

Sessions start at: 5.00PM and 6.15PM

Online Meeting Rules



- If not muted, mute yourself.
- Ask your questions in the chat window.
- Use mic if you are explicitly asked.
- If you want to show something, we will make you be a presenter
- If you like you can activate your camera. We love to see you all 😊
- Please do not spam the chat window.
- Do not post inappropriate content.
- Have fun. 😊



GFU Cyrus AG

gfu.net

FOCUS

TOP

ANBIETER FÜR
WEITERBILDUNG

2022

FOCUS 43/2021
IN KOOPERATION MIT
FACT[®] „FIELD“

PRÄSENZ- UND ONLINESCHULUNGEN

FÜR ENTWICKLER, SOFTWAREARCHITEKTEN, ADMINS UND PROJEKTMANAGER



Offene Schulungen



Inhouse- / Firmenschulungen



Individualschulungen



8.031

EKOMI BEWERTUNGEN



100.542

TEILNEHMENDE

1.658

SEMINARTHEMEN

26.236

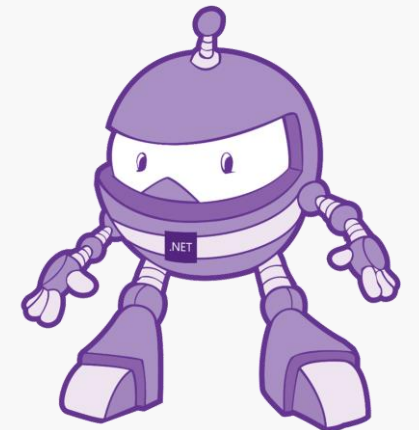
DURCHGEFÜHRTE SEMINARE



nano
FRAMEWORK

Making it easy to write C# code for
embedded systems

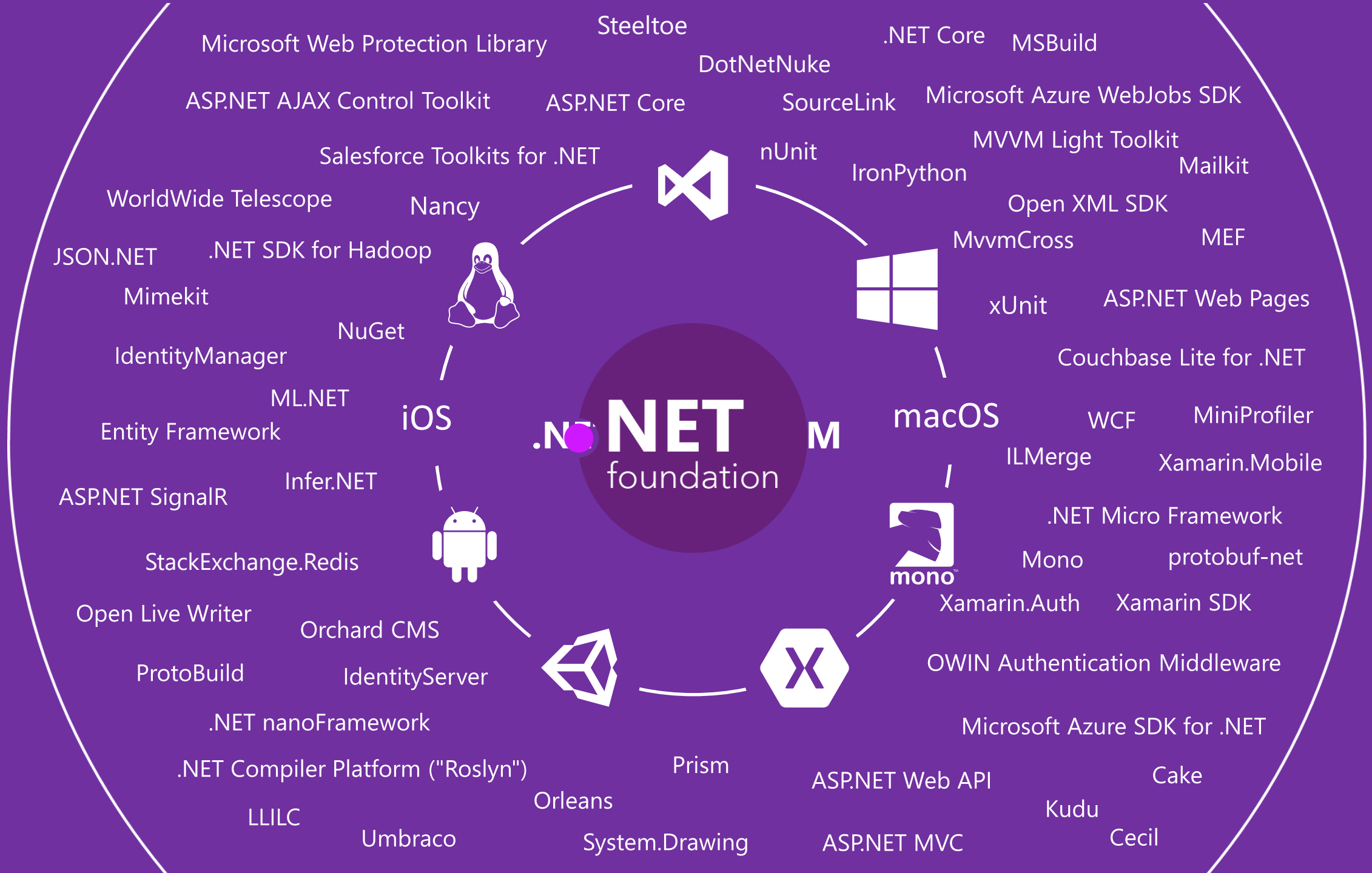
eclosolutions



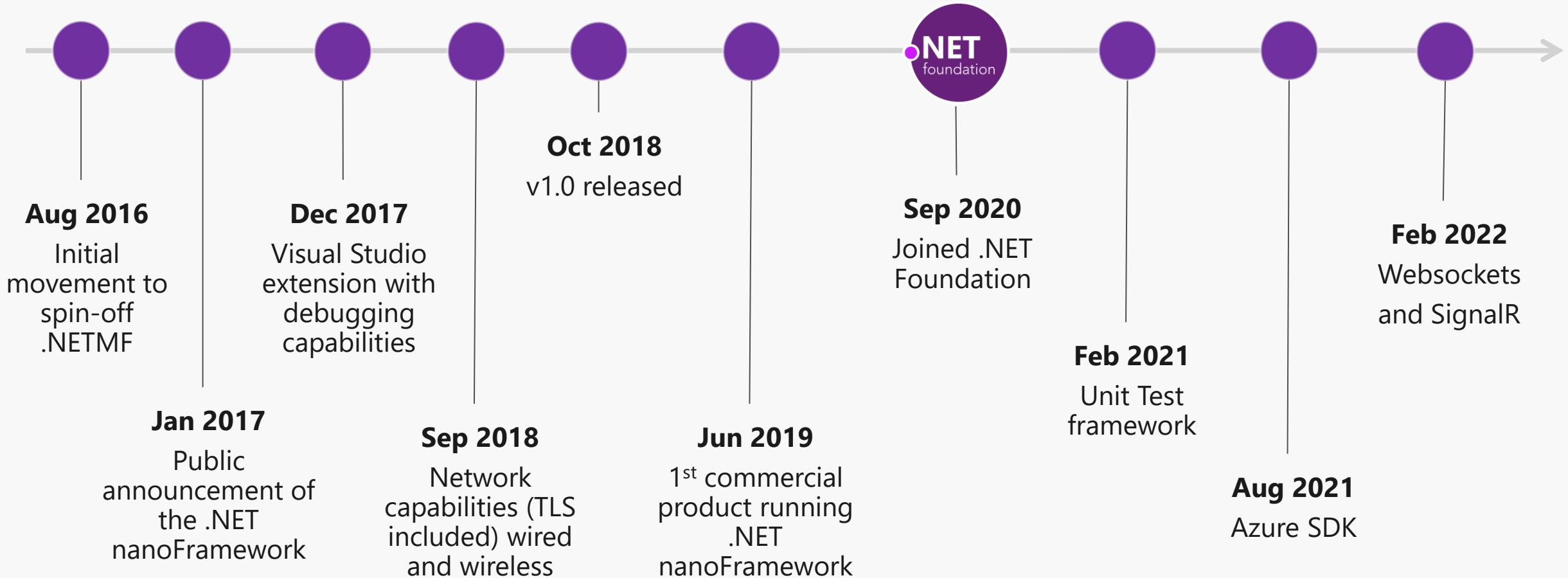
.NET nanoFramework

José Simões – CEO Eclo Solutions, founder, core team lead
@Jose_Simoes





.NET nanoFramework Journey



.NET nanoFramework Open Source

182


NuGet packages

+1,5M

NuGet packages
downloads

+15k

Visual Studio Extension
downloads



.NET nanoFramework

<http://www.nanoframework.net> [@nanoFramework](#) contact@nanoframework.net [Part of .NET Foundation](#) Verified

Overview

Repositories 96

Packages

People 26

Teams 9

Projects 24

Insights

Security

Pinned

Customize your pins

Home Public

The landing page for nanoFramework repositories.

☆ 590 🍴 45

nanoFramework.IoT.Device Public

This repo includes .NET nanoFramework implementations for various sensors, chips, displays, hats and drivers

● C# ☆ 61 🍴 36

Samples Public

Code samples from the nanoFramework team used in testing, proof of concepts and other explorational endeavours

● C# ☆ 199 🍴 80

nf-Community-Targets Public

Repository with target boards provided by nanoFramework community members

● C ☆ 39 🍴 24

nf-interpreter Public

nanoFramework Interpreter, CLR, HAL, PAL and reference target boards

● C ☆ 216 🍴 104

nf-Community-Contributions Public

Repository with contributions from nanoFramework community members. Drivers, extensions, utilities, feature demos...

● C# ☆ 23 🍴 24

Repositories

90

Contributors

70

Code lines

+500k

Stars

+2k

Forks

+600

What is .NET nanoFramework?

- Shrunk .NET Common Language Runtime, small and efficient, ready to run on constrained embedded devices
- Enables the writing of managed applications in C#
- Subset of the .NET Base Class Library
- Most common .NET APIs (threading, collections, math, ...)

What is .NET nanoFramework?

- Native multithreading
- Support for Interop code
- API aligned with .NET Core IoT
- Capable of running on any 32 bits core
- Basically it's about a couple of threads running on top of *any* RTOS

What .NET nanoFramework is NOT

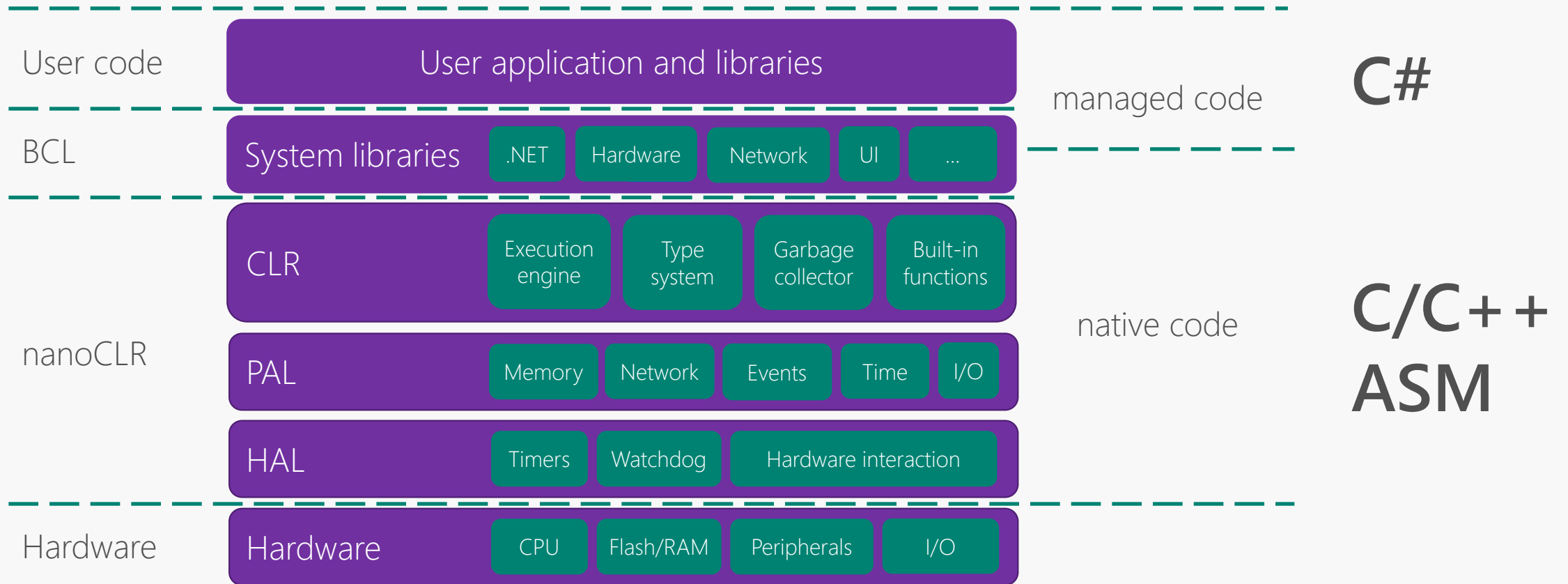
- It is **not** an RTOS (but runs on top of one)
- Does **not** have a JIT
- It is **not** capable of using standard .NET assemblies

Demo: Hello World

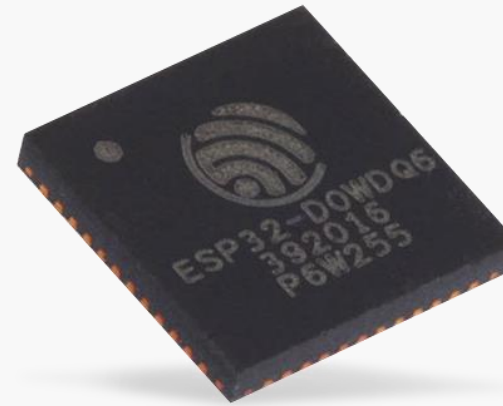
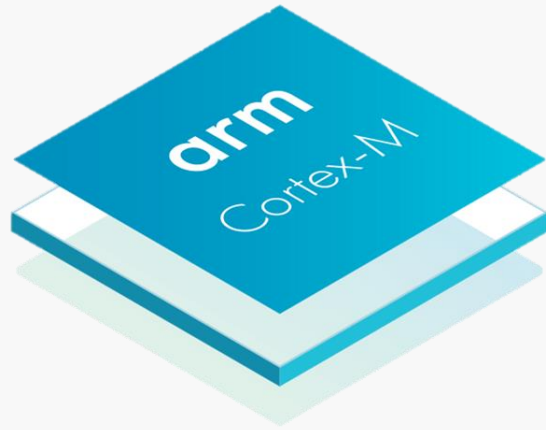
Microsoft .NET



.NET nanoFramework Architecture



Supported platforms



- Any 32 bits core e.g. ARM Cortex-M, Tensilica Xtensa LX6/7 (ESP32/S2)
- Internal or external flash (XIP) **~128kB**
- Internal or external RAM **~64kB**

Supported RTOS



ChibiOS



Free RTOS



TI RTOS



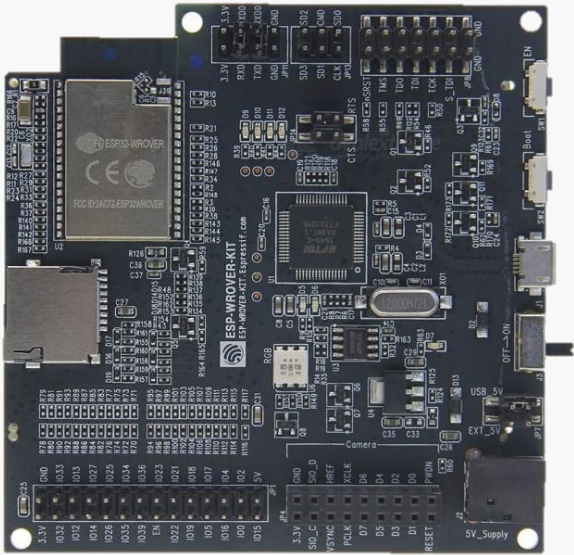
Azure RTOS

.NET nanoFramework Reference Targets



ST Microelectronics (STM32F0/F4/F7/L4/H7 series)

.NET nanoFramework Reference Targets



ESP32 WROVER KIT



ESP32 DEVKIT-C



FEATHER S2



M5STACK

.NET nanoFramework Reference Targets

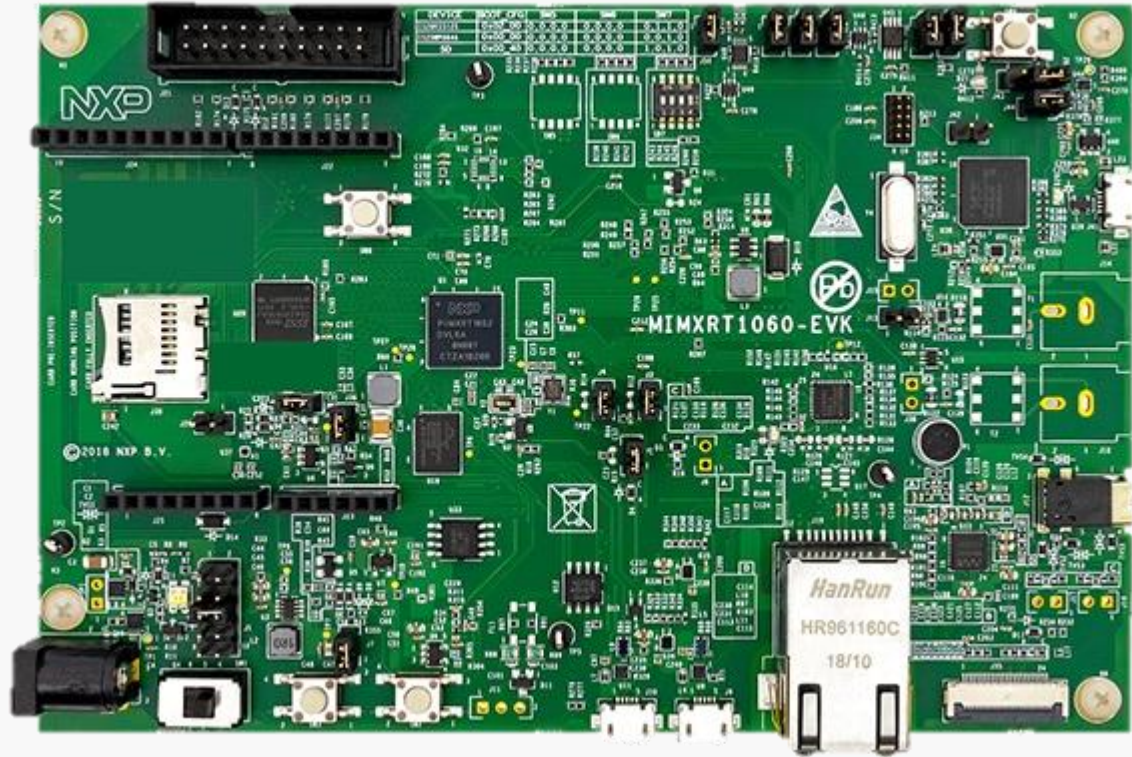


TI CC3220



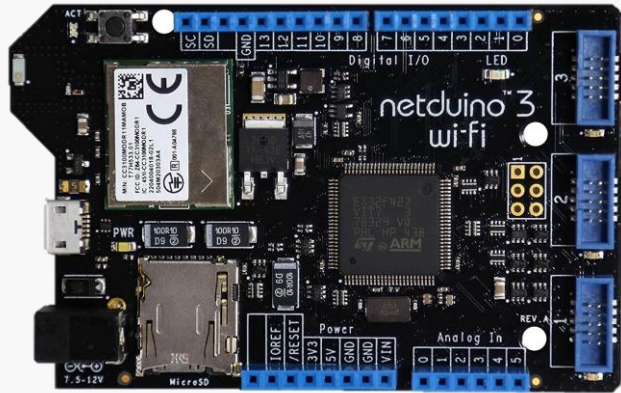
TI CC1352R/P

.NET nanoFramework Reference Targets

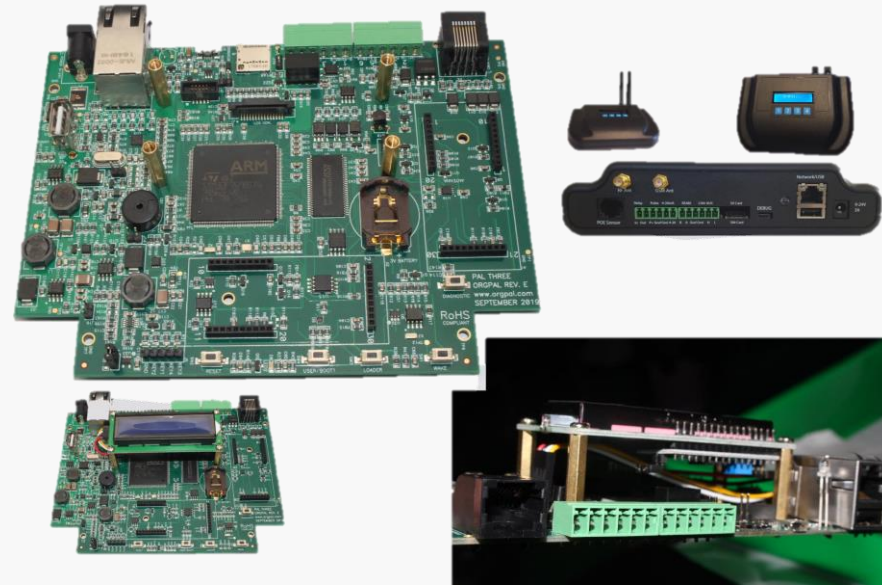


NXP MIMXRT1060-EVK

.NET nanoFramework Reference Targets

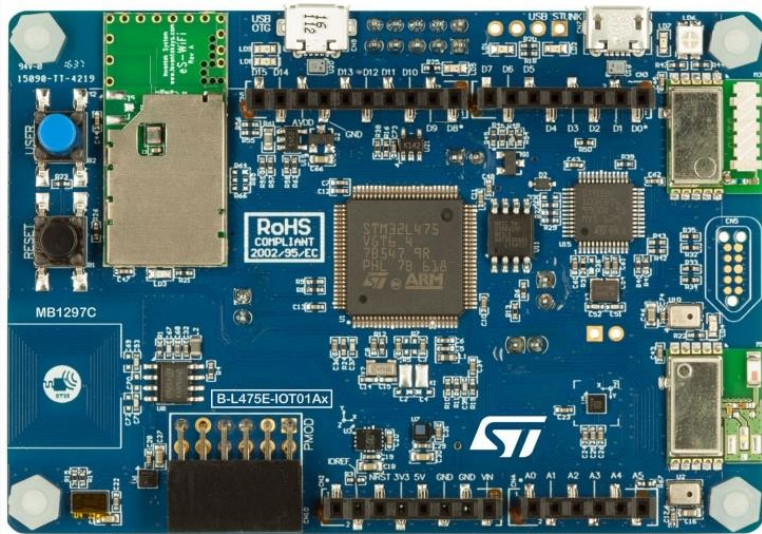


NETDUINO3

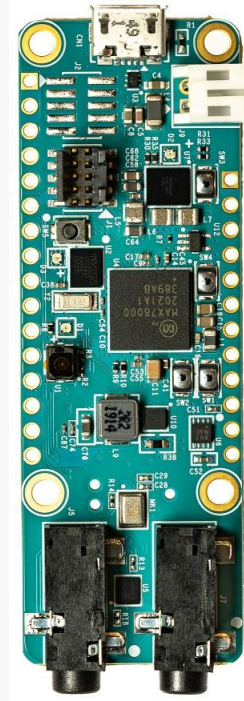


OrgPal PALTHREE

.NET nanoFramework Targets (work in progress)



ST BL475E-IOT01A

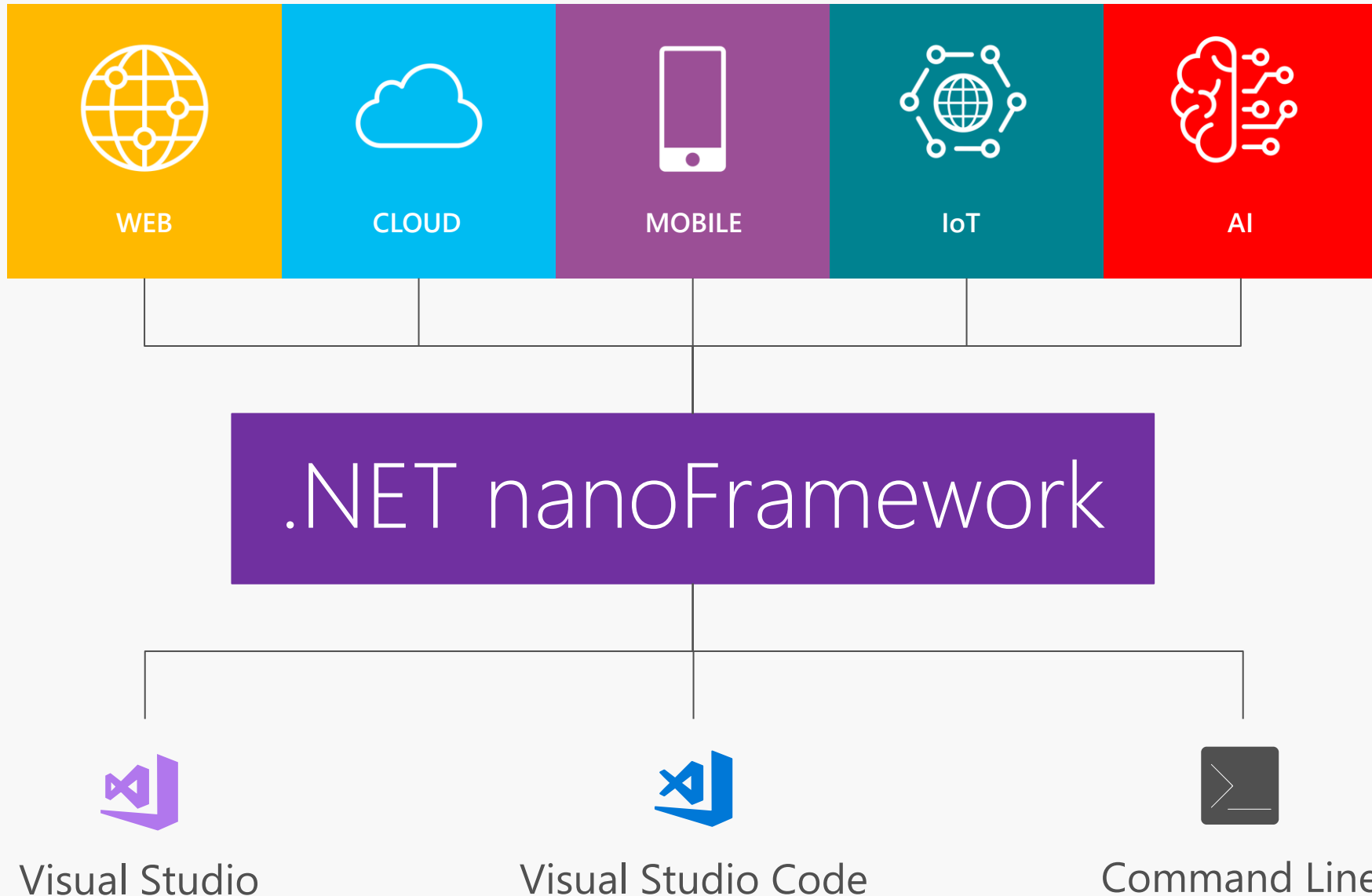


MAX78000



RPI PICO

Your platform for building (almost) anything



Ready to use libraries



NuGet

Conveniently
available and
distributed



Extensible

Standard .NET API, easy
to use and extend,
allowing code reuse



Open source

Developed in the
open on GitHub



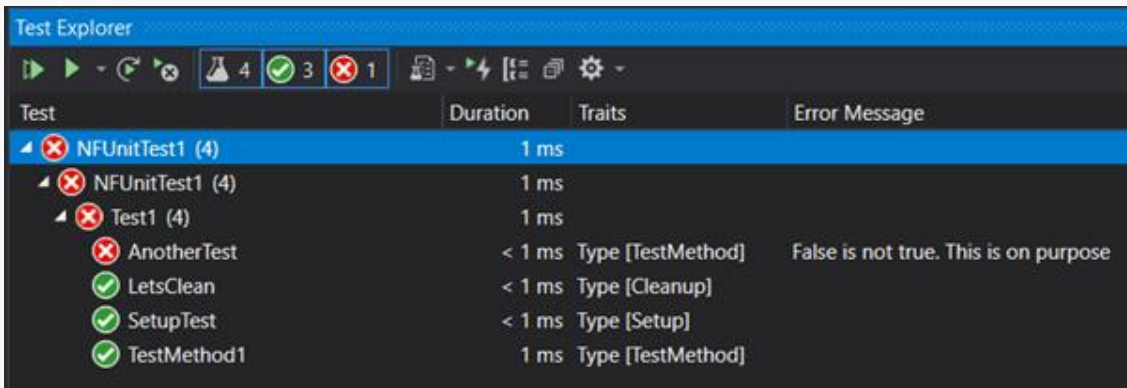
Build what you need

Components
available to match
what you need

SPI
GPIO
I2C
UART
Network
1-Wire
ADC
Wi-Fi
File IO
RegEx
PWM
CAN
Json
SignalR
HTTP(s)
MQTT
AMQP

Unit Test framework

- Standard Visual Studio test adapter
- Test discovery and executor
- Runnable in WIN32 image or directly on hardware



The screenshot shows the Test Explorer window with a toolbar at the top containing icons for running, refreshing, and other test actions. Below the toolbar is a table with columns for Test, Duration, Traits, and Error Message. The test hierarchy is expanded, showing 'NUnitTest1 (4)' with a red 'X' icon, 'NUnitTest1 (4)' with a red 'X' icon, and 'Test1 (4)' with a red 'X' icon. Under 'Test1 (4)', there are four test items: 'AnotherTest' (red 'X'), 'LetsClean' (green checkmark), 'SetupTest' (green checkmark), and 'TestMethod1' (green checkmark). The 'AnotherTest' item has an error message: 'False is not true. This is on purpose'.

Test	Duration	Traits	Error Message
✖ NUnitTest1 (4)	1 ms		
✖ NUnitTest1 (4)	1 ms		
✖ Test1 (4)	1 ms		
✖ AnotherTest	< 1 ms	Type [TestMethod]	False is not true. This is on purpose
✔ LetsClean	< 1 ms	Type [Cleanup]	
✔ SetupTest	< 1 ms	Type [Setup]	
✔ TestMethod1	1 ms	Type [TestMethod]	

```
[TestClass]
0 references
public class Test1
{
    static private int _global = 0;
    static private int[] _array;

    [TestMethod]
    0 references
    public void TestMethod1()
    {
        Assert.NotEqual(0, _global);
        Assert.Equal(_array[0], 1);
        Assert.Throws(typeof(ArgumentNullException), () =>
        {
            Debug.WriteLine("Throwing a ArgumentNullException");
            throw new ArgumentNullException();
        });
        string str = "nanoFramework Rocks!";
        Assert.StartsWith("nano", str);
    }

    [TestMethod]
    0 references
    public void AnotherTest()
    {
        Assert.True(false, "This is on purpose");
    }
}
```

Test Detail Summary

- ✔ TestMethod1
 - 📄 Source: [UnitTest1.cs](#) line 14
 - 🕒 Duration: 1 ms
 - ➡ [Open additional output for this result](#)

Demo: Unit Tests



Thank you!



nano
FRAMEWORK

nanoframework.net
github.com/nanoframework