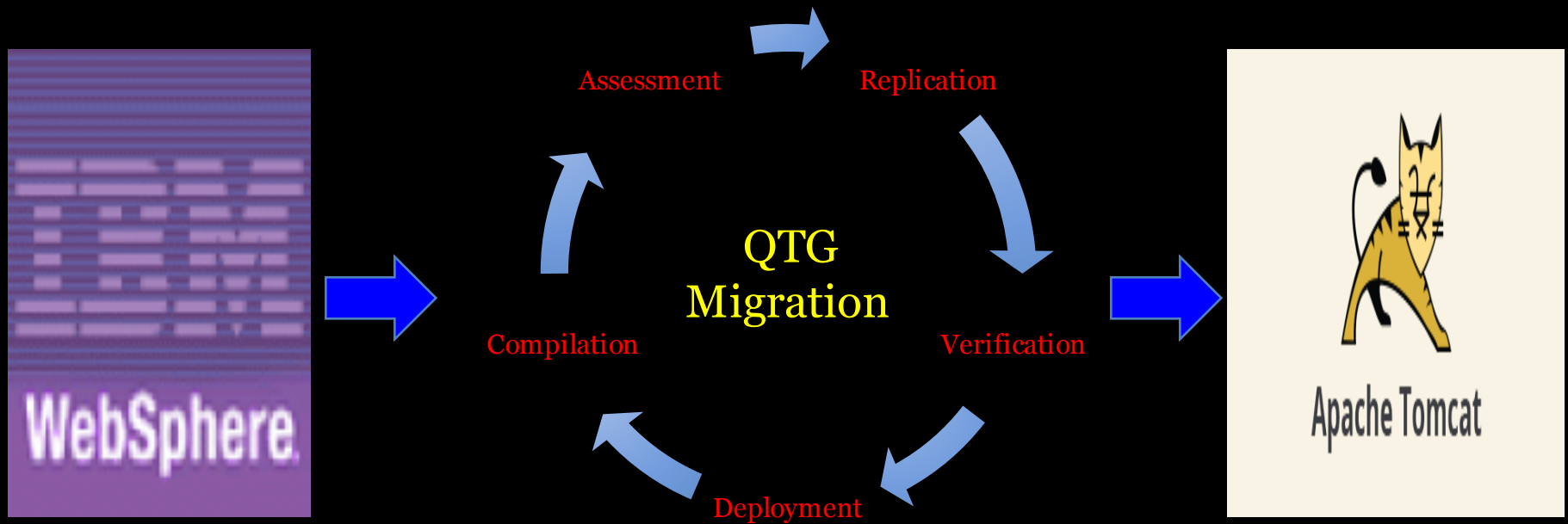


# QTG Migration Overview





# Migration Process

- Examine Migration Objectives
  - Business Needs, Cost Savings, Tech/Arch Objectives
- Examine Migration Targets
  - Define the scope of application/services can be migrated
- Confirm Migration Ability
  - Code Analysis, Proof Of Concepts, Etc.
- Examine Security, Infrastructure/Hardware, Scaling, Fail Overs.
- Convert Code
  - Code/Configuration changes required for the migration.
- Parallel Development
  - How the migration can go parallel with ongoing development.
- Implementation Strategy



# Why Migrate to Tomcat

- Reduce Complexity
  - “do more with less” processes and staffing
  - Developer productivity is also somewhat higher with Tomcat.
  - Transition to a more horizontal, lighter weight, modular deployment architecture.
  - During development/debugging, Tomcat can be stopped and re-started in a few seconds, rather than the minutes required each time by WebSphere. In one study, this impacted developer productivity by more than an hour per day
- Reduce Operating Costs
  - Reduces Websphere Licensing (at end of 3-year ELA).
  - Reduces maintenance cost of the zAAPs after we eliminate usage.
  - Maintaining WebSphere is very costly, not the least because of the vendors service contract pricing, but also because of the amount of hardware required to support a WebSphere instance and the associated space/power/cooling costs.
  - With typical Tomcat operating costs/server coming in at 1/4 to 1/6 the cost of WebSphere.



# Migration Checklist

- Application primarily uses servlets and/or JSPs.
  - Check if app leverages any WebSphere specific services and identify their equivalent replacements for Tomcat.
- Application uses Spring Framework.
  - Determine configuration and deployment changes.
- Application is written to be strictly standards-compliant.
  - Determine if other Java EE technologies are used and identify equivalent replacements for Tomcat.
- Application is third-party software that is also available for Tomcat.
- Application uses EJB or other WebSphere server functionality not readily available for Tomcat.
  - Need code refactoring to remove the use of such functionality. This is a “new application,” not a migration.

# Tomcat Vs Websphere Versions

WebSphere Version	Specifications and their Versions	Equivalent Tomcat Version
8.0	Servlet 3.0, JSP 2.2, JSF 2.0, Java 1.6	Tomcat 7.0
CE 2.1.x and 2.2.x	Servlet 2.5, JSP 2.1, JSF 1.2, Java 1.6	Tomcat 6.0 or higher
7.0	Servlet 2.5, JSP 2.1, JSF 1.2, Java 1.6	Tomcat 6.0 or higher
6.1	Servlet 2.4, JSP 2.0, JSF 1.1, Java 1.5	Tomcat 5.5 or Tomcat 6.0
6.0	Servlet 2.4, JSP 2.0, JSF 1.1, Java 1.4	Tomcat 5.5 or Tomcat 6.0
5.1	Servlet 2.3, JSP 1.2, (no JSF), Java 1.4	Tomcat 4.1

Note that Tomcat 6.0 requires Java 1.5 or higher, and Tomcat 7.0 requires Java 1.6 or higher.

# Existing QTG Modules

- **EstimatesBusiness.jar** — Shared by all QTG Services.
  - EJB, Services, DAO, Entities, DTOs, Utils – All business logic and transactions resides here, it's shared by all modules below.
- **Estimates.ear**
  - EstimatesWeb.war – Web Application
    - QTG User Interface [JSF, Controllers , Java Scripts, Images, Etc]
  - EstimatesPublicWeb.war – Web Application
    - Old Mysites 1.0 and there are few servlets accessed by Our Public .com Site (United/Mayflower.com).
  - EstimatesWebService.war – SOAP Service - Accessed by GMM, RORD and other COBOL Programs.
    - CubesheetWebService, GetOpportunityService, GMMOpportunityWebService, LocaleWebService, OpportunityValidateAndUpdateService, OpportunityWebService, QuoteRegisterValidationService, QuoteStatusInfoService, ServiceCrewWebService
  - ExternalEstimatesWebService.war – SOAP Service
    - MoversSuite (52 Agents), CompuSource (2 agents), RedSky (4 agents), Consensus (1 Agent) , and then U19 Armstrong and UVL Canada that wrote their own software.

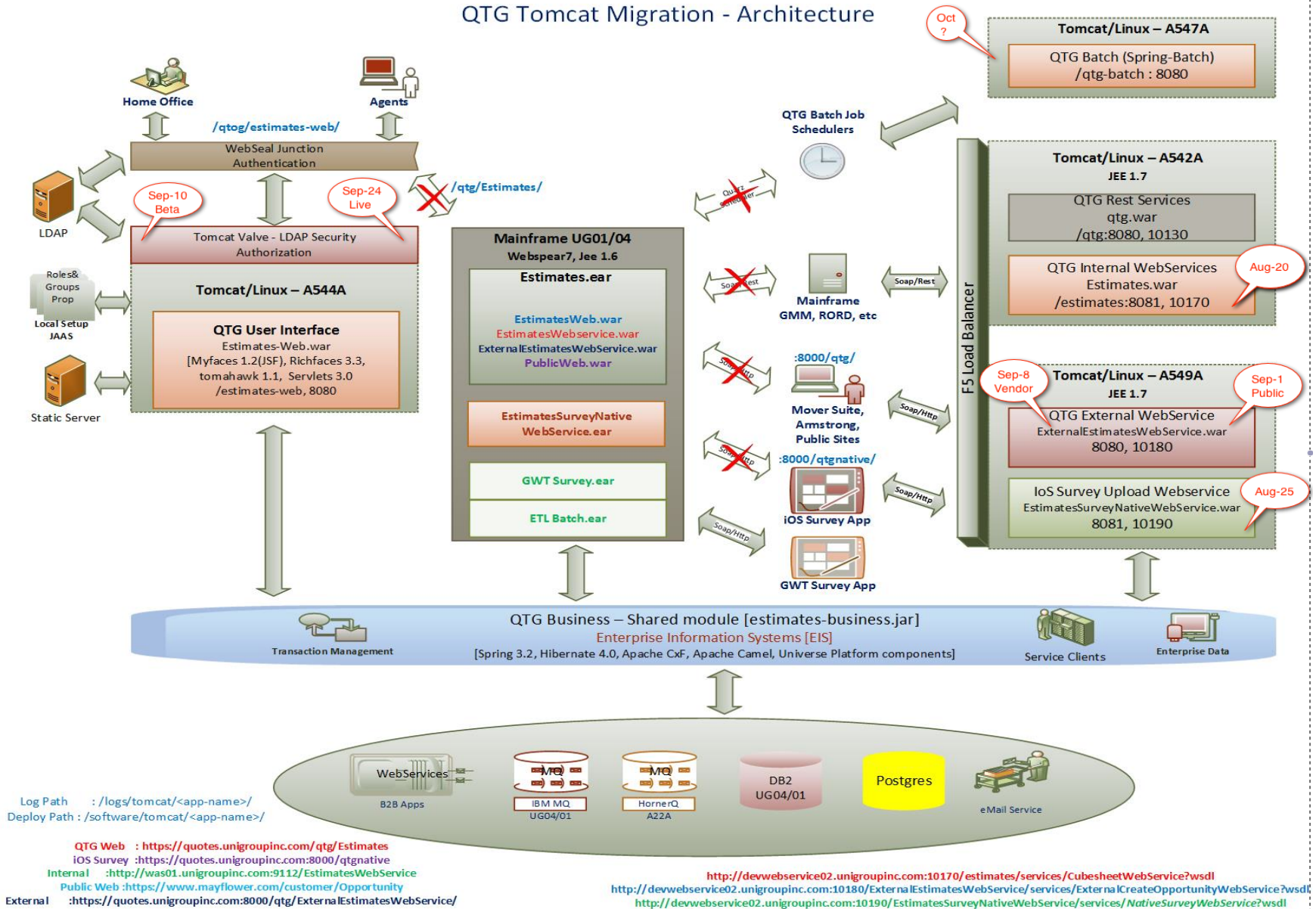
Continued.....

# Existing QTG Modules

- NativeSurveyWebService.ear– SOAP Service
  - Accessed by IoS Survey and Sales Tools
- QTG-Batch
  - CreditCard Authorizations, CreditCard Reversals Authorizations, CreditCard Balance Due, Opportunity Distribution, Mark Quotes To Be Deleted, Gmm Distribution, Mark Local Quotes To Be Deleted.
- QTG-ETL.ear – Batch Job. [Not in Scope]
  - Feeds data from QTG to ETL db for reporting. BI team under discussion to migrate to Postgres and make changes in the Data mart. Will be revisited later time.
- GWT-Survey.ear – Web Application & Service [Not In Scope]
  - Offline survey application, will be retired soon, users using this application has to be migrated to use IoS.



## QTG Tomcat Migration - Architecture







# High Level Migration Tasks

- Isolate Estimates.ear (Enterprise Module) into independent web modules/services.
  - /Estimates-Web
  - /Estimates-PublicWeb
  - /estimates-web-service
  - /ExternalEstimatesWebService
  - /EstimateSurveyNativeWebService
  - /qtg-batch
- Convert these projects from Ant to Maven for better dependency, build and release management.
- Configure Tomcat to use existing LDAP security for Authentication.

Continued....



# High Level Migration Tasks

- Develop custom login module to handle file based Authentication for Local testing.
- Rid Off EJB layer from estimates-business and introduce spring JTA/JPA transactions using AOP.
- Rid Off DB2, IBM-MQ, Hornet-Q and other JNDI resources and use property based spring bean resources.
- Upgrade to Jee7, Spring 3.2 and Hibernate 4.0.
- Rid Off , IBM Webservice implementation - Rewrite EstimatesWebService, ExternalEstimatesWebService & EstimatesSurveyNativeWebService to use Apache Cxf JAX-WS.

Continued...



# High Level Migration Tasks

- Convert existing QTG quartz batch jobs to qtg-batch using spring-batch.
- Work with infrastructure team to setup the Tomcat servers with required configuration.
- Setup new QTG webseal [/qtog] junction for tomcat , needed for Beta/Parallel run in Production.
- Install App Dynamics performance monitor tools on tomcat.
- Setup GIT repository and Jenkin jobs for all QTG Modules.
- Document the Migration Function/Technical details.
- Document the Testing and Release strategy.

# IBM Websphere Tech Stack / Configuration

## **Estimates.ear** : WAS-7 – JEE 1.6

[Estimates.war, EstimatesWebservice.war, ExternalEstimatesWebService.war & PublicWeb.war]

- No of Instances - 8
- Max Sessions per Container – 200 (1600 concurrent sessions)
- Heap Size Min/Max – 2.5GB (~ 50% used)
- Threads per container
  - webcontainer: 50
  - default: 20
  - Servant Procès Thread Count : 27
- DB Min/Max connections per container – 1/45 (360 connections)
- Connection/Unused Timeout , Reap Time – 1800, 180 secs
- Peak Load (10am and 2pm) => 200 req / sec



# IBM Websphere Tech Stack / Configuration

**EstimatesSurveyNativeWebService.ear** : WAS-7 – JEE 1.6

- No of Instances - 2
- Max Sessions per Container - 100
- Heap Size Min/Max – 768m/768m
- Threads per container
  - webcontainer: 50
  - default: 20
  - Servant Procès Thread Count : 27
- DB Min/Max connections per container – 1/45
- Connection/Unused Timeout , Reap Time – 1800, 180 secs
- Peak Load – 60 Req/Sec

# Tomcat Tech Stack / Configuration

**Estimates-web.war** : Linux/Tomcat-7 – JEE 1.7

JSF 1.2 [Myfaces], Servlets 3.0, Spring 3.2 ,Hibernate 4 & Apache CxF.

## Estimates-Web [A544]

Stga544a/b machines	1 CPU	4Gb Ram	2Gb min/max Heap
size	Prda544a/b machines	1 CPU	4Gb Ram
size			2Gb min/max Heap

## Estimates-service [A542]

Stga542a/b machines	2 CPU	7Gb Ram	2Gb min/max Heap size
◦ (all other instances have 1Gb min/max Heap size)			
Prda542a/b machines	2 CPU	9Gb Ram	2Gb min/max Heap size
◦ all other instances have 2Gb min/max heap size.			

# URL & Git Repository

Application/Service	Server deva, qaa, stga, prda	GIT Repo / Jenkin Jobs
<b>Estimates-Web [GUI]</b> <a href="https://devquotes.unigroupinc.com/qtog/estimates-web/faces/pages/opportunities/schedule.jspx">https://devquotes.unigroupinc.com/qtog/estimates-web/faces/pages/opportunities/schedule.jspx</a>	544	<a href="https://git.unigroupinc.com:sales/qtg.git">git@git.unigroupinc.com:sales/qtg.git</a> Build-deploy-estimates-web-dev & stage
<b>Estimates-Service [SOAP]</b> <a href="http://devwebservice02.unigroupinc.com:10170/estimates/services/CubesheetWebService?wsdl">http://devwebservice02.unigroupinc.com:10170/estimates/services/CubesheetWebService?wsdl</a>	542	<a href="https://git.unigroupinc.com:sales/estimates-service.git">git@git.unigroupinc.com:sales/estimates-service.git</a> Build-deploy-estimates-dev & stage
<b>QTG-Service [Rest]</b>	542	<a href="https://git.unigroupinc.com:sales/service-qtg.git">git@git.unigroupinc.com:sales/service-qtg.git</a> Build-deploy-qtg-dev & stage
<b>ExternalEstimates-Webservice</b> <a href="http://devwebservice02.unigroupinc.com:10180/ExternalEstimateService/services/ExternalCreateOpportunityWebService?wsdl">http://devwebservice02.unigroupinc.com:10180/ExternalEstimateService/services/ExternalCreateOpportunityWebService?wsdl</a>	549	<a href="https://git.unigroupinc.com:sales/externalestimatesweb-service-service.git">git@git.unigroupinc.com:sales/externalestimatesweb-service-service.git</a> Build-deploy-externalestimatesweb-service-dev & stage
<b>EstimatesSurveyNative-Webservice</b> <a href="http://devwebservice02.unigroupinc.com:10190/EstimatesSurveyNativeWebService/services/NativeSurveyWebService?wsdl">http://devwebservice02.unigroupinc.com:10190/EstimatesSurveyNativeWebService/services/NativeSurveyWebService?wsdl</a>	549	<a href="https://git.unigroupinc.com:sales/estimatesurveynative-web-service-service.git">git@git.unigroupinc.com:sales/estimatesurveynative-web-service-service.git</a> Build-deploy-estimatesurveyweb-service-dev & stage
<b>QTG Batch</b> <a href="http://deva547a:8080/qtg-batch/api?_wadl">http://deva547a:8080/qtg-batch/api?_wadl</a>	547	<a href="https://git.unigroupinc.com:sales/batch-qtg.git">git@git.unigroupinc.com:sales/batch-qtg.git</a> Build-deploy-batch-qtg-dev & stage



## IBM Performance – Based on July,2015 peak 36hrs

Application/Service	Request / Sec	Avg_Rsp_Tm in Ms
Estimates-Web	15	150
Estimates-Service [EJB]	170	13
Public-Web	1	160
Estimates-Webservice	1	2
ExternalEstimates-Webservice	1	4
EstimateSurveyNative	1	500

# Tomcat Vs WAS Load Testing [ QTG Web]

## 1 VU - 3 Iterations - 1 Script only

Aug 18 - 12:23:24 PM	Response time in Miliseconds		
Tomcat	Min	Avg	Max
1-Access QTGo	273	<b>1471.7</b>	2902
2-Logon	920	<b>2429.7</b>	4377
3-New Opp Open	1542	<b>1955.7</b>	2760
4.1-Customer Info	1558	<b>1634.3</b>	1782
4.2-Address Info	797	<b>990.3</b>	1200
4.3-Address Info 2	1059	<b>2316</b>	3752
4.4-Address Info 3	894	<b>2358.7</b>	3139
5-Access Assign Est	1361	<b>2753.7</b>	4165
6.1-Confirm Survey	357	<b>1311.3</b>	1814
6.2-Confirm Survey 2	2702	<b>2740.3</b>	2785
7-Logout	197	<b>670</b>	1600

Aug 18 - 12:31:29 PM	Response time in Miliseconds		
Websphere	Min	Avg	Max
1-Access QTGo	43	<b>665.7</b>	1647
2-Logon	300	<b>770.7</b>	1710
3-New Opp Open	355	<b>665.7</b>	1263
4.1-Customer Info	224	<b>1182.3</b>	1695
4.2-Address Info	297	<b>792.3</b>	1782
4.3-Address Info 2	189	<b>700.7</b>	1714
4.4-Address Info 3	401	<b>1145</b>	1815
5-Access Assign Est	1719	<b>1759.3</b>	1823
6.1-Confirm Survey	1475	<b>1509.3</b>	1577
6.2-Confirm Survey 2	436	<b>910.3</b>	1820
7-Logout	1471	<b>1476</b>	1483

## 5 VU - 3 Iterations - 1 Script only

Aug 18 - 12:40:11 PM	Response time in Miliseconds		
Tomcat	Min	Avg	Max
1-Access QTGo	165	<b>1746.7</b>	2951
2-Logon	787	<b>2771.9</b>	3949
3-New Opp Open	861	<b>2908</b>	3956
4.1-Customer Info	559	<b>1730.9</b>	2098
4.2-Address Info	519	<b>1882.2</b>	2491
4.3-Address Info 2	464	<b>1807.1</b>	2791
4.4-Address Info 3	842	<b>2171.4</b>	2923
5-Access Assign Est	2131	<b>2919.1</b>	4344
6.1-Confirm Survey	302	<b>1628.4</b>	2047
6.2-Confirm Survey 2	1314	<b>2680.1</b>	3729
7-Logout	155	<b>1003.4</b>	1747

Aug 18 - 12:48:30 PM	Response time in Miliseconds		
Websphere	Min	Avg	Max
1-Access QTGo	45	<b>675.7</b>	1689
2-Logon	307	<b>1859.5</b>	3349
3-New Opp Open	397	<b>1245.2</b>	2450
4.1-Customer Info	170	<b>1058.7</b>	1799
4.2-Address Info	235	<b>1212.1</b>	1730
4.3-Address Info 2	198	<b>1346.2</b>	1782
4.4-Address Info 3	404	<b>1533.8</b>	3687
5-Access Assign Est	278	<b>1321.1</b>	2540
6.1-Confirm Survey	61	<b>934.9</b>	1574
6.2-Confirm Survey 2	382	<b>1396.5</b>	1904
7-Logout	60	<b>990.9</b>	1591

**5 VU - 5 Iterations - 1 Script only**

<b>Aug 31 - 1:01:08 PM</b>	<i>Response time in Miliseconds</i>		
<b>Tomcat</b>	<b>Min</b>	<b>Avg</b>	<b>Max</b>
1-Access QTGo	71	<b>2037.6</b>	2888
2-Logon	804	<b>3106.2</b>	4553
3-New Opp Open	1431	<b>3477</b>	4164
4.1-Customer Info	449	<b>1653.5</b>	2122
4.2-Address Info	546	<b>1853.6</b>	2898
4.3-Address Info 2	617	<b>1779.2</b>	2287
4.4-Address Info 3	1017	<b>2401.2</b>	5883
5-Access Assign Est	977	<b>2758</b>	3911
6.1-Confirm Survey	208	<b>1506.6</b>	2123
6.2-Confirm Survey 2	1545	<b>2658.7</b>	3477
7-Logout	149	<b>1283.4</b>	1890

2228.6363  
64

<b>Aug 31 - 1:35:16 PM</b>	<i>Response time in Miliseconds</i>		
<b>Websphere</b>	<b>Min</b>	<b>Avg</b>	<b>Max</b>
1-Access QTGo	75	<b>1245.4</b>	1705
2-Logon	402	<b>2615.3</b>	3236
3-New Opp Open	503	<b>1436.9</b>	1925
4.1-Customer Info	214	<b>1462.4</b>	1747
4.2-Address Info	236	<b>1584.4</b>	2744
4.3-Address Info 2	192	<b>1292.1</b>	1723
4.4-Address Info 3	508	<b>1630.1</b>	2153
5-Access Assign Est	357	<b>1633.3</b>	2326
6.1-Confirm Survey	83	<b>1278.9</b>	1675
6.2-Confirm Survey 2	427	<b>1383.6</b>	2048
7-Logout	81	<b>1205.2</b>	1502

1524.3272  
73

**QTG Tomcat is ~50% slower based on this results.**

## WAS Vs Tomcat comparison (Estimates-Service)

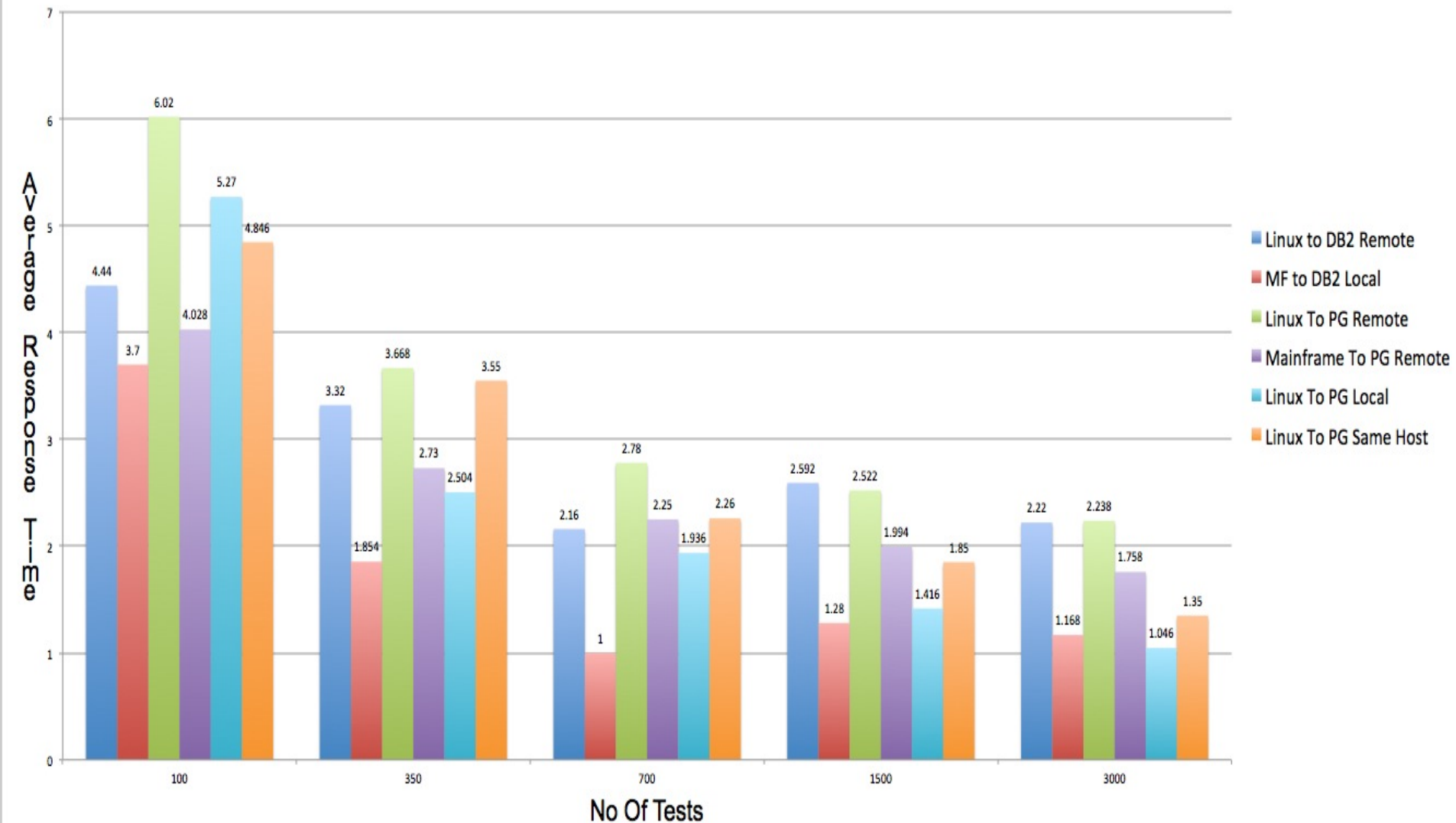
Client : Soap UI

Server : stga542a/b & ug04

Tomcat						WAS			
Thread	CPU %	Tps	Avg_Rsp_Tm	Max_Rsp_Tm	Min_Rsp_Tm	Tps	Avg_Rsp_Tm	Max_Rsp_Tm	Min_Rsp_Tm
5	6%	6.47	22.28	137	12	6.44	12.28	388	5
15	9%	19.28	20.55	391	10	19.5	6.44	88	4
25	8%	32.19	18.5	148	9	32.94	6.87	348	4
50	15%	64.82	19.97	1102	7	65.59	5.89	128	4
100	20%	128.38	17.52	204	7	131.47	6.55	359	3
			19.764				7.606		

Tomcat is 160% slower.

**JDBC Test**  
**Mainframe/Linux Vs Db2/Posgres Performance Analysis**  
Linux : deva542a, Postgres : devd542a  
Mainframe : UG04, DB2: UG04:DBT



## JDBC Java Test

### Linux Vs Mainframe & DB2 Vs Postgres

Linux\_To\_Db2\_Remote

Vs

MF\_To\_Db2\_Local

Linux 63% Slower

Linux\_To\_Pg\_Remote

Vs

MF\_To\_Pg\_Remote

Linux 35% Slower

Linux\_To\_Pg\_Local

Vs

MF\_To\_Db2\_Local

Linux 35% Slower

Linux\_To\_Pg\_Remote

Vs

Linux\_To\_Pg\_Local

Remote 43% Slower

Linux\_To\_Pg\_Remote

Vs

Linux\_To\_Pg\_Remote\_Same Host

Same host 24% Faster

# Migration Code Changes

- Web.xml
  - Upgrade to servlet 3.0 from 2.4 and remove all ejb-ref.
  - Configure AnnotationConfigWebApplicationContext to support both spring xml/annotation. [No SpringContextLoader]
- Develop CustomLoginModule for Local Setup.
  - Access Users/Groups property files in GIT instead of shared location.
- Remove EJB Session Bean dependency and Inject Business class directly in Controllers.
  - Change SpringUtils.java to get bean from Spring WebApplicationContext.
- Support Image blob/lob – add ;progressiveStreaming=2; in URL String. [Universal JDBC driver ]
- Spring / Hibernate
  - Use Apache DBCP2 data source with connection pooling.
  - Use Hibernate-4 LocalSessionFactoryBean[Support both hbm & annotation]
  - Use *Hibernate-4 HibernateTransactionManager and Use AOP Txn Advise [NO More EJB/CMT Transactions]*
  - Use sessionFactory.getCurrentSession() to get a session, and use the native Hibernate Session API directly. [No HibernateTemplate]
  - org.hibernate.usertype.UserType –Signature change in nullSafeSet() Method.
  - org.springframework.orm.hibernate3.HibernateInterceptor is deprecated. Use *org.hibernate.Interceptor* in *SessionFactory*.
  - Hibernate.createBlob deprecated -> Use NonContextualLobCreator.
  - Hibernate.STRING[Wrapper] is deprecated. Use StringType.INSTANCE [{Wrapper}Type.INSTANE]
- Comment out IBM Quartz Scheduler dependency com.ibm.websphere.scheduler.

*Continue.....*



# Migration Code Changes

- CyberSourceSOPServlet.java -> Creditcard Signature, Used cybersource signature rest service.
- GZIPResponseStream.java – Add unimplemented method isReady() & setWriteListener(). [Servlet version]
- Move all the auto generated jax-ws DTO (with Jax-b annotation) objects to estimates-business.
  - convert date to DateTimeUtils.XMLGregorianCalendar()
  - getFullUnPackInd() to isFullUnPackInd() & isFullUnPackInd
- Use Apache Axis 1.4 -> CxF does not support RPC style WSDL client. web service client project.
- MapToJSON.java -> StringEscapeUtils.escapeJava
  - not working correctly for version commons-lang2.6, used commons-lang3.
- Update new application context name in java, jsp and configuration files.
- Use JUL to SLF4BridgeHandler for Logging.
- *Update test-spring\* configuration for Junit using Testng and Mockito. [No DBUnit]*
- Use Java IO package instead of com.ibm.jvm.util.ByteArrayOutputStream.  
[RawRecipientDataExportHelper].
- ValuationController.java -> BigDecimal.scale(-2) - represents in 8.6E+3, soap binding does not like it.  
Patch to setScale(0) to fix this for now. Need more analysis.

# Tomcat LDAP Security Configuration

- /Conf/context.xml
  - `<Environment name="config/environment" value="DEV" type="java.lang.String"/>`
- Server.xml ( RoleBase – Dev : Estimates, Stage :QuotesToGo, Prod :QuotesToGo )
  - `<Valve className="com.unigroupinc.security.UniGroupAMTomcatValve" debugTrace="true" fallThrough="true" groupsHeader="iv-groups" ivServerName="quotes-webseald-devweb20" trustedRemoteAddr="10\204\0\84"/>`
  - `<Realm className="com.unigroupinc.security.UniGroupJNDIRealm" connectionName="uid=wpsbind,ou=people,ou=employees,dc=unigroupinc,dc=com" connectionPassword="3oqMKct2" connectionURL="ldaps://devuniweb21.unigroupinc.com:636" alternateURL="ldaps://devuniweb21.unigroupinc.com:636" roleBase="ou=Estimates,ou=Applications,DC=UNIGROUPINC,DC=COM" roleName="cn" roleSearch="(uniqueMember={o})" userPattern="(uid={o},ou=People,ou=Employees,DC=UNIGROUPINC,DC=COM)(uid={o},ou=People,ou=Agents,DC=UNIGROUPINC,DC=COM)"`
- Copy AMTomcatValve.jar & unigroup-security.jar into Tomcat Lib folder.

# Other Utilities

- App-Dynamics – Application Monitor Demo
- Changing log level runtime
  - <http://devwebservice02.unigroupinc.com:10170/estimates/log4j.jsp>
- Viewing Build details in QTG service applications
  - [http://devwebservice02.unigroupinc.com:10170/estimates/app\\_info.jsp](http://devwebservice02.unigroupinc.com:10170/estimates/app_info.jsp)
- Demo viewing Tomcat Deployment and Logging Directory
- Performance Logging [JMON]
  - */log/tomcat/perf-warn.log & perf-statistics.csv*
  - Format : Method, Hits, LastTime, AvgTime, MinTime, MaxTime, StdDiv
  - Ex  
`:com.unigroupinc.service.qtg.service.OpportunityServiceImpl.findByTrackingId,700.0,10.00,28.94,9.00,2697.00,214.31`

# QTG Batch Jobs

JOB Name	CRON Expression [ <u>Sec Min Hours DaysOfMonth</u> <u>Month DaysOfWeek Year</u> ]	Details
CreditCardAuthorizations	0 30 17 ? * MON-SAT	Runs daily Mon-Sat - 5.30PM
CreditCardReversalsAuthorizations	0 0 18 ? * MON-SAT	Runs daily Mon-Sat – 6PM
CreditCardBalanceDue	0 15 18 ? * MON-SAT	Runs daily Mon-Sat – 6.30PM
OpportunityDistribution	0 0 5 1 1,4,7,10 ?	Runs Jan, Apr, July & Oct -1 <sup>st</sup> day 5.00 AM
GMMDistributionQuarterly	0 50 5 1 1,4,7,10 ?	Monthly every Jan, Apr, July & Oct -1 <sup>st</sup> day 5.50 AM
MarkQuotesToBeDeleted	0 30 21 ? * MON	Weekly every Mon – 9.30 PM
MarkLocalQuotesToBeDeleted	0 30 21 ? * TUE	Weekly every Tue – 9.30 PM

# What's New

- Java

- <http://radar.oreilly.com/2011/09/java7-features.html>
- <http://www.oracle.com/technetwork/java/javase/8-whats-new-2157071.html>

- Spring

- <http://docs.spring.io/spring/docs/3.0.x/spring-framework-reference/html/new-in-3.html>
- <http://docs.spring.io/spring/docs/3.2.x/spring-framework-reference/html/new-in-3.2.html>
- <http://docs.spring.io/spring/docs/current/spring-framework-reference/html/new-in-4.0.html>

- Hibernate

- <http://docs.jboss.org/hibernate/core/4.0/quickstart/en-US/html/>

- Unit Test with Spring TestNG and Mockito

- <http://www.javacodegeeks.com/2014/02/use-mockito-to-mock-autowired-fields.html>
- <http://www.vogella.com/tutorials/Mockito/article.html>

- Apache Cxf (JAX-WS & JAX-RS support)

- <http://cxf.apache.org/docs/why-cxf.html>

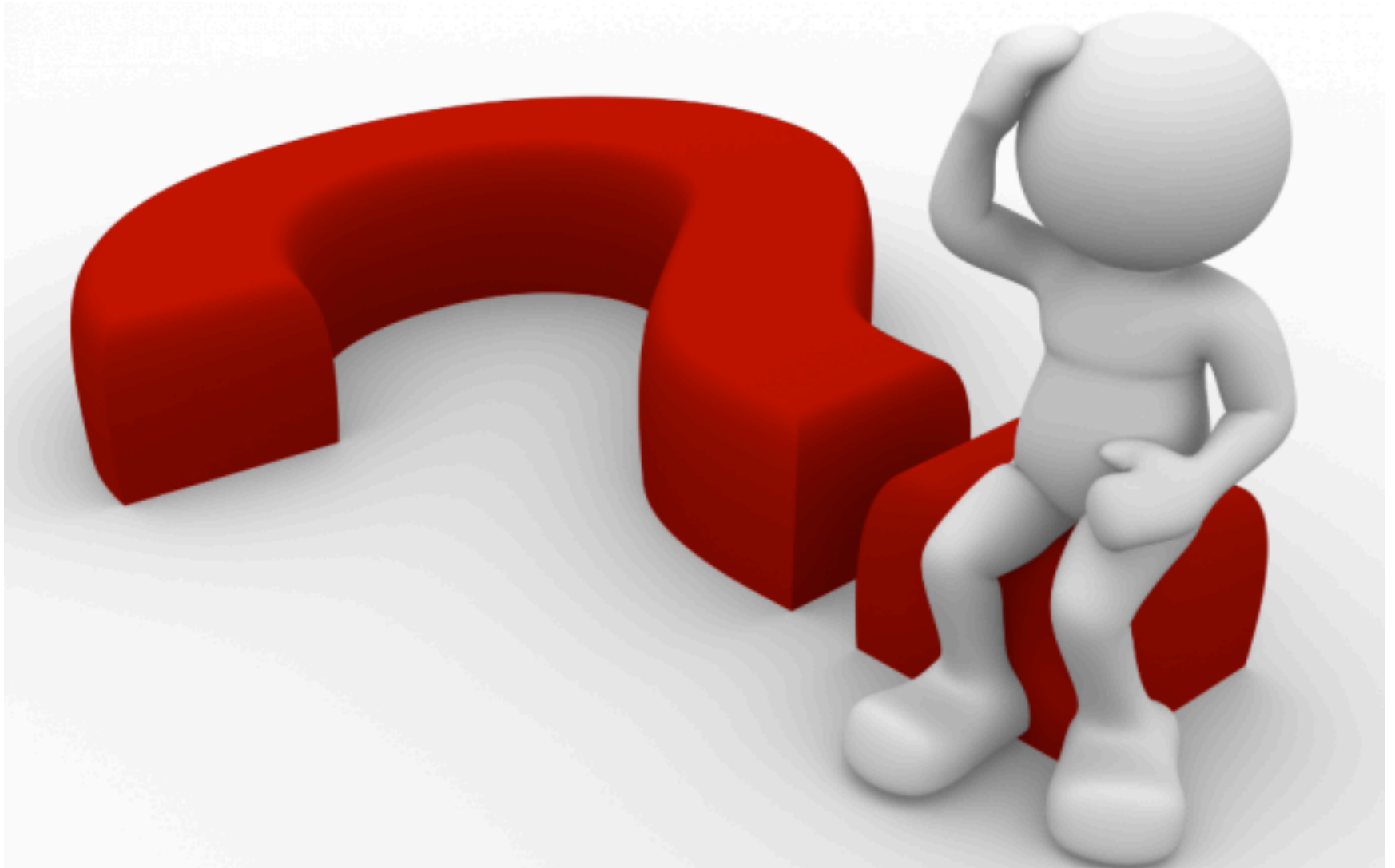
- Spring Boot

- <http://projects.spring.io/spring-boot/>

- Spring Cloud

- <http://projects.spring.io/spring-cloud/>

# Questions & Answers





*Thanks!*

