Best Practices for Performance Testing Mobile Apps

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I don’t believe in “best practices”...

I do believe in guidelines and better approaches for a given situation
Key Questions

Why is mobile app performance important?

How is mobile different?

How can I adapt?
Why Should I Care?

M-Commerce

66% of shoppers abandon transactions because of poor performance.

1 second delay equals a 7% drop in conversions.

2013 Mobile Commerce Insights study conducted by Jumio
Still Not Convinced?

- **Efficiency/Performance (including network-related)**: 64% (2012) vs 59% (2013)
  - 2012: 64%
  - 2013: 59%

- **Security (protection of sensitive data on the phone or over the air)**: 18% (2012) vs 56% (2013)
  - 2012: 18%
  - 2013: 56%

- **Functionality**: 48% (2012) vs 43% (2013)
  - 2012: 48%
  - 2013: 43%

- **Portability**: 46% (2012) vs 38% (2013)
  - 2012: 46%
  - 2013: 38%

- **User Interface/Ease of Use**: 36% (2012) vs 36% (2013)
  - 2012: 36%
  - 2013: 36%

- **Certification of Application**: 14% (2012) vs 34% (2013)
  - 2012: 14%
  - 2013: 34%

- **Compatibility/Regression Testing**: 31% (2012) vs 29% (2013)
  - 2012: 31%
  - 2013: 29%

2013-2014 World Quality Report

Base: 825 Respondents
Evolution of Performance Testing

2-Tier Client Server | Web | Mobile

**Challenges**
- Proprietary Protocols
- Skilled Resources
- Testing Large Loads
- Complex / Integrated Systems

**State of the Practice**
- 1990: In-Lab Testing
- 2000: Open Source Tools
- 2010: Cloud-based Testing
- Tool Maturation
- Specialized Resources
- Skilled Resources

Questions mark

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Mobile Challenges & Adaptations
Mobile Challenges – User Access

Your users have options...

Native App

Mobile Site

Full / Responsive Site
Assess the User and Load Profile

1. Determine the user profile
   - Business processes
   - Native app, mobile site, full site
   - Preferred browser
   - Network conditions
   - Geographic location

2. Determine the load profile
   - Volume of users by business process and location
   - Volume of users by access type
   - Frequency / throughput

Incorporate constant feedback from application logs and other monitoring solutions
Mobile Challenges - Network

Mobile User ≠ Connected User

Network bandwidth and quality affect both end user experience and system load
Assess Impact of Network Variability

1. Assess baseline performance (single user)
   - Observe UX with real devices behind network virtualization solutions

2. Assess performance under load
   - Put system under virtual user load
   - Observe UX with real devices behind network virtualization solutions

Diagram:
- Virtual Users
- Real Devices
- NV (Network Virtualization)
Network Virtualization Tools

Single User (Device and/or Emulator)
• Apple Network Link Conditioner
• Android Emulator
• Charles Proxy
• HP (Shunra) NV

Multiple Virtual Users
• HP (Shunra) NV
• Load test tools (built-in)
• Charles Proxy
Mobile Challenges – User Location and Volume

A high volume of global users is difficult to reproduce in a lab...
Utilize Cloud-based Testing Solutions

- Achieve production level loads
- Test entire infrastructure (vs. behind the firewall)
- Distribute load geographically
- Assess user impact on real devices
Test Tool Differences for Mobile

- Recording
- Network Emulation
- User Agent

*Everything else is generally the same as desktop/web...*
How do we capture the traffic?

Proxy Recording
- Enable proxy recording in tool
- Configure device proxy settings to point to workstation
• Map settings to user groups
• Keep it simple – predefined settings are typically sufficient
• Ideal capabilities:
  – Predefined settings for common profiles
  – Vary bandwidth, latency and packet loss
  – Multiple profiles per load generator
Specifying the User Agent

- Map settings to user groups
- Use predefined settings
- Understand how your system responds to different user agents
Mobile Challenges – Device Performance

Measuring System / Network Metrics is Not Enough...

- Battery Drain
- Memory
- Graphics
- CPU
- I/O
Critical device metrics:
- CPU
- Memory
- Battery
- Storage

Capture metrics while exercising app
Include appropriate devices / configurations
Incorporate automation for consistency

Mobile development platforms
- Android DDMS
- iOS Instruments / Xcode

Mobile test automation tools
- TouchTest (SOASTA)
- Trust (Mobile Labs)
- MonkeyTalk (Gorilla Logic)

Mobile lab / cloud solutions
- Device Connect (Mobile Labs)
- Keynote DeviceAnywhere
- Perfecto Mobile
Measurement Scenarios

- Exercise
- Target App

- Background
- Target App

- Background
- Common Apps
- Email
- Phone
- Chrome
- Messages

- Device
- Only
- Apple
- Android
Start Early...
How does performance testing fit?

Source: Agile and Test Estimation
Sharon Robson
Performance Testing in an Agile Environment

Waterfall

Plan → Design → Build → Test → Deploy

Performance Testing

Too late!
Performance Testing in an Agile Environment

Agile

Sprint 1  Sprint 2  Sprint 3  ...  Deploy

Performance Testing

Same Process...

Same Risk!
Performance Testing in an Agile Environment

**Agile**

Sprint 1  ➔  Sprint 2  ➔  Sprint 3  ➔  ...  ➔  Deploy

Performance Testing  ➔  Performance Testing  ➔  Performance Testing  ➔  Performance Testing

**Waterfall Approach**
- Rigid
- 4-6 week test cycle

**Agile Approach**
- Flexible
- 2 week sprints

Waterfall Approach + Agile Approach =
Ultimate Goal...

Early Cycle / Ongoing Performance Analysis

Shift Left

Late Cycle Performance Testing
Identify Gaps

What’s stopping us from analyzing performance continuously?

• Performance objectives weren’t part of user stories
• Agile teams lacked performance engineering expertise
• APM tools / skills were non-existent
Performance Testing in an Agile Environment

Capture non-functional requirements

Make performance everyone’s job

Create a role to coordinate performance activities

CoE performance test architects become mentors

Begin developing a performance focused culture
Incorporating Performance Requirements...

... as acceptance criteria for existing user stories

As a dealer I want to create a product configuration for an order so that my customer can purchase the equipment they need

- All steps in the product config. process will have a response time of less than 2 seconds
- 1,500 dealers are concurrently using the system to configure products for customer orders

... as technical stories

As a dealer, I want the response time of any step in the product configuration process to be less than 2 seconds

... as constraints

The system will respond in less than 2 seconds for all steps in the product configuration process for a maximum of 1,500 concurrent users configuring orders
Performance Testing in an Agile Environment

- Incorporate performance testing / analysis into each sprint
- Unit performance testing
- Component / system level performance testing
- Include performance testing in the CI chain
Performance Unit Testing

Start with existing unit tests

“Decorate” them with timers and load

Monitor results across builds

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Beyond Unit Testing

Component and system level testing

Map user stories onto system components

Benchmark in development / QA environment

Look for trends in measurements vs. absolutes

Use service virtualization for 3rd party or yet to be developed components

Incorporate as part of the CI chain

Harden scripts against application changes
Adding Performance Tests to CI

Lessons Learned

Custom plug-ins exist to run performance tests as part of the CI chain – very useful.

People get mad when you unnecessarily break the build.

- Allow for non-production-like environment
- Set your response time tolerances and client timeouts accordingly

They get really mad when you can’t figure out why you broke the build.

- Add error handling and logging to scripts to enable quick failure investigation
Key takeaways...

- Mobile users are not the same as connected users
- Performance is more than backend / network
- Push performance analysis to the left in the development cycle
Questions…

Direct future questions to:

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