

Presented by:

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▪ Jonas Petereit

- Software engineer since 2017 (B. Eng.)
- Human Machine Interface (HMI) development
(<https://www.beckhoff.com/en-us/products/automation/twincat-3-hmi>)
- Developing cross-platform applications for Windows, Linux and FreeBSD

▪ Beckhoff Automation GmbH & Co. KG

(<https://www.beckhoff.com/en-us>)

- Industrial automation
- PC-based control
- “TwinCAT transforms almost any PC-based system into a real-time control [...].”
(<https://www.beckhoff.com/en-us/products/automation/twincat>)
 - Windows: an OS distributed by Microsoft, TwinCAT support since 1996
 - TC/BSD: an OS based on FreeBSD which includes real-time extensions
(<https://www.beckhoff.com/en-us/products/ipc/software-and-tools/twincat-bsd>)

1. .NET fundamentals
 - Common Language Runtime (CLR)
 - Just-In-Time (JIT) compiler
2. Support for FreeBSD
 - History
 - Initial support in 2019
 - Private and community support since 2020
 - Patches and compilation
3. Use cases
 - Azure Pipelines Agent
 - Custom cross-platform applications → Live demo
4. Next steps

1. .NET fundamentals

Common Language Runtime (CLR)

- Executes managed code
 - Written in high-level languages like C#
 - Compiled to Intermediate Language (IL)

Platform independent

- CLR itself is unmanaged code
 - Mainly written in C/C++
 - Turns managed code into machine code

Platform dependent

↑
CLR needs FreeBSD support!

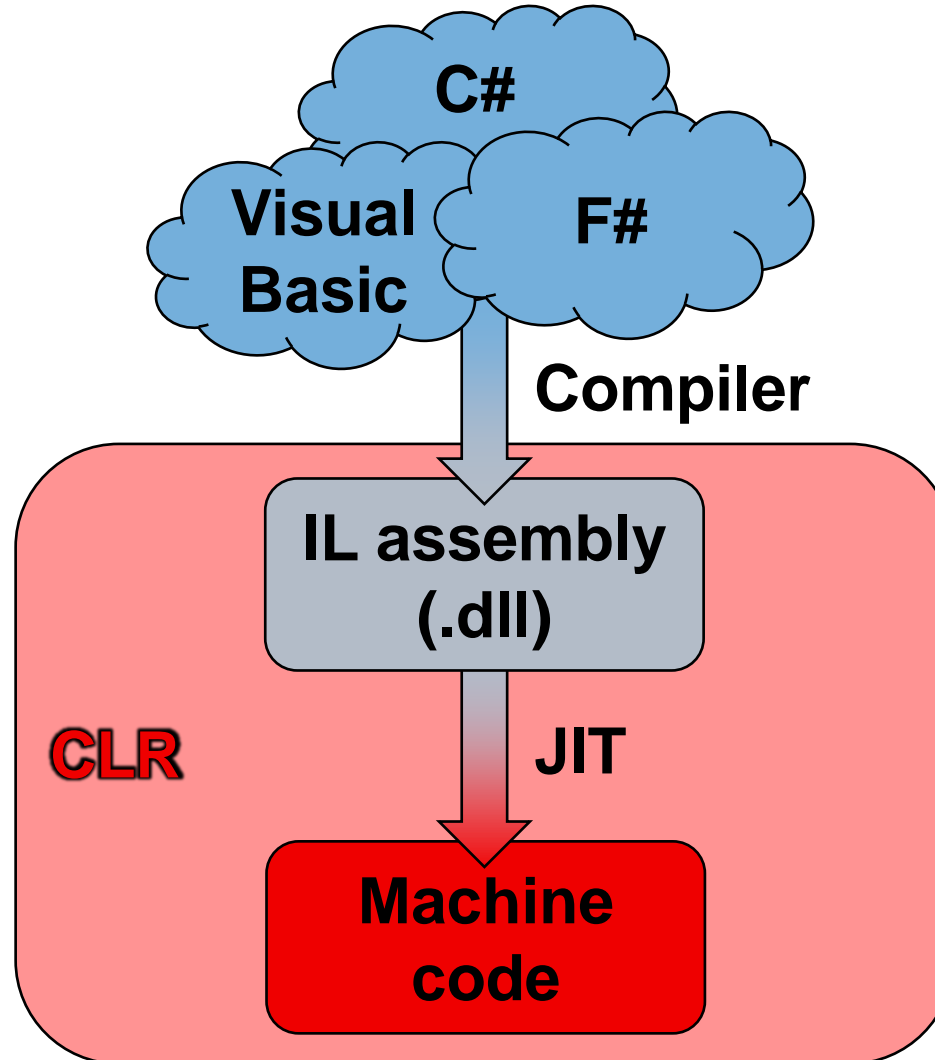
1. .NET fundamentals

Just-In-Time (JIT) compiler

Language-specific but platform-independent

Language-independent and platform-independent

Language-independent but platform-specific

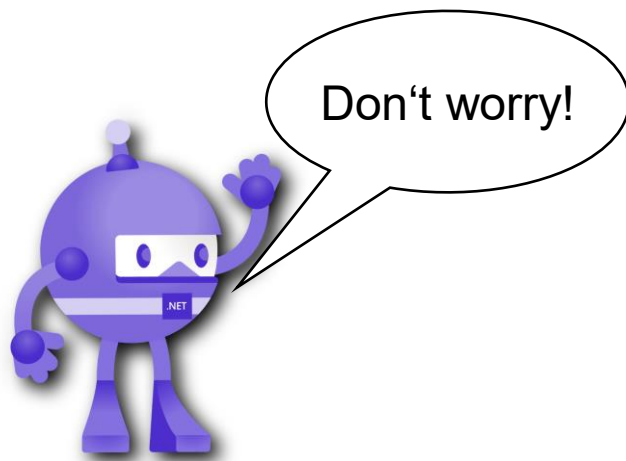


2. Support for FreeBSD History – Initial support in 2019

- Microsoft says about .NET:

“Fast and cross-platform
[...] You can write, run, and
build on multiple platforms, including
Windows, Linux, and macOS.”

(<https://dotnet.microsoft.com/en-us>)

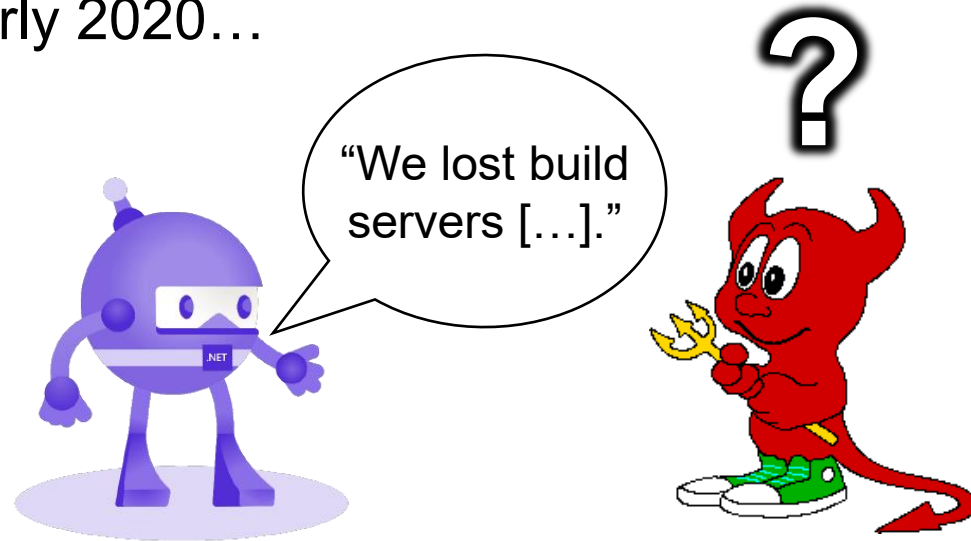


- OSPlatform.FreeBSD property was added with .NET Core 3.0 in September 2019
(<https://learn.microsoft.com/en-us/dotnet/api/system.runtime.interopservices.osplatform.freebsd?view=netcore-3.0>)

2. Support for FreeBSD

History – Private and community support since 2020

- In early 2020...

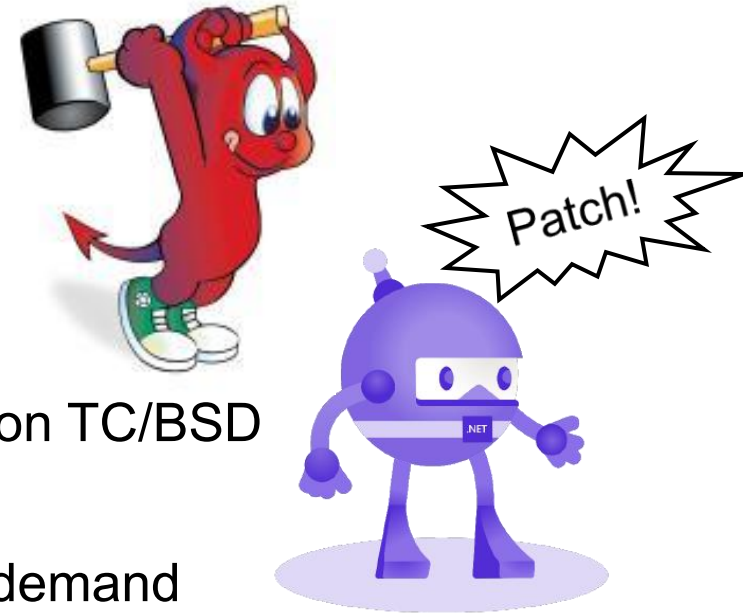


<https://github.com/dotnet/source-build/issues/1139#issuecomment-522106312>

- (Semi-)official FreeBSD support has been dropped
- FreeBSD support only from private and community developers (by companies like Beckhoff and on GitHub)

2. Support for FreeBSD Patches and compilation

- C++ code in CLR still exists but sometimes needs patches:
 - Problems with unsupported library versions
 - FreeBSD releases reached EOL
 - Missing NuGet package versions
- At Beckhoff we...
 - ... set up a GitLab pipeline to build .NET and test it on TC/BSD
 - ... cross-compile .NET Runtime and SDK on Linux
 - ... can provide new versions for a .NET release on demand
- At GitHub there are...
 - ... pre-built .NET binaries for FreeBSD available
 - ... build scripts and documentation (<https://wiki.freebsd.org/.NET>)



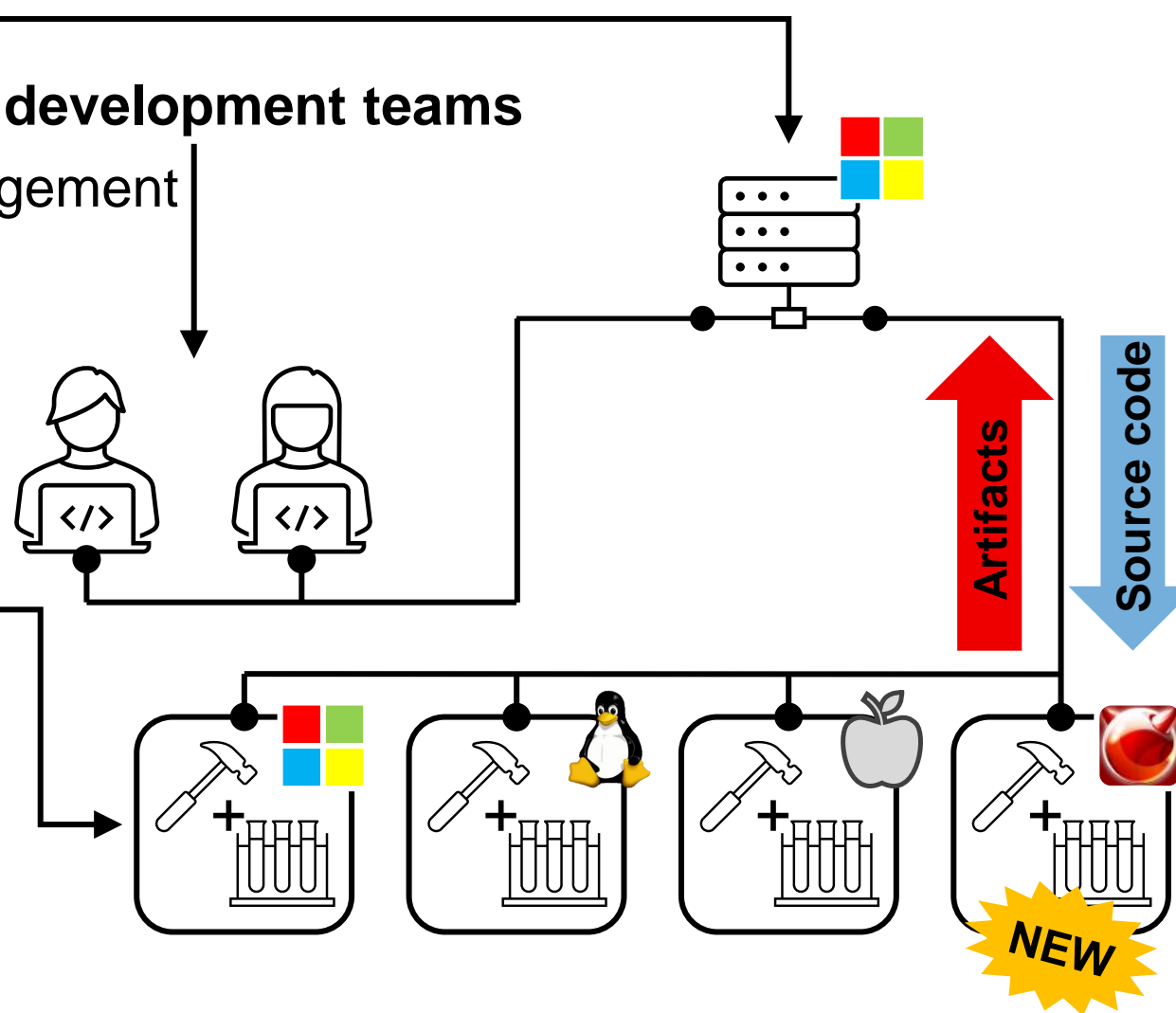
3. Use cases Azure Pipelines Agent

■ Azure DevOps Server

- Collaboration software for **software development teams**
 - Version control and project management
 - **Build and test**
- Closed source
- Hosted on Windows

■ Azure Pipelines Agents

- “Azure DevOps build and test client”
- Source code available on GitHub
- Hosted on Windows, Linux, macOS and FreeBSD

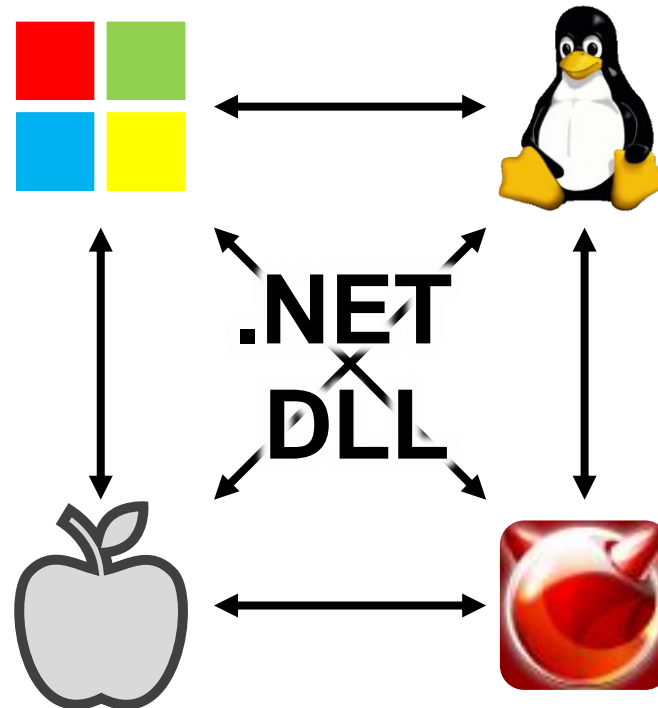


3. Use cases

Custom cross-platform applications

- Remember:
Compiler creates IL assemblies that are **platform-independent**

- But:
Binary executables are **platform-dependent**



- Live demo: 
Compile and run .NET Console apps on Windows and FreeBSD

▪ Short-term goals

- Ask yourself: *Do I need .NET for FreeBSD?*
- Use existing .NET binaries for FreeBSD (<https://wiki.freebsd.org/.NET>)

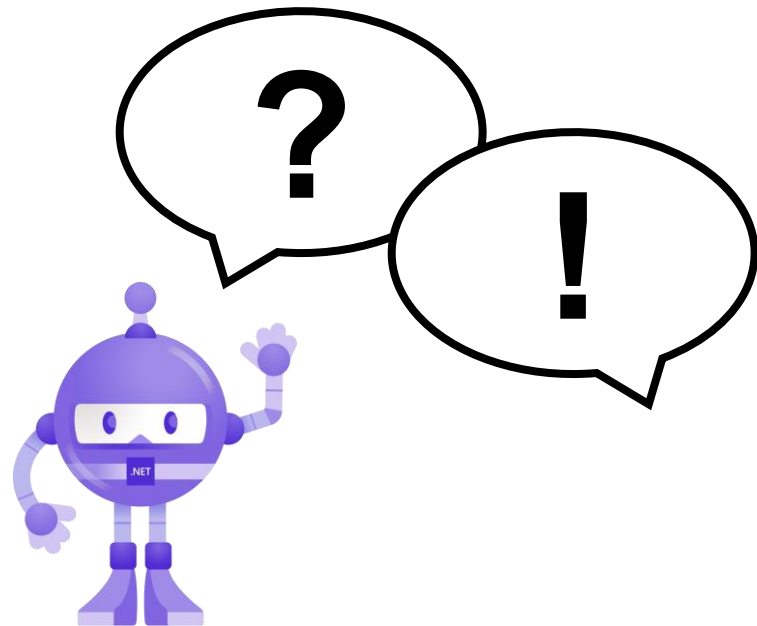
▪ Medium-term goals

- Moving Beckhoff's GitLab repo to GitHub
- Keep Azure Pipelines Agent for FreeBSD up to date (<https://github.com/microsoft/azure-pipelines-agent/pull/3266>)
- Fix existing bugs and missing .NET unit tests for FreeBSD
- Request FreeBSD support from NuGet package developers

▪ Long-term goals

- Convince Microsoft to officially support FreeBSD
- Add .NET to the FreeBSD ports tree

Thank you for your attention!



- dotnet bot (normal):
<https://avatars.githubusercontent.com/u/9011267>
- dotnet bot (waving 1):
<https://devblogs.microsoft.com/dotnet/announcing-net-maui-preview-9>
- dotnet bot (waving 2):
<https://en.wikipedia.org/wiki/.NET#/media/File:Dotnet-bot.svg>
- Tux (Linux character):
[https://en.wikipedia.org/wiki/Tux_\(mascot\)#/media/File:Tux.png](https://en.wikipedia.org/wiki/Tux_(mascot)#/media/File:Tux.png)
- FreeBSD daemon with trident:
<https://www.freebsd.org>
- FreeBSD daemon with hammer:
https://www.freebsd.org/gifs/daemon_hammer.jpg

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