Splunks Of War: Creating A Better Game Development Process Through Data Analytics

Phil Cousins
Principal Software Engineer, The Coalition (Microsoft)
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Agenda

- About Me
- What we do
- Splunk Adoption
- Growing Splunk
- Driving Game Quality
- Future Plans
- Key Takeaways
- Questions
About Me

- Principal Software Engineer @ The Coalition (Microsoft)
- Lead of the tools, build and automation teams
- My Job: To make the game development process easier
What we do

- Microsoft studio out of Vancouver, BC, Canada
- We develop AAA games for Xbox One and Windows 10
- 300+ team of software engineers, designers, artists, producers and quality assurance
- Gears of War 4 is out 11\textsuperscript{th} October!
What we do: Workflow Challenges

- Code
- Levels
- Visual Effects
- Animations
- Audio Effects

Azure Server
Win10 PC
Xbox One
What we do: Software Challenges
What we do: Geographic Challenges
Splunk Adoption

- A lot of tools, workflows and people to support
- Users weren’t always good at telling us what might be wrong (especially in different time zones)
- We needed a way to centralize our data capturing solution and to be able to act on what we found
Splunk Adoption

- Looked at a few solutions but Splunk provided us with the ability to:
  1. Require no centralized schema for our logs
  2. Vast array of plugins like Windows Universal Forwarder
  3. Searching and visualizing your data is simple
  4. Easily create alerts and reports on the data we were monitoring
Splunk Adoption: Topology

log file → search head → indexer
Splunk Adoption

- Started small, ingesting well formatted logs
- All requirements came from within my team
- Very much reactionary to begin with
Splunk Adoption: Workflow Monitoring

- Started to create dashboards for all of our major tools
Our perforce server would randomly crash

CPU, Disk and Network looked fine

Started ingesting results of admin commands (p4 monitor)
Our outsourcers started to complain about sync times.

We had little insight into how much content was being submitted each day.
Splunk Adoption

- For the first time we could get detailed insight into key tools, workflows and infrastructure
- Helped drive operation KPIs for the group and provide alerting coverage
- We started to get the data thirst and so did others!
Growing Splunk

- We started to expand on the logs we were monitoring
- Added direct database connection for static lookups
- Began adding in more windows forwarders from build machines
- We started to move from reactionary to more preventative monitoring
- We started asking more questions, writing more reports and expanding the people allowed to use the system
- Until...
Growing Splunk: Growing Pains

- Noticed Splunk Indexers falling further and further behind
- Searches were taking longer and longer
- We had failed to monitor the hardware we were running Splunk on
Growing Splunk: Topology v2

search head

indexer1  indexer2  indexer  indexer4  indexer5

universal forwarder1  universal forwarder2  universal forwarder3  universal forwarder4

forwarder1  forwarder2  forwarder3  forwarder125

License/Deployment Server

SQL Server
Growing Splunk: Monitoring Compile Times

- Game compile times were very long
- Custom build solution in Unreal 4 using Nmake and C#
- Zero telemetry so nothing to action on
Growing Splunk: Monitoring Compile Times

NMake → Unreal Build Tool → EXEs and DLLs

Trace Listener

```c
public FBX(TargetInfo Target)
{
    Type = ModuleType.External;

    string FBXSDKDir = UEBuildConfiguration.UEThirdPartySourceDirectory + "FBX/2016.1.1/";
    PublicSystemIncludePaths.AddRange(
        new string[] {
            FBXSDKDir + "include",
            FBXSDKDir + "include/fbxsdk"
        });

    if (Target.Platform == UnrealTarget)
    {
        string FbxLibPath = FBXSDKDir + "Lib/Win" + WindowsPlatform.GetVisualStudioCompilerVersionName() + "/;"
        FbxLibPath += "Win/Release/";
        PublicLibraryPaths.Add(FbxLibPath);
        PublicAdditionalLibraries.Add("libfbxsdk.lib");
        // We are using DLL versions of the FBX libraries
        Defines += "("FBXSDK_SHARED"");
        RuntimeDependencies.Add(new RuntimeDependency("fxb/libfbxsdk.dll");
    }
}
```

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Growing Splunk: Monitoring Compile Times

- UnrealLightmass-UdpMessaging.dll [0:00.76 at +0:45]
- UnrealLightmass.exe [0:00.71 at +0:45]
- Telemetry Event (BuildTime) MachineName=TC-BUILD16-DLNV;
  NumLogicalCores=16; NumPhysicalCores=16; Targets=UnrealLightmass Win64 Development; NumActions=57;
  NumCompileActions=44; NumPchCompileActions=4; NumLinkActions=13; ElapsedTime=46.367389
- XGE execution time: 95.53 seconds
- Telemetry Event (PerformanceInfo.2) TotalExecutionTimeSec=95.53;
  TotalTimeSpentGettingIncludesSec=0.42; TotalIncludesRequested=0; DirectIncludeCacheMissesTotalTimeSec=0.01;
  TotalDirectIncludeCacheMisses=8; TotalFindIncludedFileCalls=437;
  IncludePathSearchAttempts=12569; TotalFileItemCount=1716; MissingFileItemCount=43
Growing Splunk: Monitoring Compile Times
## Growing Splunk: Monitoring Compile Times

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Growing Splunk: Monitoring Compile Times
Growing Splunk: Game Deployment

- Our build machines produce ~1TB of builds a day
- Users require auto deployments of 60GB builds to Xbox One and Windows 10 machines
Growing Splunk: Game Deployment

File Server

Cache Agent

Cache Agent

Cache Agent

Cache Agent

Win10 PC

Xbox One

Xbox One
Growing Splunk: Game Deployment

• As we ramped up our team, QA started reporting slowdowns in the system
• Luckily Splunk was already installed and gathering data on all agent!
Growing Splunk: Game Deployment
Driving Game Quality: Challenges

- Driving quality is hard (especially in games)
- Requires getting the right information to the right people at the right time
- The information must be actionable and understandable by the target audience
- You require one source of truth as not to confuse people
- Most of our work was very engineering focused in the past
Driving Game Quality: Challenges

A number of KPIs when looking at a game product:

1. Visual Quality
2. Gameplay Quality
3. Technical Quality

How can you quantify and track these values to be able to report on them?
Driving Game Quality: Challenges

• It was hard!
• Technical quality was the easiest to quantify and measure
• Expanded KPIs:
  1. Frames per second
  2. Memory usage
  3. Crashes
  4. Test Coverage
Driving Game Quality: Results
Driving Game Quality: Implementation v2

- Good start but our users wanted more data
- Tests only gave a snap shot of the state of the game
- Again we got the data thirst!
Driving Game Quality: Implementation v2

AI Driven Walkthrough Tests

Automation Host

Xbox One

server

Xbox One

Xbox One

Xbox One

Xbox One

Xbox One

Xbox One

Xbox One

Xbox One

Xbox One

Xbox One
Driving Game Quality: Results v2

- With all of this data a rework of our dashboards was required
- We needed to make the data actionable to designers, artists, project managers and engineers
- We made our first Splunk app
<table>
<thead>
<tr>
<th>MapName</th>
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<th>% Over 30 FPS</th>
<th>Lowest Available Memory (MB)</th>
<th>FPS</th>
<th>Lowest Available Memory (MB)</th>
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Driving Game Quality: Results v2
Driving Game Quality: Results v2
Driving Game Quality: Results v2
Driving Game Quality: Results v2

### Out of Memory Crash Details

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**Crash Pointmap**

- **Floor name**: Tunnels
- **Map**: SPAI2 185944
- **Automation**: Crash Bandit
- **Extras**: OOM Crashes

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Driving Game Quality: Results v2

- All built using standard web technologies
Driving Game Quality: Results v2

- Accelerated searches
- Great for large data sources
Driving Game Quality: Results v2

- Saved Searches are your friend
- Watch out for expiring artifacts
Driving Game Quality

- Unification of telemetry and reporting was a huge success
- One single source of truth
- Trend visualization for KPIs
- Faster issue discovery and resolution
- Saved time and money reporting on data
- Delivers consumable and actionable data
Driving Game Quality

- The team now uses Splunk for its daily performance meetings and to help drive what levels need to be looked at
- Many additions requested for future titles now people can see what Splunk can do
Future Plans: Outsourcing

- Deal with ~15 outsourcing partners on a project
- Different timezones
- Different languages
- Different or custom workflows
- Much harder to provide support
Future Plans: Outsourcing
Future Plans: Outsourcing
Future Plans: Outsourcing

- Less dependencies on other solutions
- Easier to setup and maintain
- Help us track and resolve issues with partners much more efficiently
Future Plans: Dev and Prod

- Currently only a single Splunk instance
- Most work currently goes on in live environment
- Some development on local instances
- We have lost .conf and dashboard changes
- We need a development environment!
Future Plans: Dev and Prod

Development Instance

Source Control (Dev Branch)

Integrates

Source Control (Prod Branch)

Production Instance

Admin

User

Code Reviewers
Future Plans: Dev and Prod

- Store all settings in source control
- Code reviews and rollbacks are easy
Future Plans: Dev and Prod

- Lock down access to production
- People less likely to break something or lose work
- Everything is backed up
- Hope to roll this out in the next 3 months
Key Takeaways

- Start with a reasonable hardware topology
- Gather as much information as you can, you never know when it might be useful
- Splunk can ingest any form of data (but give it a hand)
- Make your reporting relevant to your audience
Resources

- Splunk Topology Examples: http://docs.splunk.com/Documentation/Forwarder/6.4.2/Forwarder/Forwarderdeploymenttopologies
- Custom Visualization Example: http://docs.splunk.com/Documentation/Splunk/6.4.2/AdvancedDev/CustomVizTutorial
Special Thanks

- Special thanks to my team back home in Vancouver
Questions?
THANK YOU