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Top Java HTTP Client Interview Questions and Comprehensive Answers

Introduction to Java HTTP Client API

Java's `java.net.http` package, introduced in Java 11, revolutionized HTTP communication by providing a modern, efficient API for both synchronous and asynchronous requests. This report delves into the most critical interview questions about `HttpClient`, `HttpRequest`, and `HttpResponse`, offering detailed explanations, code examples, and best practices.

HttpClient: Configuration and Usage

Q1: How do you create and configure an `HttpClient`?

Answer:
The `HttpClient` is created using a builder pattern, allowing customization of protocol versions, timeouts, redirect policies, and proxies. For example:

```
HttpClient client = HttpClient.newBuilder()
    .version(HttpClient.Version.HTTP_2)  // Prefer HTTP/2
    .connectTimeout(Duration.ofSeconds(10))
    .followRedirects(HttpClient.Redirect.NORMAL)
    .proxy(ProxySelector.of(new InetSocketAddress("proxy.example.com", 80)))
    .build();
```

Key configurations include:

- **Protocol Version**: HTTP/2 improves performance through multiplexing and header compression[1] [2].
- **Timeout**: Prevents indefinite blocking during connection establishment[1] [3].
- **Redirect Policy**: Controls automatic redirection handling (e.g., `Redirect.NORMAL` for same-protocol redirects)[1] [4].

Q2: Is `HttpClient` thread-safe?

Answer:
Yes, `HttpClient` is immutable and thread-safe. A single instance can handle multiple concurrent requests efficiently, reducing resource overhead[1] [4].

HttpRequest: Building and Customizing Requests

Q3: How do you construct different HTTP methods (GET, POST, PUT, DELETE)?

Answer:
Use the `HttpRequest.Builder` to specify the method and body (if required):

```
// GET request
HttpRequest getRequest = HttpRequest.newBuilder()
    .uri(URI.create("https://api.example.com/data"))
    .GET()
    .build();

// POST request with JSON body
String jsonBody = "{\"name\":\"John\"}";
HttpRequest postRequest = HttpRequest.newBuilder()
    .uri(URI.create("https://api.example.com/users"))
    .header("Content-Type", "application/json")
    .POST(HttpRequest.BodyPublishers.ofString(jsonBody))
    .build();
```

- **Headers**: Added via `.header(key, value)` [1] [3].
- **Body Handling**: `BodyPublishers` convert data into a sendable format (e.g., strings, files) [3] [5].

Q4: How do you handle timeouts for requests?

Answer:
Set a timeout at the request level to avoid hanging indefinitely:

```
HttpRequest request = HttpRequest.newBuilder()
    .uri(URI.create("https://api.example.com"))
    .timeout(Duration.ofSeconds(15))
    .build();
```

If the timeout expires, an `HttpTimeoutException` is thrown [3] [4].

HttpResponse and Body Handling

Q5: How do you read a response body as a string or JSON?

Answer:
Use `BodyHandlers` to process the response:

```
// Synchronous
HttpResponse<String> response = client.send(request, HttpResponse.BodyHandlers.ofString()
System.out.println(response.body());
```

```
// Asynchronous
client.sendAsync(request, HttpResponse.BodyHandlers.ofString())
    .thenApply(HttpResponse::body)
    .thenAccept(System.out::println);
```

For JSON, use libraries like Jackson with a custom `BodyHandler`:

```
public class JsonBodyHandler<T> implements HttpResponse.BodyHandler<T> {
    private final Class<T> type;
    public JsonBodyHandler(Class<T> type) { this.type = type; }

    @Override
    public HttpResponse.BodySubscriber<T> apply(HttpResponse.ResponseInfo responseInfo) {
        return HttpResponse.BodySubscribers.mapping(
            HttpResponse.BodySubscribers.ofInputStream(),
            inputStream -> {
                try (InputStream stream = inputStream) {
                    ObjectMapper mapper = new ObjectMapper();
                    return mapper.readValue(stream, type);
                } catch (IOException e) {
                    throw new UncheckedIOException(e);
                }
            });
    }
}

// Usage
HttpResponse<User> response = client.send(request, new JsonBodyHandler<>(User.class));
```

This approach streams and parses JSON efficiently[6] [2].

Synchronous vs. Asynchronous Requests

Q6: When should you use synchronous vs. asynchronous requests?

Answer:

- **Synchronous**:
  - Use cases: Simple scripts, CLI tools, or when sequential processing is required.
  - Blocks the thread until the response is received.

```
HttpResponse<String> response = client.send(request, BodyHandlers.ofString());
```

- **Asynchronous**:
  - Use cases: GUI applications, microservices handling concurrent requests.
  - Returns a `CompletableFuture` to avoid blocking:

```
client.sendAsync(request, BodyHandlers.ofString())
    .thenApply(HttpResponse::body)
    .thenAccept(body -> updateUI(body))
    .exceptionally(ex -> { log.error(ex); return null; });
```

Advantages:

- Better resource utilization (non-blocking I/O)[7] [2].
- Scalability for high-throughput applications[6] [8].

Q7: How do you handle errors in asynchronous requests?

Answer:
Use `CompletableFuture`'s error-handling methods:

```
client.sendAsync(request, BodyHandlers.ofString())
    .thenApply(response -> {
        if (response.statusCode() >= 400) {
            throw new RuntimeException("HTTP error: " + response.statusCode());
        }
        return response.body();
    })
    .thenAccept(System.out::println)
    .exceptionally(ex -> {
        System.err.println("Request failed: " + ex.getCause().getMessage());
        return null;
    });
```

- **Key Points**:
  - Check status codes for HTTP errors (e.g., 404, 500)[9] [4].
  - Use `exceptionally()` to handle exceptions during request/response[9] [8].

Advanced Topics

Q8: How do you send multipart/form-data or URL-encoded form data?

Answer:
For URL-encoded forms:

```
Map<Object, Object> data = Map.of("username", "john", "password", "secret");
String form = data.entrySet().stream()
    .map(e -> URLEncoder.encode(e.getKey().toString(), StandardCharsets.UTF_8) +
             "=" + URLEncoder.encode(e.getValue().toString(), StandardCharsets.UTF_8))
    .collect(Collectors.joining("&"));

HttpRequest request = HttpRequest.newBuilder()
    .header("Content-Type", "application/x-www-form-urlencoded")
    .POST(BodyPublishers.ofString(form))
```

```
    .uri(URI.create("https://api.example.com/login"))
    .build();
```

For multipart forms, use `BodyPublishers.ofByteArrays()` with boundaries[3] [5].

Q9: How do you track download progress for large files?

Answer:
Implement a custom `BodySubscriber` to monitor bytes received:

```
public class ProgressBodySubscriber implements HttpResponse.BodySubscriber<Void> {
    private final Path outputPath;
    private final Consumer<Long> progressCallback;
    private volatile long bytesReceived = 0;

    public ProgressBodySubscriber(Path outputPath, Consumer<Long> progressCallback) {
        this.outputPath = outputPath;
        this.progressCallback = progressCallback;
    }

    @Override
    public CompletionStage<Void> getBody() {
        return CompletableFuture.completedFuture(null);
    }

    @Override
    public void onSubscribe(Flow.Subscription subscription) {
        subscription.request(Long.MAX_VALUE);
    }

    @Override
    public void onNext(List<ByteBuffer> buffers) {
        bytesReceived += buffers.stream().mapToInt(ByteBuffer::remaining).sum();
        progressCallback.accept(bytesReceived);
        // Write buffers to file...
    }
}

// Usage
HttpRequest request = HttpRequest.newBuilder()
    .uri(URI.create("https://example.com/large-file.zip"))
    .build();

HttpResponse<Void> response = client.send(request,
    responseInfo -> new ProgressBodySubscriber(Paths.get("file.zip"), bytes -> {
        System.out.println("Downloaded: " + bytes + " bytes");
    }));
```

This approach updates the UI or logs progress periodically[10].

Conclusion

The `java.net.http` package provides a robust, modern API for HTTP communication, supporting both synchronous and asynchronous paradigms. Key takeaways include:

1. **Reuse Clients**: `HttpClient` instances are thread-safe and optimized for reuse[1] [4].
2. **Async for Scalability**: Prefer asynchronous requests for non-blocking I/O in high-concurrency apps[7] [8].
3. **Error Handling**: Always check status codes and handle exceptions gracefully[9] [4].
4. **Customization**: Use `BodyHandler` and `BodySubscriber` to process responses efficiently[2] [10].

Mastering these concepts ensures efficient, maintainable HTTP interactions in Java applications.

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1. https://docs.oracle.com/en/java/javase/11/docs/api/java.net.http/java/net/http/HttpClient.html
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