



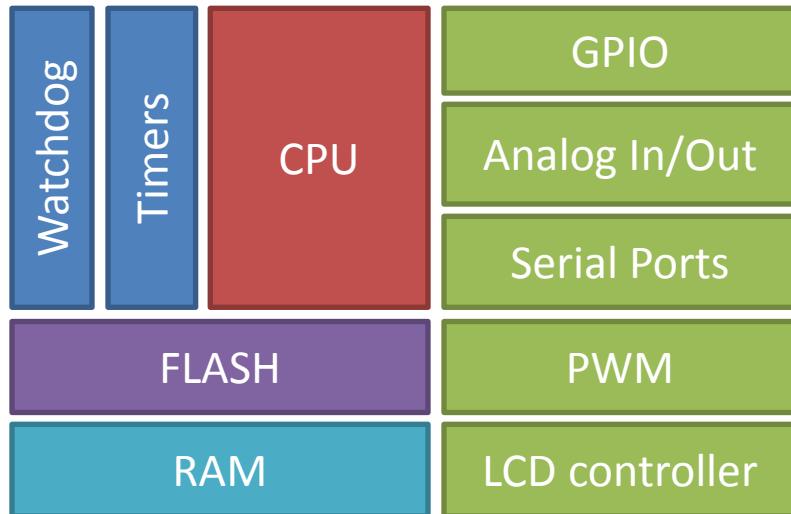
Invent the future of small intelligent devices here.

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# What is a Microcontroller?

“A microcontroller is a **small computer** on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals.”  
*Wikipedia.org*



# Where are Microcontrollers?

Microcontrollers are used in automated products devices, such as automotive, medical devices, remote controls, office machines, appliances, power tools, and even toys.

			
8-bit 8Mhz. <16KB Flash <1K RAM	Cortex M0 50Mhz. <128KB Flash <8K RAM	Cortex M3/M4 120MHz. <2MB Flash <256K RAM	Multimedia Application processors xGhz External Flash and RAM
Simple firmware for simple function	Moderate firmware	Complex OS-less firmware Embedded Linux	Windows 8 Windows Phone Android
Touchless faucet	Air-bag	Blood pressure monitor	Smartphone



Source of Images is ARM.com

# What is .NET Micro Framework?

- How Microsoft define it:

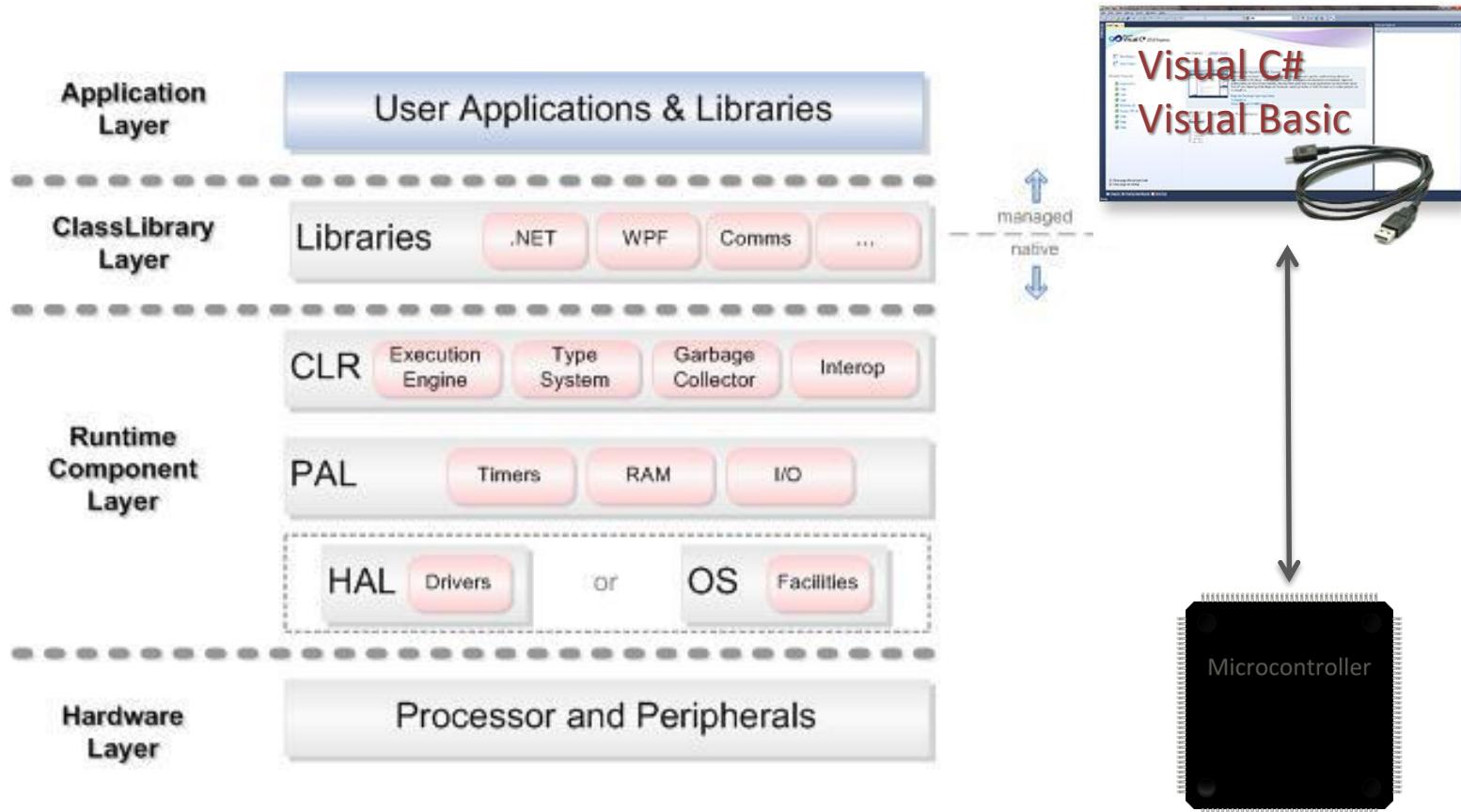
The .NET Micro Framework is .NET for small and resource constrained devices. It offers a complete and innovative development and execution environment that brings the productivity of modern computing tools to this class of devices.



- In simpler words:

A light weight version of .NET Framework specifically designed to run on a basic integrated circuit without an operating system.

# .NET Micro Framework Architecture



# Where does .NETMF fit in?

The core .NET Micro Framework only requires 300KB of Flash

			
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# Facts about .NET Micro Framework

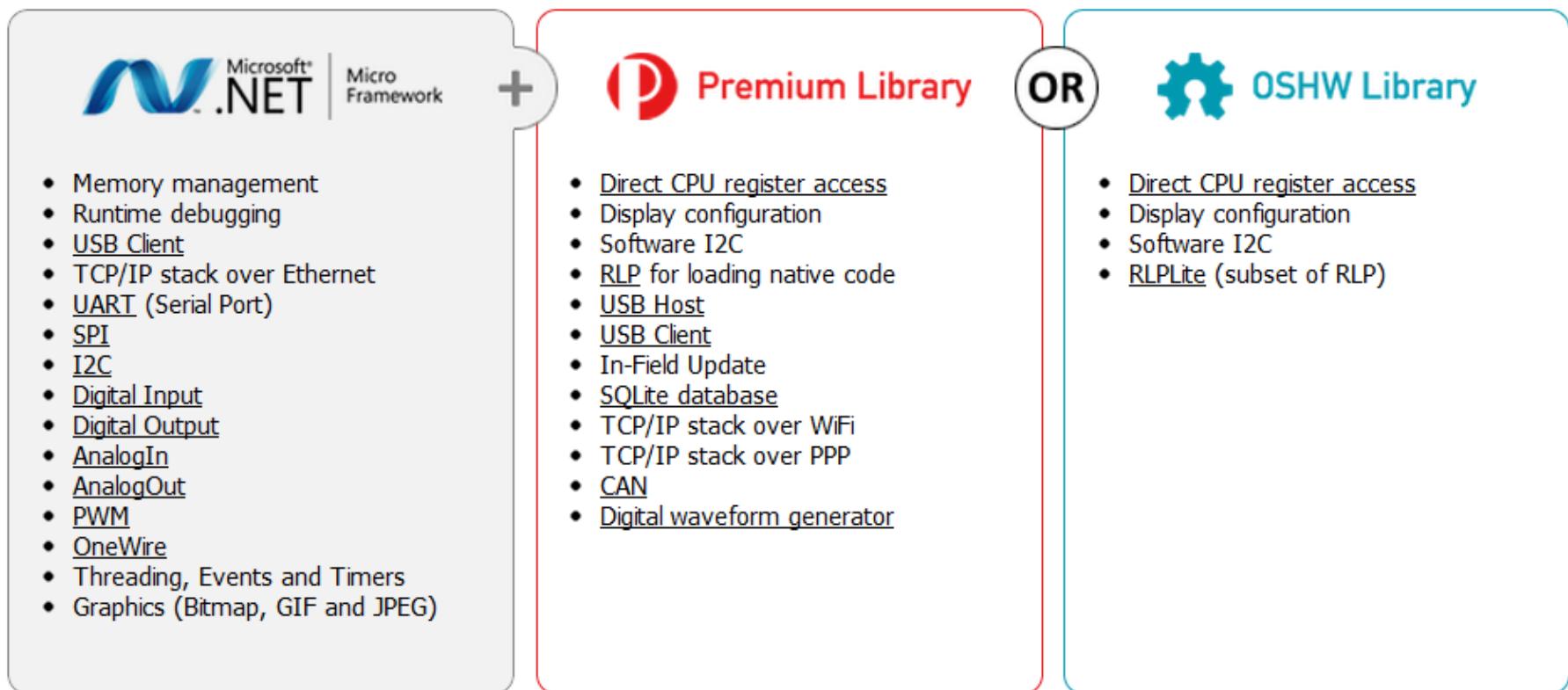
- Open source [netmf.codeplex.com](http://netmf.codeplex.com)
- Supports the express free version of Visual studio development platform.
- Supports Graphics, WPF, networking with SSL, FAT file system, memory management, runtime debugging and Threading.
- Unlike an OS, it provides direct access to low level peripherals such as GPIOs, serial, Analog-In and PWM ports.

# Internet of things with NETMF

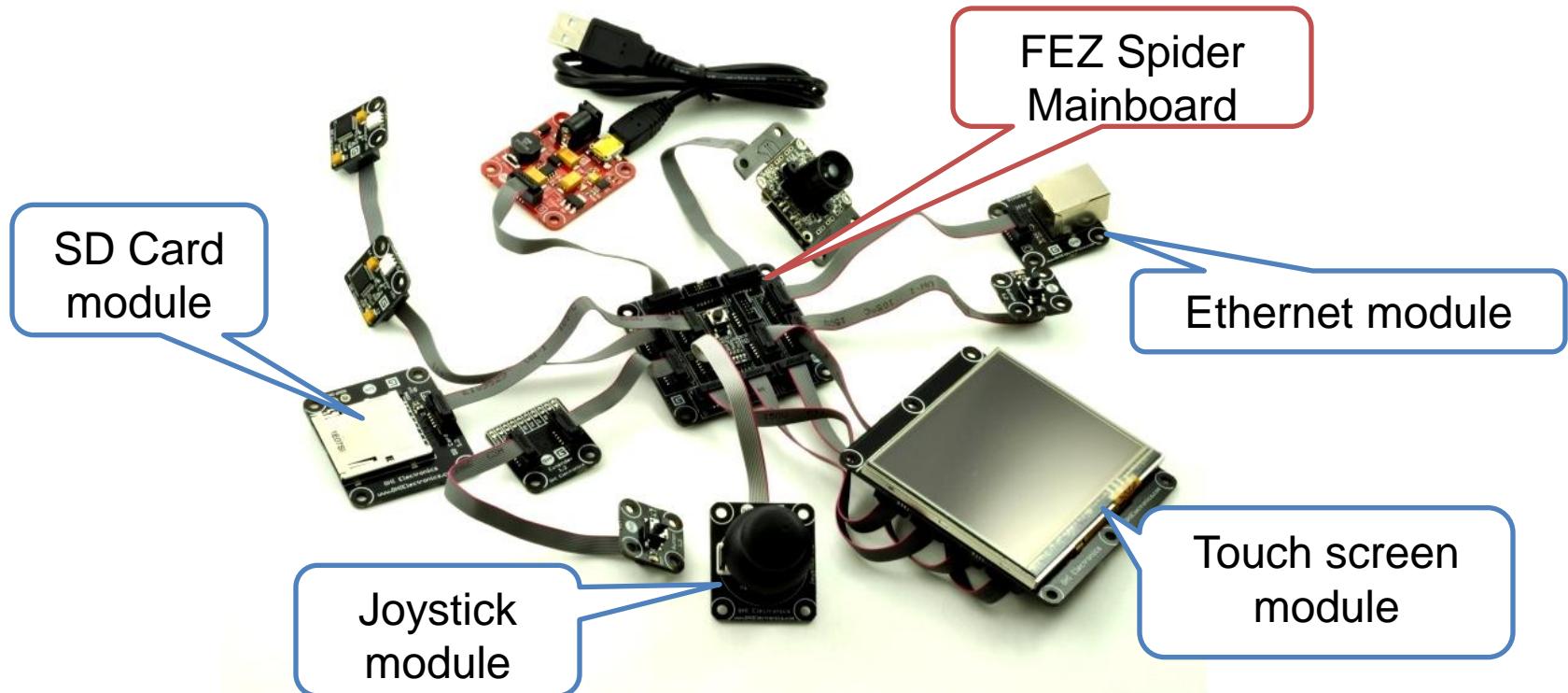
- Billions of OS-less device will be online
  - Appliances
  - Home automation
  - Remote data logger
- .NET Micro Framework provides out-of-the-box features that would facilitate that goal, without the overhead of an OS: TCP/IP, HTTP, File System...etc.

# Some available Off-the-shelf solutions

GHI Electronics is a leading provider of .NET Micro Framework solutions (hardware/software) premium or open source.

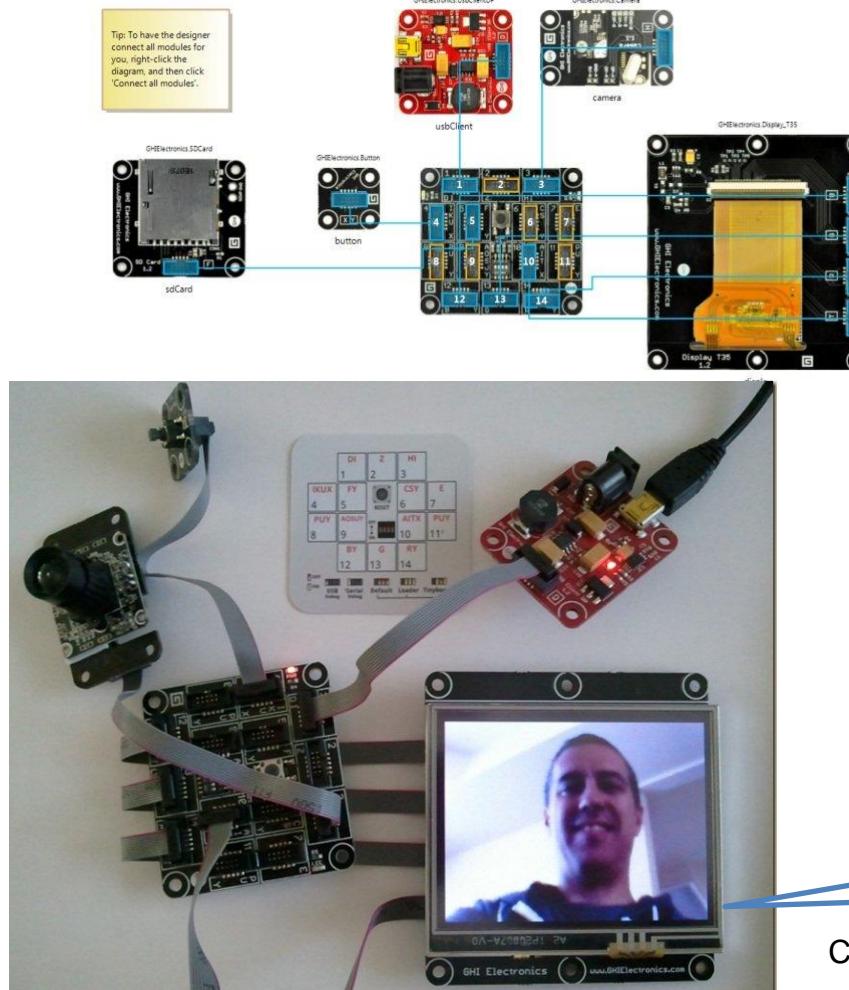


# .NET Gadgeteer



- A modular hardware standard created by Microsoft.
- Its software platform is based on .NET Micro Framework.
- .NET Gadgeteer and .NET Micro Framework generate the synergy that help create sophisticated concepts with minimal efforts and learning curve.

# How does .NET Gadgeteer work?



Project builder  
software and  
coding

A screenshot of Microsoft Visual Studio showing the code for a .NET Gadgeteer application. The code defines a **GadgeteerAppGettingStarted** namespace and a **Program** class. It initializes a **usbClientDP** module and a **button** module. The **ProgramStarted** method handles button presses and prints a message to the console. The **button\_ButtonPressed** event handler blinks a **MulticolorLED** module.

```
namespace GadgeteerAppGettingStarted
{
    public partial class Program
    {
        // Define and initialize GTM.Modules here, specifying their socket numbers.
        GTM.GHIelectronics.USBClientDP usbClientDP = new GTM.GHIelectronics.USBClientDP(1);
        GTM.GHIelectronics.Button button = new Button(4);
        GTM.GHIelectronics.MulticolorLED led = new MulticolorLED(10);

        void ProgramStarted()
        {
            // Initialize event handlers here.
            button.ButtonPressed += new Button.ButtonEventHandler(button_ButtonPressed);
            button.ButtonPressed += new Button.ButtonEventHandler(button_ButtonPressed);

            // Do one-time tasks here
            Debug.Print("Program Started");
        }

        void button_ButtonPressed(Button sender, Button.ButtonState state)
        {
            led.BlinkRepeatedly(GT.Color.Blue);
        }
    }
}
```

Actual  
Hardware

Courtesy of: <http://devhammer.net/blog/are-you-a-gadgeteer>

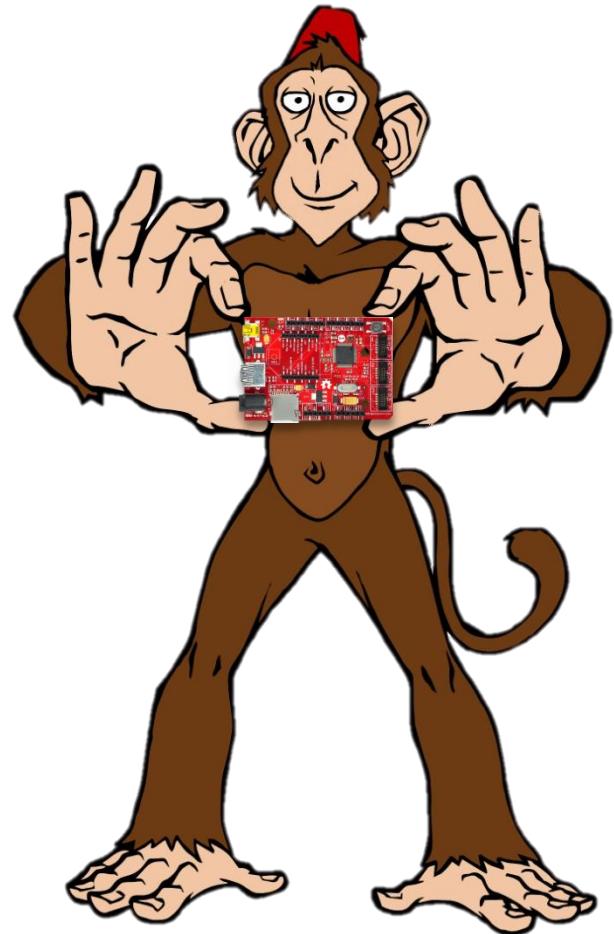
# .NET Gadgeteer

- GHI Electronics is a leading provider and supporter of .NET Gadgeteer platform.
- GHI offers several .NET Gadgeteer compatible mainboards and numerous modules.



# Demo

- How to blink an LED.
- Digital Clock
- Digital Camera in less than 10 minutes



# Resources

## Links

- Start here:  
<http://www.ghielectronics.com/support/dotnet-micro-framework>
- Products:  
<http://www.ghielectronics.com/products/dotnet-micro-framework>
- Microsoft's NETMF:  
<http://www.netmf.com>

## Books

- Getting started with .NET Gadgeteer Book, by Simon Monk, O'Reilly
- Expert .NET Micro Framework, by Jens Kuhner, APress
- Getting Started with the Internet of Things, by Cuno Pfister, O'Reilly

# www.TinyCLR.com

- Most active NETMF community  
Thousands of active members
- Custom-made forum, monitored by GHI  
Tens of thousands of posts
- Code-share section  
Hundreds of open source projects



9/24/2012

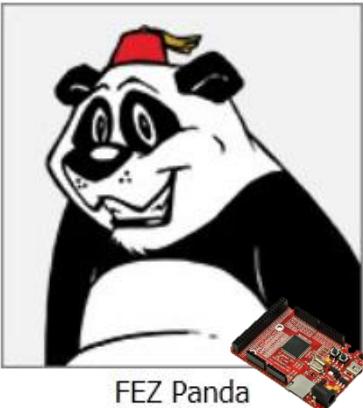
**GHI** electronics  
where hardware meets software

**TINYCLR**  
.NET Micro Framework Community

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# A story about the FEZ-olution

- With .NET Micro Framework, GHI Electronics has been always committed to providing **FEZ** products.
- FEZ started as “Freakin' Easy” in 2009
- Someone said, “It is so freakin' easy a monkey can do it!”
- Fez is also a short cylinder red felt hat with a tassel.
- FEZ changed to “Fast & Easy” in 2011



# Q&A

