TECHNISCHE UNIVERSITÄT DRESDEN

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IT quality and software reliability focus: load- and performancetest

Ringvorlesung TU Dresden

Dresden, 2017-12-04

Agenda

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1. profi.com AG
2. software development
3. why Load & perfomrance testing?
4. Stairway to load & performance testing
5. Choose the right tools
6. Execute and analyze the results
7. Summary

Agenda

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From physics to IT consultancy?!

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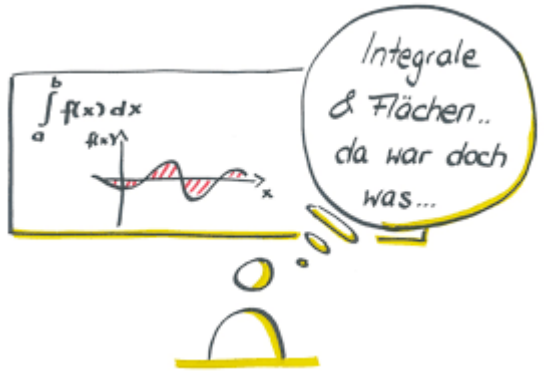

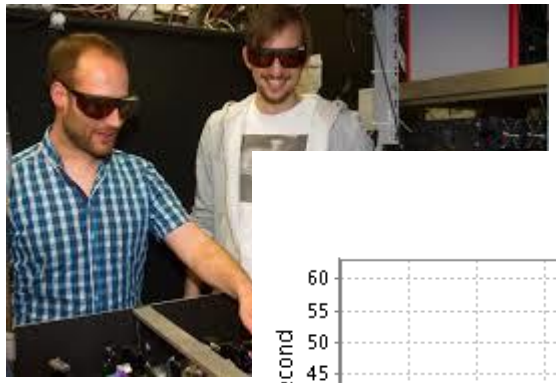

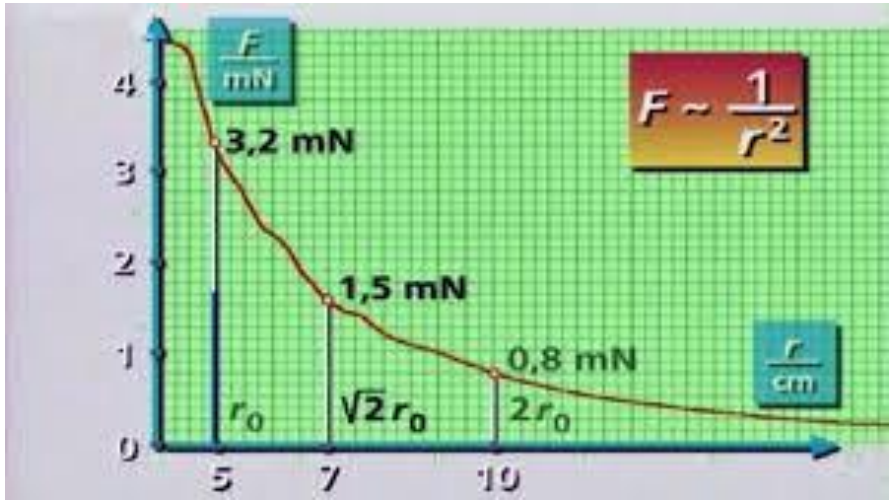

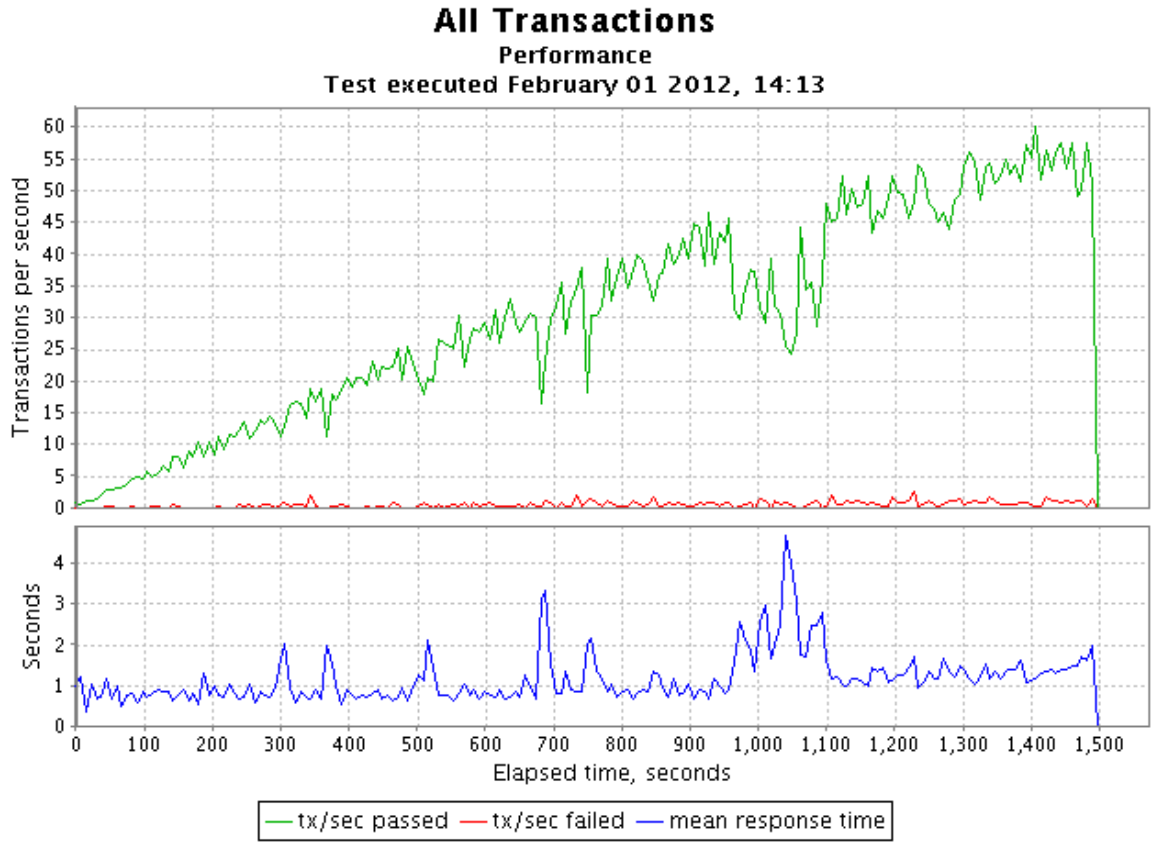

Background Mathematical/Natural science, and?

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- Understanding for numbers and their relations
- Doing conceptual things from scratch
- Be focussed to do the right things at the right time
- Having the correct ratio of looking left and right vs. being focussed
- Creating models
- Giving talks

Speakers

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- Dr. Jan Sickmann
  - IT Consultant
  - focus: load- and performancetest

- Dr. Carsten Neise
  - Senior IT Consultant
  - focus: data management

DID YOU KNOW, THAT WE…

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- were founded 16 years ago
- have more than 75 specialists in all disciplines
- daily testing over 450.000 lines of „new “ sourcecode
- do load & performance tests up to 100.000 virtual users per application
- provide our services to all sizes of compagnies, big and small
- are MicroFocus Platinum Partner for Applications and IT Operations Software

OUR PORTFOLIO

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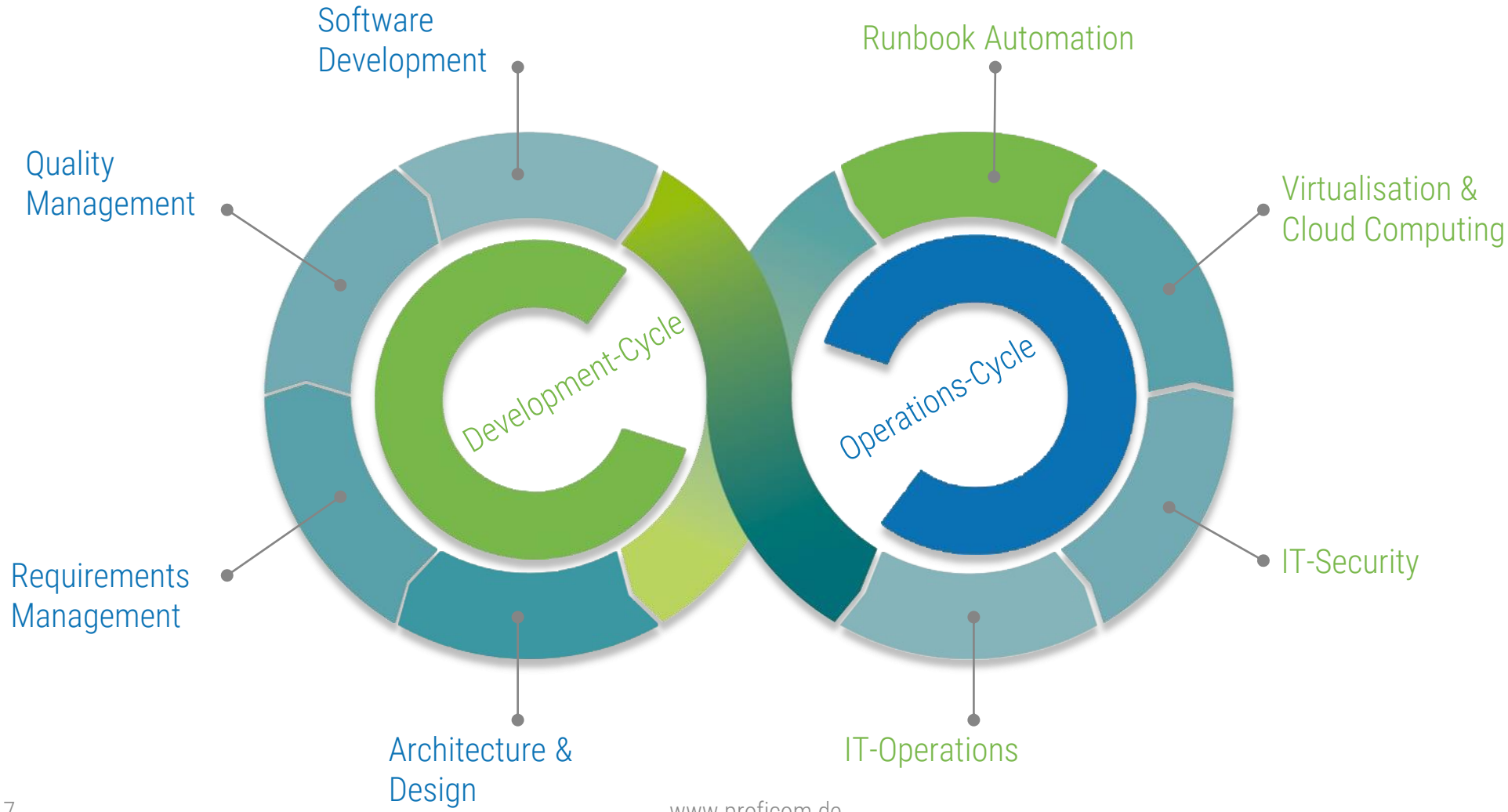

QUALITY MANAGEMENT SERVICES

- Objective evaluation of methods like model-based testing, test automation, modularization of tests, outsourcing and mobile testing
- Identification of optimization potential
- Analysis of all existing systems and all processes established in your business
- Conception regarding the introduction of the new lifecycle management tool
- Individual product and method training sessions for your employees
- Early life support during the introduction

CLOUD SERVICES

- Strategic consulting during the introduction of cloud computing in your business
- Conception and implementation of an appropriate system architecture
- Administration and operation of virtual infrastructures
- Advice on questions regarding contract design, copyright law, IT security and data privacy
- Integration of deployment processes for cloud services within your corporate IT
- Automation of basic system administration tasks up to the integration into the automated build, deployment and test processes in the cloud

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Platinum Partner

turnkey

paloalto NETWORKS

experitest

Microsoft Partner
Gold Application Lifecycle Management

perfecto mobile

OUR CUSTOMERS

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MGI
METRO Group
Information Technology

Endress+Hauser

HAUFE. LEXWARE

Volkswagen Bank

ThyssenKrupp

Bundesagentur
für Arbeit

BOSCH

ERGO

UniCredit

DB Mobility
Networks
Logistics

DAIMLER

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COMMERZBANK

VHV VERSICHERUNGEN

intel infineon

TOLL COLLECT
service on the road

Deutsche Post

EWE TEL

ND SATCOM

Consors bank !
by BNP PARIBAS

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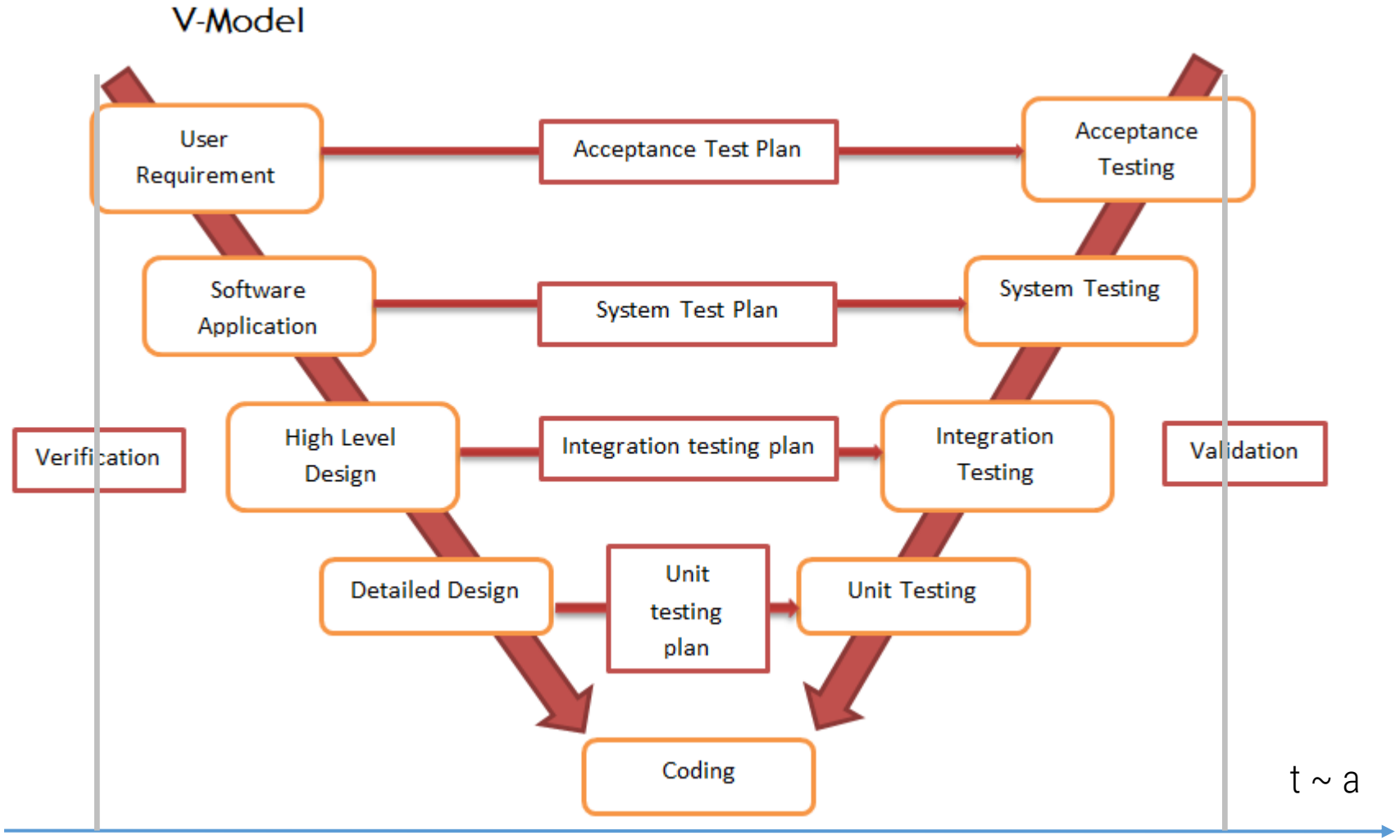
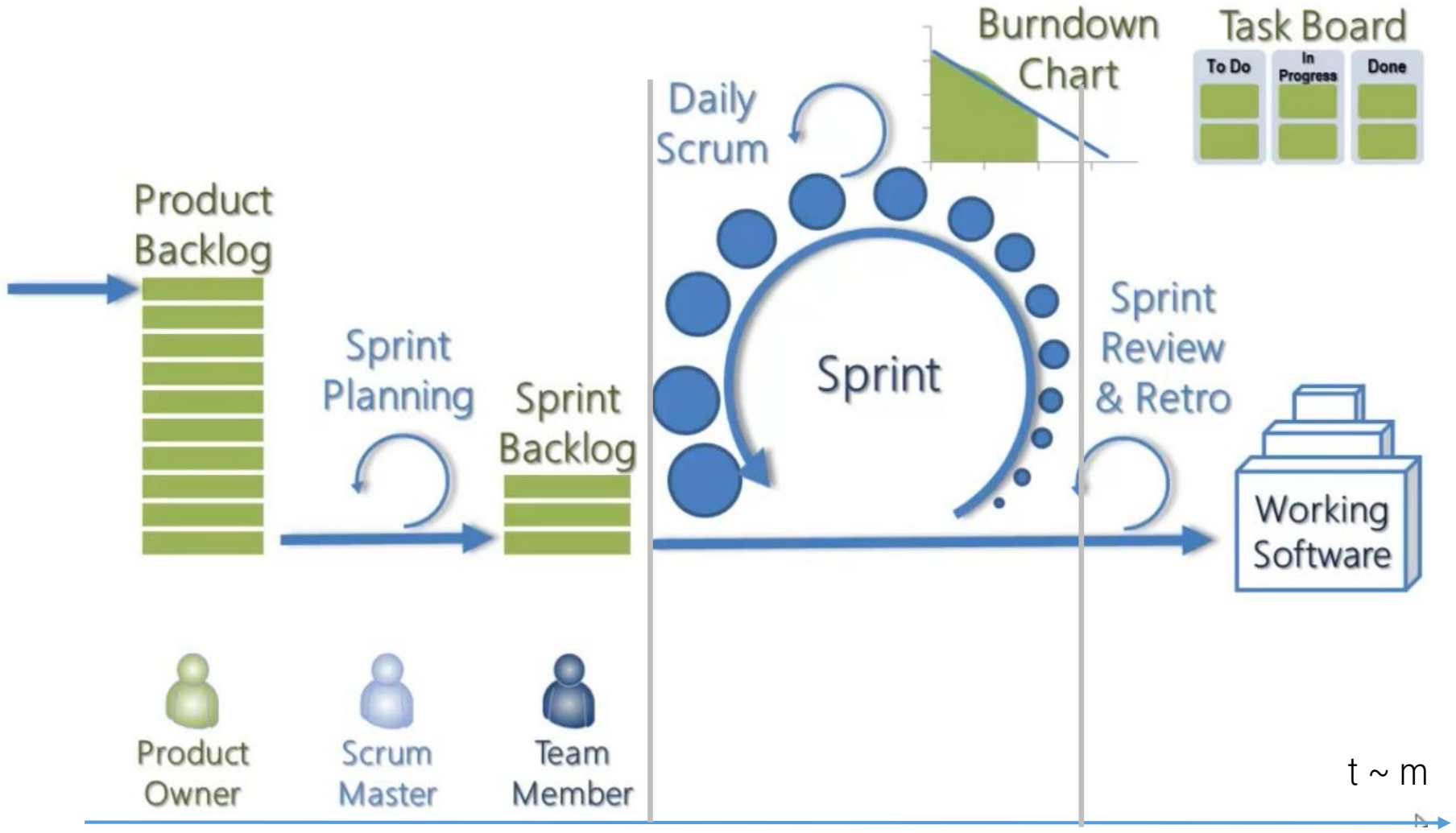
Classic models – V-Model



Modern models – Scrum Framework



Different requirements

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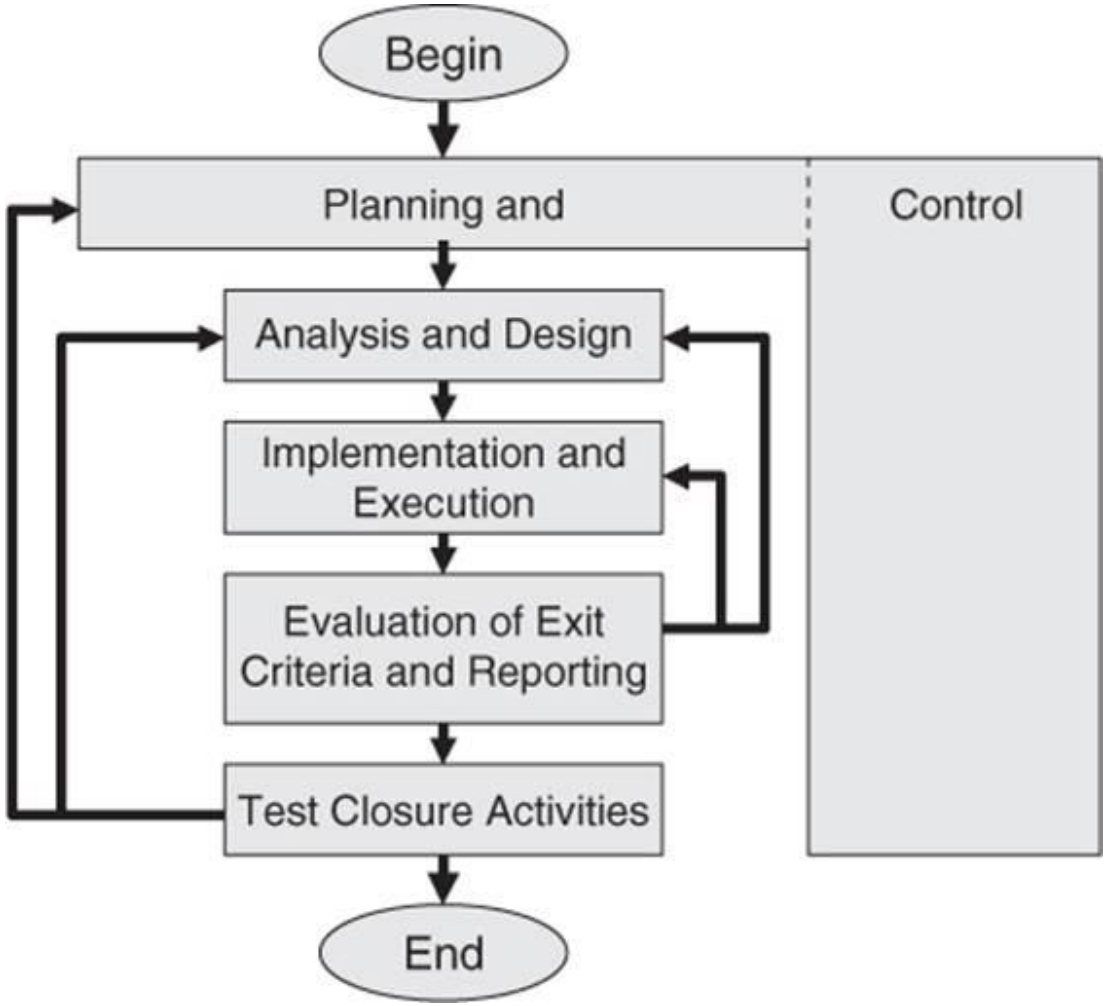
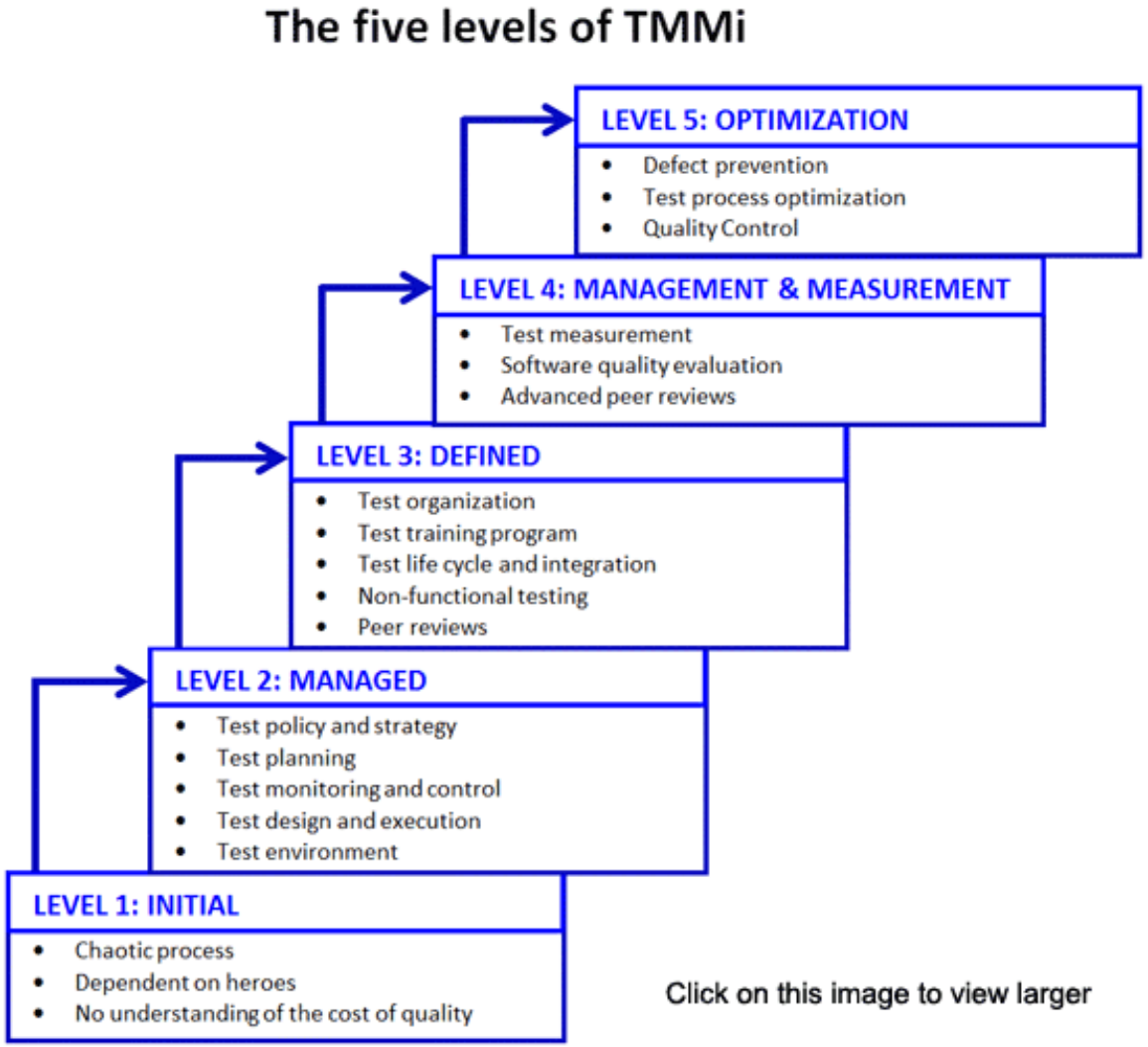
University	Industry
Stand alone development, often only single development	Development in groups, distributed all over the world.
Tasks for implementing can seldomly split into parallel subtasks which can be done by different persons (VIM, Xemacs, …)	Tasks are offen split in several subtasks which are implemented by several programmers (Visual Studio, IntelliJ, Eclipse, …)
Code has to be very performant, fast for numerous calculations	Depending on exakt use-case, but code performance is not such an big issue as in university
Fortran, C++, Ruby, Python, …	.NET, Java
Very accurate and exact code	Software has to be **released very fast**, bugs are often taken into account
GUI not really in scope	GUI matters

Fundamental test process (ISTQB)



Levels of software test - TMMi



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Why load & performance testing?

- Prevent costly failure[illegible]al applications
- Assure per[illegible]der real world conditions
- Locate p[illegible]re your customers do
- Avoid wr[illegible]cisions
- Reduce c[illegible]
- Reduce infrastr[illegible]

Biggest web failures in 2016*

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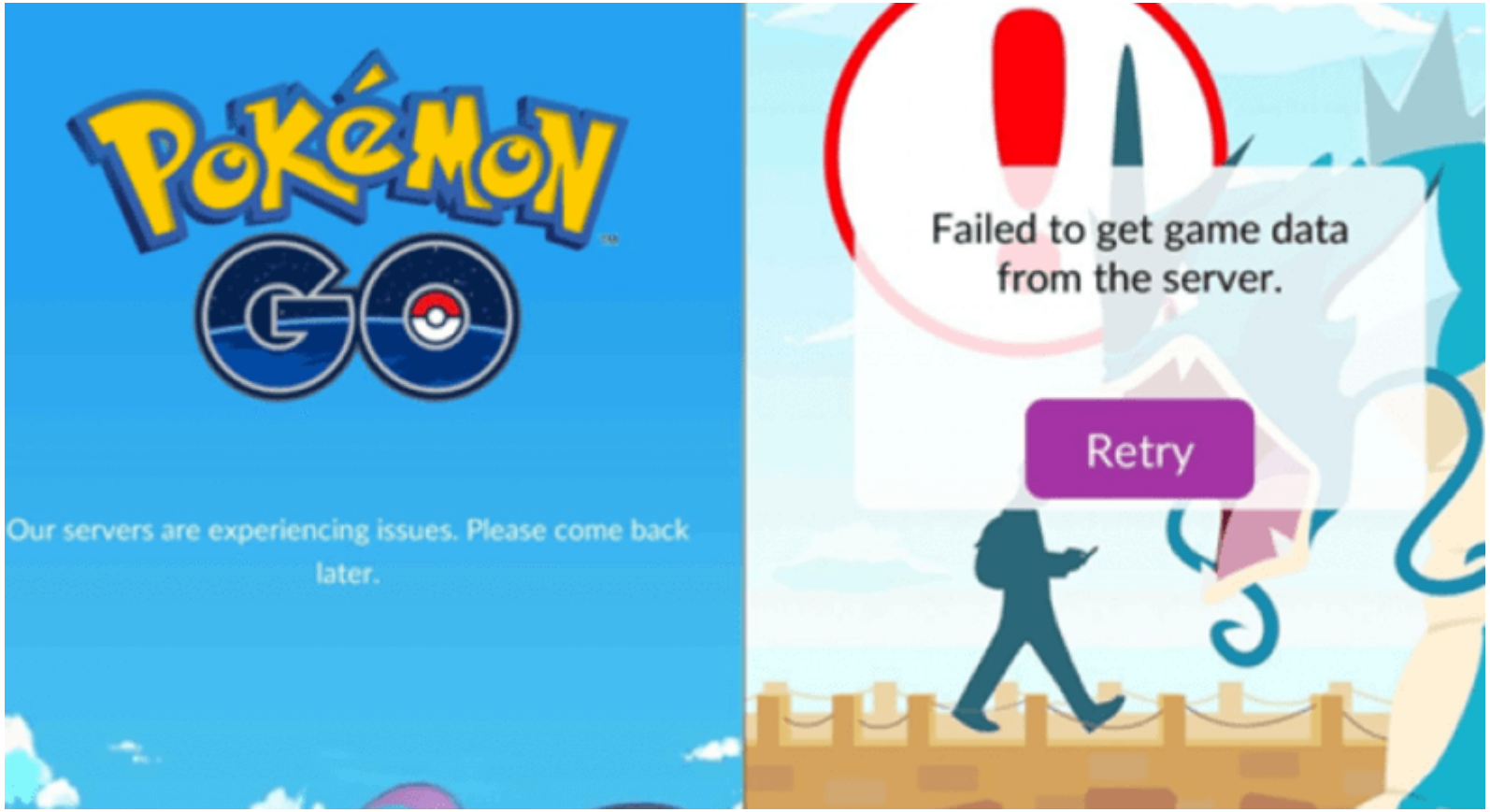

*https://www.blazemeter.com/blog/biggest-web-failures-2016-and-2017-resolutions

Biggest web failures in 2016*

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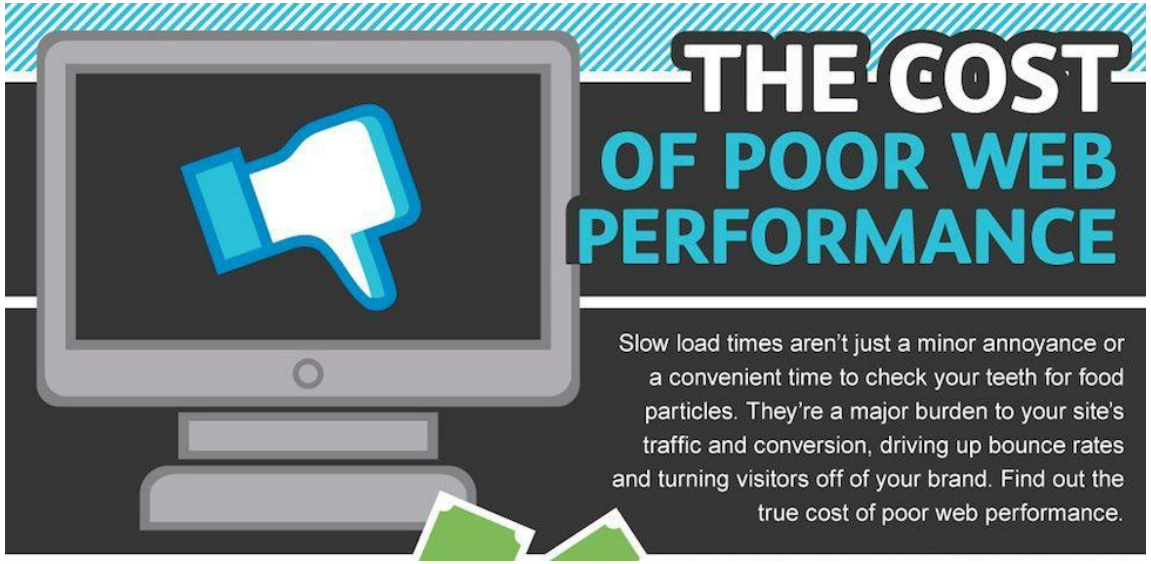
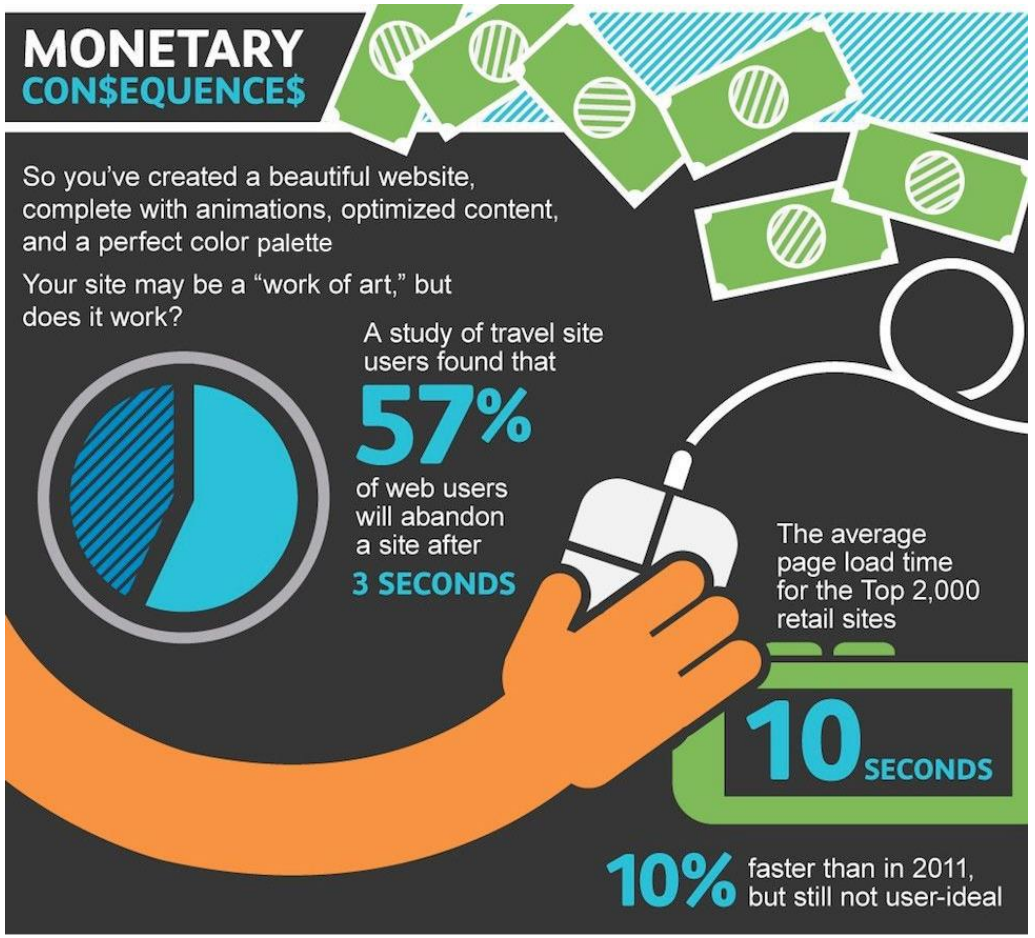
*https://www.blazer nd-2017-resolutions

The cost of poor web performance*





*Kendal Peiguss, smartbear.com, Nov 30, 2012
https://blog.smartbear.com/web-performance/the-cost-of-poor-web-performance-infographic/

The cost of poor web performance*

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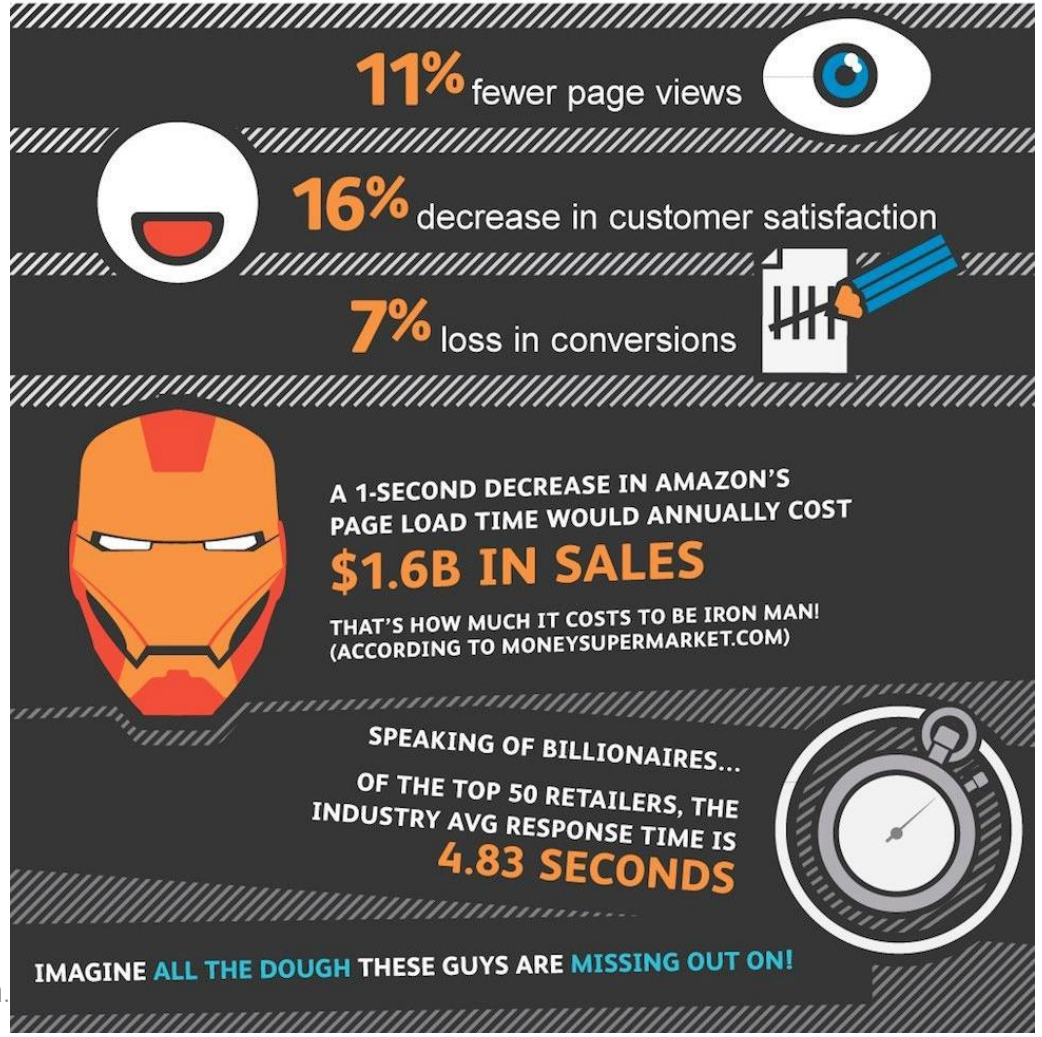
Research found out that

1 sec increase in response time could cause...



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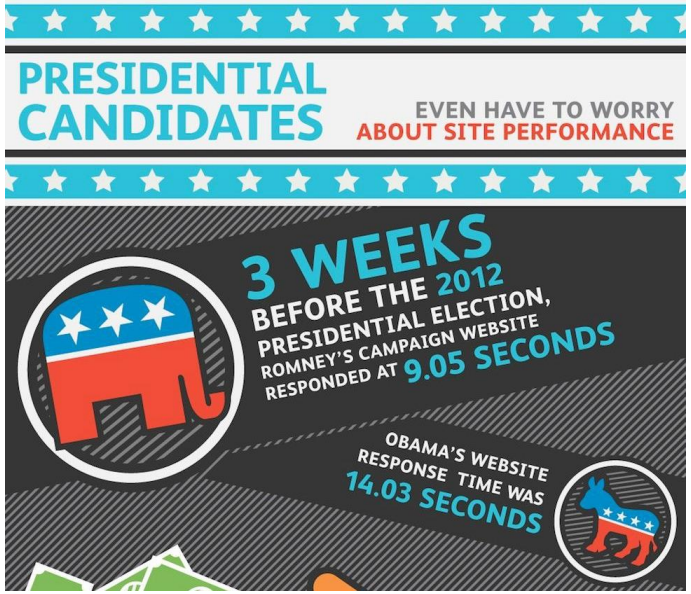

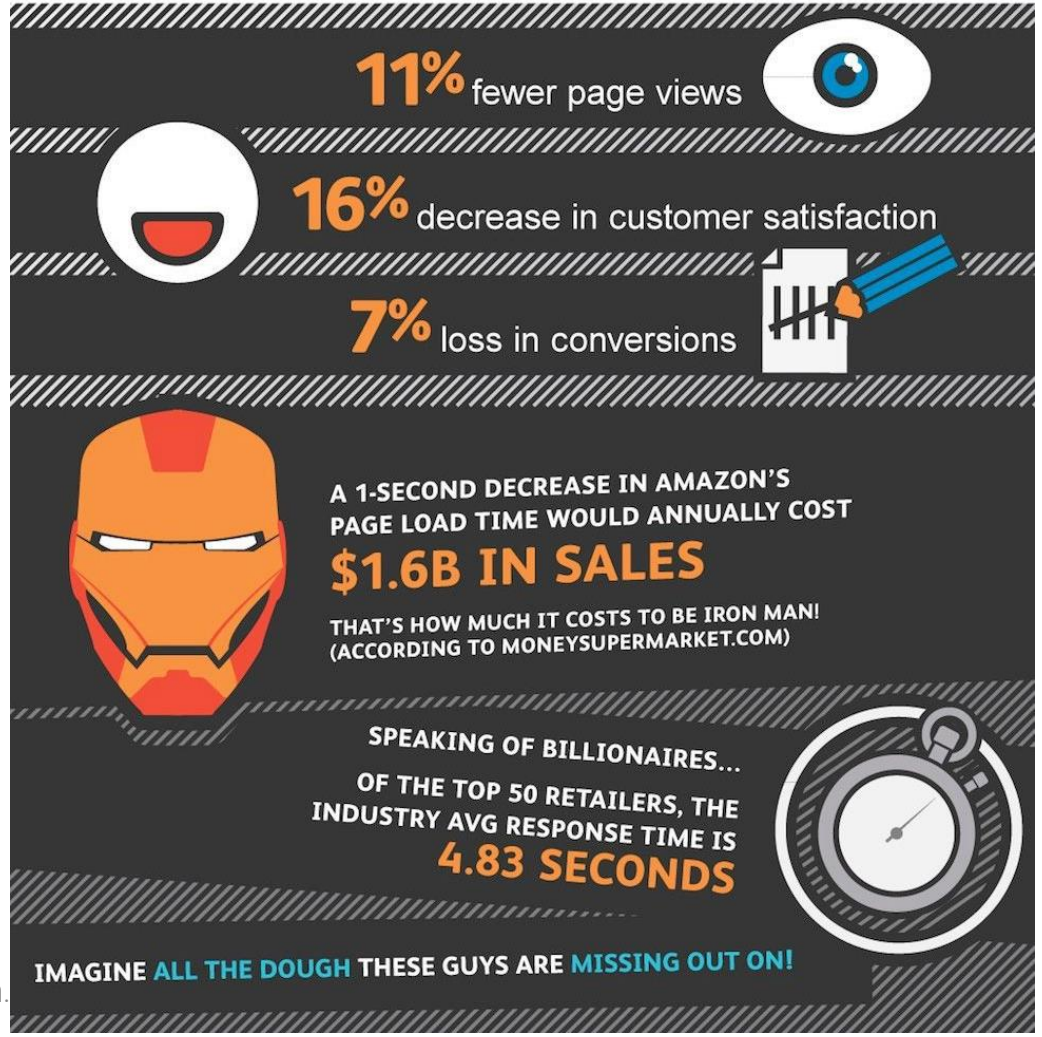

Performance vs. load vs. stress testing

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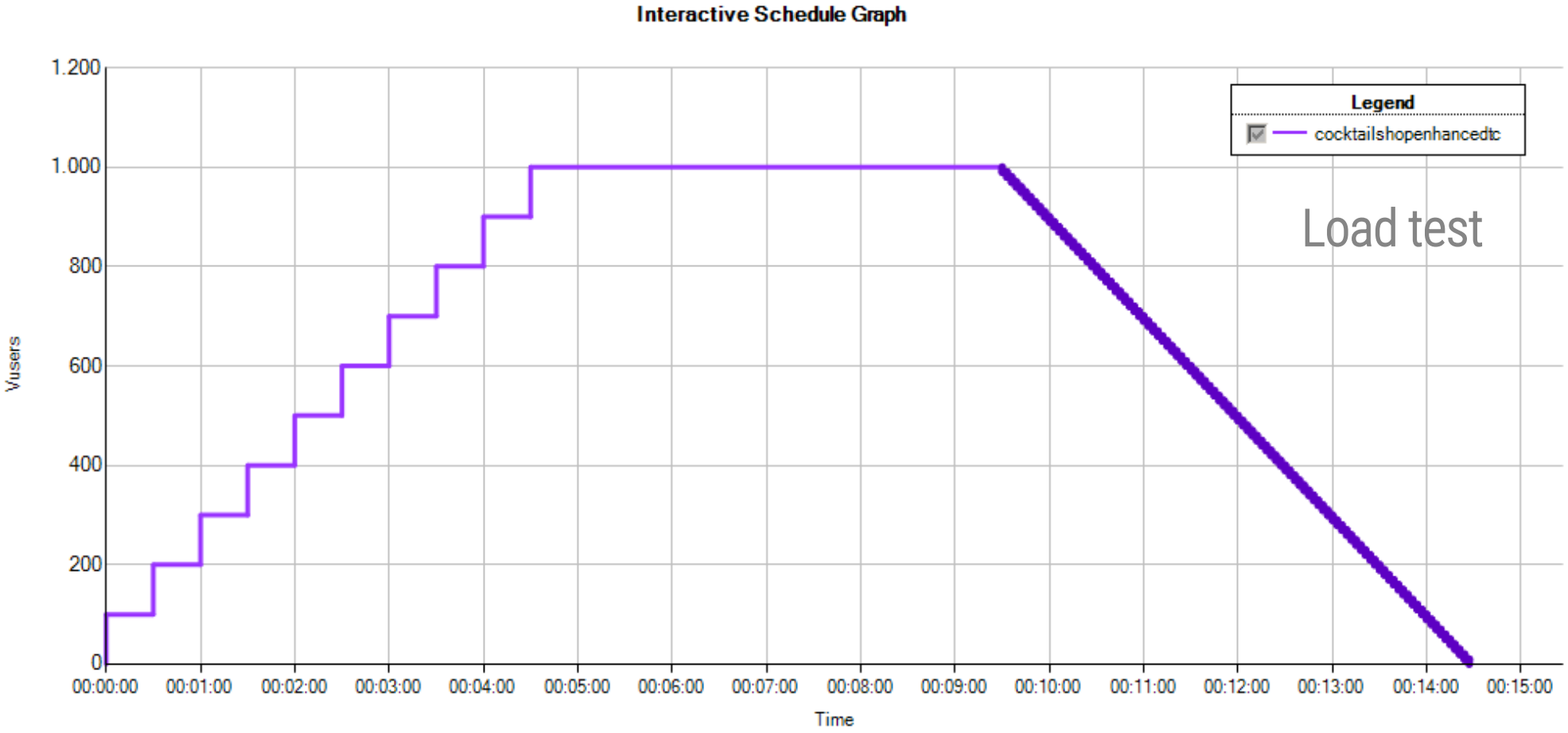

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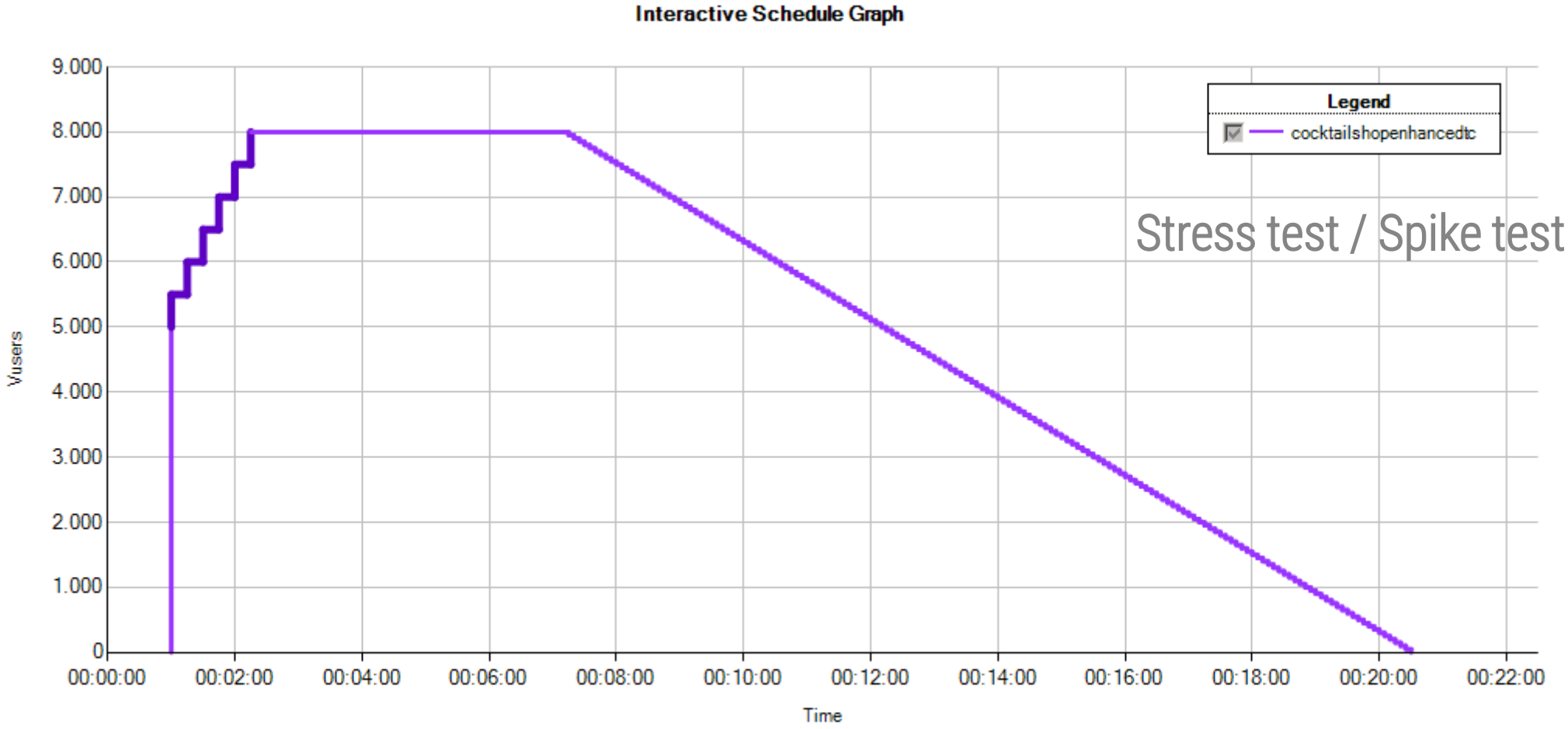

Types of performance testing

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Component testing	Find the behavior and performance of each tier
Load testing	Determine if the system handles anticipated real-world load
Stress testing	Find system break point; measure if system environment is properly configured for unexpected, high-transaction volume
Volume testing	Check system stability under extended periods of load

Examples of Performance Test Objectives

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- Application response time
- Coniguration sizing
- Regression
- Reliability
- Capacity planning
- Bottleneck identification

Functional vs. non functional testing

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Functional testing	
Goal	Example
Functionality	Do business processes still match the requirements after an implementation?

Non functional testing	
Goal	Example
Performance under load	Does the response time at 1,000 parallel requests match the requirements?
Stability	Does 1,000 parallel requests influence the system over a certain time?
Functionality under load	Do all business processes still work correctly under load?

Functional vs. non functional testing

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Keep an eye on
basic performance (single user)
even during functional testing!

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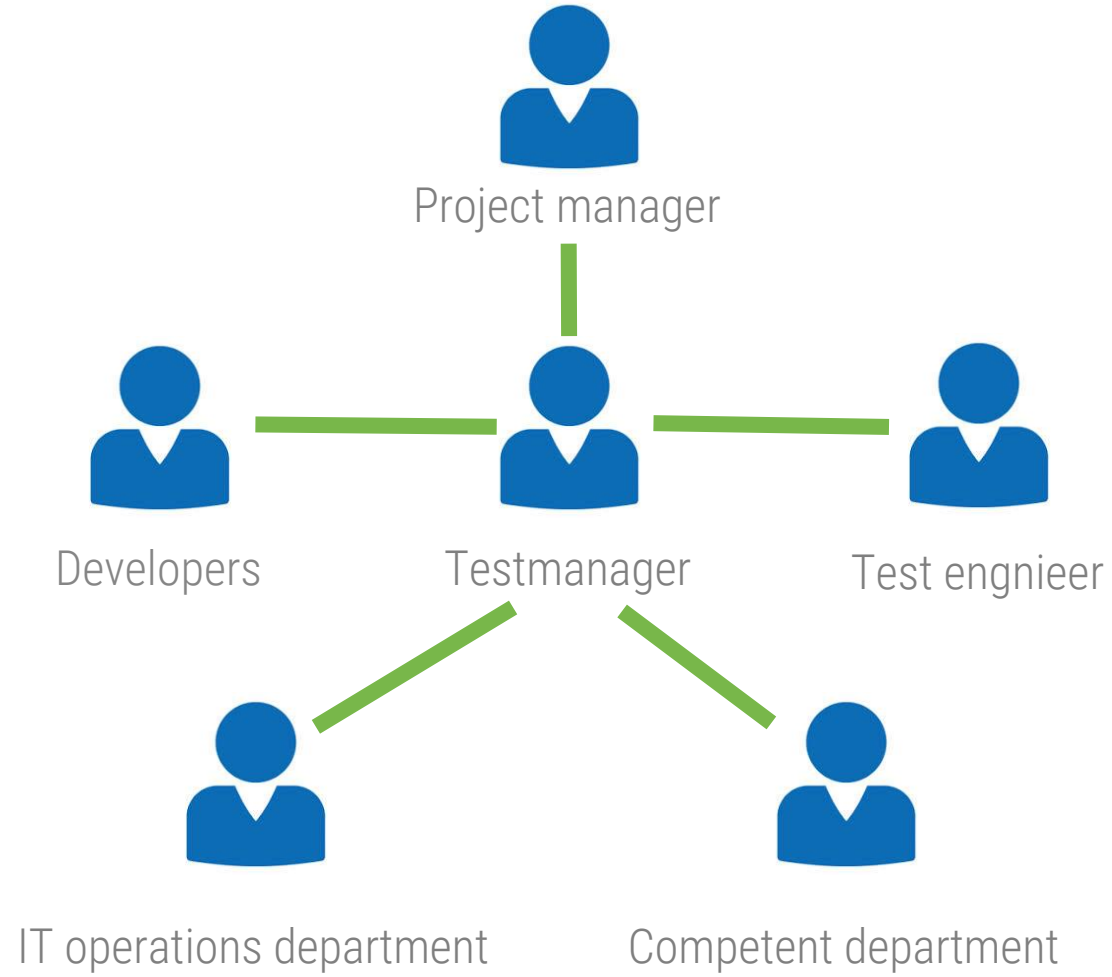
Get the right people together



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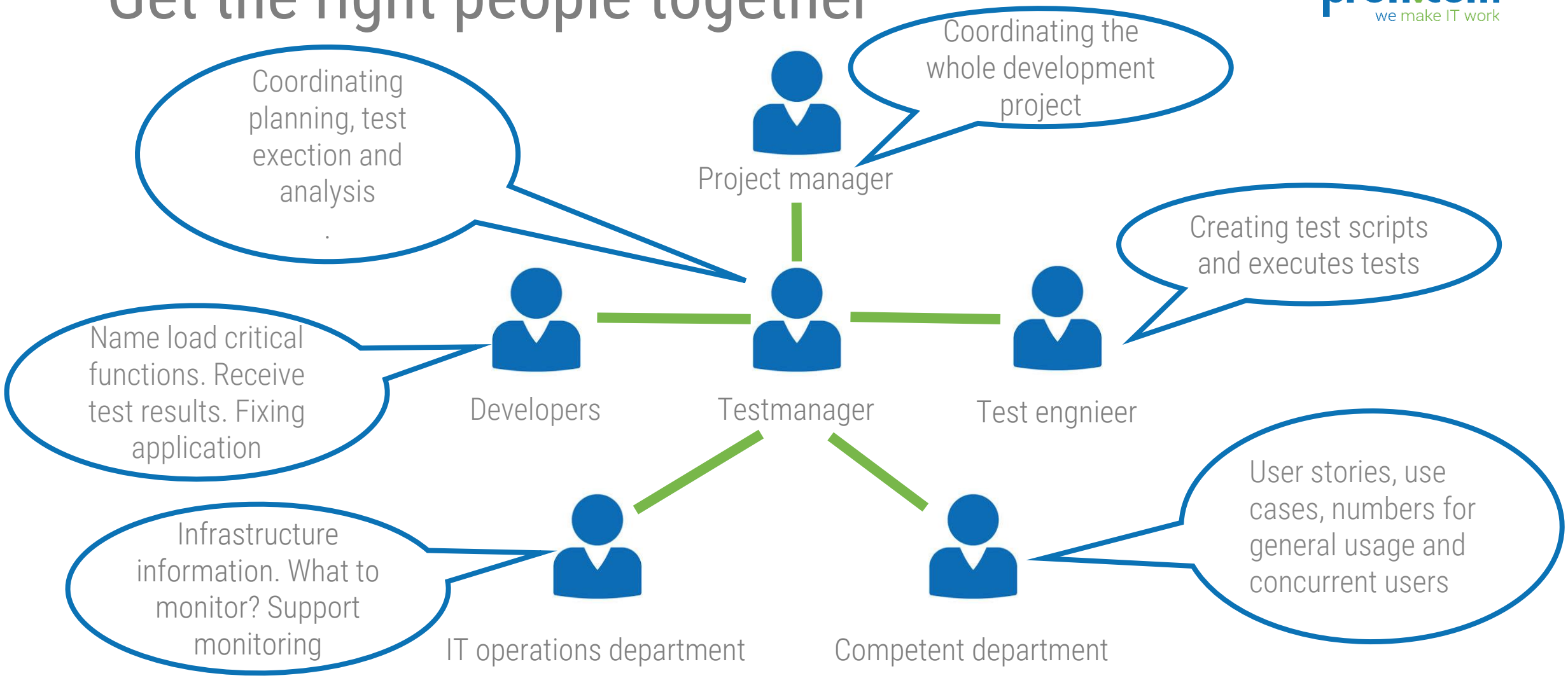

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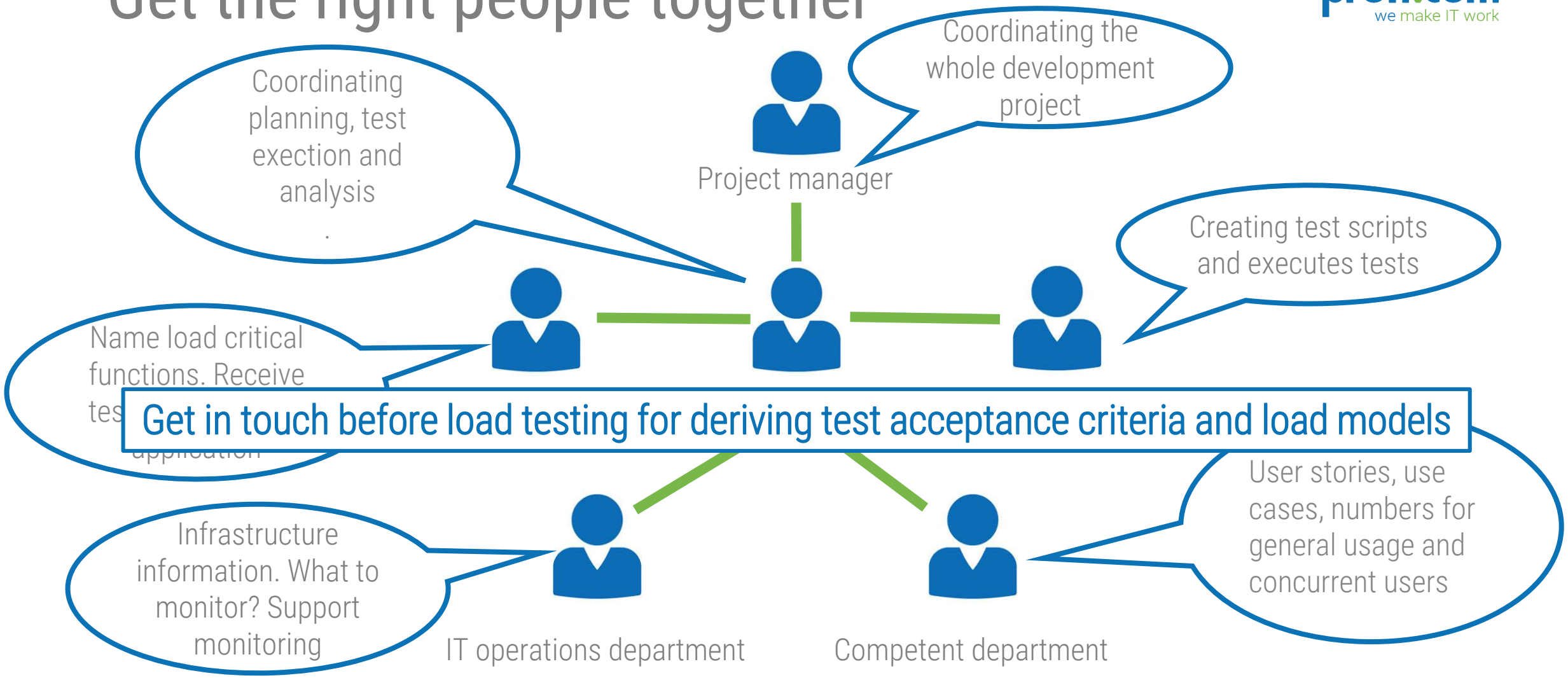

Defining Goals

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- Start with conceptual goals
- Jotting down goals that can‘t be measured will allow later filtering to create more focused goals
- Examples:
  - Responsivness of a search function: Are we able to get search results within a reasonable time?
  - System administrator’s concern if the “Update” transaction functions during heaving usage.
  - etc.

Quantifying Goals

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Conceptual goal	Quantitive goal
▪ The search must be fast enough	▪ Search transaction time 5 sec for 2,000 concurrent users during peak hours (8-10 a.m.)
▪ Confirm that save function works under heavy traffic	▪ Achive 300 concurrent users for save function at peak time (noon)

Business process matrix

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Business process	Users (typical day)	Users (peak time)	Dynamic content	Mission critical	Test
Sign in	70/hr	210/hr	Low	High	?
Creating new accounts	10/hr	15/hr	Moderate	Low	?
Searches for artists	130/hr	180/hr	Moderate	Moderate	?
View artist‘s page	20/hr	30/hr	Moderate	High	
Purchase MP3s	40/hr	90/hr	High	High	?

Defining a real world load

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- Concurrency = Number of users acting (!) on the application at the same time (!)

- Application level
  - How many users are active on the system?
- Business process level
  - How many users are buying MP3s?
- Transaction level
  - How many users press „Buy MP3“ now?

Defining a real world load

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- Do not focus on business processes/transactions or concurrent users alone!
- Better:
  - How many users
  - execute which transactions (business process)
  - during which time?

- Dervive from business process matrix and statistics
- Create an extended transaction/business process matrix

Creating a transaction matrix

TRANSACTION MATRIX / Load Test - Planning / Calculation

[redacted] Oracle Forms 11g (MCR TIME RECORDING)

Process	MCR Time Rec		Process	QUO P-ID Calc		Process	MCR All TREC	
Group	Normal Activ 100%		Group	Low Activ 40%		Group	MCR All TREC	
Vuser max	800 VUser		Vuser max	132 VUser			800 VUser	
Iteration / h	2,4 Iter./h/VUser		Iteration / h	3,9 Iter./h/VUser				

Current Vuser (Virtual User)

Business Process - Navigation		Complexity	Response Time		MCR Time Rec			QUO P-ID Calc			MCR All TREC		
Action / Use Cases		Frequency	SLA	Accept									
Nr.	Transaction Name (TA) selected	high/mid/low	< in s	< in s	TA/Iteration	TA / h	TA / s	TA/Iteration	TA / h	TA / s	TA / h	TA / min	TA / s
								1	511	0,14			
								1	511	0,14			
Use Cases Modul "MCR Time Recorder"													
Action 1 mcr login													
1	Start Url				1	1889	0,52				1889	31,48	0,52
2	Login				1	1889	0,52				1889	31,48	0,52
Action 2 mcr time recording nav													
3	Input <TREC> and enter				1	1889	0,52				1889	31,48	0,52
Action 3 mcr timerecording (loop)													
4	Edit Task 1 <Comment><Hours>				2	3777	1,05				3777	62,95	1,05
5	Edit Task 2 <Hours>				2	3777	1,05	1	511	0,14	3777	62,95	1,05

Nr.	Transaction Name (TA) selected	TA/Iteration	TA / h	TA / s	TA/Iteration	TA / h	TA / s	TA/Iteration	TA / h	TA / s	TA/Iteration	TA / h	TA / s	TA / h	TA / min	TA / s
Action 6 quo calc open (loop)																
15	Set Filter <No profile selected>							5	1366	0,38	1	511	0,14	1876	31,27	0,52
16	Filter P-ID calculation							5	1366	0,38	1	511	0,14	1876	31,27	0,52
17	Open P-ID calculation							5	1366	0,38	1	511	0,14	1876	31,27	0,52
18	Nav Tree <Approvals><SE3>							5	1366	0,38	1	511	0,14	1876	31,27	0,52
19	PDF Report							5	1366	0,38	1	511	0,14	1876	31,27	0,52
20	Report Selection all							5	1366	0,38	1	511	0,14	1876	31,27	0,52
21	Report Selection press <Cancel>							5	1366	0,38	1	511	0,14	1876	31,27	0,52
22	Tab <SE3 Approval Overview>							5	1366	0,38	1	511	0,14	1876	31,27	0,52
23	Tab <SE3 Control Approval Workflow>							5	1366	0,38	1	511	0,14	1876	31,27	0,52
24	Tab <SE3 Approval Global>							5	1366	0,38	1	511	0,14	1876	31,27	0,52
25	SE3 <Close>							5	1366	0,38	1	511	0,14	1876	31,27	0,52
Action 7 quo calc close (loop)																
26	Aquisition <Close2>							5	1366	0,38	1	511	0,14	1876	31,27	0,52
Action 8 quo exit																
27	<Exit>	1	325	0,09	1	587	0,16	1	273	0,08	1	511	0,14	1696	28,27	0,47

		MCR Time Rec	QUO P-ID Calc
	Transactions (Requests) per Iteration of Business Process	21 TA / Iteration	16 TA / Iteration
+	Response Time Total per Iteration (One User) +	25,0 s / Iteration	30,0 s / Iteration
	Thinktime between the Transactions (average)	75,0 s / TA	60,0 s / TA
+	Thinktime Total per Iteration (average) +	1500,0 s / Iteration	900,0 s / Iteration
∑	Duration of Business Process per Iteration (One User) ∑	1525,0 s / Iteration	930,0 s / Iteration

Total Transaction		
TA/h	TA/min	TA/s
39659	661	11,02

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Documenting user steps and input data

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Action 1 msp login

TA 1: Start URL:
http://si0app228.[redacted]/forms/frmservlet?config=IGPK_PERF_SSO&record=names

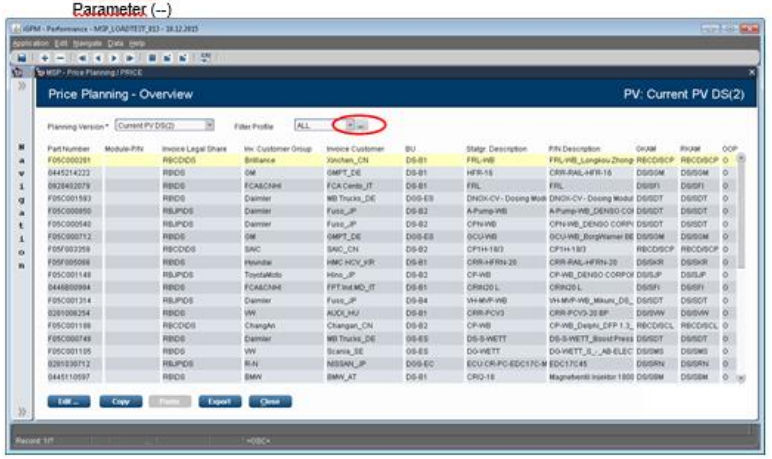
TA 2: Login
Parameter (Test user „USER.dat" unique)

Action 5 msp price nav (loop)

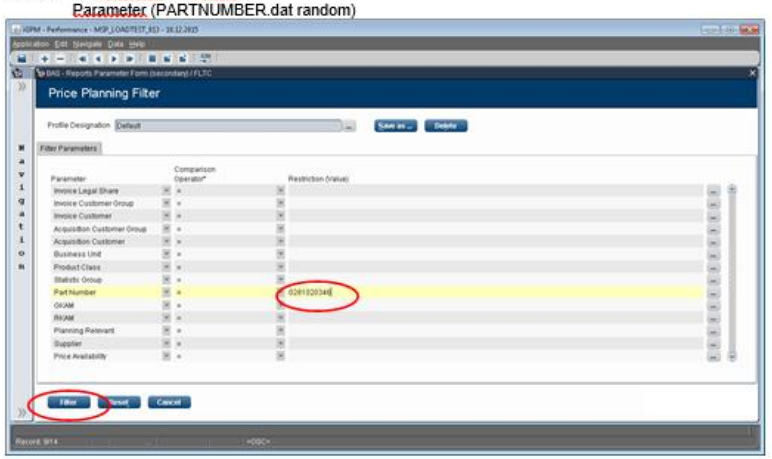
TA 13: Input <PRICE> and enter
Parameter (--)

Action 6 msp price planning (loop)

TA 14: Filter Profile
Parameter (--)



TA 15: Part Number set <Filter>
Parameter (PARTNUMBER.dat random)



Live Demo

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Determining valid test data

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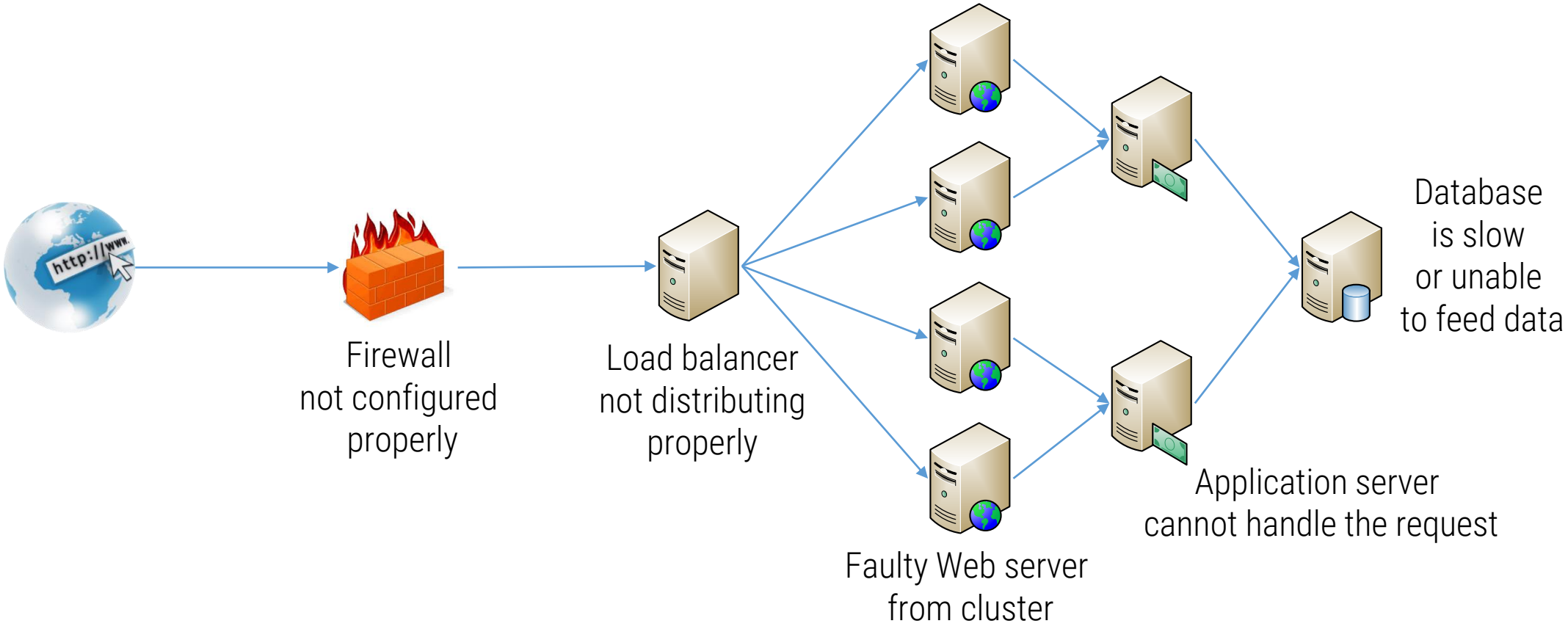
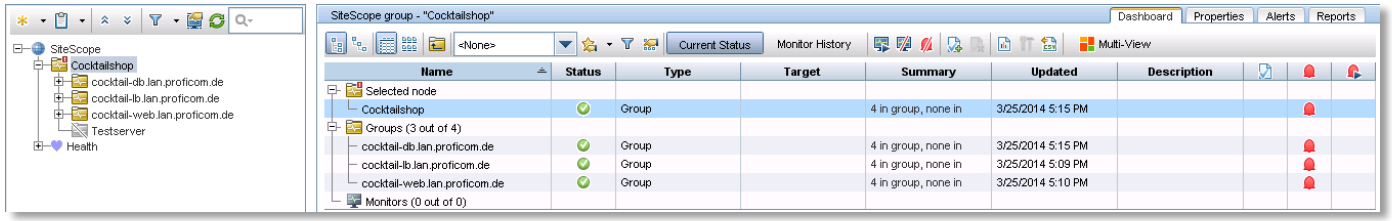
- Sources:
  - Application Data
    - Data is resident in the application's database
    - Examples: ID numbers and passwords
  - User-Generated Data
    - Originates with the user
    - Examples: new unique ID or email address
  - External Data
    - Data is unknown before the application is run
    - Examples: confirmation and purchase order numbers

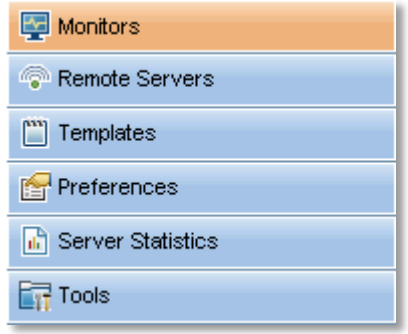
Monitoring system components



System performance monitors

- System resource monitors
- Network monitors
- Firewall monitors
- Webserver monitors
- Application server monitors
- Database monitors
- ERP/CRM monitors





Test environment

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- Mirrors the production environment
- Is dedicated to performance testing only (no interference with production users)
  - Allows data to be written, read, destroyed
  - Allows test system to be rebooted
- Allows to run the business processes correctly (application code freeze)
- Must contain sufficient hardware to generate the defined load

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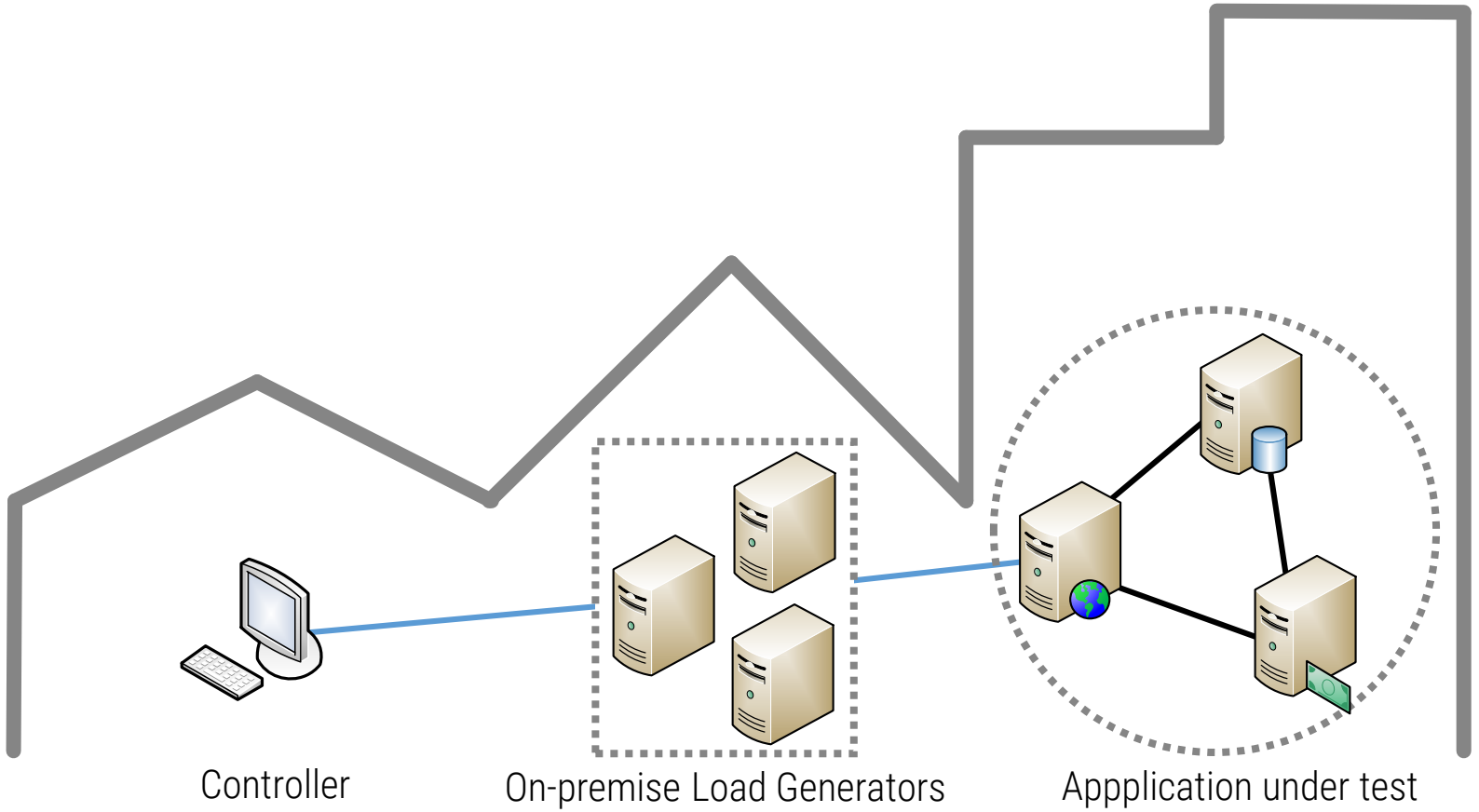
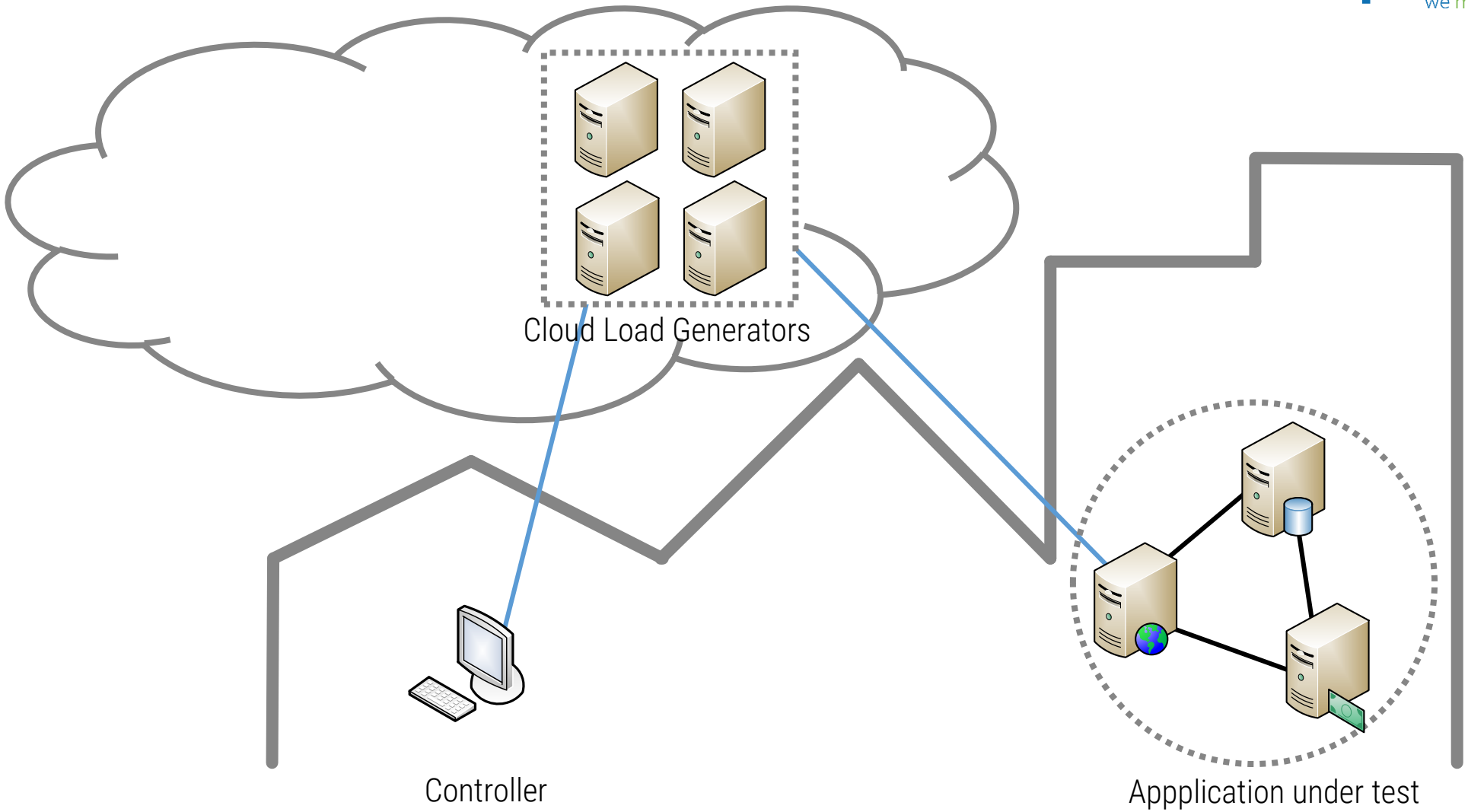
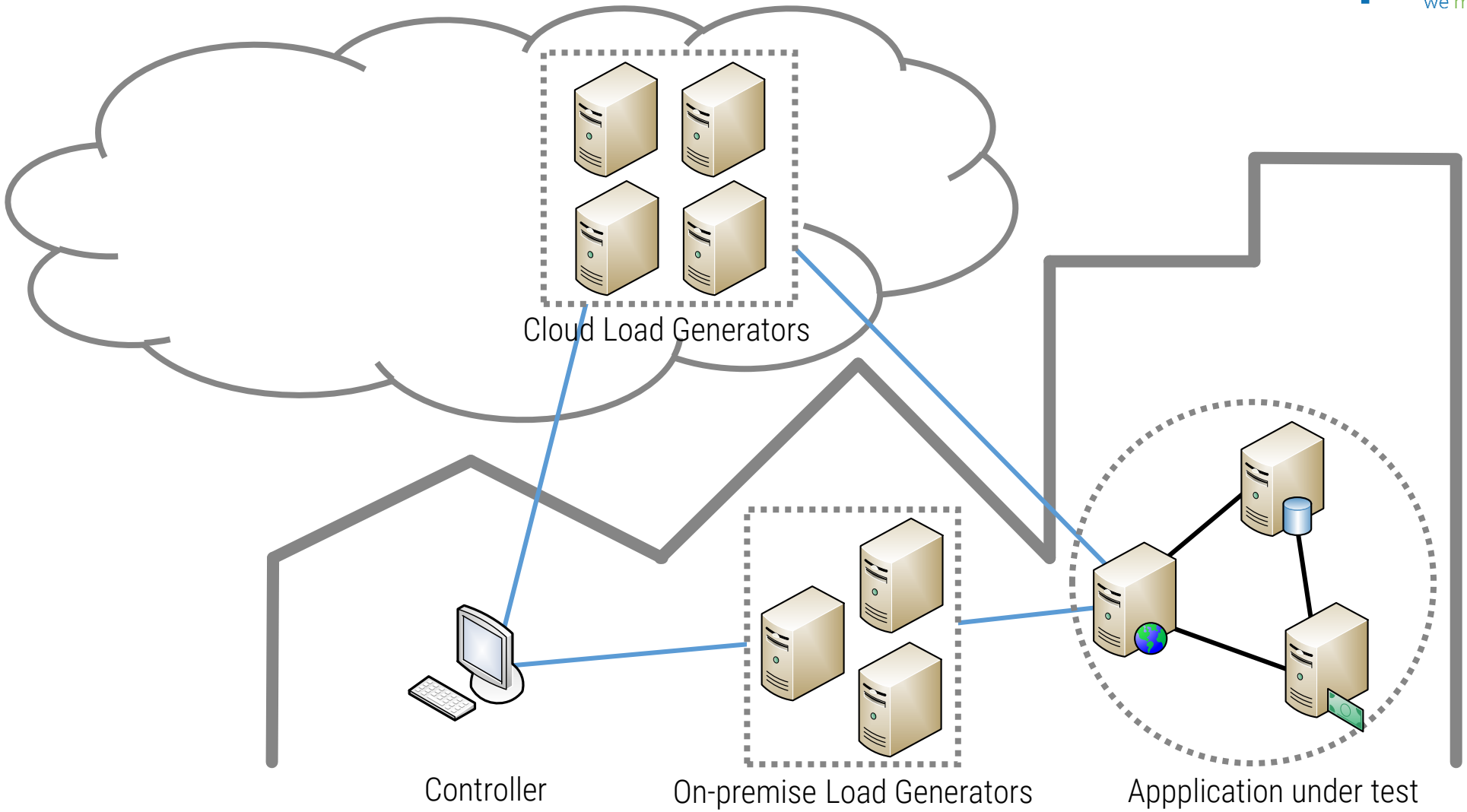
LoadRunner on-premise



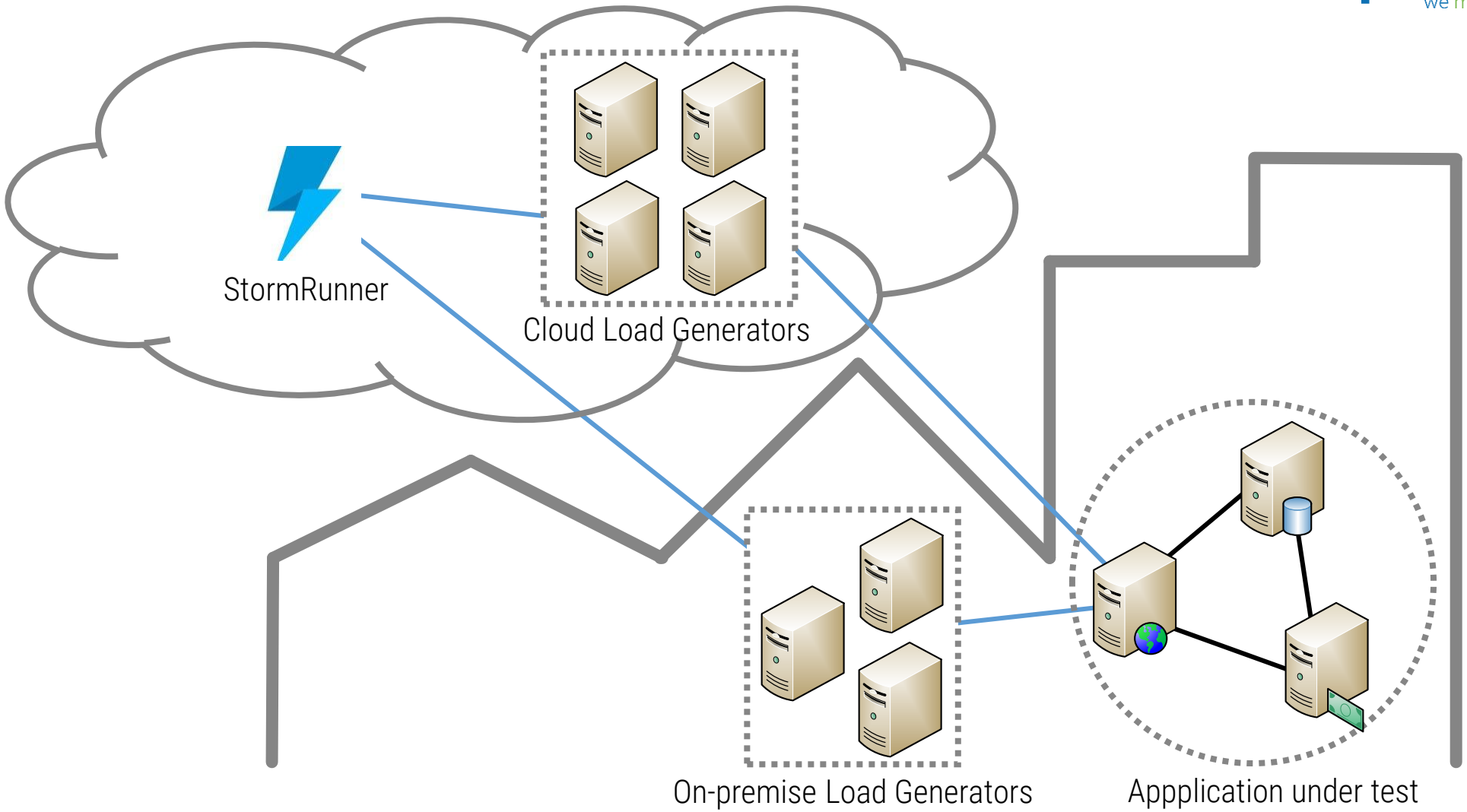
LoadRunner on-premise + cloud LGs



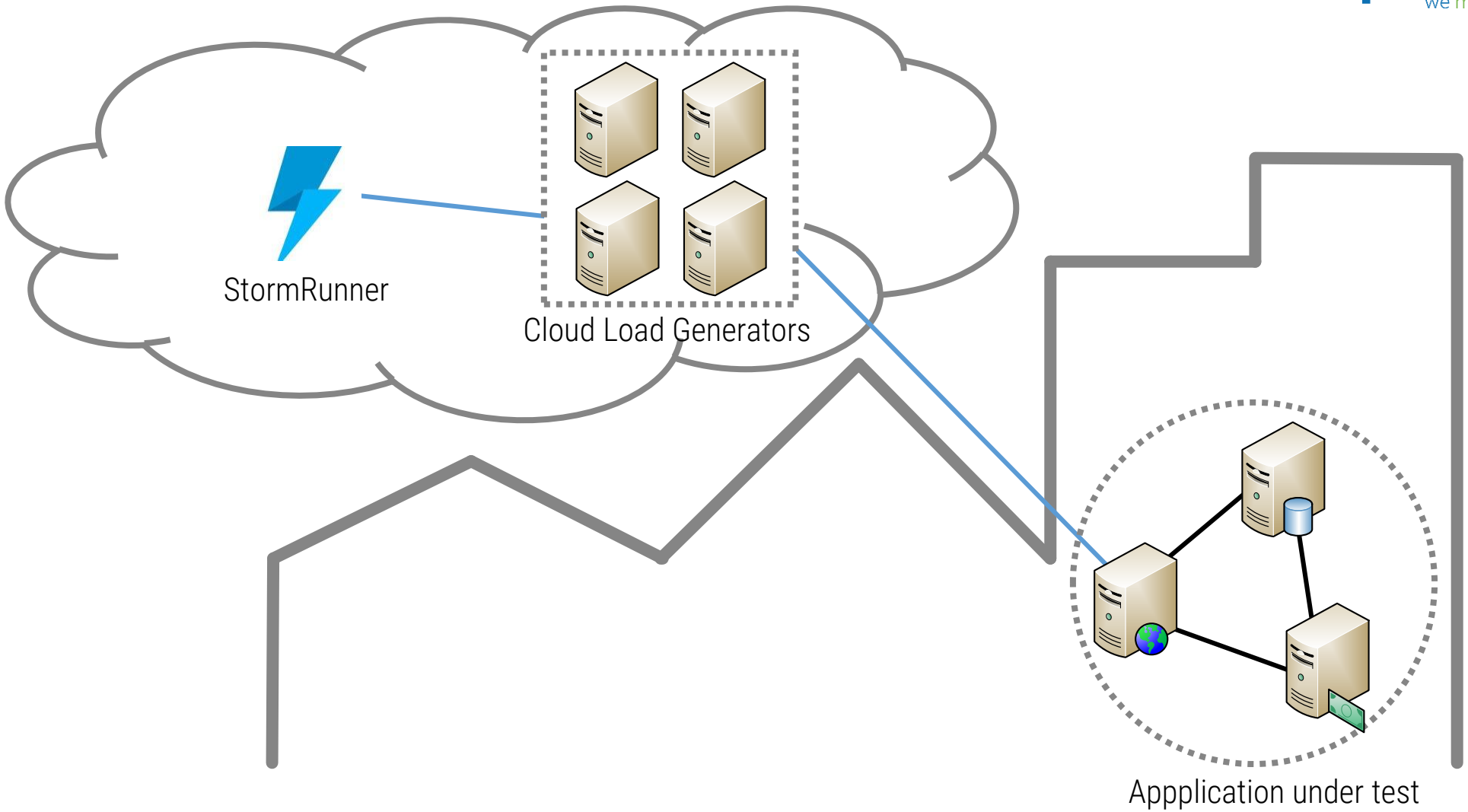
LoadRunner on-premise + cloud LGs



StormRunner + on-premise LGs



StormRunner



Agenda

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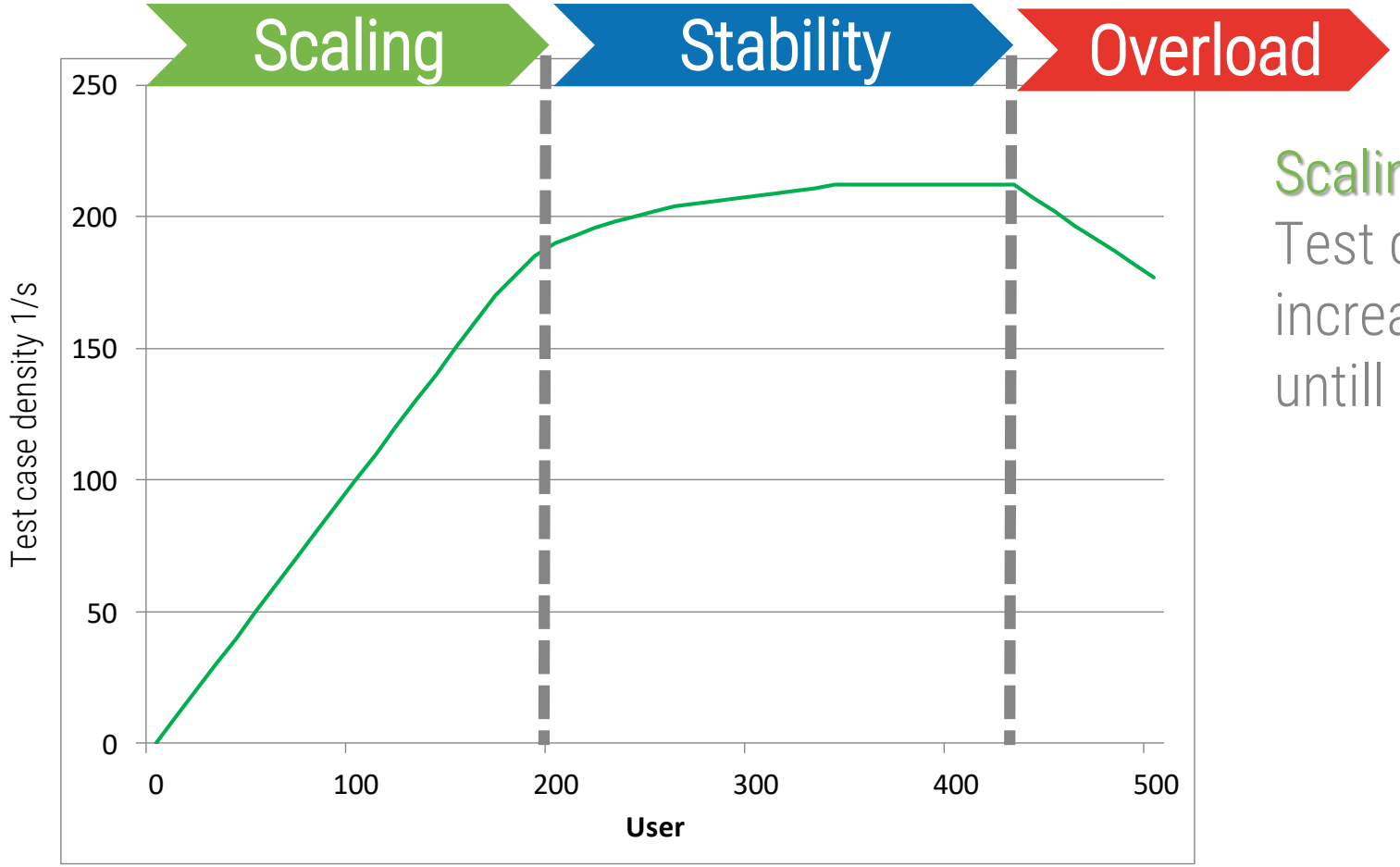
1. profi.com AG
2. software development
3. why load & performance testing
4. stairway to load & performance testing
5. choose the right tools
6. execute and analyze the results
7. summary

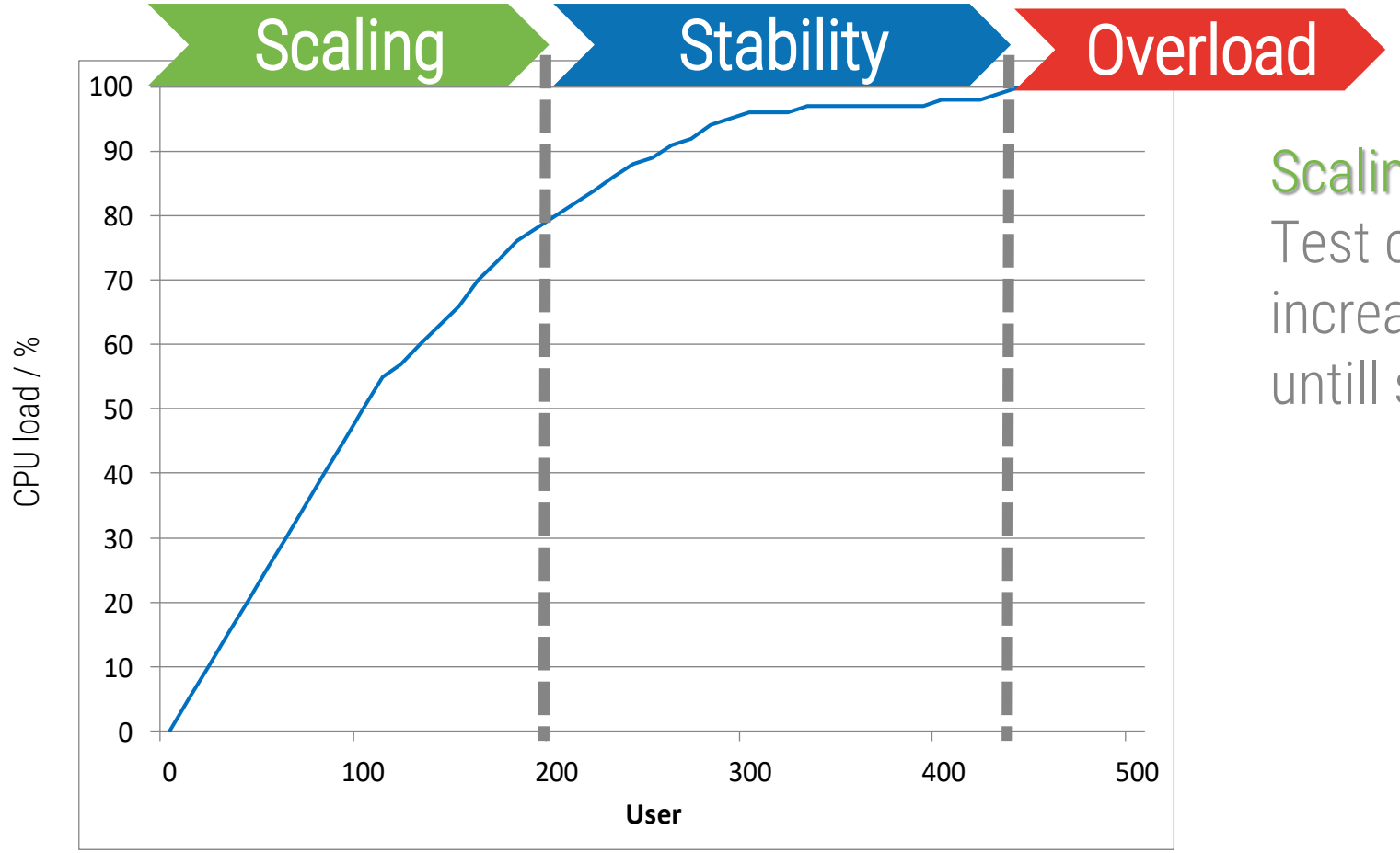
Phases of ideal load test



Scaling

Test case density ~ load increases with number of users untill saturation of bottleneck device

Phases of ideal load test



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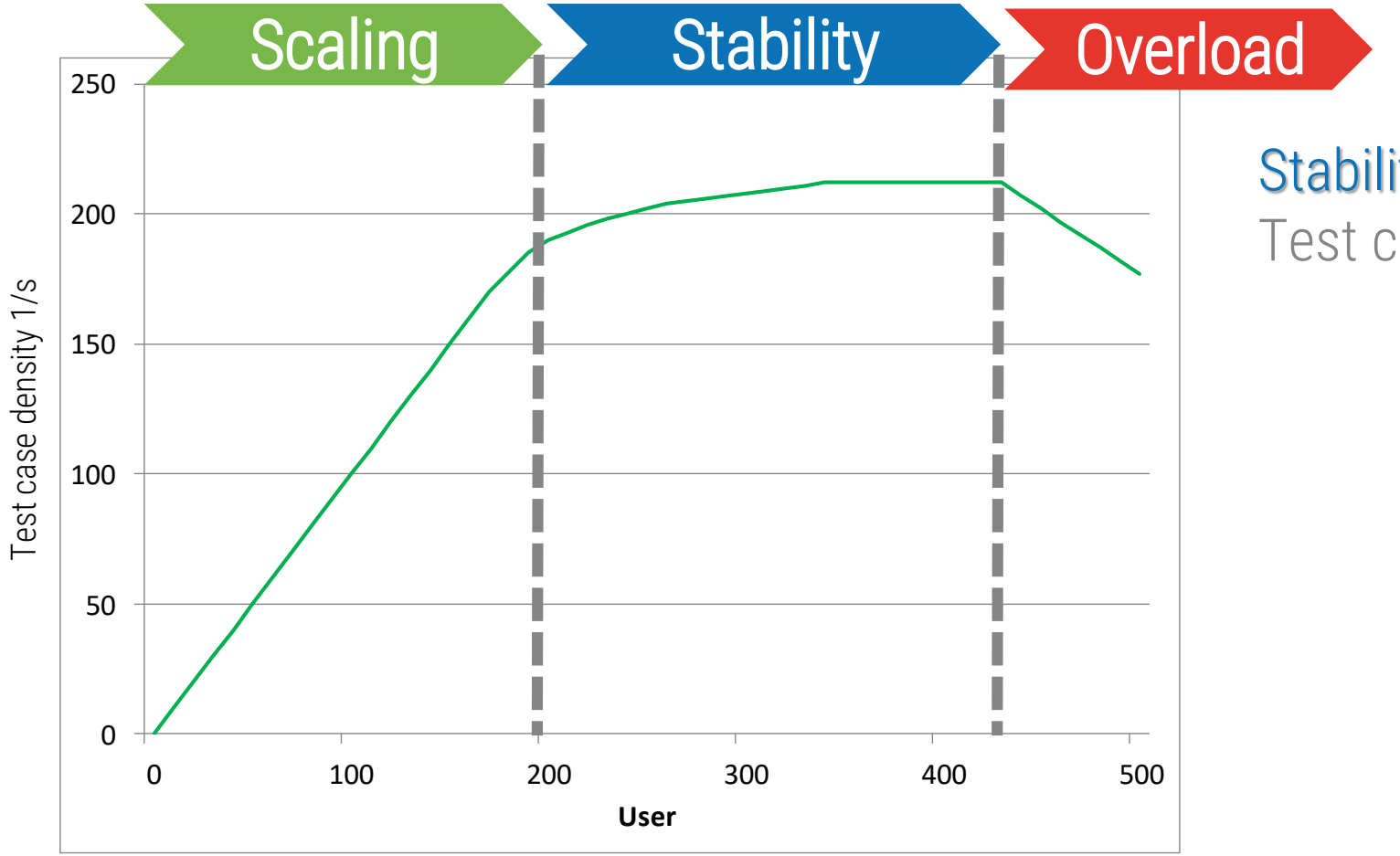
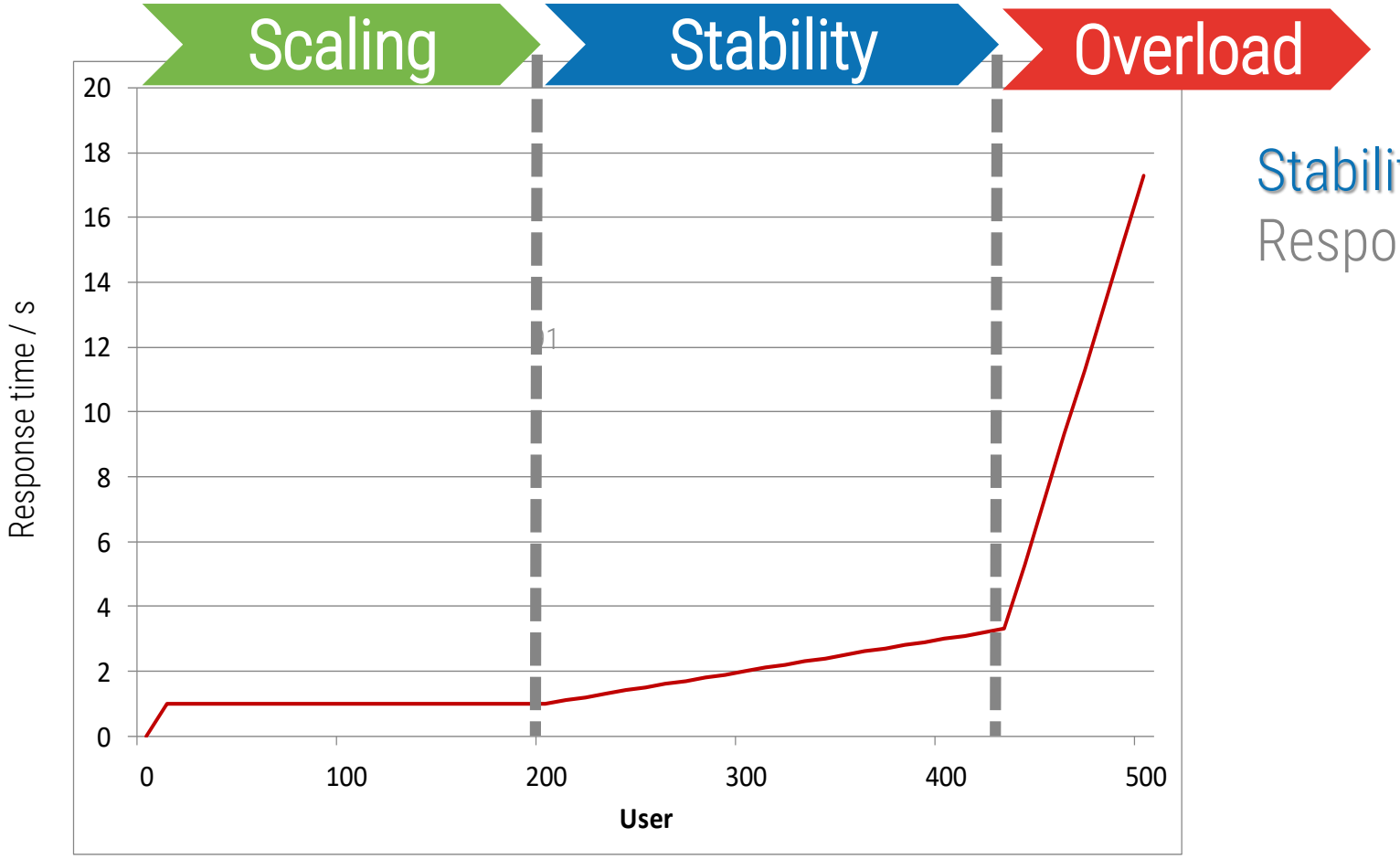


Stability

Test case density ~ load = const.

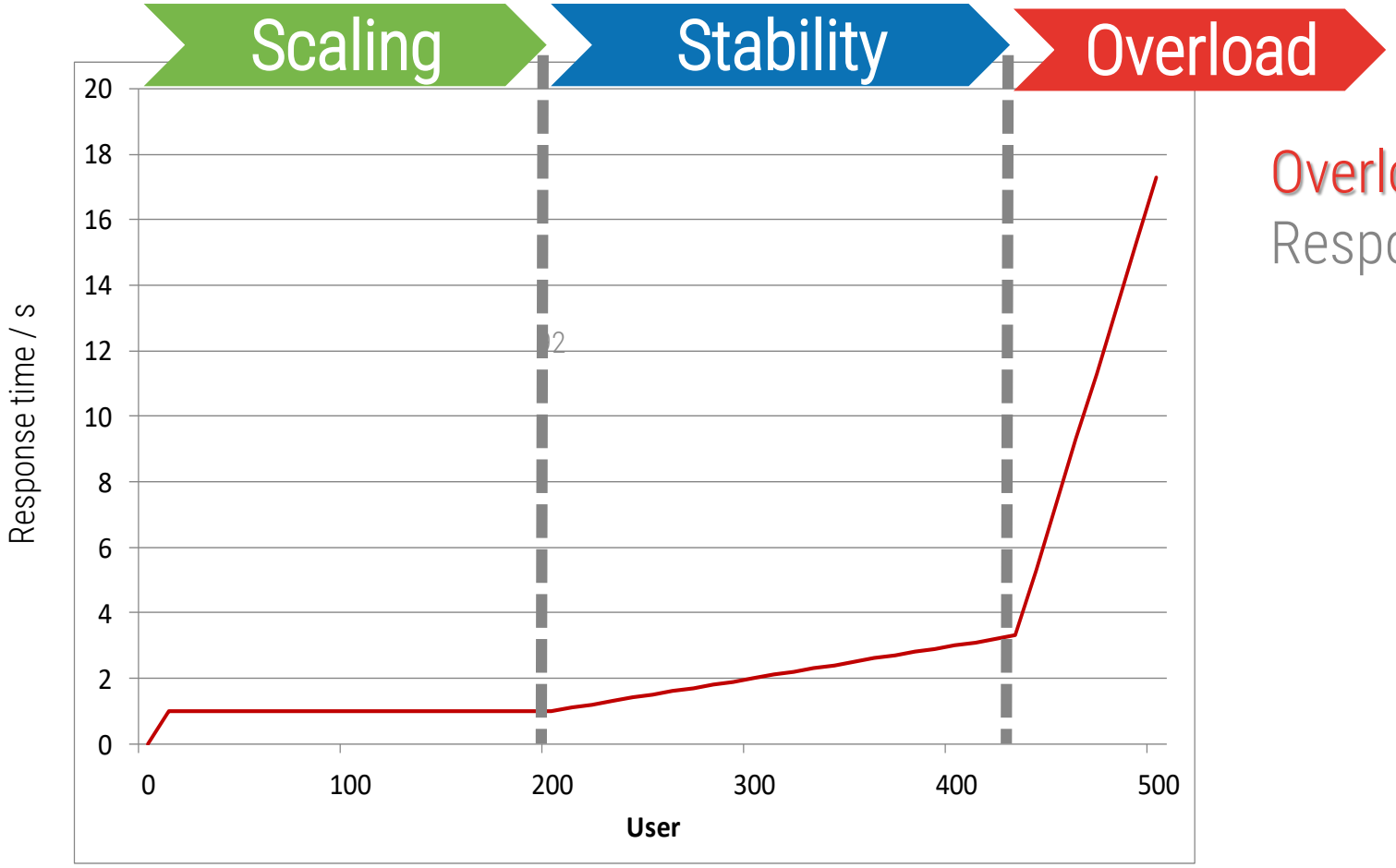
Phases of ideal load test



Stability

Response time increases slightly

Phases of ideal load test



Overload

Response time acts impredictable

Analyzing results

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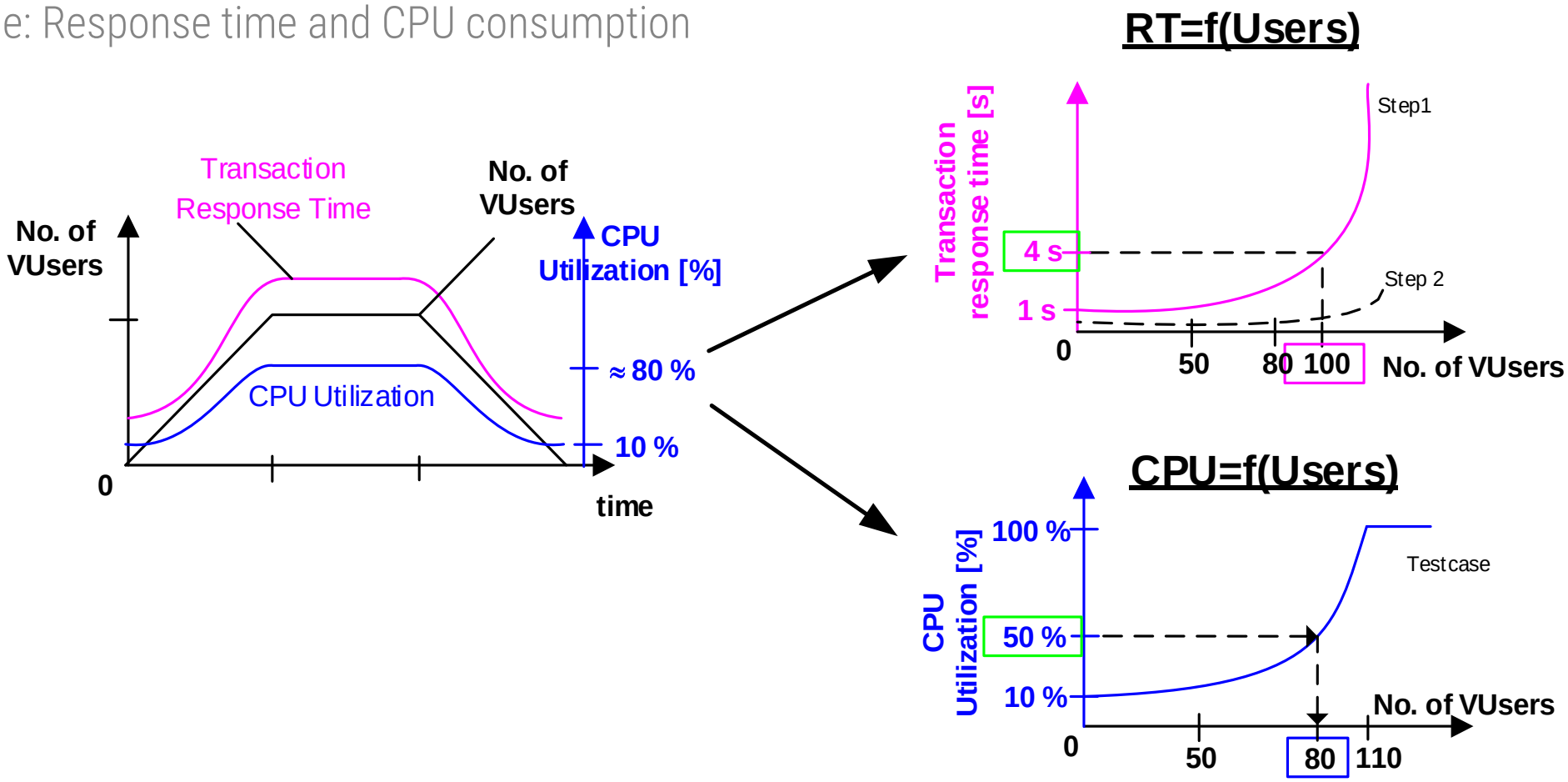
- Is there enough test hardware available in the test environment?
  - Benchmark business processes against the testing hardware
- Take a business process and execute a small number of users against the application.
  - Validates the functionality of the business process
  - Potentially exposes unknown data dependencies
- Evaluate the testing infrastructure against the footprint.
  - Do I have enough hardware to generate the user load?
  - Do I have enough memory?
  - Do I have enough CPUs?

Analyzing results

Example: Response time and CPU consumption



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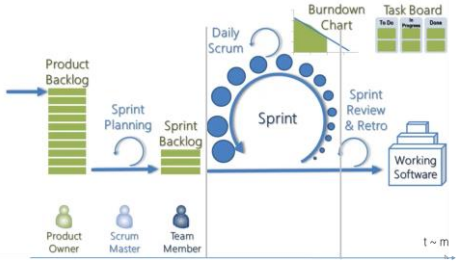
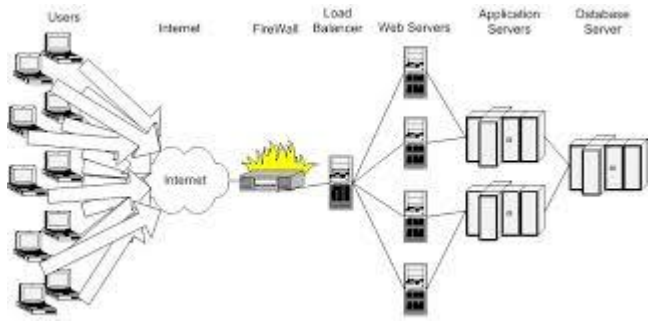
Summary

Results/data analysis
& interpretation

Consulting



Quality in software life cycle – essential!
Software testing – indispensible!



Complex infrastructures
& test designs

Coordinational
& conceptual skills

Performance
& load testing

Functional testing

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Questions?

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