Troubleshooting MSBuild

Agenda

- Terminology
- Concepts
- Binlog Viewer
- ETW + PerfView
- Case 1 – Targets ordering
- Case 2 – overbuild/underbuild
- Case 3 – slow build

Materials

dotutils.net/wug-talk

The team

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Terminology

- Properties
- Items, Metadata
- Targets, Tasks
- Conditions
- Projects
- Property/Item Functions
- Imports, Sdks, .props, .targets

```xml
<Project Sdk="Microsoft.NET.Sdk">
  <PropertyGroup>
    <OutputType>Exe</OutputType>
    <TargetFramework>net8.0</TargetFramework>
  </PropertyGroup>


  <ItemGroup>
    <PackageReference Include="Verify.Xunit"
             Version="23.1.0" />
  </ItemGroup>


  <Target Name="ShowHash">
    <Message Text= "Exexuted $(Now)" />
  </Target>
</Project>
```

Terminology

- **Properties**
- $(Prop)
- Env vars
- /p[roperty]:<name>=<value>

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Terminology

- **Items, Metadata**
- @(Item)
- @(Item->'%(metadata)')
- %(Item.metadata)
- Items transformations
- Batching

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Terminology

- **Targets, Tasks**
- Unit of execution
- Dependencies
- U2D check
- Coma vs semicolon, quotes

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Terminology

- **Conditions**

- ==, !=, Exists, !Exists

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Terminology

- **Projects**
- Scheduling unit, import unit

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Terminology

- **Property/Item Functions**

- *$([MSBuild]::StableStringHash($(TargetPath)) .ToString('X8'))*

- *$([System.DateTime]::Now)*

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Terminology

- **Imports, Sdks, .props, .targets**
- Sdk.props, Sdk.targets
- Directory.Build.props
- Directory.Build.targets
- Nuget.g.props, nuget.g.targets
- github.com/microsoft/MSBuildSdks

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Concepts

- Evaluation
- Execution
- Restore
- Multitargeting

Concepts

- **Evaluation**
  1. Environment, Global props, toolset props
  2. Properties and imports via top down traversal
  3. Item definitions (2nd top down traversal)
  4. Items (3rd traversal)
  5. UsingTask elements
  6. Target elements

Concepts

- **Execution**

- Expansion order within target

- Multiple processes

- Projects - data boundaries

- Projects dependencies discovered just-in-time

- Logging events ('BuildEventArgs') transferred to main node and dispatched in serial mode

Concepts

- **Restore**

- /t:Restore, -restore, --no-restore

- *dotnet build* vs *msbuid.exe* (vs ~~*devenv /build*~~)

Binlog Viewer

- Collecting

- Contained data

- Embedded files

- Autoupdate (ClickOnce), Forward compatible mode

ETW, PerfView

- perfview collect
  /NoGui
  /Providers=*Microsoft-Build   // Collect MSBuild ETW events
  /threadTime   // Collect thread times (with stacks)
  /BufferSize:8096   // MB, in-memory buffer (I/O catching-up)
  /CircularMB:8096   // Max result file size
  /NoNGenRundown   // Skip symbols for NGEN
  /Merge:False   // Symbols, Bins. Needed for export
  /DataFile:<name>

- *perfview collect /NoGui /Providers=*Microsoft-Build /threadTime /BufferSize:8096 /CircularMB:8096 /NoNGenRundown /Merge:False /DataFile:example01*