LIGHTS IN LINE

How *Lights In Line AB* can help increase the

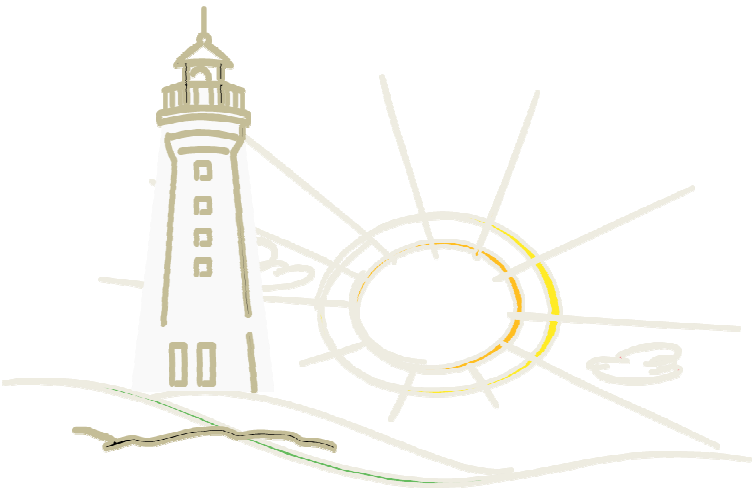
Availability

and reduce the

Response Times

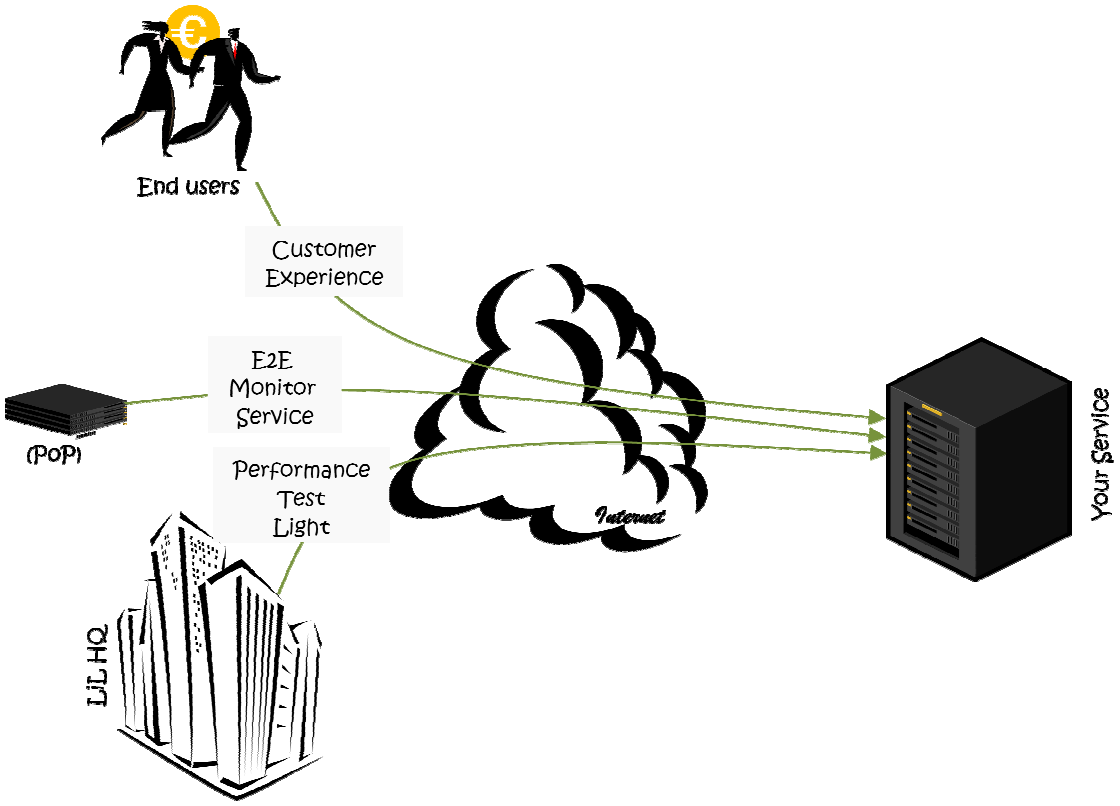
of

Your Website



Lights In Line

Content



LIGHTS IN LINE

Your web site offers a great service, You've designed an excellent User Interface; Time to make business. But…If response times are unacceptable and/or the site is down too often you're not perceived as available.

LIGHTS IN LINE, have for many years helped our customers to implement and manage processes which increase their availability. In fact, our business idea is: "Support our customers by assuring the quality of their IT-systems in regards to performance architecture and stability".

Services in the areas of availability analysis and performance testing/optimization have been developed during the last years in cooperation with our customers. Through these services Your chances of high availability are greatly increased.

Advantages :

- Fixed, low price
- Quick startup
- Fast results

E2E Monitor Service

Our E2E service monitors the availability of your site/service from the *end-user* perspective. We take the full responsibility for the monitor service, e.g. set-up, management and reporting are included in the fixed monthly cost. No need for You to invest time or money for equipment.

Options :
After three months (minimum contract time) You may choose to…

- Continue to run the E2E Monitor Service with your own resources. This is possible since the solution is based on Open Source code, plus 3rd party components. *Lights In Line* may also support in the transfer.
- Let *Lights In Line* continue to manage the service.

Performance Test Light

The service includes *Lights In Line* performing a set of basic performance tests (according to our proved working method) on your web site, either on the production site or on your test site. All is done in a controlled fashion, and there is no need for you to invest in new expensive equipment.

Options :
After the report, you may decide …

- That you have enough information for the moment and finish testing.
- That the tests have revealed areas that need deeper analysis and continued testing.

LIGHTS IN LINE

E2E Monitor Service

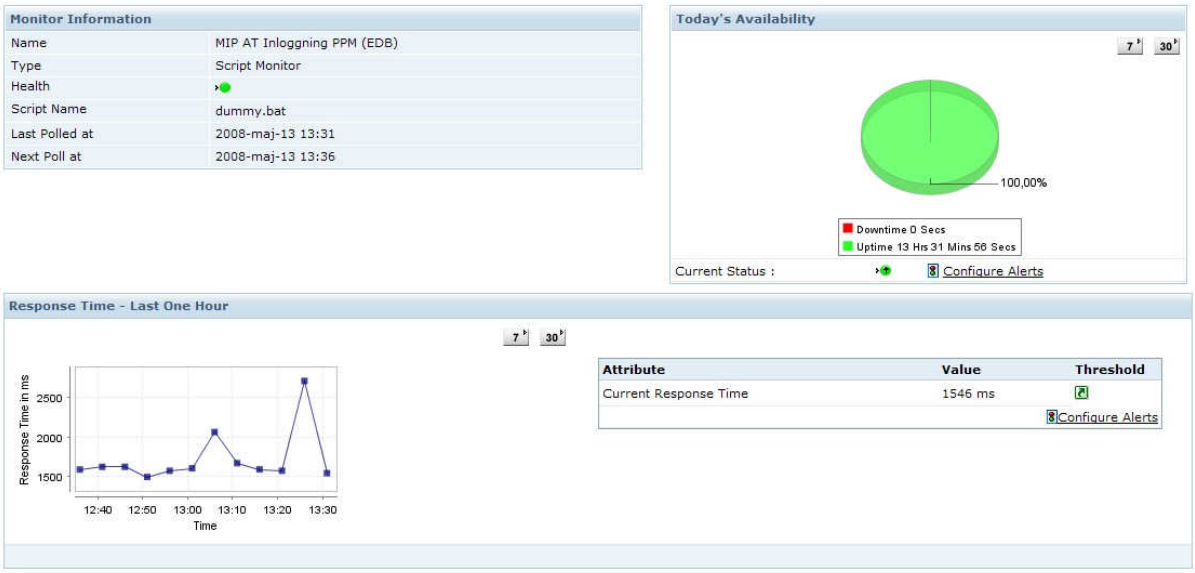
Traditional management systems monitors the physical resources of the server park.

We add the possibility to look at the web system from the end users perspective. Thus we can observe not only that for instance a server is working, but also that the *application*, from end-to-end, works as required and delivers the expected result in appropriate time.

We use the results of the monitoring to identify the times when the system is heavily used, and how response times are affected. We gain the opportunity to work proactively and perform necessary changes in the application before the end-user is affected.

We provide the monitoring equipment, software, documentation of the use cases, scripting and summary reports. Meetings, adjustment of the scripts, change/improvement suggestions and further measures are included by default.

Example of Availability and Response Time graphs :



E2E Monitor Service – Starting Prices (price per month)

3-month contract 13.000 SEK + vat (when applicable).

12-month contract 10.000 SEK + vat (when applicable).

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Performance Testing Light

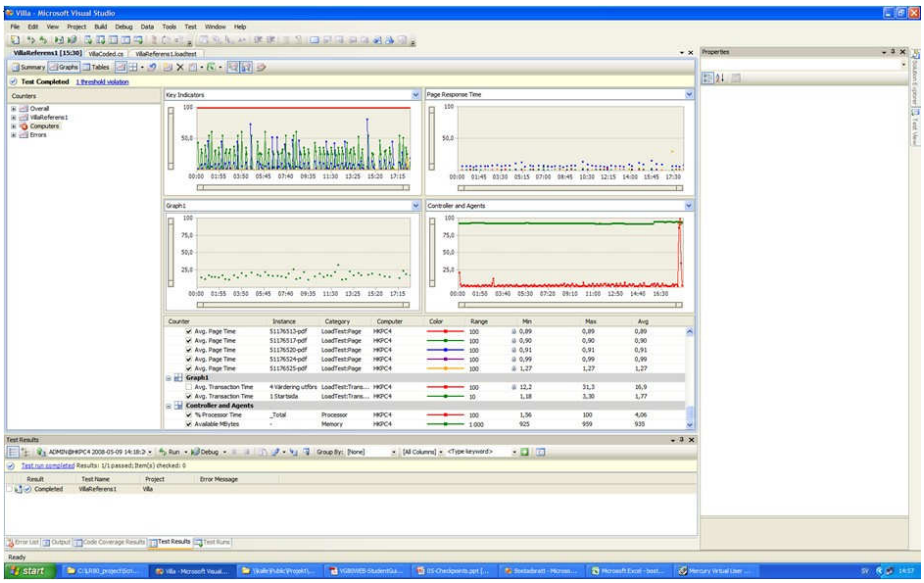
Know Thou Limitations ! (or at least your Web Performance…)

Questions: Is my system fast enough ? How many simultaneous users does it support[1] ? Do I have enough HW capacity, or maybe too much ? How will it cope as I get more customers ? Where are the bottlenecks ? Answer : Call *Lights In Line* !

We now offer a ”lighter” version of our performance testing and consulting service. During the low-use hours of your web solution (or on your testing site), we perform a set of performance tests aimed at providing a starting point for further decisions.

The tests are done online via the Internet towards the Customer website. The offer includes one use-case with a maximum of 10 “steps”. We have the possibility to test at speeds up to 1 Gbps. The tools we use include Microsoft Visual Studio Team System - test edition, HTTP analyzer and Wireshark.

Results from a test run with Microsoft’s Team System



Included :

Assignment specification, use-case specification, response time analysis light, scripting of use-case, load-test, preliminary report meeting, performance report light.

The performance report includes response time analysis light, baseline tests (one user), load test with multiple users, and more.

Price :

15 000 – 25 000 SEK + vat (when applicable) depending on extent of tests

[1] Obviously depends on what the user is doing…

LIGHTS IN LINE

Company Presentation

When Your company makes business on the Internet, the availability of your website is of the highest priority. Even the shortest break or period of bad response times may be disastrous; suddenly your customers may have left for someplace else..

For many companies, web services is the main source of new market shares and increased revenue. The examples are plentiful and both banking, airline tickets as well as consumer products are sold today over the 'net. Having a well functioning web service, always available for business then becomes of the highest priority for the management.

"Business Idea: To support our customers by assuring the quality of their IT-systems in regards to performance architecture and stability. This is accomplished by converting our customers goals into measurable goals, verifying them and providing well documented conclusions, and recommendations, and in some cases direct rectification of the infrastructure"

Lights In Line is a leading edge company with full focus on availability and technical quality, with the ability to identify problem areas in your web services before your end-users call to let you know. As always it is better to know where problems may appear before they happen, right ?

….and how can Lights In Line help You with this ?

AVAILABILITY ANALYSIS & RESPONSE TIME MEASUREMENTS is the first step towards increased awareness of how your web services works, as seen from the end-users perspective. This may be the warning signal that that either confirms that all is well, or indicates the need for rectifications, big or small. If there is a need for continuous monitoring, you may outsource this function completely to *Lights In Line* which then will monitor the availability of your service.

TOOLS & SOFTWARE – with the analysis methods of *Lights In Line* and our wide competence within monitoring and load testing, we can help you identify the tools best suited for your company and needs.

PERFORMANCE TESTING & OPTIMISATION implies that *Lights In Line* with efficient methods and long experience technically verifies your web services. *Lights In Line* performs stability-, scalability- and risk testing and analysis, including technical drill downs to verify that the entire system is up to the task.

CONSULTING & ADVICE – *Lights In Line* offers advanced expert competence and change support for your business critical systems. *Lights In Line* documents the basis for decision and designs the processes for testing and optimization required to perform your IT project with the highest quality and security.

EDUCATION – *Lights In Line* also offers customer adapted training and workshops within all our areas of expertise, and for our dedicated test tools.

LIGHTS IN LINE

Management Team

Bo Svensson, founder and President of *Lights In Line*, has extensive experience in managing testing and quality assurance:

"*With multi-year experience working as IT-director and technical project manager in public-, commercial-, industrial-, and IT consulting organizations I understand the need for early and frequent quality assurance and performance testing. Based on my experience I have defined a set of effective methods within this area, and through Lights In Line these are now available to our customers*".

E-mail: bo.svensson@lightsinline.se

Christian Gerdes, founder and Vice President of *Lights In Line*, has experience including :

- 14 years developer experience with Internet technologies
- 10 years consultancy and project management work experience within IT
- 8 years experience with performance testing and optimization
- HP (Mercury) LoadRunner Certified Product Consultat (CPC)
- Certified Software QA Specialist

Mr. Gerdes is currently Chairman of the HP User Group Sweden (HUGS).
(Covering HP Software products for Testing, QA, Surveillance and Operations)

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LIGHTS IN LINE

EXAMPLE COMPANY
Performance Test Light
Report

LIGHTS IN LINE AB
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info@lightsinline.se

Content

1 Summary

1.1 Background

During the last couple of weeks the number of login attempts to the portal of Example Company (EC) has increased with a factor of four (4), and is now at a level of 200+ unique visitors during peak hour. On April 16th, the peak hour load was 290 logins (each unique visitor corresponds to 1.4 logins).

Using "AdminTools" (measures response time from production data) and the E2E Monitor Service (automated response time measurements), EC has noticed that there is a correspondance between response time and the number of logins/s.

Since there are a number of other services running on the servers simultaneously, it is difficult to establish the exact relation between the throughput (logins/s) and response time.

1.2 Task

Question: Can Example Company handle a five times increase of peak hour traffic (1000 logins/h) with acceptable response times, i.e. less than 10 s. for the use case "Login" ?

The Use Case "Login" must consist of the same steps that are currently monitored by the E2E Monitor Service, i.e.

1. Open start page www.examplecompany.com
2. Go to Login page
3. Login (use "Profile 2")
4. Logout

1.3 Result

1.3.1 Implementation

The performance test were carried out with the following steps :

- Definition of the use cases
- Response time analysis
- Create scripts for load tests
- Reference test ("base line") towards the production environment (15:30 2008-04-10)
- Verifying load test towards the production environment, non-destructible (10:40-11:21 2008-04-21)

1.3.2 Performance, Use case "Login"

During the test, the system under test (SUT) was monitored by service technicians at EC (see table below). The following data was measured:

VU	Throughput (/s)	Response time (s)	Feedback EC technician
1	0,25	4,06	"all is well"
2	0,51	3,93	"CPU = 25%"
3	0,73	4,11	"CPU < 30%, with peaks"
4	0,77	5,17	"CPU < 30%, with peak up to 90%"

VU = Virtual User, Response time = for use case "Login", CPU = CPU on the web server, other servers not affected.

The highest measured throughput was 0,77 use case "Login"/s = 2772 per hour, with a response time of 5 sec.

1.3.3 Other observations

A number of failed tests were noted, up to 1% of the logins failed, during the highest load. The error was of the type "http error 500 – InternalServerError".

While being observed by the EC service technician, the CPU load of the web server "jumped" up to 60-70%, once a minute, for the duration of 5 – 10 s. This happened independently of the load test. When this happened during a load test, the CPU load increased to 90%, and the response times increased significantly.

During the test, the background load from real users were unusually high, due to the market situation.

1.4 Conclusion

The intent of the test was to find out whether the web service of Example Company could handle a five times increase (1000/h) if peak hour traffic with acceptable response times, i.e. less than 10 s. for the use case "Login".

The answer is that a throughput corresponding to 2772/h is reached with a response time of a little more than 5 seconds, this with a background load of approximately 300 more per hour. Higher loads were not tested, not to disturb the production environment.

The performance goals are achieved with a good margin.

It is recommended that the "jumping" CPU usage of the web server is investigated further.

2 Results

2.1 Response time analysis – Profile 1

A response time analysis (see appendix – terms) was made from a workstation at LiLHQ directly towards the production environment (http://www.examplecompany.com). The measurement was made for a user with "Profile 1".

Results:

Step	TVS (s)	WS (ms)	HTTP Req	Rec packets	Rec (kB)	B/p	Sent packets	Sent kB	Sent B/p
1	1	652	10	234	240	1029	187	20,6	293
2	1	156	1	63	78	1233	46	6,8	149
3	5	5400	*	122	147	1287	82	17,7	216
4	2	1470	*	152	198	1303	102	16	158
Sum		7678	11	571	663		417	61,1	

Explanation: TVS, WS etc. see appendix. For step 3,4 http Request cannot be observed due to encrypted traffic.

2.2 Response time analysis – Profile 2

A response time analysis (see appendix – terms) was made from a workstation at LiLHQ directly towards the production environment (http://www.examplecompany.com). The measurement was made for a user with "Profile 2".

Results :

Step	TVS (s)	WS (ms)	HTTP Req	Rec packets	Rec (kB)	B/p	Sent packets	Sent kB	Sent B/p
1	1	1012	10	233	244	1049	184	21	117
2	1	344	1	63	78	1242	49	7	143
3	3	2351	*	120	155	1296	78	17	222
4	1	963	*	156	202	1299	103	16	162
Sum	6	4670	11	572	679		414	61	

Profile 1 has a considerably longer login time than Profile 2.

2.3 Load test – reference (Login "Profile 1")

A reference test was performed from a workstation at LiLHQ directly towards the production environment (http://www.examplecompany.com).

This implies that the load level was set to one "VU", using "think times", i.e. a low load is used the achieve "lowest possible" response time.

As can be observed, the step "Login" is the slowest.

Step in use case	Use case	Response time (sec)	Elapsed Time (sec)
1 Start page	”Login”	0,55	3,56
2 Login page	”Login”	0,036	3,05
3 Login	”Login”	**2,64**	5,77
4 Logout/return to startpage	”Login”	0,55	0,55
Sum		3,78	12,93

”Elapsed Time” includes ”think times” (total of 9 s)

2.4 Load test – reference (Login ”Profile 2”)

A reference test was performed from a workstation at LiLHQ directly towards the production environment (http://www.examplecompany.com).

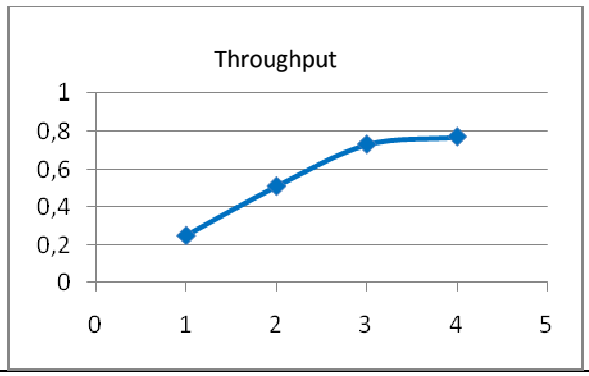
It was observed that the step “Login” consumes twice the time as compared to Profile 1.

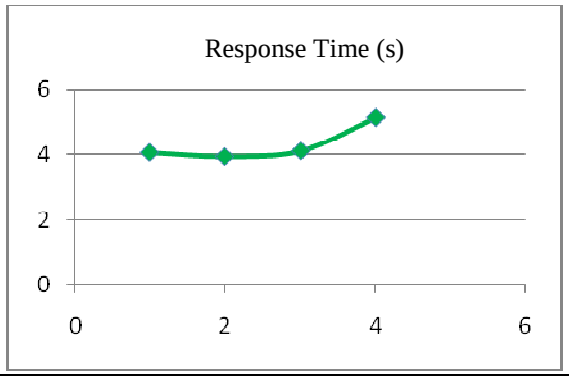
Step in use case	Use case	Response time (sec)	Elapsed Time (sec)
1 Start page	”Login”	0,55	3,56
2 Login page	”Login”	0,038	3,05
3 Login	”Login”	**5,49**	9,7
4 Logout/return to startpage	”Login”	1,74	1,74
Sum		7,82	18,05

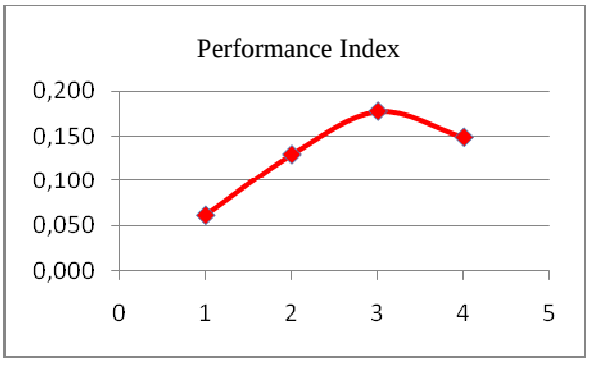
2.5 Load test - Verification

A load test was performed from a workstation at LiL HQ directly towards the production environment including 4 test runs with 1,2,3 and 4 VUs. This means that every VU stepped through the use case ”Login” as quickly as possible, without ”think times”. The average throughput and response time (among others) are measured. This is the test that actually verifies whether the performance goals are fulfilled.

VU	Throughput (/s)	Response time (s)	PI
1	0,25	4,06	0,062
2	0,51	3,93	0,130
3	0,73	4,11	0,178
4	0,77	5,17	0,149







Simple analysis: According to the methods of Lights In Line, the maximum Performance Index (throughput divided by response time) is reached using 3 VUs, at a throughput of 0.73 use cases per second. Increased load makes the response times increase, which indicates that some part of the system has become a bottleneck. Please note that for a real analysis to be made, the following prerequisites must be fulfilled:

- No background load
- Higher load allowed (more VUs)
- All part of the SUT must be monitored for CPU, Mem etc.

2.6 Response times for each step

The table below shows the time consumed by each step in each performed load test (1 – 4 VUs).

The response time that shows the highest increase is step 3, Login.

1 VU	Response time (sec)
1 Startpage	0,56
2 Login-page	0,061
3 Login	2,84
4 Logout and return to start	0,57

2 VU	Response time (sec)
1 Startpage	0,58
2 Login-page	0,061
3 Login	2,66
4 Logout and return to start	0,61

3 VU	Response time (sec)
1 Startpage	0,59
2 Login-page	0,068
3 Login	2,76
4 Logout and return to start	0,65

4 VU	Response time (sec)
1 Startpage	0,65
2 Login-page	0,089
3 Login	3,67
4 Logout and return to start	0,71

3 Test data & Tools

The tools used were MS Visual Studio 2008 Team System, Test Edition, HTTP Analyzer and the Network sniffer Wireshark 1.0.

The following identities were used for login:

User id = mtest (Profile 2), User id = atest (Profile 1).

Appendix - Terms

Term	Explanation
Use case	A chain of one or more usage steps within an application
Usage steps (step)	An action performed by a user within an application
Response time for use case	The sum of the response times for all steps (w/o think time)
Response time for step	Time consumed to perform one step (w/o think time)
Think time	A variable used in test tools to simulate the ”thinking time” for a user between two steps.
Elapsed time	Response time + think time for a use case or step
Background load	The normal, existing load in a production environment.
Peak-load	Highest load on a system during a set time unit, e.g. hour
Response time analysis	Manual measurement and analysis of a use case regarding data volumes, response time and used bandwidth to quickly identify problems that may appear during heavy load (i.e. before more complex/expensive tests are performed).
Load test	Generic term for test of various intensity and time.
- reference	A low intensity test if e.g. a use case, used for future reference (sometimes known as “baseline test”.
- verification	The verify that a system meets defined performance goals at given conditions.
- stress	What happens when the system is over loaded ?
- stability	What happens when the system is loaded at ”normal” levels during extended time ?
- ”bottleneck”	Increase the load gradually, until the system becomes “saturated” (response times increase drastically). Which part of the system is the ”weak link” ?
Script	Instructions for an automated test tool
PI	Performance Index, defined as throughput/response time
VU	Virtual User, that emulates the steps/actions made by a real user
Throughput	The number of use cases the system can process per time unit
B/p	Bytes per packet – indicates if the network is used efficiently
TVS	A Lights In Line qualified stopwatch used for manual timing ;-)
WS	Wireshark – SW to measure and analyze network
E2E Monitor Service	Automated tool for SLA & response time monitoring of production systems