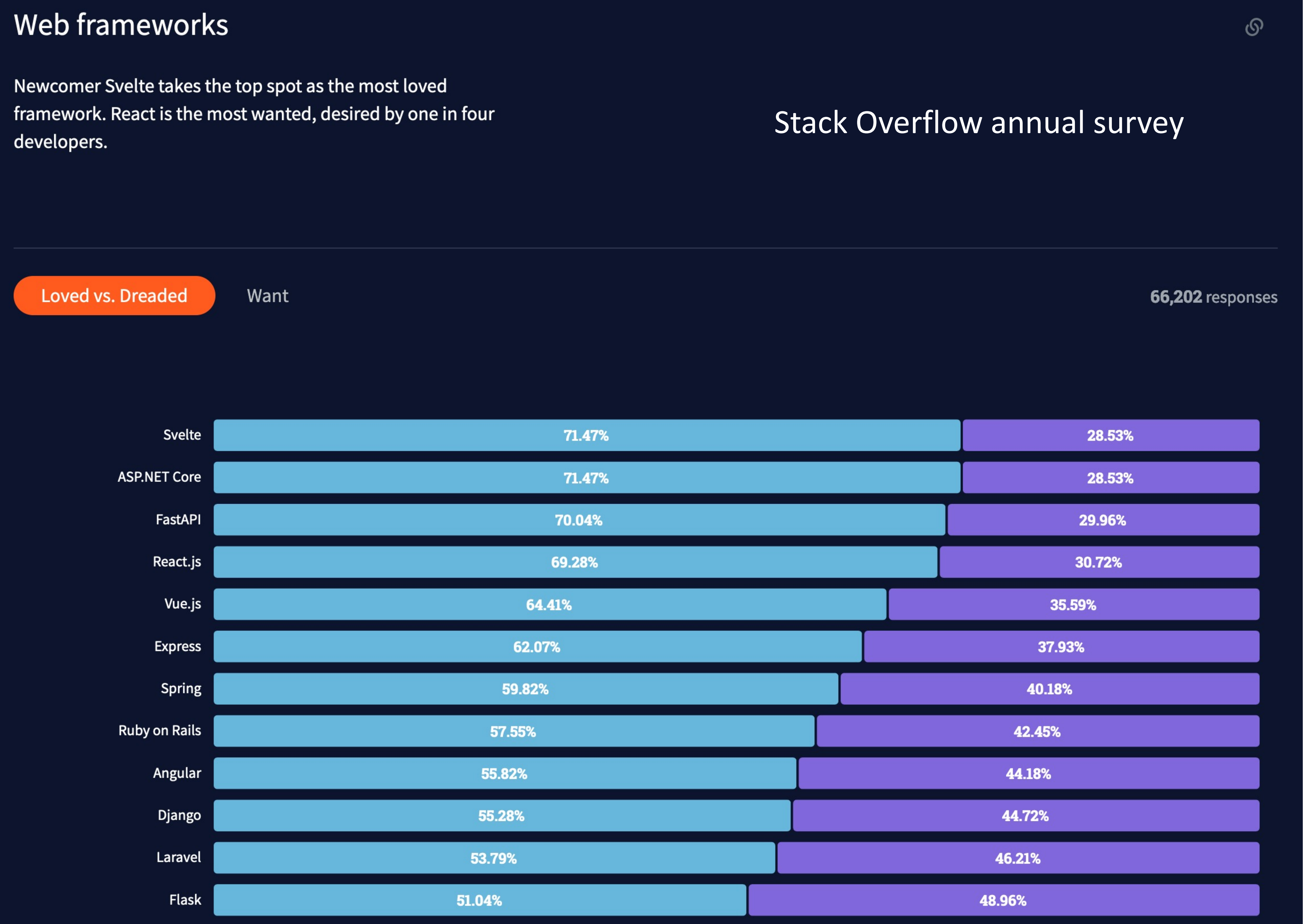
- Choose .NET for prototypes, start-ups, and small-scale applications
  - Quick and easy transition from a small to large-scale project

- Choose .NET for cloud and AI applications
  - The Azure SDK for .NET allows developers to provision and manage Azure resources
  - Azure App Service and Azure Functions can host applications that are built by using .NET languages
  - ML.NET is a free machine learning library for .NET languages

- Choose .NET to build IoT applications
  - Tools and libraries that work with Raspberry Pi and HummingBoard

How does .NET compare to others?

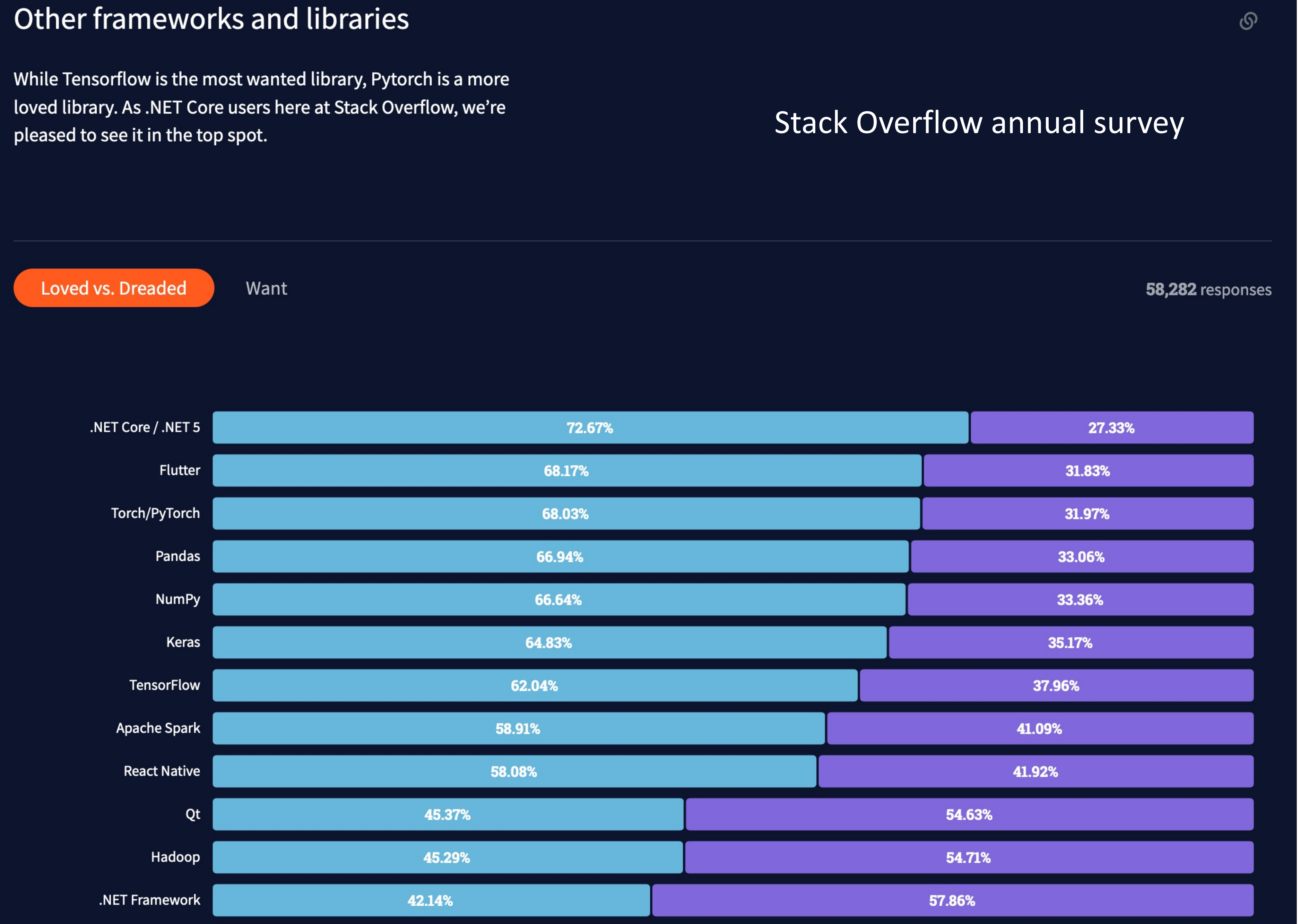
- .NET developers number more than 5 million
- The results of a Stack Overflow poll in 2019 and 2020, 2021 showed that .NET Core is the most loved framework
- Students love .NET; 40 percent of developers who are new to .NET are students
- The GitHub repositories for .NET and ASP.NET are ranked among the top 30 highest-velocity open-source software (OSS) projects
- GitHub lists C# in the top five programming languages. And the language is increasing in popularity, according to the 2020 TIOBE programming community index
- .NET has the fastest web framework on the planet, according to TechEmpower benchmarks, an independent, open-source set of web performance benchmarks that measure dozens of languages and application frameworks



Web frameworks

Newcomer Svelte takes the top spot as the most loved framework. React is the most wanted, desired by one in four developers.

Stack Overflow annual survey

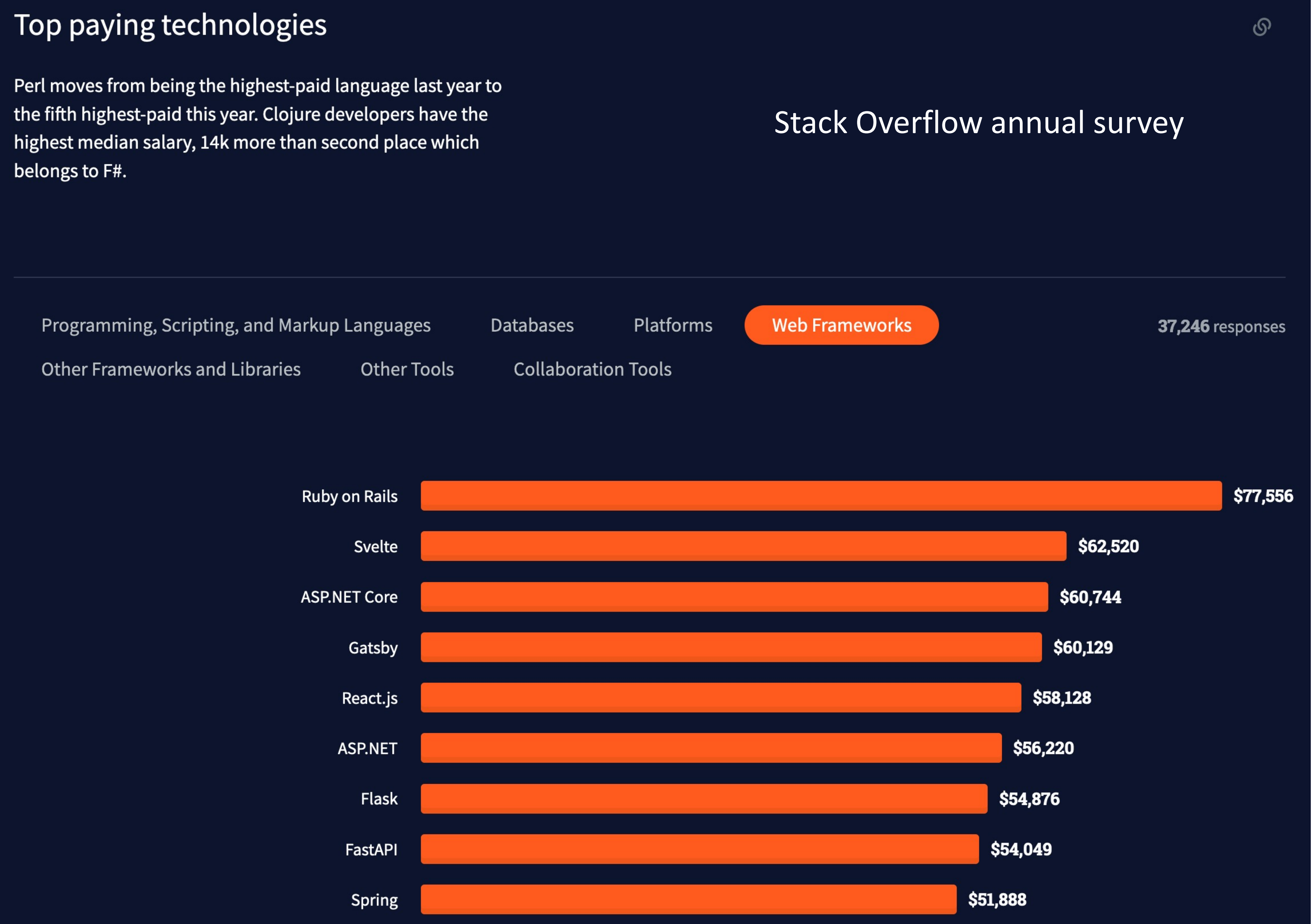


Other frameworks and libraries

While Tensorflow is the most wanted library, Pytorch is a more loved library. As .NET Core users here at Stack Overflow, we're pleased to see it in the top spot.

Stack Overflow annual survey

UNIVERSITY OF WESTMINSTER



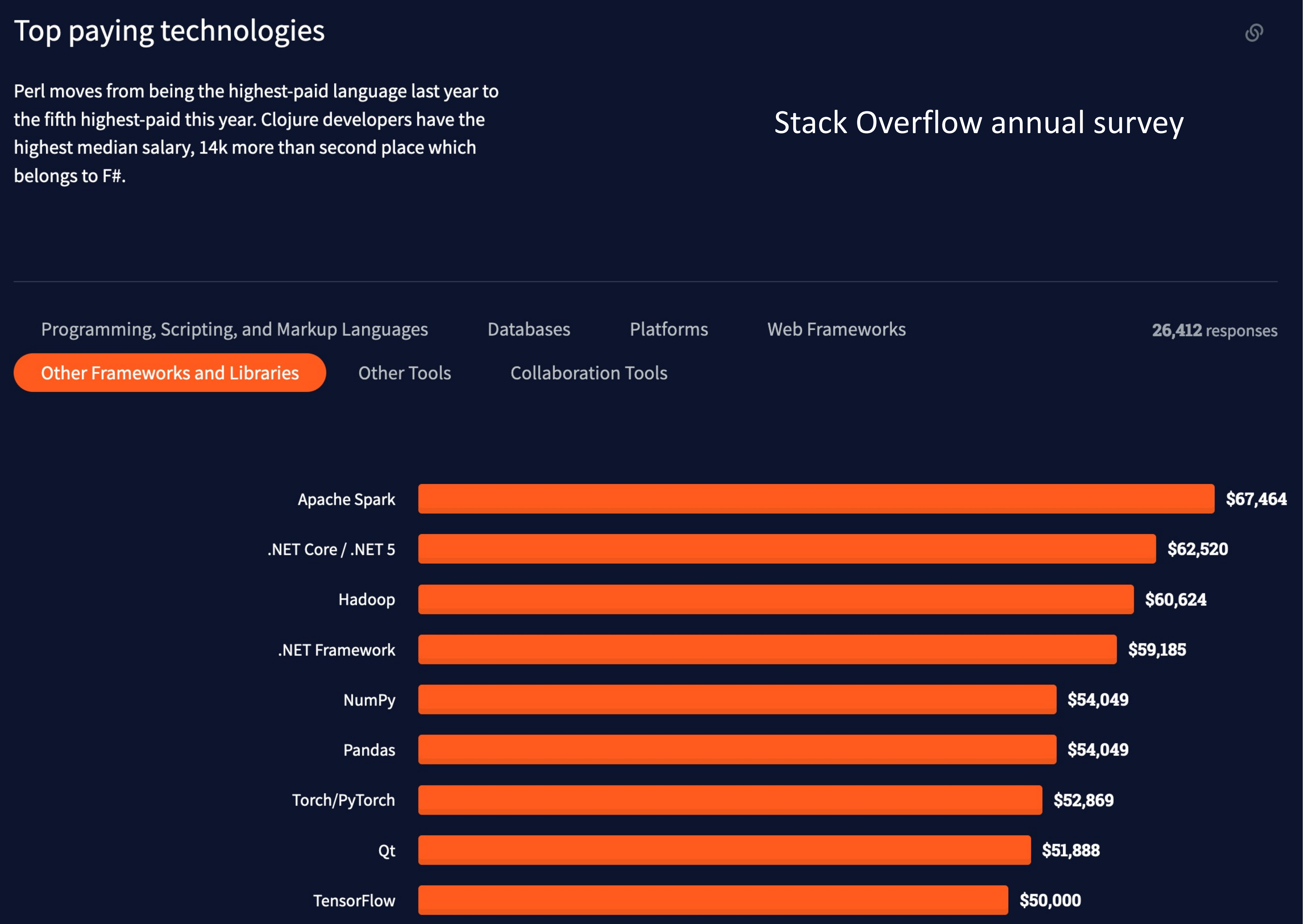
Top paying technologies

Perl moves from being the highest-paid language last year to the fifth highest-paid this year. Clojure developers have the highest median salary, 14k more than second place which belongs to F#.

Stack Overflow annual survey

37,246 responses

Stack Overflow annual survey



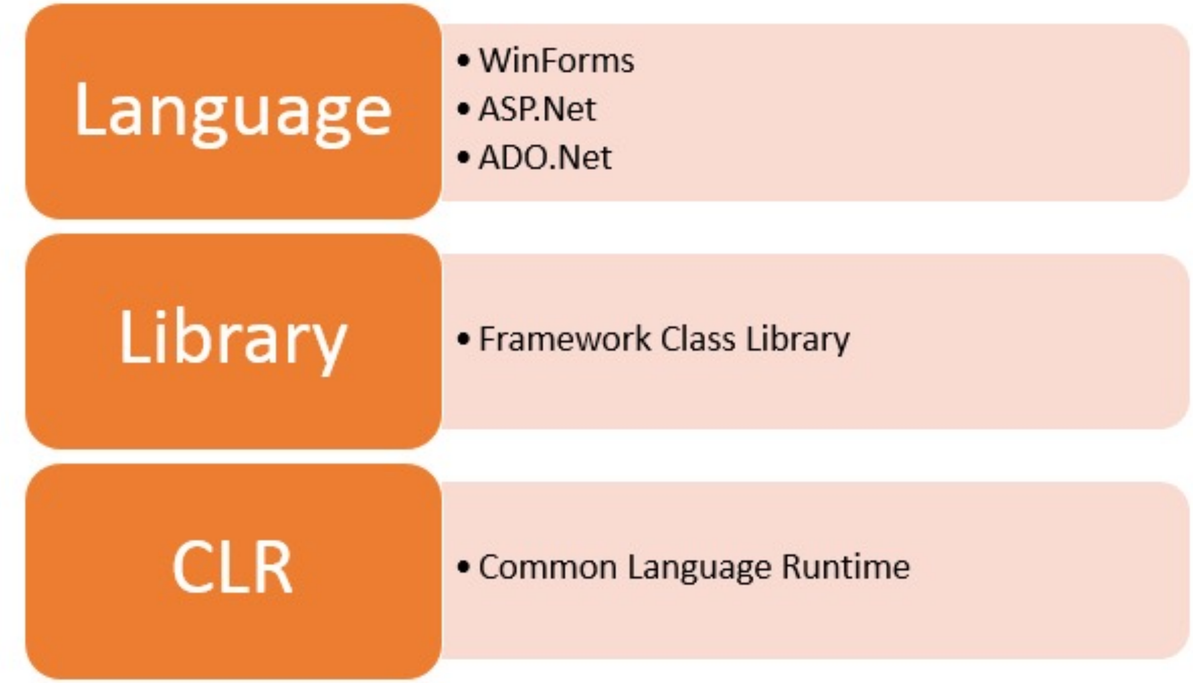
Top paying technologies

Perl moves from being the highest-paid language last year to the fifth highest-paid this year. Clojure developers have the highest median salary, 14k more than second place which belongs to F#.

Programming, Scripting, and Markup Languages | Databases | Platforms | Web Frameworks | Other Frameworks and Libraries | Other Tools | Collaboration Tools

26,412 responses

.NET Framework - architecture



Language
- WinForms
- ASP.Net
- ADO.Net

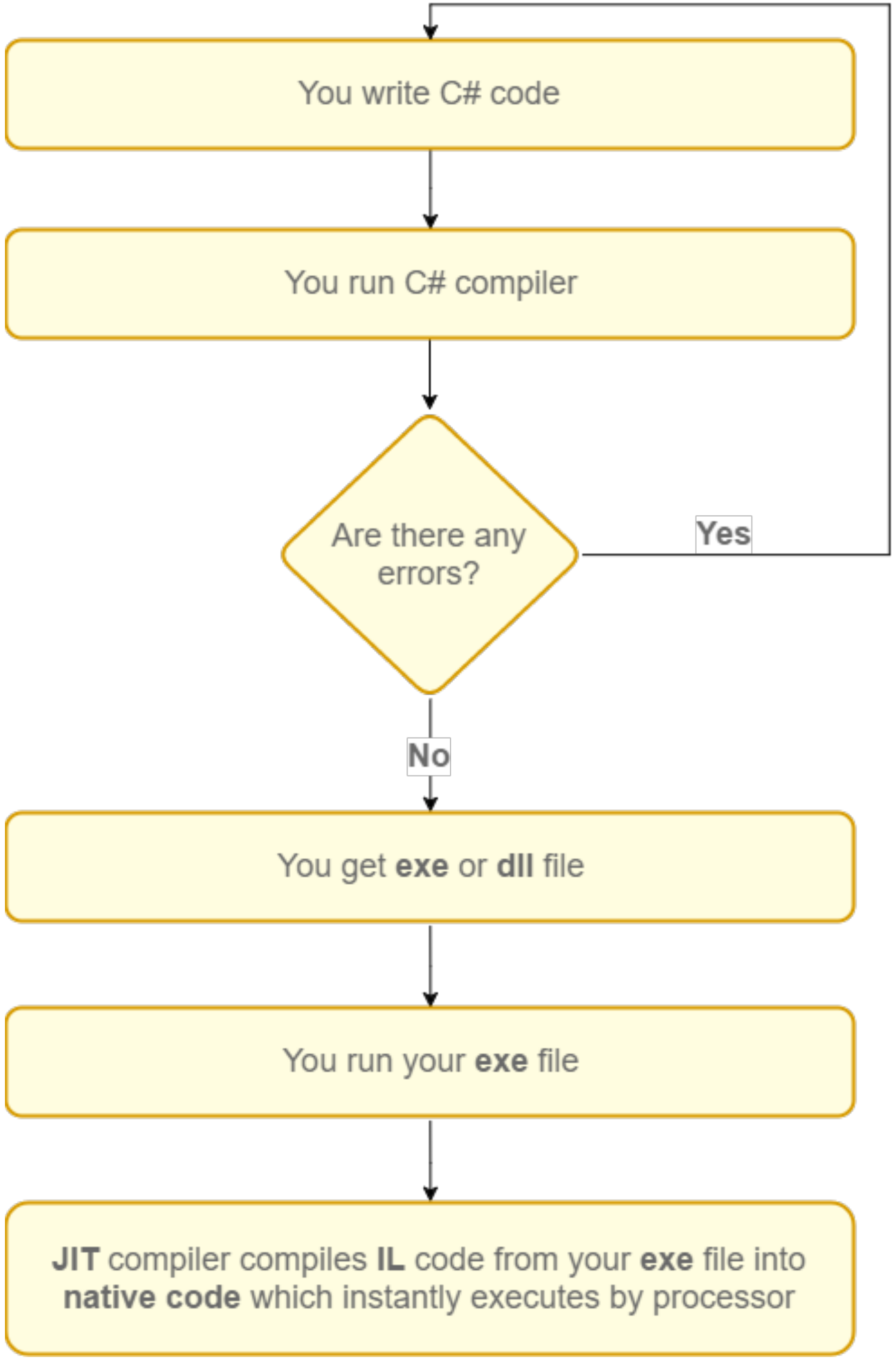
Library
- Framework Class Library

CLR
- Common Language Runtime

Architecture Diagram: https://www.guru99.com/net-framework.html

- C#, F# and VB are the languages which are typically used for building .NET apps.
- Collection of classes, interfaces, and methods. Provides core functionalities such as: exception handling, I/O, network communication, etc.
- Manages the execution of the program. It converts managed code to IL using JIT compiler.

.NET Framework – code execution process



You write C# code

You run C# compiler

Are there any errors?

Yes

No

You get **exe** or **dll** file

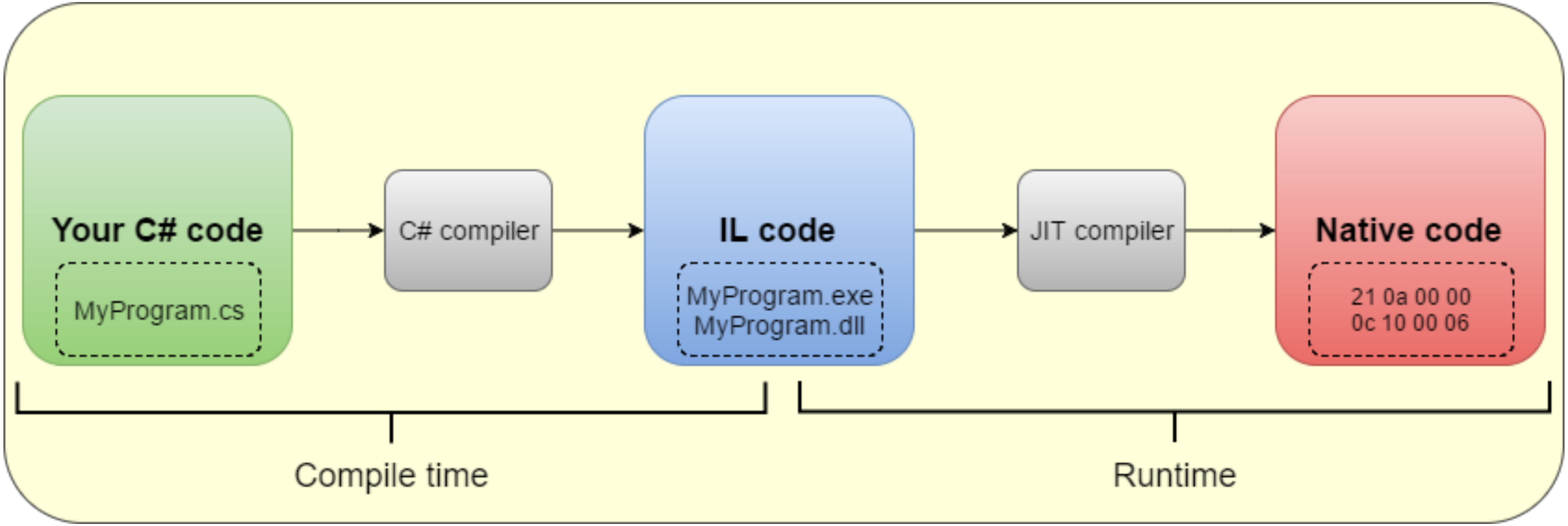
You run your **exe** file

JIT compiler compiles **IL** code from your **exe** file into **native code** which instantly executes by processor

Reference:
https://codeasy.net/lesson/c_sharp_compilation_process

UNIVERSITY OF WESTMINSTER

.NET Framework - compilation



Compilation process: https://codeasy.net/lesson/c_sharp_compilation_process

How to use .NET?

- Set up your development environment
  - Install Visual Studio 2019 Community Edition
  - Install **.NET Core for cross-platform development** workload, which installs the .NET SDK. The .NET SDK contains all of the libraries, tools, and templates that you need to get started writing code.

- Create a new project either using Visual Studio or .NET CLI
- Build functionality
- Compile and run your application (either with VS or CLI)
- Debug your application

Resources

- Documentation
  - https://docs.microsoft.com/en-us/dotnet/ - .NET
  - https://docs.microsoft.com/en-us/dotnet/csharp/ - C#

- Online courses
  - Linkedin Learning: https://www.linkedin.com/learning/introducing-dot-net-core

- Books
  - Microsoft .NET - Architecting Applications for the Enterprise (Developer Reference) by Dino Esposito and Andrea Saltarello
  - Patterns of Enterprise Application Architecture by Martin Fowler