FROM APM EXPERTS FOR EVERYONE:
Application Performance Management With Open Source Tooling

Java Forum Stuttgart 2016
Christoph Heger, Alexander Wert
Why is performance important?

User Experience

<table>
<thead>
<tr>
<th>Response Time Limit</th>
<th>Perception</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 second</td>
<td>Users feel their actions are directly causing something to happen</td>
</tr>
<tr>
<td>1.0 second</td>
<td>Users feel they are navigating freely and stay focused on their current train of thought</td>
</tr>
<tr>
<td>10.0 seconds</td>
<td>Users feel a break of the flow, get impatient while waiting and leave the site</td>
</tr>
</tbody>
</table>

Jacob Nielsen, Power of 10: Time Scales in User Experience, 2009

Reports

- 49% of online shoppers expect load times of $\leq 2$ seconds
- 50% of online shoppers abandon page if load time is $>2$ seconds
- 42% of men and 35% of women don’t give a company a second chance after experiencing slow load times

Business Impact

- Brand perception, conversions, revenue, shopping card abandonment, page views, and search engine rankings
The HealthCare.gov Fiasco

Summary

- Among the worst software launches in history
- Hundreds of millions of dollars were spent
- Outages and slow response times were the norm
- U.S. government had to apologize
- Companies like Google and Red Hat rushed

Never actually tested for scalability and performance before its launch

125k plus concurrent users peak

Load times between 6 and 22 seconds depending on business transaction
Ellen DeGeneres’ Oscars selfie crashes Twitter

Summary
- 2.6 million retweets in about 2 hours
- 20 minutes service disruption

Disruptive change in user behavior
Take Away

Performance matters!

[Image source: http://content.hollywire.com/sites/default/files/Success-Kid.jpg]
APPLICATION PERFORMANCE MANAGEMENT
Application Performance Management … is a Cross-cutting Concern!

Application Performance Management …

… spans the entire software lifecycle

… covers all system layers

… requires collaboration of different business units

- Requirements
- Design
- Development
- Testing

- Clients
- Network
- App
- System

Development

Business

Operations
APM in the Software Lifecycle

- Elicit Requirements for Performance
- Design for Performance
- Create Code for Performance
- Test for Performance
- Development
- Testing
- Operations
- Requirements
- Monitor Application
APM across System Levels

- Latencies, bandwidth, CDNs, …
- System monitoring, availability, scaling, …
- Page rendering times, resource loading times, …
- Hotspots, bottlenecks, component communication, request flow, …

From APM Experts for Everyone: Application Performance Management With Open Source Tooling
APM Requires Collaboration

- What is the root cause of a performance problem?
- How to resolve problems?

- How does performance and user experience affect the business success?
- How do business metrics correlate with application performance metrics?
- Are there currently any performance / availability issues with the application?
- How to handle peak loads and anticipated future loads?
APM is a Versatile and Complex Topic

Performance Testing
Application Perf. Monitoring
Root Cause Diagnosis
Performance Modelling
Synthetic Monitoring
Real User Monitoring
Regression Testing
Web Perf. Testing
Commercial APM Tools

Challengers
- CA Technologies
- IBM
- HP Enterprise
- Dell
- Riverbed Technology
- BMC Software

Niche Players
- AppNeta
- ManageEngine
- Microsoft
- Tingyun
- Nastel Technologies
- JenniferSoft

Leaders
- Dynatrace
- AppDynamics
- New Relic

Gartner’s Magic Quadrant for Application Performance Monitoring Suites (12/2015), Cameron Haight, Will Cappelli, Federico De Silva
Open Source Tools for APM

Monitoring & Application Deep Dive

- SCOUTER
- Kieker
- INSPECTIT
- ZIPKIN
- Glowroot

System & Resources Monitoring

- iCINGA
- influxdata
- sensu
- Prometheus
- ZABBIX

Performance Modeling

- QME
- MNet++

Low-Level Performance Profiling

- JRat
- VisualVM
- JMemProf
- Profiler4J

Load Testing

- Selenium
- Apache JMeter
- The Grinder

Web Performance Analysis

- YSlow
- WebPageTest
- Chrome Developer Tool
- Google Page Speed

Real User Monitoring

- PIWIK
- Bucky
- Open Web Analytics
- eAnalytics
Application Performance Monitoring

What is Performance Monitoring About?

Goals

Monitor Application Health

Identify anomalies and performance issues

Monitor Application Health

Estimate Business Impact

Dashboards

Anomaly Detection

Problem Diagnosis

Real Users

Prod. Environment

Monitoring Tool

07.07.2016 From APM Experts for Everyone: Application Performance Management With Open Source Tooling
Application Performance Monitoring
Gathering and Visualizing Timeseries Data

Data Collectors

- Kieker
- VisualVM
- Custom Code
- INSPECTIT

Graphing Tools

- Grafana
- Kibana
- graphite

Time Series Databases

- InfluxDB
- graphite
- Prometheus

Persist data

Query & Visualize
Application Performance Monitoring
Dashboards

SELECT mean("duration") FROM "stream" WHERE "type" = 'normal' AND "businessTransaction" =~ /$BusinessTransaction$/ AND $timeFilter GROUP BY time($interval) fill(null)

Alias by
normal requests
Format as
Time series

07.07.2016 From APM Experts for Everyone: Application Performance Management With Open Source Tooling
Application Performance Monitoring
Dashboard

REQUEST STATS FOR BUSINESS TRANSACTION: LOGIN

- Request Count: 304
- Normal Requests Count: 154
- Anomaly Request Count: 150
- Avg. Throughput: 0.08 requests

Response Times:
- Response Time Distribution
- Median: 15.5 ms

Throughput:
- Request Throughput
- Max: 0.20 rps

Slow Request Rate:
- Slow request rate distribution
- Min: 0%
- Max: 100%
- Avg: 5.2%

Summary:
- Metric | Count | Min | Avg | Max | Total
- duration (normal) | 154 | 95.15 ms | 1.96 s | 3.55 s | 5.04 min
- duration (problem) | 150 | 59.99 ms | 4.56 s | 29.08 s | 11.41 min
Application Performance Monitoring

The Flaw of Averages

The Flaw of Averages: Why We Underestimate Risk in the Face of Uncertainty
Sam L. Savage, with illustrations by Jeff Danziger – http://flawofaverages.com

Gil Tene – http://latencytipoftheday.blogspot.de/
Application Performance Monitoring
Anomaly Detection & Alerting

[2016-06-29 14:04:14 - Anomaly] AnomalyDetection has been started

[2016-06-29 14:04:14 - Anomaly] AnomalyDetection has been started

[2016-06-29 14:17:14 - Anomaly] AnomalyDetection has been started


[2016-06-29 14:45:14 - Anomaly] Business transaction 'Search' shows an anomalous behavior. Anomaly started at 2016-06-29 14:45:14 at has an error rate of 100.0 percent.

[2016-06-29 14:46:51 - Anomaly] Anomaly in business transaction 'Search' is still present. Current error rate is 100.0 percent.


Click here to type a chat message: Supports GitHub-flavored markdown.
Application Performance Monitoring

Missing Business Context

**CPU utilization over time**

How critical is this peak in CPU utilization?

**Asking the right questions:**

→ How are the users affected?
→ Which business transactions are affected?
→ Are any time-critical batch jobs affected?
Application Performance Monitoring

Defining Business Context
Application Performance Monitoring
Problem Diagnosis

- Deep Dive into request execution flow necessary

- Level of Detail vs. Measurement Overhead
  - Do not instrument frequently called methods (e.g. Getters, Setters, String class, etc.)
  - Instrument system and component boundaries (entry and exit points)
Configuring Instrumentation

The image shows the interface of an application performance testing tool, inspectIT, with a focus on sensor definitions for timer sensors. The configuration panel allows for detailed settings for each method to be monitored, including class, method name, parameters, annotation, and visibility. Specific options for charting and capturing context are also available, with settings for catch types, parameters, and accessor paths.
Application Performance Testing & Diagnosis

What is Performance Testing About?

Goals

- Evaluate Application Behaviour under Load
- Test Scalability of Application
- Identify & Diagnose Performance Problems

Load Generator

- Agent
- Agent
- Agent

Test Environment

Request

Response

Monitoring Tool

- load
- e-2-e response times
- throughput

- detailed invocations
- system resource data
- deep dive information

07.07.2016 From APM Experts for Everyone: Application Performance Management With Open Source Tooling
Application Performance Testing & Diagnosis

Regression Tests

Load Driver

System Under Test

Load data

data

INSPECTIT

Jenkins

detailed measurement data

Jenkins

e-2-e response times

Response Time [s]

Execution Nr.

0 1 2 3 4 5 6 7

[Graph showing e-2-e response times over multiple executions]

From APM Experts for Everyone: Application Performance Management With Open Source Tooling
WEB PERFORMANCE ANALYSIS
Web Performance Analysis

What is Web Performance Analysis about?

End User Experience?

Satisfied  Tolerating  Frustrated

Performance

- Performance issues
- Functional Errors
- Network (Local ISPs, Mobile network carriers)
- Third party content providers

User Actions

- First user action
- Last user action
- Did the visit convert?
- Did the visit bounce?

Users

- Device
- Resolution
- Browser Versions
- Geolocation
Web Performance Analysis
Measuring End-User Experience

[Image of Chrome Developer Tools with performance analysis results for JAVA FORUM stuttgart event]
Web Performance Analysis

Testing and Monitoring Web Performance

- **Real User Testing**
  - External testing with all major
  - browsers,
  - operating systems,
  - mobile devices
  - and real world data

- **Synthetic Monitoring**
  - Continuous external testing
  - Known testing nodes
  - Different Locations (ISP, Networks)
  - No baseline traffic required
  - Competitor Benchmark
  - Availability testing (incl. 3rd Party)
  - e.g., every 30 mins from different nodes

- **Real User Monitoring**
  - Real End Users
  - Real Interaction
  - Real traffic

![QoS Validation](sitespeed.io)

QoS Optimization

QoS Expectation

Anomaly
Web Performance Analysis

webpagetest.org

Web Performance Analysis

Synthetic Testing

https://dashboard.sitespeed.io/dashboard/db/compare-multiple-sites
Open-Source tools sufficiently address APM needs!

There are lots of them for different purposes!

Combine them!