



Fast and Flexible Tracing/Logging in .NET

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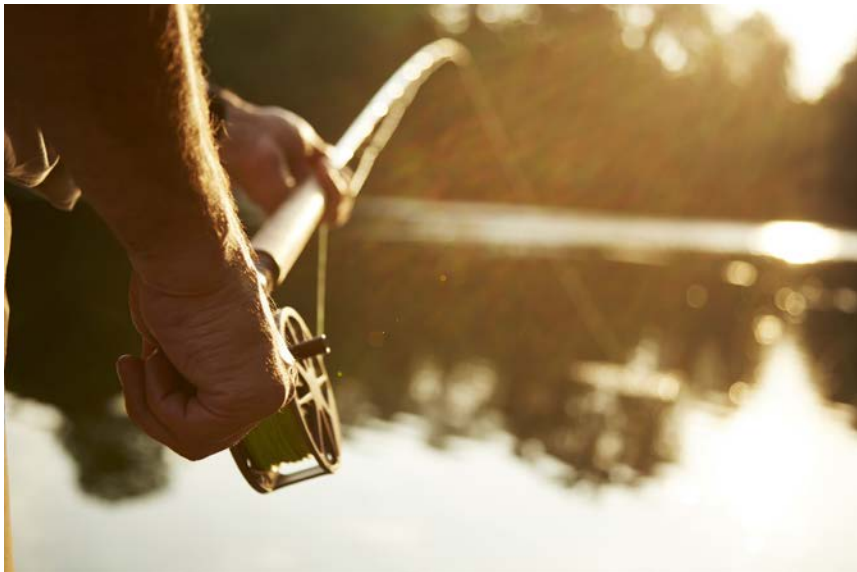
About me

- Commodore 64 BASIC
- '97 Clipper/FoxPro (dBASE)
- '01 Assembler (LILA 777, x86)
PASCAL, C, C++, Java
- '08 C#, PL-SQL (Oracle)
- '09 C#, T-SQL (MS SQL)
- '15 C#, Architecture

- EcoStruxure ADMS
 - 20 millions LoC
 - 90 3rd party integrations
 - 55 systems in production
 - 60 servers per typical system
 - 5 TB of RAM, 700 CPU cores
 - Critical infrastructure – limited access
 - Long deployment cycles

The Challenge

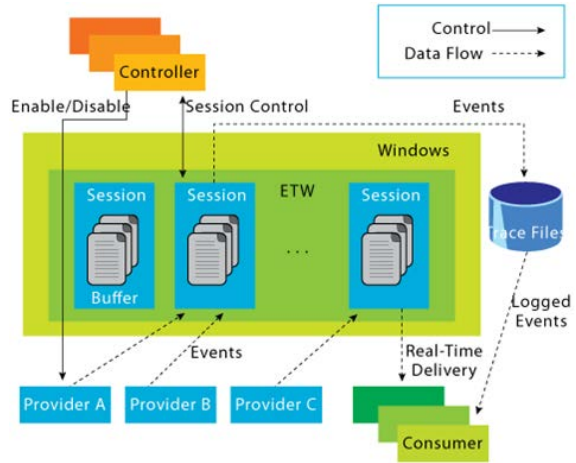
- If we log every possibly interesting „event“
 - Log file unreadable
 - Performance degrades
- If we restrict logging
 - The hardest issues always need something that we didn't log
- Logging configuration is part of the application
- Event processing is in the same process
- Treat logs as event streams
[<https://12factor.net/logs>]



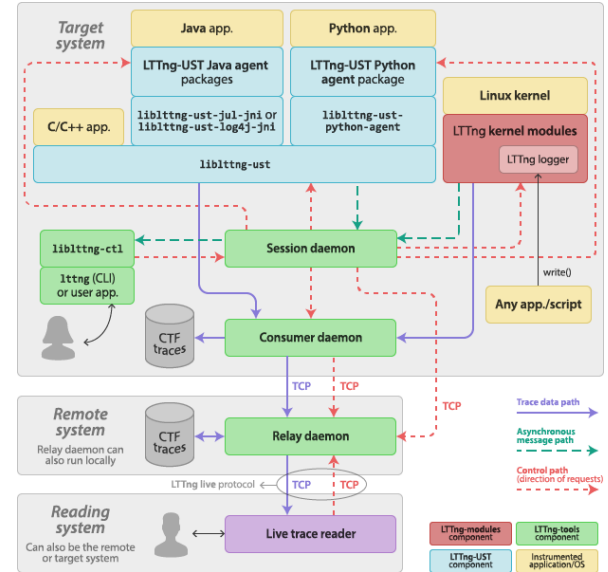
The Alternative

What if we **remove everything** that we can from the target process?

EventSource



On Windows – ETW (Event Tracing for Windows)



On Linux – LTTng (Linux Trace Toolkit Next Generation)

Features

- Structured
- Fast
- Isolated
- Integrated
- Flexible
- Localized
- TraceEvent
- Advanced analysis



Structured

- Event
 - Time
 - Process
 - Thread
 - Processor
 - Keywords
 - Level
 - ...
 - Custom properties (a.k.a. payload)



Fast

BenchmarkDotNet=v0.13.4, OS=Windows 10 (10.0.19045.2486)
 Intel Core i5-8365U CPU 1.60GHz (Coffee Lake), 1 CPU, 8 logical and 4 physical cores
 .NET SDK=7.0.102
 [Host] : .NET 7.0.2 (7.0.222.60605), X64 RyuJIT AVX2
 DefaultJob : .NET 7.0.2 (7.0.222.60605), X64 RyuJIT AVX2

Method	Mean	Error	StdDev	Median	Gen0	Allocated
NLogFile_NoArguments_NoLog	1.708 ns	0.0653 ns	0.0802 ns	1.663 ns	-	-
EventSource_NoArguments_NoLog2	4.337 ns	0.1163 ns	0.0971 ns	4.300 ns	-	-
Interlocked_Increment	4.747 ns	0.0755 ns	0.0669 ns	4.712 ns	-	-
EventSource_NoArguments_NoLog1	15.598 ns	0.4449 ns	1.2179 ns	15.234 ns	-	-
ConsoleLogger_NoArguments_NoLog	31.802 ns	0.5699 ns	0.6335 ns	31.673 ns	-	-
DynamicEventSource_NoArguments_NoLog	34.609 ns	0.6713 ns	0.7183 ns	34.474 ns	-	-
EventSource_NoArguments	544.720 ns	10.9372 ns	13.4318 ns	539.941 ns	-	-
EventSource_3StringArguments	582.355 ns	11.0065 ns	13.9196 ns	575.500 ns	-	-
DynamicEventSource_NoArguments	689.695 ns	13.5322 ns	16.1092 ns	685.150 ns	-	-
DynamicEventSource_3StringArguments	1,020.512 ns	20.0225 ns	24.5894 ns	1,011.556 ns	0.0114	40 B
NLogFile_NoArguments	3,469.797 ns	65.9200 ns	168.9781 ns	3,432.333 ns	0.0381	120 B
NLogFile_3StringArguments	4,029.150 ns	79.3109 ns	136.8075 ns	3,987.517 ns	0.1221	384 B
ConsoleLogger_NoArguments	577,667.785 ns	11,392.6642 ns	15,594.4073 ns	580,839.307 ns	-	184 B
ConsoleLogger_3StringArguments	606,542.032 ns	12,009.6963 ns	27,352.1557 ns	602,449.365 ns	-	592 B

Isolated

- No exceptions
- No configuration files
 - Controller chooses what to collect dynamically
- No I/O operations
 - Session saves the data or dispatches for further processing

Integrated

- Part of the .NET framework
- Windows Event Log (Event Viewer)
- Windows Performance Analyzer (WPA)
- Logman (Performance Monitor)
- PerfView
- Event Correlation, Activity Tracking (TPL)
- Other Event Sources
 - Kernel, .NET Runtime, Network, Drivers, File Operations, IIS, ...
- Triggers in advanced analysis



Flexible

- What to log?
 - Log level
 - Keywords
 - Process
- How to log?
 - Real-time processing
 - Circular file
 - Unlimited file
- Custom Event Consumer



Localized

- Typically used for Windows Event Log
- Standard approach w/ resource dll-s



TraceEvent

- Event Consumer library
- Real-time or file source
- Dynamic event parsers
- Parser generator for typed parsers



Advanced Analysis

- PerfView
- Accumulate events in memory
- When something interesting happens dump to file



DEMO

Drawbacks

- Verbosity
- Silent mistakes
- Steep(er) learning curve
- Documentation

Recap

- Minimal impact to traced process
 - Performance
 - Exceptions
 - No code/configuration change
- Flexibility in analysis
 - Structure
 - Existing tools
 - Combination with other event sources
 - Custom processing

Life Is On



Schneider
Electric