Automated Debugging of Bad Deployments
Problem
Bad Deploy

Bad code is being deployed and the success rate drops. Where is the bad code?
Bad Deploy

Bad code is being deployed and the success rate drops. Where is the bad code?

Tedious to deal with because:

- Many commits per deploy
- Many deploys per day over many services

Automate all the things!
Bad Deploy: Resolution

1. Roll back deploy

2. Debug
   1. Find the error
   2. What commit caused it?

3. Fix problem

4. Restart deploy
Types of Errors

- Performance regressions
- Broken webpages
- Empty results
- Unexpected status codes (404, 500 etc.)
- ...
Types of Errors

• Performance regressions
• Broken webpages
• Empty results
• Unexpected status codes (400, 500 etc.)

Focus on stack traces: common and lots of information
Debugging Steps
1. Finding New Stack Traces

Challenges:

- Finding stack traces
- Finding new stack traces
- Deduplicating similar stack traces
2. Finding the Bad Commit

• In: Stack trace and a range of commits

```python
Traceback (most recent call last):
  File ".../core/managers/user_manager.py", line 2835, in add_typed_search_query
    File "/mnt/virtualenv_A/local/lib/python2.7/site-packages/thrift_utils/thrift_client_mixin.py", line 210, in wrap_with_pool
      return method(client, *args, **kwargs)
    File "/mnt/virtualenv_A/local/lib/python2.7/site-packages/thrift_utils/thrift_client_mixin.py", line 484, in method_wrapper
      result = method(self.client, *args, **kwargs)
    File "/services/dataservices/thriftLib/DataServices.py", line 1772, in createOrUpdateTypedSearchQuery
      self.send_createOrUpdateTypedSearchQuery(context, userId, queryType, query)
    File "/services/dataservices/thriftLib/DataServices.py", line 1782, in send_createOrUpdateTypedSearchQuery
      oprot.writeObject(self.query.encode('utf-8'))
UnicodeDecodeError
```

• Out: Commit that caused the stack trace

commit 101d6d7b71ed2d7c9bf570d826ad7e620e8d07b9
Finding New Stack Traces
Finding Stack Traces

Log Aggregation

• Collect logs with Kafka and Elasticsearch+Logstash+Kibana (ELK Stack)

• Prioritize real time versus completeness
  • Incomplete data is better than none

• Easy to search for known stack traces
Identifying New Stack Traces

- **Old vs. new stack traces**
  - Too many stack traces to look at manually
  - Use Elasticsearch REST API

- **Compare 2 Elasticsearch queries**
  - Canary vs production
  - Before and after deploy

```python
for trace in canary_traces:
    if trace not in production_traces:
        new_traces.append(trace)
```
Deduplicating Similar Stack Traces

**Simple string matching doesn’t work**
- Line numbers change during a deploy
- Optional code paths (sampled metrics collection)

**Elasticsearch filter and aggregation query**
- Filter: logs containing stack traces on set of hosts X, during time window Y
- Aggregate by:
  1. Exception name (*TypeError*)
  2. File name (*test.py*)
  3. Exception value (*unsupported operand type(s) for +: 'int' and 'NoneType'*)

Exception values may contain variables

```python
def bad_code():
    5 + None

bad_code()
```

Traceback (most recent call last):
  File "test.py", line 5, in <module>
    bad_code()
  File "test.py", line 3, in bad_code
    5 + None
TypeError: unsupported operand type(s) for +: 'int' and 'NoneType'"
Finding the Bad Commit
Finding the Bad Commit

Which of 71 commits caused this stack trace?

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    result = method(self._client, *args, **kwargs)
  File ".services/dataservices/thrift_libs/DataServices.py", line 1772, in createOrUpdateTypedSearchQuery
    self.send_createOrUpdateTypedSearchQuery(context, userId, queryType, query)
  File ".services/dataservices/thrift_libs/DataServices.py", line 1782, in send_createOrUpdateTypedSearchQuery
    args.write(self._oprot)
  File ".services/dataservices/thrift_libs/DataServices.py", line 8975, in write
    oprot.writeString(self.query.encode('utf-8'))
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• git blame different files
• git whatchanged
• ...
• Slow and tedious
git-stacktrace

https://github.com/pinterest/git-stacktrace

git-stacktrace

git-stacktrace is designed to make it easy to figure out which commit caused a given stacktrace.

git-stacktrace looks for:

- commits in given range that touched files in the stacktrace
- commits in given range that added/removed code present in the stacktrace
git-stacktrace: Goals

Make it easy to figure out which commit caused a given stack trace

How a commit can trigger a stack trace:
1. One of the files touched in the commit shows up in the stack trace
2. An actual line of code from the commit shows up in the stack trace
3. The commit caused a different code path to be executed which in turn caused the stack trace

Tradeoff: Too many matches vs. no matches
Idea: 5 commits are easier to review than 71
Return a ranked list of all possibly related commits
git-stacktrace

$ git stacktrace 8a25be..b3864b2 < stacktrace
Traceback (most recent call last):
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    query)
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    oprot.writeString(self.query.encode('utf-8'))
UnicodeDecodeError

commit 101d6d7b71ed2d7c9bf570d826ad7e620e8d07b9
Commit Date: Thu, 9 Mar 2017 19:24:47 -0800
Author:      John Doe <johndoe@pinterest.com>
Subject:     A bad commit
Link:        https://example.com/D1000
Files Modified:
  - services/dataservices/thrift_libs/DataServices.py
  - services/dataservices/thrift_libs/DataServices.py:8975
Lines Added:
  - "args.write(self._oprot)"
  - "oprot.writeString(self.query.encode('utf-8'))"
git-stacktrace: How It Works

One of the files touched in the commit shows up in the stack trace

```
git log --raw
:100644 100644 c99e4d0... da4d504... M  git_stacktrace/git.py
:100644 100644 2bb13df... 78c7f4e... M  git_stacktrace/tests/test_git.py

../services/dataservices/thrift_libs/DataServices.py == services/dataservices/thrift_libs/DataServices.py
```

Match stack trace line numbers with lines changed in a commit

```
git log --patch
```

Breaks if a later commit adds/removes lines in the file

Use git pickaxe to determine if a commit added a line of code in the stack trace

```
git log -S
```

Strongest signal
$ git stacktrace 81a25be..b3864b2 < stacktrace

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Uses at Pinterest
Elasticsearch Queries + git-stacktrace at Pinterest

- Run on every API and web deploy
- Allows us to quickly detect new rare errors
- Significantly reduced debugging time