Writing Your Own Diagnostic Tools with Event Tracing for Windows (ETW)

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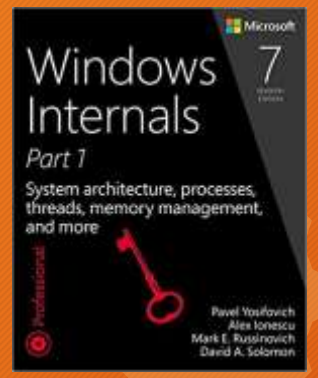
Something About Me



- Developer, Trainer, Author and Speaker
- Book author
  - “Windows Internals 7th edition, Part 1” (co-author, 2017)
  - “WPF 4.5 Cookbook” (2012)
  - “Windows Kernel Programming” (WIP, 2019)
- Pluralsight author
- Author of several open-source tools (http://github.com/zodiacon)
- Blogs: http://blogs.microsoft.co.il/pavely, http://scorpiosoftware.net

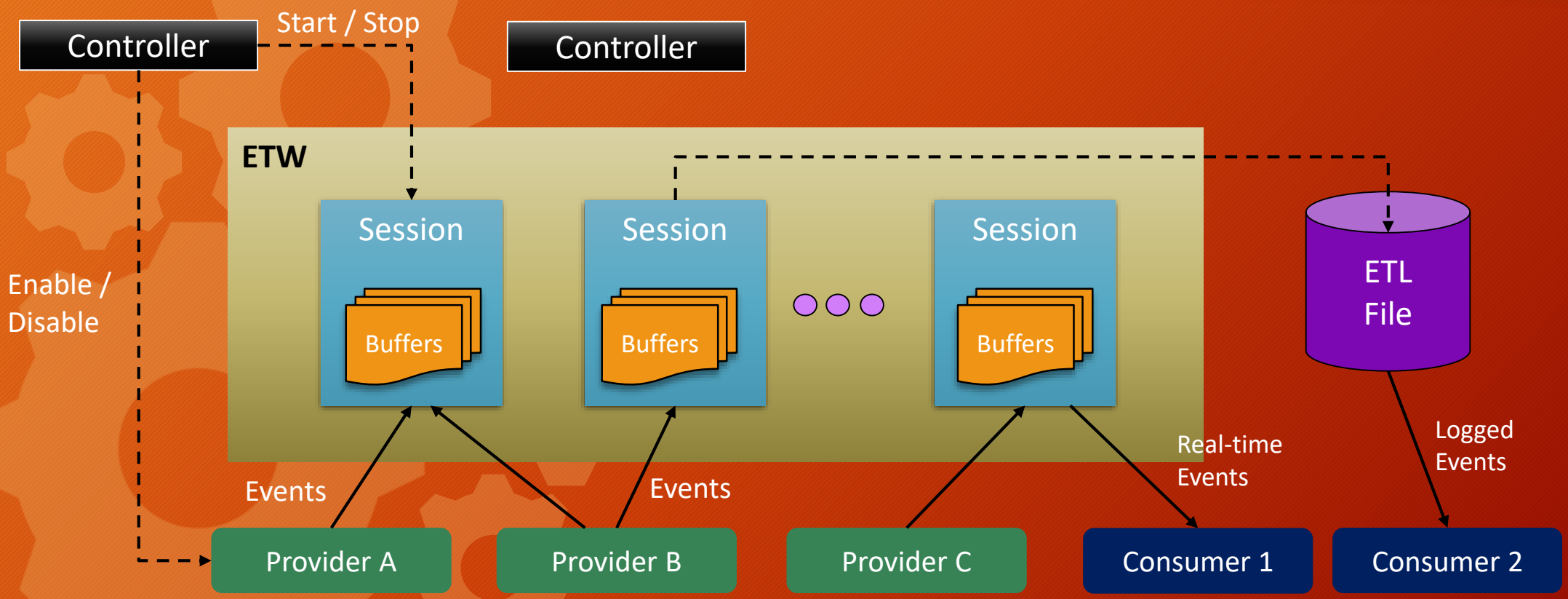
Agenda

- Introduction to ETW
- Tools
- Libraries
- Demos
- Summary
- Q & A

Event Tracing for Windows (ETW)

- Introduced in Windows 2000
- Event Tracing / Logging mechanism
  - Low overhead even with high event volume
- Traces can be recorded to a file and/or to a real-time session
- System-wide
- Lots of registered providers out of the box
  - `c:> logman query providers`

ETW Architecture



ETW Sessions

Demo

Tools for Working with ETW

- Xperf, Tracerpt, Logman
  - Built-in tools for recording ETW / reporting / formatting
- Windows Performance Recorder (WPR) / Analyzer (WPA)
  - Part of the Windows Performance Toolkit (Windows SDK)
- TraceView
  - Windows SDK and WDK
- PerfView
  - Uses ETW to analyze (mostly) .NET related issues
- ProcMonX
  - Possible replacement for ProcMon
- Your own tools!

ETW Explorer

Demo

Working with ETW in .NET

- Providers
  - `System.Diagnostics.Tracing` namespace
    - Not the focus of this talk
- Consumers
  - Open source libraries (available through Nuget)
    - `Microsoft.Diagnostics.Tracing.TraceEvent`
      - Used by PerfView
    - `Microsoft.O365.Security.Native.ETW`
      - krabs wrapper (a.k.a. “Lobsters”)

Simple Provider and Consumer

Demo

The Kernel Provider

- Requires running elevated to use
- Prior to Windows 8 – only one such session can exist
  - Name of session must be “NT Kernel Logger”
    - `KernelTraceEventParser.KernelSessionName` has this name
- Many interesting events
  - Mostly “documented” in MSDN

Consuming Kernel Provider Events

Demo

`TraceEvent` and Parsers

- The `Diagnostics.TraceEvent` library comes with several built-in parsers
  - E.g. Kernel and CLR
- For other providers, a tool can generate the required parser code based on the XML manifest
  - TraceParserGen.exe

Parser Generator

Demo

The CLR Provider

- Events published by the CLR itself
- Use `ClrTraceEventsParser` to consume
- Register for interesting events
- Filter by the process(es) of interest

- For .NET Core (2.2 and later)
  - Use the `EventListener` class

Consuming CLR Provider Events

```
try {
    // many lines of code
}
Catch {
    // maybe log
}
```

Demo

Call Stacks

- ETW Events can provide call stack
- The Microsoft.Diagnostics.Tracing.Etlx.TraceLog class does all the heavy lifting
- Must enable some kernel provider events

Call Stacks

Demo

Summary

- ETW is a low-overhead logging infrastructure
  - Common across kernel mode and user mode
- Many ETW providers out of the box
  - Research and experiment
- Easy to consume to a file or a real-time session
  - Sometimes state management is required
- Call stack is also available

Thank you!