PowerShell Conference Europe

Going past Profiler, profiling PowerShell code using PerfView.

Jakub Jareš

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The #1 for PowerShell Management

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Jakub Jareš

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- Pester owner and maintainer. Author of Assert module, and Profiler module. Senior software engineer at Microsoft, developing VSTest and MSTest. I don't represent Microsoft here.

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Need info about Prague, ask me.

Prizes!!!

https://rb.gy/kk77g

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My Math module is broken 😢

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Profiler

```
S:\p\profiler [tracesource +2 ~2 -0 !]> $r.Top50SelfDuration | select SelfPercent, SelfDuration, HitCount, File, Module, Function, Text | ft

SelfPercent SelfDuration     HitCount File          Module  Function          Text
----------- ------------     -------- ----          ------  --------          ----
      98.29 00:00:00.6597939        4 Avocado.psm1  Avocado Get-EmojiInternal $r = Invoke-WebRequest -Method GET -Uri "https://emojipedia.org/$(
       1.44 00:00:00.0097032        2 Avocado.psm1  Avocado Get-EmojiInternal $match = $r.Content.ToString() -split "`n" | Select-String '<h1><s
       0.22 00:00:00.0014554        2 demo.ps1                                & "$PSScriptRoot/demo-scripts/Get-Icons.ps1" }
       0.01 00:00:00.0001037        1 Get-Icons.ps1                           Import-Module $PSScriptRoot\Avocado.psm1
       0.01 00:00:00.0000425        2 Avocado.psm1  Avocado Get-EmojiInternal $match.Matches.Groups[-1].Value
       0.01 00:00:00.0000350        1 Get-Icons.ps1         Get-Icons         Get-Unicorn
       0.00 00:00:00.0000216        1 Avocado.psm1  Avocado Get-Unicorn       Get-EmojiInternal -Emoji unicorn
       0.00 00:00:00.0000209        2 Avocado.psm1  Avocado Get-EmojiInternal if (200 -ne $r.StatusCode) {
       0.00 00:00:00.0000186        1 Get-Icons.ps1                           Get-Icons
       0.00 00:00:00.0000177        1 Avocado.psm1  Avocado Get-Avocado       Get-EmojiInternal -Emoji avocado
       0.00 00:00:00.0000167        2 Avocado.psm1  Avocado Get-EmojiInternal }
       0.00 00:00:00.0000136        1 Get-Icons.ps1         Get-Icons         Get-Avocado
       0.00 00:00:00.0000086        1 Get-Icons.ps1         Get-Icons         }
       0.00 00:00:00.0000062        2 Avocado.psm1  Avocado Get-EmojiInternal $ProgressPreference = 'SilentlyContinue'
       0.00 00:00:00.0000050        1 Avocado.psm1  Avocado Get-Avocado       }
       0.00 00:00:00.0000046        1 Avocado.psm1  Avocado Get-Unicorn       }
       0.00 00:00:00.0000045        2 Avocado.psm1  Avocado Get-EmojiInternal function Get-EmojiInternal ($Emoji) {
       0.00 00:00:00.0000029        1 Get-Icons.ps1         Get-Icons         function Get-Icons () {
       0.00 00:00:00.0000020        1 Avocado.psm1  Avocado Get-Unicorn       function Get-Unicorn {
       0.00 00:00:00.0000020        1 demo.ps1                                {
       0.00 00:00:00.0000018        1 Avocado.psm1  Avocado Get-Avocado       function Get-Avocado {
```

[nohwnd/Profiler: Script, ScriptBlock and module performance profiler for PowerShell 5, and PowerShell 7. (github.com)]

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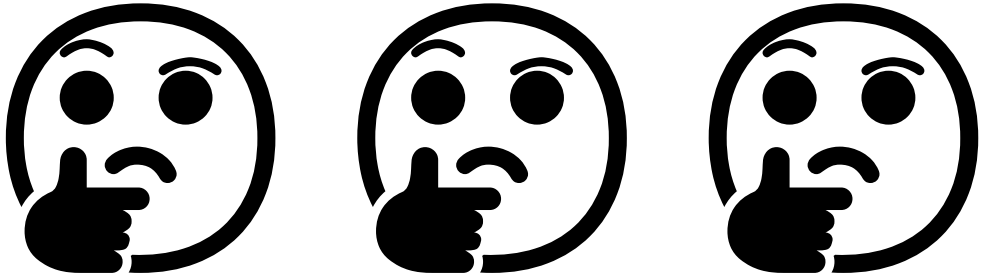
Profiler limitations

- Can only see PowerShell code.
- Can see only entry point of C# code (e.g. binary cmdlet, [IO.File]::ReadAllText()) but not the internals.
- Can't see PowerShell internals.

Often this is blessing, but sometimes it is a curse.



We need to go deeper.

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PerfView

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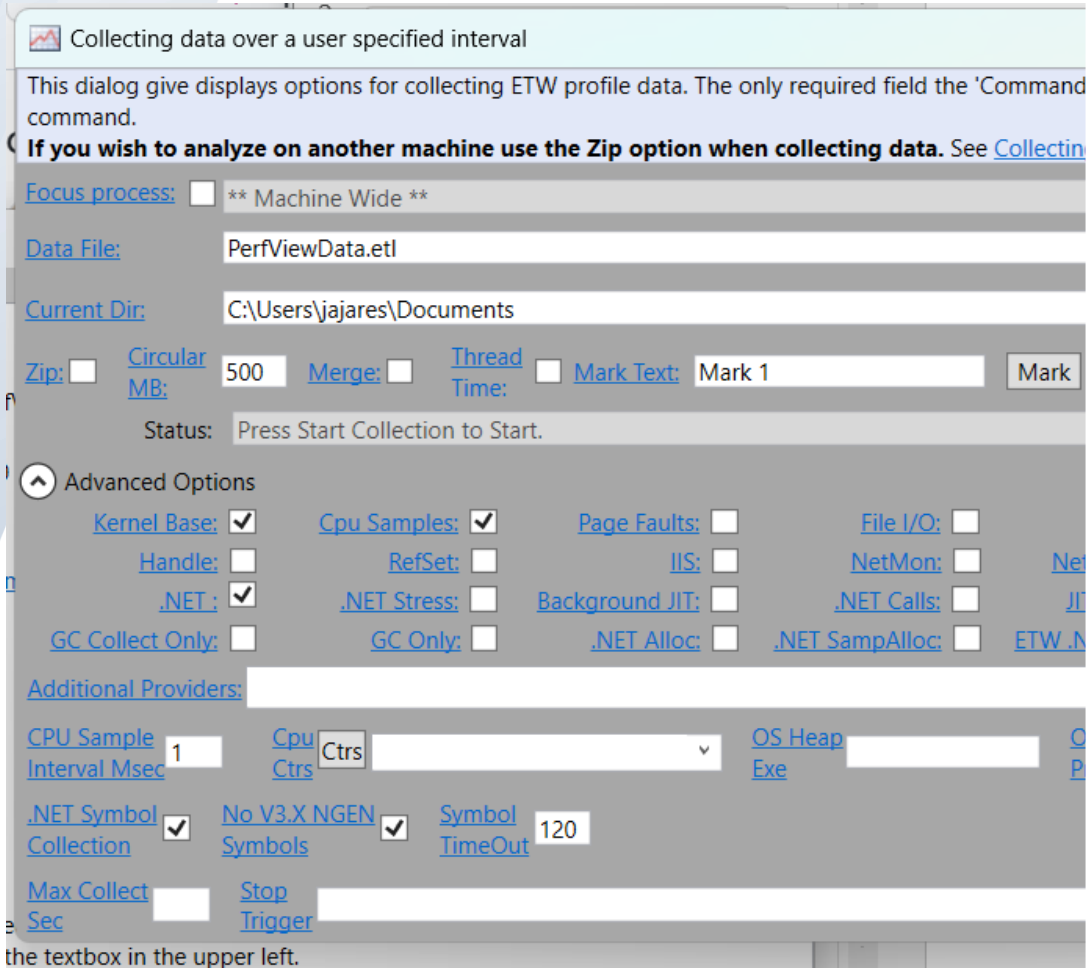
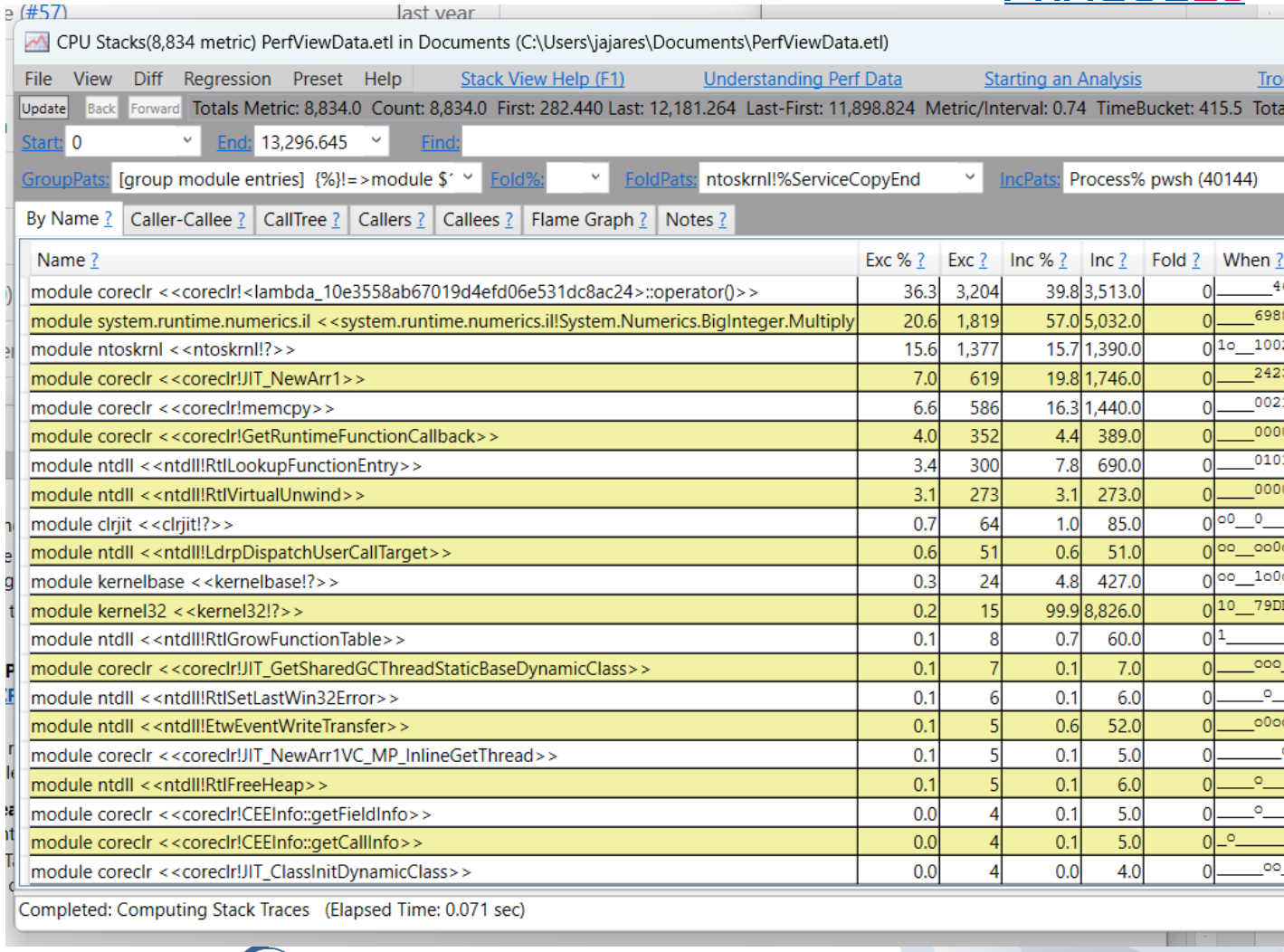
Installing PerfView

choco install PerfView –y

[microsoft/perfview: PerfView is a CPU and memory performance-analysis tool (github.com)]

PerfView





Name ?	Exc % ?	Exc ?	Inc % ?	Inc ?	Fold ?	When ?
module coreclr <<coreclr!<lambda_10e3558ab67019d4efd06e531dc8ac24>::operator()>>	36.3	3,204	39.8	3,513.0	0	
module system.runtime.numerics.il <<system.runtime.numerics.il!System.Numerics.BigInteger.Multiply	20.6	1,819	57.0	5,032.0	0	
module ntoskrnl <<ntoskrnl!?>>	15.6	1,377	15.7	1,390.0	0	
module coreclr <<coreclr!JIT_NewArr1>>	7.0	619	19.8	1,746.0	0	
module coreclr <<coreclr!memcpy>>	6.6	586	16.3	1,440.0	0	
module coreclr <<coreclr!GetRuntimeFunctionCallback>>	4.0	352	4.4	389.0	0	
module ntdll <<ntdll!RtlLookupFunctionEntry>>	3.4	300	7.8	690.0	0	
module ntdll <<ntdll!RtlVirtualUnwind>>	3.1	273	3.1	273.0	0	
module clrjit <<clrjit!?>>	0.7	64	1.0	85.0	0	
module ntdll <<ntdll!LdrpDispatchUserCallTarget>>	0.6	51	0.6	51.0	0	
module kernelbase <<kernelbase!?>>	0.3	24	4.8	427.0	0	
module kernel32 <<kernel32!?>>	0.2	15	99.9	8,826.0	0	
module ntdll <<ntdll!RtlGrowFunctionTable>>	0.1	8	0.7	60.0	0	
module coreclr <<coreclr!JIT_GetSharedGCThreadStaticBaseDynamicClass>>	0.1	7	0.1	7.0	0	
module ntdll <<ntdll!RtlSetLastWin32Error>>	0.1	6	0.1	6.0	0	
module ntdll <<ntdll!EtwEventWriteTransfer>>	0.1	5	0.6	52.0	0	
module coreclr <<coreclr!JIT_NewArr1VC_MP_InlineGetThread>>	0.1	5	0.1	5.0	0	
module ntdll <<ntdll!RtlFreeHeap>>	0.1	5	0.1	6.0	0	
module coreclr <<coreclr!CEEInfo::getFieldInfo>>	0.0	4	0.1	5.0	0	
module coreclr <<coreclr!CEEInfo::getCallInfo>>	0.0	4	0.1	5.0	0	
module coreclr <<coreclr!JIT_ClassInitDynamicClass>>	0.0	4	0.0	4.0	0	

PerfView

- is free
- is non-invasive
- is very portable

- Only works on windows
- Is little hard to use

Profiling basics

- Samples and events.
- Kernel CPU sampler provides samples every 1ms. This sample have callstack of every CPU.
- Profiler (and Pwsh) emit events when interesting stuff happens, via additional Providers.

- PerfView observes samples and events via ETW and writes them into etl file.

Capture trace

- Capture trace of Import-Module that is running under Trace-Script from latest Profiler.

- Including provider *Profiler.

  Look at events, from Profiler.

Focus the correct time

- Find Index and Return index of the event we are interested in.
- Find the text we are interested in.
- Limit PerfView view to just that time.

How can PerfView see the internals of my module?

- Thanks to PDB / symbols.
- A map from compiled code in a dll, to source files from which it was produced.

- Enables debugging, and stopping at breakpoints.

- Embedding pdbs and source link · PowerShell · Discussion #19774 (github.com)

Building PowerShell locally

```
$version = $PSVersionTable.GitCommitId
git checkout “v$version”
Import-Module build.psm1
Start-PSBootstrap
Start-PSBuild

Function Start-DevPwsh {
        C:\p\powershell\src\powershell-win-
        core\bin\Debug\net7.0\win7-x64\publish\pwsh.exe
}
```

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🤔 The curious case of slow Pester import

Raffle reminder!

https://rb.gy/kk77g

Import-Module Pester 5.4.1

- Import takes ~4 seconds.
- Reported by dbachecks / Rob.
- Profiler tells us Get-Help is causing this.

- Later Frode notices that only the shipped version has this problem.

Profiling Pester with Profiler

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- import-module /p/profiler/profiler/profiler.psd1
- $trace = trace-script { import-module pester -force }

- $trace.Top50SelfDuration | select -First 10 SelfPercent, SelfDuration, HitCount, Module, Function, Text | Format-Table

Getting help, in and out


```powershell
# .SYNOPSIS
# Gets an AD user.
function Get-User {

    param (
        # The name of the user to find.
        $Name
    )
}
```

WPA

Using WPA

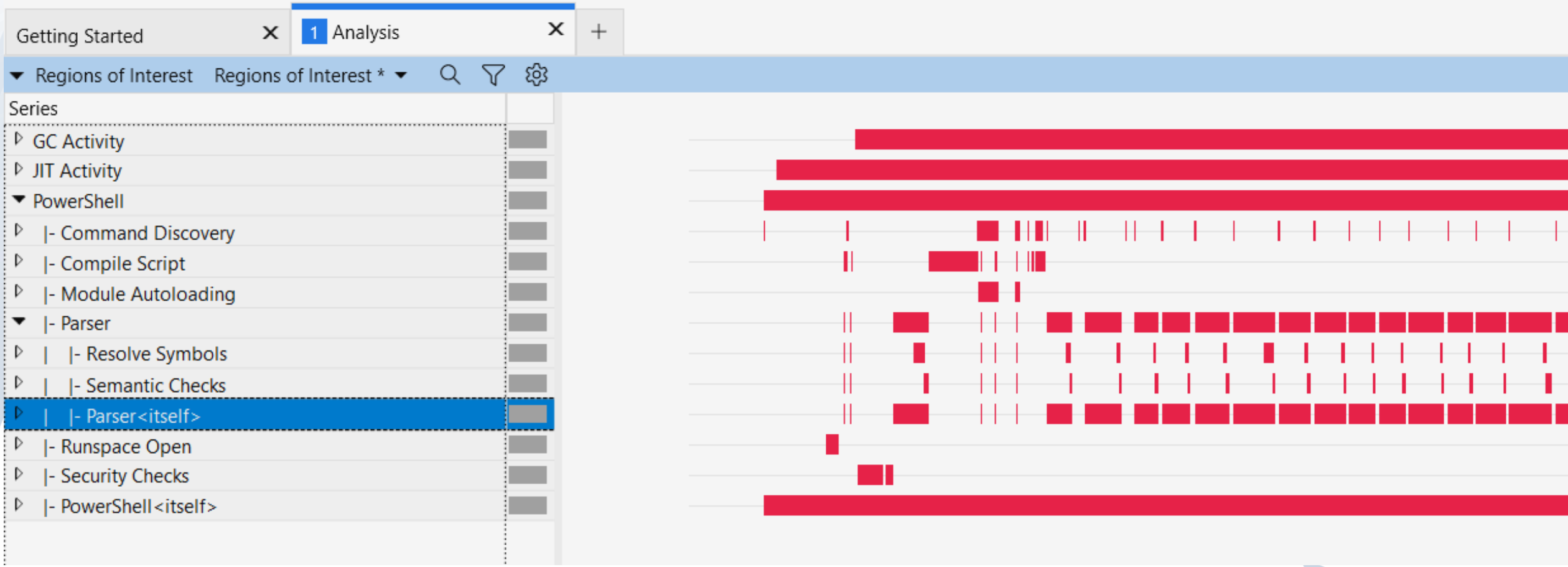
- PowerShell itself has this nice guide on performance
- PowerShell/tools/performance at master · PowerShell/PowerShell · GitHub

which is great at giving you visual view of what is happening, when your problem is actually in powershell "engine".

WPA

- windows performance analyzer. Nice tool, super powerful. You need a PHd to use it.

  Makes it easy to see that parser is busy.


Getting Started
1 Analysis
Regions of Interest
Regions of Interest *
Series
GC Activity
JIT Activity
PowerShell
|- Command Discovery
|- Compile Script
|- Module Autoloading
|- Parser
| |- Resolve Symbols
| |- Semantic Checks
| |- Parser<itself>
|- Runspace Open
|- Security Checks
|- PowerShell<itself>

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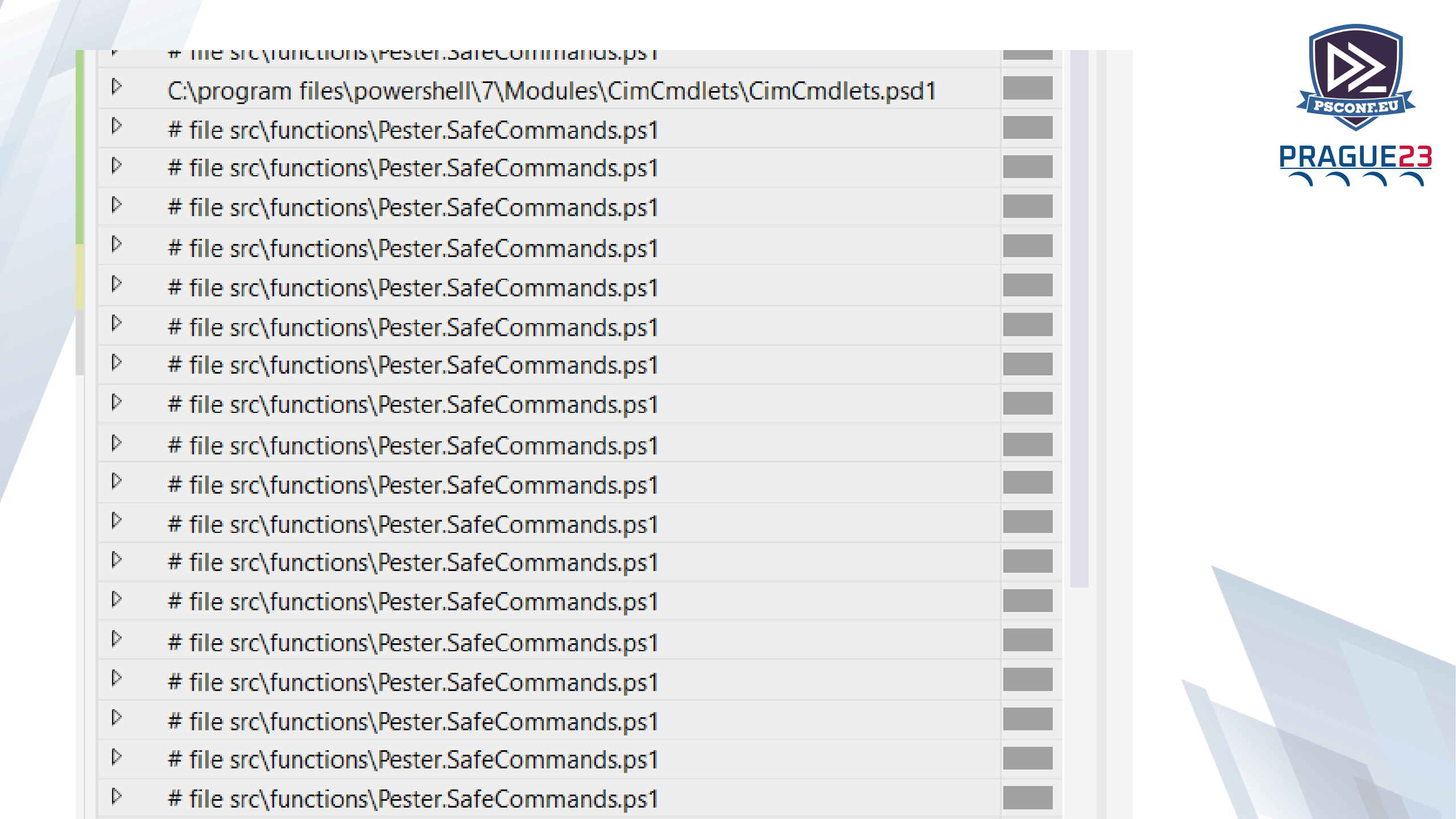
C:\program files\powershell\7\Modules\CimCmdlets\CimCmdlets.psd1
file src\functions\Pester.SafeCommands.ps1
file src\functions\Pester.SafeCommands.ps1
file src\functions\Pester.SafeCommands.ps1
file src\functions\Pester.SafeCommands.ps1
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WPA

- WPA is super useful for a developer of PowerShell, the setup they have is really nice.

  Our problem is a great fit for what is being observed so it is easy to see the problem.

  What I can't see easily though is why Get-Help is marked as taking so much time.

Summary

Summary

- PerfView is a free powerful tool.
- Try it, it is not scary.

Q&A

15 minutes

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