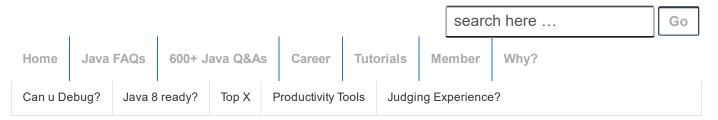
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Home > Interview > Pressed for time? Java/JEE Interview FAQs > Java Application
Architecture Interview Essentials > 04: ♦ How to go about designing a medium
size JEE application?

# **04: ★ How to go about designing a medium size JEE application?**

Posted on May 4, 2015 by Arulkumaran Kumaraswamipillai



A very popular open-ended question to judge your Java/JEE experience.

**Q**. How would you go about designing a medium sized JEE application?

**A**. Don't start with 3-tier architecture, logical layers, Spring/Hibernate framework etc. The phases of designing any systems are:

Requirements Gathering => Baseline Architecture => Design Alternatives & impact analysis => Choice of

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technologies/frameworks/tools etc => Capacity/Infrastructure planning => Logical/physical modelling.

## **#1.** Ask the right questions: Gather functional & non functional requirements

#### Non functional requirements include:

- 1. How many transactions per minute or hour should the system handle?
- 2. How many concurrent users should it handle?
- 3. Where does it get the data from? database, web services, topics/queues, etc. What integration styles are required? Identify the communication protocols and message formats between the client and server.
- 4. Any requirements to externalize business rules?
- 5. Any special security requirements like two factor authentication, two-way SSL, WS-security to encrypt credit card details, etc
- 6. Data retention, auditing, logging, fault tolerance, system monitoring, and disaster recovery requirements.
- 7. Any load balancing and caching requirements.
- 8. Any static resources to be on CDN (Content Delivery Networks) for performace

#### #2. Draw a proposed solution diagram.

You must know the different integration styles and high level architectures like SOA, WOA, MOM, EDA, etc. Identify all the key components of the solution. Describe how each high level requirement is going to be addressed by the overall solution and its components. This is known as the **baseline** architecture.

- What should be a typical Java EE architecture?
- Java/JEE Architectural Patterns with lots of diagrams
- Java/JEE Integration Patterns with lots of diagrams

#### ⊕ Spring, Hibernate, & I

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Each functional and non-functional requirement needs to be mapped to the technical solution. Gaps in requirements need to be identified.

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## #3. Identify the design alternatives, and analyze pros and cons of each alternative.

If you just take technical design alone, there will be many possible design alternatives, and each alternative has its own pros and cons along with likely trade-offs to be made in your design decisions. You will have to list the relevant assumptions, potential risks, likelihood and impacts of those risks to the business. At times, tactical solutions need to be favored over strategical solution due to business demands, budgetary constraints, and time to market. List all design choices and pros and cons for each choice. It is also imperative to not cut corners as a particular choice might look attractive now, but in a longer term require more rework and budget.

So, design is often all about making the informed choices and trade offs. You make the design choices based on the functional and non-functional requirements, budgetary and non-budgetary constraints, environmental and political factors, and collective experience. Your architectural decisions need to adhere to the frameworks, policies and standards in place and need to be approved by the relevant stake holders, architecture review board, superiors, and peers. So, this requires good communication skills both written and oral to convince the relevant stake holders. You need to look at things from both business and technology perspective, and present it based on the target audience without too much technical jargon.

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#### Examples:

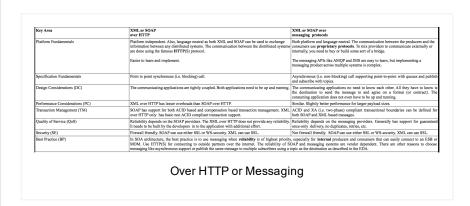
- 1. RESTful web service Vs. SOAP web service
- 2. Web Service Vs. messaging using a MOM
- 3. Build new component, reuse existing, or buy, etc

Look at from different key areas like Transaction Management, Security, Performance, etc. Click on each diagram to enlarge.

#### Example 1: SOAP Vs RESTful

Key Area	SOAP based Web service	RESTful Web service
Specification Platform Fundamentals (SF/PF)	Transport is platform & protocol neutral. Supports multiple protocols like HTTP(S), Messaging, TCP, UDP, SMTP, etc.	Transport is protocol specific. Supports only HTTP or HTTPS protocols.
	Permits only XML data format, hence language neutral.	Permits multiple data formats like XML, JSON data, text, HTML, atom, RSS, etc.
	You define operations, which tunnels through the POST or GET. The focus is on accessing the named operations and exposing the application logic as a service.	Any web browser or HTTP compliant clients like cURL can be used because the REST approach uses the standard GET, PUT, POST, and DELETE web operations. The focus is on accessing the named resources and exposing the data as a service.
	Defines the contract via WSDL.	Traditionally, the big drawback of REST was the lack of contract for the web service. This has changed with WSDL 2.0 defining non SOAP bindings and the emergence of WADL.
		Simpler to implement. REST has Ajax support. It can use the XMLHttpRequest object.
		Good for stateless CRUD (Create, Read, Update, and Delete) operations, which are mapped to HTTP methods POST, GET, PUT, and DELETE respectively.
Performance Consideration (PC)	SOAP based reads cannot be cached. The application that uses SOAP needs to provide cacheing.	REST based reads can be cached. Performs and scales better.
Security (SE)	Supports both SSL security and WS-security, which adds some enterprise security features. Supports identity through intermediaries, not just point to point SSL.	Supports only point-to-point SSL security.
	WS-Security maintains its encryption right up to the point where the request is being processed.  WS-Security allows you to secure parts (e.g. only credit card details) of the message that needs to be secured. Given that encryption/decryption is not a cheap operation, this can be a performance boost for larger messages.	The basic mechanism behind SSL is that the client encrypts all of the requests based on a key retrieved from a third party. When the request is received at the destination, it is decrypted and presented to the service. This means the request is only encrypted while it is traveling between the client and the server. Once it his the server (or a proxy which has a valid certificate), it is decrypted from that moment on.
	It is also possible with WS-Security to secure different parts of the message using different keys or encryption algorithms. This allows separate parts of the message to be read by different people without exposing other, unneeded information.	The SSL encrypts the whole message, whether all of it is sensitive or not.
	SSL security can only be used with HTTP. WS-Security can be used with other protocols like UDP, SMTP, etc.	
Fransaction Management (TM)	Has comprehensive support for both ACID based transaction management for short-lived transactions and compensation based transaction management for long-running transactions. It also supports two-phase commit across distributed resources.	REST supports transactions, but it is neither ACID compliant nor can provide two phase commit across distributed transactional resources as it is limited by its HTTP protocol.
Quality of Service (QoS)	SOAP has success or retry logic built in and provides end-to-end reliability even through SOAP intermediaries.	REST does not have a standard messaging system, and expects clients invoking the service to deal with communication failures by retrying.
Best Practice (BP)	In general, a REST based web service is preferred due to its simplicity, performance, scalabilit hensive support for security, transactional reliability and stricter contract.	ty, and support for multiple data formats. SOAP is favored where service requires compre

#### **Example 2**: HTTP Vs Messaging protocols



#### **Example 3**: Client side Vs Server side mashups

Design Considerations (DC)	Easy to implement if the site you want to mash up with provides a JavaScript library.	Server side mash-up	
	Easy to implement if the site you want to mash up with provides a JavaScript library.	The server area as a buffer between the client and the other applications. This an abded clients from problems in other websits. For example, you can each transform the data treatment into a different format (e.g. XML to JSON), manipulate the data to suit your requirements, etc.	
	It reduces load on the server.		
	The following questions need to be addressed.		
	Q. Can the client directly access the service and content for the mashup?		
	Q. Is the other website stable and perform adequately?		
	Q. Is there too much application logic on the client side?		
	Q. Can the client handle the protocols and the data formats returned by the mashups		
Security (SE)	Q. Can you trust the code and content from another site?	It is much easier to handle security requirements on the server through authen- tication, encryption, and data validation for any malicious characters.	
	You need to assess the risks of these outside additions to your site. For example, bringing in an image or an RSS feed has limited risk because if the content is not available, the browser will handle it with a missing symbol.	induction, energypoint, and dama variation to a may matter-to-be contracted.	
	Q. Is your client request restricted by the browser sandbox security, which is also known as the XMLHttpRequest sandbox?		
	Many mashups use ajax functionality, and to protect against possible security threats, most browsers allow JavaScript code that contains an XMLIRREpeaset no commensation only with the site from which the browser isolated the code. This means, the cross domain calls are restricted. Mret This restriction may be circumvented by loading a JavaScript from your afte, which dynamically generates the script tag that interacts with other domains. Ent, this exposes your site no potential security threats.		
	Research for CORS and JSONP to circumvent this cross domain restriction.		
Performance	The requests and responses are passed directly between the client and the mashup server. Hence receiving a response typically takes less time.	The request and response go through additional hops to the proxy server, which can adversely impact performance.	
	Delays from other websites can frustrate the user and degrade the overall user experience.	You can cache the data returned by the other applications.	
	HTML 5 supports multi-threading with worker threads to improve performance.	You can make concurrent asynchronous calls to many applications at the same time.	
Best Practices (BP)	<ul> <li>Provide adequate input validation to protect from security vulnerabilities like cross site scripting (XSS). Use vulnerability checking tools like Skipfish.</li> </ul>		
	Perform cross browser compatibility test to ensure that it works across different browsers and operating systems. Some mashups may load more slowly on some browsers.		
	<ul> <li>Take notice of the terms of use and legality. Each API typically carries terms of use that specify who can use the content and how it can be used.</li> </ul>		

## #4. Make a decision on technology stack and frameworks to be used

- AngularJS for web tier and Spring/Hibernate for the service and data tiers.
- Git for source control & Jenkins for continuous integration.
- Eclipse or InteliJ IDE for development.
- unit testing, integration testing, and performance testing frameworks & tools. Java/JEE testing frameworks in detail with examples & tutorials
- JBoss application server to run the web services
- and so on list of popular Java/JEE frameworks & tools to jog your memory.

Build a **vertical slice** for a typical use case as a proof of concept for the baseline architecture. Revise and improve on your design in the successive iterations. Here is a typical vertical slice of JEE representing the tiers.

#### **#5.** Infrastructure & Capacity planning

- Infrastructure planning: hosts, servers, operating system, application/web servers, firewall rules, inter zone connectivity, etc
- Capacity planning: physical memory, hard disk space,
   CPU cores, JVM heap sizes, etc

#### #6. Logical & physical modelling

- Identify the data requirements, and come up with logical and physical ER (Entity-Relationship) diagrams. ERD basics interview Q&A
- UML diagrams like class, state chart, sequence,
   deployment, etc. UML Diagrams Basics Interview Q&As

**Note**: If you are designing a low latency application like a trading system, then read up on

- Writing low latency applications in Java Interview Q&A
- 13 Tips to write low latency applications in Java
- Java GC tuning for low latency applications
- Capture throughput & latencies with "Metrics Core" tutorial

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