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Performance Testing
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1:30 PM

Embedding Performance Engineering into the CI/CD Pipeline

Presented by:

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Anjeneya Dubey

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Anjeneya Dubey is the director of performance engineering for McGraw-Hill Education, a learning science company that delivers personalized learning experiences. His responsibilities include ensuring that every product built is high performing, highly scalable, highly available, highly reliable, and fault tolerant. In his past five years with McGraw-Hill, Anjeneya has built automated performance engineering frameworks that detect performance and scalability issues early on in a fast-paced agile environment. Previously he was a technology consultant, focused on providing enterprise quality and performance engineering solutions. Anjeneya has worked with large institutions to set-up enterprise performance and quality engineering solutions.

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Embedding Performance Engineering Into Continuous Integration & Continuous Delivery Pipeline
By – Anjeneya Dubey

Because learning changes everything.™

Mc Graw Hill Education

Little Context about McGraw-Hill Education and Me

Mc Graw Hill Education
Improving outcomes and delivering ed tech at scale across higher education and K-12

We partner with... 14,000+ authors and educators in various fields of study.

connect
is an open learning environment applicable to all subjects used by students and instructors in higher education.

- 3.6 million final assignments submitted within Connect in 2017
- 109 million U.S. student assignments submitted within Connect in 2017

ALEKS
is an adaptive learning technology focused on math and chemistry used by students and instructors in K-12 and higher education.

- 4.0 million total unique users in 2017
- 6.8 billion interactions (questions answered) since 2010

LEARNSMART
is an adaptive learning program that personalizes learning and designs targeted study paths for students.

- 9.3 billion interactions (questions answered) since 2009
- Recently growing at an average of more than **100 million interactions per month**

connectED
is our content delivery platform serving teachers and students in schools across K-12.

- 8.6 million unique users in 2017
- 22 percent increase in unique users in 2017

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- Software engineering
- Performance Engineering
- Capacity Engineering
- Infrastructure Planning and implementation
- AWS Cloud Architecture & Operations
- Site Reliability Engineering

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2

Agenda

- Continuous Integration and Continuous Delivery
- What does it mean to include performance engineering into the CI CD Pipeline
- Challenges
- What did we do to include performance engineering in the pipeline
 - Process changes
 - Performance test types
 - Test Environment management
 - Test Data management
 - Tools and Technologies we use
 - Pass/fail Decision Making
- Self Service Performance Engineering
- Using AI in production
- Do's and Don'ts
- Summary

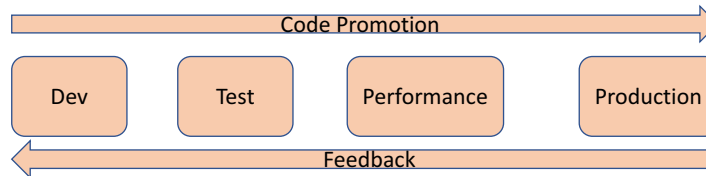
Continuous Integration/Continuous Delivery

- Automated build process and build verification tests for each environment in Continuous integration
- Extend Continuous integration by rapidly deploying capabilities to users to gain competitive advantage
- Reduce test cycle time & time to market
- Highly automated testing & release/roll-back
- Quicker automated decision making & feedback loop

Embedding Performance into the Pipeline

Your pipeline as code

- Dev -> Test-> Prod
- Dev -> Test-> Performance -> Prod

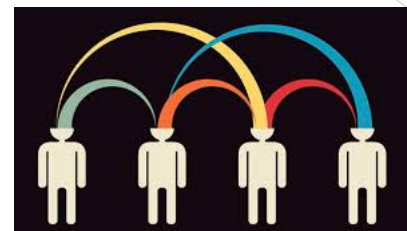


What does it mean?

Adding Performance environment into the pipeline means that now the performance tests are blocking your code promotion

Challenges - Cultural

- Performance is an after thought
- Is not part of the agile teams
- Is not part of the quality teams
- Do not get included in the agile ceremonies
- Create awareness on performance tasks
- Empower dev to test



Challenges - Technical

- Automating the performance testing and analysis
- Reducing Time to prepare and execute test
- Quickly reacting to performance metrics
- Automatic Pass/Fail
- Scaling the load test tool for variety of tests
- Keep the testing env/data consistent
- What to Shift left what to shift right
- Cost of running performance test on every build

How do we do it @MHE?

Process changes

- Make non functional/Performance requirement as part of the functional requirement
- API contracts
- Include performance as part of definition of done for sprints
- Clear definition of performance ready product
- Discuss Performance results as part of the sprint demos with all stake holders

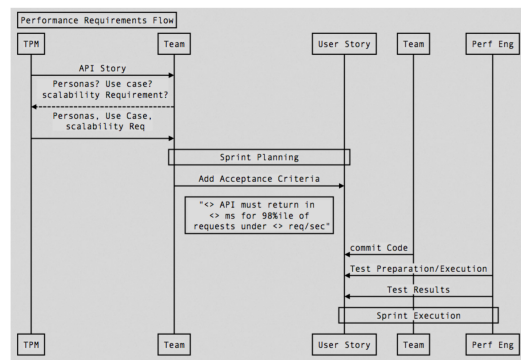
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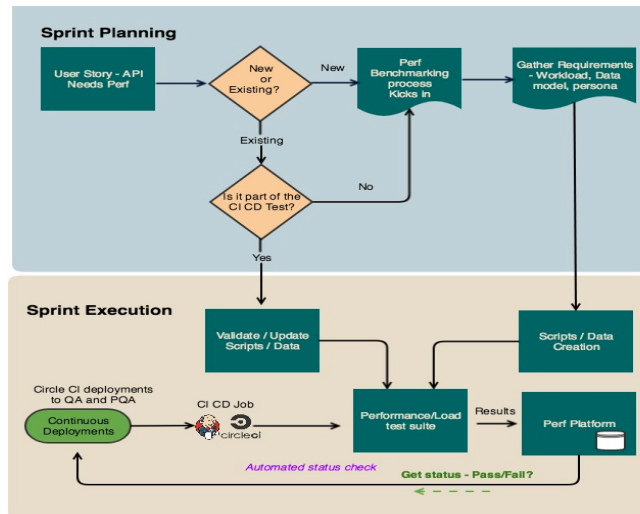
Performance Requirements Workflow

Stories with acceptance criteria that includes clear performance requirements

- API X must handle load of xx transactions per sec with 95%ile response time as 100 ms
- All Stories must be evaluated if they require performance criteria
- Performance tests should be created to validate the criteria within the sprints
- Poor Performance = Functional Bug



Typical PE Process



Test Environment

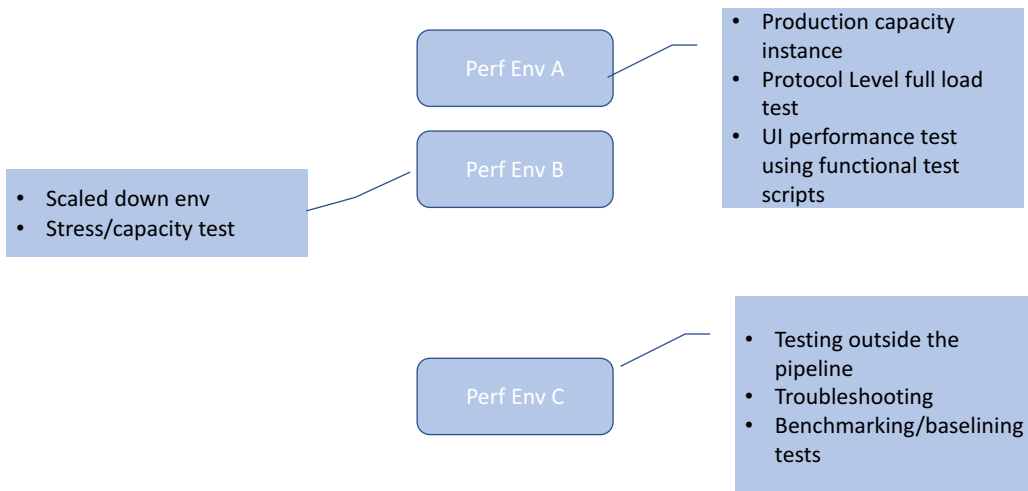
- Use production like performance env
- Spin up only when you run test to save cost
- Refresh DBs for test data management

Cloud makes it easier

- Can expand and contract - Autoscaling
- Infrastructure as code – Terraform,Puppet
 - Creating & destroying envs at ease
 - Create parallel envs for parallel executions



Spin up parallel envs for parallel executions



Performance Test types in CI CD

- User Experience - Browser side performance
- Load tests
- Capacity/Stress Tests

Single user performance

Good UX = Customer Happy

How do we measure that?



- Collect single user browser side response times
- Leverage functional test scripts(selenium)
- Create scenarios that you want to measure through our self service automation framework
- All Methods in the scripts have the snippet that collects the response times
- Executed from various geo locations
- Usable time vs last byte
- Collecting HAR & Creating videos of the tests for offline analysis
- Upload the data to S3
- MHE Performance Platform takes over from there

Load tests

- Full load tests
- Scaled Down tests
- Stress test to find capacity

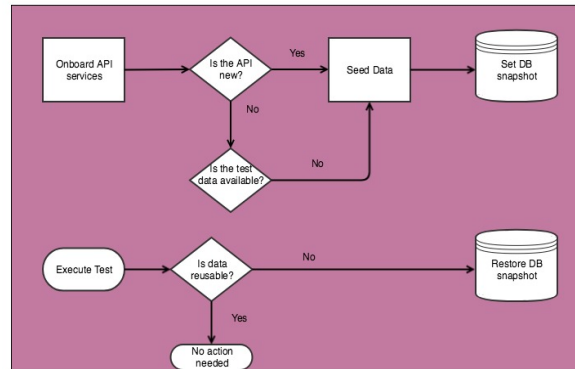
Feature Flags

What to do when you find performance issues?

- Block the release
- Turn Off the feature that creates the performance issue

Test Data management

- Make our tests self contained
- Create & destroy data as part of the test as much as possible
- For the ones you cant create during the test you create as part of the environment build out
 - Spin up parallel Aurora RDS with pre seeded test data to speed up env build out

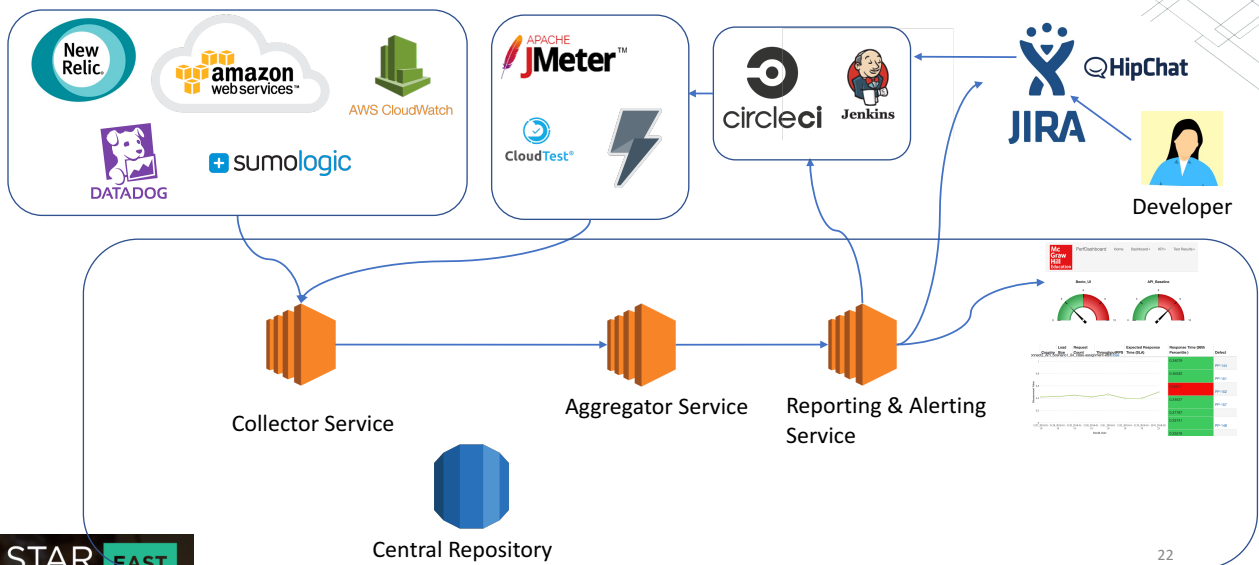


Tools & Technologies we use

Performance Engineering Platform

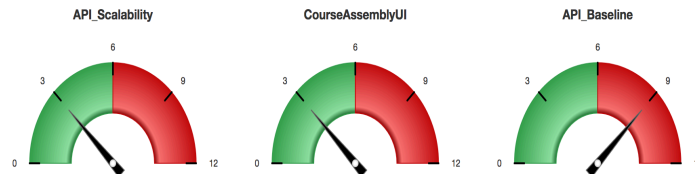
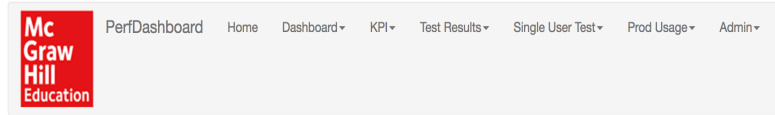
- Singular platform to manage performance lifecycle for all of our products
- Powers CI CD for Performance engineering
- Central repo for all metrics
- Dynamic thresholds
- Pass fail decision making
- Powers Self Service Performance Engineering

PE Platform Overview





PE Platform – Performance test types

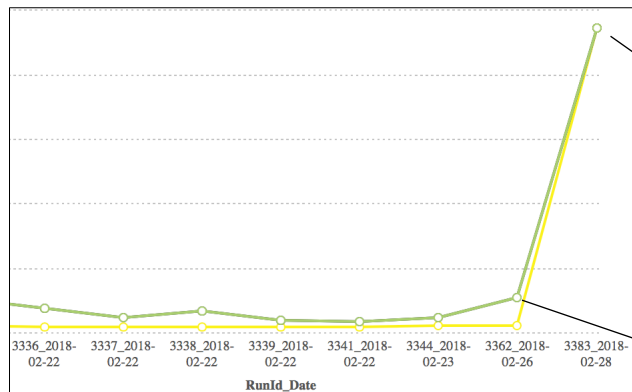


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23



Trending – Performance graph for each build



Build 3383 on 2/28 is failed for an API

Build 3362 on 2/26 is broken for an API as the response time degraded almost 30%

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24

Containerize JMeter

- We use JMeter heavily for the all the CI CD testing
- Distributed load testing – we need 1 master & N number of slaves to generate huge load
- Scaling the JMeter for thousands of users was a challenge
- Dockerize JMeter gives the scale needed
- Speeds up the provisioning
- Part of the infra as code – which means when the code gets deployed automatically JMeter farm gets provisioned where the test gets executed

Automated Pass/Fail

Based on 3 basic rules

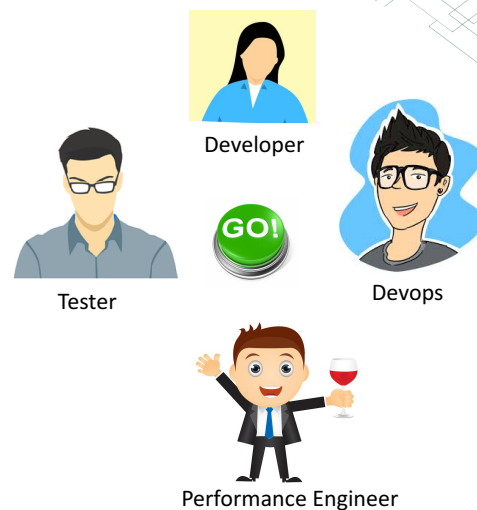
- Simple & Easy
- Implementable
- Dependent on throughput, response times and system KPIs

Thresholds for pass/fail

- Static Business response times SLAs
- Dynamic user experience/API level Response times thresholds
- Dynamic System Resource utilization thresholds
- Based on historical trend for each API and alerts if it deviated from last n tests
- Allows separate threshold for each API
- Doesn't allow slippage even within the contract

Self-Service Performance Engineering

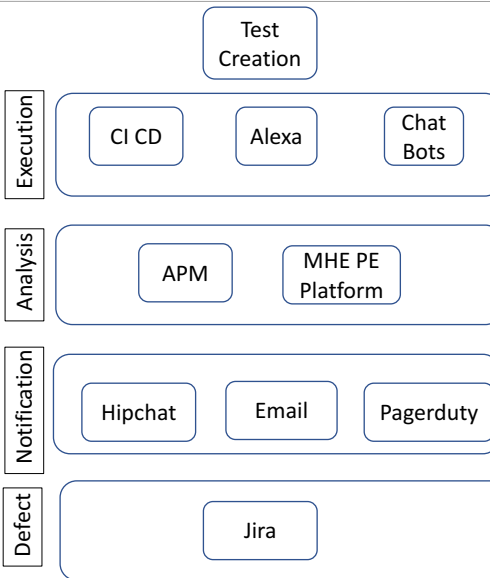
- You don't need to be performance engineer to run test
- Automate the entire performance cycle
 - Script Creation through a UI
 - Execute test as part of CI CD or Execute it on demand through voice enabled Alexa or a chatBot
 - Analysis through APM and MHE built Performance Platform
 - Automated Notification through Hipchat/Email/Pager Duty
 - Automated Defect creation with details in jira



Self-Service Performance Engineering

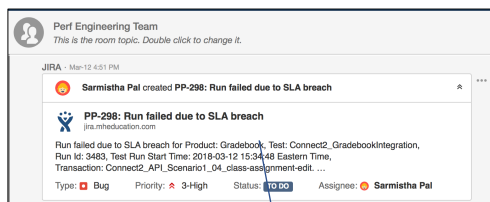
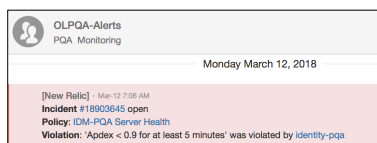


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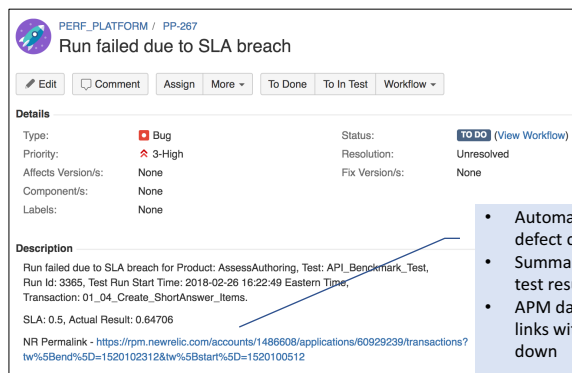


29

Notifications



- Automated real time hipchat notifications
- With Jira link and details



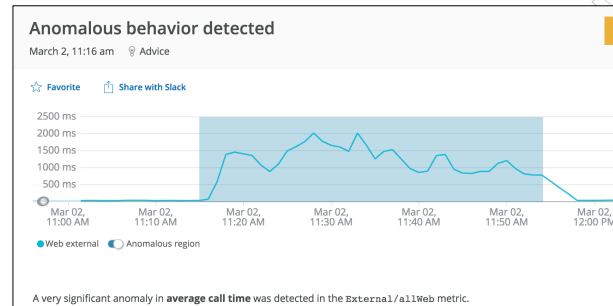
- Automated defect creation
- Summary of the test result
- APM dashboard links with drill down

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30

Shift Right - Anomaly detection

- Twitter Anomaly Detection
- Twitter's Breakout Detection
- Pearson Correlation Algorithm
- K-Means Clustering
- New Relic Radar



Do's & Don'ts

Do's

- Start with simple
- Perfect it later
- Remove false positives - Get it right from the beginning
- Know your applications KPIs
- Run parallel tests
- Run continuous tests

Don'ts

- Don't run benchmark & endurance test in CI
- Don't remove the failing tests to pass through CD
- Don't keep increasing the thresholds to pass tests
- Don't reinvent your PE framework rather see how you can leverage your existing tools and framework in CI CD

Summary

- Include performance engineering in your CI CD pipeline
- Automate automate & automate
- Make your tests repeatable
- Collect metrics along the way
- Avoid false positives
- Keep analysis & decision making simple
- Empower devs to test

Questions?