



The Continuous APM Solution

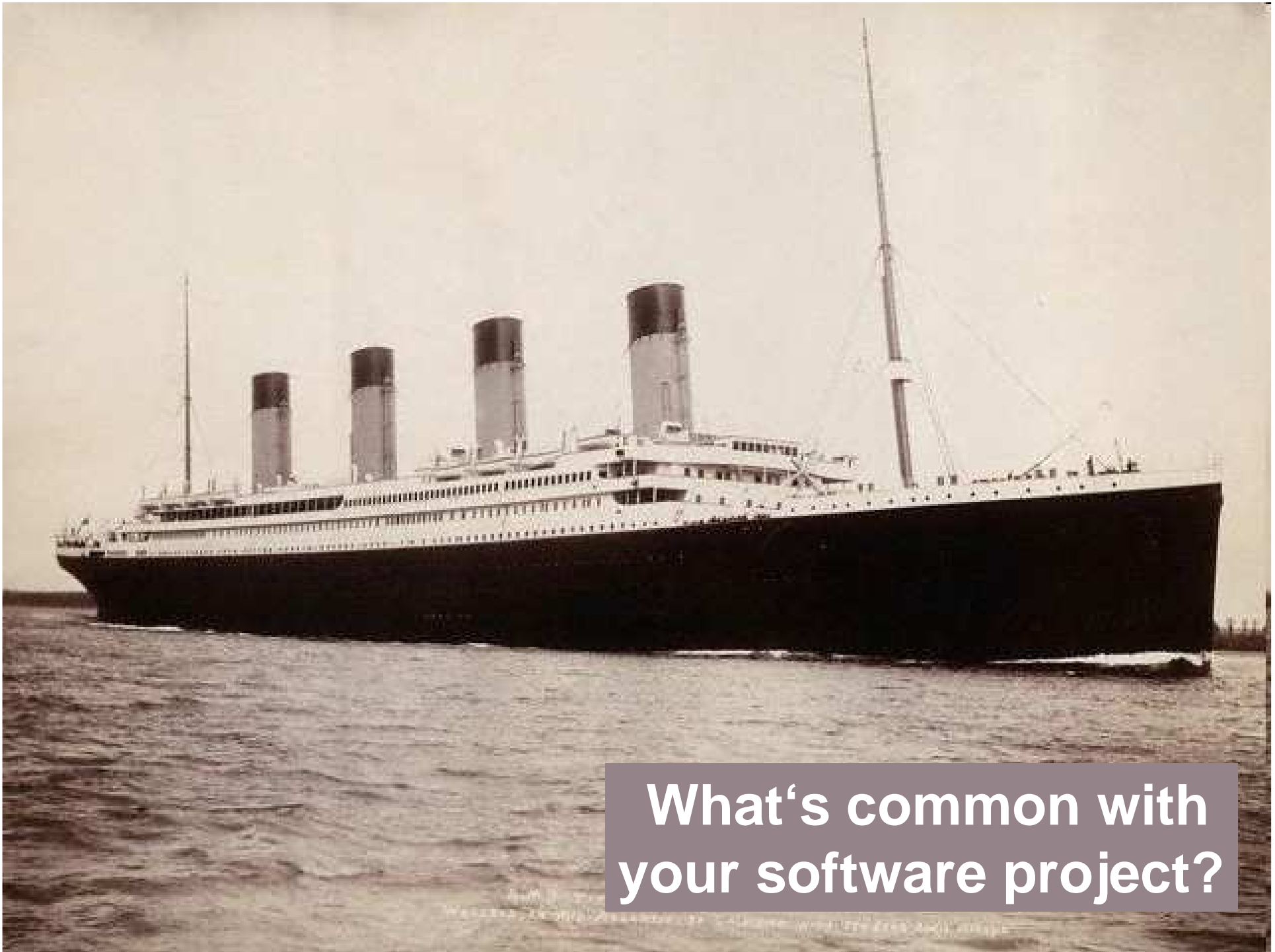
Building for Performance and Scalability

How to integrate performance management into your development process

Alois Reitbauer, Technology Strategist

<http://blog.dynatrace.com>

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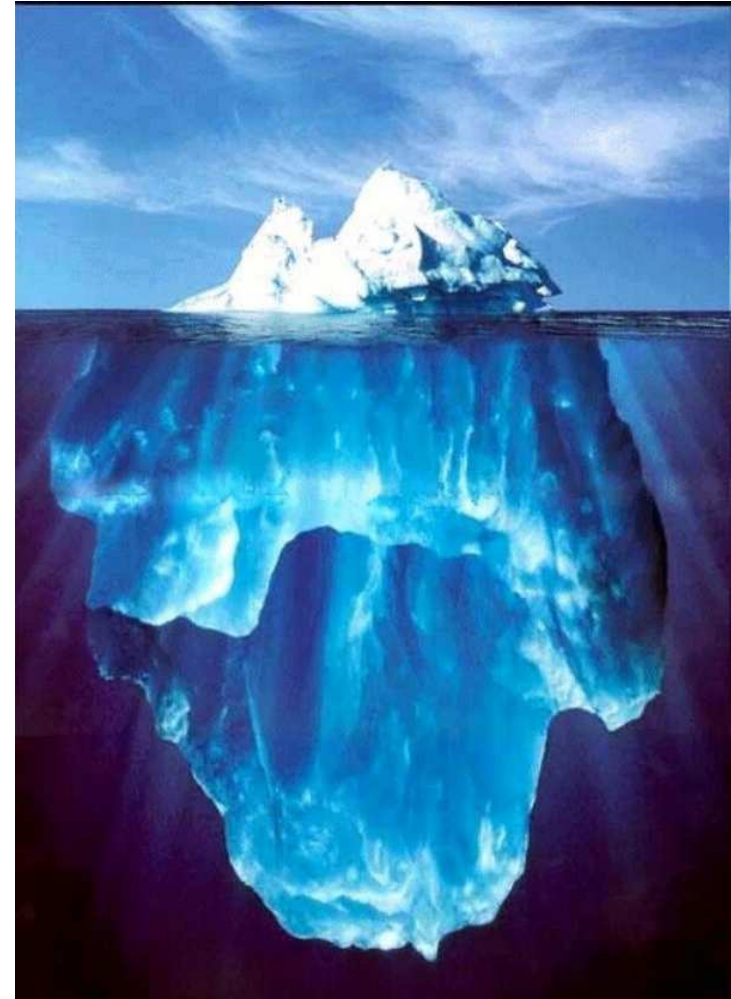


**What's common with
your software project?**



The Iceberg

- Performance problems often don't show up during development
- Performance testing is done late in the lifecycle (if at all)
- Problems manifest late in load testing or production
- Development must solve problems in a „hostile“ environment

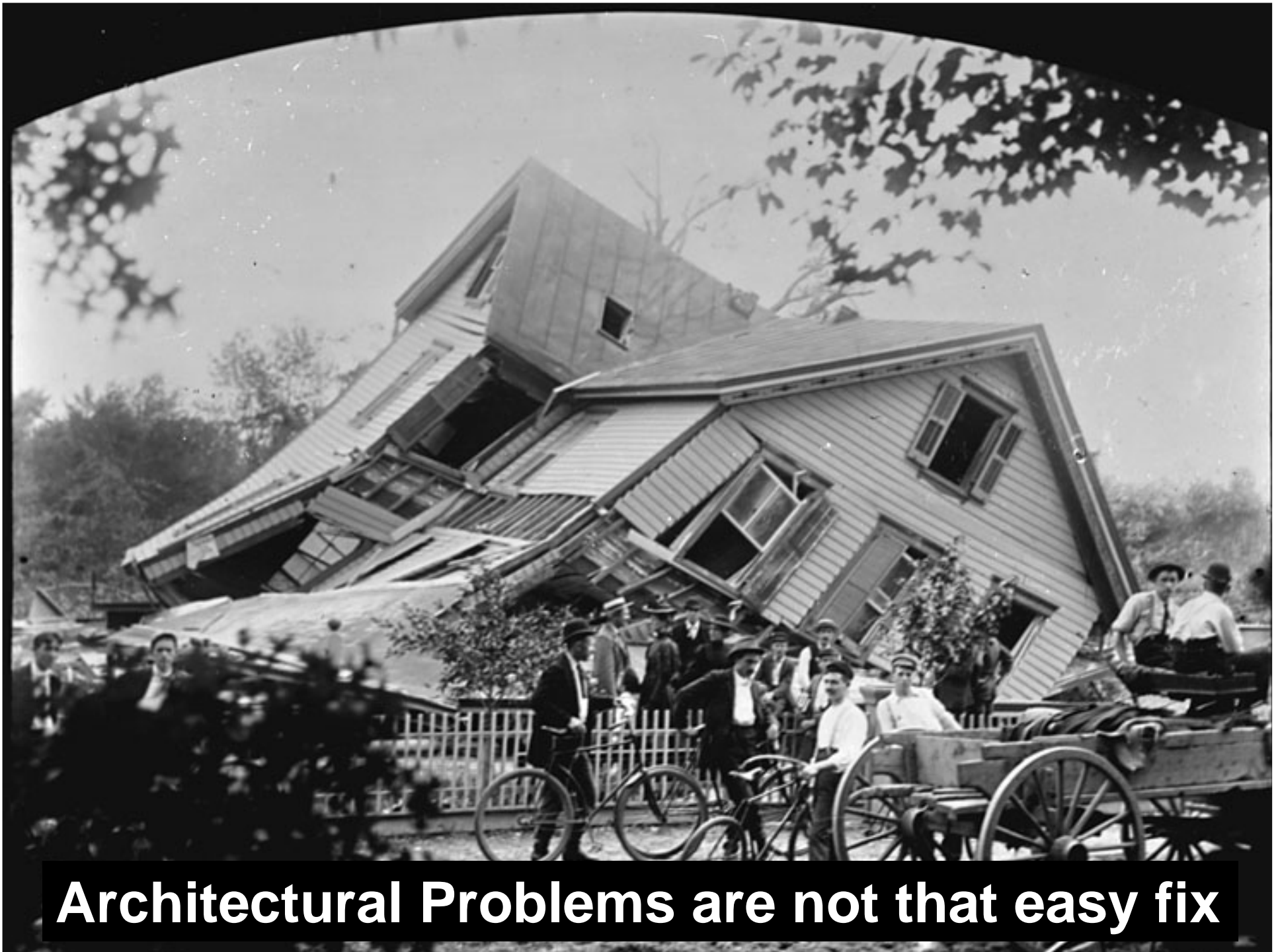




What is going on under the surface?

Photograph by Maria Stenzel





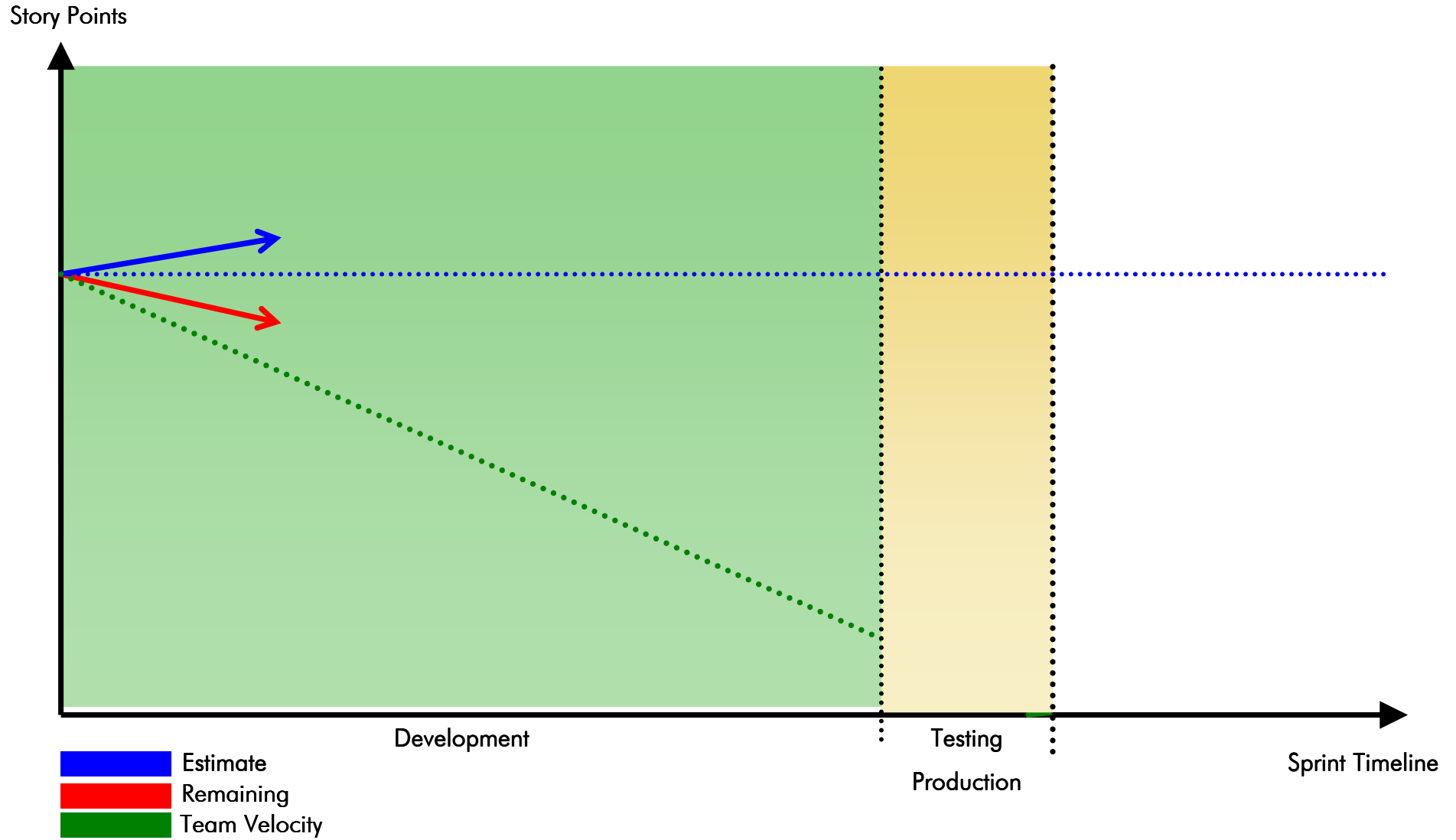
Architectural Problems are not that easy fix

However, you are agile and flexible





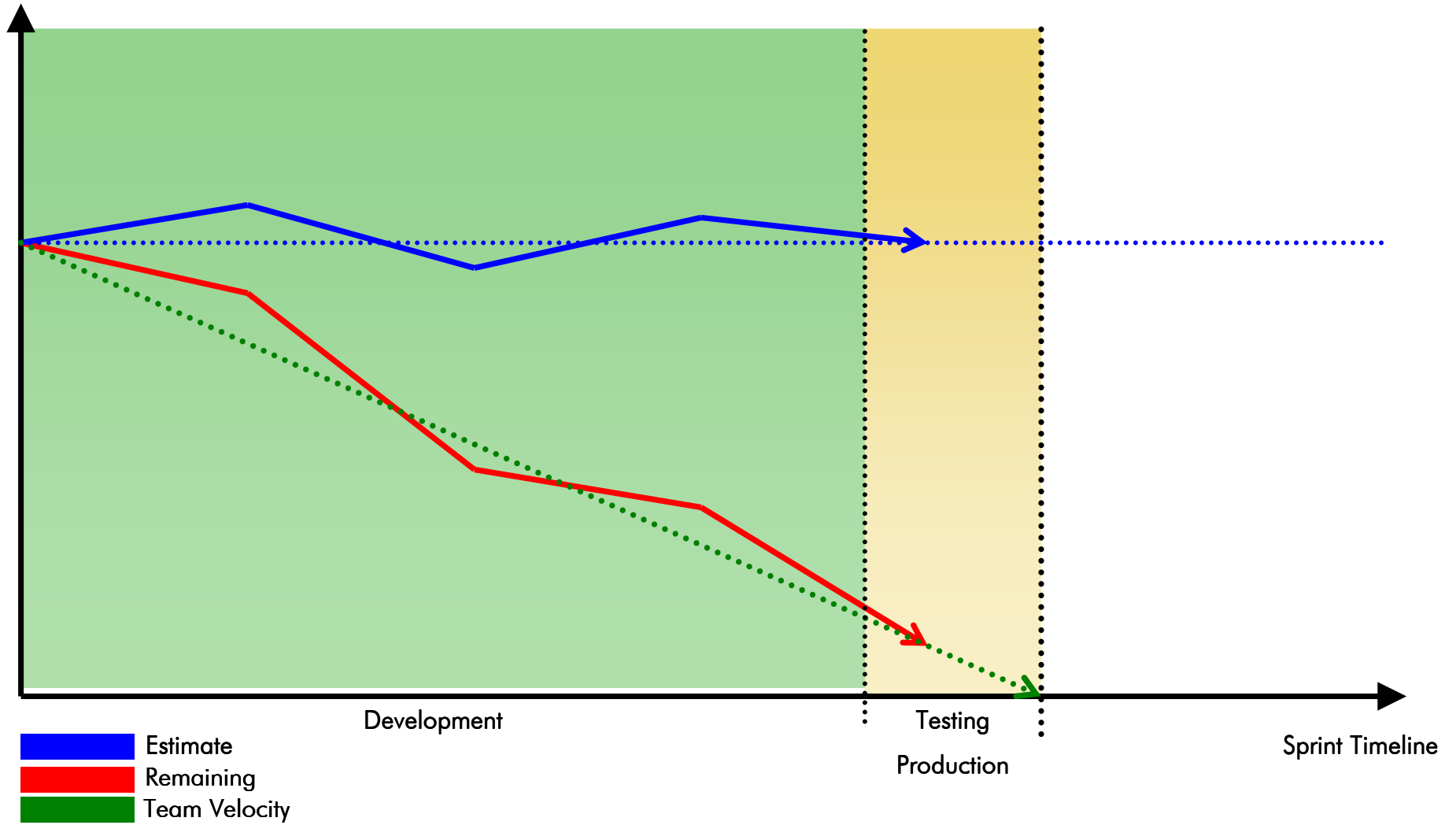
Monitoring in Agile Development





You are in control

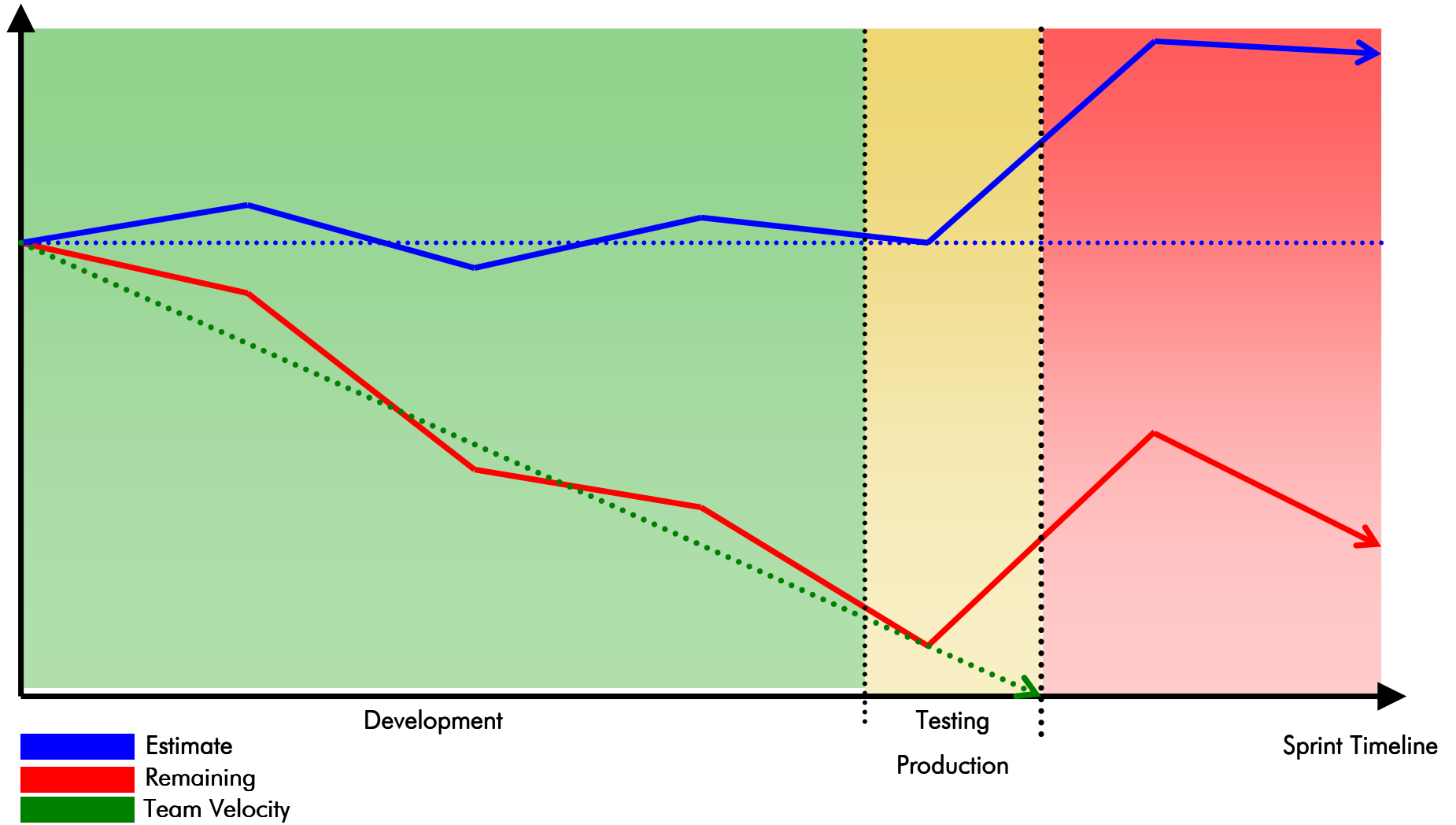
Story Points





What happened?

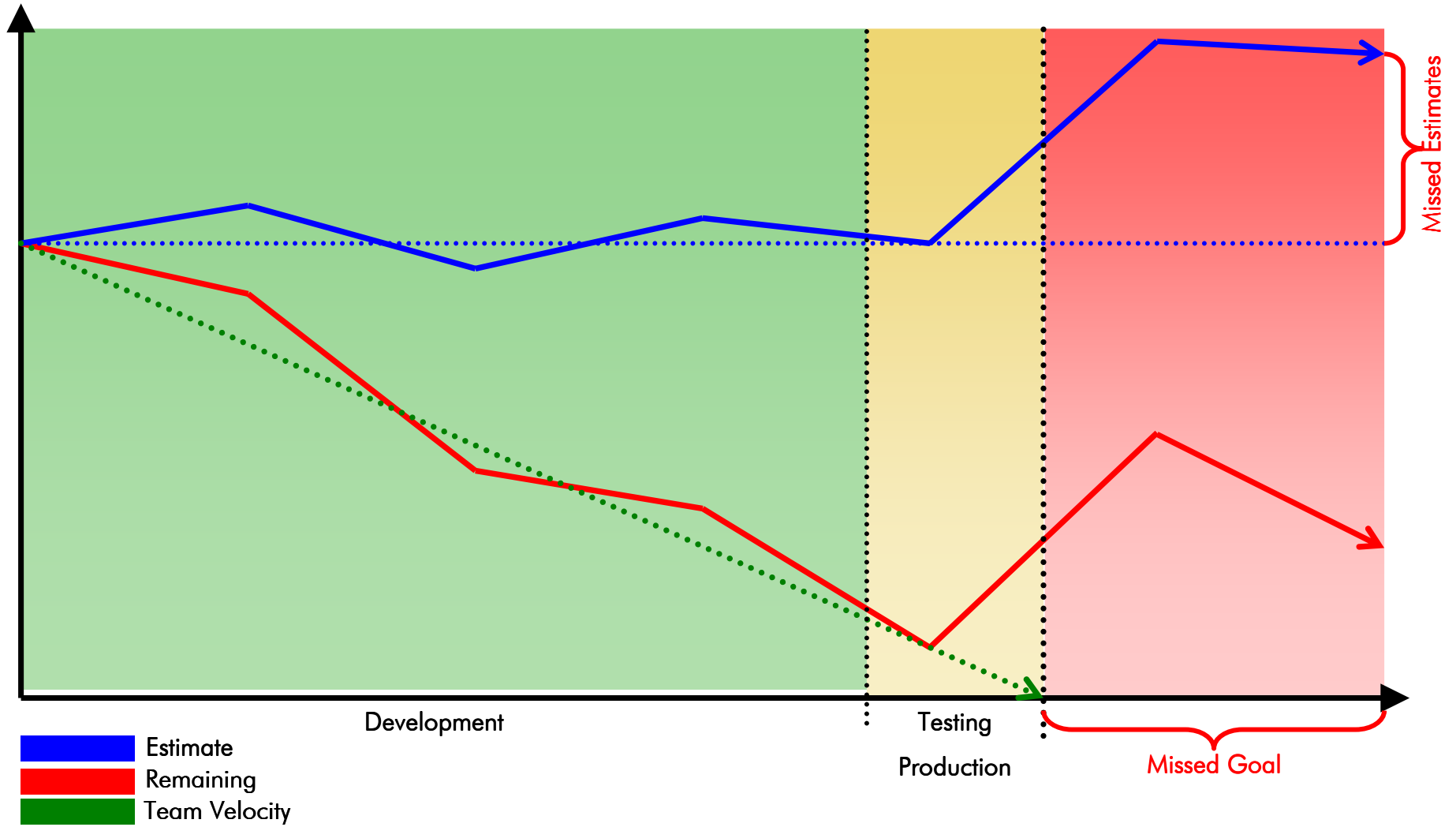
Story Points





Missed Goals and Estimates

Story Points



So

**... make performance management
part of your development
processes**

BUT



PREMATURE OPTIMIZATION

Come on, do it! Do it now! It feels soooo good.

Taken from K. Scott Allen's Blog : (www.odetocode.com)

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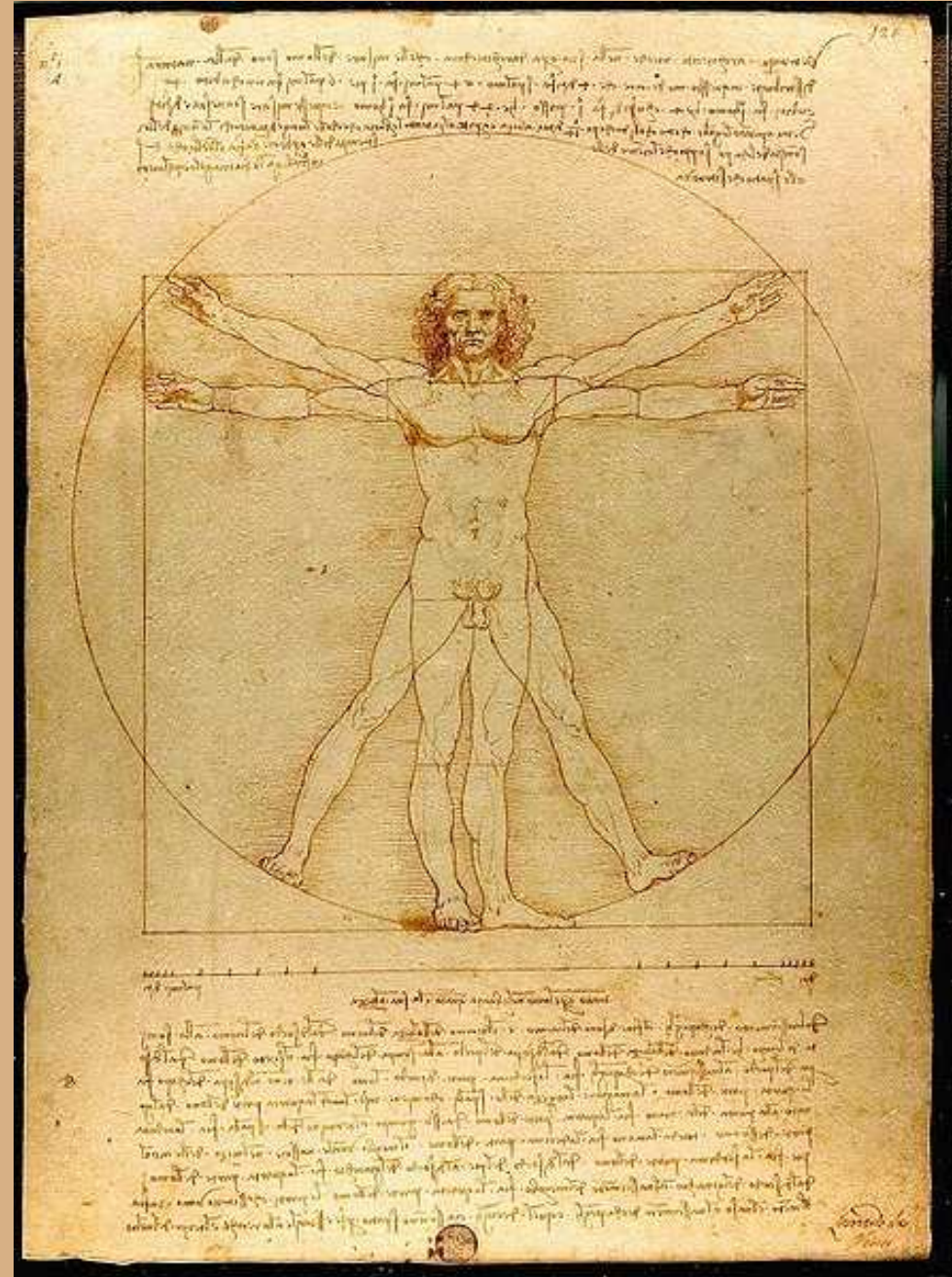


What if this was the problem?

Method	Class	Argument
exampleLazyLoading()	com.dynatrace.samples.database.Hibern...	
openSession()	org.hibernate.impl.SessionFactoryImpl	
createQuery(java.lang.String)	org.hibernate.impl.SessionImpl	from Person p
list()	org.hibernate.impl.QueryImpl	
list(java.lang.String, org.hibernate.engine.QueryParameters)	org.hibernate.impl.SessionImpl	
isTransactionInProgress()	org.hibernate.impl.SessionImpl	
prepareStatement(java.lang.String)	org.apache.derby.client.am.Connection	select person0_ID as ID0_, person0_firstName as firstName0_, person0_lastName
new PreparedStatement40(org.apache.derby.client.am.A...	org.apache.derby.client.am.PreparedSta...	org.apache.derby.client.am.Agent;org.apache.derby.client.am.Connection;java.lang
executeQuery()	org.apache.derby.client.am.PreparedSta...	select person0_ID as ID0_, person0_firstName as firstName0_, person0_lastName
initializeCollection(org.hibernate.collection.PersistentCollection)	org.hibernate.impl.SessionImpl	
prepareStatement(java.lang.String)	org.apache.derby.client.am.Connection	select addresses0_person_ID as person6_1_, addresses0_ID as ID1_, addresses0_
executeQuery()	org.apache.derby.client.am.PreparedSta...	select addresses0_person_ID as person6_1_, addresses0_ID as ID1_, addresses0_
initializeCollection(org.hibernate.collection.PersistentCollection)	org.hibernate.impl.SessionImpl	
prepareStatement(java.lang.String)	org.apache.derby.client.am.Connection	select addresses0_person_ID as person6_1_, addresses0_ID as ID1_, addresses0_
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executeQuery()	org.apache.derby.client.am.PreparedSta...	select addresses0_person_ID as person6_1_, addresses0_ID as ID1_, addresses0_
initializeCollection(org.hibernate.collection.PersistentCollection)	org.hibernate.impl.SessionImpl	
prepareStatement(java.lang.String)	org.apache.derby.client.am.Connection	select addresses0_person_ID as person6_1_, addresses0_ID as ID1_, addresses0_
executeQuery()	org.apache.derby.client.am.PreparedSta...	select addresses0_person_ID as person6_1_, addresses0_ID as ID1_, addresses0_

Tree Visualization API Distribution

Anatomy of Performance and Scalability Problems



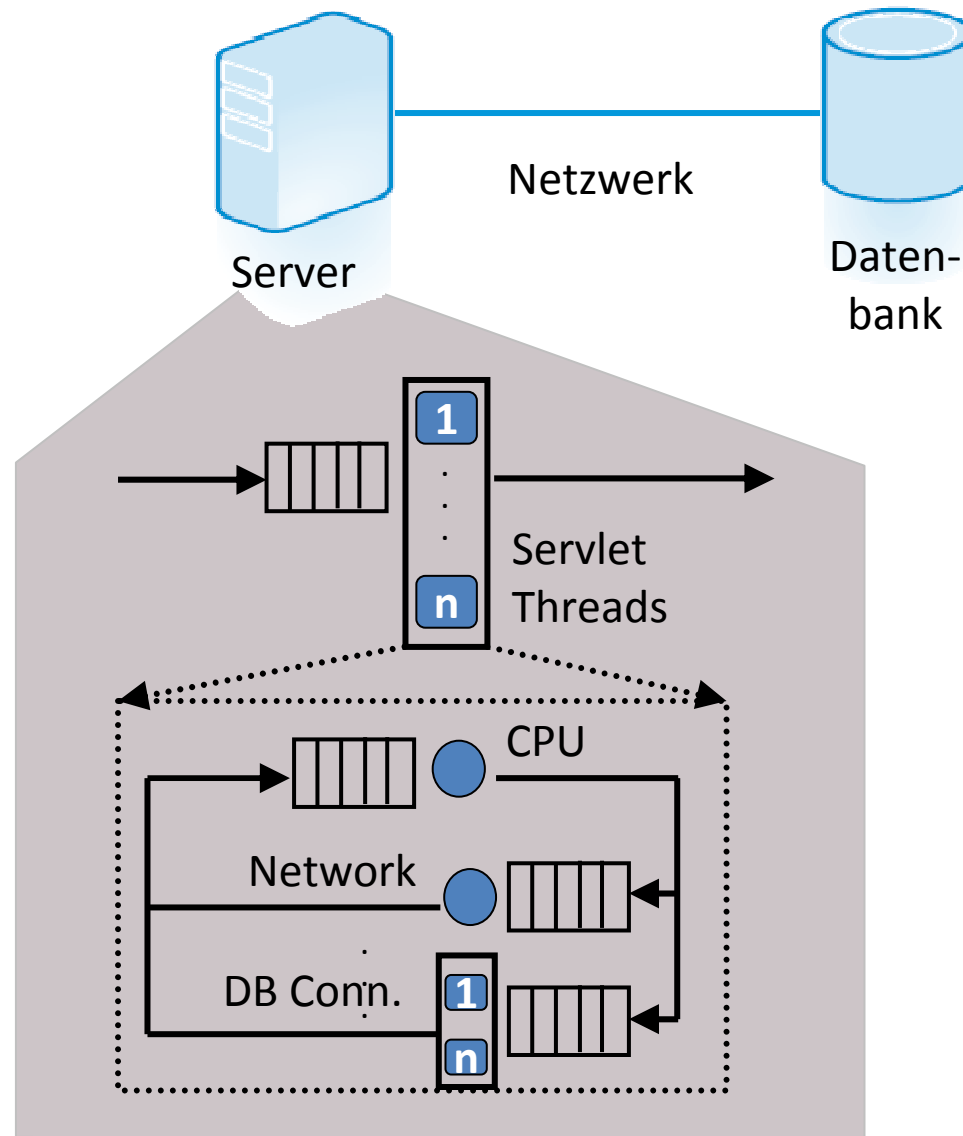


The Performance/Scalability View

- Queueing Theory
 - Modelling of bottleneck resource in a software systems
 - Modell resources as nodes and requests as queues
 - Example: CPU or number of current servlet request
- Queueing Networks
 - Model a computer system as a number of interconnected resources
 - Link resources together
 - Example: CPU, Network, Connection Pools, Servlet Threads,



A Web Application as a Queue Network



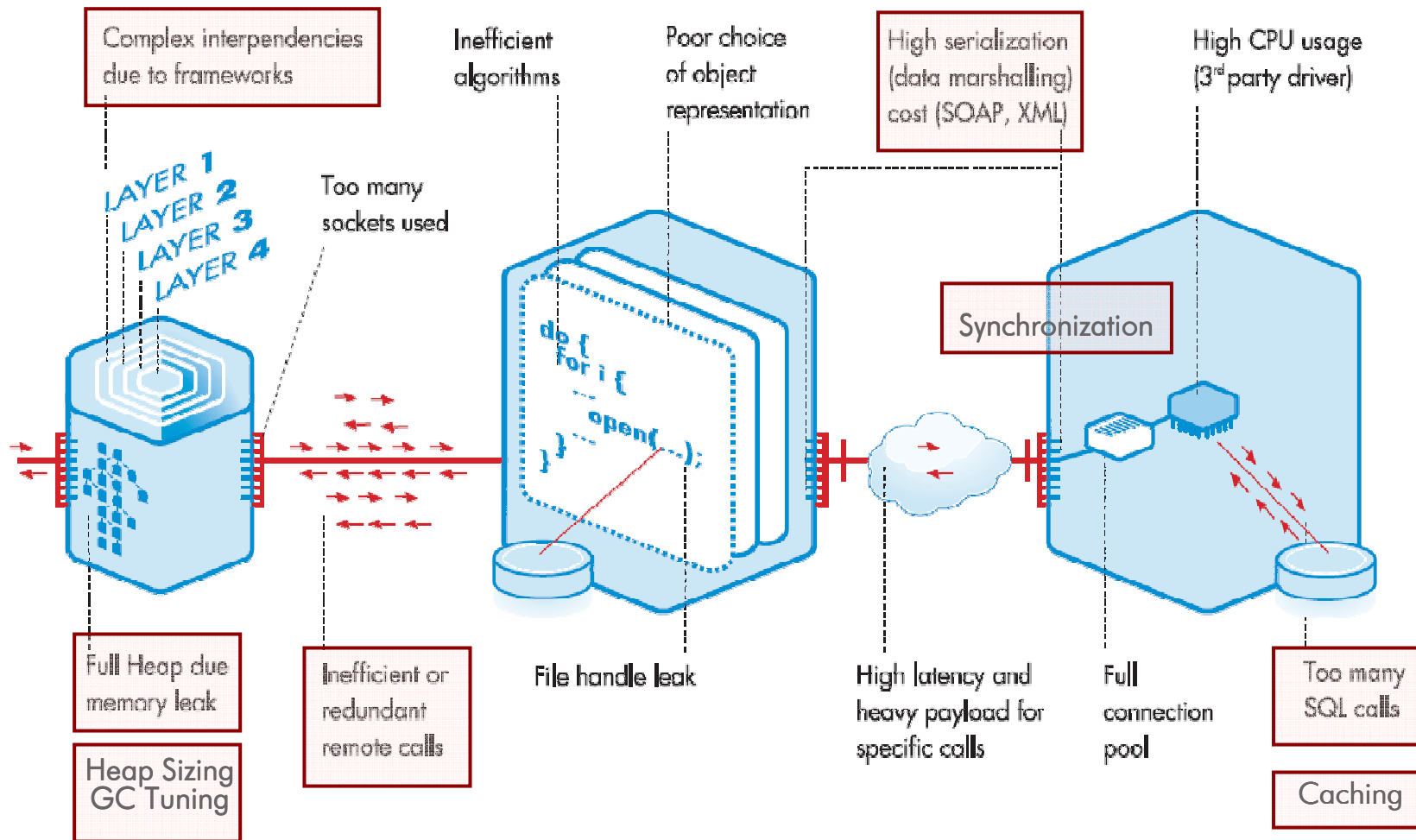


Limiting Factors for Software Systems

- CPU Usage
 - Scale with Hardware
- Memory Usage
 - Scale with Hardware
- I/O and Network
 - Limited and difficult to scale
 - Architectural changes required
- Access to Shared Resources
 - Difficult to scale or not scalable at all
 - Architectural changes required



Avoid Anti Patterns



How to integrate performance management into development?



What to do ... and when

- Developer Workplace
 - Impact analysis of code changes
 - Automatic verification against architectural rules
 - Verify that code change introduced no performance regressions
- Continuous Integration
 - Verify against earlier builds
 - Check every use case so changes have no side effects
 - Monitoring at code level to see regressions early
- Load Testing
 - Run major performance test
 - Perform scalability and deployment tuning



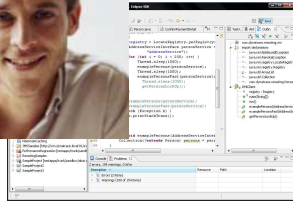
Performance Management in Development

Developer



(1) Develop Feature

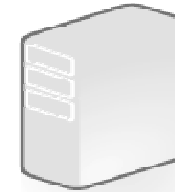
(2) Local Verification



(3) Commit Feature



CI System

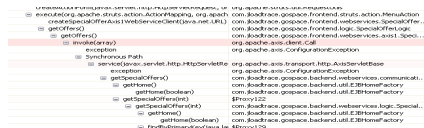


(4a) Automated Build

(4b) Unit Test

(4c) Performance Tests

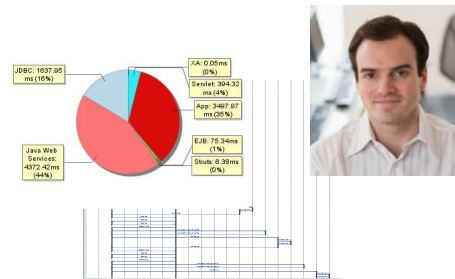
(5a) Realtime Performance Feedback



(5c) Realtime Performance Regression

(5b) Realtime Architecture Validation

Development Manager



Test Automation

deFindTag()	org.apache.struts.taglib.tiles.Inse...	
getHome()	com.footrace.gospace.backend...	
getTag()	com.footrace.gospace.backend...	
getTname()	com.footrace.gospace.backend...	0.01 (19%)
getAvatar()	com.footrace.gospace.backend...	0.02 (55%)
getAvatar()	com.footrace.gospace.backend...	-0.58 (-1411%)
isLoaded()	com.footrace.gospace.backend...	0.03 (72%)
getSpecialOffers(int)	\$Proxy122	-20.68 (-518%)
getTag()	com.footrace.gospace.backend...	0.01 (25%)



Architecture Validation with Unit Testing

- Unit tests only verify functionality
- Let your unit tests fail if
 - The same SQL Statement is executed more than once
 - Too many remoting roundtrips
 - Certain exceptions are thrown and handled
 - Objects are not released
 - ...

Method	Class	Argument	API	Total [ms]	Exec [ms]	Return
Run(Microsoft.VisualStudio.TestTools.UnitTesting.AssemblyAttribute)	Microsoft.VisualStudio.TestTools.UnitTesting.AssemblyAttribute	'TestAccountInform...	UnitTest	13203.52	468.15	
PrivateInvoke(System.Runtime.Remoting.Obj...	System.Runtime.Remoting.Obj...		.NET Remo...	11.43	11.43	
PrivateInvoke(System.Runtime.Remoting.Obj...	System.Runtime.Remoting.Obj...		.NET Remo...	7.73	7.73	
RunAssemblyInitializeMethod()	Microsoft.VisualStudio.TestTools.UnitTesting.AssemblyAttribute		UnitTest	0.06	0.06	
RunClassInitializeMethod()	Microsoft.VisualStudio.TestTools.UnitTesting.AssemblyAttribute		UnitTest	1227.39	10.54	
PrivateInvoke(System.Runtime.Remoting.Obj...	System.Runtime.Remoting.Obj...		.NET Remo...	1.25	1.25	
PrivateInvoke(System.Runtime.Remoting.Obj...	System.Runtime.Remoting.Obj...		.NET Remo...	1.10	1.10	
TestClassInit(Microsoft.VisualStudio.TestTools.UnitTesting.AssemblyAttribute)	DotNetPayTesting.L...		TestInit	1214.50	1214.50	
exception	System.IO.FileNotFoundException	Could not load file o...	Exception	-	-	
exception	System.IO.FileNotFoundException	Could n	Contributor Details			
exception	System.IO.FileNotFoundException	Could n	Method:	exception	Class:	System.IO.FileNotFoundException
exception	System.IO.FileNotFoundException	Could n	Argument 1:	Could not load file or assembly 'C:\Program Files\Microsoft Visual Studio 9.0\Common7\IDE\PrivateAssemblies\DotNetPayTesting.XmlSeriali... dependencies. The system cannot find the file specified.		
exception	System.IO.FileNotFoundException	Could n	Return:	-		
exception	System.IO.FileNotFoundException	Could n	Agent:	VSTestHost@GRABS:11536	API:	Exception
exception	System.IO.FileNotFoundException	Could n	Thread Name:	Agent: adapter run thread for test 'TestAccountInformation' with id '786a6ccb-35e3-4ded-8c0e-769ce0c26ff0' <20>		
exception	System.IO.FileNotFoundException	Could n				
exception	System.IO.FileNotFoundException	Could not load file o...	Exception	-	-	

Analyze execution of each single unit test – identify architectural issues



Learn how foreign code works

- Get insight into whats going on „under the hood“
 - Understand internals of the frameworks you use
 - Choose the right usage for your use case

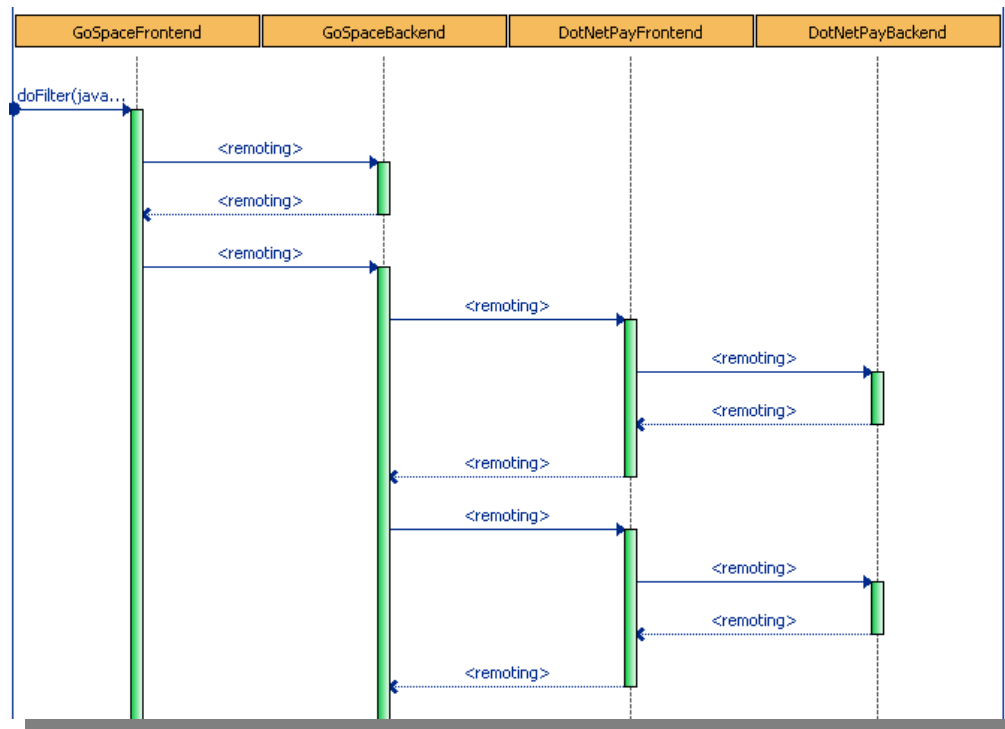
Method	Class	Argument
loadData()	com.dynatrace.sam...	
openSession()	org.hibernate.impl.S...	
beginTransaction()	org.hibernate.impl.S...	
createQuery(java.lang.String queryString)	org.hibernate.impl.S...	from Person p where p.id=1
list()	org.hibernate.impl...	
list(java.lang.String query, org.hibernate.enx...	org.hibernate.impl.S...	
isTransactionInProgress()	org.hibernate.impl.S...	
prepareStatement(java.lang.String)	org.apache.derby.cl...	select person0_ID as ID0_ person0_firstName as firstName,...
executeQuery()	org.apache.derby.cl...	select person0_ID as ID0_ person0_firstName as firstName,...
createQuery(java.lang.String queryString)	org.hibernate.impl.S...	from Person p where p.id=1
list()	org.hibernate.impl...	
list(java.lang.String query, org.hibernate.enx...	org.hibernate.impl...	
isTransactionInProgress()	org.hibernate.impl...	
prepareStatement(java.lang.String)	org.apache.derby.cl...	
executeQuery()	org.apache.derby.cl...	
managedFlush()	org.hibernate.impl...	

Method	Class	Argument
loadDataByClass()	com.dynatrace.sam...	
openSession()	org.hibernate.impl.S...	
beginTransaction()	org.hibernate.impl.S...	
load(java.lang.Class entityClass, java.io.Serializ...	org.hibernate.impl.S...	
load(java.lang.String entityName, java.io.Sei...	org.hibernate.impl.S...	com.dynatrace.samples.hibernate.dataobjects.Person
getFirstName()	com.dynatrace.sam...	
immediateLoad(java.lang.String entityName, org.hibernate.impl.S...	org.hibernate.impl.S...	
prepareStatement(java.lang.String)	org.apache.derby.cl...	select person0_ID as ID0_1_ person0_firstName as fir...
executeQuery()	org.apache.derby.cl...	select person0_ID as ID0_1_ person0_firstName as fir...
load(java.lang.Class entityClass, java.io.Serializ...	org.hibernate.impl.S...	
load(java.lang.String entityName, java.io.Sei...	org.hibernate.impl.S...	com.dynatrace.samples.hibernate.dataobjects.Person
getHibernateLazyInitializer()	com.dynatrace.sam...	
getFirstName()	com.dynatrace.sam...	
managedFlush()	org.hibernate.impl.S...	
flush()	org.hibernate.impl.S...	
getHibernateLazyInitializer()	com.dynatrace.sara...	



Gain insight into Service Interactions

- Do you know how your services really interact?
 - Compare your model to the real world
 - Identify configuration issues
 - Analyze individual transaction flows



Analyze all service interactions for single transactions



Is it really that easy?



Well, there are some hurdles



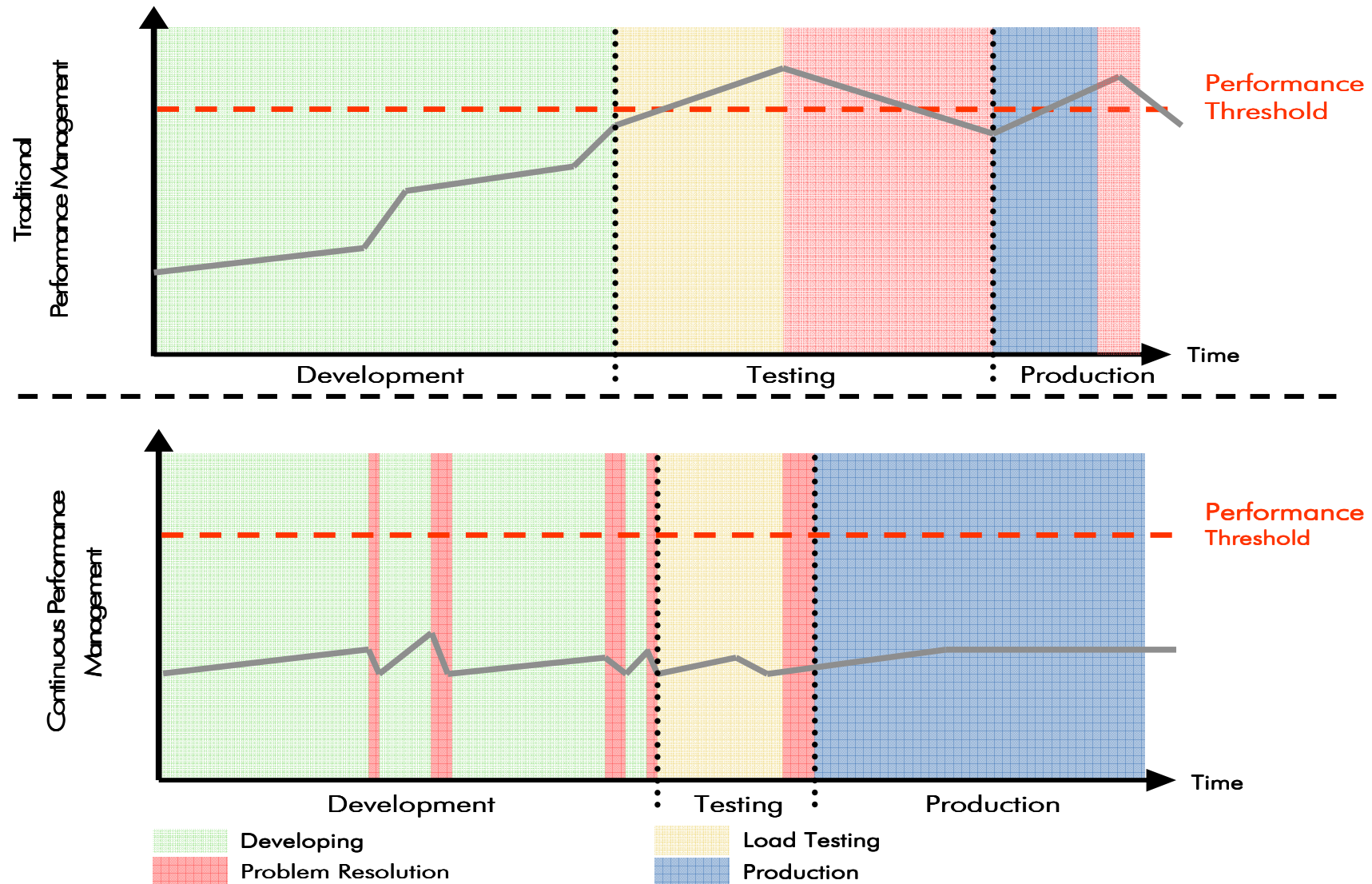
- Some performance problems will not show up in development
- „Real-world“ components are missing
- Timing information only of limited value
- Performance test case design can be hard

However, about 50 percent of performance problems can be found in early development stages

What's the benefit?



Avoid the iceberg





Feel free ...

... to contact me

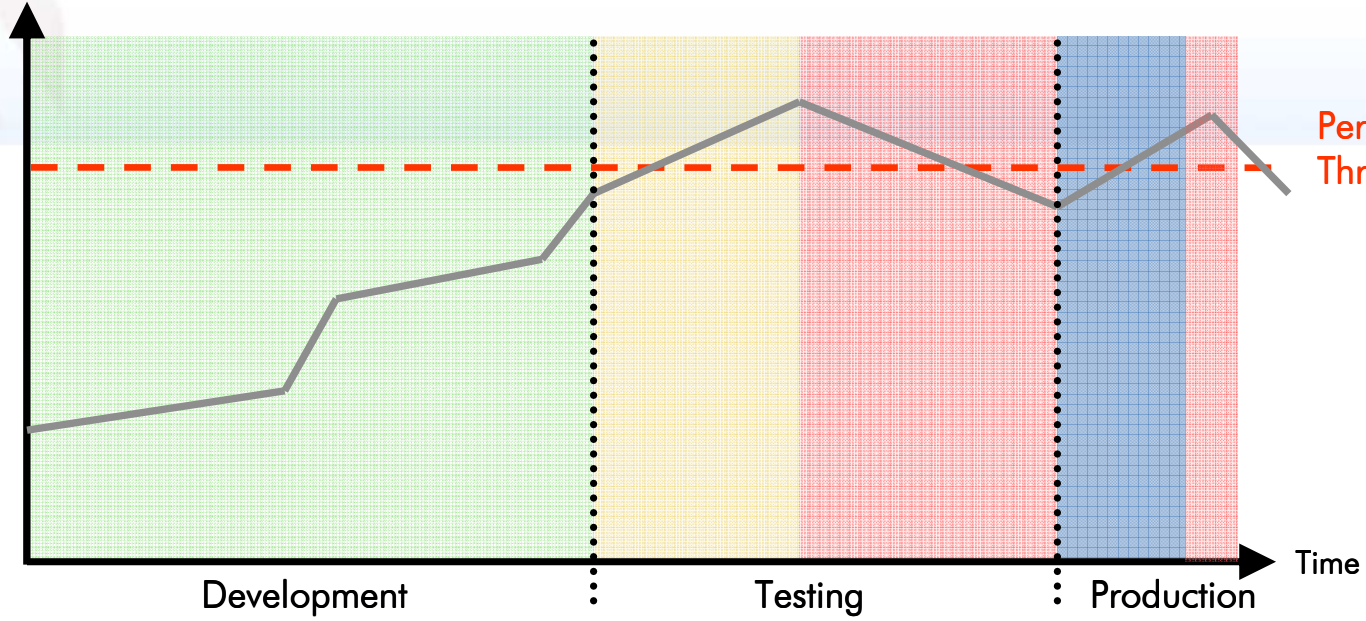
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Traditional Performance Management



Performance Threshold

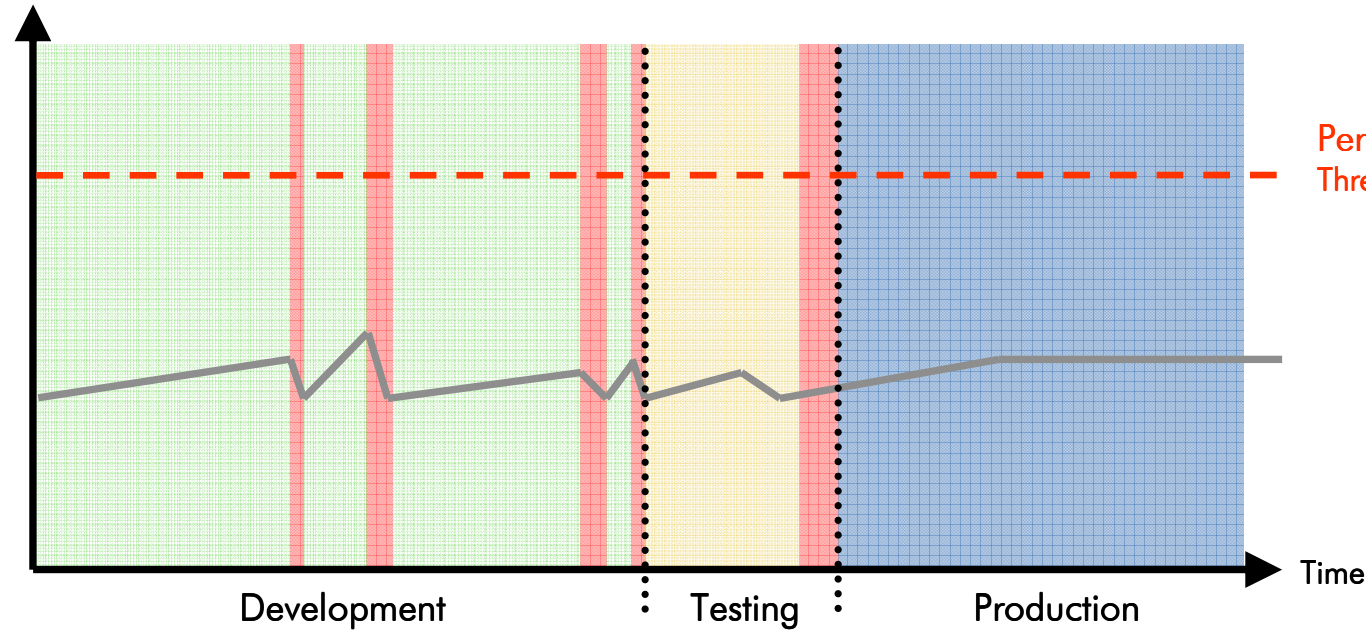
Development

Testing

Production

Time

Continuous Performance Management



Performance Threshold

Development

Testing

Production

Time

Developing

Problem Resolution

Load Testing

Production

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software