Making Software Performance Engineering an Integral Part of SDLC : Practice & Experience

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Introduction

• Business & Technology Landscape: Presence of Large, Complex, Mission Critical Web Applications

• Evolution from Static Content Platforms to Critical Transactional Platforms

• Impact of Poor Performance: Loss of Brand Value, Productivity, Revenue, Customer Complaints, Rework
Performance Matters!!

• Increase in Response Times from 2 to 10 seconds resulted in 38% of the end users abandoning their site [GOMEZ – The Web Performance Division of Compuware, “Why Web Performance Matters: Is Your Site Driving Customers Away?”, 2010]


• Loss of Revenue ➔ 1 second delay meant a 7% in conversions [B. Simic, “The Performance of Web Applications: Customers Are Won or Lost in One Second” Aberdeen Group, pp. 4, 2008]
The Fix-it-Later Approach

- We will tune the system later, there is no time now
- We will provision more hardware if required
- Our software does not have any performance issues
- We cannot do anything about performance since the software is not yet built

We need something to measure

Performance Management requires significant time and effort
The Solution.....

• Make SPE an Integral Part of SDLC
  – SDLC has attained high level of maturity for functional requirements of a software
  – The objective is to integrate Software Performance Engineering in SDLC to produce software that meets its objectives for
    • Responsiveness
    • Scalability
SPE in SDLC

Ensure each requirement is understood from performance perspective

Ensure architecture and design considers the performance perspective (design for performance)

Ensure implementation level performance related mistakes are avoided

Ensure system performance is enough to deploy

Ensure deployment does not weaken performance

Ensure performance of the system is maintained

Performance Requirements Specs

Design Considerations Simple Models

Reviews Single User Tests

Performance Tests

Deployment Specs

Proactive Monitoring Capacity Planning

Minimize the risks arising out of poorly performing software
SPE in SDLC: Home Page of a Web Site

Requirements for the Home Page

Develop the Home Page

Unit and System Tests

Performance Tests

Deploy

Optimize & Tune – Rework

Performance Incidents

Optimize & Tune – Rework
• **Specific requirement**
  - The average response time of 95% or more of the samples must be within 6 seconds

• **Technical feasibility using a simple model**
  - Page Response Time is a function of
    • Domain name lookup time (D)
    • Typical round trip time (RTT)
    • SSL negotiation (SSL)
    • Number of connections established by the browser (1.5 RTT * c)
    • Number of requests: the main page + embedded resources (N)
    • Bandwidth (B)
    • Total download data size: the main page + embedded resources (PS)
    • Server processing time (S)
  - If PS is 2000 KB and the bandwidth is 1.5 Mbps link
    • $PS/B = (2000*1024*8)/(1.5*1024*1024) = 10$ seconds (the performance objective of 5 seconds cannot be met)
# SPE in SDLC: Home Page of a Web Site

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<thead>
<tr>
<th>#</th>
<th>Resource</th>
<th>Content Type</th>
<th>Start Offset</th>
<th>DNS Lookup</th>
<th>Initial Connection</th>
<th>Time to First Byte</th>
<th>Content Download</th>
<th>Bytes Downloaded</th>
<th>Status Code</th>
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</table>
SPE in SDLC: Home Page of a Web Site

• Use a Review Checklist and Tool

  • Are components of the web page minified (minification is the process of eliminating items like new lines, spaces and comments)?
  • Is a caching policy defined for content?
  • Is there any reference to a non-existing content (requests will result in a 404 error)?
  • Are any resources included more than once?
  • Are any images scaled in html?
  • Are the number of Http requests optimal (more trips to the server lead to a slower web page)?
  • Are any database calls required?
SPE in SDLC : Home Page of a Web Site

• Unit Level Performance Tests

• Do a single user test prior to performance test and check whether performance requirement is met (a bandwidth emulation tool can be used) can be used?

• System Level Performance Tests

• Performance tests are now an established part of SDLC
• Use Little’s Law to validate results from a performance test
  • \( N = X(R + Z) \)
  • \( N \) = number of users accessing the system
  • \( X \) = throughput
  • \( R \) = average response time
  • \( Z \) = think time

\[ N = 10 \times 1 = 10 \]

Execution time = 1 second

10 requests/second

10 requests/second
SPE in SDLC: Home Page of a Web Site

• Deployment Checklist

• Is caching enabled for JavaScript?
• Is caching enabled for CSS?
• Is caching enabled for images (this depends on the nature of business)?
• Is compression enabled for JavaScript?
• Is compression enabled for CSS?
• Is compression enabled for HTML?
• Is execution time recording enabled in Web Server Log?
• Is keep alive setting enabled?

A study of 19 web sites found that 13 did not have compression enabled and 15 did not have caching enabled
SPE in SDLC : Home Page of a Web Site

• Plan for Proactive Monitoring & Analysis

• Tools available
  • Webpagetest
  • GTMetrix
  • Custom setup for injecting synthetic requests (from one or more locations)

• Manage performance proactively
  • Analyze trends & look for deviations
  • If trend shows an increasing trend, plan for additional capacity and/or optimizations proactively
  • Does web server log show 404 status codes?
  • Does web server log show 304 status codes?
  • Predict impact of adding a new item in the web page
SPE in SDLC: Service Fee Calculation

- **Specific requirement**
  - The average response time of 90% or more of the samples must be within 3 seconds

- **Performance by Design**
  - How often rules change?
  - Do we make trips to the database to fetch the rules for calculating the service fee?
  - Can we keep these rules in memory? How do we keep the memory updated in case a rule change?

*We can design for performance rather than optimizing or tuning at a later stage. Caching of static data to be included in the design.*
SPE in SDLC: Workflow Transactions

• Specific requirement
  • The average response time of all the samples must be within 5 seconds

• Performance by Design
  • What is the life of a workflow?
  • Can we have an archival policy for completed workflows (move them away from the tables which contain active workflows)?

We can design an archival policy rather than doing it when we have a performance incident. Design archival policy and tables as part of database design process.
**SPE in SDLC : Batch Processing**

- **Specific requirement**
  - The average execution time of the batch must be within 60 minutes

- **Performance by Design**
  - Looping queries (SQL in a loop) as against batch mode executions?
  - Is there a better way (an application saving documents related to a transaction separately as against creating groups of similar documents)?

*SPE needs to be an integral part of developing batches – execution time window is at a premium*
SPE in SDLC: Proactive Anomaly Detection

Kill the query causing the slowness
Q & A