

Live Database Trace Visualization in Large Software Landscapes

ICSA 2017 Tutorial
Runtime Modeling and Visualization

Software Engineering Group, Kiel University
Christian Zirkelbach — April 04, 2017

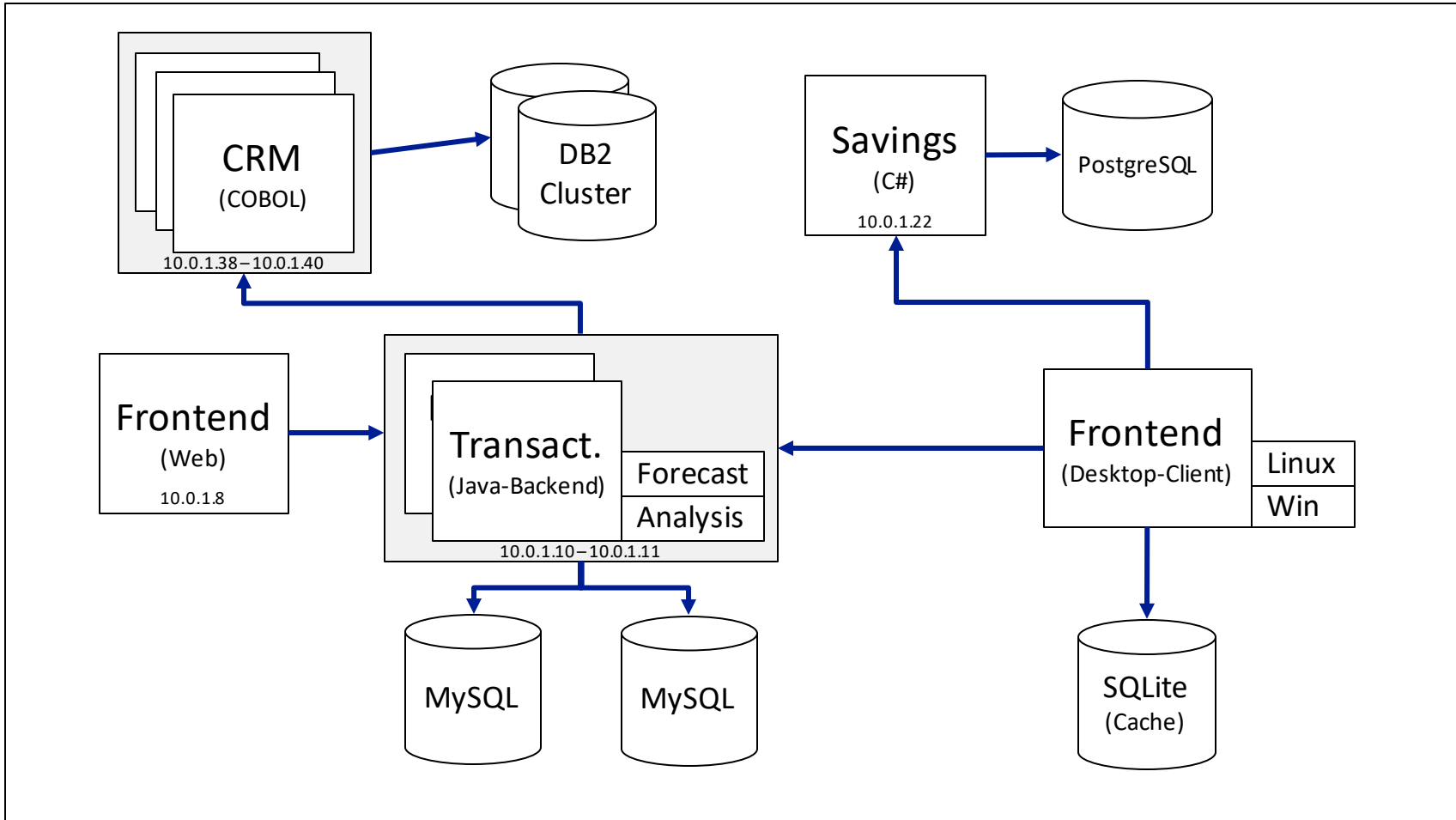


Schedule of Events

09:00 – 09:10	Welcome and General Introduction
09:10 – 09:40	Study Foundations
09:40 – 10:00	Model-based Software Application Monitoring
10:00 – 10:30	Runtime Architecture Modeling and Visualization
10:30 – 11:00	Coffee Break
11:00 – 12:15	Introduction to the ExplorViz, Palladio, and iObserve Approaches with following Tool / Visualization Demos
12:15 – 12:30	Study Setup
12:30 – 14:00	Lunch
14:00 – 15:30	Comprehensibility Study
15:30 – 16:00	Coffee Break
16:00 – 16:30	Live Database Trace Visualization in Large Software Landscapes
16:30 – 17:00	Feedback and Open Discussion

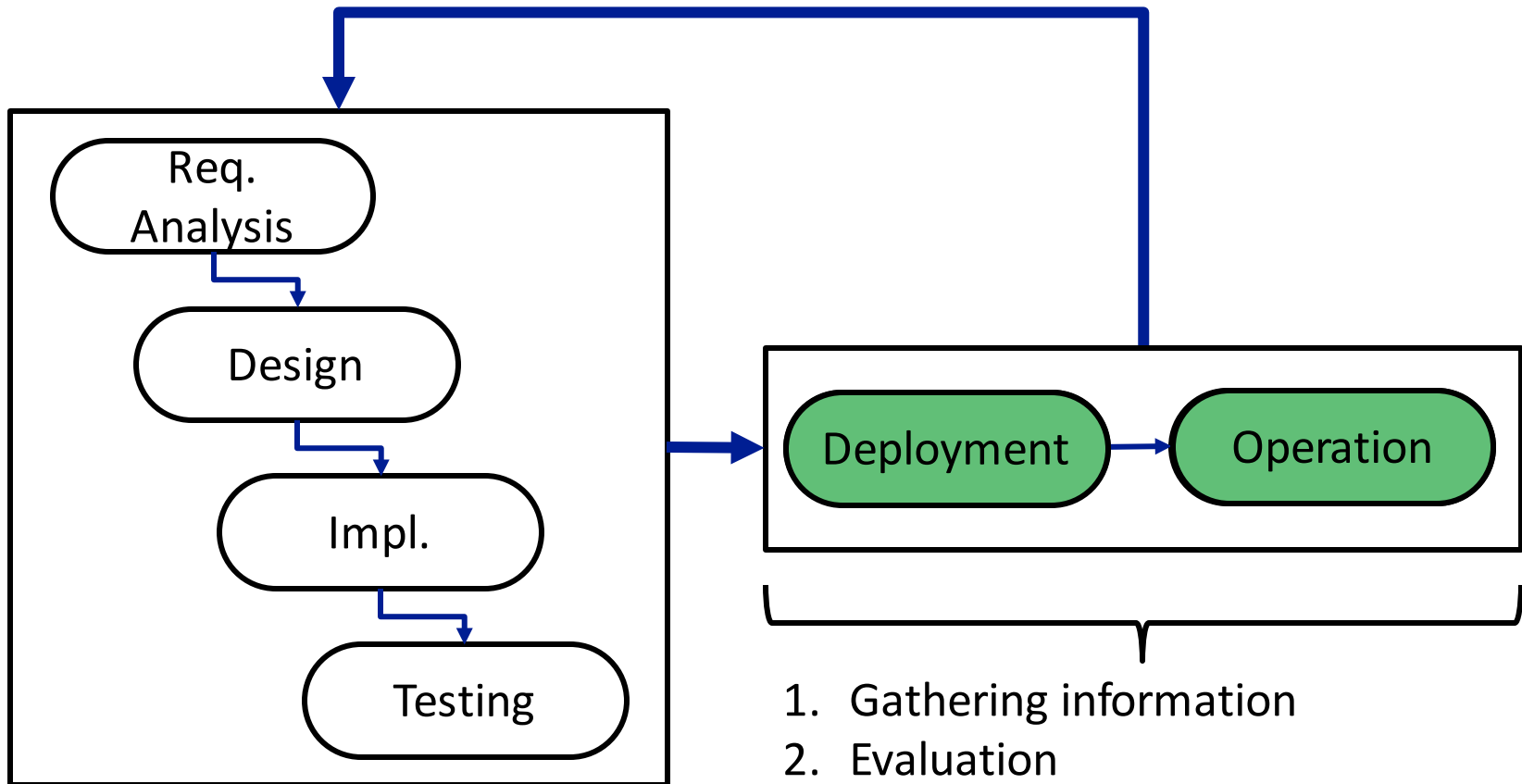
Example Software Landscape (Banking Industry)

Systems, Applications, and Databases



- Handling large-scale, enormous-in-size data repositories [Cuzzocrea et. al]
- Changing requirements or increasing workload
- Performance issues or customer requests [Zirkelbach et. al]
→ inevitable software updates or refactoring
- Legacy systems: often based on outdated technologies and poorly documented [Godfrey and German]
- Insufficient knowledge of the (actual) systems hamper the process [LaToza et. al]

Where to start?

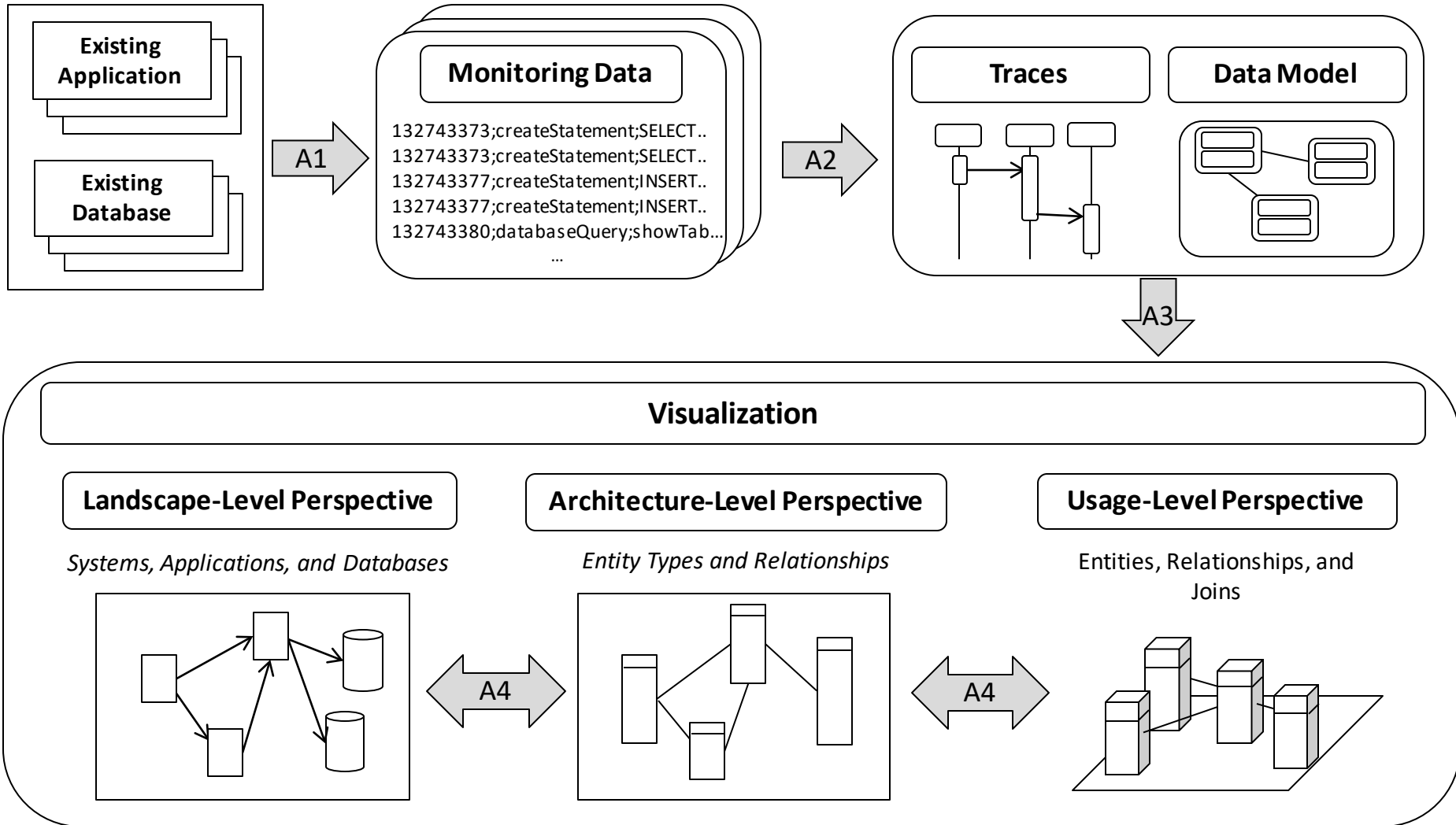


Extended system development life cycle (SDLC) based on [Avison and Fitzgerald]

Envisioned Approach



Envisioned Approach

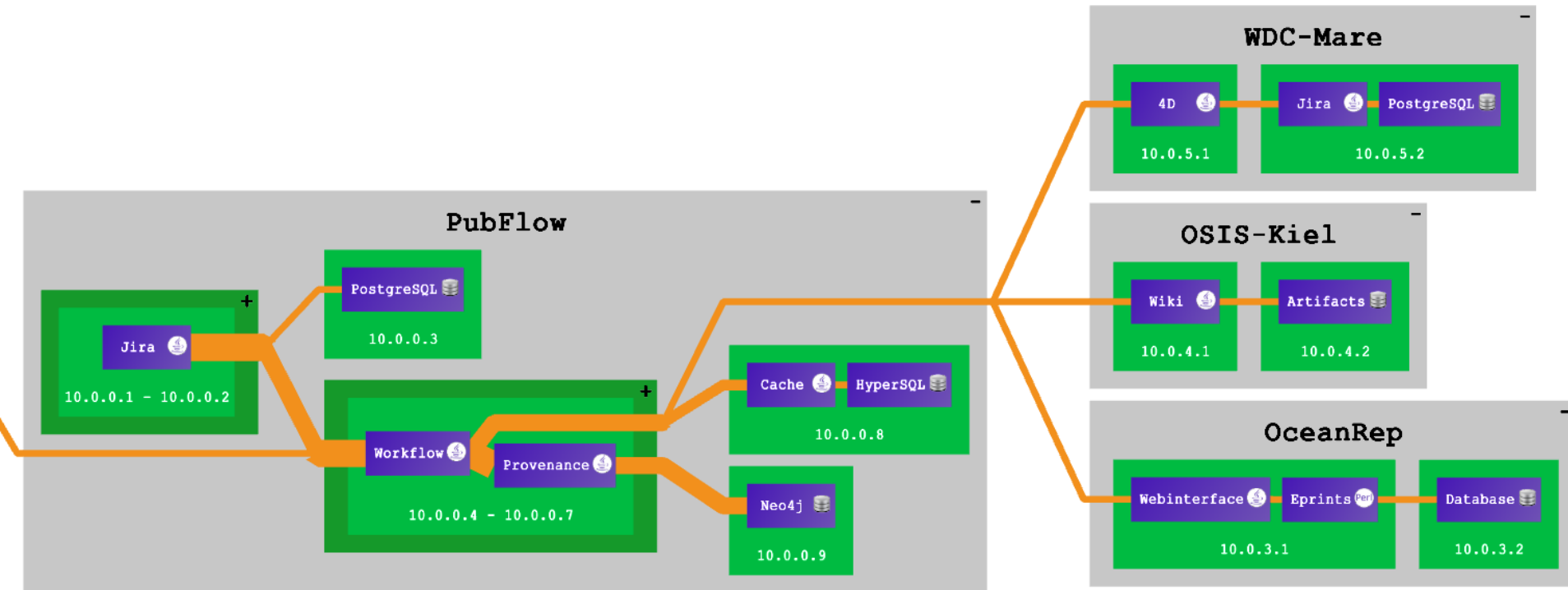


Legend A1: Monitoring | A2: Analysis | A3: Transformation | A4: Navigation

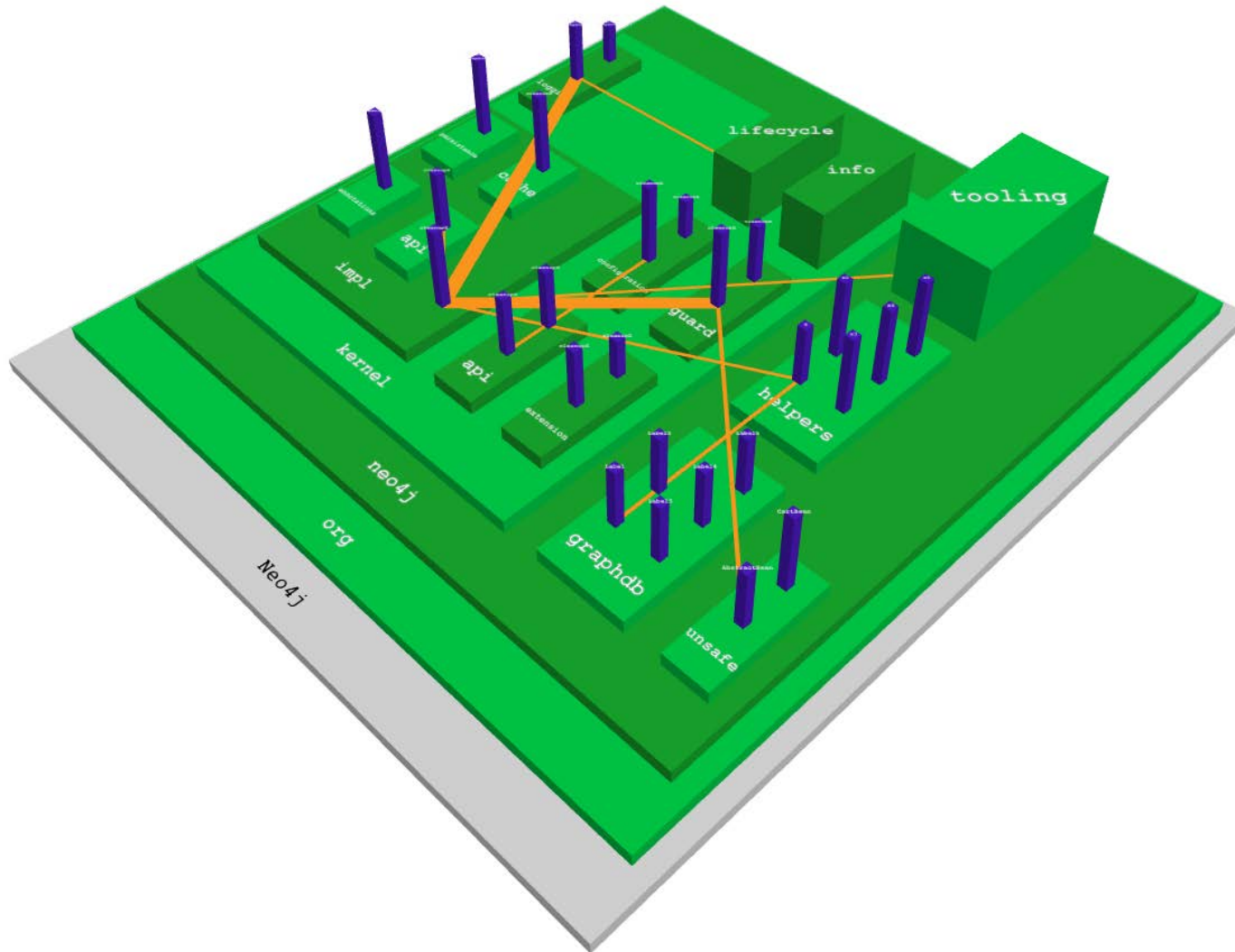
Related Work



ExplorViz



ExplorViz





inspectIT
File Window Help

Wiki search

Repository Storage Man Data Explore Show All

Recorded data DVD_STORE [n/a] SQL Statements Show All

Show available: Online Local

Filter storages

Local CMR
Recorded data [Local CMR] - Readable, 7.5 MiB

Recorded data

General information

Repository: Local CMR (localhost:8182)
Description:
Size on disk: 7.5 MiB
State: Readable
Unique ID: 3a3e6944-1235-4a46-9a7b-9097d90f88d7

Labels

Type	Value
Creation Date	Aug 4, 2015 12:41:16 PM
Data Timeframe	Aug 4, 2015 12:09:12 PM - Aug 4, 2015

Add Remove

Database URL	Statement	In Invocations	Count	Avg (ms)	Min (ms)	Max (ms)	Duration (ms)
.././database/database	select product0_PROD_ID as PROD1_5_, product0_ASIN as ASIN5_, product0_DESCRIPTION as DESCRIPT3_5_ from PRODUCTS product0_ where product0_TITLE like '%drama%' or lower(product0_TITLE) like '%drama%' or product0_TITLE like '%and%' or lower(product0_TITLE) like '%and%' or product0_TITLE like '%action%' or lower(product0_TITLE) like '%action%'	100% (in 20 inv)	20	61.6	47.7	81.3	1232.1
	select product0_PROD_ID as PROD1_5_, product0_ASIN as ASIN5_, product0_DESCRIPTION as DESCRIPT3_5_ from PRODUCTS product0_ where product0_TITLE like '%best%' or lower(product0_TITLE) like '%best%' or product0_TITLE like '%friend%' or lower(product0_TITLE) like '%friend%'	100% (in 105 inv)	105	0.0	0.0	0.2	2.5
	select product0_PROD_ID as PROD1_5_1_, product0_ASIN as ASIN5_1_, product0_DESCRIPTION as DESCRIPT3_5_1_ from PRODUCTS product0_ where product0_TITLE like '%thriller%' or lower(product0_TITLE) like '%thriller%'	100% (in 109 inv)	109	0.1	0.0	6.7	13.1
	select product0_PROD_ID as PROD1_5_, product0_ASIN as ASIN5_, product0_DESCRIPTION as DESCRIPT3_5_ from PRODUCTS product0_ where product0_TITLE like '%king%' or lower(product0_TITLE) like '%king%' or product0_TITLE like '%last%' or lower(product0_TITLE) like '%last%' or product0_TITLE like '%wish%' or lower(product0_TITLE) like '%wish%'	100% (in 4 inv)	4	94.1	70.8	124.3	376.4
	select user0_USERID as USERID1_, user0_FIRSTNAME as FIRSTNAME1_, user0_LASTNAME as LASTNAME1_ from USERS user0_ where user0_TITLE like '%my%' or lower(user0_TITLE) like '%my%' or user0_TITLE like '%best%' or lower(user0_TITLE) like '%best%' or user0_TITLE like '%friend%' or lower(user0_TITLE) like '%friend%'	100% (in 30 inv)	30	0.1	0.0	0.1	1.8
	select inventory0_INV_ID as INV1_0_2_, inventory0_PROD_ID as PROD4_0_2_, inventory0_QUAN_IN_STOCK as QUAN_IN_STOCK1_ from INVENTORY inventory0_ where inventory0_TITLE like '%drama%' or lower(inventory0_TITLE) like '%drama%' or inventory0_TITLE like '%and%' or lower(inventory0_TITLE) like '%and%' or inventory0_TITLE like '%action%' or lower(inventory0_TITLE) like '%action%'	100% (in 200 inv)	800	0.0	0.0	0.1	23.3
	select product0_PROD_ID as PROD1_5_, product0_ASIN as ASIN5_, product0_DESCRIPTION as DESCRIPT3_5_ from PRODUCTS product0_ where product0_TITLE like '%king%' or lower(product0_TITLE) like '%king%' or product0_TITLE like '%last%' or lower(product0_TITLE) like '%last%' or product0_TITLE like '%wish%' or lower(product0_TITLE) like '%wish%'	100% (in 16 inv)	32	1.2	0.0	14.6	39.3
	select product0_PROD_ID as PROD1_5_, product0_ASIN as ASIN5_, product0_DESCRIPTION as DESCRIPT3_5_ from PRODUCTS product0_ where product0_TITLE like '%drama%' or lower(product0_TITLE) like '%drama%' or product0_TITLE like '%and%' or lower(product0_TITLE) like '%and%' or product0_TITLE like '%action%' or lower(product0_TITLE) like '%action%'	100% (in 6 inv)	6	74.3	63.2	90.4	445.6
	select sum(orderline0_QUANTITY*product1_PRICE) as col_0_0_ from ORDERLINES orderline0_ PRODUCTS product1_ where orderline0_TITLE like '%drama%' or lower(orderline0_TITLE) like '%drama%' or orderline0_TITLE like '%and%' or lower(orderline0_TITLE) like '%and%' or orderline0_TITLE like '%action%' or lower(orderline0_TITLE) like '%action%'	100% (in 16 inv)	32	4.6	0.0	13.9	148.1

Parameters	In Invocations	Count	Avg (ms)	Min (ms)	Max (ms)	Duration (ms)
['%my%', '%my%', '%best%', '%best%', '%friend%', '%friend%']	100% (in 1 inv)	1	70.8	70.8	70.8	70.8
['%best%', '%best%', '%fast%', '%fast%', '%thriller%', '%thriller%']	100% (in 1 inv)	1	82.3	82.3	82.3	82.3
['%drama%', '%drama%', '%and%', '%and%', '%action%', '%action%']	100% (in 1 inv)	1	124.3	124.3	124.3	124.3
['%king%', '%king%', '%last%', '%last%', '%wish%', '%wish%']	100% (in 1 inv)	1	99.0	99.0	99.0	99.0

select product0_PROD_ID as PROD1_5_, product0_ASIN as ASIN5_, product0_DESCRIPTION as DESCRIPT3_5_, product0_IMAGE_URL as IMAGE4_5_, product0_PRICE as PRICES_, product0_TITLE as TITLES_ from PRODUCTS product0_ where product0_TITLE like '%drama%' or lower(product0_TITLE) like '%drama%' or product0_TITLE like '%and%' or lower(product0_TITLE) like '%and%' or product0_TITLE like '%action%' or lower(product0_TITLE) like '%action%'

Related Work



InspectIT

https://www.inspectit.rocks

Invocation Sequence

Nest	Start Time	Method	Duration (m)	Child Count	URI	Use case
04.08.2015 12:33:50.7	04.08.2015 12:33:50.7	doFilter(ServletRequest, ServletResponse, FilterChain) - org.jboss.web.tomcat.filters.ReplyHeaderFilter	125.799	64	/dvdstore/browse	DVDstore02_search
04.08.2015 12:33:48.6	04.08.2015 12:33:48.6	doFilter(ServletRequest, ServletResponse, FilterChain) - org.jboss.web.tomcat.filters.ReplyHeaderFilter	121.502	65	/dvdstore/browse	DVDstore02_search
04.08.2015 12:33:44.4	04.08.2015 12:33:44.4	doFilter(ServletRequest, ServletResponse, FilterChain) - org.jboss.web.tomcat.filters.ReplyHeaderFilter	109.345	67	/dvdstore/browse	DVDstore02_search
04.08.2015 12:33:42.3	04.08.2015 12:33:42.3	doFilter(ServletRequest, ServletResponse, FilterChain) - org.jboss.web.tomcat.filters.ReplyHeaderFilter	101.624	66	/dvdstore/browse	DVDstore02_search
04.08.2015 12:33:38.1	04.08.2015 12:33:38.1	doFilter(ServletRequest, ServletResponse, FilterChain) - org.jboss.web.tomcat.filters.ReplyHeaderFilter	101.692	64	/dvdstore/browse	DVDstore02_search
04.08.2015 12:33:36.0	04.08.2015 12:33:36.0	doFilter(ServletRequest, ServletResponse, FilterChain) - org.jboss.web.tomcat.filters.ReplyHeaderFilter	116.688	64	/dvdstore/browse	DVDstore02_search

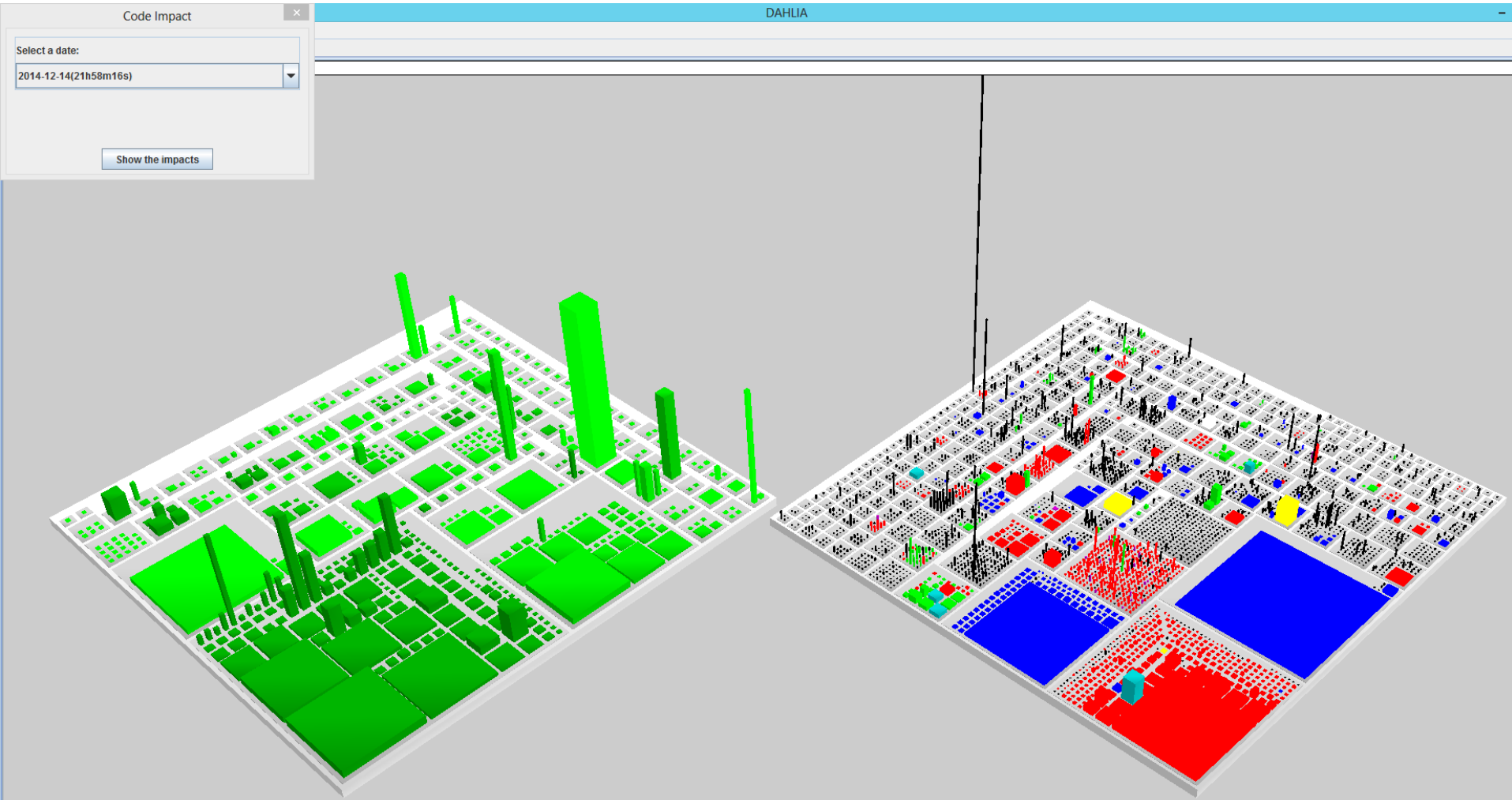
Method

Method	Duration (m)	Exc. dura	Cpu	Stack	Delta	SQL
doFilter(ServletRequest, ServletResponse, FilterChain) - org.jboss.web.tomcat.filters.ReplyHeaderFilter	125.799	6.231	108.592	0	0	
doFilter(ServletRequest, ServletResponse, FilterChain) - org.jboss.seam.servlet.SeamFilter				0	0	
doFilter(ServletRequest, ServletResponse, FilterChain) - org.jboss.seam.web.HotDeployFilter				0	0	
doFilter(ServletRequest, ServletResponse, FilterChain) - org.jboss.seam.web.RedirectFilter				6	6	
doFilter(ServletRequest, ServletResponse, FilterChain) - org.jboss.seam.web.ExceptionFilter				6	6	
doFilter(ServletRequest, ServletResponse, FilterChain) - org.jboss.seam.web.MultipartFilter				6	6	
doFilter(ServletRequest, ServletResponse, FilterChain) - org.jboss.seam.web.IdentityFilter				6	6	
doFilter(ServletRequest, ServletResponse, FilterChain) - org.jboss.seam.web.LoggingFilter				6	6	
doFilter(ServletRequest, ServletResponse, FilterChain) - org.tuckey.web.filters.urlrewrite.UrlRewriteFilter				6	6	
forward(ServletRequest, ServletResponse) - org.apache.catalina.core.ApplicationDispatcher	119.569	0.008	102.369	6	6	
doForward(ServletRequest, ServletResponse) - org.apache.catalina.core.ApplicationDispatcher	119.561	0.124	102.363	6	6	
checkSameObjects(ServletRequest, ServletResponse) - org.apache.catalina.core.ApplicationDispatcher	0.002	0.002	0.002	6	6	
wrapResponse(ApplicationDispatcher\$State) - org.apache.catalina.core.ApplicationDispatcher	0.001	0.001	0.001	6	6	
wrapRequest(ApplicationDispatcher\$State) - org.apache.catalina.core.ApplicationDispatcher	0.010	0.010	0.010	6	6	
processRequest(ServletRequest, ServletResponse, ApplicationDispatcher\$State) - org.apache.catalina.core.ApplicationDispatcher	119.424	0.006	102.226	6	6	
invoke(ServletRequest, ServletResponse, ApplicationDispatcher\$State) - org.apache.catalina.core.ApplicationDispatcher	119.418	20.646	102.221	6	6	
service(ServletRequest, ServletResponse) - javax.faces.webapp.FacesServlet				6	6	
getIsEmpty() - com.jboss.dvd.seam.ShoppingCartBean	0.003	0.003	0.002	10	10	
executeQuery() - org.h2.jdbc.JdbcPreparedStatement	0.020	0.020	0.020	10	10	select product0_PROD_ID as PROD1_5_, product0_ASIN as ASIN5_, pr...
executeQuery() - org.h2.jdbc.JdbcPreparedStatement	0.096	0.096	0.096	11	11	select inventory0_INV_ID as INV1_0_2_, inventory0_PROD_ID as PROD...
executeQuery() - org.h2.jdbc.JdbcPreparedStatement	0.038	0.038	0.038	11	11	select inventory0_INV_ID as INV1_0_2_, inventory0_PROD_ID as PROD...
executeQuery() - org.h2.jdbc.JdbcPreparedStatement	0.026	0.026	0.026	11	11	select inventory0_INV_ID as INV1_0_2_, inventory0_PROD_ID as PROD...
executeQuery() - org.h2.jdbc.JdbcPreparedStatement	0.036	0.036	0.036	12	12	select inventory0_INV_ID as INV1_0_2_, inventory0_PROD_ID as PROD...
executeQuery() - org.h2.jdbc.JdbcPreparedStatement	0.042	0.042	0.042	12	12	select inventory0_INV_ID as INV1_0_2_, inventory0_PROD_ID as PROD...
executeQuery() - org.h2.jdbc.JdbcPreparedStatement	0.030	0.030	0.030	12	12	select inventory0_INV_ID as INV1_0_2_, inventory0_PROD_ID as PROD...

Object to locate: Previous Next 1/1

DAHLIA 2.0

<https://staff.info.unamur.be/lme/DAHLIA>



Conclusions & Open Questions



- Lack on database monitoring in long-living systems
 - Based on...
 - obsolete technologies and platforms
 - poor documentation
 - insufficient knowledge
- Presented an approach as a solution
 - Live database trace visualization for large software landscapes
 - Adresses developers and operators
 - Early work in progress – open for feedback and suggestions

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