Debugging @ Scale

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Bing & Cortana Engineering
Relays 6-2 in 033 failed special speed test in relay.
Relays changed.

1100
Started Cosine Tape (Sine check)

1525
Started Multi Adder Test.

1545
Relay #70 Panel F
(moth) in relay.

First actual case of bug being found.

1600 Antenna started.
1700 Closed down.

Looks familiar?
The (dual) nature of debugging
When auto-mitigation fails...
Debugging is Hard

https://xkcd.com/1722
Who most of us are - Explorers
Who we should Be? - ER
Traditional Tools of the Debugging Trade
Traditional tools don’t scale 😊
Concepts we can use...
MAKE ERROR MESSAGES USEFUL FOR USERS *AND* ENGINEERS
500
Unexpected Error :

An error occurred and your request couldn't be completed. Please try again.

A common error message
A better approach
USE DISTRIBUTED TRACING AS THE NEW ‘DEBUGGER’
APPLY TRANSFORMS AND ‘MACHINE LEARNING’ TO MAKE LOGS USEFUL
THIS IS YOUR MACHINE LEARNING SYSTEM?

YUP! YOU POUR THE DATA INTO THIS BIG PILE OF LINEAR ALGEBRA, THEN COLLECT THE ANSWERS ON THE OTHER SIDE.

WHAT IF THE ANSWERS ARE WRONG?

JUST STIR THE PILE UNTIL THEY START LOOKING RIGHT.
...From Our ‘Pile Of Linear Algebra’

- Log-relevant Tokenization
- Feature Extraction
- Instance-Based Learning
  - KNN: k-Nearest Neighbor
- Linear Classifiers
- Clustering
  - k-Means
Design for Reproducibility
Reproducibility

- Log playback
- Forking traffic
- Single box/Mocking
- Snapshot Debugger
- Experimentation
INVEST IN DEEP OPTICS WITH NRT METRICS
NEAR REAL TIME METRICS

- Expand to business metrics

REAL USER MEASUREMENTS (RUM)

Navigation Timing API
DEVELOP ANOMALY DETECTION AS A PLATFORM CAPABILITY
• Detect anomalies across metrics
• Enable outlier detection on logs
• High data dimensionality allows better detection
PRIVACY *HAS* TO BE A FIRST-CLASS CITIZEN FOR DEBUGGING
Be Mindful Of:

• GDPR – Very pertinent for EU
• Log sanitization
• Log Retention and On demand purge
• Exposure to 3rd Party Analysis Systems and Hosting
• The Latent Power of Aggregated Logs
OLD TRICKS STILL WORK, BUT CAN BE TRICKY
Still in use...

• Debug Mode for subset in Production
• Deploying private builds on a subset
• Logging onto machine instances
• Attaching debugger
• Others?
CLOSING THOUGHTS

• NRT Telemetry and Distributed Tracing – Key Elements
• At scale, machine-learning isn’t just a buzzword – it actually delivers
• Be mindful of privacy concerns. Your business is at stake
• Debugging in fun 😊
Only half of programming is coding. The other 90% is debugging.

/r/ProgrammerHumor

Questions?

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