Splunk + AWS:

Two Great Things Even Better Together!

Al Liebl - Splunk

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Your Tour Guide

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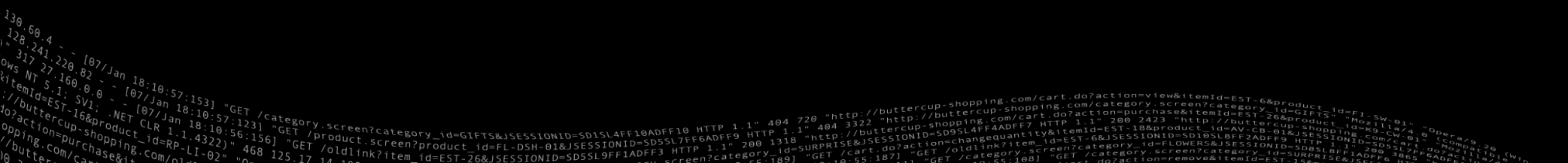
Background

Not our First Rodeo

- AWS Incident Response (IR) manages multiple simultaneous investigations each week
  - Investigations can range from a few hundred GB in size to tens of TB or more
- AWS IR usually spins up a new Splunk environment for most new investigations
  - Also have a permanent (non-ephemeral) Splunk environment for on-going work.
- AWS has internal tools to handle all data collection
- Philosophy = move fast and break things but learn from it



Something Happened. We Have a Ton of Data. Now What?

Let the Games Begin!

Deploying Splunk for Data at Scale

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Getting the Party Started!

Day 1

- We know this will be a large investigation – we just don't know how large
  - Relevant data requested from internal systems – will take some time to be delivered
- Using the AWS Add-on via Heavy Forwarder for ingest
  - All data to be delivered via S3
- Discussed server options
  - Spin up new HW or build out existing cluster?
- Decided to keep it simple using known environments/tools
  - Build out as we need to
  - Use simplest ingest method

Monday May 14, 2018 - Recap

We don't Know What we don't Know

- We're in a holding pattern until we understand the actual data volume
- We're being conservative while fact finding
- Sounded reasonable at the time…

Blocking and Tackling

Day 2

- Data is being delivered from internal systems
  - Entire data set will be delivered in ~130 files
  - Smallest files ~15 GB in size
  - Largest files currently 1+ TB and still growing
  - Still unsure of total data set size
- Begin onboarding data to the existing cluster
- Prepared to add indexer nodes as needed

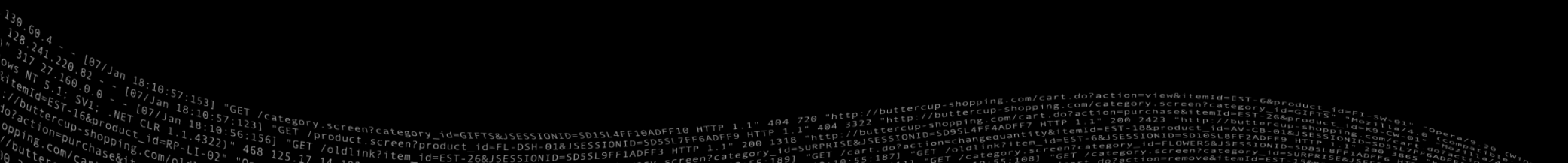
Current cluster specs:

6 c4.8xlarge for indexers

3 c4.8xlarge for search heads

1 c4.2xlarge for CM/LM

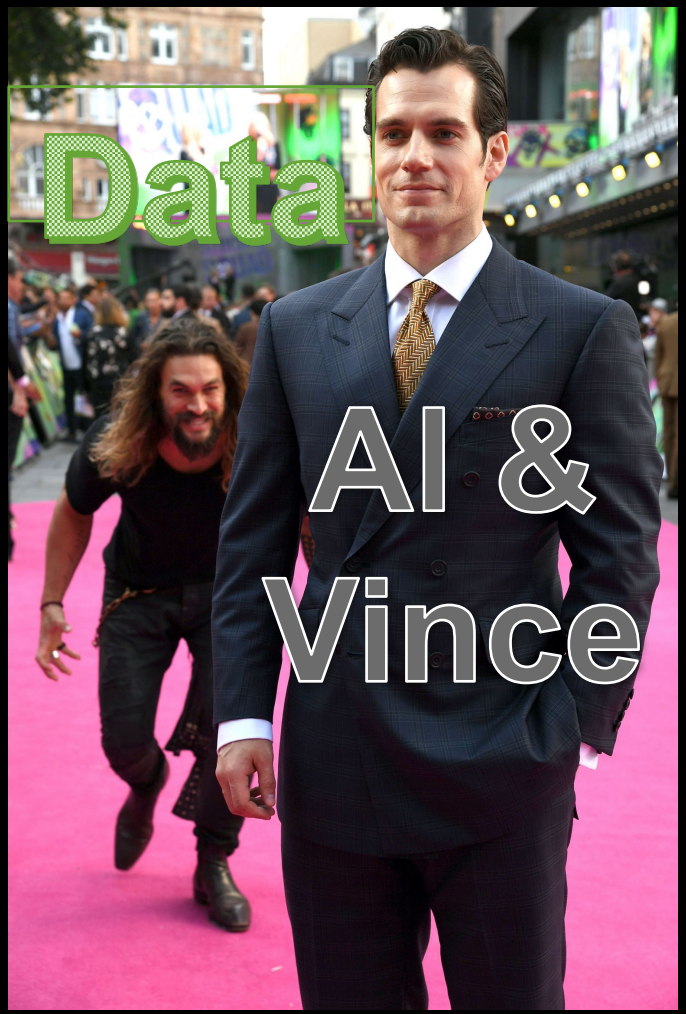
1 c4.2xlarge for HF



Tuesday May 15, 2018 - Recap

Something Doesn't Seem Right…

- Becoming concerned about file size
- Largest files are now 3+TB by EOD
- Suspect final data set will be more than 100 TB
- Ingest is proceeding but slower than desired
- We increase the number of pipelines/inputs on the HF
  - Great idea but… let's talk about those big files



The Default isn't Always the Best

Day 3

- After 24 hours we only have 1.4 TB ingested
- Performance is slow because we used Generic S3 AWS input method
- All requested data has been delivered and totals 115 TB
  - At current rates it will only take 82 days to load the data
- Discuss options for tuning ingest and the ramifications of using the existing environment
  - Need to dramatically modify storage and number of nodes
  - Probably easier to build out a new cluster

Performance with the AWS TA

Getting the Most Bang for your Instance

- When using the AWS TA:
  - When available use SQS based inputs for better scale and built in fault tolerance
    - SQS based approach is stateless and allows for multiple HF
  - Generic S3 works but will be slower and no fault tolerance
    - Generic S3 is stateful and only runs on a single HF
  - High volume data can leverage Lambda functions to HEC
  - Kinesis is great for high volume real-time ingest
- Since the TA needs a HF, increase your pipelines if you have the resources and need to scale

Wednesday May 16, 2018 - Recap

- Generic S3 = bad idea
- SQS based S3 = better idea
- Bigger cluster = more indexers
- More indexers = better search performance & faster ingest times

Things are About to get Real!

Day 4

- Decide to go BIG and build out a new cluster
  - But how many nodes?
  - Automation will be critical
- Need to get data loaded ASAP
  - But what's the best method?
- And the best part…we can use any AWS services/resources we want as long as we move fast!

How Big is Big?

Day 4

- Decide to build out the cluster to support sustained ingest @100TB per day
- Using c4.8xlarge (36 cores, 60 GB RAM) instances
  - 504 indexers – 168 per AZ
  - 3 search heads
  - 1 cluster master
  - 1 license master
  - 1 deployment server
  - 1 monitoring console
- Indexer storage on SSD EBS volumes - total of 2,000,000 provisioned IOPS
  - 7 TB per indexer
  - RF=3, SF=2

Terraform + Ansible != Terrible!

Day 4

- AWS IR has a collection of Terraform and Ansible scripts to automate Splunk deployments
  - We will use as the basis for building out our new cluster
- Terraform for base deployments
  - Used to deploy instances and storage
- Ansible for tricky Splunk modifications
  - Great for distributing .conf files and applying commands en masse
- Use version control with your scripts and you've leveled up!

What About the Data?!

Day 4

- Decide to ingest via Universal Forwarders pulling data from local disk
  - Gives us the most control over ingest performance
  - More forgiving if we need to make changes
- 12 UF using c4.8xlarge (36 cores) - Why so big?
  - Pipelines!
  - Docs indicate you can safely increase pipelines to 2
  - We're going to use 8 – Don't try this at home!
- Begin transferring data from S3 buckets to EBS volumes attached to UF

Thursday May 17, 2018 - Recap

Building for Speed!

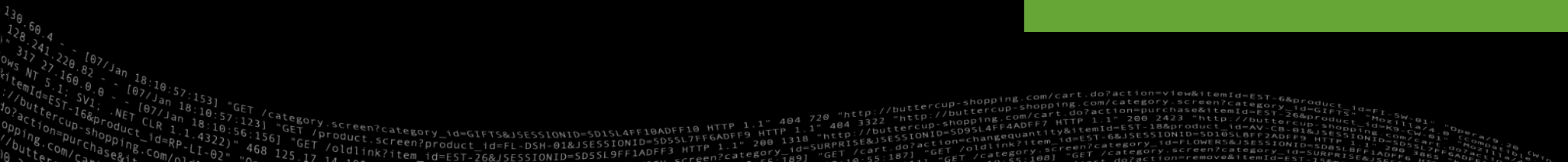
- Why are we using indexer clustering?
  - Clustering is NOT a performance enhancer
  - But having a Cluster Master manage indexer discovery is priceless
- Provisioning and automation will be critical

Server.conf on CM:

[indexer_discovery]
pass4SymmKey = <string>
polling_rate = <integer>
indexerWeightByDiskCapacity = <bool>

Outputs.conf on UF:

[indexer_discovery:<name>]
pass4SymmKey = <string>
master_uri = <uri>
[tcpout:<target_group>]
indexerDiscovery = <name>
[tcpout]
defaultGroup = <target_group>



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Attempt #2 or How to DOS yourself

Day 5

- Data still being copied from S3 to UF servers
- We iterate on the deployment scripts and the Cluster deploys
  - We now have 504 indexers hell bent for leather!
  - But we need an index and some props/transforms first
  - Good thing we're in a cluster right?
- Funny thing about updating a 504 node cluster – DIY DOS!
  - The Cluster Master is single threaded AND
  - All nodes ask for updates at the same time by default

Pro-tips for Clustering at Scale

Learn from our Pain!

- On the Cluster Master
  - In sever.conf set max_peers_to_download_bundle = some reasonable number like 20
    - Normally used to deal with large bundle sizes but also applies at scale
  - Make sure your apps are clean
    - You shouldn't ignore validation errors even in apps you don't care about
- On the peer nodes
  - Note that indexes won't show up until you've added data
  - In server.conf you can set parallelIngestionPipelines
    - Docs state 2 is safe
    - We're using 8 for maximum speed

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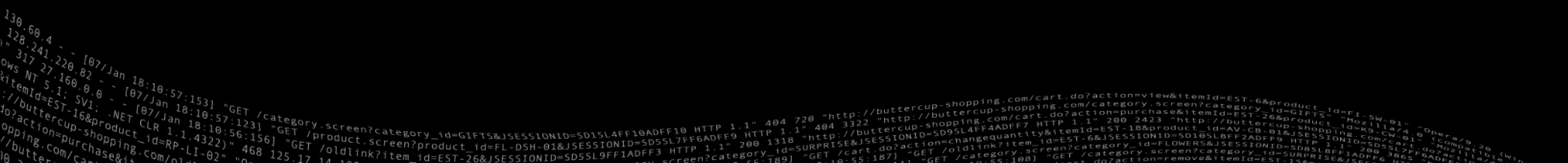
Friday May 18, 2018 - Recap

TGIF?!

- First UF has all of it's data but we're fighting with the Cluster Master to replicate configuration bundles
- We decide to let the CM try to sort itself out while we sleep
- Clustering is great but has its' challenges
  - Downside – we're fighting to get simple configuration files replicated
  - Upside – did we mention you also get great data distribution with indexer discovery!
- Pipeline settings on UF and indexers should make things interesting



Getting it Right the First Time for the Second Time

Day 6

- In the morning the the indexers seem good so we start loading some data
- We notice events aren't parsing correctly so we stop ingest
- Props.conf is bad and we're still fighting with the CM
- Clock is ticking so we need a new plan
  - Decide to rebuild AGAIN
  - We pause the automation after the cluster has 3 nodes, add our .conf changes to the CM, and resume
  - Takes 1:45 to complete and everything looks good!

splunk> .conf18

Saturday May 19, 2018 - Recap

Say Rebuild Again! I Dare You!

- Automation + Brute Force = Problem Solved
  - We didn't realize cluster replication issues were due to bad app configurations so we improvised
- AWS + Automation = Awesome!
  - 500+ fully configured instances and 2,000,000 dedicated IOPS provisioned in less than 2 hours!
- Lesson learned in hindsight: Slow down with clustering if you want to go fast

Unleash the Data?

Day 7

- 12:05 AM and the cluster is ready to load
- We fire up the UFs, data starts flowing, and we go to bed
- Midday we have a look and see only 2.4 TB has been ingested.
  - Not good.
  - At this rate it will take about 24 days
- What is going on?!

I See What You Did There…

Day 7

- We dig a bit deeper and realize that:
  - We only started one UF before going to bed
  - The UF only had 2 pipelines defined
  - So we saw 2.4 TB of ingest on a single UF with only 2 pipelines in 12 hours!
- So we set pipelines to 8 for each UF and let them rip… Guess what happens next

[redacted]

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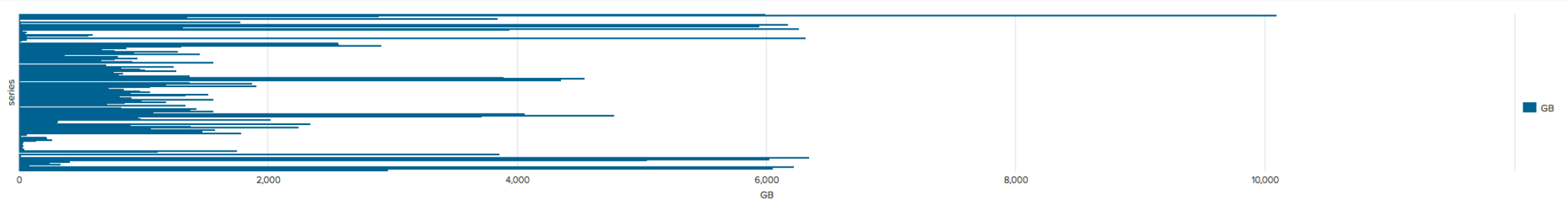
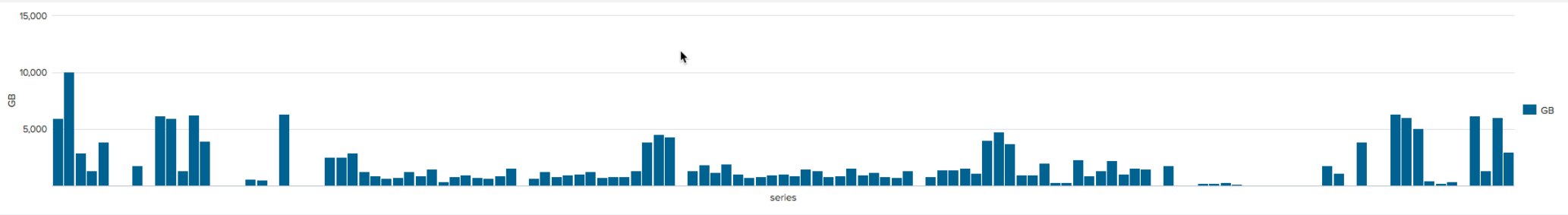
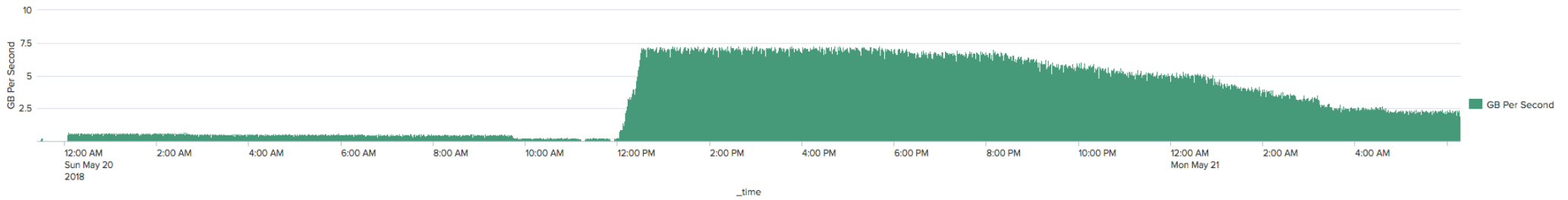
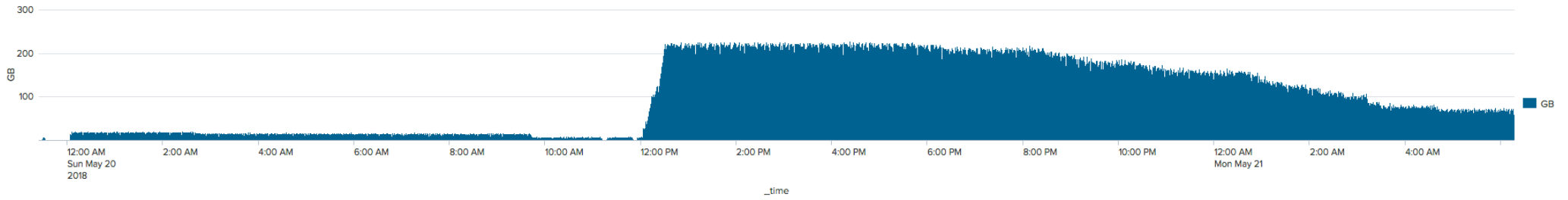




GB Per Second Ingest Rate



Ingest Rate Over Time in GB's



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Sunday May 20, 2018 - Recap

From Garden Hose to Firehose

- Adding pipelines to both the UF and indexers resulted in massive throughput
  - Nearly 7.5 gigs per second!
- While the data was loading we could see even data distribution across indexers
  - Just check license volume per indexer
- Preliminary searches are flying because map reduce is happy!
  - Good data distribution + many search peers = happy users

How Important is _time?

Day 8

- By 1 PM we have successfully loaded all 115 TB of data!
- Searches are very fast!
- Then we realize something is wrong with the data!
  - It's no big deal, it's only _time
  - There is an extra "%" in the regex for time extraction so extraction fails!
  - Events have been given timestamps based on their file time
  - How well will that work when there are more than 10 files nearly 5 TB in size?!

Monday May 21, 2018 - Recap

Improvise, Adapt, and Overcome?

- Splunk is a time series index
  - Need to be SURE that sourcetypes are properly defined
  - Always validate props.conf before replicating
  - Pro-tip: Default sourcetype definitions are meant to be tuned
    - Indexing performance can be improved more than 2X with minor modifications:
      - Set LINE_BREAKER, TRUNCATE, TIME_PREFIX, MAX_TIMESTAMP_LOOKAHEAD, SHOULD_LINEMERGE=FALSE
      - Avoid BREAK_ONLY_BEFORE

To Rebuild or not to Rebuild, That is the Question

Day 9

- We consider rebuilding the cluster yet again
  - Very difficult (but not impossible) to search without using _time
  - Need to determine if _time is needed for desired analysis
- Good news!
  - We only need to worry about _time if we find certain matches in the data
  - So now all searches are done for all time
  - Good thing we have a performant cluster!
- End result = Success!
  - Nothing responsive in this data set

Tuesday May 22, 2018 - Recap

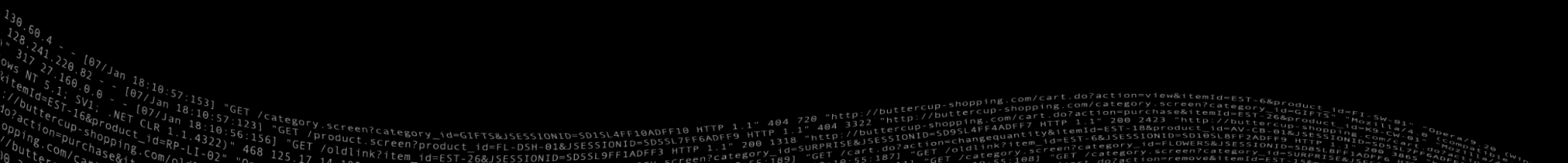
TL;DR: Self inflicted Wound NOT Fatal

- Successfully completed the investigation but it wasn't pretty
- We could have saved time with some Just In Time validation
  - Pro-tip: Create a Docker environment for sourcetype validation!
- Entire investigation took 9 days
- Most work was done via web conference after normal working hours

Lessons Learned

Or How to Avoid Working All Weekend

- Automation is Critical
  - Requires an up front investment but pays off in spades when you need to move fast
  - Document your scripts to make reuse simple
  - Standardize your tools for maximum potential
- Clustering is invaluable
  - Simplified management (e.g. indexer discovery) makes it easy to scale
  - Keep your CM/Apps clean and simple to minimize problems – eliminate cruft!
  - Eliminates concerns regarding data distribution
- JIT validation means breaking less things
  - Validate .conf files before deploying
    - EVEN SIMPLE ONES!
  - Consider Docker for simplified testing
  - Proper version control will make iterating easier



Thank You

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