

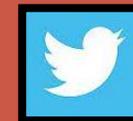


Keep an eye on your **APEX** Applications

About me



- +15 years experience with Oracle
- Passionate about APEX from 2008 (APEX 3.1)
- Career change in 2019



@KravosAles



ales.kravos@right-thing.solutions

Keep an eye on your **APEX** Applications

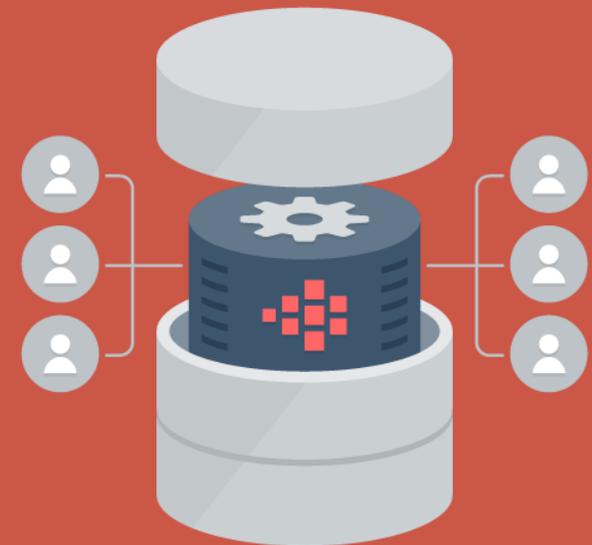


All application metadata and logs
are stored in the **Database**

How are my applications used?

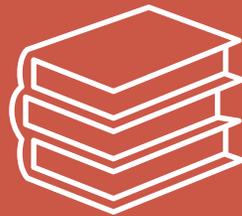
How are they built?

Do they comply with our development
standards?





APEX Database Views



APEX Database Views



- Available from APEX 2.2
- Public
- Hide obsolete data model attributes
- Contain descriptive columns for Foreign keys references
- Contain calculations
- From APEX 3.0 there is an interface to browse through the views and their content

APEX Database Views



The screenshot shows the APEX Application Builder interface for 'Application 102'. The main workspace displays five cards: 'Run Application', 'Supporting Objects', 'Shared Components', 'Utilities', and 'Export / Import'. A large white arrow points to the 'Shared Components' card. Below the workspace is a search bar and a 'Go' button. At the bottom, there is a list of pages: '0 - Global Page - Desktop', '1 - Home', '2 - BLOB column', '3 - Basic Cards', '4 - Image URL', and '5 - BLOB Column as URL'. On the right side, there is a sidebar with sections: 'About' (with instructions on how to use the application), 'Tasks' (with options like 'Delete this Application', 'Copy this Application', 'Manage Backups', and 'Browse by Facets'), and 'Recently Edited Pages' (listing '9999. Login Page' and '22. Card Actions').

APEX Database Views



Utilities		About
Application Dashboard Review a summary of this application.	Advisor Perform various checks on this application, including programming errors and best practices.	The Utilities page features links to summaries and reports that enable developers to view an application from various perspectives. Learn More ...
Upgrade Application After upgrading to a new release, review components for upgrading to include the latest features.	Recently Updated Pages View a history of the page updates made on this application.	Page Specific Utilities
Attribute Dictionary Manage item / column user interface defaults for a selected page.	Change History View a detailed report of component updates made on this application.	Cross Page Utilities >
Debug Messages Review debug messages generated by this application.	Oracle APEX Views Query the various views against Oracle APEX metadata.	Page Groups >
Export Repository View a history of application exports.	Manage Backups Review backup history, perform a manual backup or restore from a backup	Region Utilities >
Embedded Code Review code such as SQL, PL/SQL, JavaScript	Application Checksum The application checksum provides an easy way to determine whether the same application is deployed across workspaces.	Button Utilities >
		Item Utilities >
		Computation Utilities >
		Validation Utilities >
		Process Utilities >

APEX Database Views



View 	Comment	Parent View
APEX_APPLICATIONS	Applications defined in the current workspace or database user.	APEX_WORKSPACES
APEX_APPLICATION_ALL_AUTH	All authorization schemes for all components by Application	APEX_APPLICATIONS
APEX_APPLICATION_AUTH	Identifies the available Authentication Schemes defined for an Application	APEX_APPLICATIONS
APEX_APPLICATION_AUTHORIZATION	Identifies Authorization Schemes which can be applied at the application, page or component level	APEX_APPLICATIONS
APEX_APPLICATION_BC_ENTRIES	Identifies Breadcrumb Entries which map to a Page and identify a pages parent	APEX_APPLICATIONS
APEX_APPLICATION_BREADCRUMBS	Identifies the definition of a collection of Breadcrumb Entries which are used to identify a page Hierarchy	APEX_APPLICATIONS
APEX_APPLICATION_BUILD_OPTIONS	Identifies Build Options available to an application	APEX_APPLICATIONS
APEX_APPLICATION_CACHING	Applications defined in the current workspace or database user.	APEX_APPLICATIONS
APEX_APPLICATION_COMPUTATIONS	Identifies Application Computations which can run for every page or on login	APEX_APPLICATIONS
APEX_APPLICATION_GROUPS	Application Groups defined per workspace. Applications can be associated with an application group.	APEX_APPLICATIONS
APEX_APPLICATION_ITEMS	Identifies Application Items used to maintain session state that are not associated with a page	APEX_APPLICATIONS
	Identifies a named collection of Application List Entries which can be included on any page using a region of type List. Display attributes are controlled	

APEX Database Views



Workspace Utilities \ Application Express Views \ Results

Report View Tree View Select Columns Filter Results

Selected View: **APEX_APPLICATIONS** ? < Filter

WORKSPACE ↑	WORKSPACE_DISPLAY_NAME	APPLICATION_ID	APPLICATION_NAME	ALIAS
SAMPLE_APPLICATIONS	SAMPLE_APPLICATIONS	101	Sample Calendar	7820
SAMPLE_APPLICATIONS	SAMPLE_APPLICATIONS	102	Sample Cards	SAMPLE-CARDS
SAMPLE_APPLICATIONS	SAMPLE_APPLICATIONS	103	Sample Charts	7830
SAMPLE_APPLICATIONS	SAMPLE_APPLICATIONS	104	Sample Collections	7940
SAMPLE_APPLICATIONS	SAMPLE_APPLICATIONS	105	Sample Data Loading	7850
SAMPLE_APPLICATIONS	SAMPLE_APPLICATIONS	106	Sample Dynamic Actions	7840
SAMPLE_APPLICATIONS	SAMPLE_APPLICATIONS	107	Sample File Upload and Download	7960
SAMPLE_APPLICATIONS	SAMPLE_APPLICATIONS	108	Sample Interactive Grids	7880
SAMPLE_APPLICATIONS	SAMPLE_APPLICATIONS	109	Sample Maps	SAMPLE-MAPS

APEX Database Views



```
select *  
from apex_dictionary;
```



APEX_VIEW_NAME	COLUMN_ID	COLUMN_NAME	COMMENTS	COMMENT_TYPE	PARENT_VIEW
1 APEX_DEBUG_MESSAGES	0 (null)		Debug messages that were recorded for page views	View	(null)
2 APEX_DEBUG_MESSAGES	1	ID	Unique ID of the message	Column	(null)
3 APEX_DEBUG_MESSAGES	2	PAGE_VIEW_ID	Page View Identifier, which is a unique sequence g...	Column	(null)
4 APEX_DEBUG_MESSAGES	3	MESSAGE_TIMESTAMP	Timestamp in GMT that message was saved	Column	(null)
5 APEX_DEBUG_MESSAGES	4	ELAPSED_TIME	Elapsed time in seconds from the beginning of the ...	Column	(null)
6 APEX_DEBUG_MESSAGES	5	EXECUTION_TIME	Time elapsed between the current and the next debu...	Column	(null)
7 APEX_DEBUG_MESSAGES	6	MESSAGE	Debug message	Column	(null)
8 APEX_DEBUG_MESSAGES	7	APPLICATION_ID	Application Identifier, unique over all workspaces	Column	(null)
9 APEX_DEBUG_MESSAGES	8	PAGE_ID	Page Identifier within the specified application	Column	(null)
10 APEX_DEBUG_MESSAGES	9	SESSION_ID	APEX Session Identifier	Column	(null)
11 APEX_DEBUG_MESSAGES	10	APEX_USER	Username of the user authenticated to the APEX app...	Column	(null)
12 APEX_DEBUG_MESSAGES	11	MESSAGE_LEVEL	Level of debug message, ranging from 1 to 9	Column	(null)
13 APEX_DEBUG_MESSAGES	12	WORKSPACE_ID	Application Express Workspace Identifier, unique o...	Column	(null)
14 APEX_DEBUG_MESSAGES	13	CALL_STACK	PL/SQL call stack where the message was written	Column	(null)

APEX Database Views



```
SELECT apex_view_name
FROM apex_dictionary
WHERE column_name = 'AUTHORIZATION_SCHEME';
```

APEX_VIEW_NAME
APEX APPLICATIONS
APEX APPLICATION ALL AUTH
APEX APPLICATION BC ENTRIES
APEX APPLICATION COMPUTATIONS
APEX APPLICATION LIST ENTRIES
APEX APPLICATION NAV BAR
APEX APPLICATION PAGES
APEX APPLICATION PAGE BRANCHES
APEX APPLICATION PAGE COMP
APEX APPLICATION PAGE DA
APEX APPLICATION PAGE DA ACTS
APEX APPLICATION PAGE PROC
APEX APPLICATION PAGE REGIONS
APEX APPLICATION PAGE CHART S
APEX APPLICATION PAGE IR COL
APEX APPLICATION PAGE REG COLS
APEX APPLICATION PAGE RPT COLS
APEX APPL PAGE CARD ACTIONS
APEX APPL PAGE IG COLUMNS
APEX APPL PAGE IG RPTS
APEX APPL PAGE MAP LAYERS
APEX APPLICATION PAGE VAL
APEX APPLICATION PAGE BUTTONS

Changes of APEX Views between APEX versions:

<https://apexdiff.foex.at/ords/util/r/apex-diff/apex-views>

APEX Views and PL/SQL API's
Learn about changes of APEX Views and API's between versions 19.2 and 21.2

Views PL/SQL API's

Search
Search Views

Version
 19.2.0 20.1.0
 20.2.0 21.1.0
 21.2.0

Changes only ?

Rows
50

Reset

View	Diff	19.2	20.1	20.2	21.1	21.2
APEX_APPLICATIONS Applications defined in the current workspace or database user.						
APEX_APPLICATION_COMPUTATIONS Identifies Application Computations which can run for every page or on login						
APEX_APPLICATION_ITEMS Identifies Application Items used to maintain session state that are not associated with a page						
APEX_APPLICATION_LISTS Identifies a named collection of Application List Entries which can be included on any page using a region of t...						
APEX_APPLICATION_LIST_ENTRIES Identifies the List Entries which define a List. List Entries can be hierarchical or flat.						
APEX_APPLICATION_LOVS Identifies a shared list of values that can be referenced by a Page Item or Report Column						
APEX_APPLICATION_PAGE_BRANCHES Identifies branch processing associated with a page. A branch is a directive to navigate to a page or URL which ...						
APEX_APPLICATION_PAGE_BUTTONS Identifies buttons associated with a Page and Region						

APEX Database Views



How to grant access to data across all Workspaces?

```
grant apex_administrator_read_role  
to [parsing_shema];
```



Monitor application **activity**



APEX Activity Logs



APEX_WORKSPACE_ACCESS_LOG

Displays all application authentication results and details

WORKSPACE	APPLICATION_ID	USER_NAME	AUTHENTICATION_METHOD	ACCESS_DATE	AUTHENTICATION_RESULT	CUSTOM_STATUS_TEXT
GRALNICA	4500	ANDREJGR	Internal Authentication	30.03.22 09:48:22	AUTH SUCCESS	(null)
INTERNAL	4500	ADMIN	Internal Authentication	30.03.22 09:44:41	AUTH SUCCESS	(null)
STARTER APPLICATIONS	115	ALES	Application Express Accounts	28.03.22 15:25:08	AUTH SUCCESS	(null)
STARTER APPLICATIONS	4500	ALES	Internal Authentication	28.03.22 15:24:47	AUTH SUCCESS	(null)
COACHING TOOL	4500	ALES	Internal Authentication	28.03.22 15:04:05	AUTH UNKNOWN USER	Invalid Login Credentials
COACHING TOOL	4500	ALES	Internal Authentication	28.03.22 15:03:50	AUTH UNKNOWN USER	Invalid Login Credentials
COACHING TOOL	4500	ALES	Internal Authentication	28.03.22 15:03:27	AUTH UNKNOWN USER	Invalid Login Credentials
STARTER APPLICATIONS	120	ALES	Application Express Authen...	25.03.22 12:43:16	AUTH SUCCESS	(null)
STARTER APPLICATIONS	120	ALES	Application Express Authen...	25.03.22 12:43:06	AUTH PASSWORD I...	Invalid Login Credentials
STARTER APPLICATIONS	121	ALES	Application Express Accounts	25.03.22 12:01:43	AUTH SUCCESS	(null)

APEX Activity Logs



APEX_WORKSPACE_ACTIVITY_LOG

⚡ APEX_USER	⚡ APEX_SESSION_ID	⚡ APPLICATION_ID	⚡ PAGE_ID	⚡ VIEW_DATE	⚡ ELAPSED_TIME	⚡ ROWS_QUERIED	⚡ PAGE_VIEW_TYPE	⚡ REQUEST_VALUE
ZORAN	13417457401618	115	(null)	18.04.22 23:26:59	0,006534	0	Logout	(null)
ZORAN	13417457401618	115	114	18.04.22 23:26:54	0,668657	0	Processing	CREATE
ZORAN	13417457401618	115	145	18.04.22 23:26:54	0,024201	2	Rendering	reset R 18172076288788874245
ZORAN	13417457401618	115	145	18.04.22 23:26:54	0,041663	2	Rendering	reset R 18172076288788874245
ZORAN	13417457401618	115	114	18.04.22 23:26:53	0,034193	0	Processing	FSP SHOW POPUPLOV
ZORAN	13417457401618	115	114	18.04.22 23:26:01	0,039747	0	Rendering	(null)
ZORAN	13417457401618	115	145	18.04.22 23:25:58	0,080528	4	Rendering	(null)
ZORAN	13417457401618	115	56	18.04.22 23:25:56	0,04709	0	Processing	SAVE
ZORAN	13417457401618	115	56	18.04.22 23:25:49	0,157005	0	Rendering	(null)
ZORAN	13417457401618	115	145	18.04.22 23:25:44	0,129205	4	Rendering	(null)
ZORAN	13417457401618	115	55	18.04.22 23:25:41	0,072446	6	Rendering	(null)
ZORAN	13417457401618	115	59	18.04.22 23:25:37	0,153519	(null)	Rendering	(null)
ZORAN	13417457401618	115	101	18.04.22 23:25:35	0,109455	0	Processing	P101 PASSWORD
ANDRAZ	1344560262968	115	(null)	18.04.22 23:25:28	0,00712	0	Logout	(null)
ANDRAZ	1344560262968	115	20	18.04.22 23:25:23	0,088391	0	Rendering	(null)
ANDRAZ	1344560262968	115	18	18.04.22 23:25:18	0,04054	3	Ajax	PLUGIN
ANDRAZ	1344560262968	115	18	18.04.22 23:25:17	0,042717	0	Ajax	PLUGIN
ANDRAZ	1344560262968	115	18	18.04.22 23:25:14	0,082189	16	Rendering	(null)
ANDRAZ	1344560262968	115	150	18.04.22 23:25:05	0,040874	0	Rendering	(null)
ANDRAZ	1344560262968	115	150	18.04.22 23:25:05	0,012545	0	Ajax	PLUGIN
ANDRAZ	1344560262968	115	150	18.04.22 23:25:00	0,147144	0	Processing	CREATE
ANDRAZ	1344560262968	115	50	18.04.22 23:25:00	0,044276	2	Rendering	reset R 18172895750449086173
ANDRAZ	1344560262968	115	150	18.04.22 23:24:53	0,014957	0	Ajax	PLUGIN
ANDRAZ	1344560262968	115	150	18.04.22 23:24:52	0,026765	0	Ajax	(null)
ANDRAZ	1344560262968	115	150	18.04.22 23:24:49	0,078585	0	Rendering	(null)
ANDRAZ	1344560262968	115	150	18.04.22 23:24:49	0,019496	0	Ajax	PLUGIN
ANDRAZ	1344560262968	115	50	18.04.22 23:24:47	0,016572	0	Ajax	PLUGIN

ERROR_MESSAGE	ERROR_ON_COMPONENT_TYPE	ERROR_ON_COMPONENT_NAME	INTERACTIVE_...	IR_SAVED_REPORT_ID	IR_SEARCH
APEX - The checksum com...	WWV FLOW SECURITY	FINAL EXCEPTION HANDLER	(null)	(null)	(null)
(null)	(null)	(null)	(null)	(null)	(null)
(null)	(null)	(null)	157578...	157578338...	row contains Japan
(null)	(null)	(null)	157578...	157578338...	(null)
(null)	(null)	(null)	(null)	(null)	(null)
(null)	(null)	(null)	(null)	(null)	(null)
(null)	(null)	(null)	(null)	(null)	(null)
(null)	(null)	(null)	157578...	157578338...	(null)
(null)	(null)	(null)	157578...	157578338...	(null)
(null)	(null)	(null)	(null)	(null)	(null)
(null)	(null)	(null)	(null)	(null)	(null)
(null)	(null)	(null)	157578...	(null)	(null)
(null)	(null)	(null)	(null)	(null)	(null)
(null)	(null)	(null)	(null)	(null)	(null)
(null)	(null)	(null)	178089...	178089708...	(null)
(null)	(null)	(null)	178089...	(null)	(null)
(null)	(null)	(null)	(null)	(null)	(null)
(null)	(null)	(null)	(null)	(null)	(null)
(null)	(null)	(null)	(null)	(null)	(null)
(null)	(null)	(null)	(null)	(null)	(null)
(null)	(null)	(null)	(null)	(null)	(null)
(null)	(null)	(null)	(null)	(null)	(null)
(null)	(null)	(null)	157578...	(null)	(null)
(null)	(null)	(null)	(null)	(null)	(null)
(null)	(null)	(null)	(null)	(null)	(null)

APEX Activity Logs



Logging is enabled on application level

Logging ✕

Determines whether or not user activity is recorded in the activity log. When set to **On**, every page view is logged, enabling an administrator to monitor user activity for each application.

Disabling logging may be advisable for high volume applications.

This attribute can only be modified if the feature configuration "Application Activity Logging" in Oracle APEX internal administration is set to "Use Application Setting".

[View Documentation](#)

APEX Activity Logs



Logs are purged after
14 days by default

Can be extended to
maximum of 180 days



Manage Log Interval

Set the minimum number of days to retain the log information for the specified logs. The maximum value that can be specified is 180 days, with a default value of 14 days. Keeping log information for longer periods can degrade runtime performance.

Logs are implemented using two underlying tables, with a switch between the log tables after the number of days specified in "Log Switch After Days".

Log Name ↑	Log Switched Date	Log Switch After Days
Access Log	03/28/2022 12:00:00 AM	14
Activity Log	03/28/2022 12:00:00 AM	14
Automation	02/27/2022 12:00:00 AM	14
Debug Messages	03/27/2022 12:00:00 AM	14
External Click Count Log	03/30/2022 12:00:00 AM	14
REST Synchronization	02/27/2022 12:00:00 AM	14
Web Service	03/24/2022 12:00:00 AM	14

Cancel

Apply Changes

APEX Activity Logs



Use cases:

- Build monitoring tools for application administrators
- Analyse user behaviour
- Track page performance
- Monitor errors logs / schedule automatic notification

APEX Activity Logs



APEX “out of the box” feature

Home Blank Edit

Features ? Check All

- Install Progressive Web App**
Give your app the ability to be installed
- Activity Reporting**
Include user activity and error reports
- Theme Style Selection**
Update default application look and feel
- About Page**
Add about this application page
- Configuration Options**
Enable or disable application features
- Access Control**
Enable role-based user authorization
- Feedback**
Allow users to provide feedback

Settings ?

Application ID Schema Authentication

Cancel **Create Application**

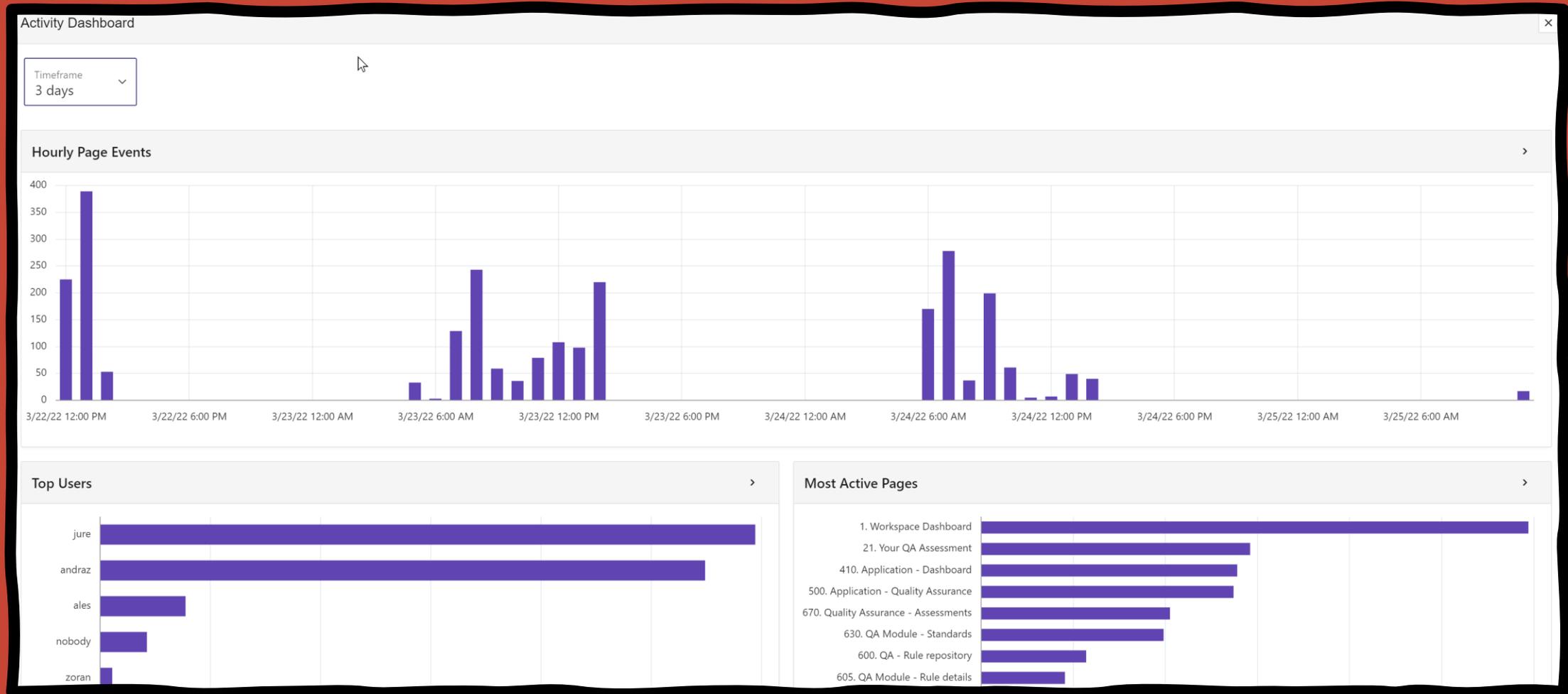
APEX Activity Logs



The screenshot shows a web application interface. At the top left, there is a logo for 'THE RIGHT THING SOLUTIONS' and a hamburger menu icon. Below the logo, a dark sidebar contains two menu items: 'Home' with a house icon and 'Administration' with a wrench icon. The 'Administration' item is highlighted with a mouse cursor. The main content area is titled 'Administration' and contains a section 'Activity Reports' with five items:

- Dashboard**: View application activity metrics (blue icon)
- Top Users**: Report of page views aggregated by user (blue icon)
- Application Error Log**: Report of errors logged by this application (red icon)
- Page Performance**: Report of activity and performance by application page (green icon)
- Page Views**: Report of each page view by user including date of access and elapsed time (green icon)

APEX Activity Logs



APEX Project Eye (APE)



united codes

APEX Project Eye

<https://www.apexprojecteye.com/>

APEX Activity Logs

APEX Project Eye
Home Settings Help ales

Instance Dashboard

Instance

Workspace

Projects Applications

Quality Assurance Administra...

Key Figures by hour

<p>0.46 ↓(59%)</p> <p>Median Elapsed Load Time</p>	<p>13.61 ↓(97%)</p> <p>Average Elapsed Load Time</p>	<p>9 ↓(133%)</p> <p>Total Page Views</p>
<p>0 (-)</p> <p>Error Count</p>	<p>2 ↓(50%)</p> <p>User Count</p>	<p>2 ↓(50%)</p> <p>Session Count</p>

Top Workspaces & Overall Statistics

Workspace	🏠	👤	📄	👁	🕒	🔍
COACHING_TOOL	6	8	31	790	0.27	04.04.2022
SAMPLE_APPLICATIONS	4	5	14	280	0.16	02.04.2022
STARTER_APPLICATIONS	1	3	12	165	0.60	04.04.2022
IGRALNICA	0	2	2	97	0.40	30.03.2022

Performances by hour

Median Load Time

Average Load Time

Total Page Views

Error Count

User Count

Session Count

Latest Activity in Instance

Workspace	App Id	Application	APEX User	HH:MM:SS Ago
STARTER_APPLICATIONS	4000	-	ALES	00: 02: 41
STARTER_APPLICATIONS	4550	-	ALES	00: 02: 43
STARTER_APPLICATIONS	4500	-	ALES	00: 02: 43
VOJKO	4000	-	VOJKO	00: 07: 16
VOJKO	122	Project Tasks	VOJKO	00: 10: 36
VOJKO	4020	-	VOJKO	00: 14: 00
VOJKO	4500	-	VOJKO	00: 14: 29
VOJKO	4350	-	VOJKO	00: 29: 53
COACHING_TOOL	4000	-	BOSTJAN.MARTINEK@RIGHT-THING.SOLUTIONS	01: 22: 03

Filters

Date From: 27.03.2022

Date To: 04.04.2022

Interval: **Hourly** Daily Weekly

Workspaces

- COACHING_TOOL
- IGRALNICA
- INTERNAL
- SAMPLe_APPLICATIONS
- STARTER_APPLICATIONS

* Data for the last 12 day(s) is taken into account.

APEX Activity Logs



Top Workspaces & Overall Statistics

Workspace						
COACHING_TOOL	6	8	31	790	0.27	04.04.2022
SAMPLE_APPLICATIONS	4	5	14	280	0.16	02.04.2022
STARTER_APPLICATIONS	1	3	13	168	0.59	04.04.2022
IGRALNICA	0	2	2	97	0.40	30.03.2022
VOJKO	1	2				

Summarized
overviews

Top Applications & Overall Statistics

Project	Application						
-	102 - Sample Cards	3	4	7	36	0.07	01.04.2022 16:32
-	109 - Sample Maps	1	2	2	11	0.09	01.04.2022 17:02
-	101 - Sample Calendar	0	1	1	1	0.08	31.03.2022 13:44
-	104 - Sample Collections	0	1	1	1	0.10	01.04.2022 17:01
-	108 - Sample Interactive Grids	0	1	1	1	0.05	30.03.2022 15:38
-	103 - Sample Charts	-	-	-	-	-	-

APEX Activity Logs

Key figures and performance trends

Key Figures by week

0.07

↑(286%)

Median Elapsed Load Time

0.21

↑(100%)

Average Elapsed Load Time

260

↑(92%)

Total Page Views

3

↑(67%)

Error Count

8

↑(88%)

User Count

35

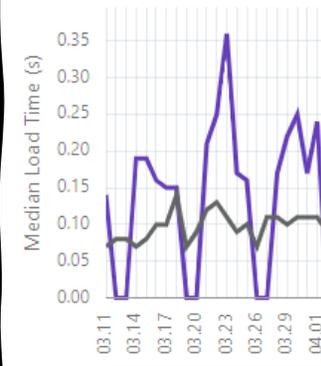
↑(94%)

Session Count

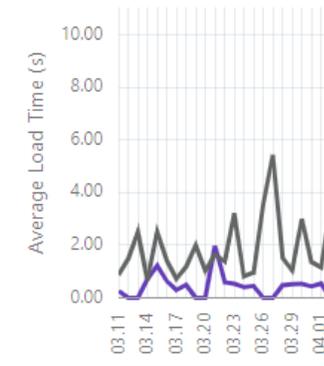
Performances by day



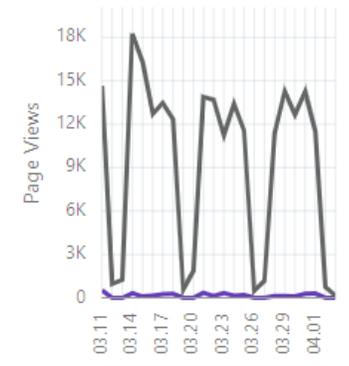
Median Load Time



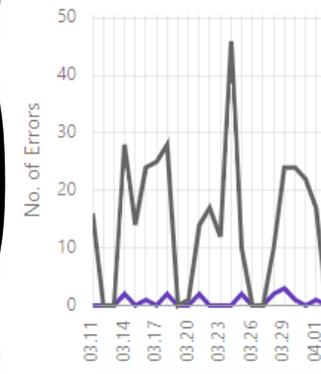
Average Load Time



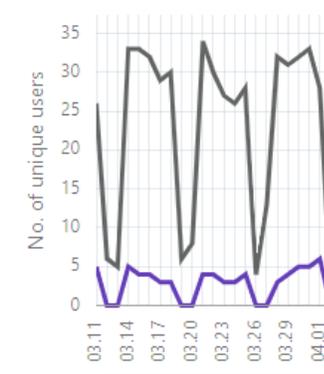
Total Page Views



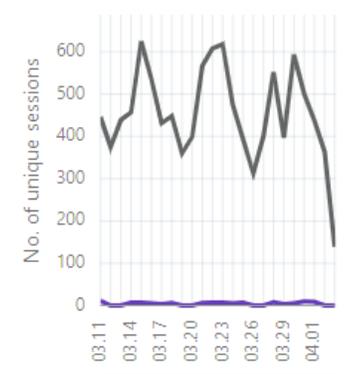
Error Count



User Count



Session Count



APEX Activity Logs

Top Users

User						
ALES	0	2	17	0.42	23.18	05.04.2022 22:47
ALJAZ	0	1	12	0.34	13.92	05.04.2022 22:58
JURE	0	1	3	1.01	17.33	05.04.2022 22:56
ZORAN	0	1	2	0.74	44.5	05.04.2022 22:55

Key Figures by day

0.23

↑(200%)

Median Elapsed Load
Time (s)

0.48

↑(44%)

Average Elapsed Load
Time (s)

30

↑(93%)

Total Page Views

0

(-)

Error Count

4

↑(75%)

User Count

4

↑(75%)

Session Count

Page activity

Interactive reports

Region ↑	Report	Description	View Mode	Status	Type			
Interactive Report Activity	Columns only	Hide views (column_id != 0)	-	Private	Private	.81	44.5	05.04.2022
Interactive Report Activity	Group by parent view	Number of dictionary views grouped by parent	Group_By	Public	Public	.3	38	05.04.2022
Interactive Report Activity	-	-	-	Public	Primary Default	.36	19.5	05.04.2022
Interactive Report Activity	-	-	-	-	-	1.03	51	05.04.2022

APEX Activity Logs



Application / User Activity Matrix ?								
Application Name	Ales	Aljaz	Andraz	Andrej	Bostjan	Jure	Uros	Zoran
Poll	24.03.2022	-	-	-	-	-	-	-
APEX Project Eye (APE) 22.1.1	04.04.2022	-	-	-	-	-	-	-
APEX Alpe Adria	03.04.2022	-	-	-	-	-	-	-
Opportunities	25.03.2022	04.04.2022	-	04.04.2022	-	-	-	04.04.2022
Team Calendar	-	04.04.2022	-	04.04.2022	-	-	-	-
Customers	28.03.2022	-	-	-	-	-	-	-

APEX Activity Logs



```
SELECT
    page_id,
    page_name,
    view_date,
    elapsed_time,
    page_view_type,
    apex_user
FROM apex_workspace_activity_log
ORDER BY view_date DESC;
```

APEX Activity Logs



SELECT

```
page_id,  
lead(page_id)  
over(partition by apex_session_id  
      order by view_date  
      ) next_page_id
```

FROM

```
apex_workspace_activity_log;
```

PAGE_ID	NEXT_PAGE_ID
9999	1
2	10000
10000	10012
10000	10010
10000	10013
10012	(null)
1	2
10000	10014
10010	10010
10010	2
10013	10000
10014	10000

APEX Activity Logs

```
SELECT page_id,  
       next_page_id,  
       COUNT(*)  
FROM (SELECT page_id,  
            LEAD(page_id)  
            OVER(PARTITION by apex_session_id  
                 ORDER by view_date  
                 ) next_page_id  
FROM apex_workspace_activity_log  
WHERE application_id = 121)  
WHERE page_id != next_page_id  
GROUP BY page_id,  
         next_page_id;
```

PAGE_ID	NEXT_PAGE_ID	COUN...
9999	1	14
1	2	5
1	10000	5
2	10000	3
10000	10014	2
10000	10011	2
10000	10012	2
10000	1	1

GoJS

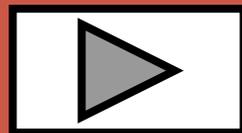
A Web Framework for Rapidly
Building Interactive Diagrams

Quality assurance

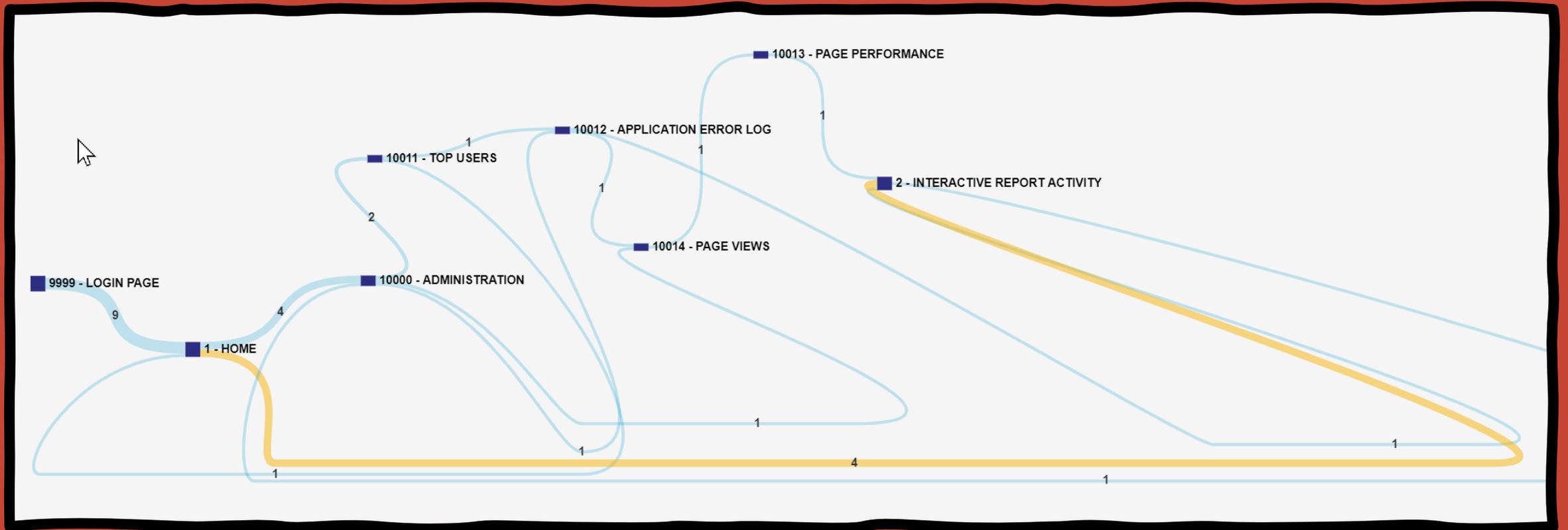


Demo

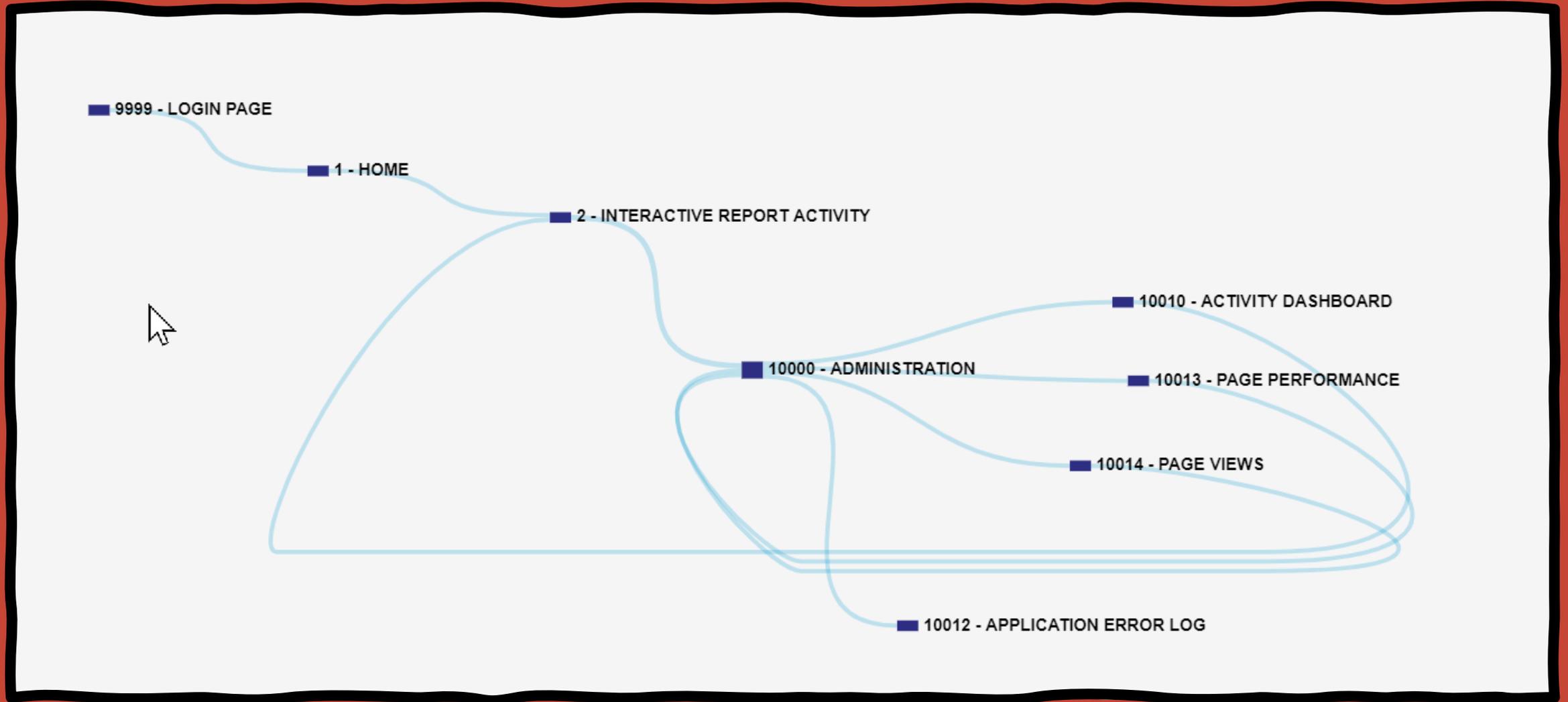
How to view session flow



APEX Activity Logs



APEX Activity Logs



APEX Activity Logs

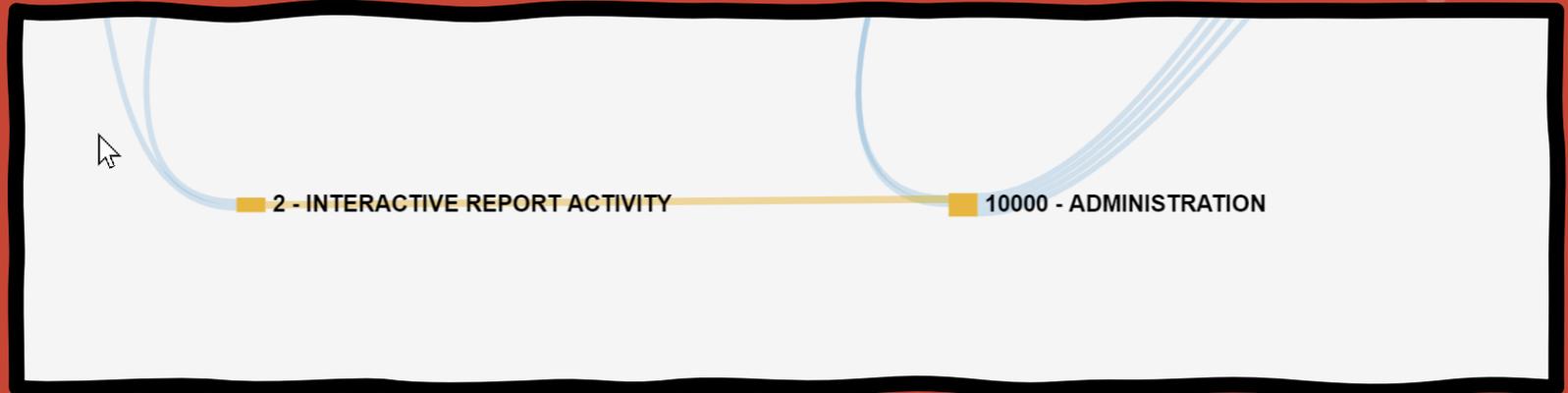


Replay Session

Session ID
4236989024322 (14) - 04.04.2022 14:52

4/12

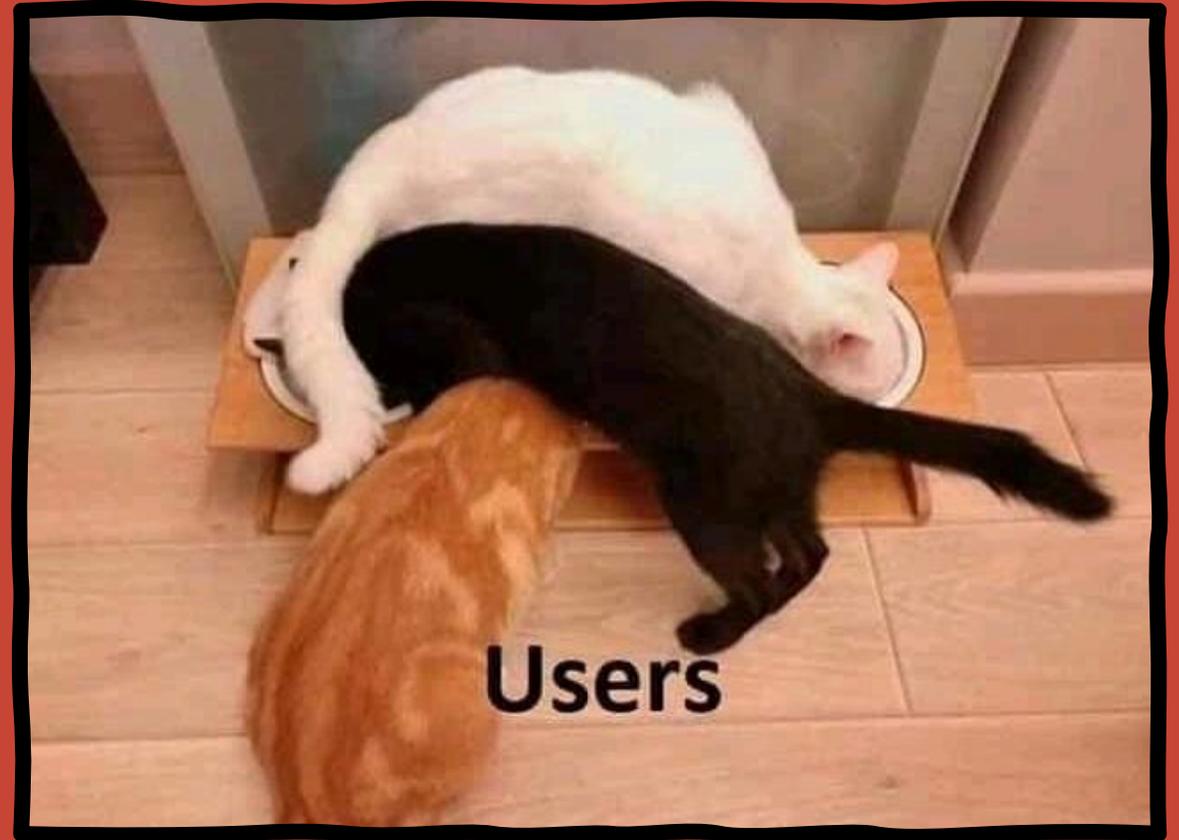
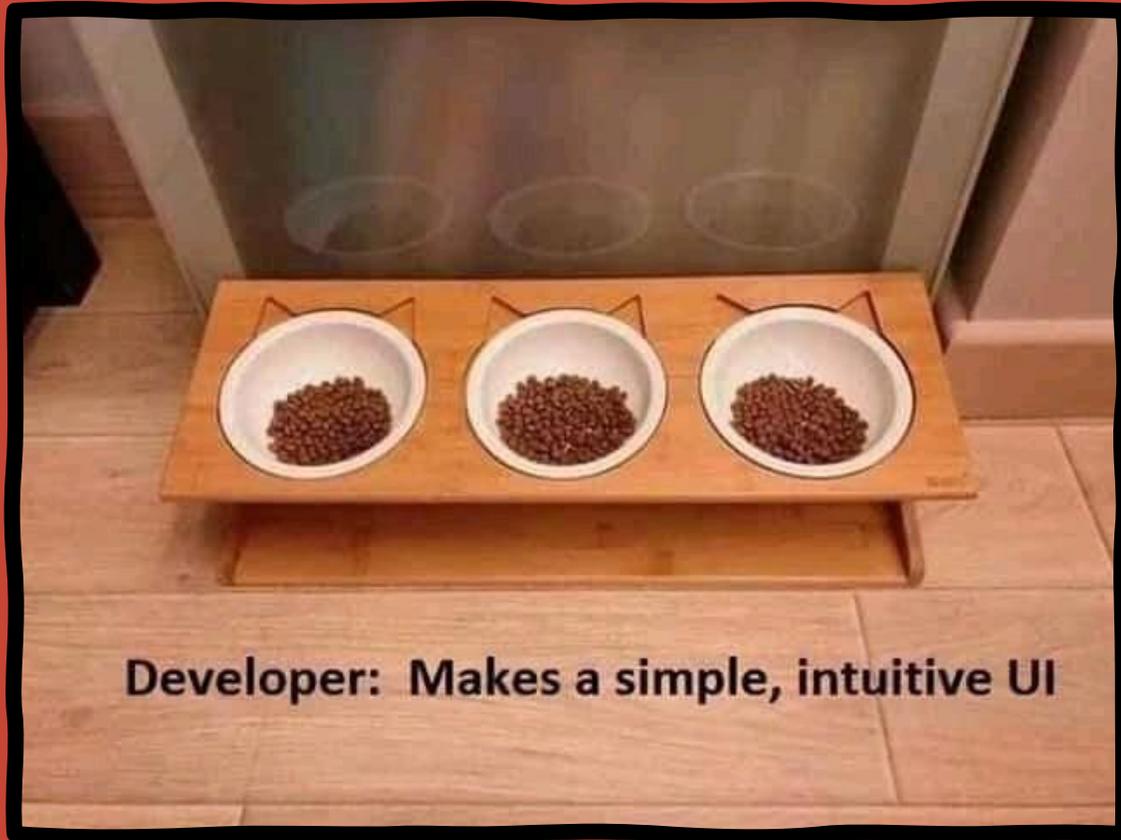
⌫ ⏪ ⏩ ⌵



Request Details

View Timestamp	Application ID	Application Name	Page Id	Page Name	Page View Type	Page View Mode	Rows Queried	Elapsed Time	Request Value	Error Message	Error On Component Type	Error On Component Name	Apex User
04-APR-22 02:52:20.863970 PM +03:00	121	APEX Alpe Adria	2	Interactive Report Activity	Rendering	Dynamic	51	1.014466	-	-	-	-	ALES
Report Total:							51	1.01					

APEX Activity Logs





Application metadata



Application metadata



Shared components: APEX_APPLICATION_%

Page components: APEX_APPLICATION_PAGE_%

**Some newer components: APEX_APPL_%*



▼ APEX_APPLICATIONS

- APEX_APPLICATION_ALL_AUTH
- APEX_APPLICATION_AUTH
- APEX_APPLICATION_AUTHORIZATION
- APEX_APPLICATION_BC_ENTRIES
- APEX_APPLICATION_BCS_ATTRIBUTES

APEX_APPLICATION_NAV_BAR

▼ APEX_APPLICATION_PAGES

- APEX_APPLICATION_PAGE_BRANCHES
- APEX_APPLICATION_PAGE_COMP
- > APEX_APPLICATION_PAGE_DA
- APEX_APPLICATION_PAGE_DB_ITEMS
- APEX_APPLICATION_PAGE_GROUPS
- APEX_APPLICATION_PAGE_MAP
- APEX_APPLICATION_PAGE_PROC

▼ APEX_APPLICATION_PAGE_REGIONS

- APEX_APPLICATION_PAGE_BUTTONS
- > APEX_APPLICATION_PAGE_CHARTS
- > APEX_APPLICATION_PAGE_IR
- APEX_APPLICATION_PAGE_ITEMS
- APEX_APPLICATION_PAGE_REG_COLS
- > APEX_APPLICATION_PAGE_RPT
- APEX_APPLICATION_PAGE_TREES
- > APEX_APPL_PAGE_CARDS
- APEX_APPL_PAGE_FILTERS
- APEX_APPL_PAGE_FILTER_GROUPS
- > APEX_APPL_PAGE_IGS
- > APEX_APPL_PAGE_MAPS

Application metadata



```
select *  
  from apex_application_list_entries;
```

LIST_NAME	DISPLAY_SEQUENCE	ENTRY_TEXT	ENTRY_TARGET	ENTRY_IMAGE
Application Navigation	10	Customers [&CUSTOMERS.]	f?p=&APP ID.:59:&SESSION.::&DEBUG.:RP,RIR,CIR:::	fa-home
Application Navigation	20	Dashboard	f?p=&APP ID.:1:&SESSION.::&DEBUG.:::::	fa-dial-gauge-cha
Application Navigation	30	Issues	f?p=&APP ID.:134:&SESSION.::&DEBUG.:::::	fa-alert
Application Navigation	40	Products [&PRODUCTS.]	f?p=&APP ID.:44:&SESSION.::&DEBUG.:::::	fa-archive
Application Navigation	50	Partners	f?p=&APP ID.:115:&SESSION.::&DEBUG.:::::	fa-thumbs-o-up
Application Navigation	60	Competitors	f?p=&APP ID.:116:&SESSION.::&DEBUG.:::::	fa-emoji-cringe
Application Navigation	70	Contacts [&CONTACTS.]	f?p=&APP ID.:18:&SESSION.::&DEBUG.:::::	fa-user
Application Navigation	80	Activities [&ACTIVITIES.]	f?p=&APP ID.:55:&SESSION.::&DEBUG.:RP,RIR,55:::	fa-newspaper-o
Application Navigation	90	Reports	f?p=&APP ID.:17:&SESSION.::&DEBUG.:::::	fa-file-text-o
Application Navigation	100	Administration	f?p=&APP ID.:12:&SESSION.::&DEBUG.:::::	fa-gear
Application Navigation	110	Categories	f?p=&APP ID.:32:&SESSION.::&DEBUG.:RP:::	(null)
Application Navigation	120	Geographies	f?p=&APP ID.:85:&SESSION.::&DEBUG.:::::	(null)
Application Navigation	130	Referenceability	f?p=&APP ID.:86:&SESSION.::&DEBUG.:::::	(null)
Application Navigation	140	Products	f?p=&APP ID.:92:&SESSION.::&DEBUG.:::::	(null)
Application Navigation	150	Referencability	f?p=&APP ID.:100:&SESSION.::&DEBUG.:::::	(null)
Application Navigation	160	Customers	f?p=&APP ID.:1:&SESSION.::&DEBUG.:RP:::	(null)
Application Navigation	170	Report Under	f?p=&APP ID.:29:&SESSION.::&DEBUG.:RP:::	(null)

Application metadata



```
select *  
  from apex_application_page_buttons;
```

PAGE_ID	REGION	BUTTON_NAME	LABEL	BUTTON_ACTION	REDIRECT_URL
1	Database Objects	VIEW OBJECTS	View Objects	Redirect to Page in this Application	f?p=&APP ID.:9:&SESSION...&DEBUG.:RP,9
1	Top 10 tables by size	VIEW TABLES	View Tables	Redirect to Page in this Application	f?p=&APP ID.:10:&SESSION...&DEBUG.:RP,
1	Mail Queue	VIEW MAIL QUEUE	View Mail Queue	Redirect to Page in this Application	f?p=&APP ID.:11:&SESSION...&DEBUG.:RP,
1	Mail Log	VIEW MAIL LOG	View Mail Queue	Redirect to Page in this Application	f?p=&APP ID.:12:&SESSION...&DEBUG.:RP,
1	Application / User Activ...	MATRIX HELP	Matrix Help	Defined by Dynamic Action	(null)
1	Performances <span class...	VIEW PERFORMANCE	View Performance	Redirect to Page in this Application	f?p=&APP ID.:412:&SESSION...&DEBUG.:RP
1	Latest Activity in Works...	VIEW ACTIVITY	View Activity	Redirect to Page in this Application	f?p=&APP ID.:8:&SESSION...&DEBUG.:RP,8
1	Database Objects	VIEW INVALID OBJECTS	View Invalid ob...	Redirect to Page in this Application	f?p=&APP ID.:9:&SESSION...&DEBUG.:RP,9
2	Mail Queue	VIEW MAIL QUEUE	View Mail Queue	Redirect to Page in this Application	f?p=&APP ID.:11:&SESSION...&DEBUG.:RP,
2	Mail Log	VIEW MAIL LOG	View Mail Log	Redirect to Page in this Application	f?p=&APP ID.:12:&SESSION...&DEBUG.:RP,
2	Performances <span class...	VIEW PERFORMANCE	View Performance	Redirect to Page in this Application	f?p=&APP ID.:412:&SESSION...&DEBUG.:RP
2	Latest Activity in Instance	VIEW ACTIVITY	View Activity	Redirect to Page in this Application	f?p=&APP ID.:8:&SESSION...&DEBUG.:RP,8
2	Database Objects	VIEW INVALID OBJECTS	View Invalid ob...	Redirect to Page in this Application	f?p=&APP ID.:9:&SESSION...&DEBUG.:RP,9
2	Database Objects	VIEW OBJECTS	View Objects	Redirect to Page in this Application	f?p=&APP ID.:9:&SESSION...&DEBUG.:RP,9
3	Verify License	GET LICENSE	Get License	Submit Page	(null)
3	Verify License	SAVE LICENSE	Save License	Submit Page	(null)
4	Workspaces	RESET REPORT	Reset	Submit Page	(null)

Application metadata



Use case #1

Understand application page flow

Application metadata



- Branches - apex_application_page_branches.branch_action
- Charts - apex_application_page_chart_s.chart_link
- Application definition - apex_applications.login_url
- Application definition - apex_applications.home_url
- Buttons - apex_application_page_buttons.redirect_url
- List entries - apex_application_list_entries.entry_target
- Breadcrumbs - apex_application_bc_entries.defined_for_page
- IR Reports - apex_application_page_ir.detail_link_target
- Report columns - apex_application_page_ir_col.column_link
- Card actions - apex_appl_page_card_actions.link_target
- Region sources - apex_application_page_regions.region_source
 - apex_page.get_url, apex_util.prepare_url or hardcoded f?p links

f?p=&APP_ID.:1:&SESSION.:&DEBUG.::

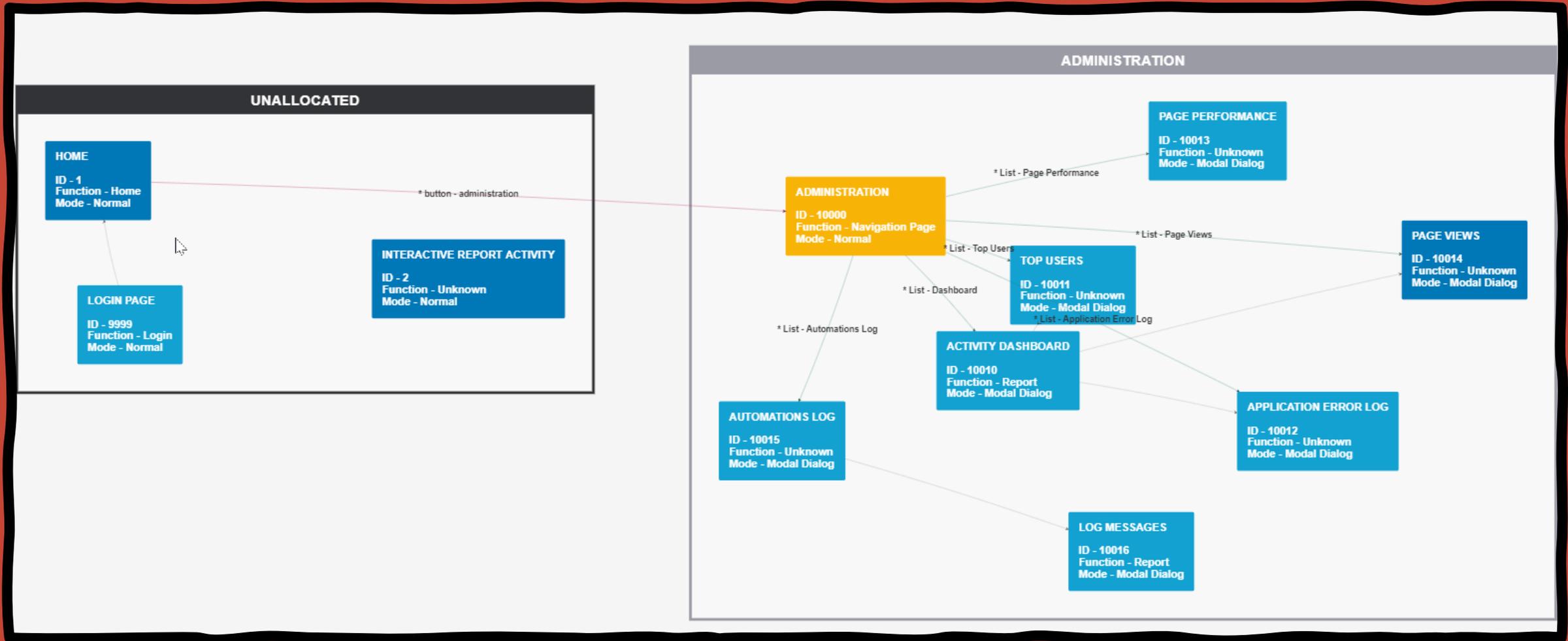
Application metadata



Page From	Page To	Links
59	2	List - Add a New Customer button - add customer
93	2	button - add customer
2	1	Breadcrumb - Customer Details
2	50	branch - after_processing

Inbound and
outbound link for
an application page

Application metadata



Application metadata



Use case #2

Database object dependencies

Application metadata



```
select page_id,item_name, db_table_name, db_column_name
from apex_application_page_db_items;
```

PAGE_ID	ITEM_NAME	DB_TABLE_NAME	DB_COLUMN_NAME
2	P2 TOTAL CONTRACT VALUE	EBA_CUST_CUSTOMERS	TOTAL CONTRACT VALUE
2	P2 ANNUAL RECURRING REVENUE	EBA_CUST_CUSTOMERS	ANNUAL RECURRING REVENUE
2	P2 CURRENCY	EBA_CUST_CUSTOMERS	CURRENCY
2	P2 REFERENCABLE	EBA_CUST_CUSTOMERS	REFERENCABLE
68	P68 INTERNAL CONTACT	EBA_CUST_PRODUCT_USES	INTERNAL CONTACT
68	P68 CUSTOMER CONTACT ID	EBA_CUST_PRODUCT_USES	CUSTOMER CONTACT ID
68	P68 VALID FROM	EBA_CUST_PRODUCT_USES	VALID FROM
68	P68 VALID TO	EBA_CUST_PRODUCT_USES	VALID TO
68	P68 COMMENTS	EBA_CUST_PRODUCT_USES	COMMENTS
133	P133 OPEN YN	EBA_CUST_ISSUE_STATUSES	OPEN YN
68	P68 REFERENCE TYPES	EBA_CUST_PRODUCT_USES	REFERENCE TYPE IDS
68	P68 PRODUCT STATUS ID	EBA_CUST_PRODUCT_USES	REFERENCE STATUS ID
95	P95 STATUS	EBA_CUST_PRODUCT_STATUSES	STATUS
2	P2 LOGO NAME	EBA_CUST_CUSTOMERS	LOGO NAME

Application metadata



- Application computations - apex_application_computations.computation
- Application processes - apex_application_processes.process
- Dynamic list of values - apex_application_lovs.list_of_values_query
- Region sources - apex_application_page_regions.region_source
- Page processes - apex_application_page_proc.process_source
- Page computations - apex_application_page_comp.computation
- Validations - apex_application_page_val.validation_expression1
- Item sources - apex_application_page_items.item_source
- Dynamic actions - apex_application_page_da_acts.attribute_01
- Server-side conditions, Default values, Read only conditions
- ...

Application metadata



```
select referenced_name,  
       referenced_type  
  from user_dependencies  
 where name = 'DUMMY_TEMPORARY_PROCEDURE' ;
```

REFERENCED_NAME	REFERENCED_TYPE
EBA_CUST_REF_PHASE	TABLE
EBA_CUST_SALES_CHANNEL	TABLE
EBA_CUST_SAMPLE_DATA	PACKAGE
EBA_CUST_SEQ	SEQUENCE
EBA_CUST_STATUS	TABLE
EBA_CUST_TAGS	TABLE
EBA_CUST_TAGS_SUM	TABLE
EBA_CUST_TAGS_TYPE_SUM	TABLE
EBA_CUST_TYPE	TABLE
EBA_CUST_TZ_PREF	TABLE
EBA_CUST_USERS	TABLE

Application metadata



Referenced database objects
on an application page

Object Dependency			>
Type	Owner	Name	
PACKAGE	STARTER_APPLICATIONS	EBA_CUST	
TABLE	STARTER_APPLICATIONS	EBA_CUST_CONTACT_TYPES	
TABLE	STARTER_APPLICATIONS	EBA_CUST_CUSTOMERS	
TABLE	STARTER_APPLICATIONS	EBA_CUST_TAGS_TYPE_SUM	

Application metadata



Database table utilization
per application components

Component Dependency		
Page	Component Name	Depend Type
1	Recently Updated Customers	Region
1	Customers by Geography	Region
1	Customers by Category	Region
1	P1_CATEGORY	Page Item List of Values
1	Summary	Region
1	Customer Updates	Region

Application metadata



Use case #3

Generate technical documentation

3.39. 59 – Competitor Threats

Page help

Manage the list of Competitor Threats that will be available to end-users for selection in the application. Click the **Create Competitor Threat** button to create a new Competitor Threat. Click the pencil icon next to any existing Competitor Threat to edit that specific threat. Click the **Reset** button to reset the interactive report. Click the **Actions** button to define the number of rows displayed per page, filter, format, download, and/or save the interactive report.

General Information

ID	59
Name	Competitor Threats
Page Group	Administration
Alias	COMPETITOR-THREATS
Page Title	Competitor Threats
Function	Unknown
Template	
Authorization Scheme	
Requires Authentication?	Yes
Session State Protection	Arguments Must Have Checksum
Cache mode	Not Cached
Last modification	10.02.2021

Page Components

Regions	Dynamic Actions	Branches	Processes
1	1	0	0
Validations	Computations	Buttons	Items
0	0	2	0

Object Dependencies

Object Type	Owner	Name	Dependency type	Dependency
PACKAGE	SYS	STANDARD	Region	Competitor Threats
TABLE	DEMO_SCHEMA	EBA_SALES_COMPETITOR_THREATS	Region	Competitor Threats
PACKAGE	SYS	SYS_STUB_FOR_PURITY_ANALYSIS	Region	Competitor Threats

1.1.4. EBA_SALES_LEAD_STATUS_CODES

Name	EBA_SALES_LEAD_STATUS_CODES
Type	TABLE
Owner	DEMO_SCHEMA
Comment	No comment found for this object

Columns

Name	Type	Comment
ROW_VERSION_NUMBER	NUMBER	
STATUS_CODE	VARCHAR2 (30)	
DISPLAY_ORDER	NUMBER	
ID	NUMBER	
STATUS_DESCRIPTION	VARCHAR2 (4000)	

Constraints

Name	Column	Type
SYS_C0022447	STATUS_CODE	Check constraint
SYS_C0022448	ID	Primary Key

Indexes

Name	Column	Order
EBA_SALES_LEAD_STAT_CDI1	STATUS_CODE	ASC
SYS_C0022448	ID	ASC

Component dependencies

Page ID	Type	Name
100	Region	Open Leads by Status
29	Page Item List of Values	P29_LEAD_STATUS_ID
100	Page Item List of Values	P100_LEAD_STATUSES
	Shared Dynamic List of Values	LEAD CODES
37	Region	Lead Status Codes
19	Region	Leads Grid
19	Region	Leads Cards
19	Region	Leads Report
133	Region	Lead Details
19	Page Item List of Values	P19_STATUS_ID

Object dependencies



Quality assurance



Quality assurance



“Quality is simply conformance to requirements”
- Project management institute

Quality assurance



Example #1 – All non-public pages should be protected with authorizations schemes

```
select *  
  from apex_application_pages  
 where authorization_scheme is null  
    and page_requires_authentication = 'Yes'
```

Quality assurance



Example #2 – Consistent SAVE button

```
select *
  from apex_application_page_buttons
 where button_name = 'SAVE'
       and not (label = 'Save'
               and button_is_hot = 'Yes'
               and button_template = 'Text with Icon'
               and icon_css_classes = 'fa-save'
               and display_position_code = 'CREATE')
```



Quality assurance



Example #3 – All page items should have some help text
(except hidden items)

Text Input
Some inline help text

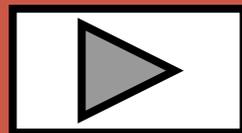
```
select *  
  from apex_application_page_items  
 where item_help_text is null  
       and inline_help_text is null  
       and display_as_code != 'NATIVE_HIDDEN'
```

Quality assurance



Demo

How to create quality standards and run quality assessments



Quality assurance



Option **Select component type** Select condition Define logic SQL statement Rule details

Page components	Application components	Database objects
Pages APEX_APPLICATION_PAGES	Application APEX_APPLICATIONS	Database Tables ALL_TABLES
Regions APEX_APPLICATION_PAGE_REGIONS	Lists APEX_APPLICATION_LISTS	Database Table Columns DB_TABLE_COLUMN
Page Items APEX_APPLICATION_PAGE_ITEMS	List Entries APEX_APPLICATION_LIST_ENTRIES	Database Triggers ALL_TRIGGERS
Buttons APEX_APPLICATION_PAGE_BUTTONS	List of Values APEX_APPLICATION_LOVS	Database Indexes ALL_INDEXES
Classic Report Columns APEX_APPLICATION_PAGE_RPT_COLS	List of Values Entries APEX_APPLICATION_LOV_ENTRIES	Database Sequences ALL_SEQUENCES
Interactive Report Columns APEX_APPLICATION_PAGE_IR_COL	Breadcrumbs APEX_APPLICATION_BREADCRUMBS	Database Jobs ALL_SCHEDULER_JOBS
Interactive Grid Columns	Breadcrumb entries	Database Packages

< Previous

Select the dictionary view you will base your rule on

Quality assurance



Browse and select the columns you will use for your conditions

Dictionary view
APEX_APPLICATION_PAGES

Search column
auth

Workspace

Application
115 - Customers

Select an application to have a preview of existing attribute values.

Select	Column Name	Comments	Values Preview (# of occurrences)
➔	AUTHORIZATION_SCHEME	An authorization scheme must evaluate to TRUE in order for this page to be displayed	ADMINISTRATION RIGHTS (62) null (46) CONTRIBUTION RIGHTS (23) View Competitors (1)
➔	PAGE_REQUIRES_AUTHENTICATION	Specifies whether this page has been defined as "Public" or requires authentication	Yes (129) No (3)

row(s) 1 - 2 of 2

Quality assurance



In a declarative way define the rule logic

The screenshot shows a multi-step configuration process for defining a rule. The steps are: Option, Select component type, Select condition, Define logic (current step), SQL statement, and Rule details. The 'Define Logic' step is active, showing a configuration for a rule condition. The condition is defined as: Dictionary view APEX_APPLICATION_PAGES, Column PAGE_REQUIRES_AUTHENTICATION, Operator =, and Value. A dropdown menu is open for the Value field, showing 'No' and 'Yes' options, with 'Yes' selected. Below the configuration, there is a section for 'Existing conditions' which lists: APEX_APPLICATION_PAGES AUTHORIZATION_SCHEME IS NULL - X.

Option Select component type Select condition **Define logic** SQL statement Rule details

Define the rule condition

Dictionary view
APEX_APPLICATION_PAGES

Column
PAGE_REQUIRES_AUTHENTICATION

Operator
=

Value

No
Yes

Existing conditions

APEX_APPLICATION_PAGES AUTHORIZATION_SCHEME IS NULL - X

Quality assurance



Validate the generated SQL statement

Rule select statement



```
1 SELECT
2     application_id || ':' || page_id as component_id
3 FROM apex_application_pages
4 WHERE page_requires_authentication = 'Yes'
5     AND authorization_scheme IS NULL
6 |
```

Quality assurance



Define the rule
meta-data

Rule creation wizard - Step 6 - Rule details

Option Select component type Select condition Define logic SQL statement Rule details

Rule details

Name
All non-public pages should have an authorization scheme defined

Category *
Best practice Consistency Error Performance **Security** Warning

Error Message
Page access is not protected with an authorization scheme

APEX version

Justification
Non-public pages should always be protected of unauthorized access as broken access control is the #1 security thread based on OWASP

How to fix
Go to page security attributes and select an authorization scheme

Directly include in Quality Standard
HROUG Standard

Severity *
High Medium Low

< Previous Create rule ✓

Quality assurance



Add other rules
to your Quality
Standard

The screenshot displays a web interface for managing quality standards. It is divided into two main sections: 'Standard' and 'Rules'.

Standard Section:

- Quality standard:** HROUG Standard
- Description:** Internal application development guides
- Documentation:** www.right-thing.solutions/quality_standard

Rules Section:

Search: All Text Columns [Go] [Actions] [Edit] [Save] [Reset]

Rule Category: ☆ 4 High Severity, Inactive rule, Medium Severity, Low Severity

<input type="checkbox"/>	Seq ↑	Rule	Severity	Active	Variables	Errors
▼ Rule Category: Best practice						
<input checked="" type="checkbox"/>	20	Page items should have some help text	Low	Yes		
▼ Rule Category: Consistency						
<input type="checkbox"/>	50	SAVE button consistency	Medium	Yes		
▼ Rule Category: Error						
<input type="checkbox"/>	30	Buttons with icon templates should always have an icon defined	Medium	Yes		
▼ Rule Category: Security						

Quality assurance



Select where to
run your rules

1 Define Scope  

Define the scope where you want to run the Quality Assessment.

Workspace	STARTER_APPLICATIONS	
Workspace	SAMPLE_APPLICATIONS	

2 Select Standards

<input checked="" type="checkbox"/>	HROUG Standard
-------------------------------------	----------------

3 Run quality assessment



Quality assurance



Analyse the assessment results

File explorer view showing a directory structure:

- SAMPLE_APPLICATIONS (339)
- STARTER_APPLICATIONS (184)
 - 115 - Customers (47)
 - 116 - Opportunities (56)
 - 117 - Poll (12)
 - 119 - Team Calendar (16)
 - Administration (1)
 - Events (2)
 - Help (1)
 - Public (6)
 - 1 - Home (1)
 - 2 - Search (2)
 - </> breadcrumbs (1)
 - 3 - Event Details - &P3_EVENT_NAME. (1)
 - 12 - Timeline (1)
 - 100 - Time Zone Preference (1)
 - Tags (1)
 - Unassigned page group (5)
 - 120 - APEX Project Eye (APE) 22.2 (50)
 - 121 - APEX Alpe Adria (3)

Issues (2)

Search: [] Go Actions [v]

Severity: [v] [x] Highlight excluded [x]

Severity: **High**

Details	Component Type	Component Name	Rule	Additional Comment	Add to exceptions	Fix
	Pages	Search	All non-public pages should have an authorization scheme define	-		

Severity: **Medium**

Details	Component Type	Component Name	Rule	Additional Comment	Add to exceptions	Fix
	Buttons	DELETE_MULTIPLE	Buttons with icon templates should always have an icon defined	-		

1 - 2

APEX Project Eye (APE)



united codes

APEX Project Eye

<https://www.apexprojecteye.com/>

Keep an eye on your **APEX** Applications



Other community and professional tools:

- Application Standards Tracker (https://github.com/hudson/code_standard_tracking)
- APEX Sec (<https://apexsec.recx.co.uk/>)
- APEX Sert (<https://github.com/OraOpenSource/apex-sert>)
- APEX Visualizer (<https://apex.mt-ag.com/en/apex-visualizer>)
- Quasto (<https://github.com/mt-ag/quasto>)

Keep an eye on your **APEX** Applications



ales.kravos@right-thing.solutions