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Performance Testing

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Agenda

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- What is performance testing?
- Types of performance testing
- What does performance testing measure?
- Where does performance testing measure?
- Performance testing methodology
- (Common) Causes of performance problems

What is performance testing?

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- Testing designed and executed to determine how a system performs in terms of **responsiveness** and **stability** under a particular **workload** ref. 2
- Investigate, measure, validate or verify:
  - Scalability
  - Reliability
  - Resource usage

Types of Performance Testing

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- **Load testing**
  - Conducted to understand the behaviour of the system under a specific expected load and identify performance bottlenecks
- **Stress testing**
  - Used to understand the upper limits of capacity within the system. Identifies the breaking point of an application
- **Soak (endurance) testing**
  - Determine if the system can sustain the continuous expected load (looks for memory leaks and performance degradation)
- **Spike testing**
  - Done by suddenly increasing the number of or load generated by, users by a very large amount
- **Configuration testing**
  - Executed in order to determine the effects of configuration changes in the performance of the system (does not measure how good or bad is the performance itself)

What does performance testing measure?

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- It depends on the type of test
- Concurrency/throughput
  - number of concurrent users or number of transactions
- Server response time
  - most commonly used. Measures time taken for one node of the system to answer the request of another
- Render response time
  - Difficult to deal with.
  - Most load testing tools do not support measurements of what happens inside a client node.
  - Use functional test scripts to perform measurements.
- Functional testing under load
  - Looking for functional defects that only reveal themselves under load
  - Disaster recovery under load

Common Performance Problems

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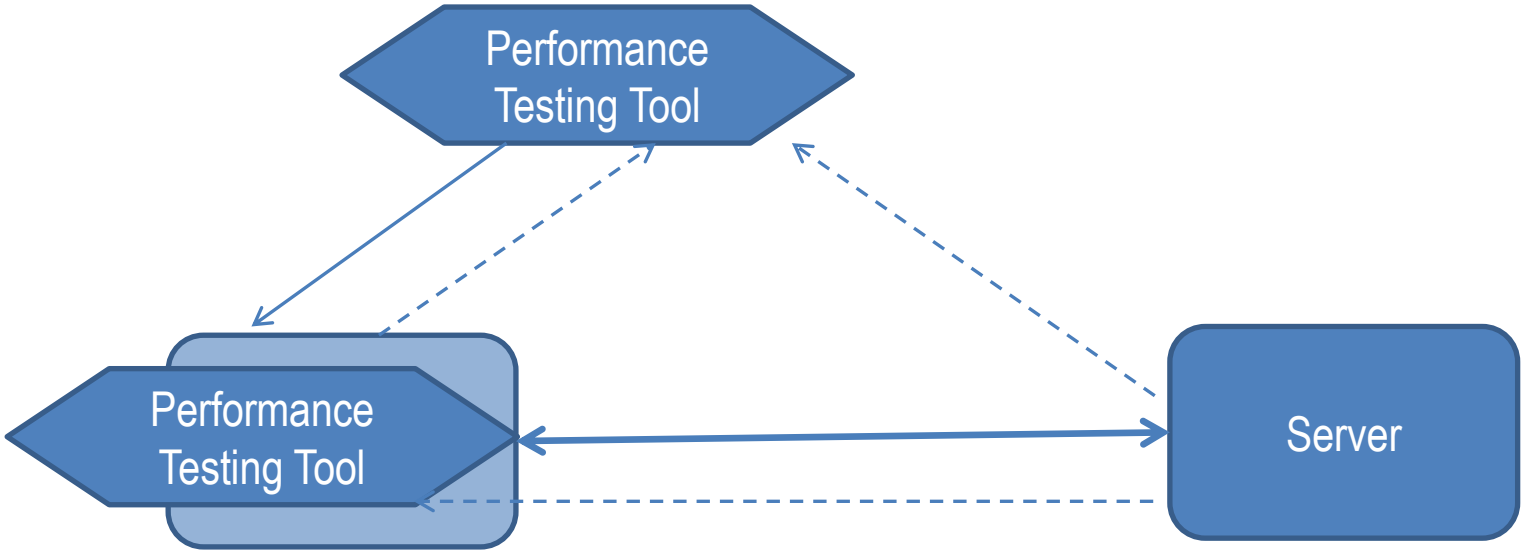
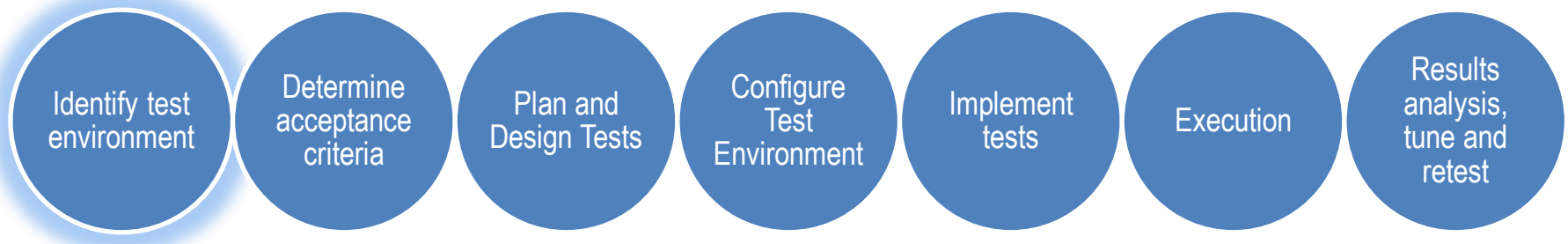
- Long loading times
- Poor response times
- Poor scalability
- Bottlenecking (degradation of system performance under certain conditions)
  - CPU utilisation
  - Memory utilisation
  - Network utilisation
  - Disk usage
  - Server(s) configuration (e.g. maximum number of connections)

Where does performance testing measure?

- It depends on what the objective of the test is
  - What do we want to measure?
- Some metrics need to be done at the client side. Some at the server (node) side.

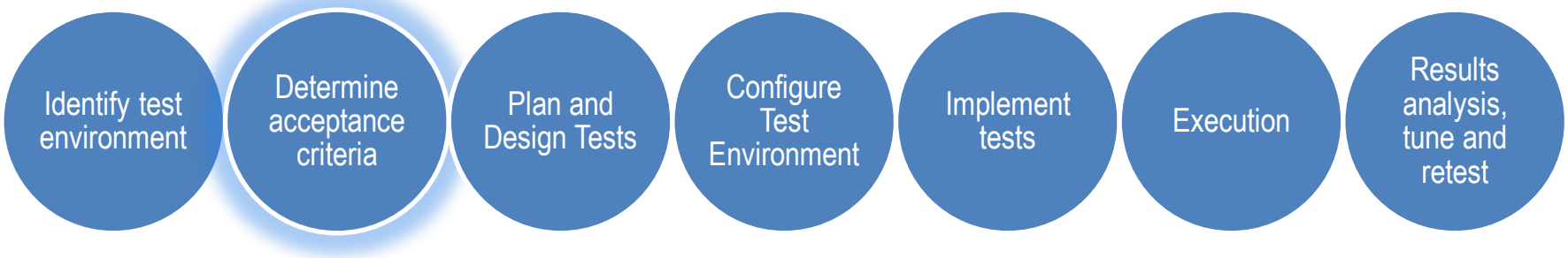


Methodology



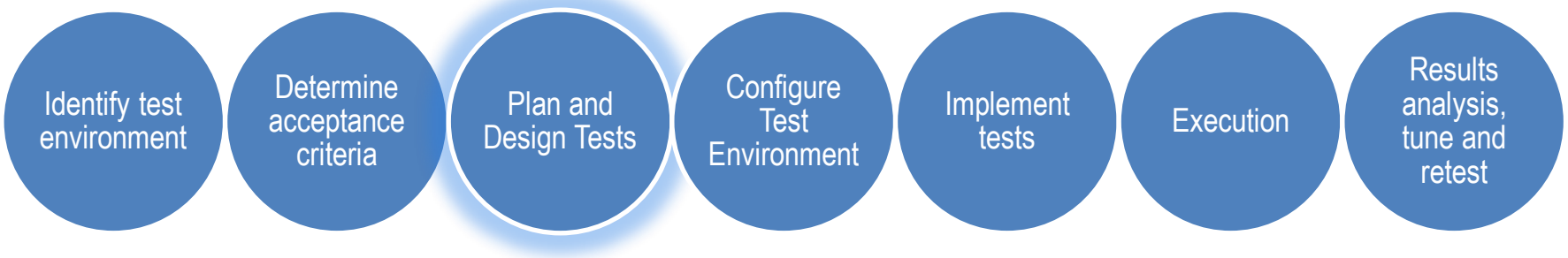
- Identify what (in a general sense) needs to be tested.
- Identify (and understand) the production environment, the test environment and their differences
- Identify available testing tools
- Decide whether to use internal or external resources

Methodology



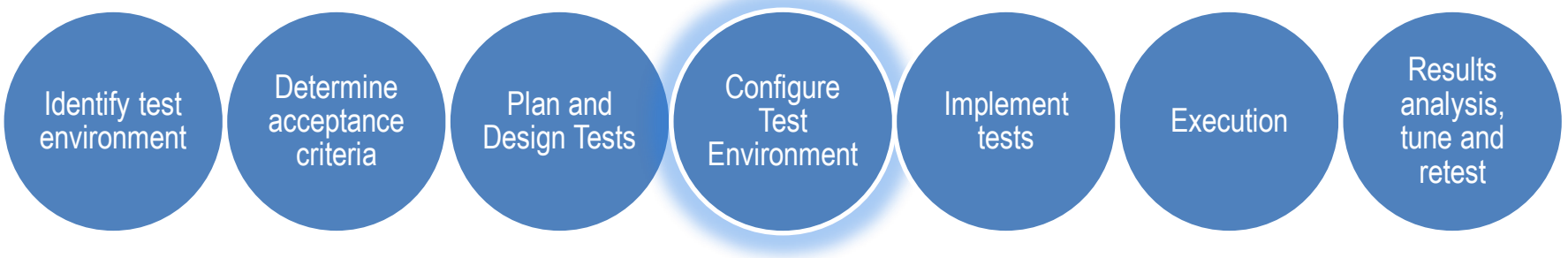
- Identify goals and constraints
  - Throughput, response times and resource allocation
- Identify other success criteria (e.g. identify the best configuration of the server among several alternatives)

Methodology



- Identify key scenarios, users and their variability (e.g. 10% of the users visit the website as guests, 50% log in as registered customers to view account balance, 40% perform another operation)
  - Where possible this needs to be “mined” from production data
- Define test data
- Establish metrics to be collected (what and where)
- Model the system to fulfil your requirements

Methodology



- Make sure network access is adequate
  - Firewall, proxies (could lock user account, interfere in response time measurements)
- Identify external elements that need to be stubbed or mocked
  - There are several external providers that will not be happy to be flooded with requests
  - Worst, you can get down someone's environment
  - If using data such as email addresses make sure to know what the system is going to do with that

Methodology

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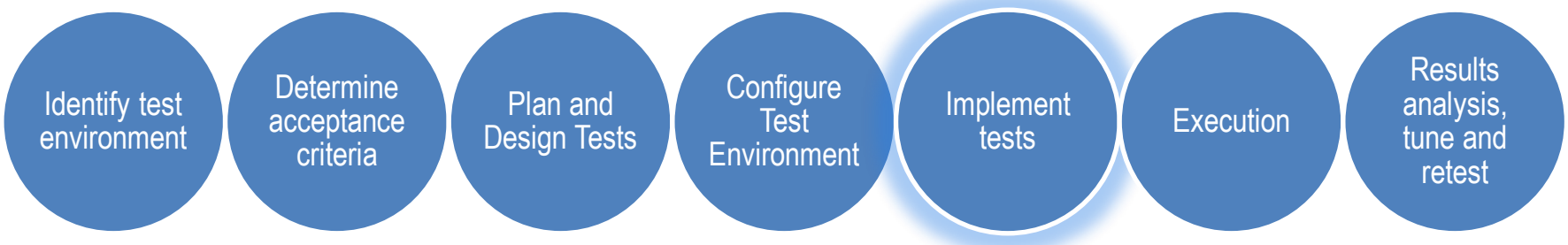
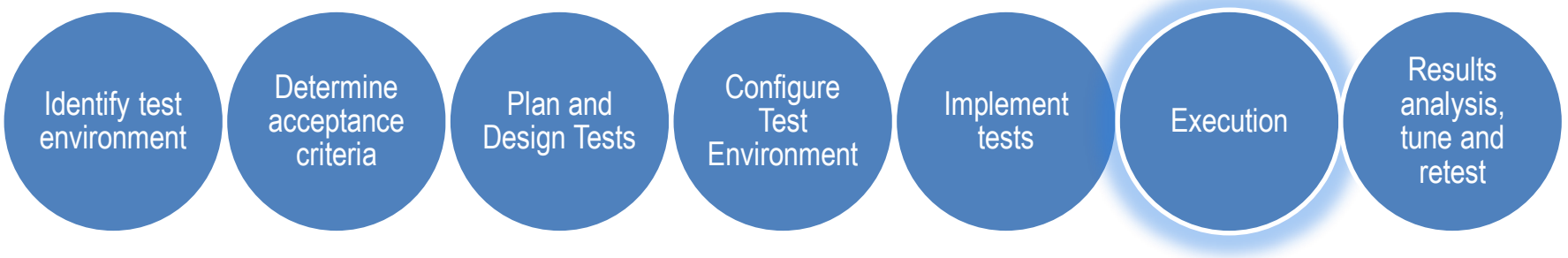


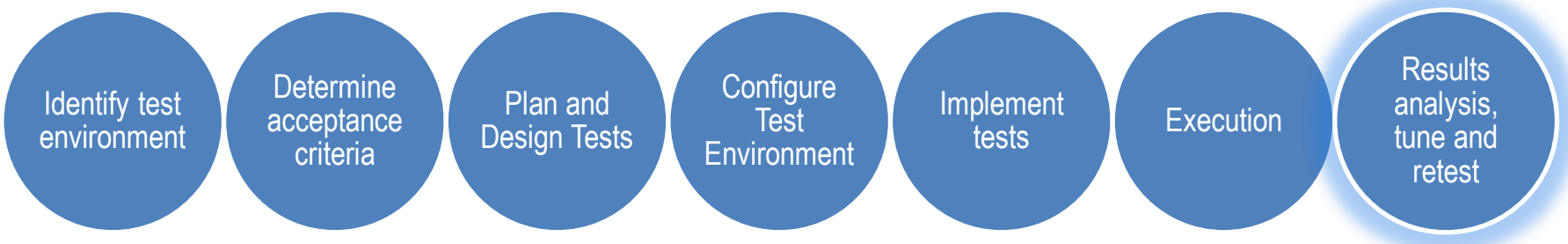
- Write performance test scripts (record and customise scenarios)
- Make sure external elements (needed) are stubbed or mocked
  - Sometimes there are external elements that can just be ignored – make sure you do so

Methodology



- Validate the tests, test data, and results collection (dry run of test scripts)
- Run and monitor
  - If the test tool is not capable of taking metrics on the server side, make sure you have alternative methods – Nagios, nmon analyser…
- Sometimes a single run is not advisable.
  - Three executions is a standard practice

Methodology



- Analyse, consolidate and share results data
  - Work together with System's Architects to define meaning of the results

Causes of performance problems

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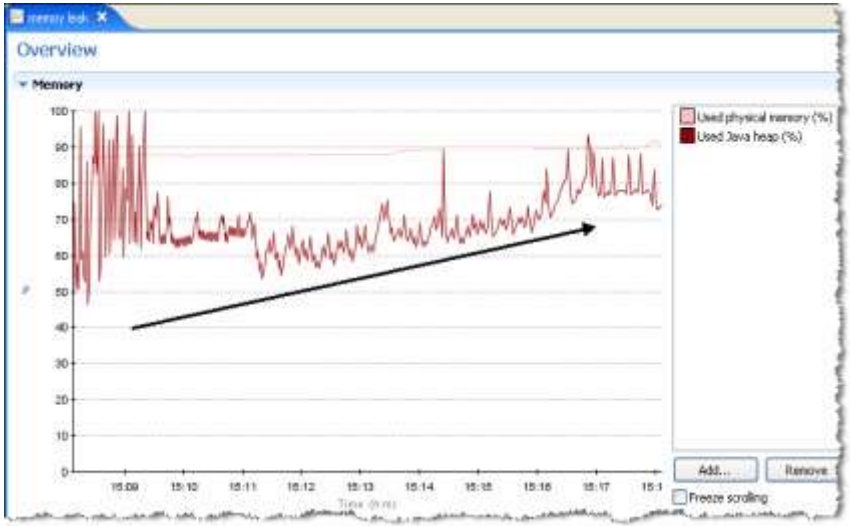
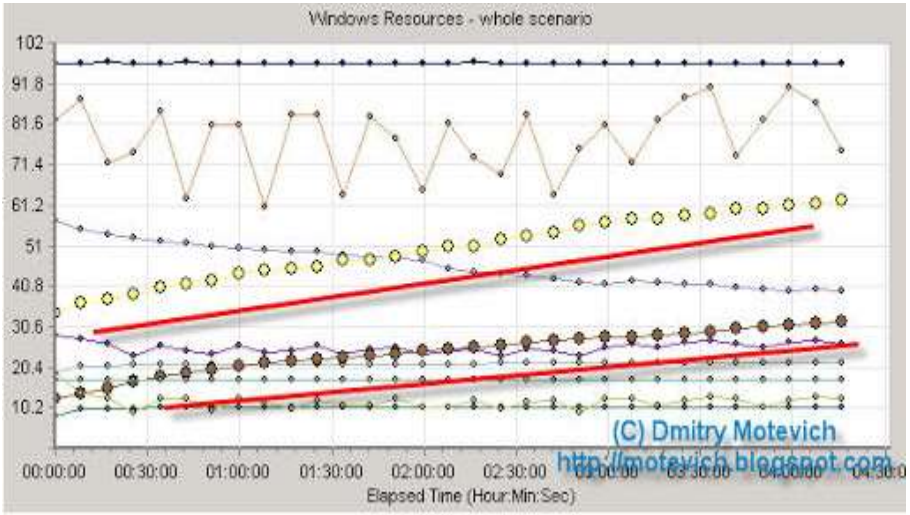
- Functional defects that appear only under load
- Memory Leaks
- Servers not capable of handling all required processing
- Limitations on the network bandwidth

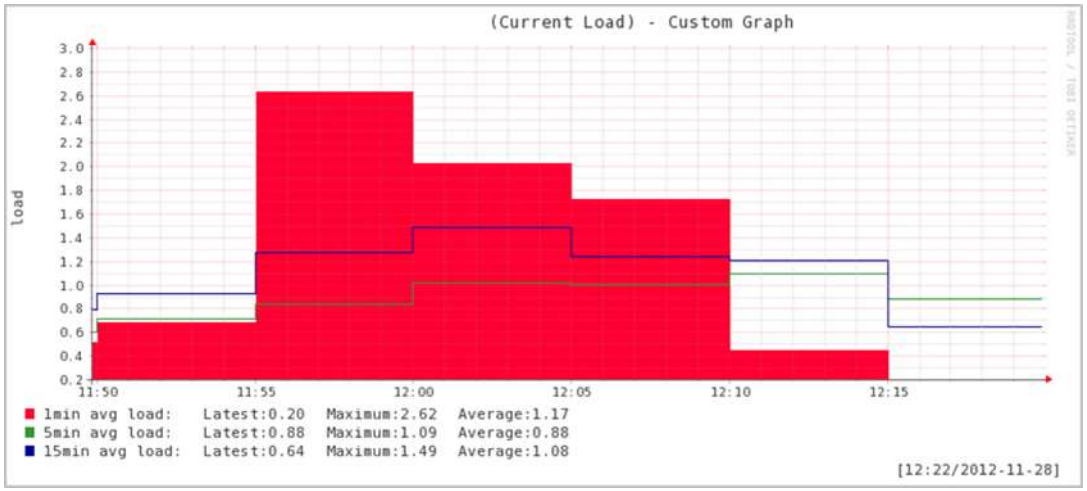
What does a mem leak look like

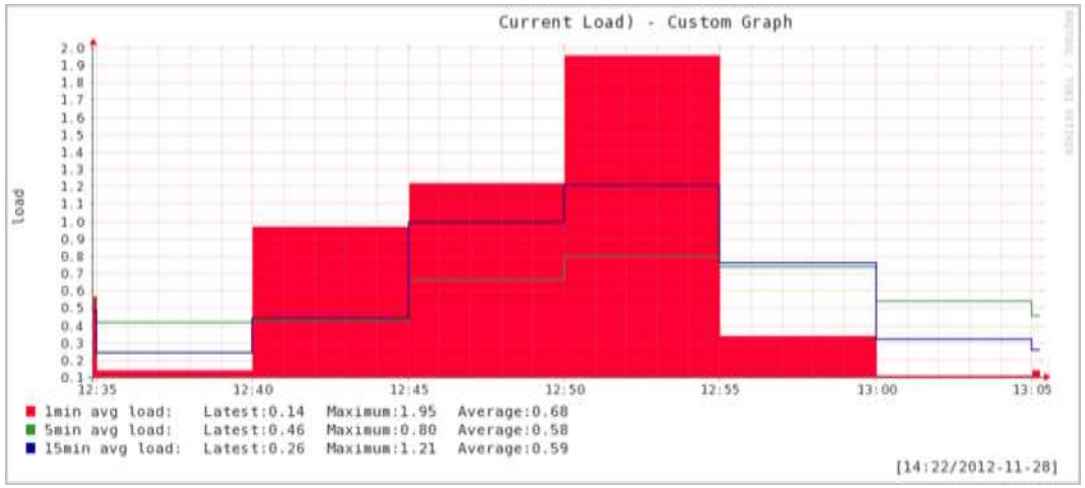




- Look for up trends in Memory Usage and/or Handle Counts
- Keep in mind that peaks can be normal as long as there is a pattern that bring them down.
  - Java (and most Web Servers) will run Garbage Collection every hour or half an hour.
  - Make sure you run your load enough time to identify the pattern.
- **TIP**: When targeting to reveal memory leaks focus on error handling scenarios.

How to interpret Server load





How to calculate load

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	HomePage	BestFares	FlightSearch	HolidaySearch	Total			Time per trans (sec)
Trans./hour	13292	4706	18165	725	36888			4
% trans per hour	36.03	12.76	49.24	1.97	100.00			
Trans per min	221.53333	78.43333333	302.75	12.08333333	614.8			
Trans per second	3.6922222	1.307222222	5.045833333	0.201388889	10.24667			
Concurrent users	15	5	20	1	41			
Size trans (Kbytes)	125	200	750	750				
Traffic (Kbytes/sec)	461.52778	261.4444444	3784.375	151.0416667	4658.389			

- To measure traffic is important especially if your load injector is on a different network segment.
- Do not exceed the maximum bandwidth of your network.

FrontEnd Performance Testing

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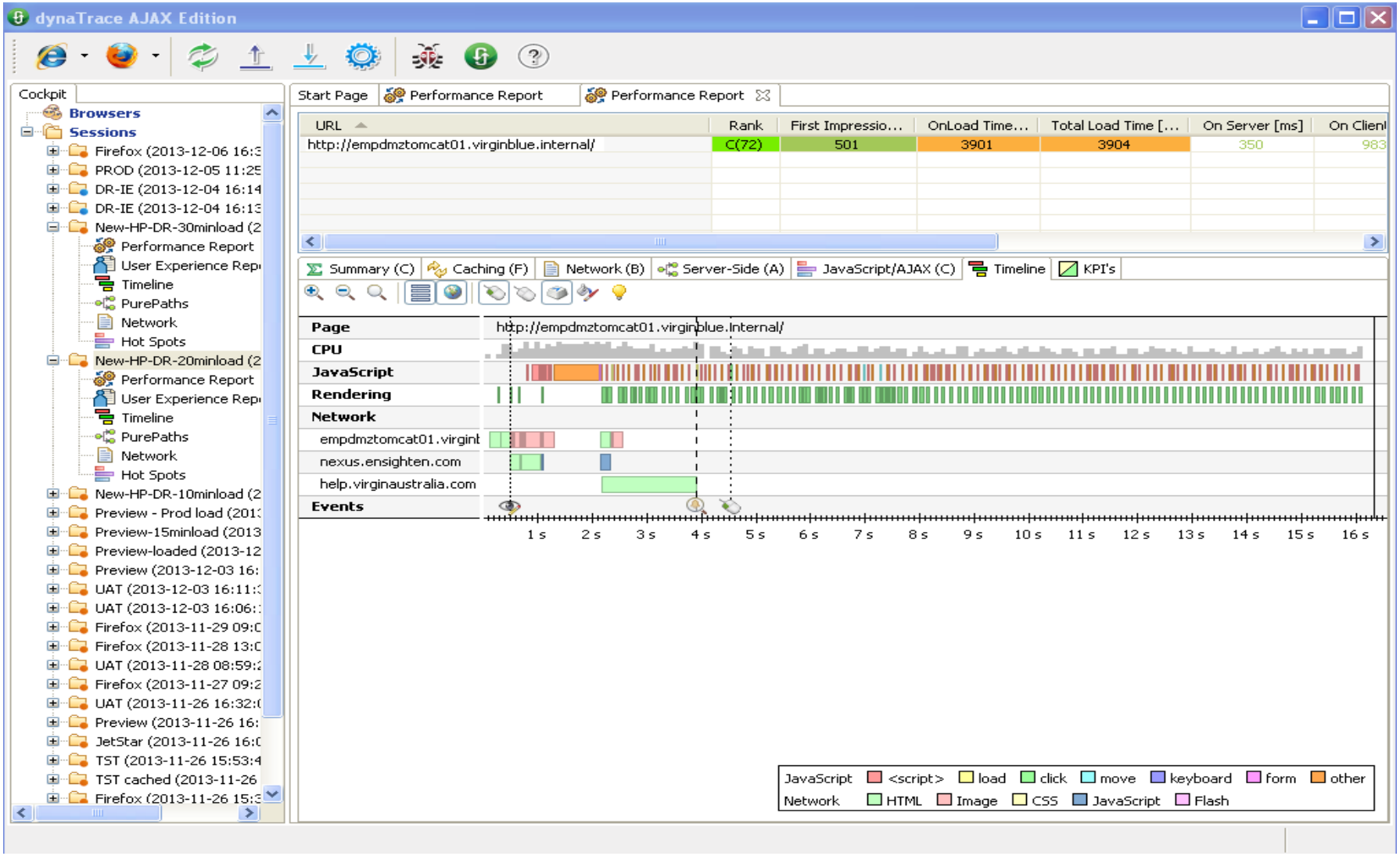
- Focus on user perceived performance (as opposed to server performance and resource utilisation)
  - Rendering times
  - Loading times / network timing
- Load injection used to simulate real usage scenarios
- No one tool performs load injection and measures performance at the user level
- JMeter combined with Dynatrace Ajax Edition (Compuware)
- Also use developer tools embedded in Chrome/Firefox

Dynatrace report



Questions

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- Can performance testing disregard functional verification?
- Degradation of performance is lineal so we can easily predict results of high loads using low loads, right?
- How do you measure page response times traditionally? Does it match what the user experiences?
- … now your questions!!!

References

1. Oracle Jrockit Mission Control – Manual
2. Wikipedia
   - http://en.wikipedia.org/wiki/Software_performance_testing
3. http://motevich.blogspot.com
4. (some experience)