ā'pěks alpe adria

APEX 23.1
Native Push Notifications
+
Easy Background Processing

Steve Muench
APEX Dev Team
April 21st, 2023

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A Career Dedicated to Oracle App Dev Tools…

1990

2021

UC Berkeley, BA Math, Dec 1989

*SQL*Forms* Support Engineer

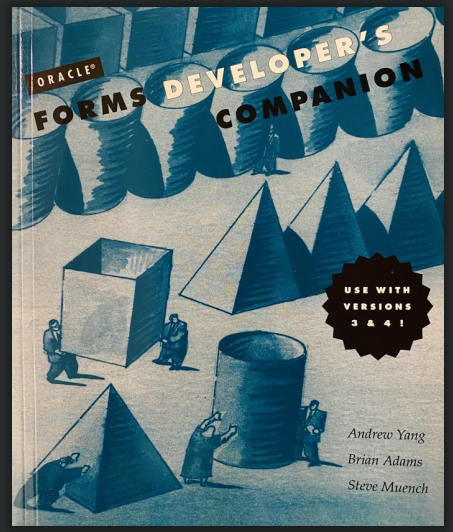
Oracle Forms PM

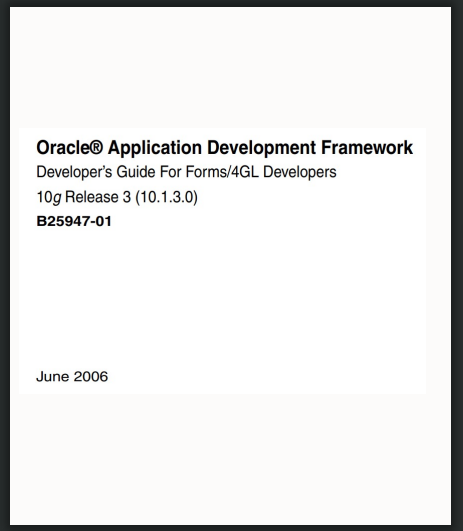
Project Sedona PM

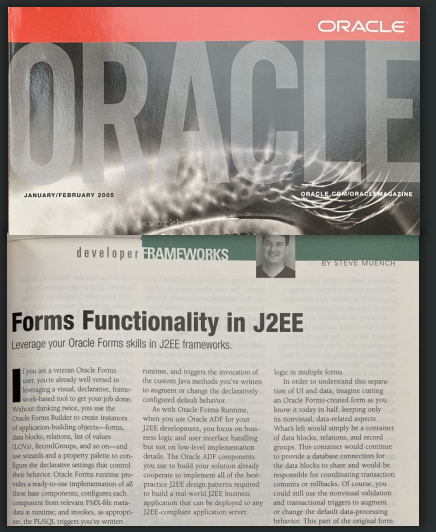
ADF BC PM | OraMag | XML

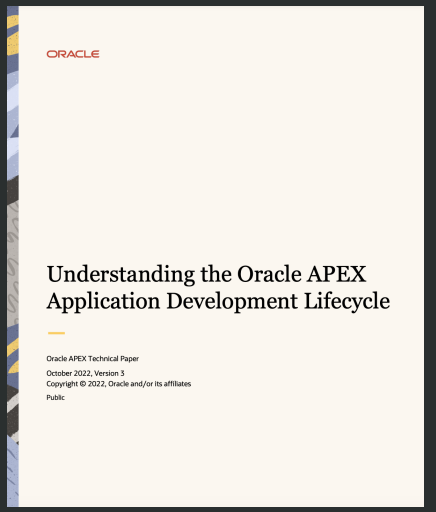
ADF Developer/Architect

Oracle APEX Architect









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New Feature Highlights in APEX 23.1

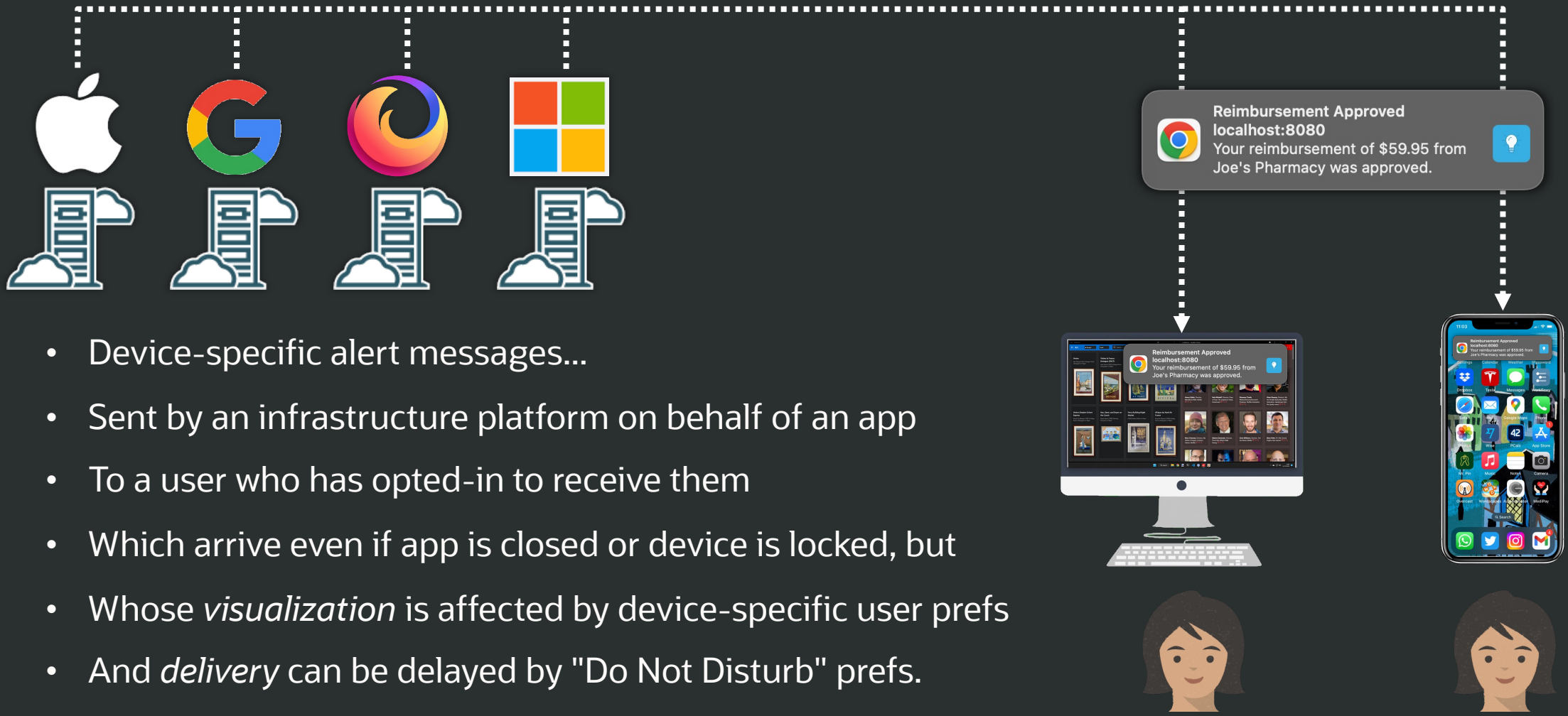
- **Send native push notifications to mobile and desktop subscribers**
- **Organize page processes into groups and easily run in the background**
- Create UI components using only templating skills for reuse in Page Designer
- Invoke REST APIs declaratively as page processes
- Configure REST data sources automatically from an OpenAPI 3 description
- Modernized Object Browser with persistent, filterable object tree

New Feature Highlights in APEX 23.1

- Improvements to context-sensitive help in the APEX App Builder
- Plugins can support 25 attributes (up from 15)
- Copy pages from the Create Page Wizard
- One-click, secure access to SQL Developer Web
- Save and run application without closing modal code editor
- New color picker
- And many smaller enhancements

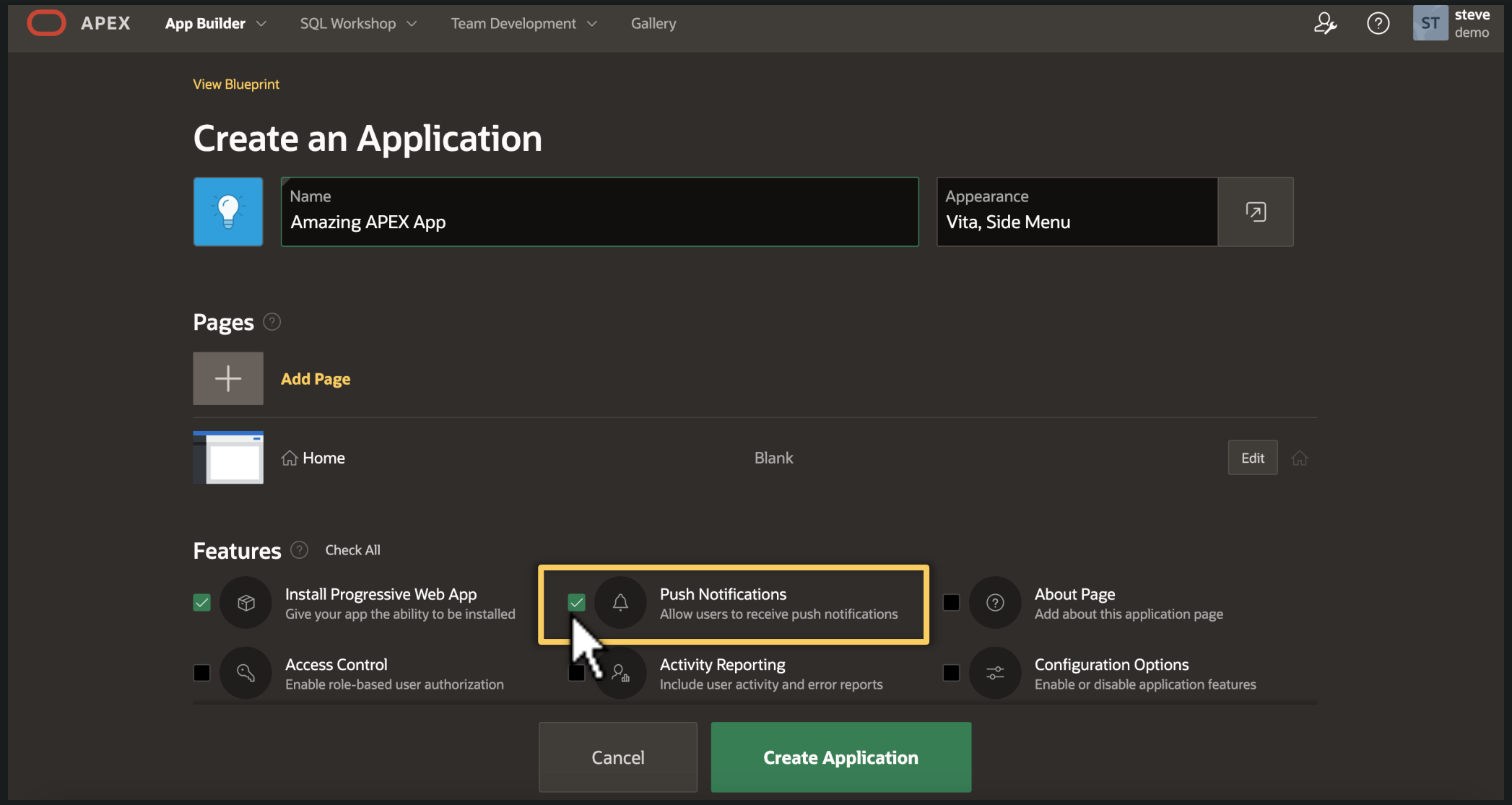
APEX 23.1
Native Push Notifications

What are Push Notifications?

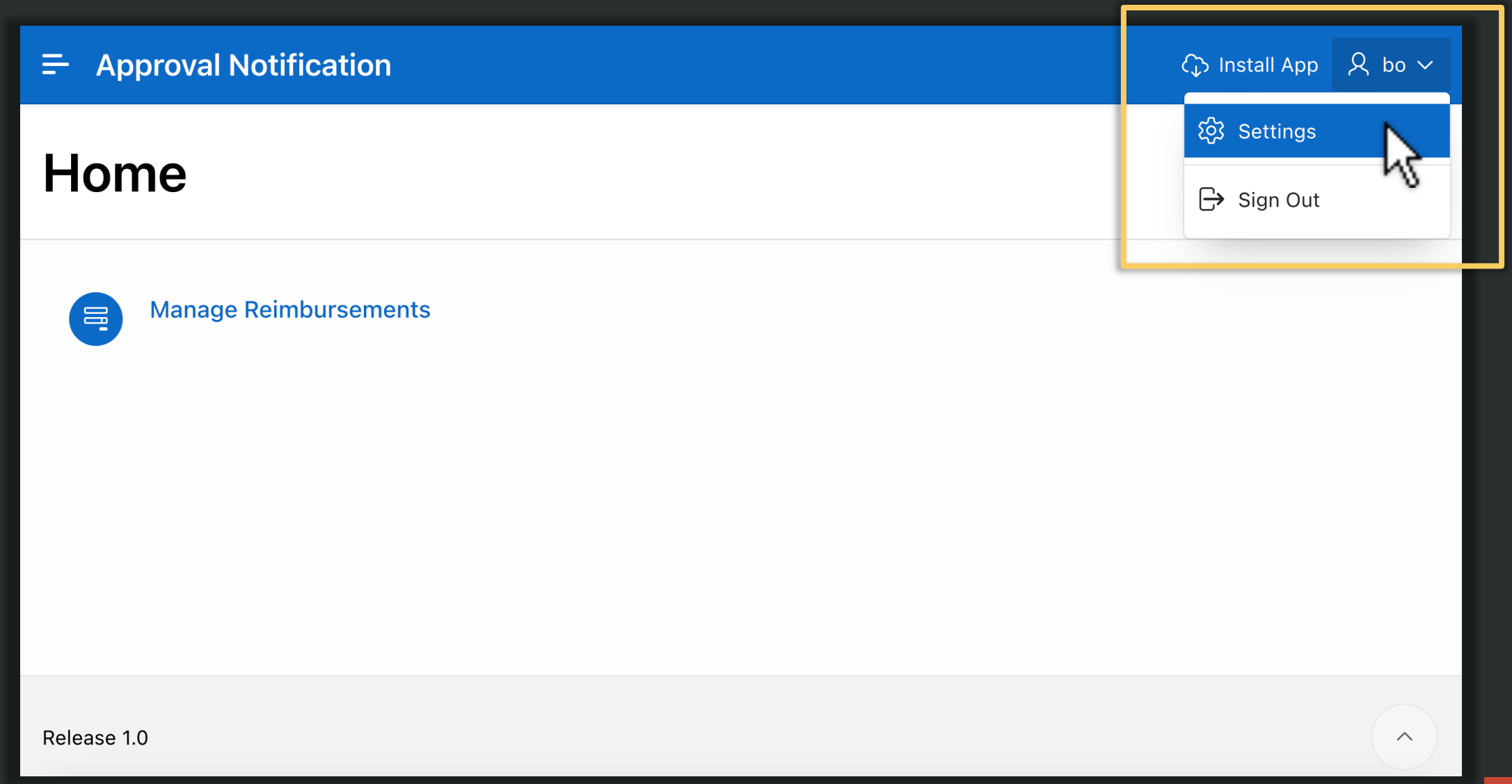


- Device-specific alert messages…
- Sent by an infrastructure platform on behalf of an app
- To a user who has opted-in to receive them
- Which arrive even if app is closed or device is locked, but
- Whose *visualization* is affected by device-specific user prefs
- And *delivery* can be delayed by "Do Not Disturb" prefs.
- They can open an appropriate app when clicked/tapped on
- Work well with *PWA-installed* apps and *persistent authentication*, but not dependent on them

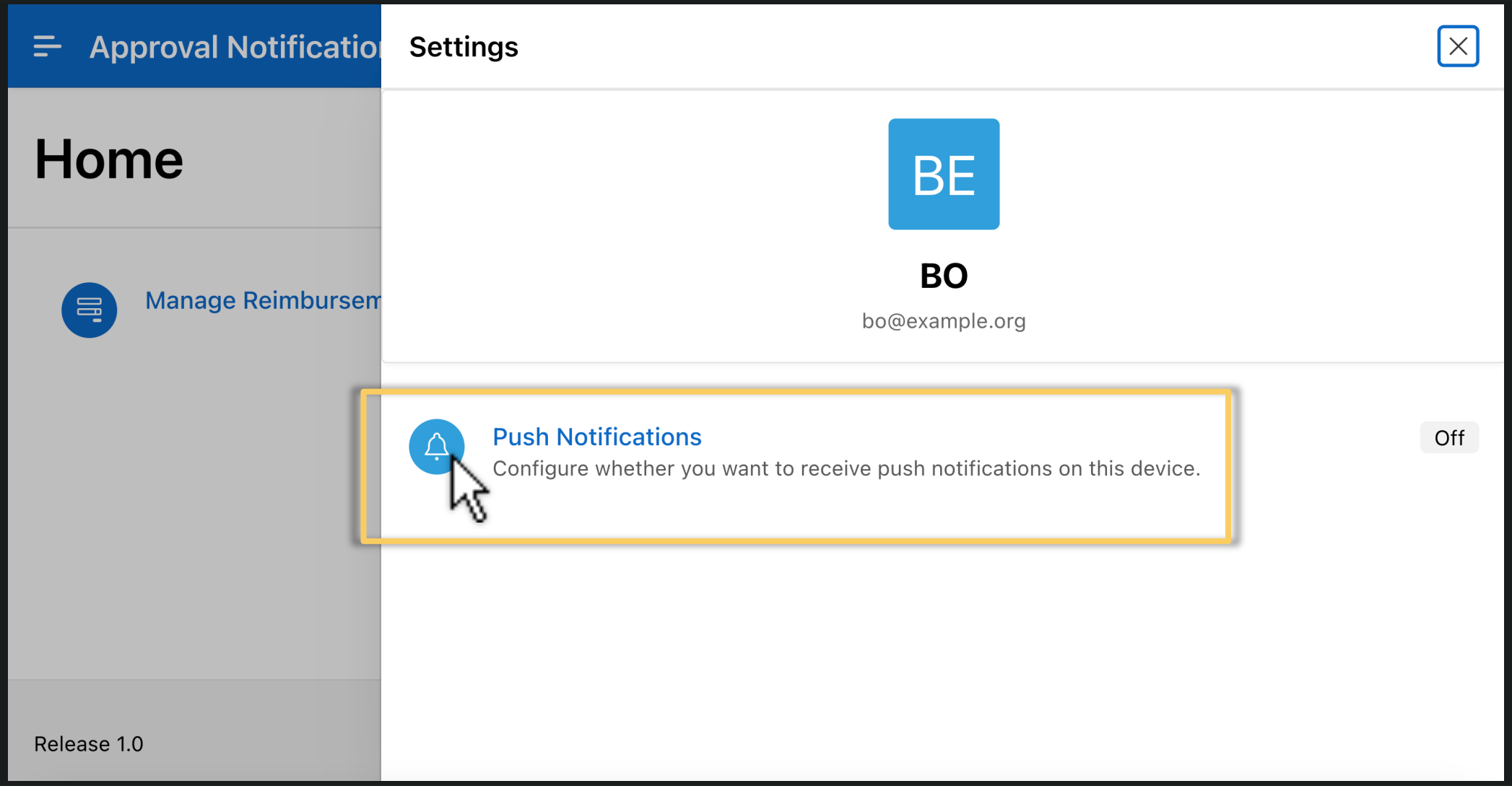
One-Click Enabling of Push Notifications for a New App



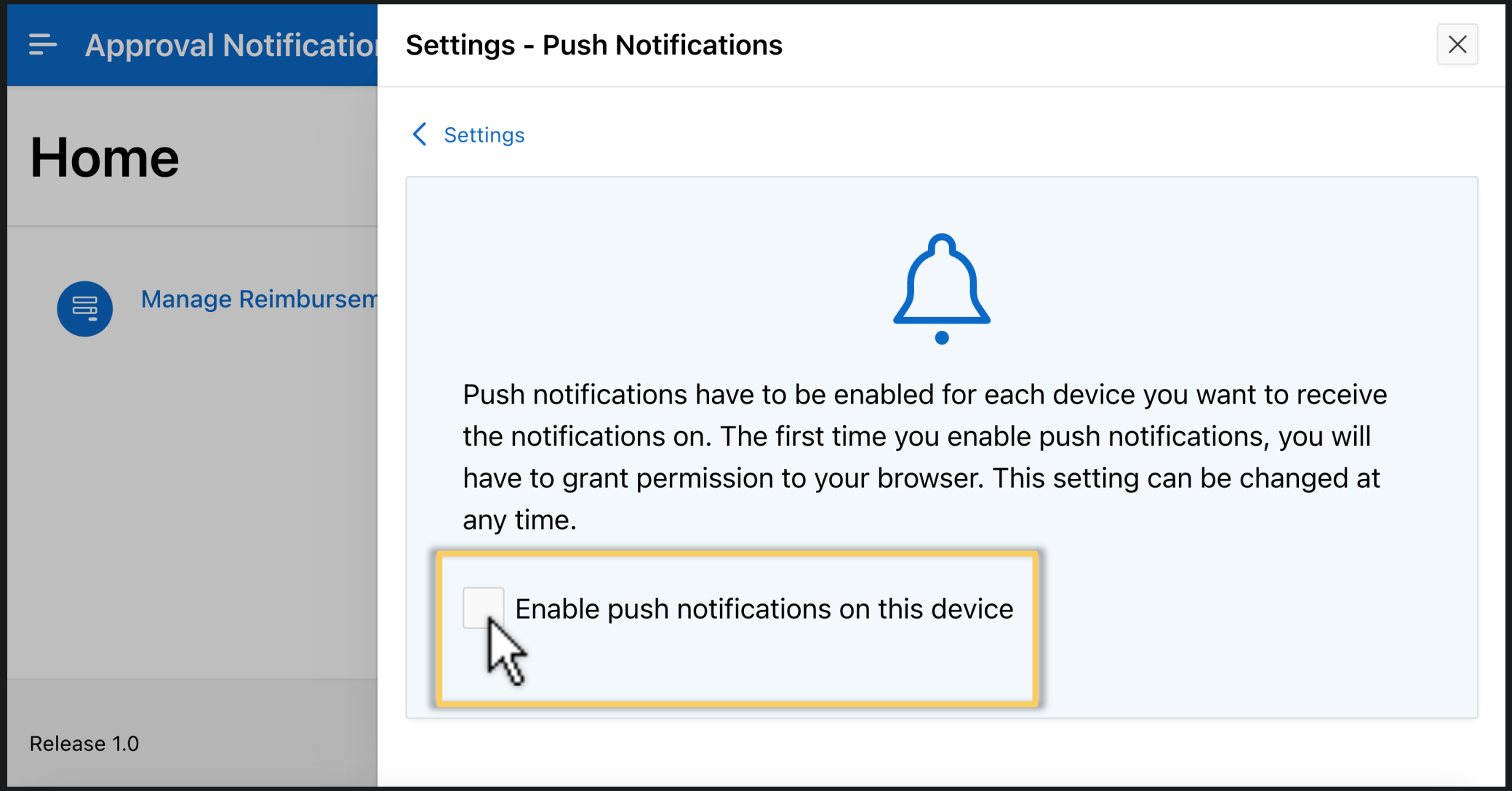
New User Settings Navigation Bar List Entry



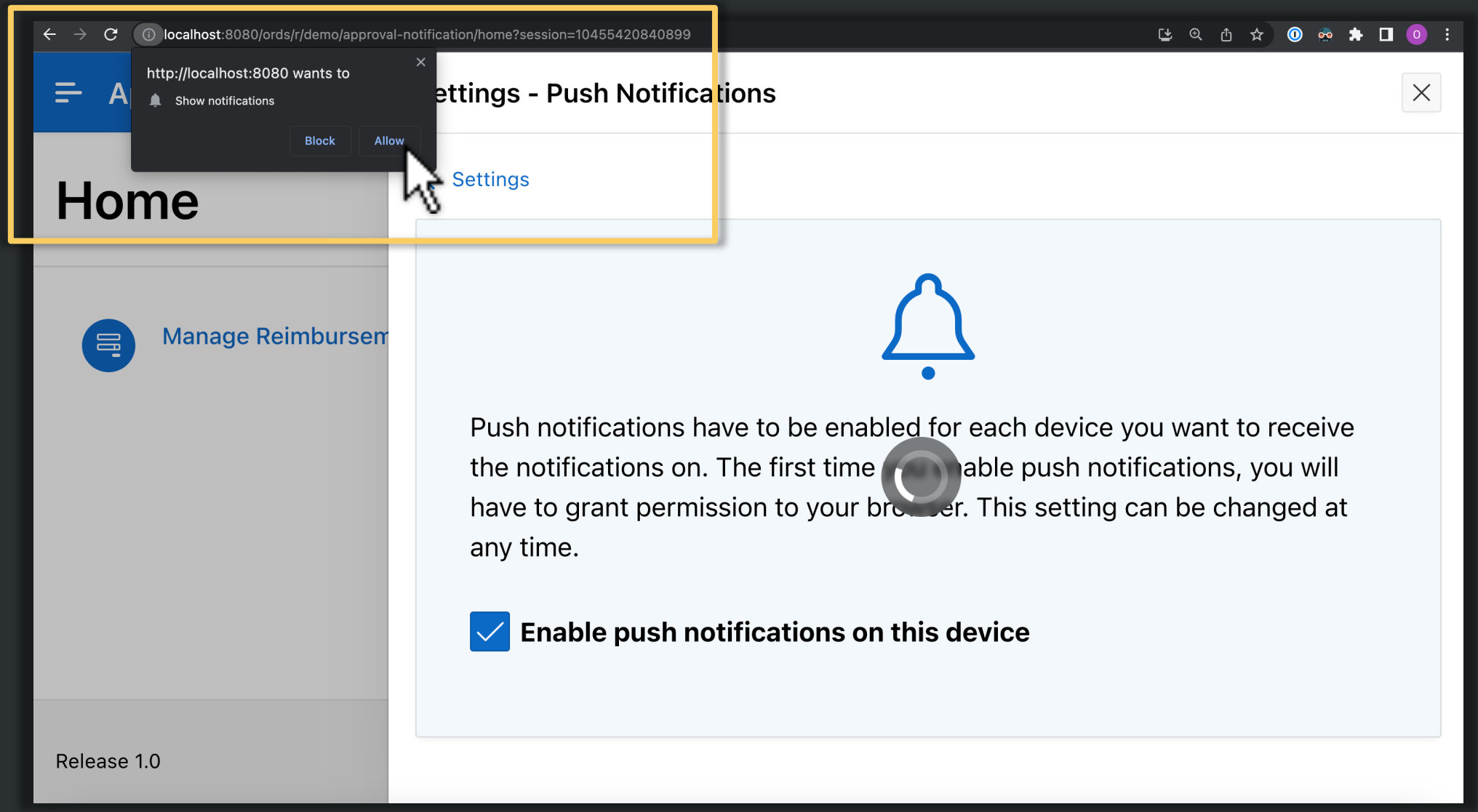
Others User Settings In the Future, or Add Your Own



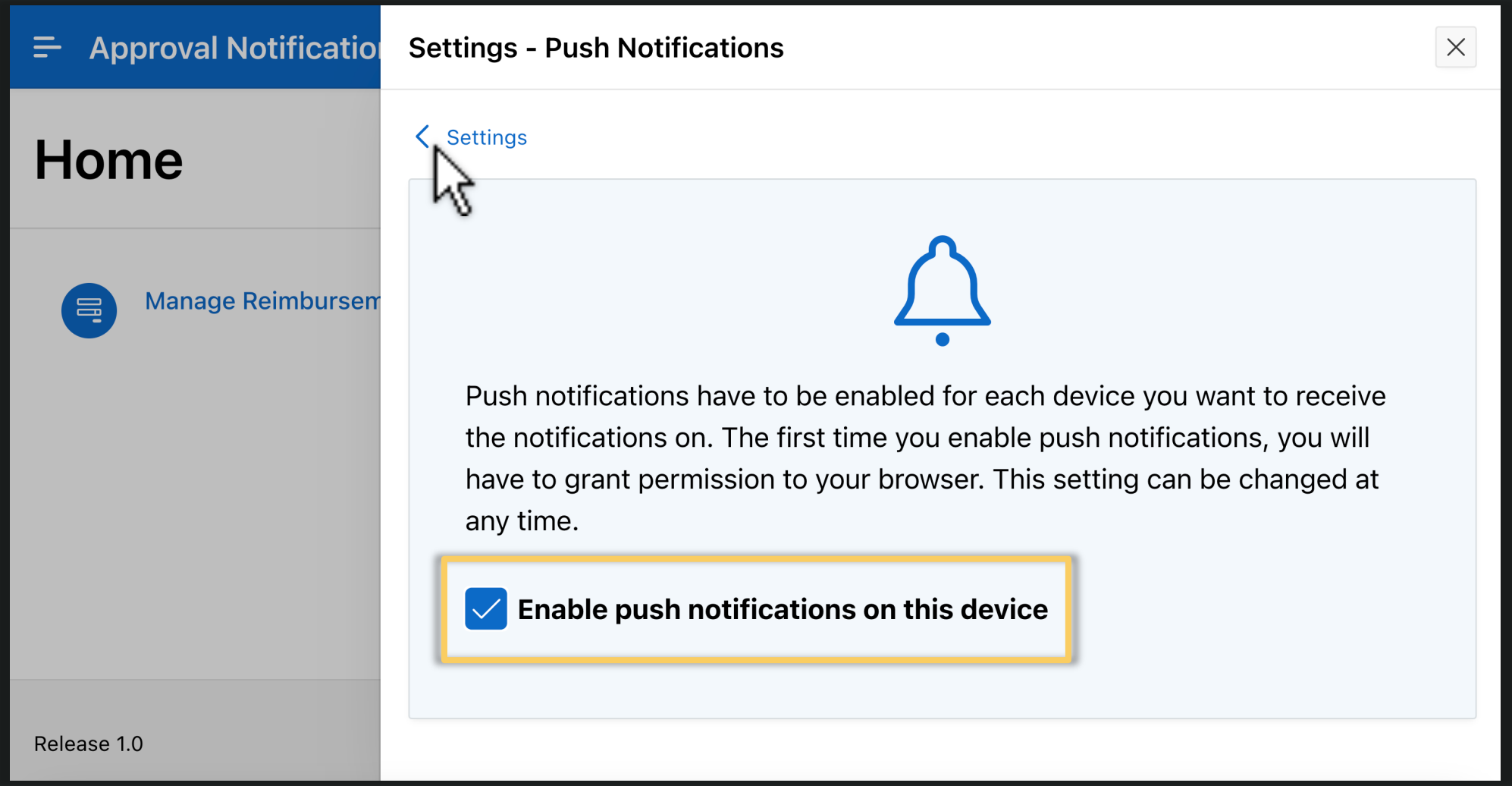
End Users Opt-in on Each Device to Receive Notifications



First Time User Must Allow Notifications



User Remains Subscribed for this App Until They Disable



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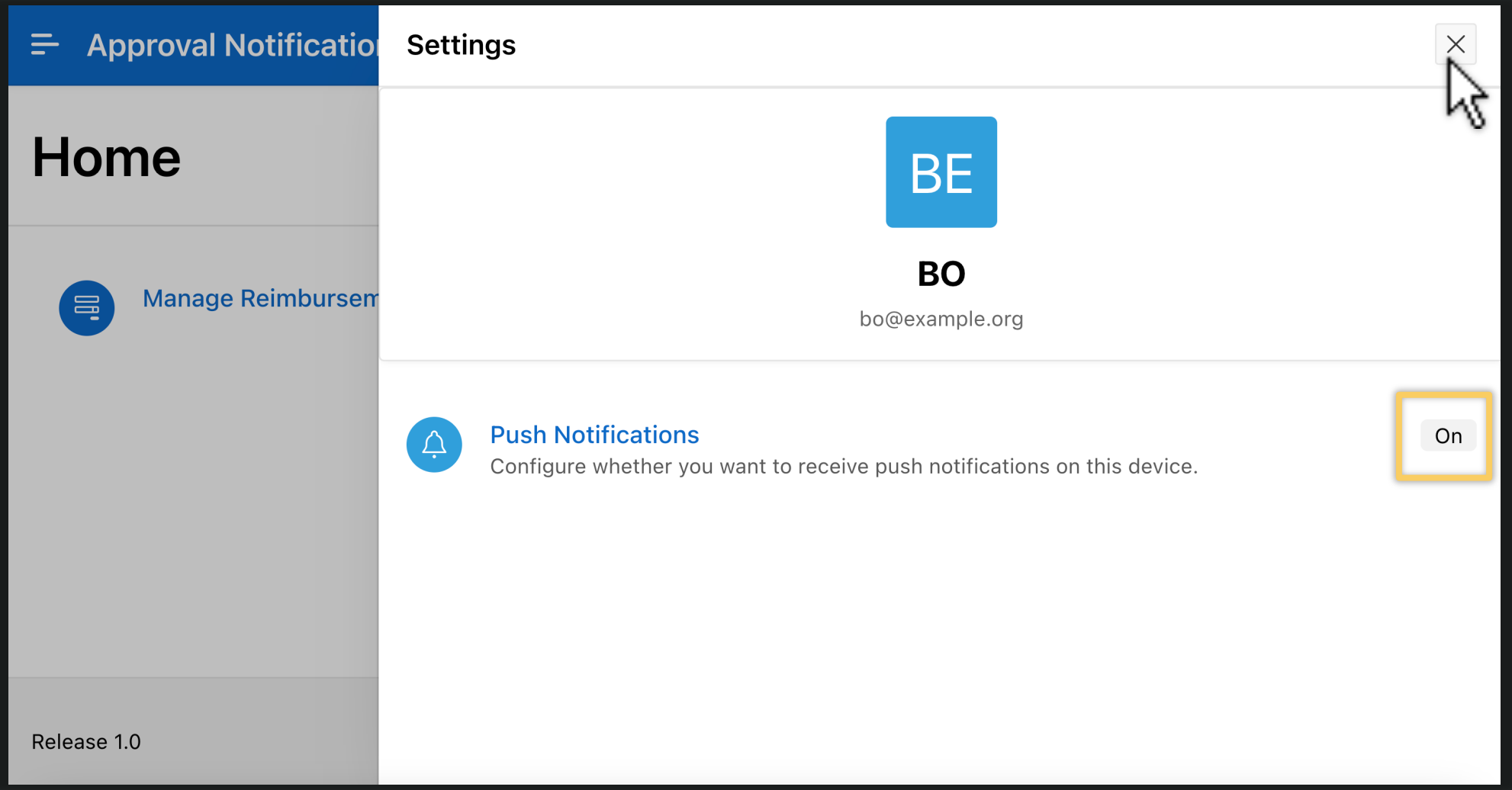
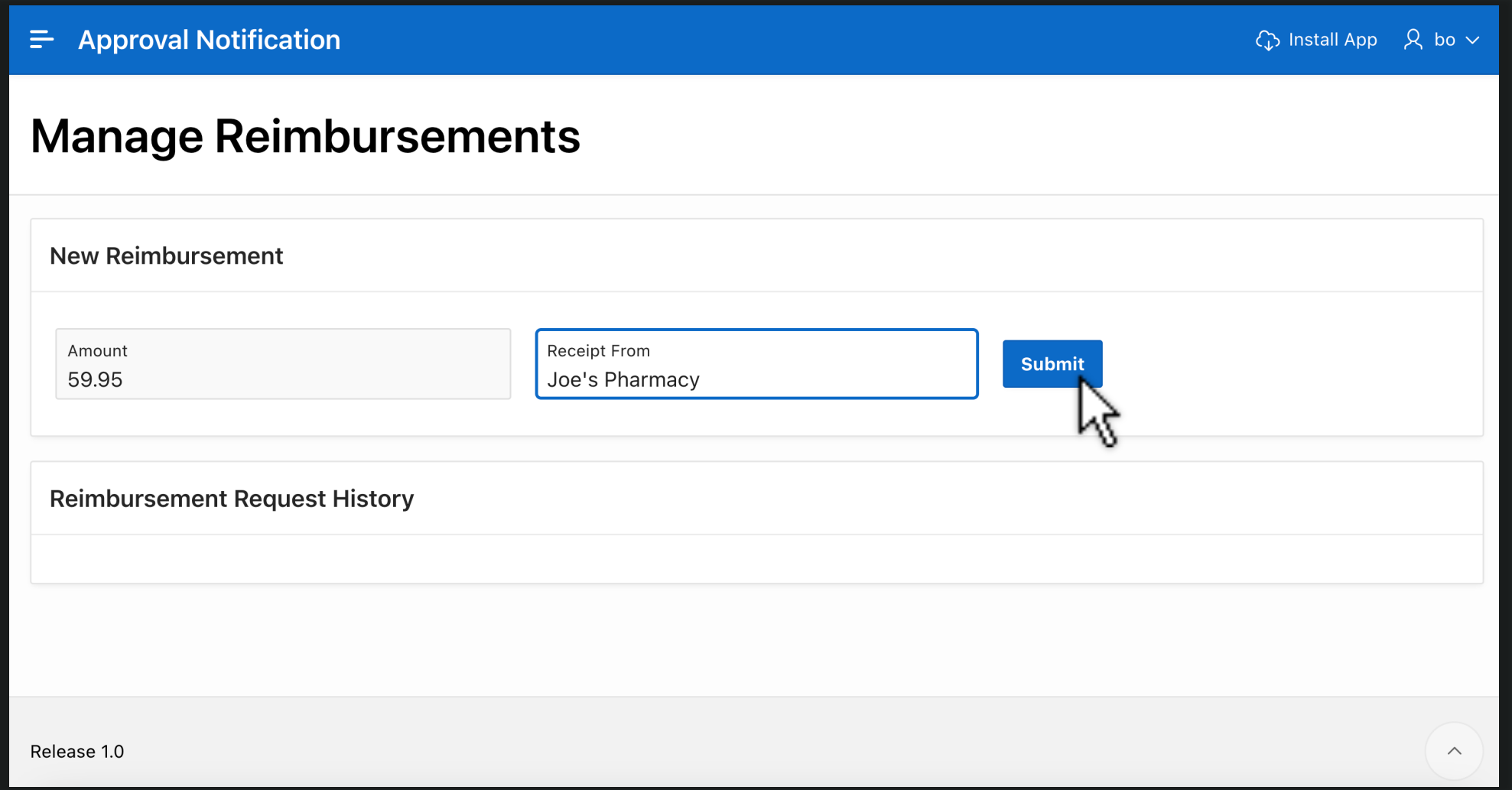


Imagine an App for Requesting a Reimbursement...



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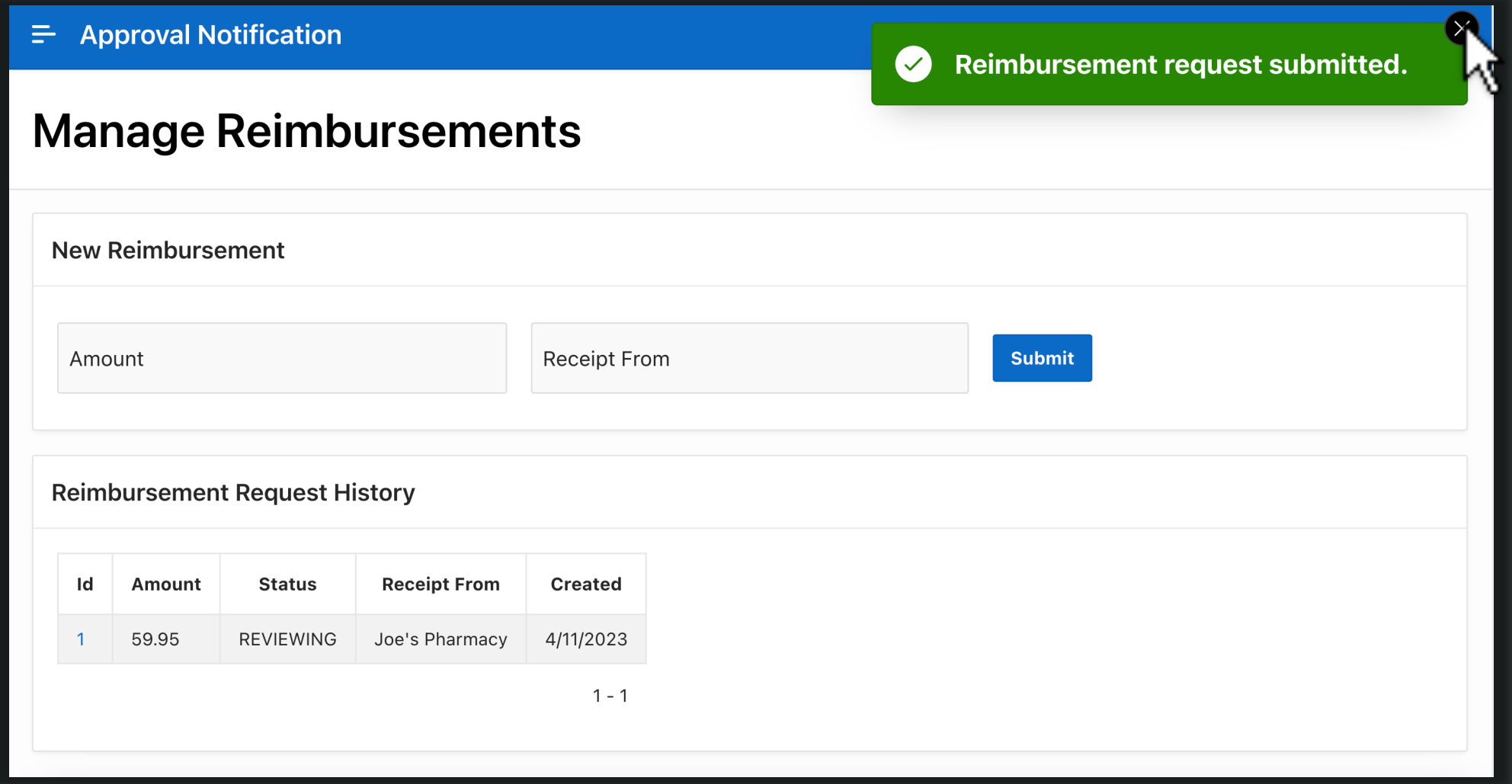
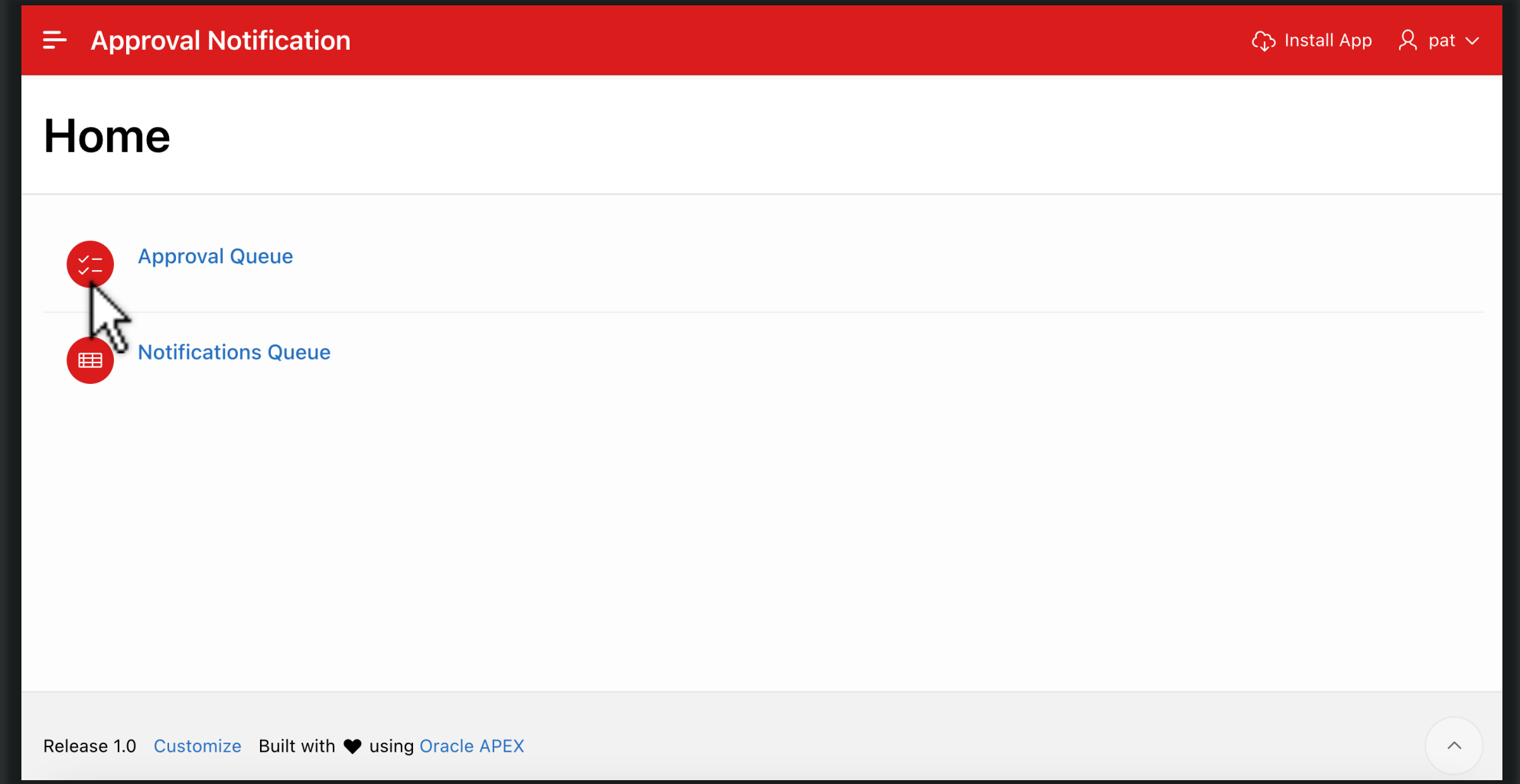


Backoffice Staff Member Approves the Request...



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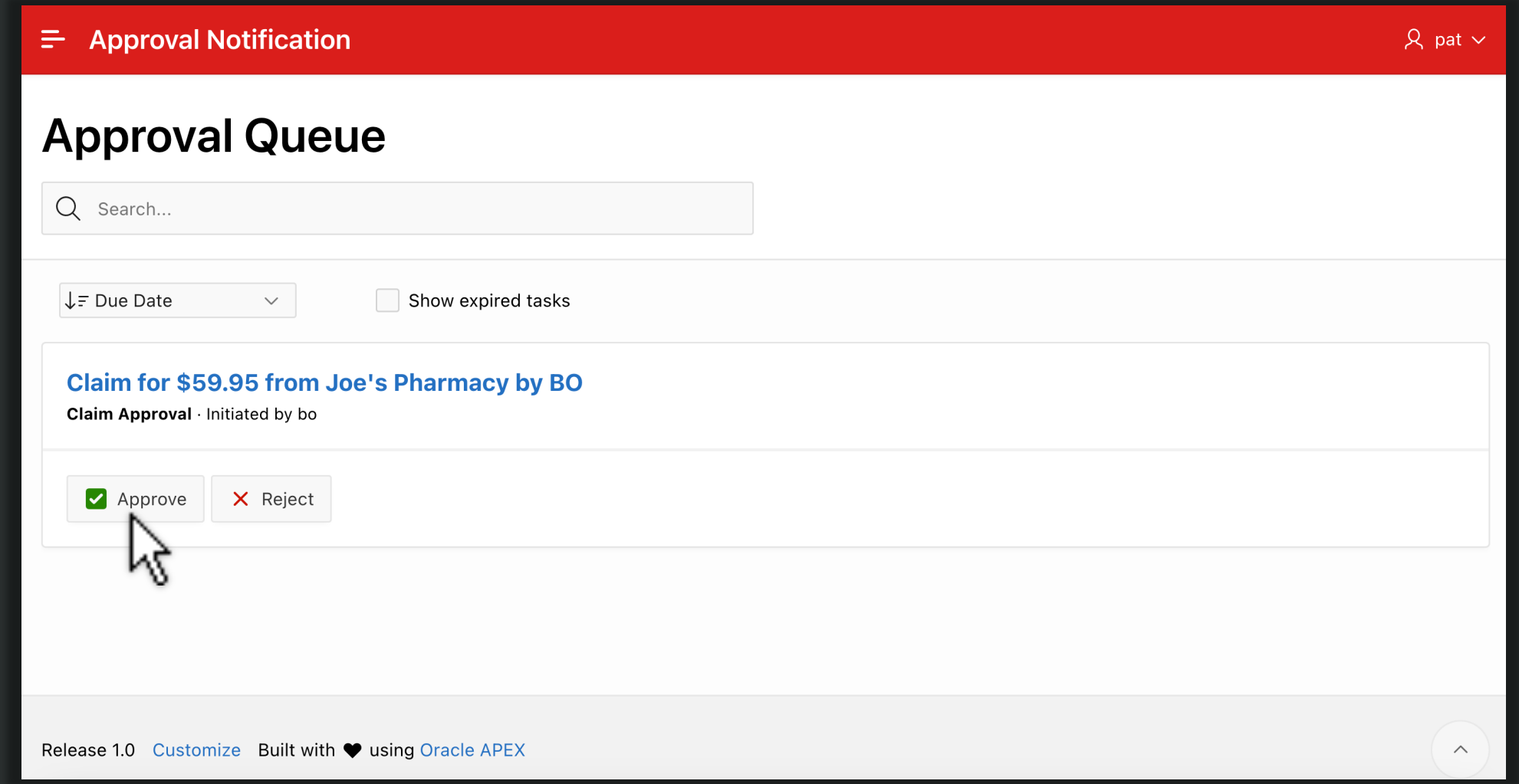
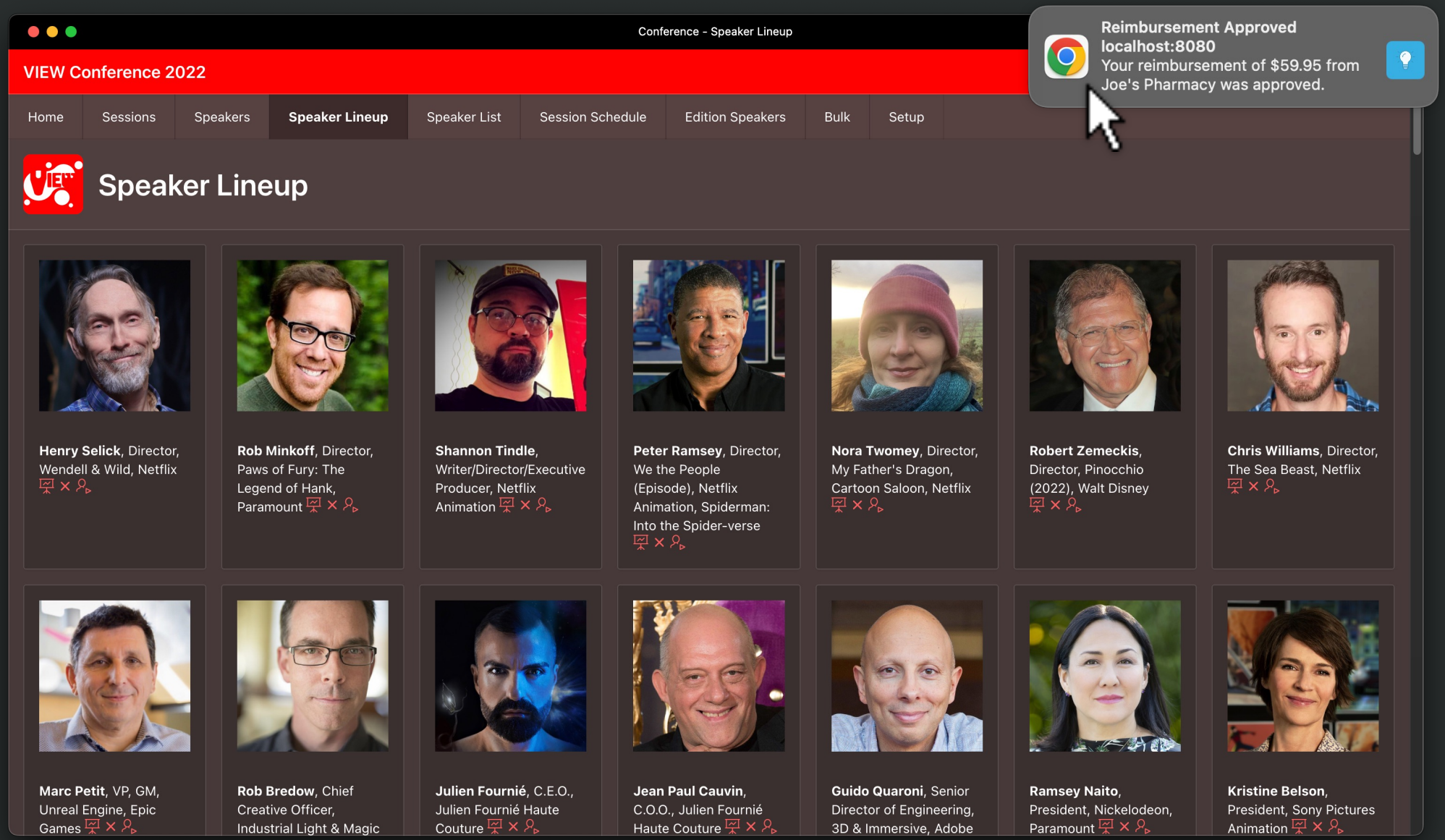
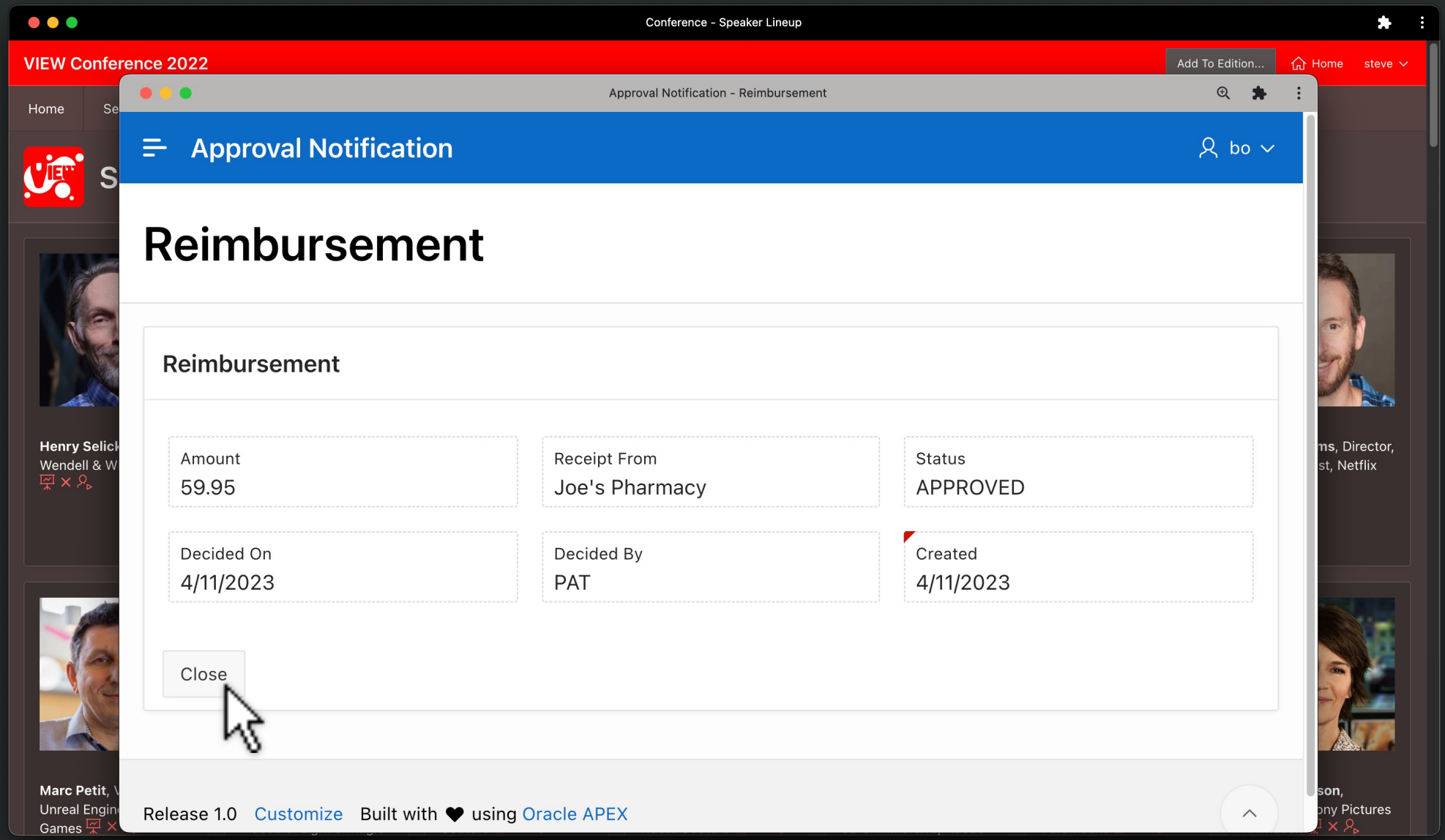


User Gets Notified Even if Relevant APEX App's Not Open

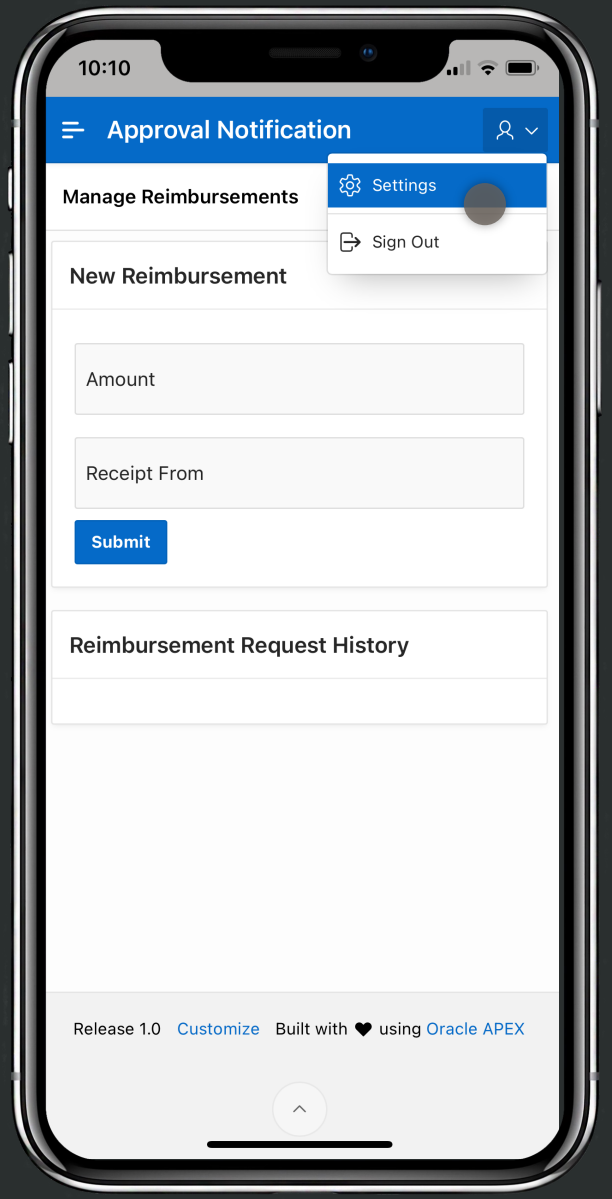


Clicking the Notification Opens App & Shows Detail

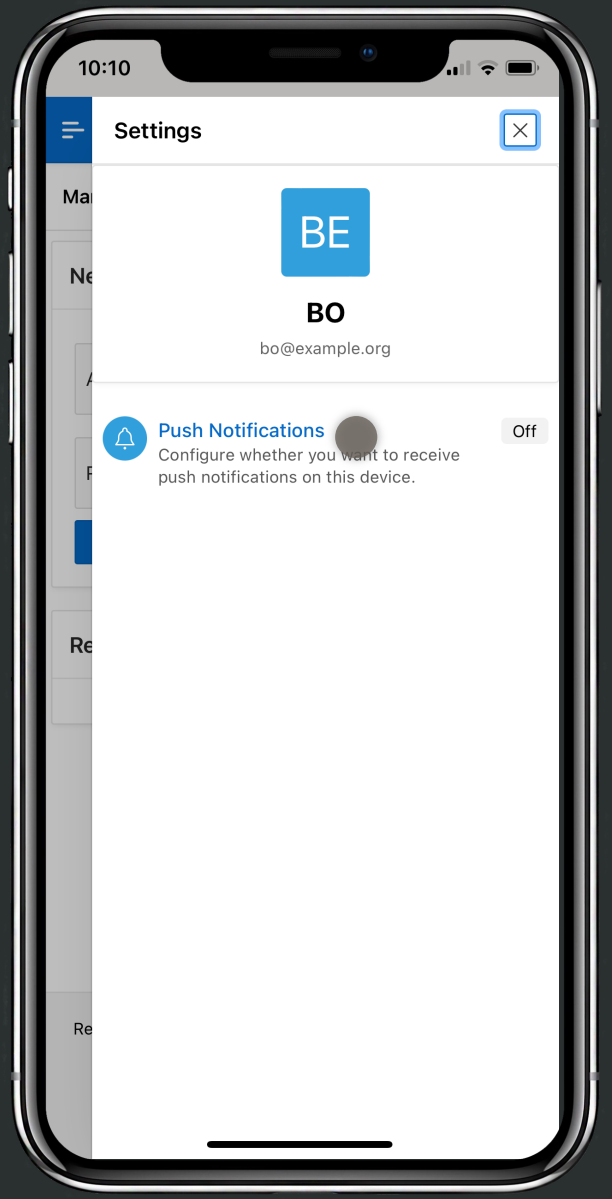


Same APEX App Works as PWA on Mobile Devices

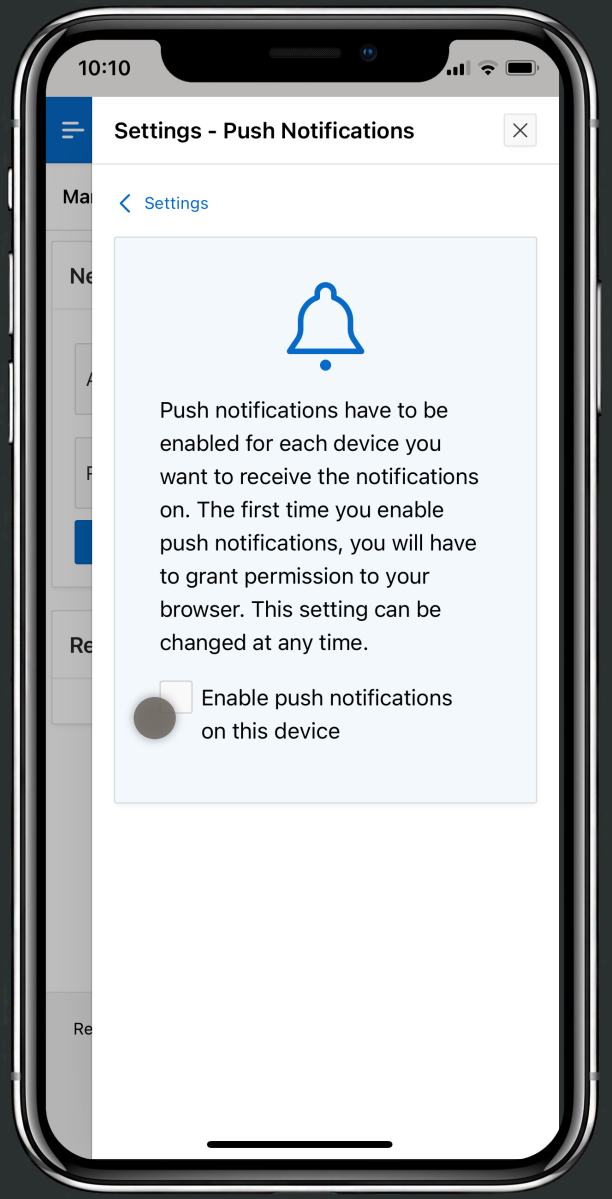
User Has to Opt-in to Push Notifications on Each Device



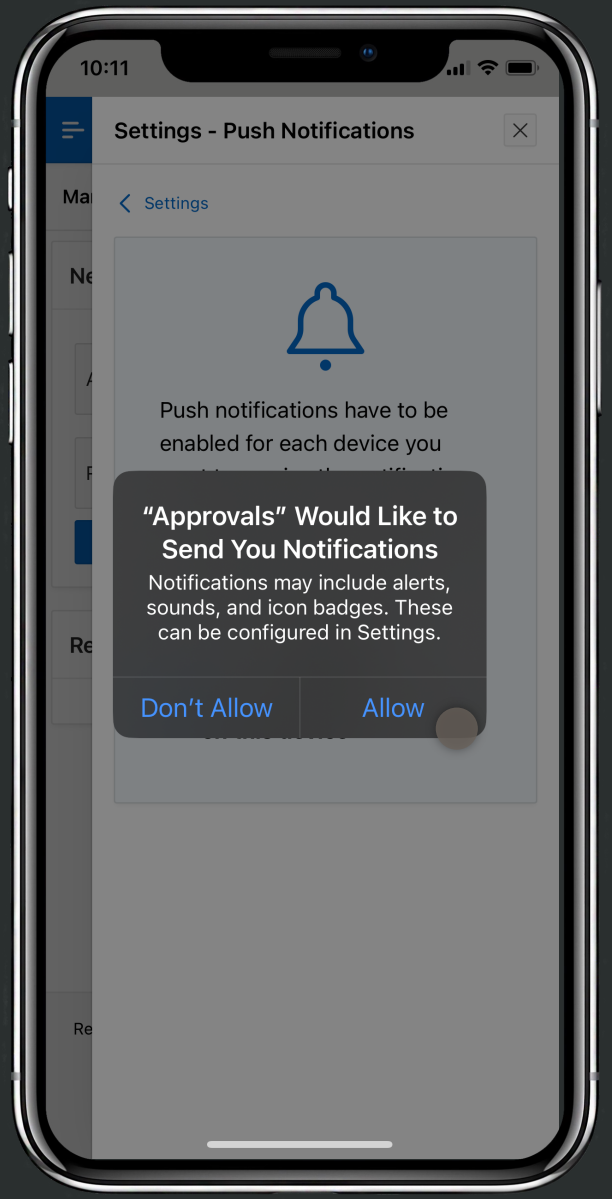
User Has to Opt-in to Push Notifications on Each Device



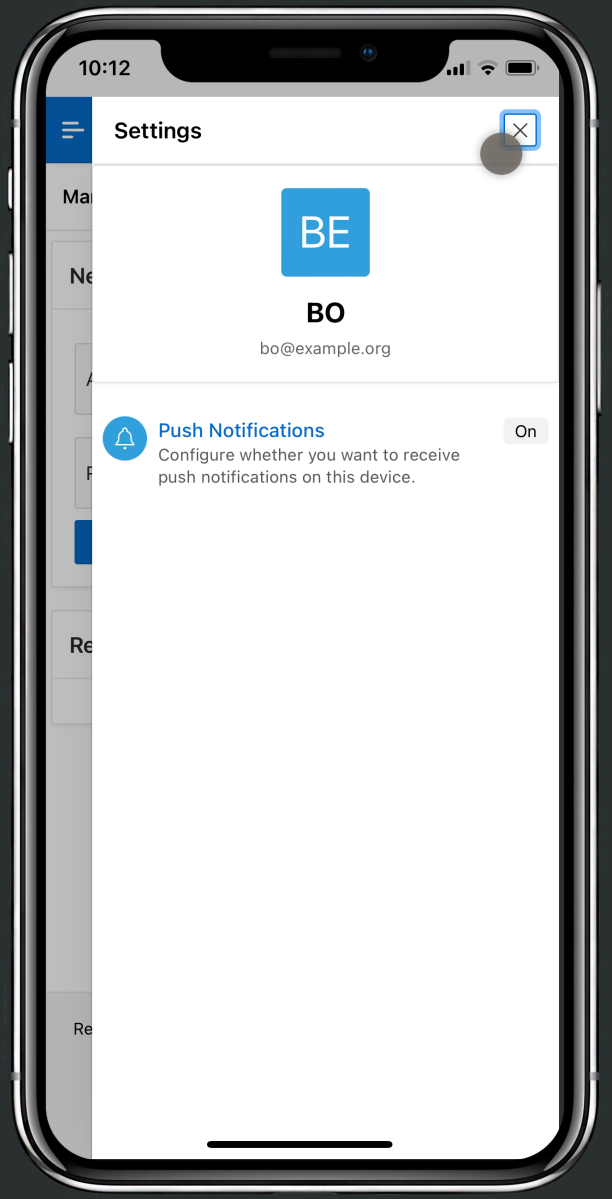
User Has to Opt-in to Push Notifications on Each Device



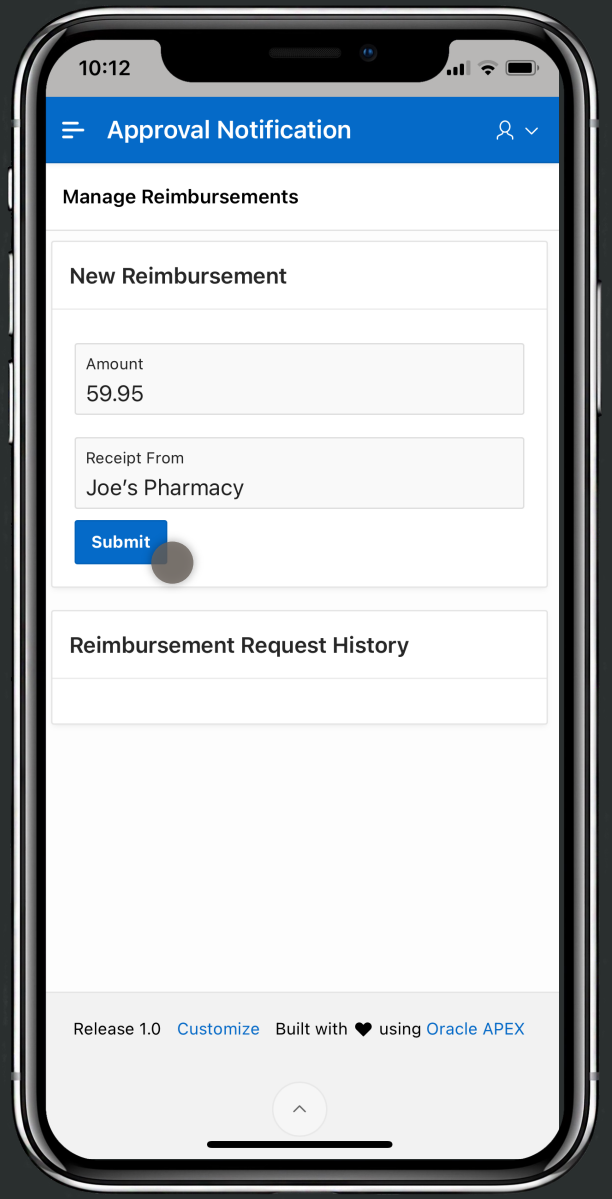
Device Asks User to Allow the Subscription



User Remains Subscribed for this App Until They Disable



Submitting an Reimbursement Request from iPhone



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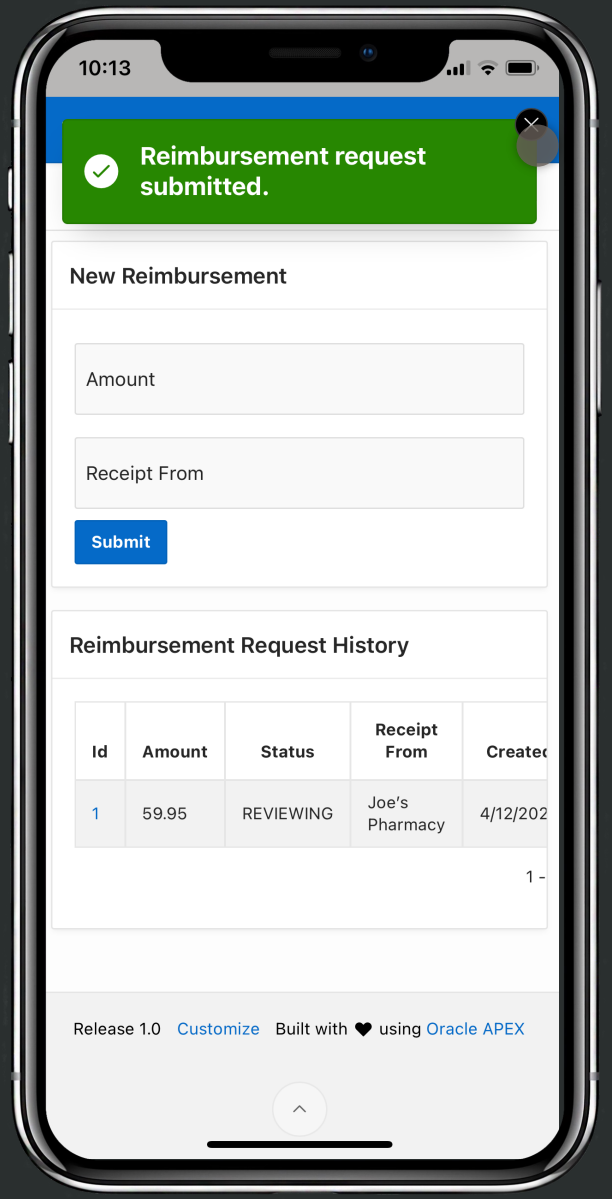
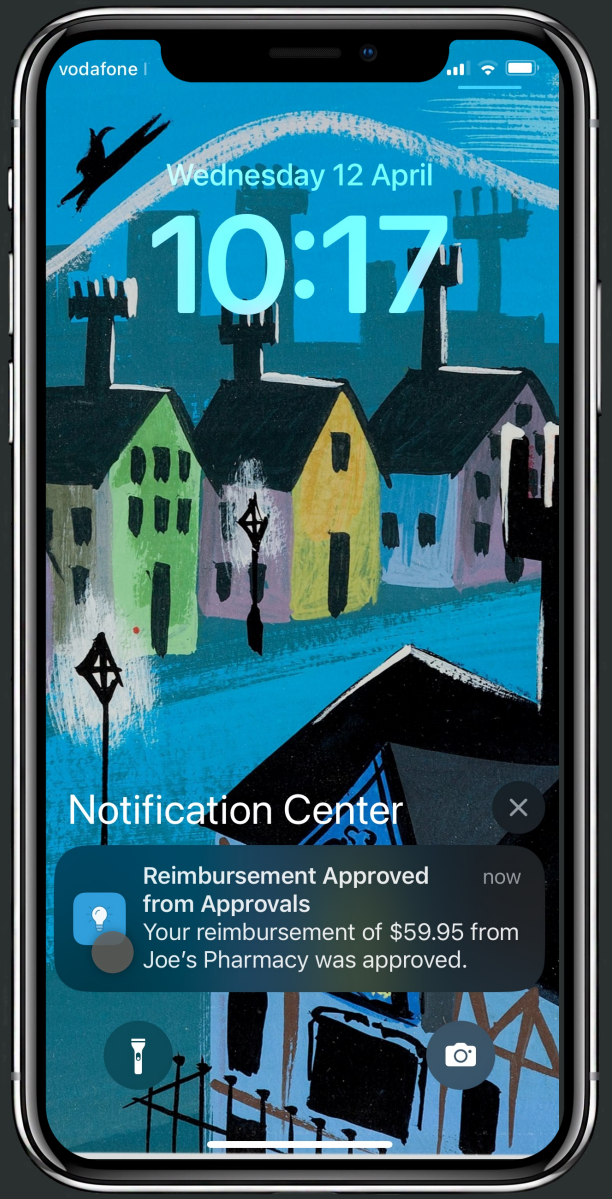
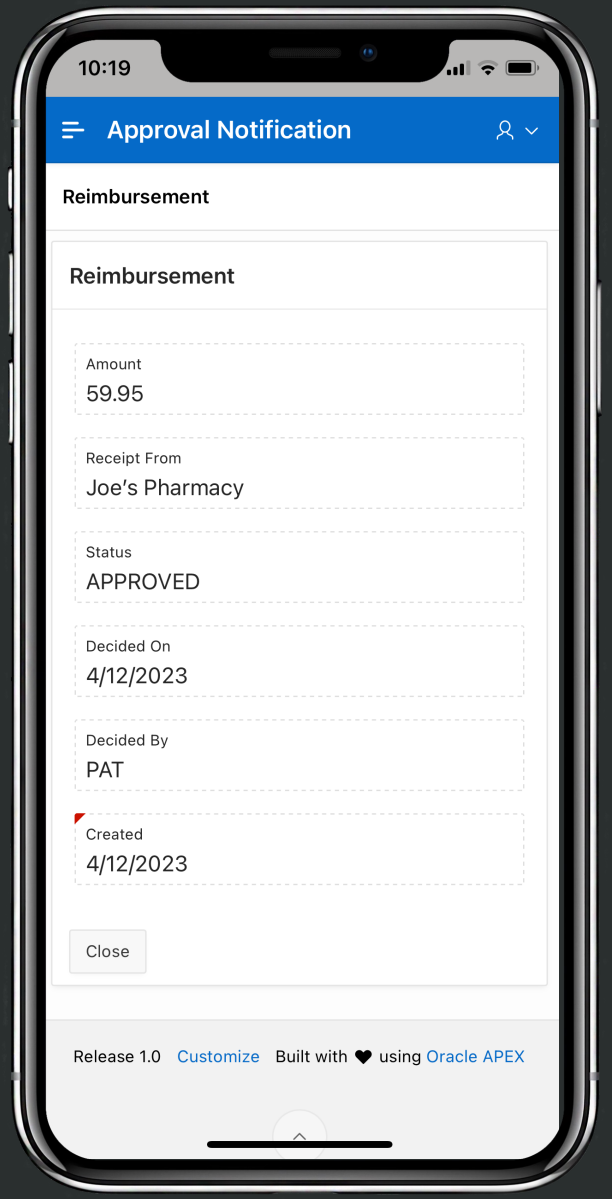


Once Reimbursement is Approved, User Gets Notified

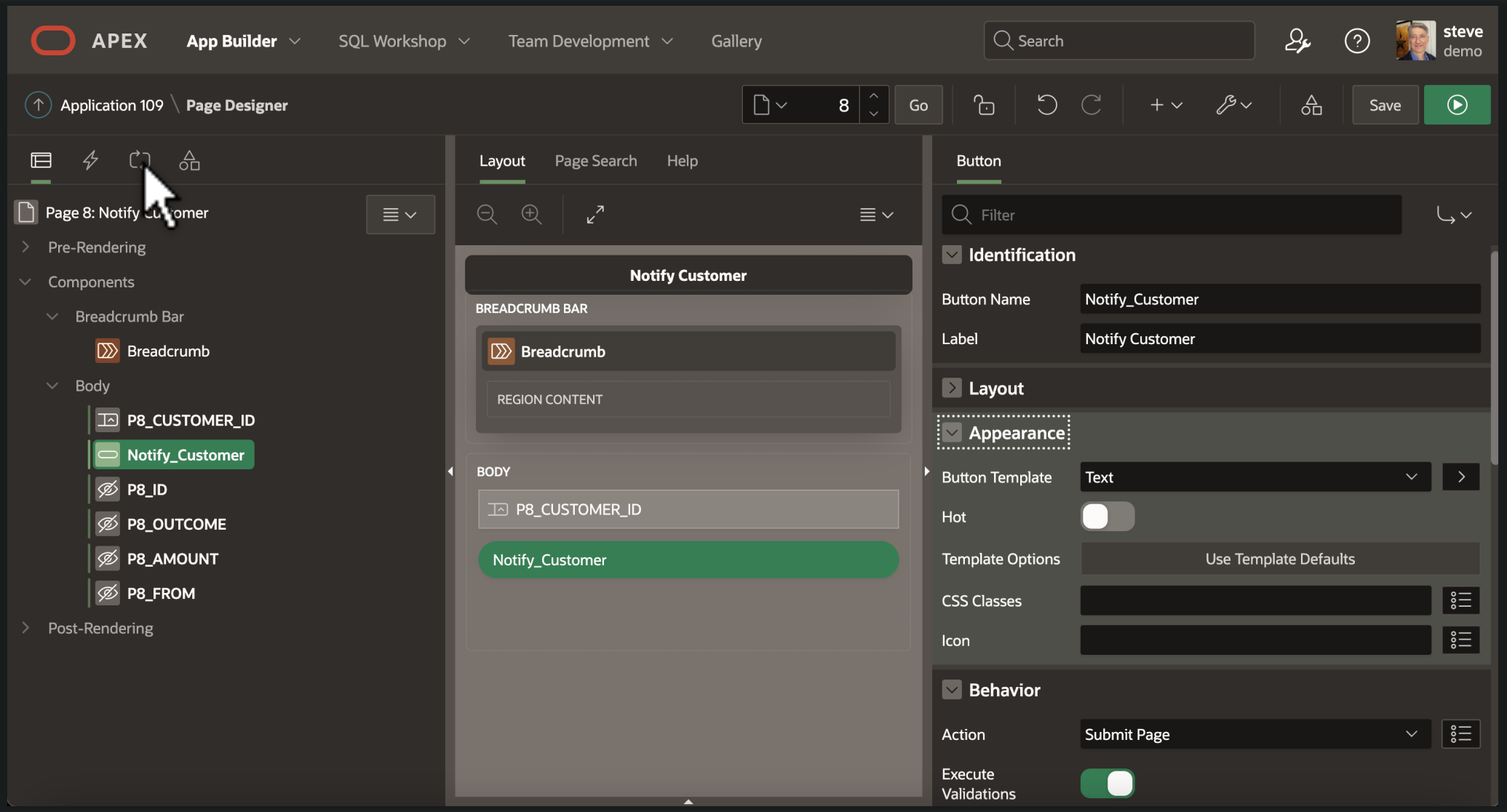


Tapping the Notification Opens App & Shows Detail

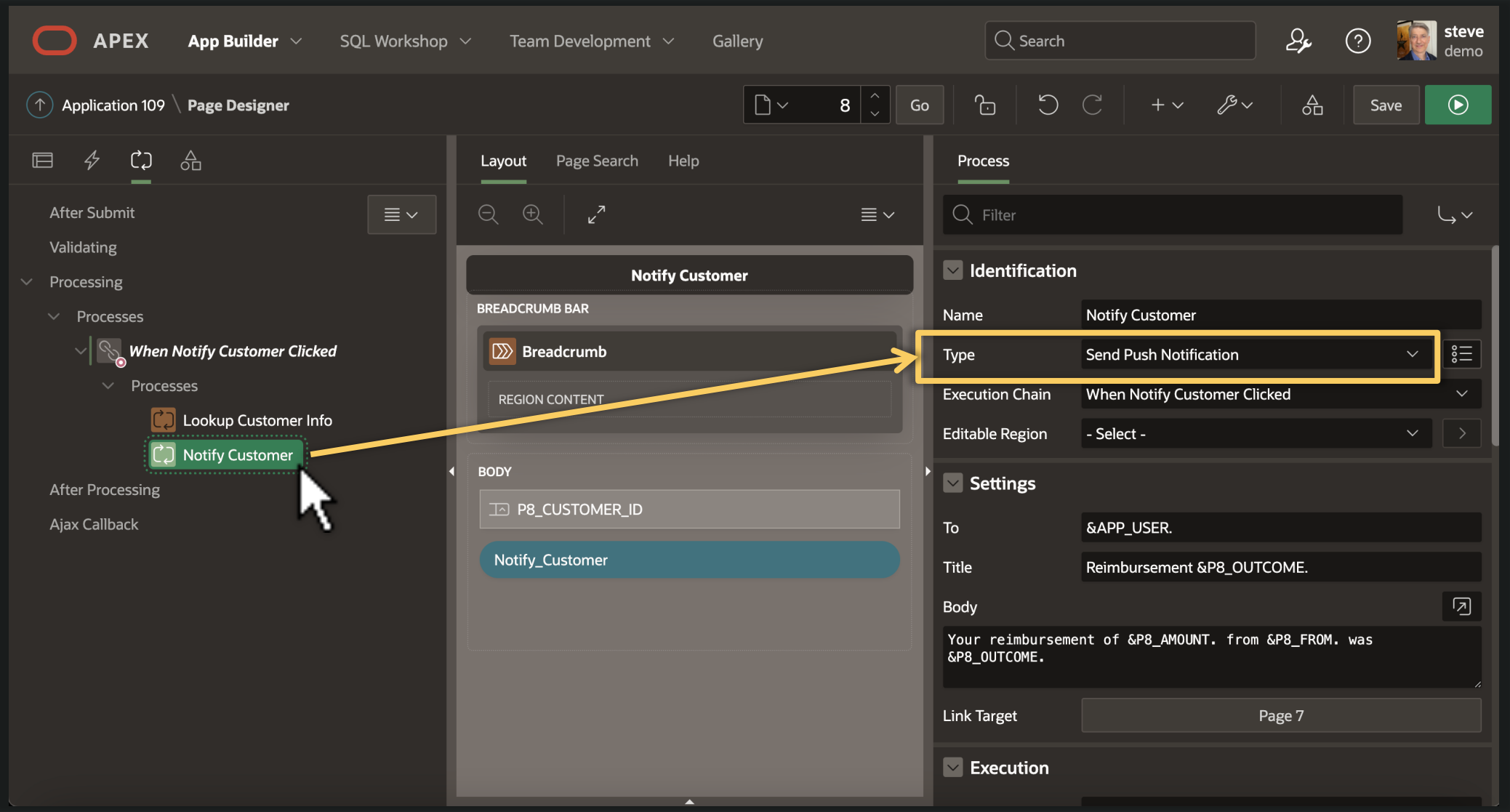


Benefits Natively from All Device Notification Features

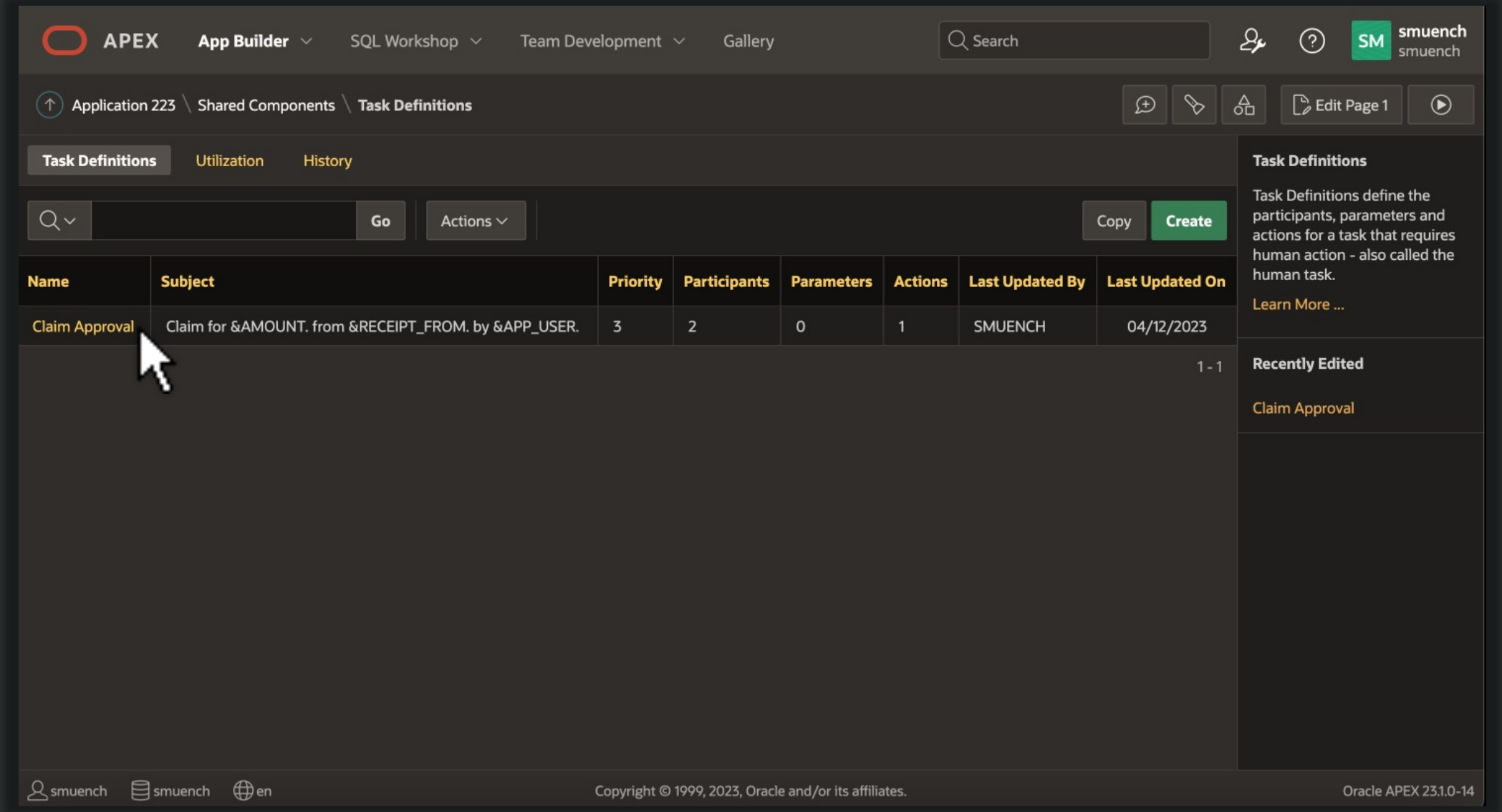
Sending Push Notifications: Page Process



Sending Push Notifications: Page Process



Sending Push Notifications: PL/SQL API from Task Def



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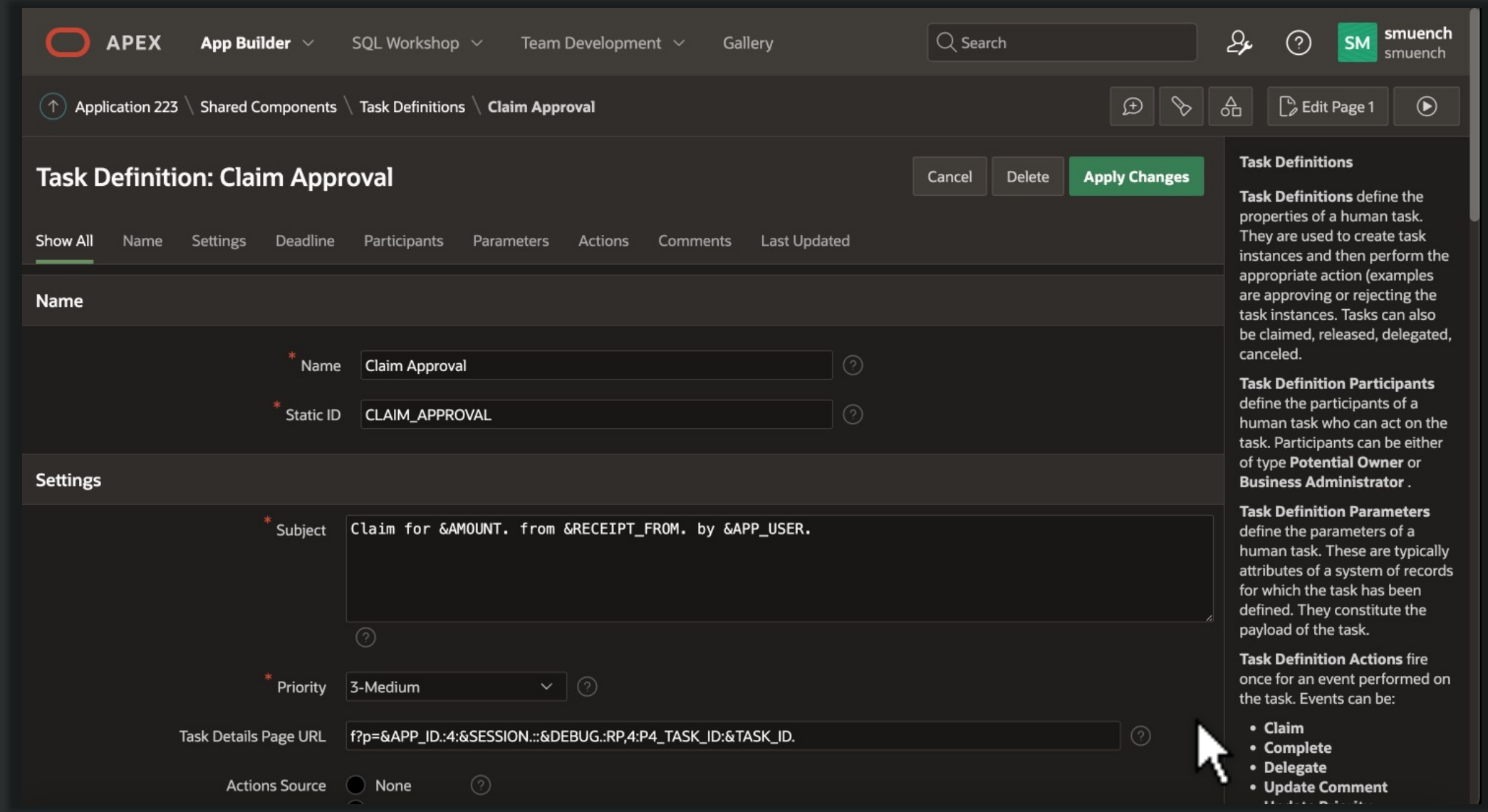

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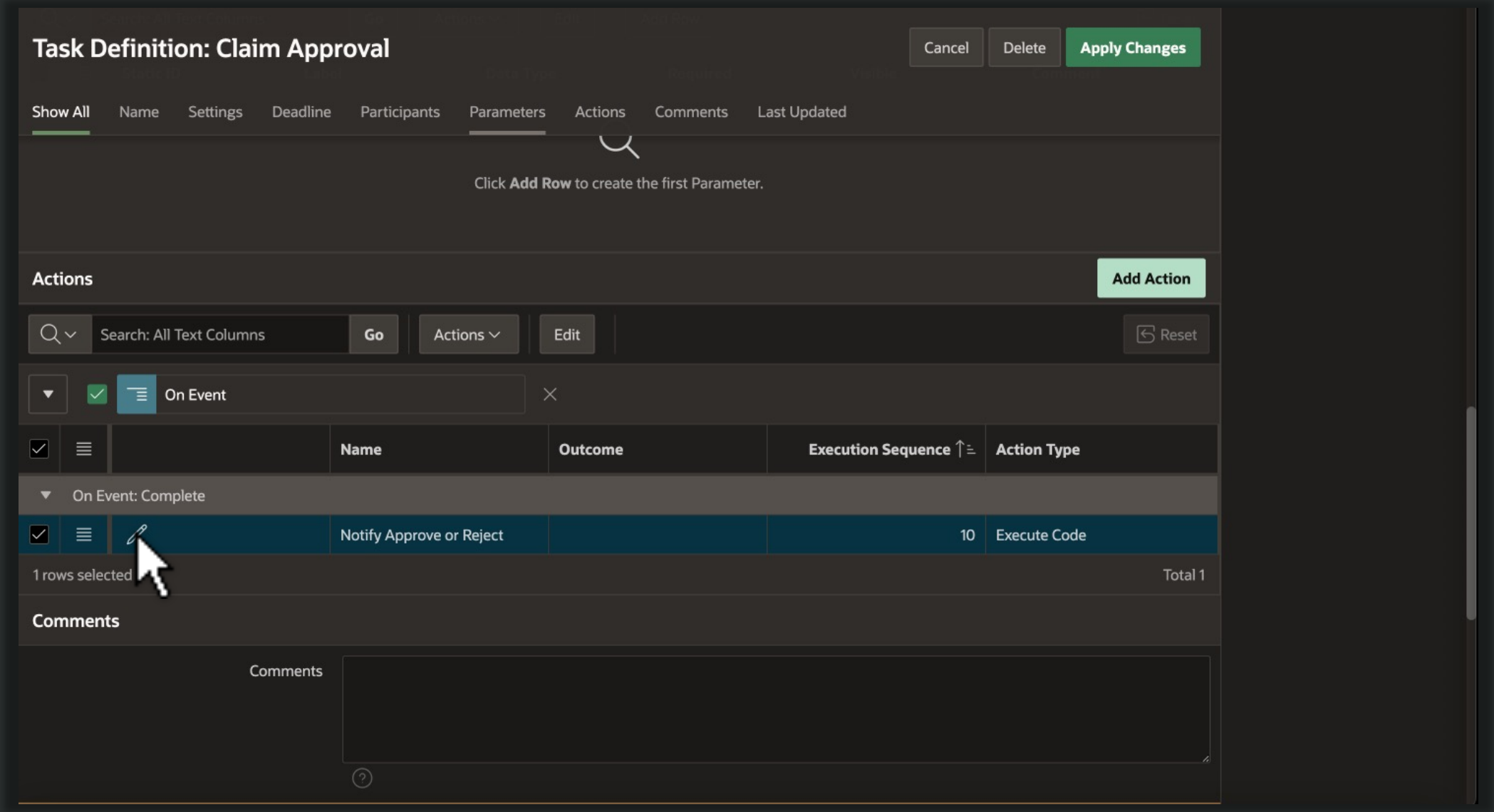

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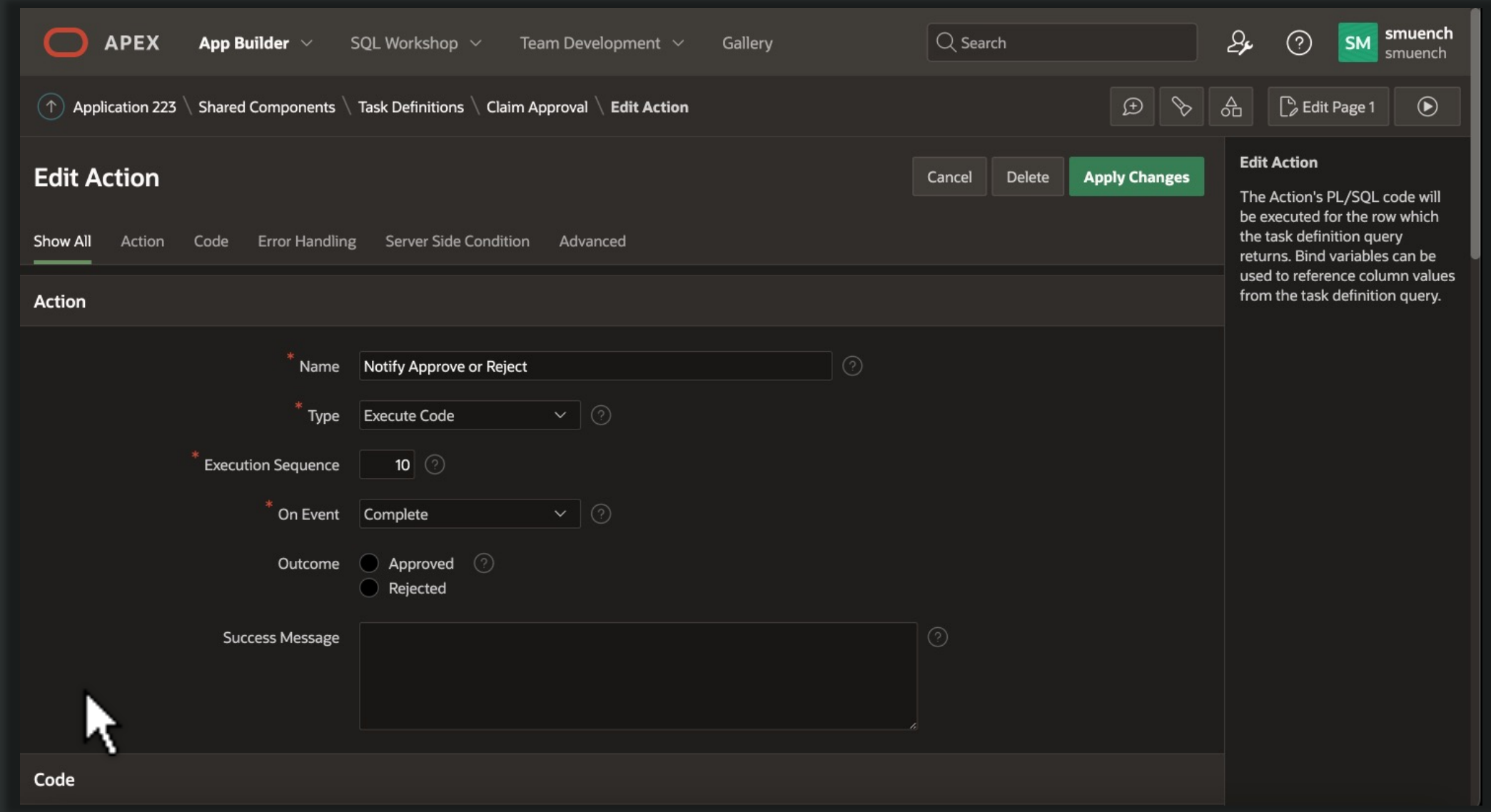

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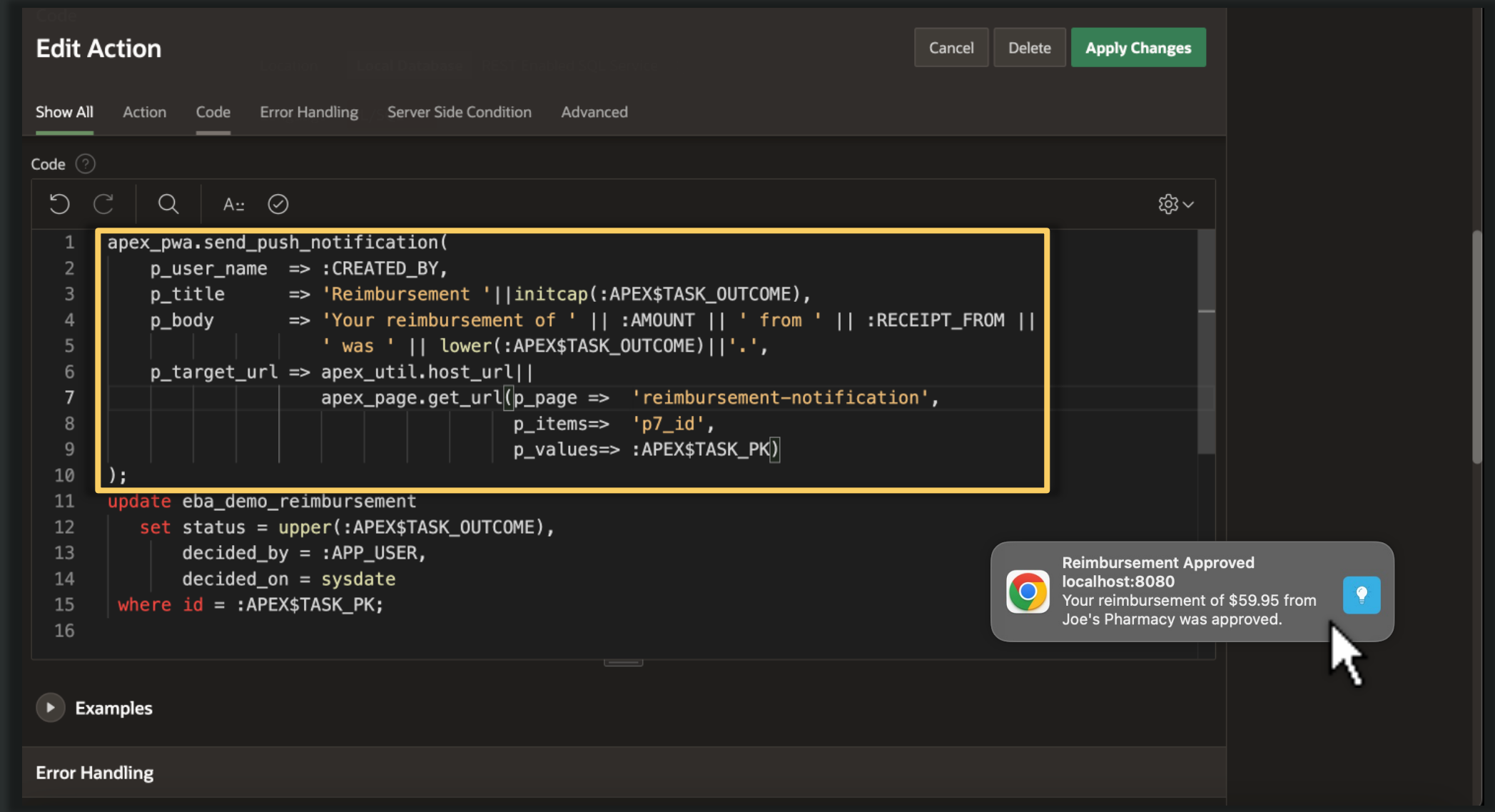

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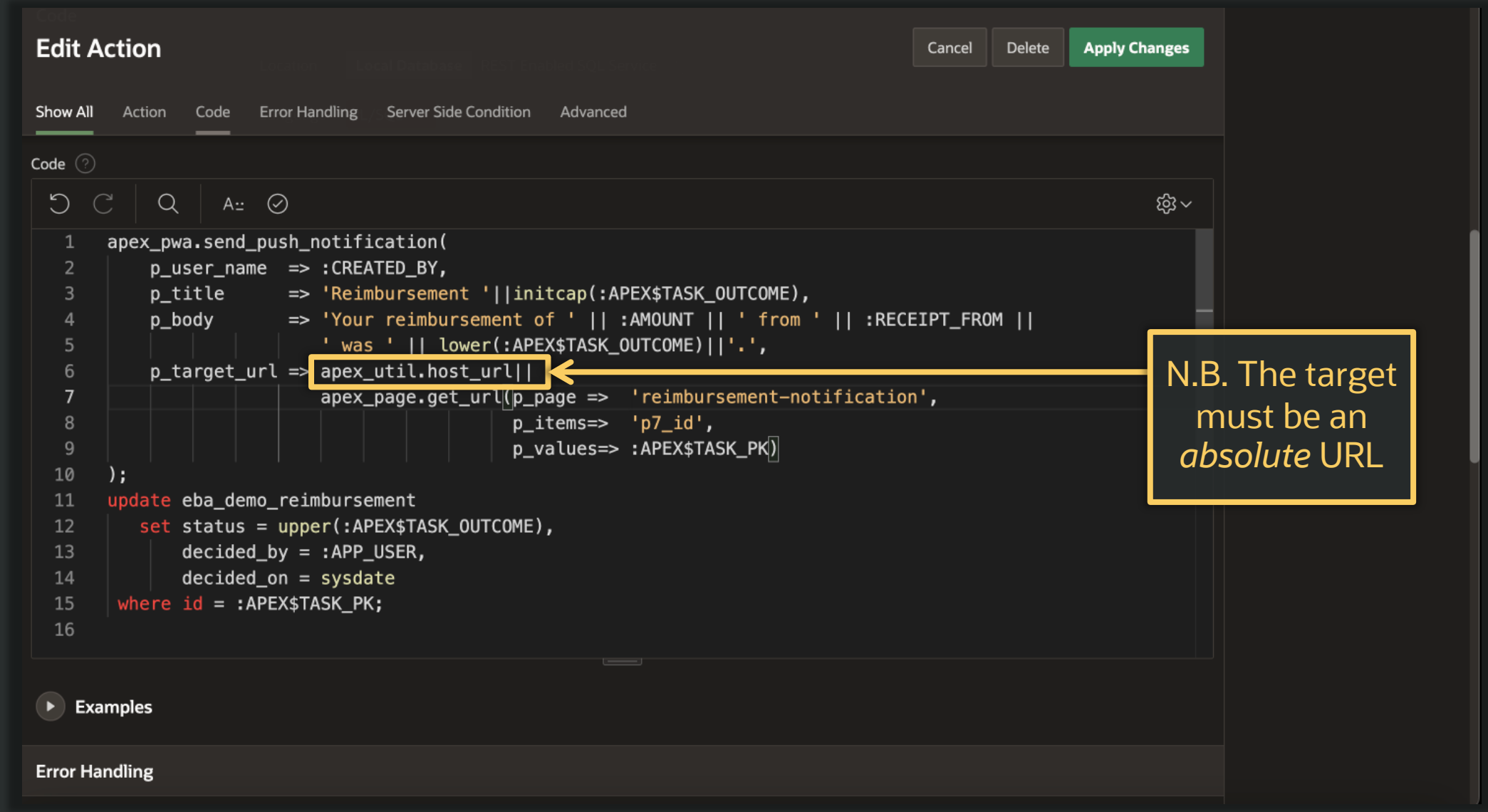

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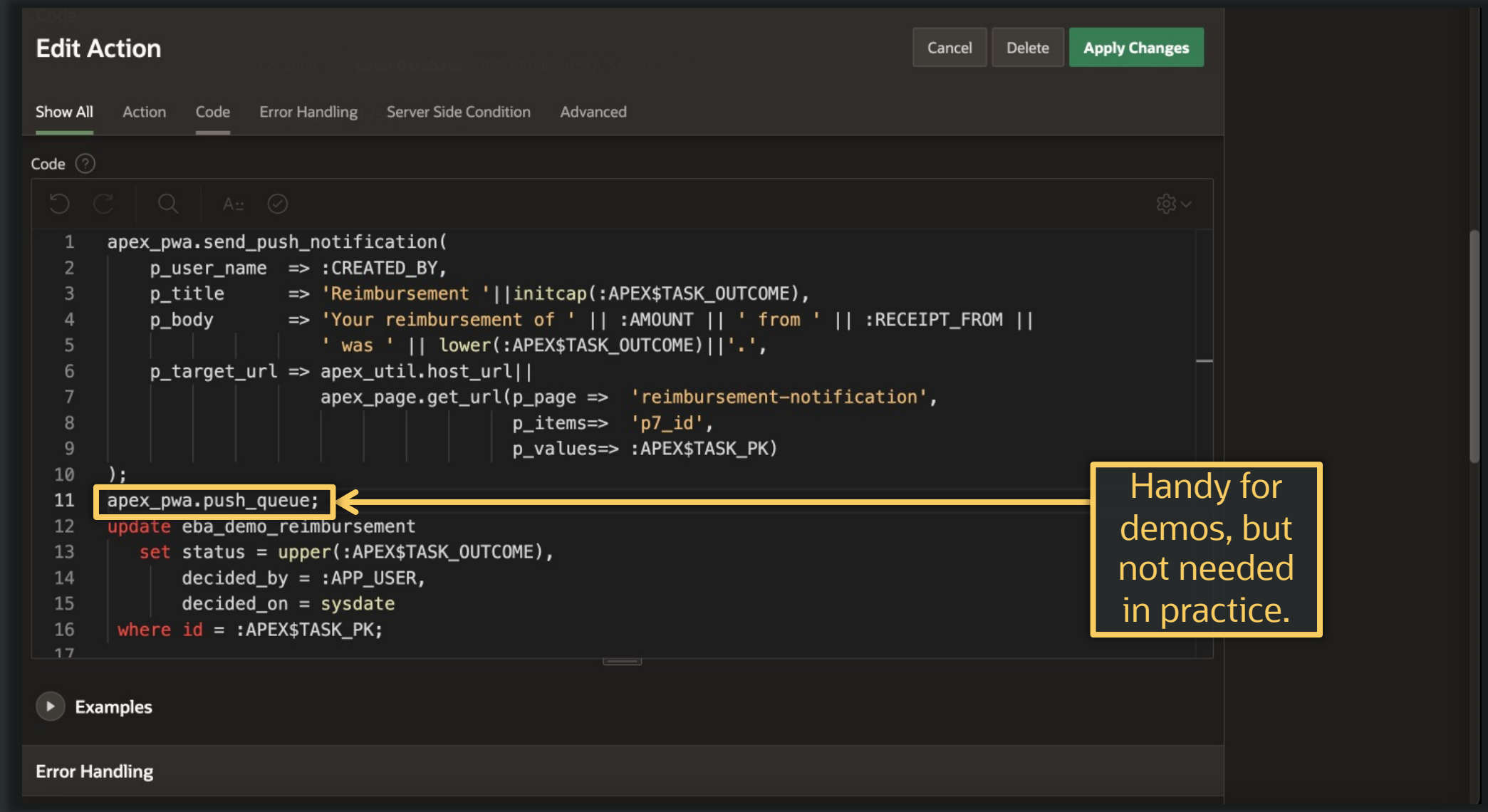
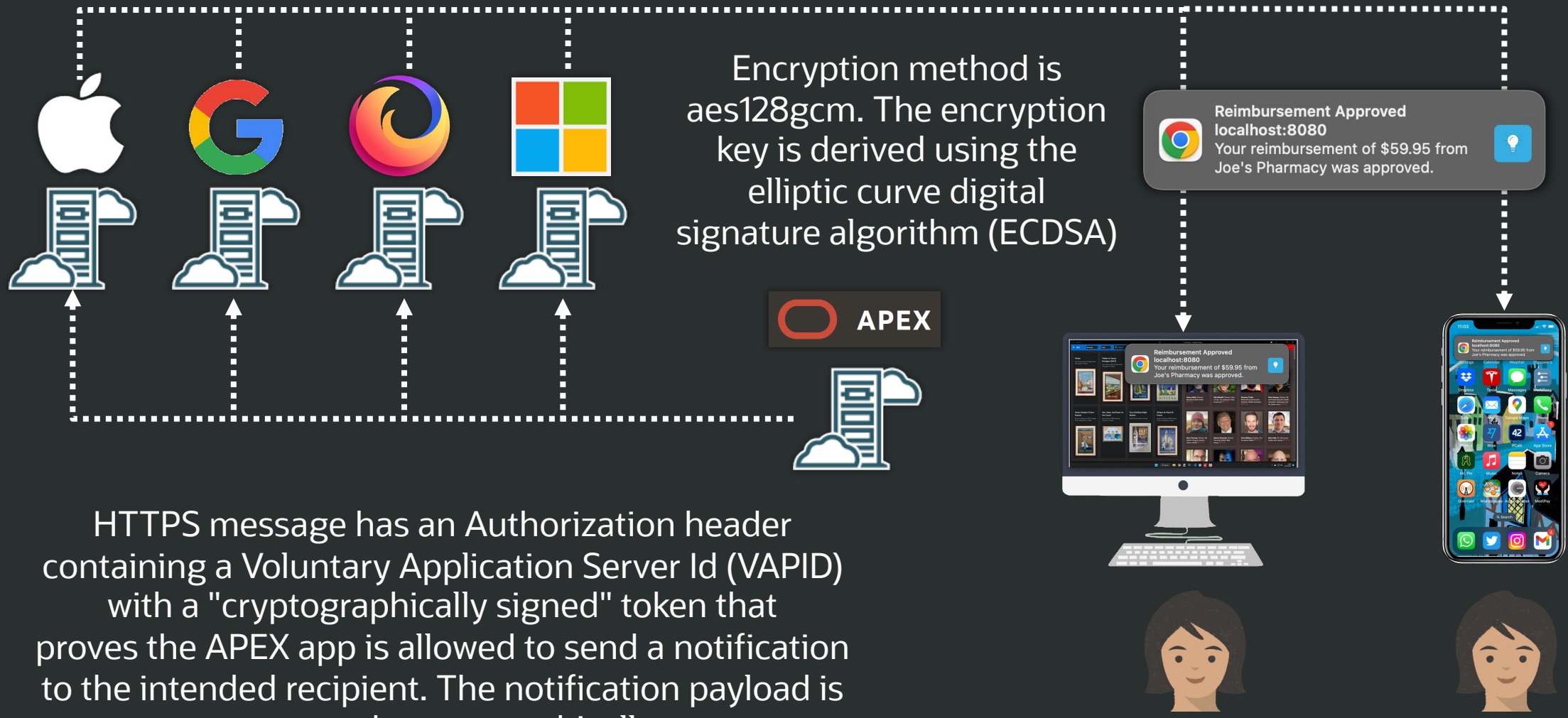
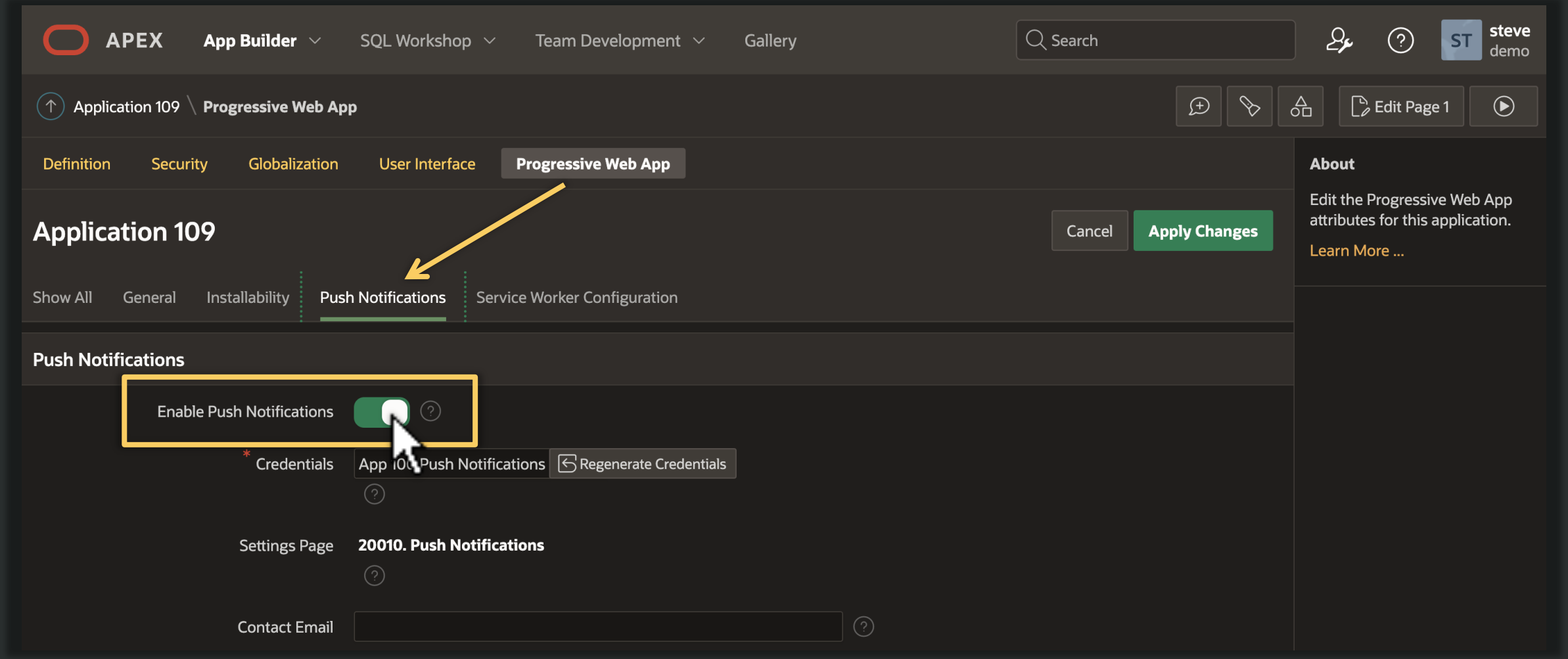


Delivery Uses Secure, Vendor-Appropriate REST Services

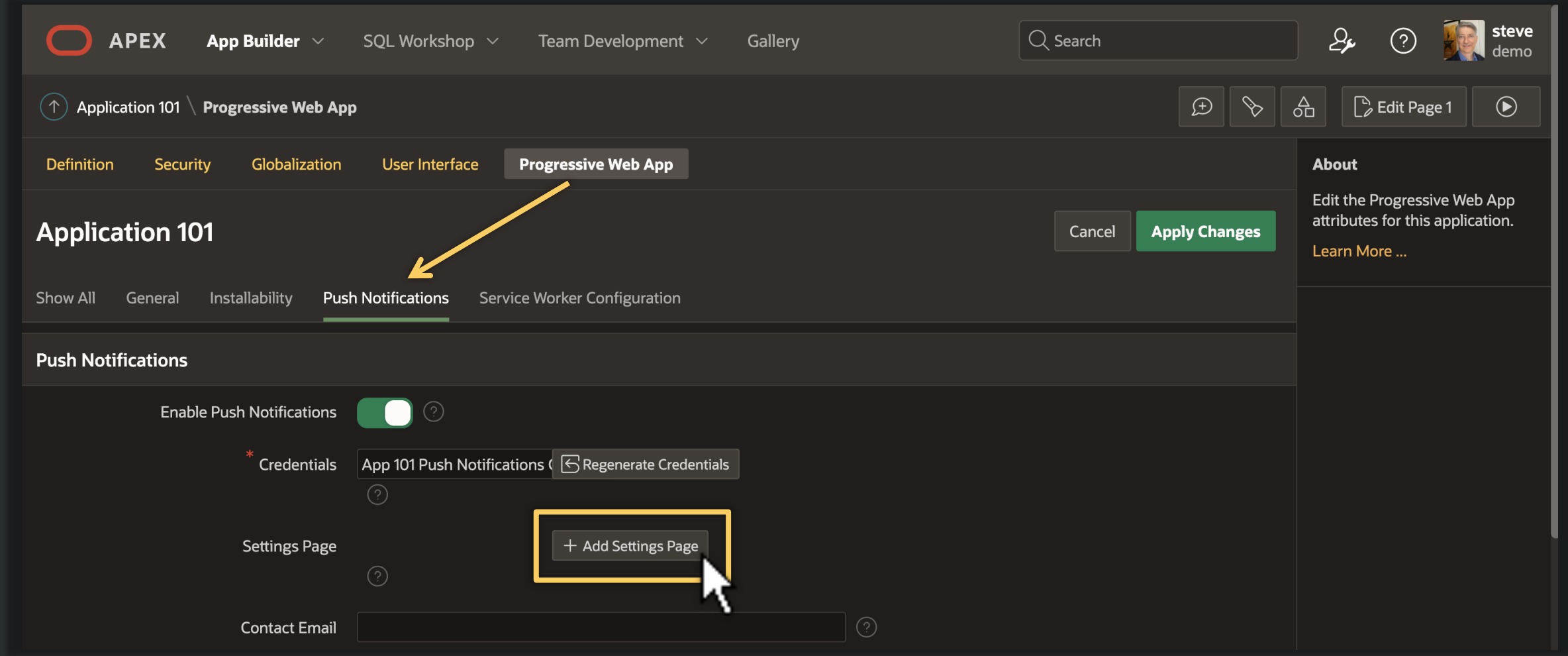


HTTPS message has an Authorization header containing a Voluntary Application Server Id (VAPID) with a "cryptographically signed" token that proves the APEX app is allowed to send a notification to the intended recipient. The notification payload is encrypted cryptographically.

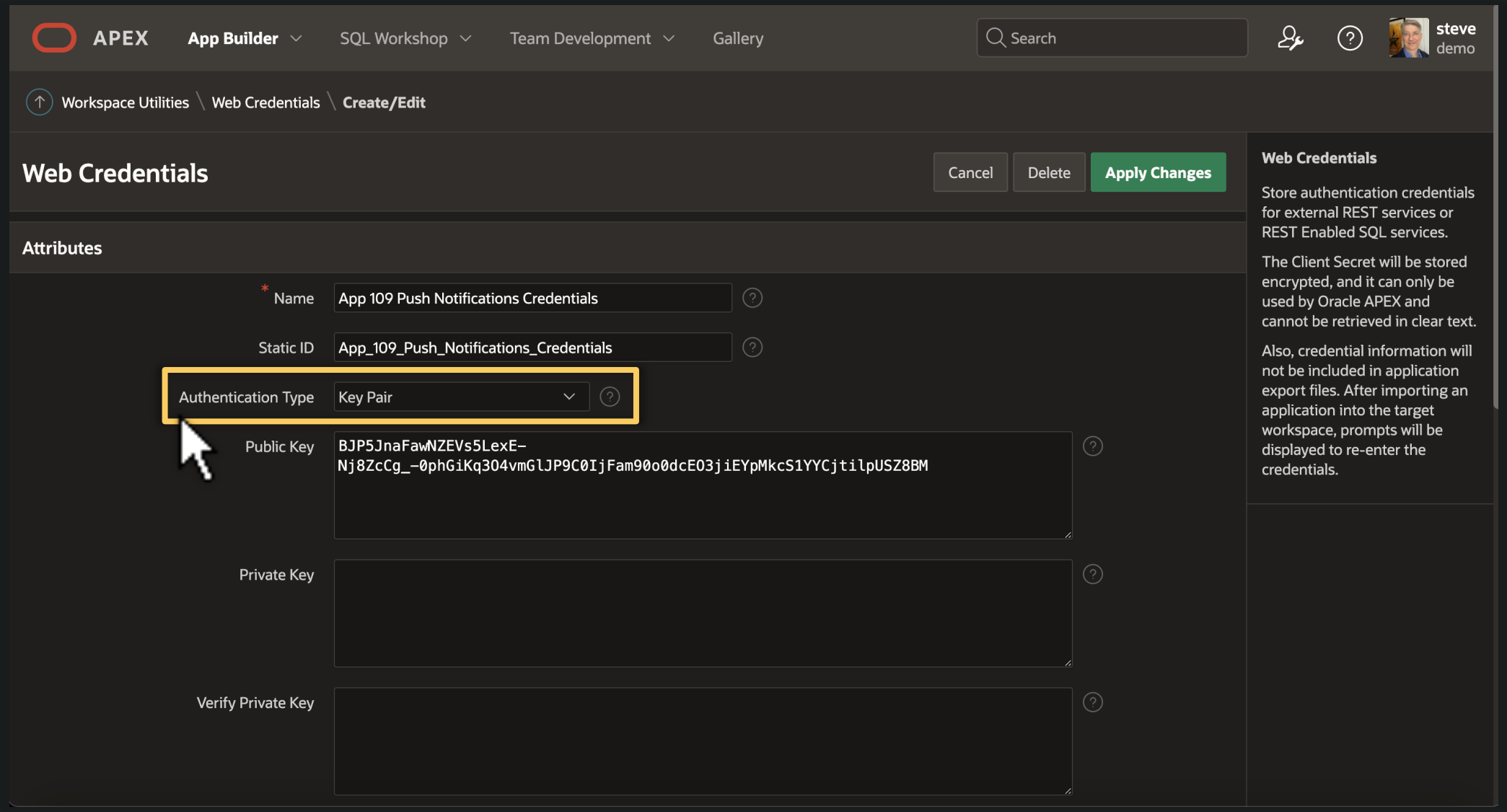
Enabling Push Notifications Support in an Existing App



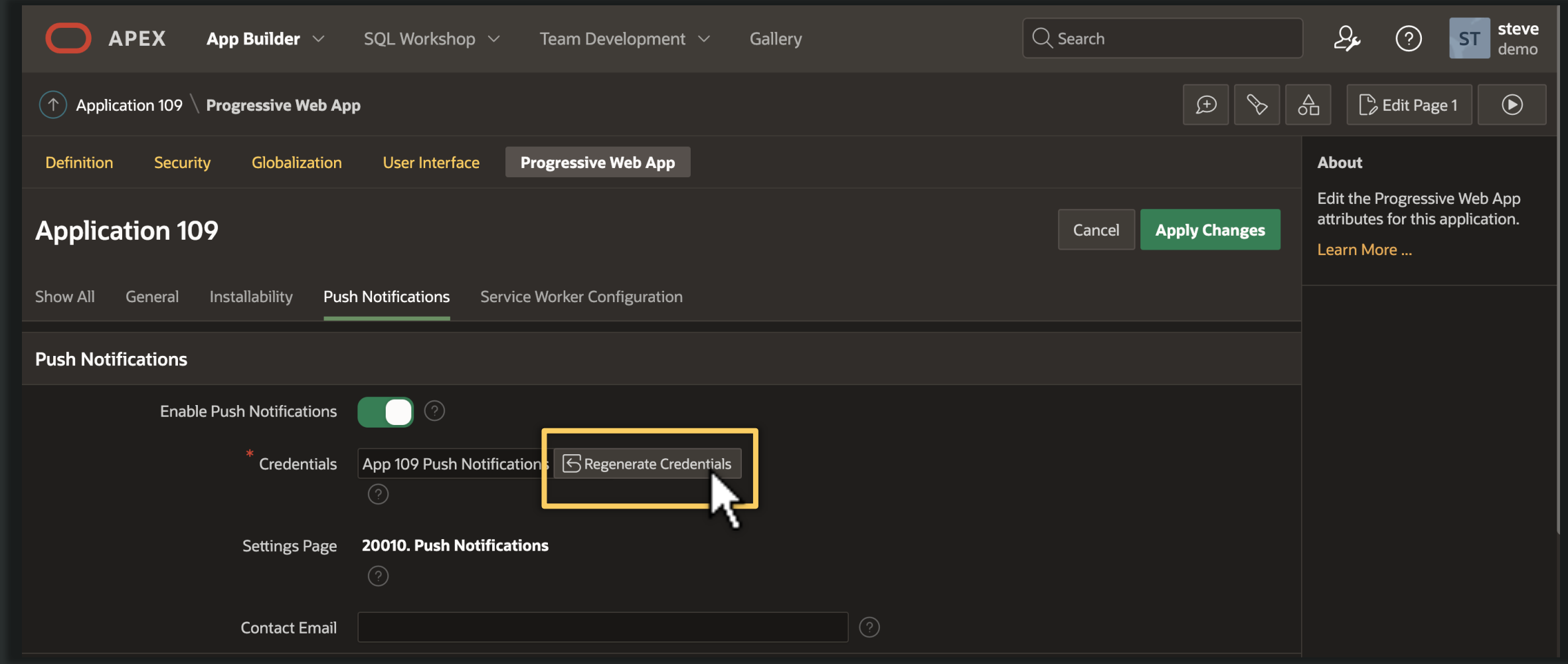
Enabling Push Notifications Settings in an Existing App



Push Notification *Key Pair* is New Kind of Credential



After Initial App Import into a Workspace, Must Regenerate Signing Keys Credentials !



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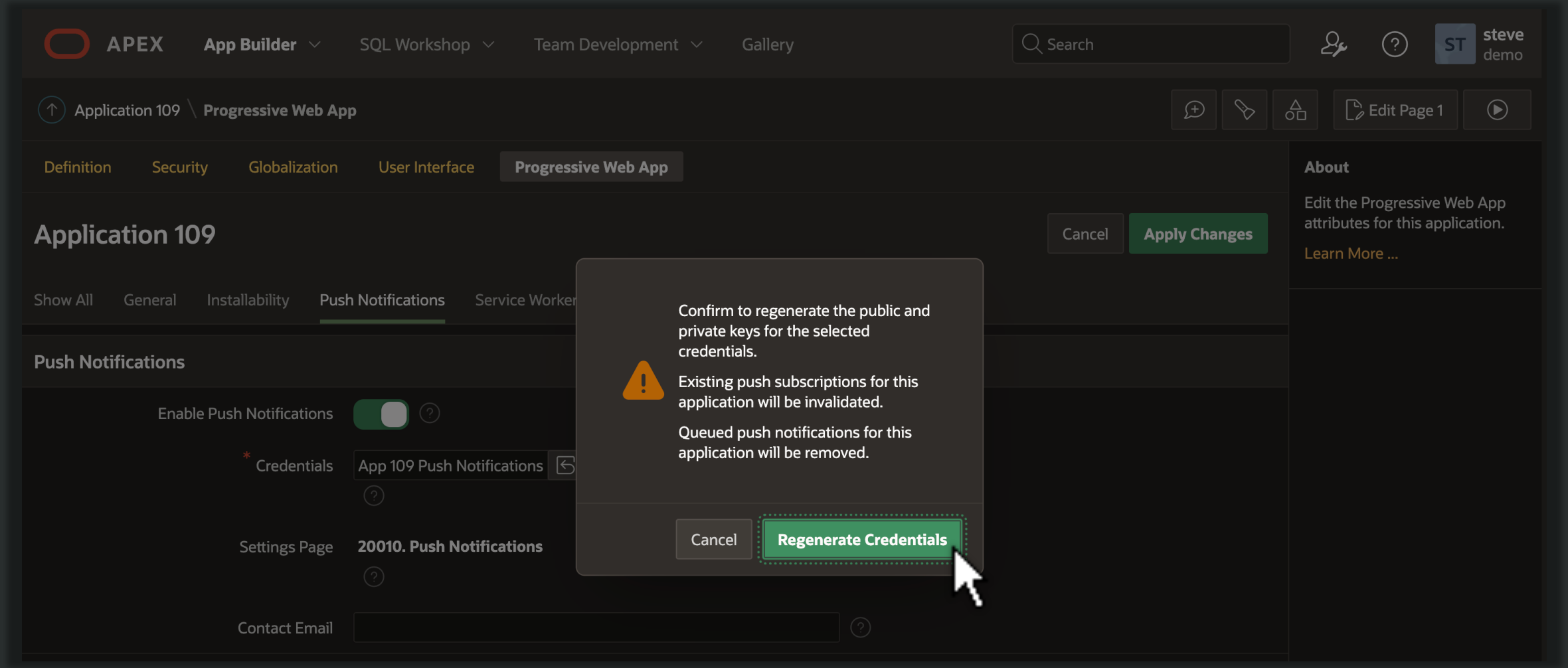
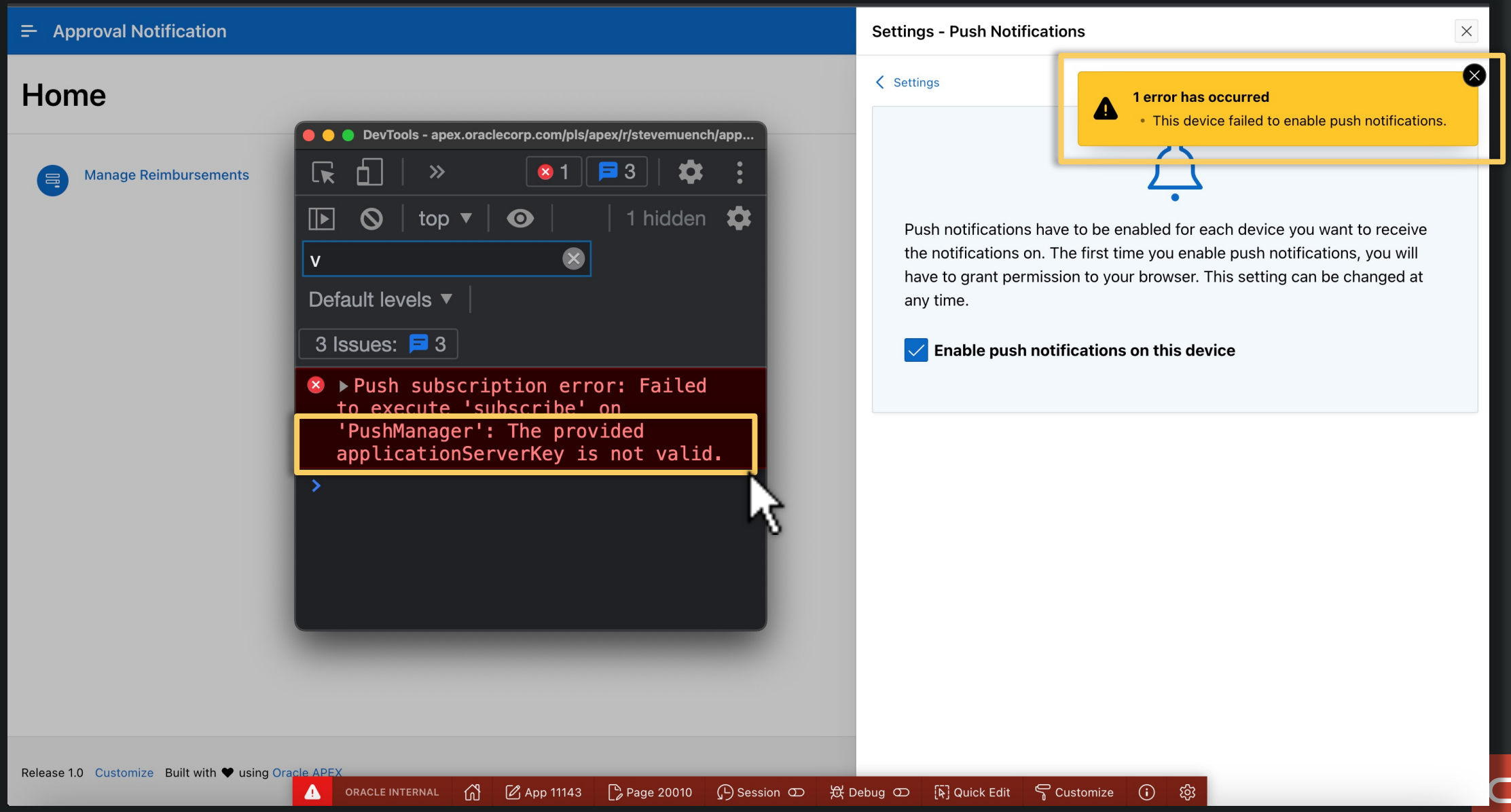
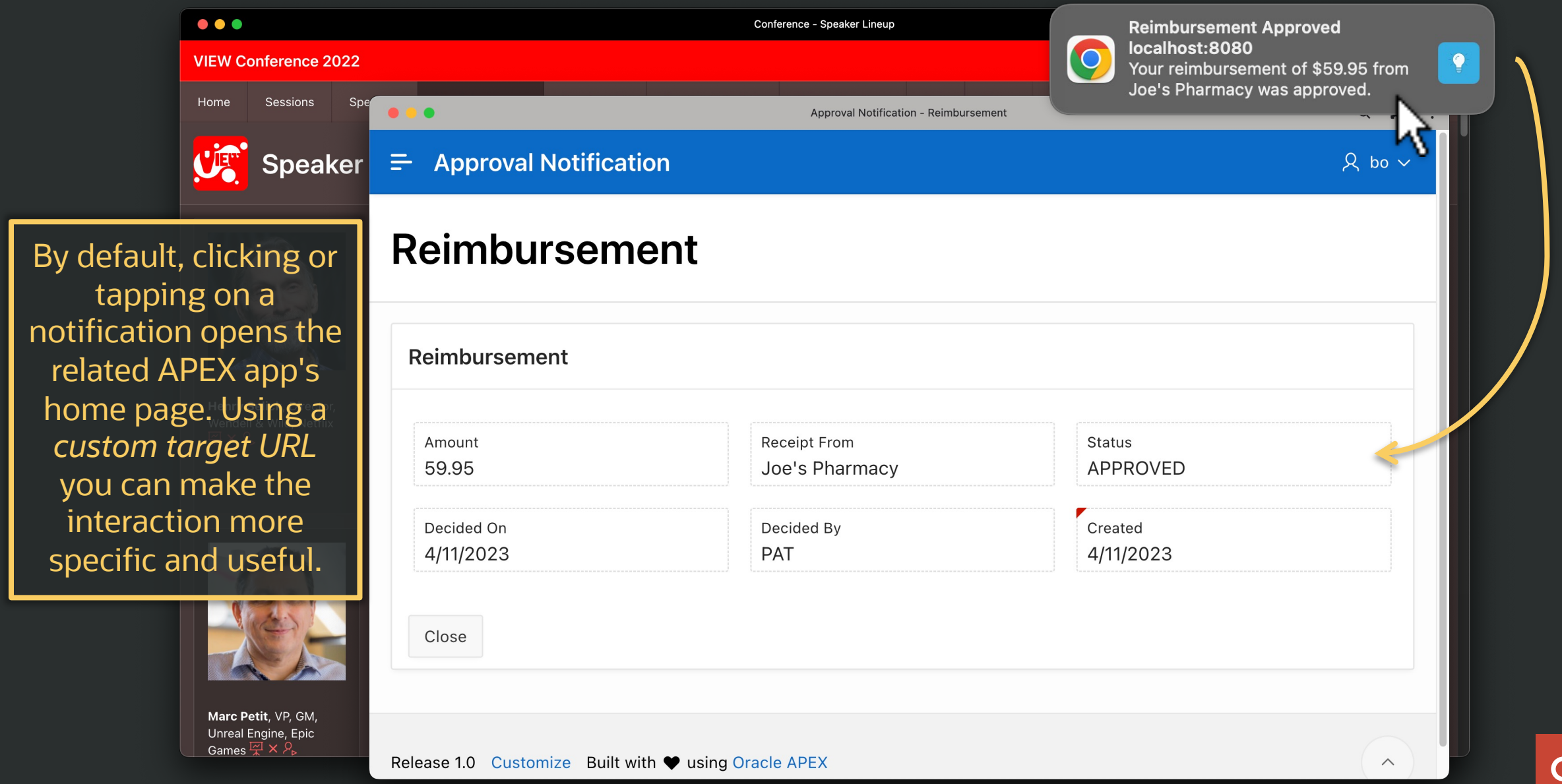


Symptom of Failing to Regenerate Signing Keys After Initial Import of an Application

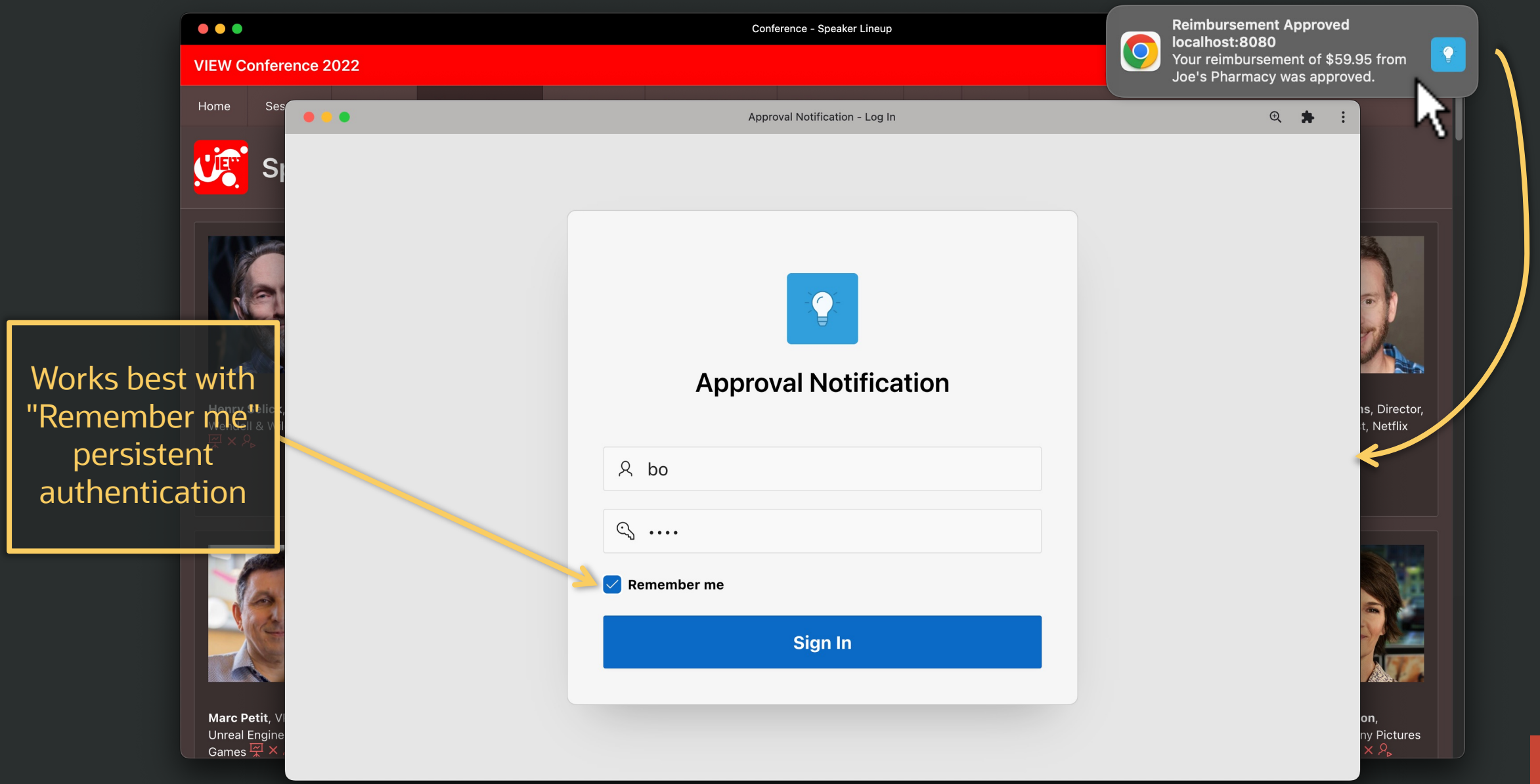


Push Notification Target URL: Open App & Detail Page

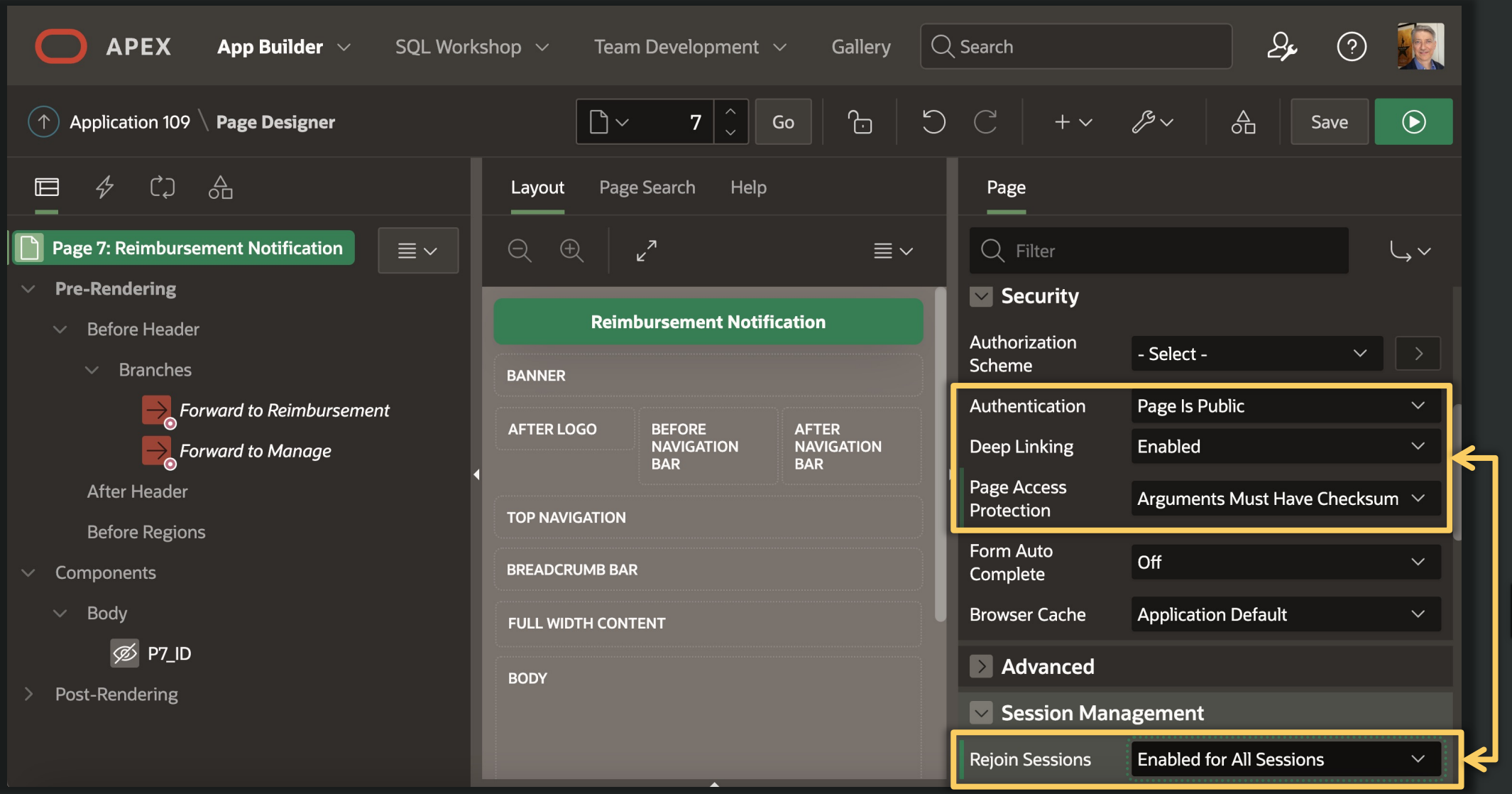


By default, clicking or tapping on a notification opens the related APEX app's home page. Using a *custom target URL* you can make the interaction more specific and useful.

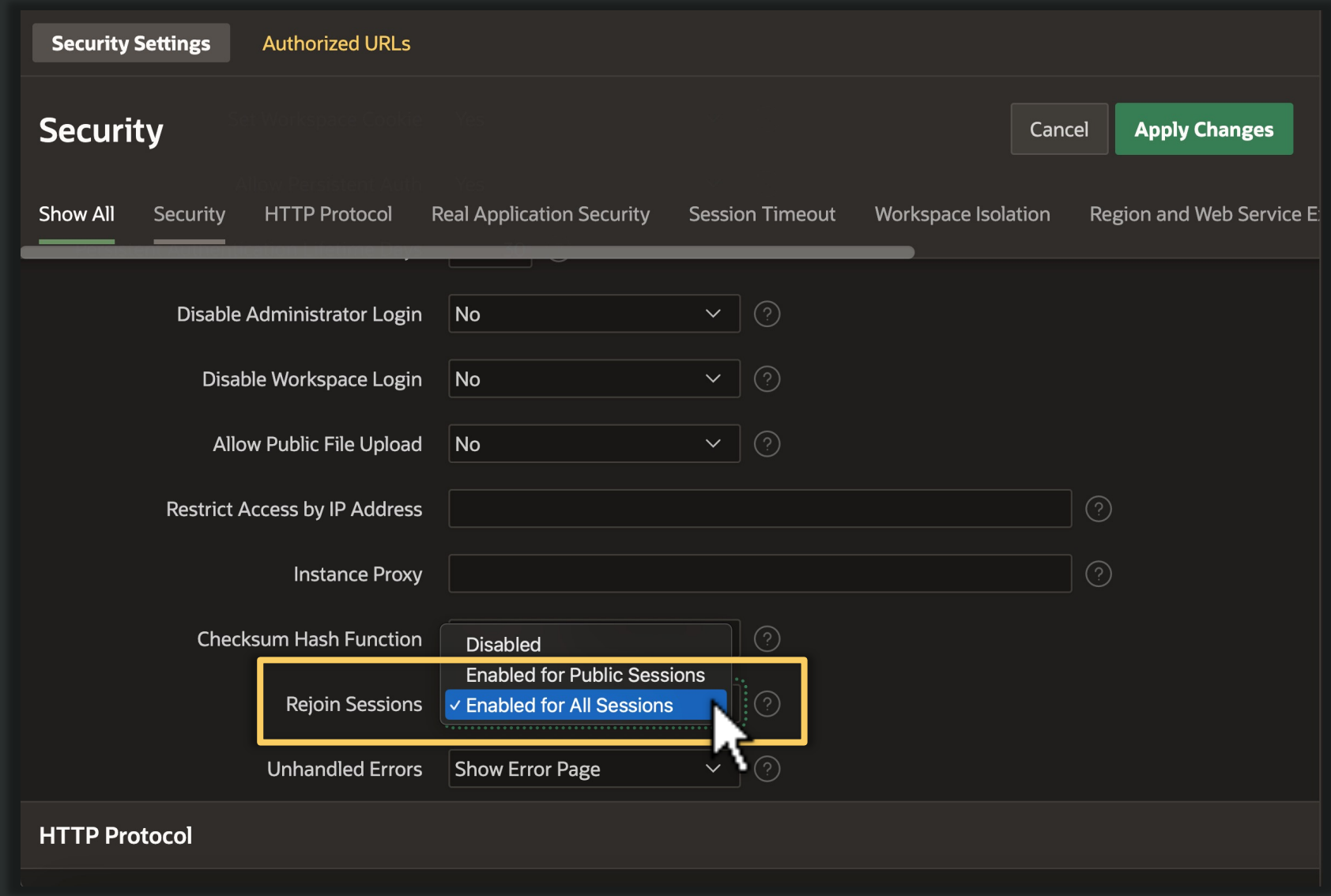
Push Notification Target URL: Open App & Detail Page



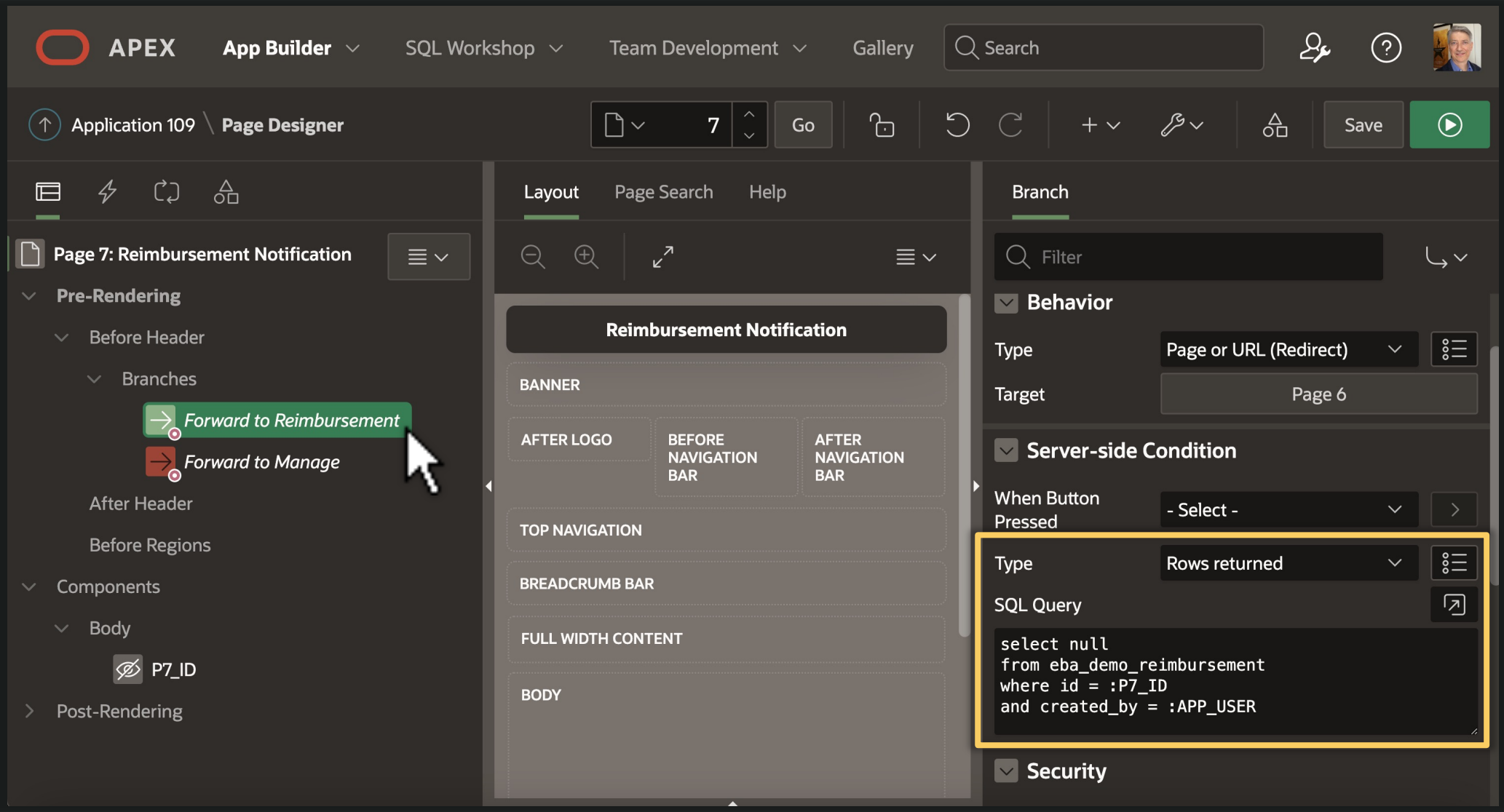
Page Security Settings for Push Notification Target to Bring Persistently Authenticated User to Details



Need to Enable Instance Level Rejoin Sessions



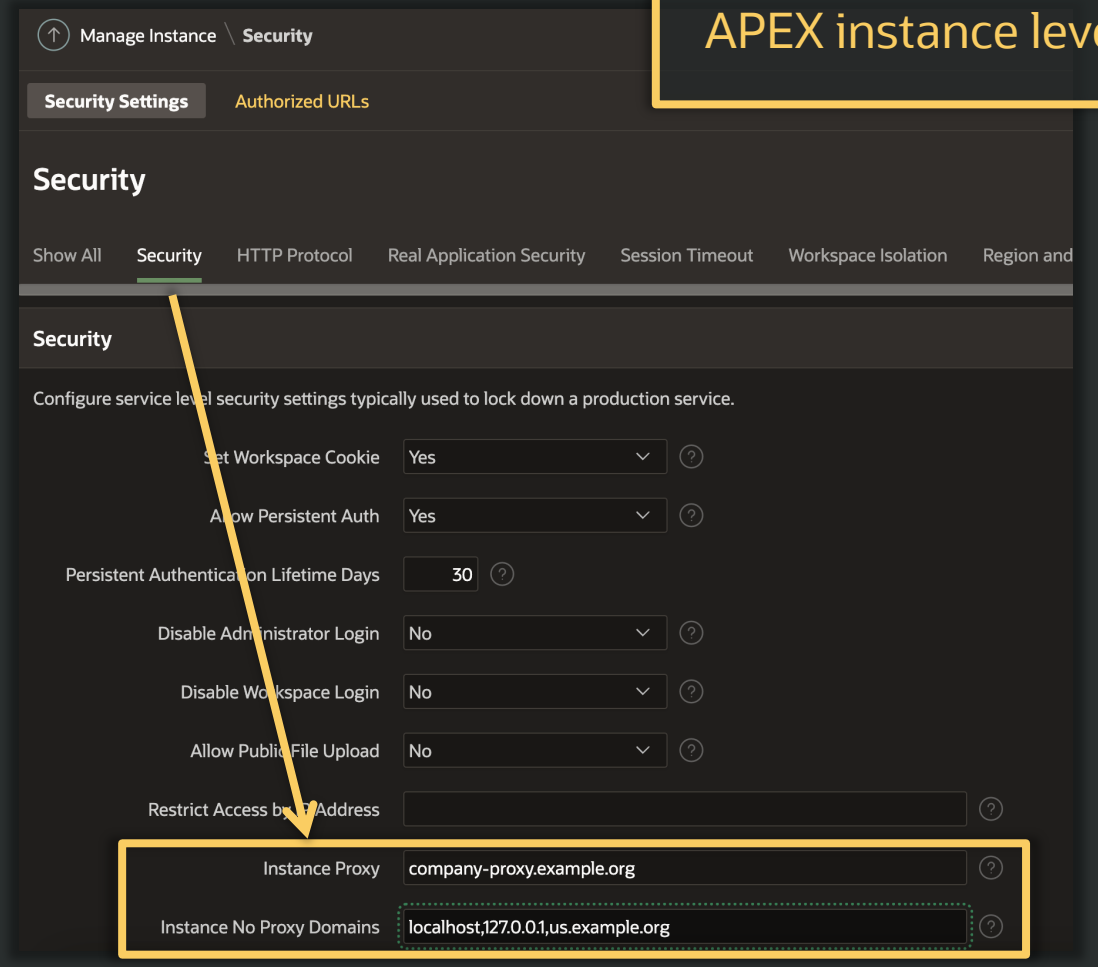
Conditional Branch to Authenticated Detail Page



If Behind a Firewall, Need to Configure Proxy Server

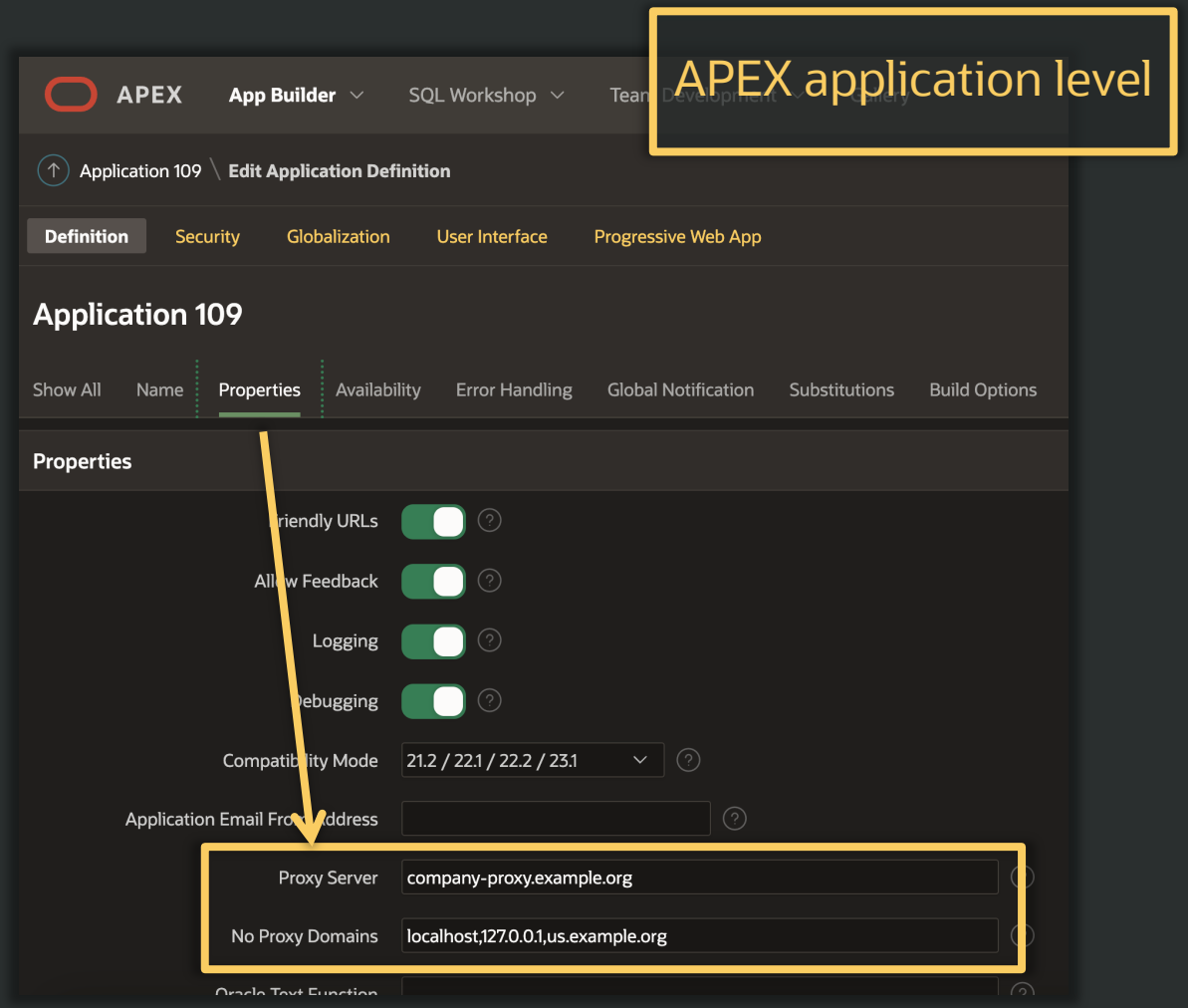
- Apple
  - `*.push.apple.com`
- Microsoft
  - `*.notify.windows.com`
- Mozilla
  - `updates.push.services.mozilla.com`
- Google
  - `android.googleapis.com`
  - `fcm.googleapis.com`

APEX instance level



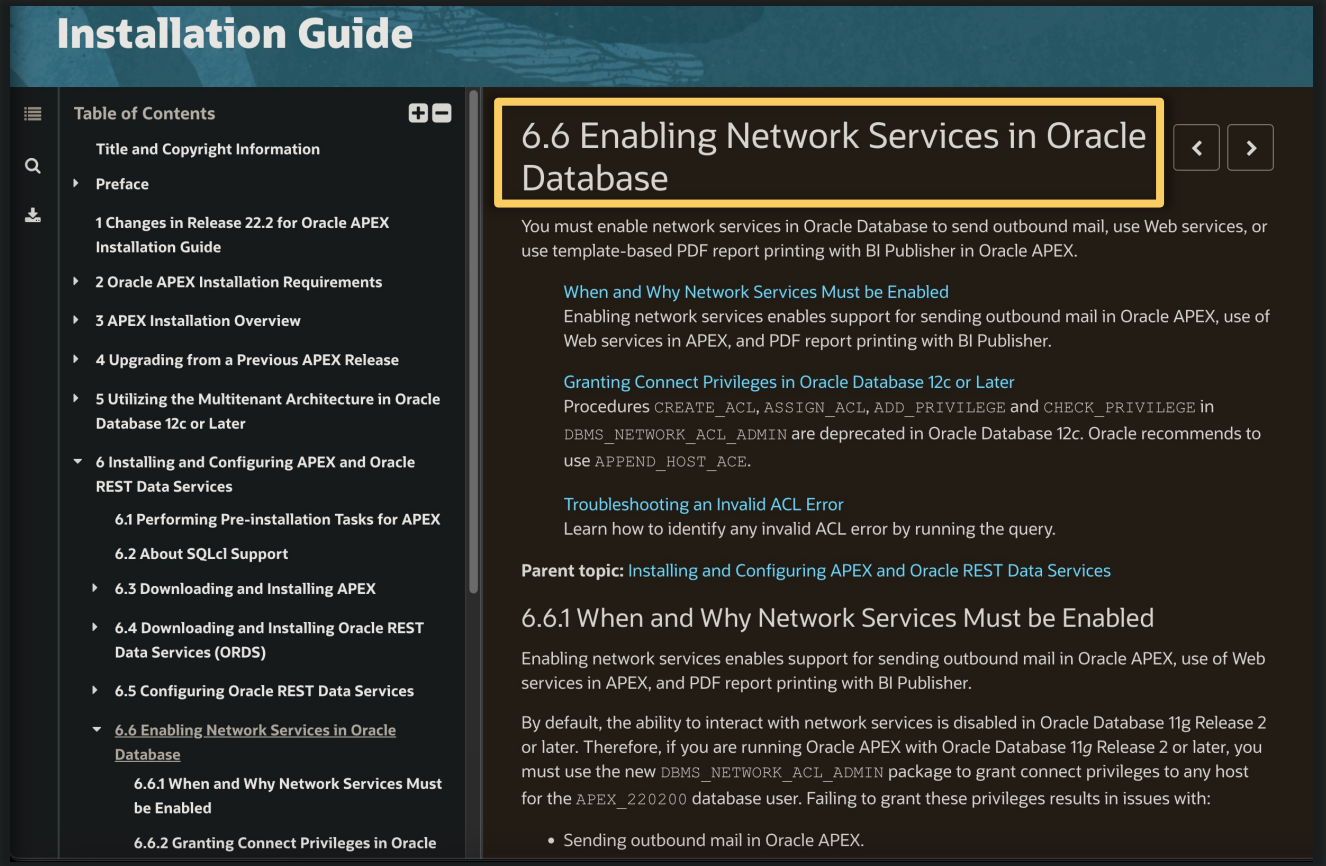
If Behind a Firewall, Need to Configure Proxy Server

- Apple
  - `*.push.apple.com`
- Microsoft
  - `*.notify.windows.com`
- Mozilla
  - `updates.push.services.mozilla.com`
- Google
  - `android.googleapis.com`
  - `fcm.googleapis.com`



APEX_230100 User Needs Outbound Endpoint ACL Grants

- Apple
  - *.push.apple.com
- Microsoft
  - *.notify.windows.com
- Mozilla
  - updates.push.services.mozilla.com
- Google
  - android.googleapis.com
  - fcm.googleapis.com



Installation Guide

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6.2 About SQLcl Support
6.3 Downloading and Installing APEX
6.4 Downloading and Installing Oracle REST Data Services (ORDS)
6.5 Configuring Oracle REST Data Services
6.6 Enabling Network Services in Oracle Database
6.6.1 When and Why Network Services Must be Enabled
6.6.2 Granting Connect Privileges in Oracle

6.6 Enabling Network Services in Oracle Database

You must enable network services in Oracle Database to send outbound mail, use Web services, or use template-based PDF report printing with BI Publisher in Oracle APEX.

When and Why Network Services Must be Enabled
Enabling network services enables support for sending outbound mail in Oracle APEX, use of Web services in APEX, and PDF report printing with BI Publisher.

Granting Connect Privileges in Oracle Database 12c or Later
Procedures CREATE_ACL, ASSIGN_ACL, ADD_PRIVILEGE and CHECK_PRIVILEGE in DBMS_NETWORK_ACL_ADMIN are deprecated in Oracle Database 12c. Oracle recommends to use APPEND_HOST_ACE.

Troubleshooting an Invalid ACL Error
Learn how to identify any invalid ACL error by running the query.

Parent topic: Installing and Configuring APEX and Oracle REST Data Services

6.6.1 When and Why Network Services Must be Enabled

Enabling network services enables support for sending outbound mail in Oracle APEX, use of Web services in APEX, and PDF report printing with BI Publisher.

By default, the ability to interact with network services is disabled in Oracle Database 11g Release 2 or later. Therefore, if you are running Oracle APEX with Oracle Database 11*g* Release 2 or later, you must use the new DBMS_NETWORK_ACL_ADMIN package to grant connect privileges to any host for the APEX_220200 database user. Failing to grant these privileges results in issues with:

- Sending outbound mail in Oracle APEX.

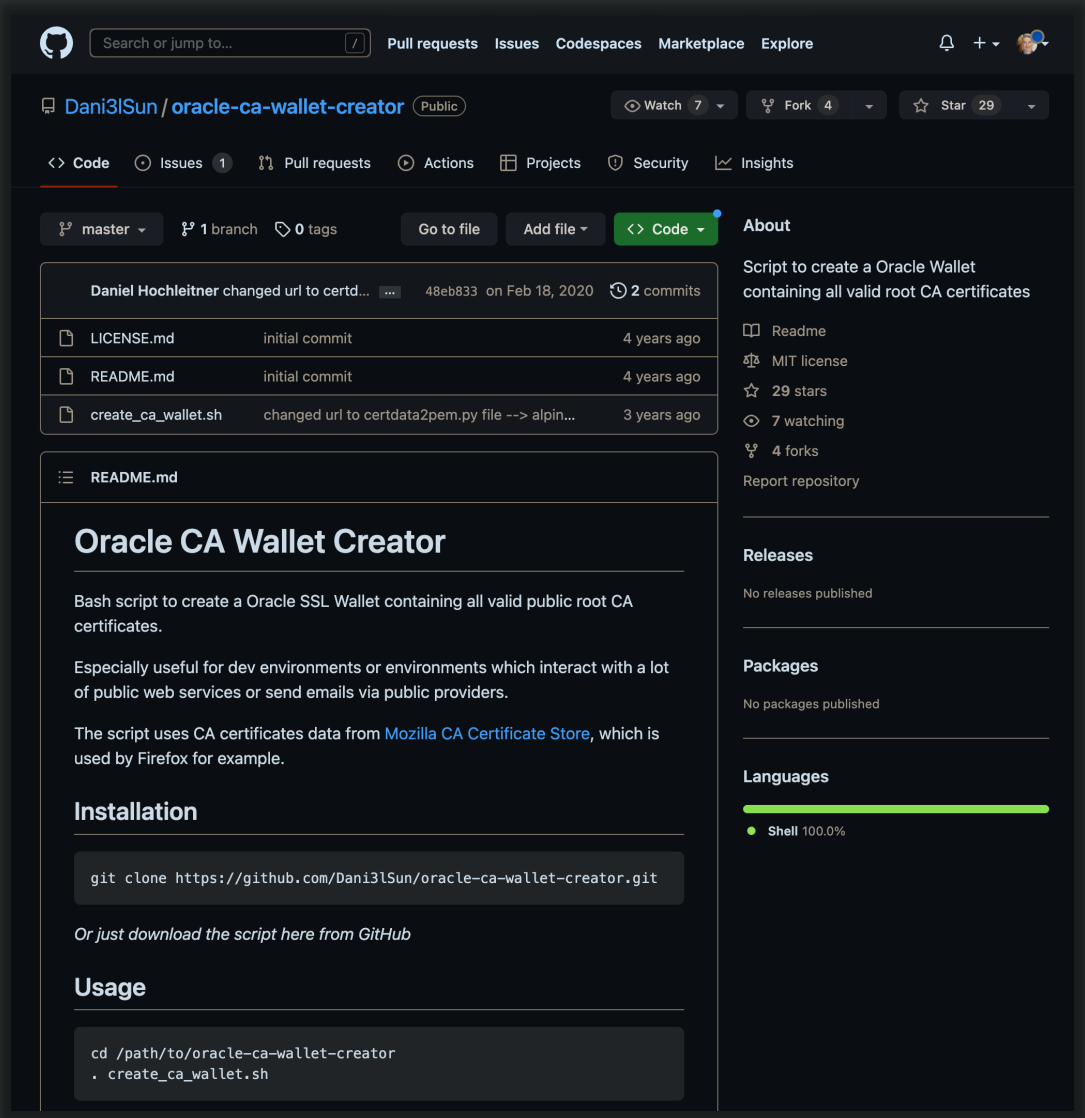
APEX_230100 User Needs Outbound Endpoint ACL Grants

- Apple
  - *.push.apple.com
- Microsoft
  - *.notify.windows.com
- Mozilla
  - updates.push.services.mozilla.com
- Google
  - android.googleapis.com
  - fcm.googleapis.com

```
declare
    l_principal varchar2(20) := 'APEX_230100';
    l_hosts apex_t_varchar2  := apex_t_varchar2(
                                    '*.push.apple.com',
                                    '*.notify.windows.com',
                                    'updates.push.services.mozilla.com',
                                    'android.googleapis.com',
                                    'fcm.googleapis.com');
begin
    for j in (select column_value as hostname from table(l_hosts)) loop
        dbms_network_acl_admin.append_host_ace (
            host       => j.hostname,
            lower_port => 443,
            upper_port => 443,
            ace        =>
                xs$ace_type(privilege_list => xs$name_list('connect'),
                            principal_name => l_principal,
                            principal_type => xs_acl.ptype_db));
        dbms_network_acl_admin.append_host_ace (
            host       => j.hostname,
            ace        =>
                xs$ace_type(privilege_list => xs$name_list('resolve'),
                            principal_name => l_principal,
                            principal_type => xs_acl.ptype_db));
        dbms_network_acl_admin.append_host_ace (
            host       => j.hostname,
            lower_port => 443,
            upper_port => 443,
            ace        =>
                xs$ace_type(privilege_list => xs$name_list('http'),
                            principal_name => l_principal,
                            principal_type => xs_acl.ptype_db));
    end loop;
end;
```

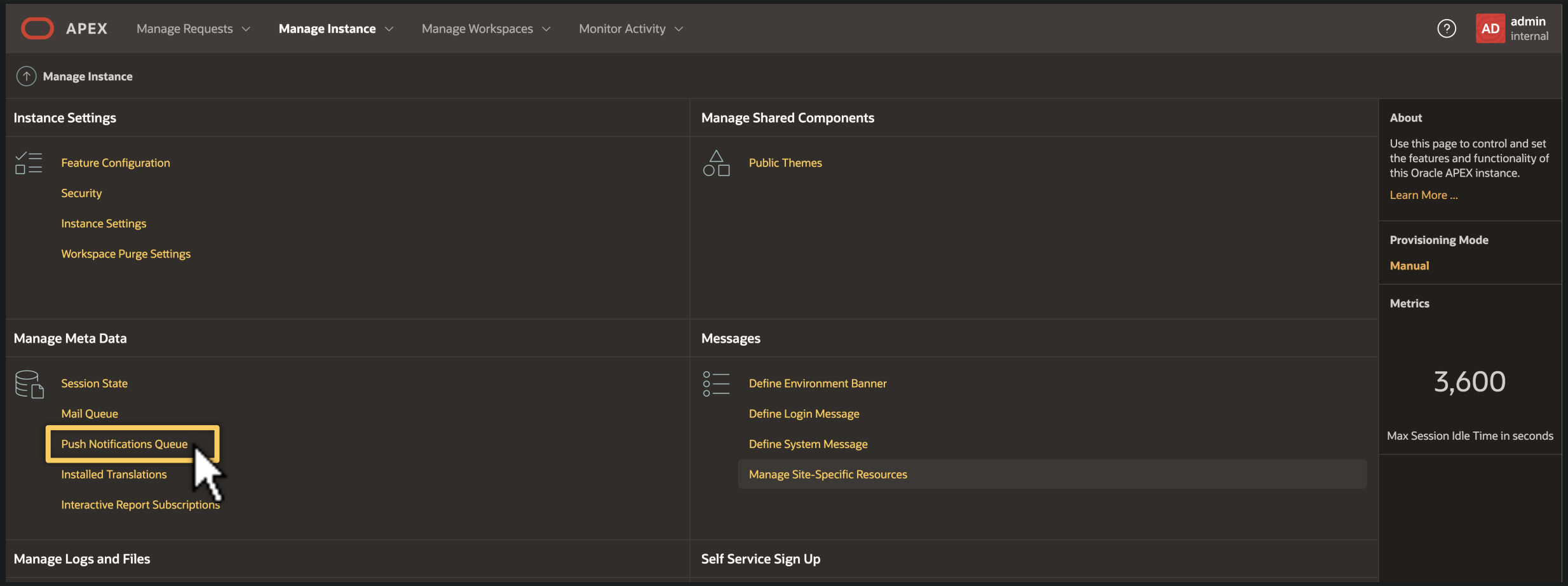
Configuring APEX Wallet Path with Root Certificates

Wallet is preconfigured for APEX Service or APEX on Autonomous DB

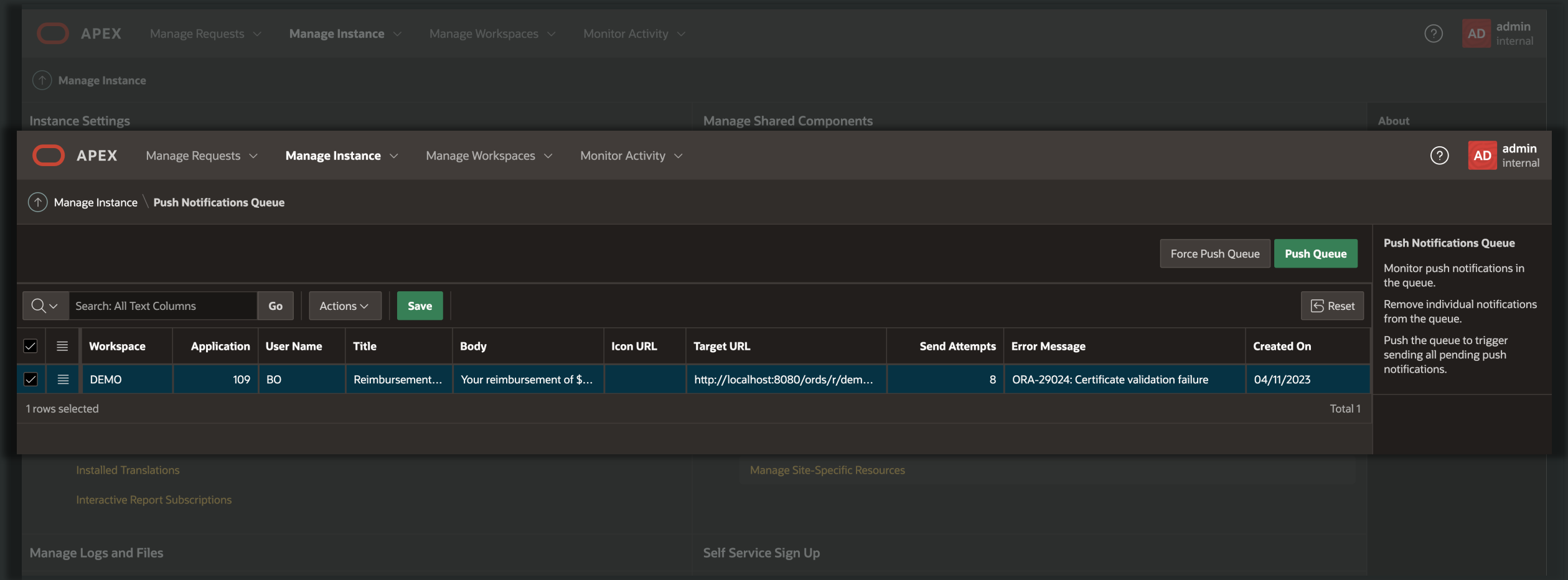


https://github.com/Dani3lSun/oracle-ca-wallet-creator

Push Notifications Queue

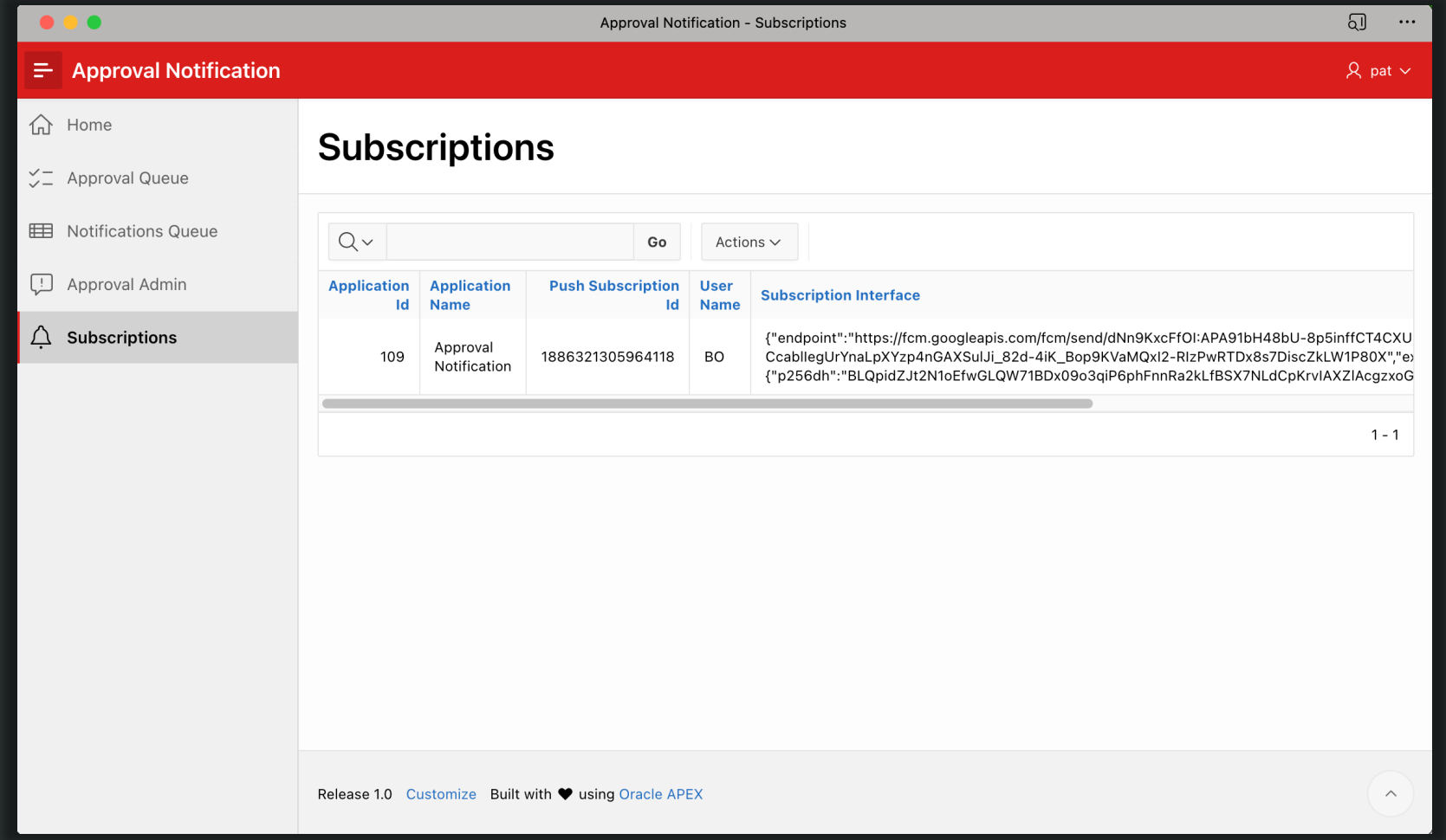


Push Notifications Queue



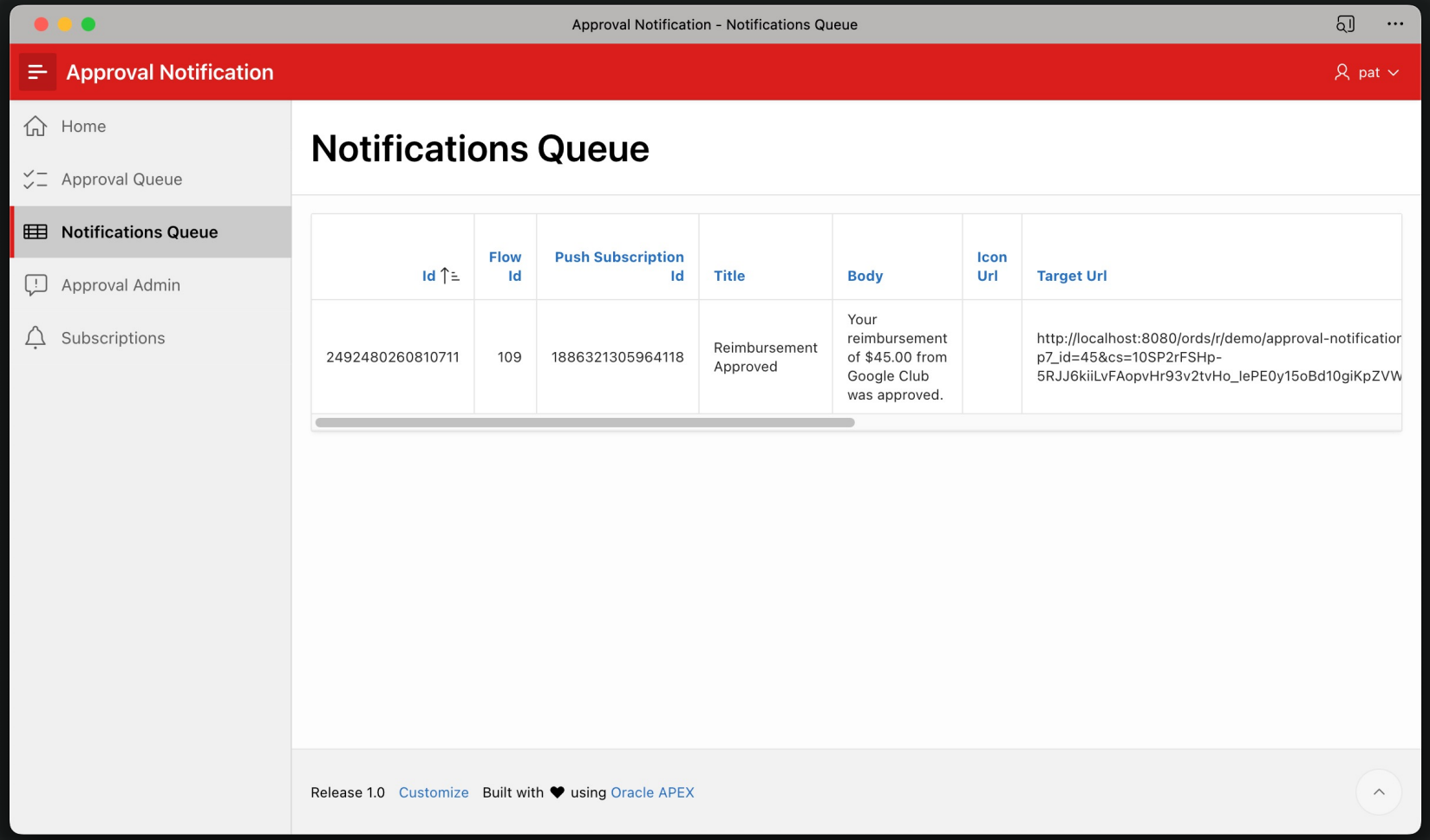
Push Notification Subscriptions View

APEX_APPL_PUSH_SUBSCRIPTIONS

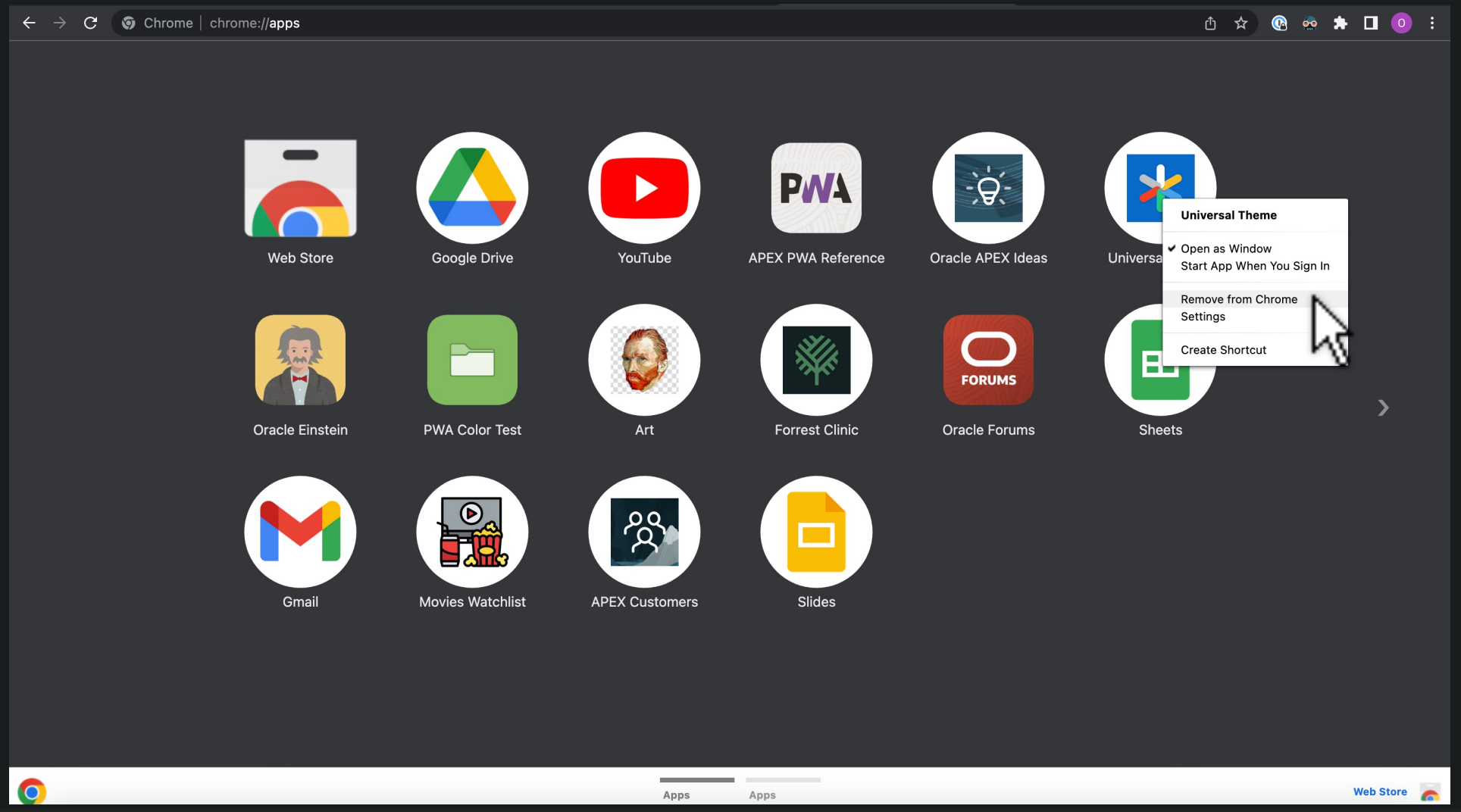


Push Notifications to Deliver View

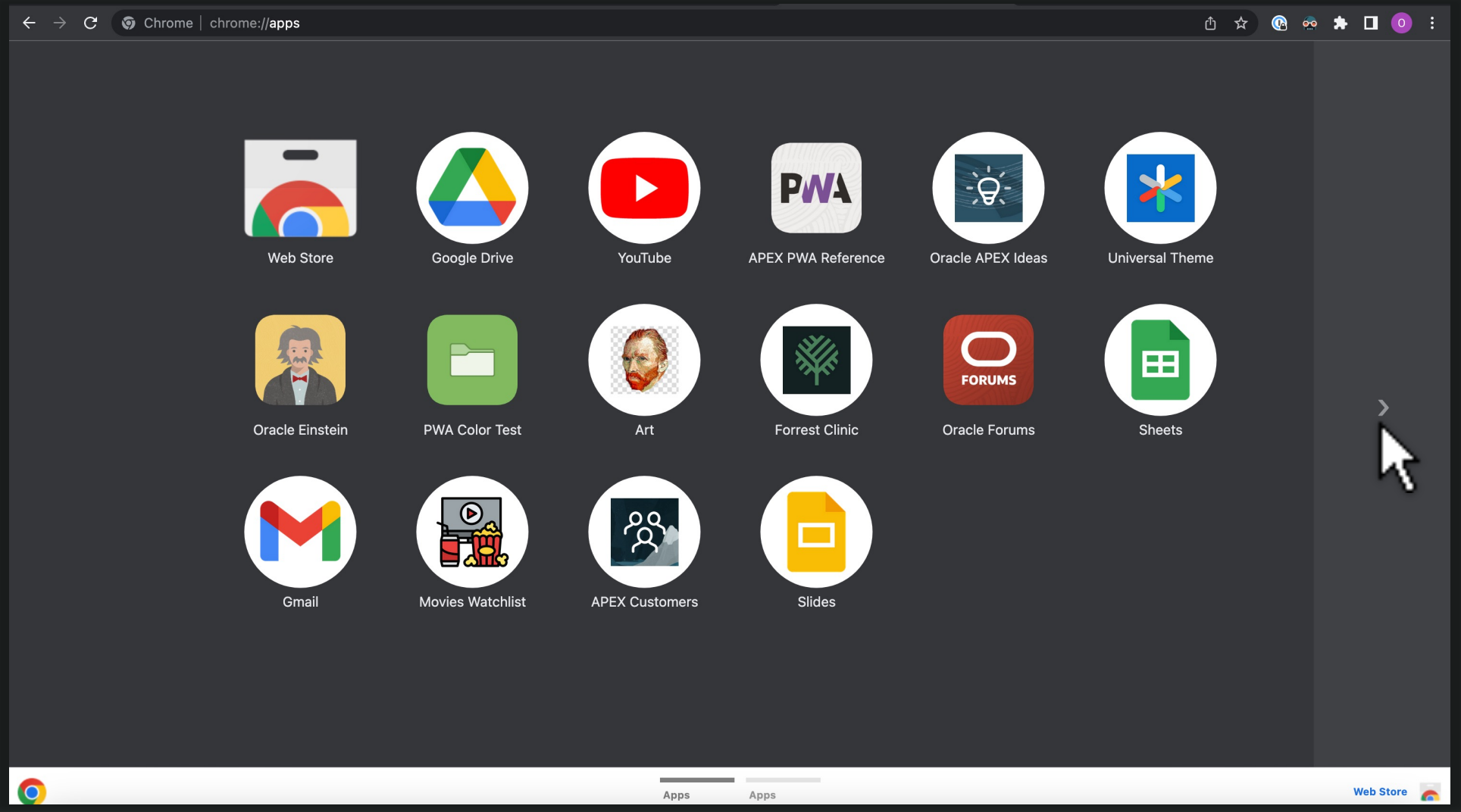
APEX_PUSH_NOTIFICATIONS_QUEUE



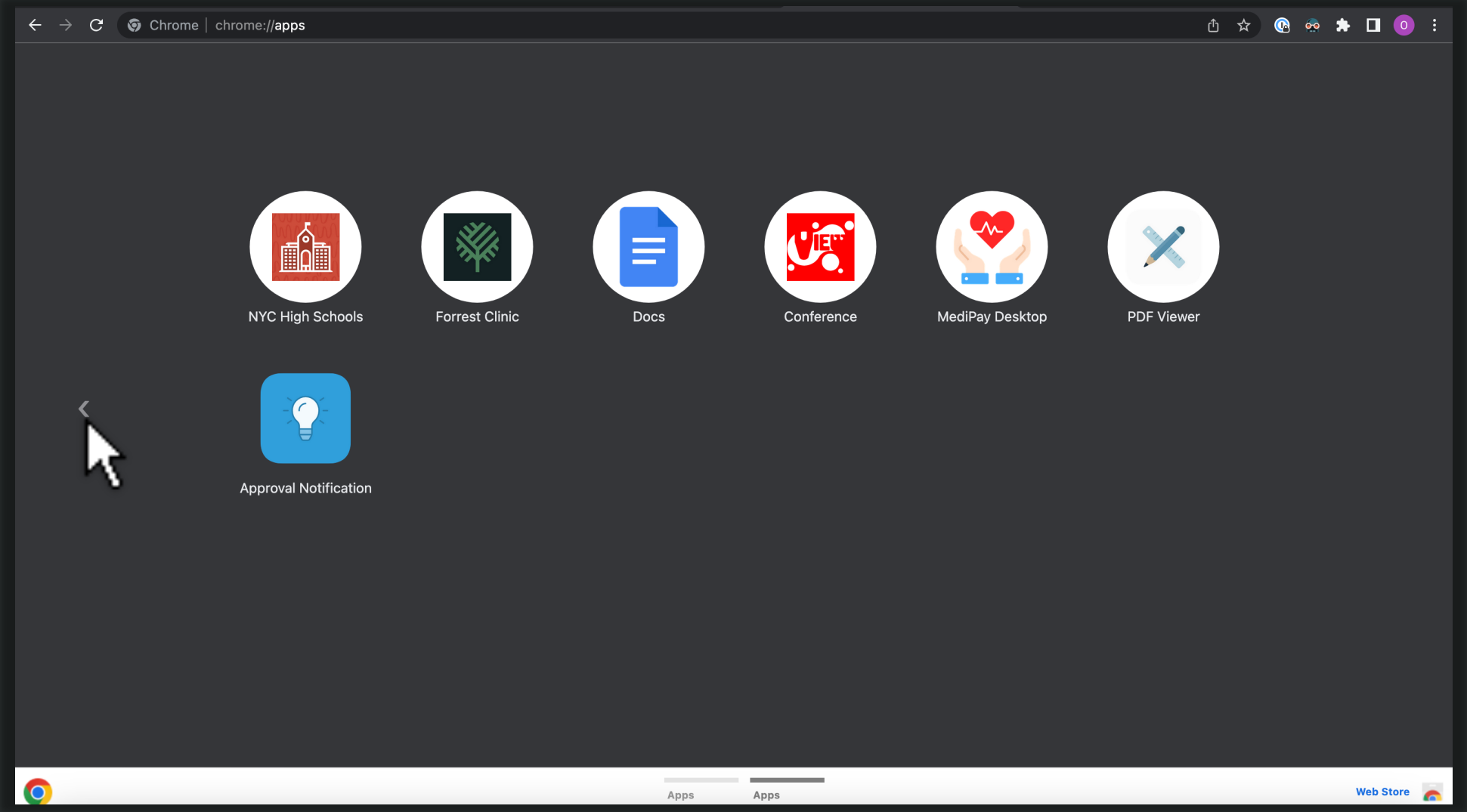
Chrome PWA Apps Management `chrome://apps`



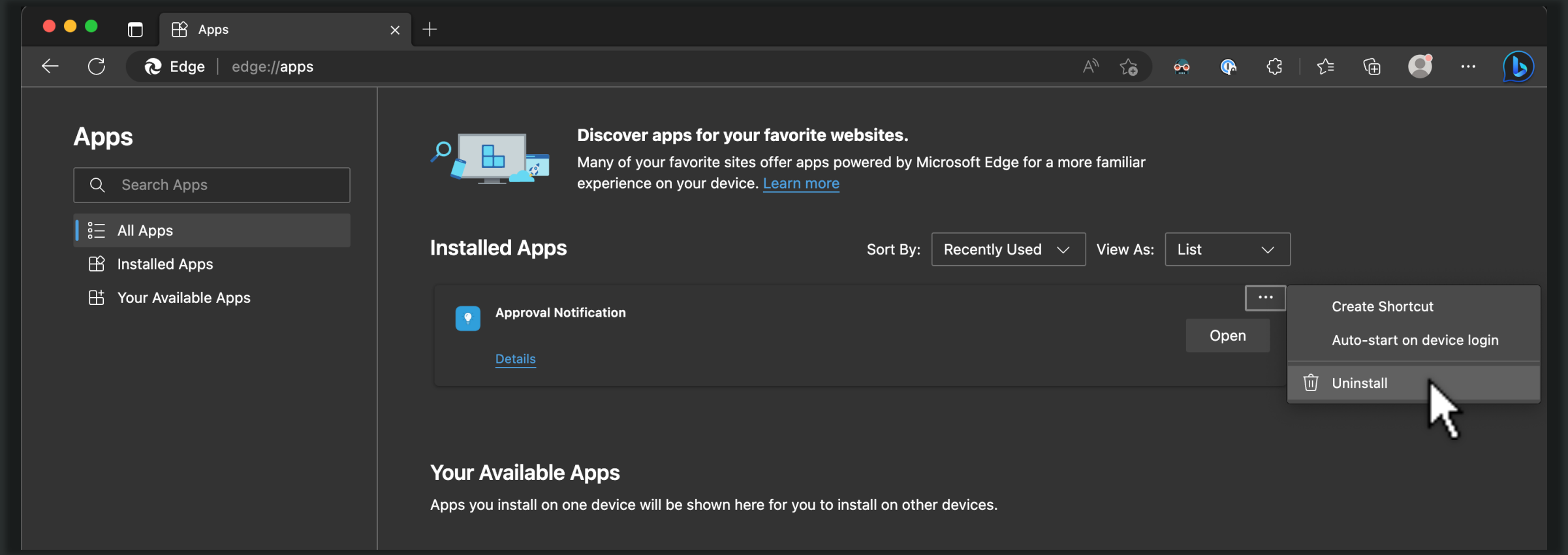
Chrome PWA Apps Management `chrome://apps`



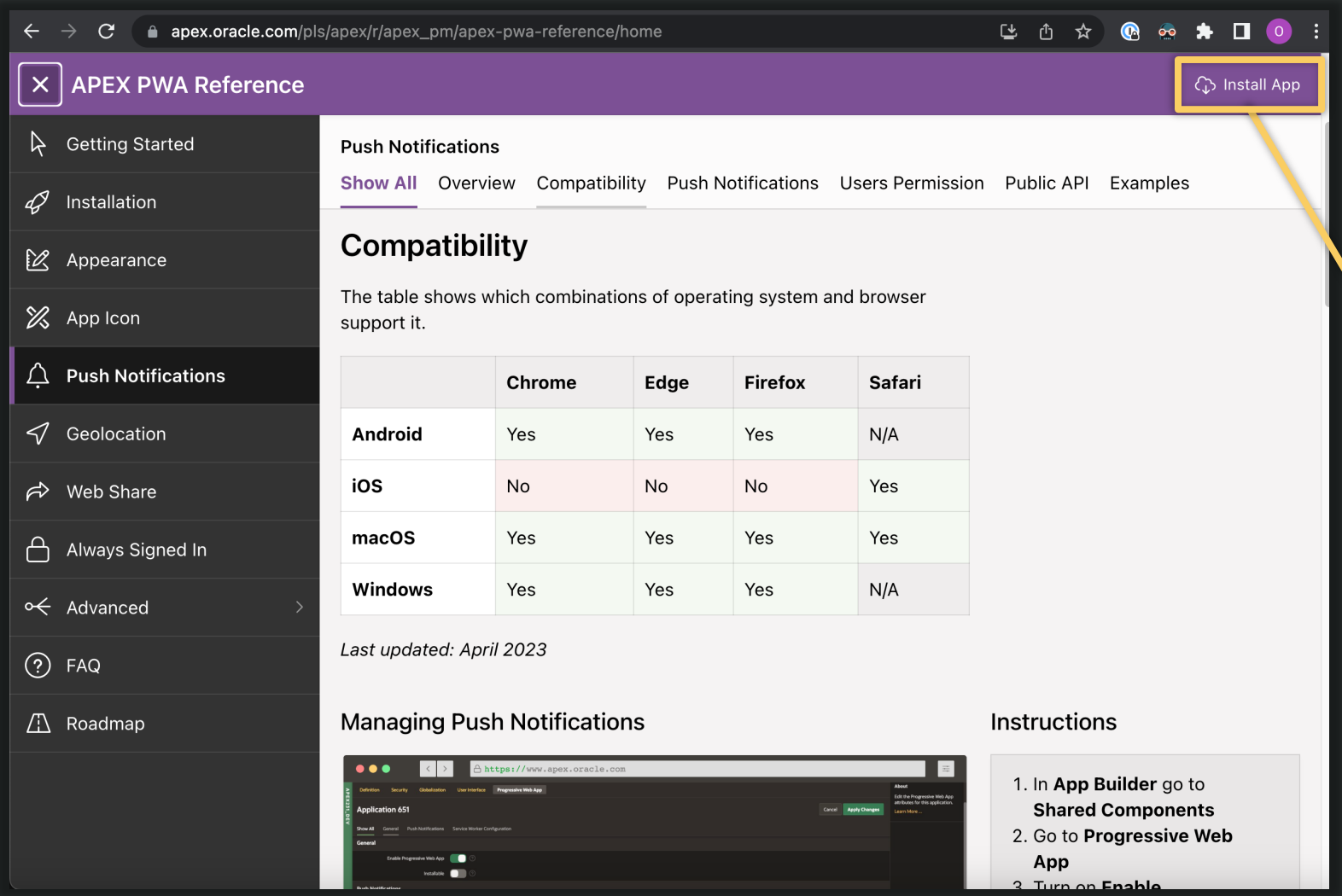
Chrome PWA Apps Management `chrome://apps`



Edge PWA Apps Management edge://apps

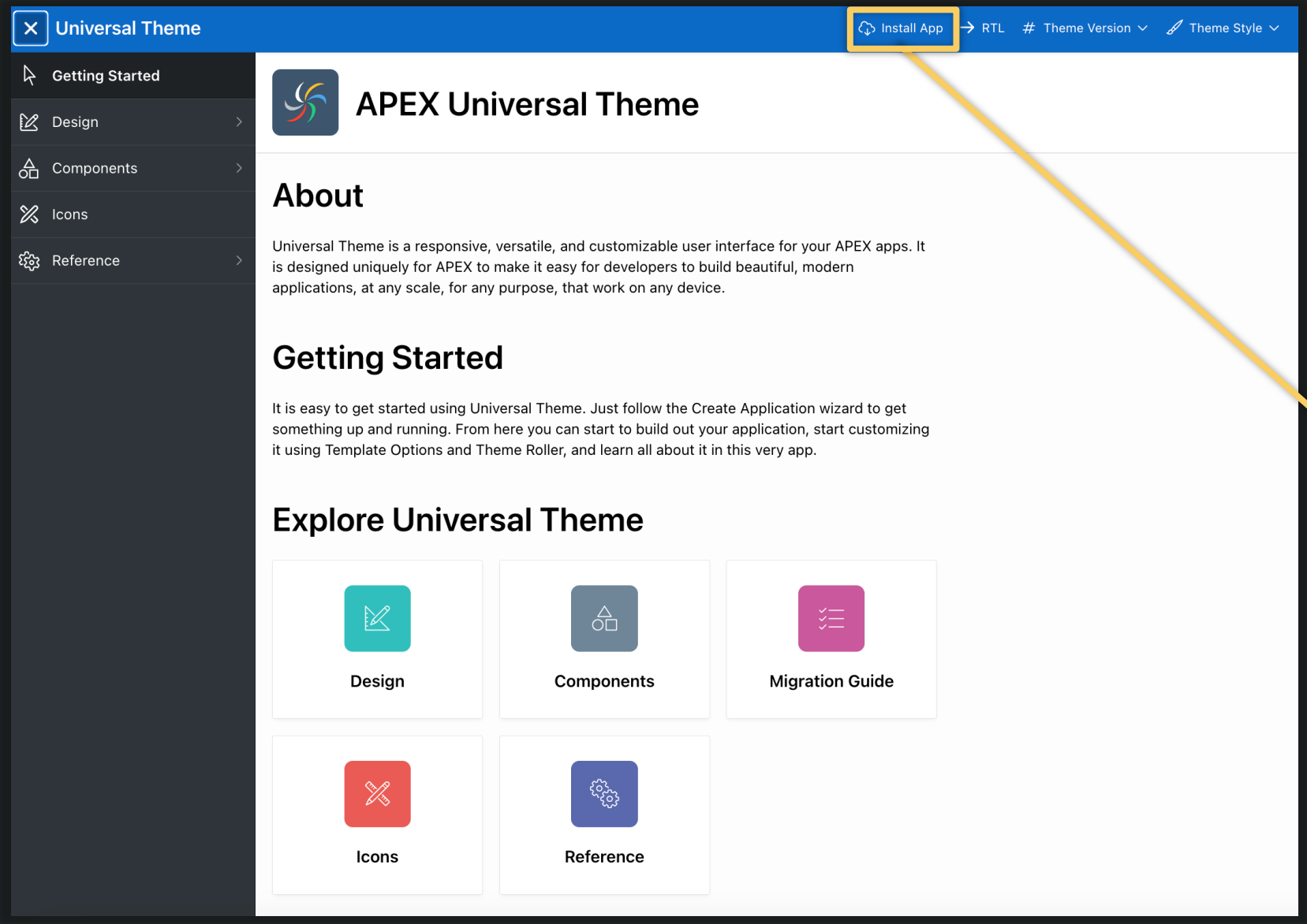


PWA Reference App apex.oracle.com/pwa



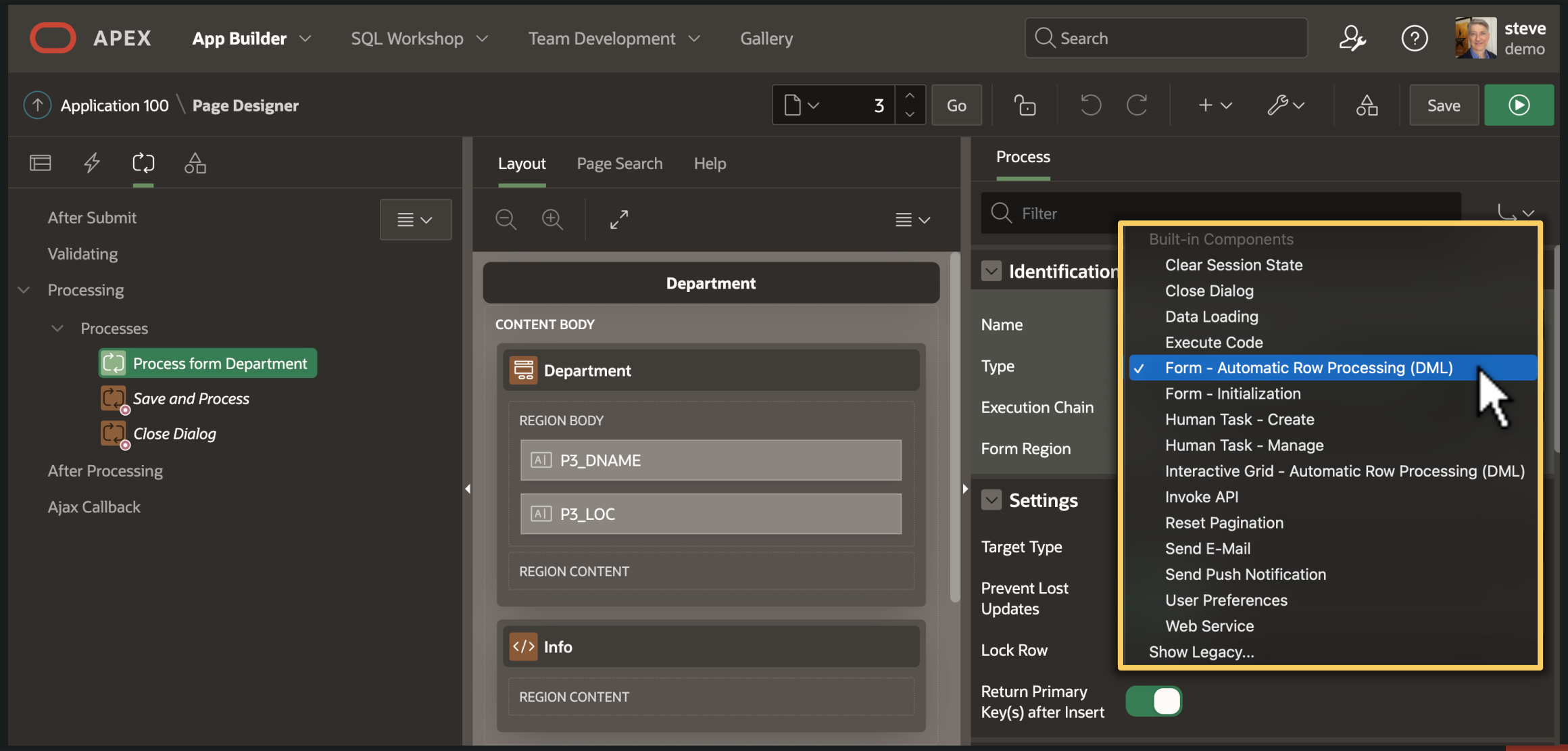
APEX PWA Reference

Universal Theme Reference App apex.oracle.com/ut

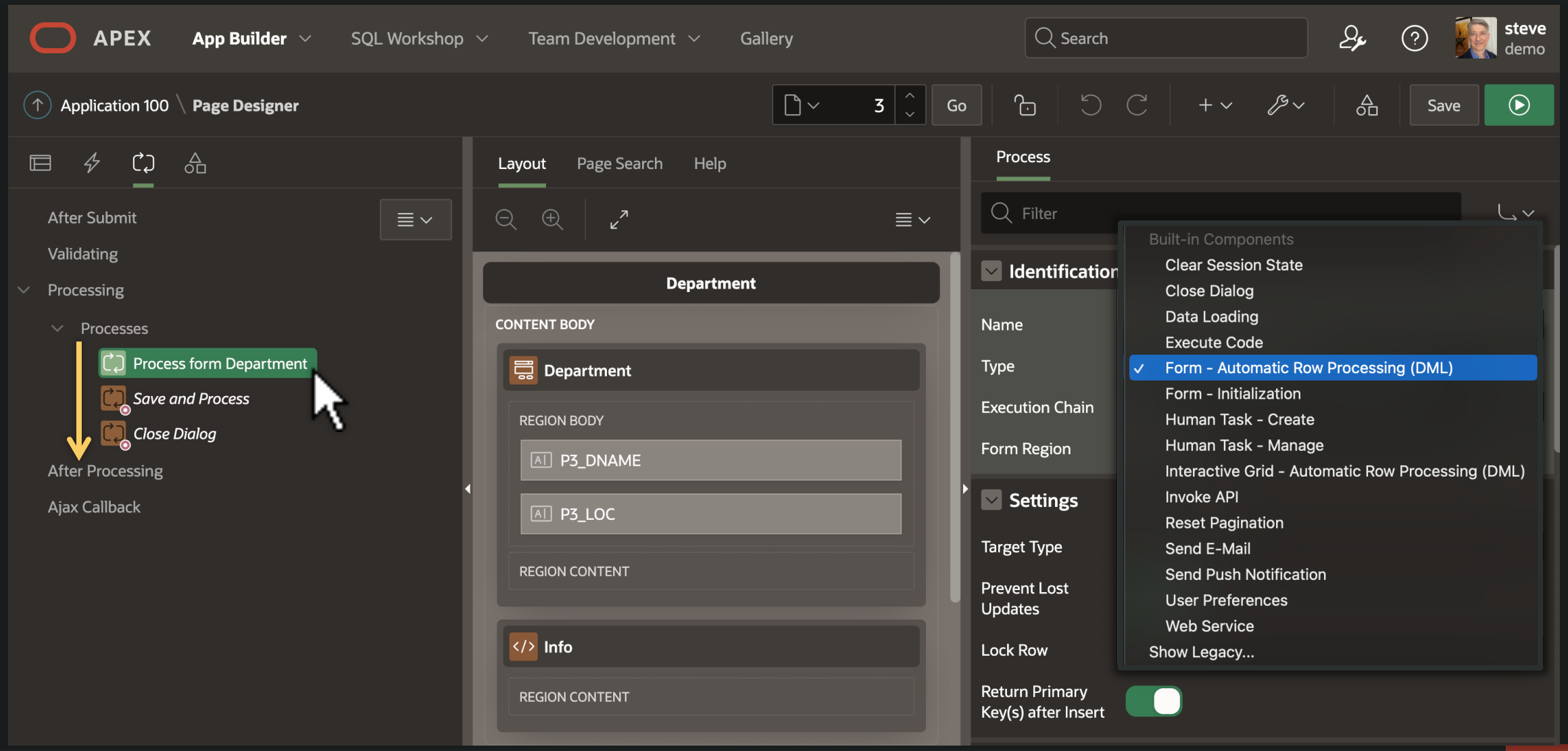


APEX 23.1
Easy Background Processing

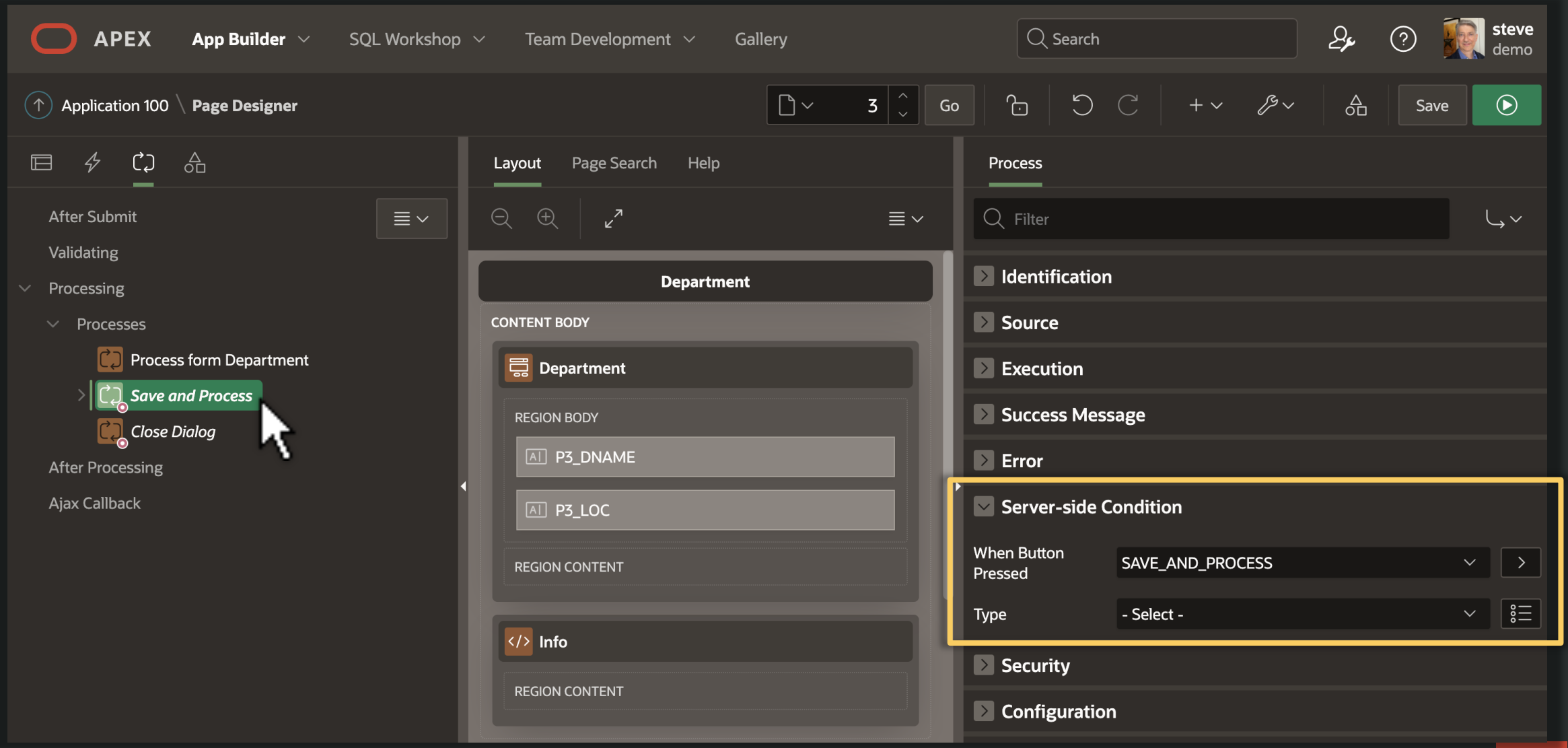
APEX Page Processes: Extensible, Declarative Actions



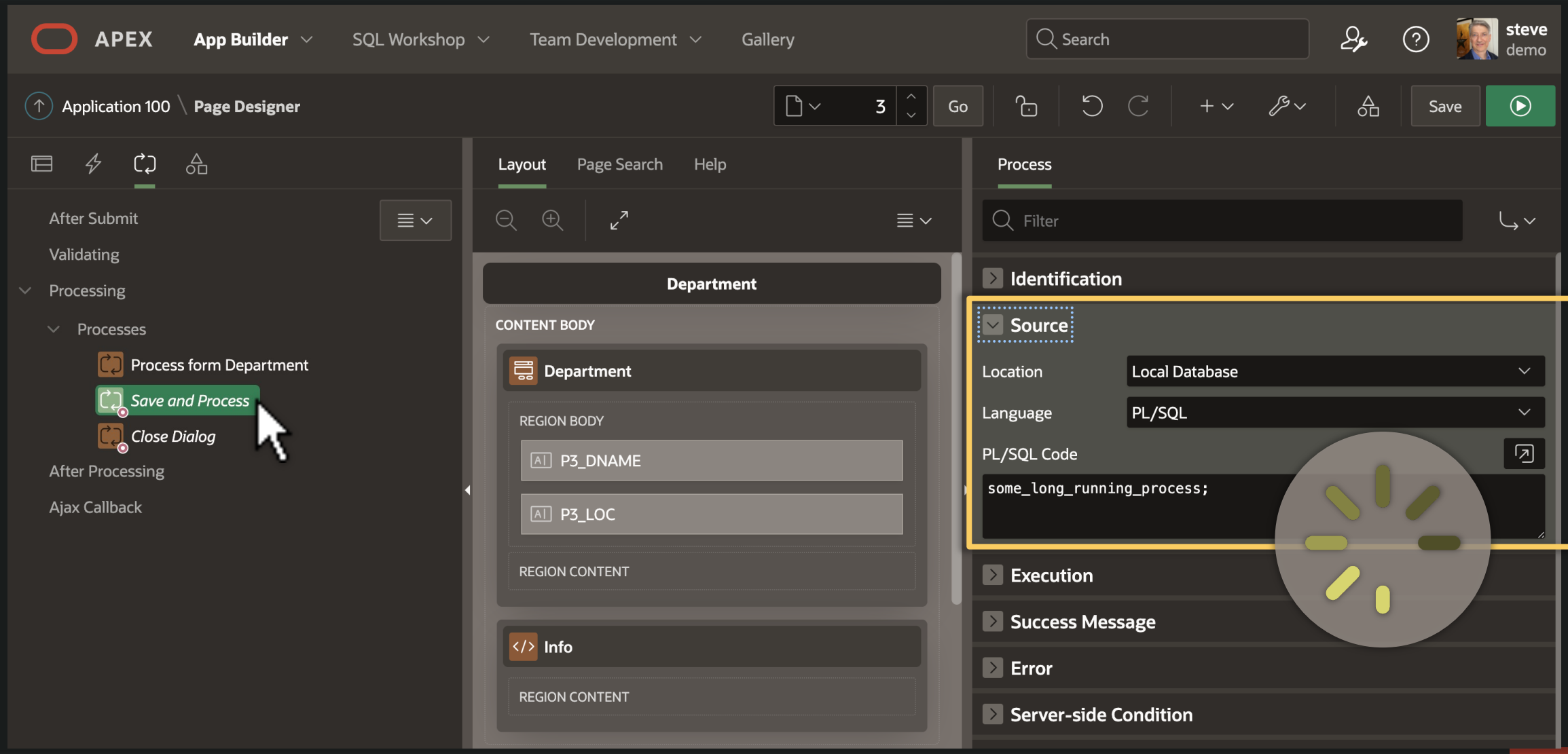
APEX Page Processes: Execute in Sequence



APEX Page Processes: Can Be Conditional

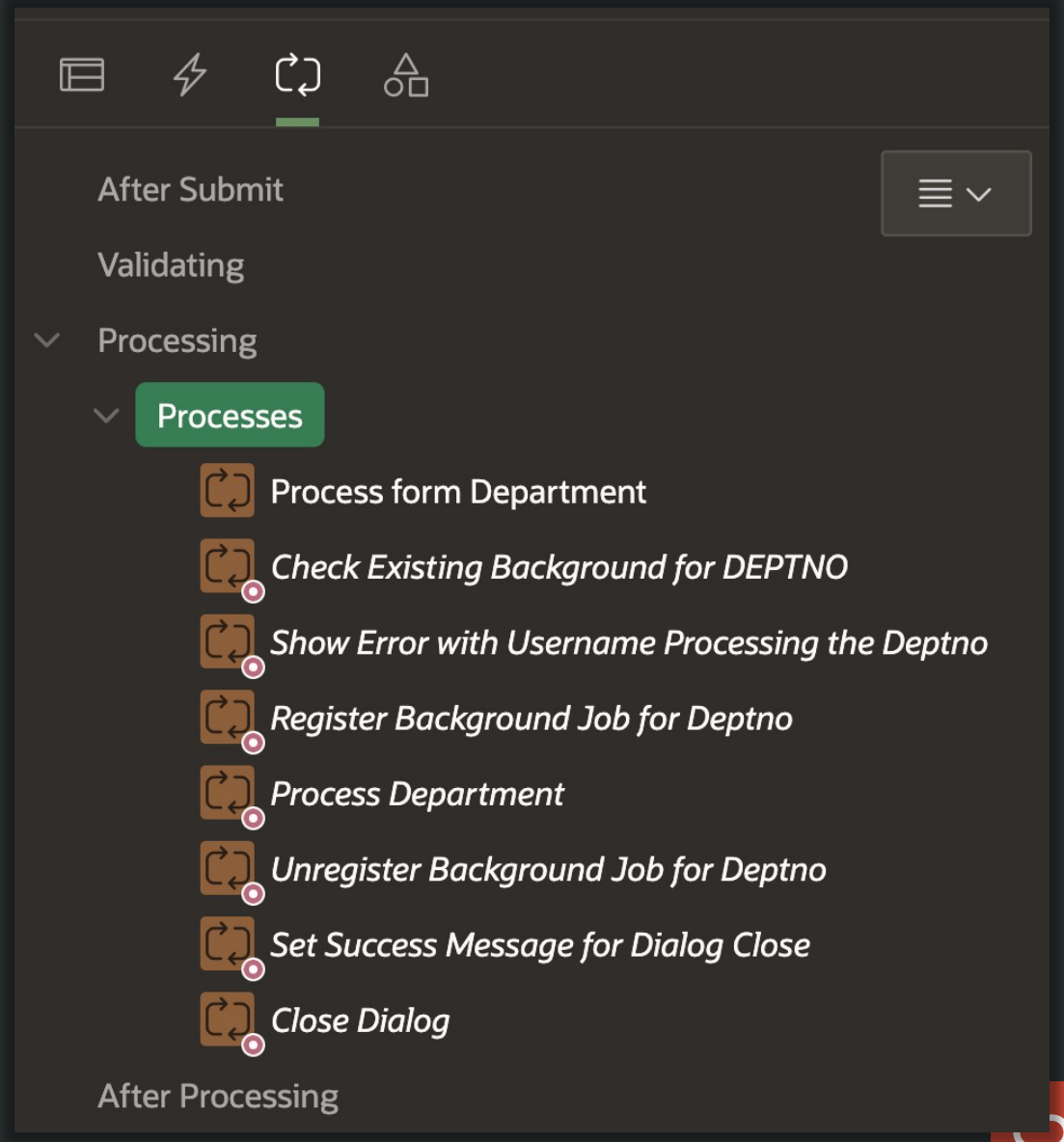


APEX Page Processes: If Long-Running, User Waits...



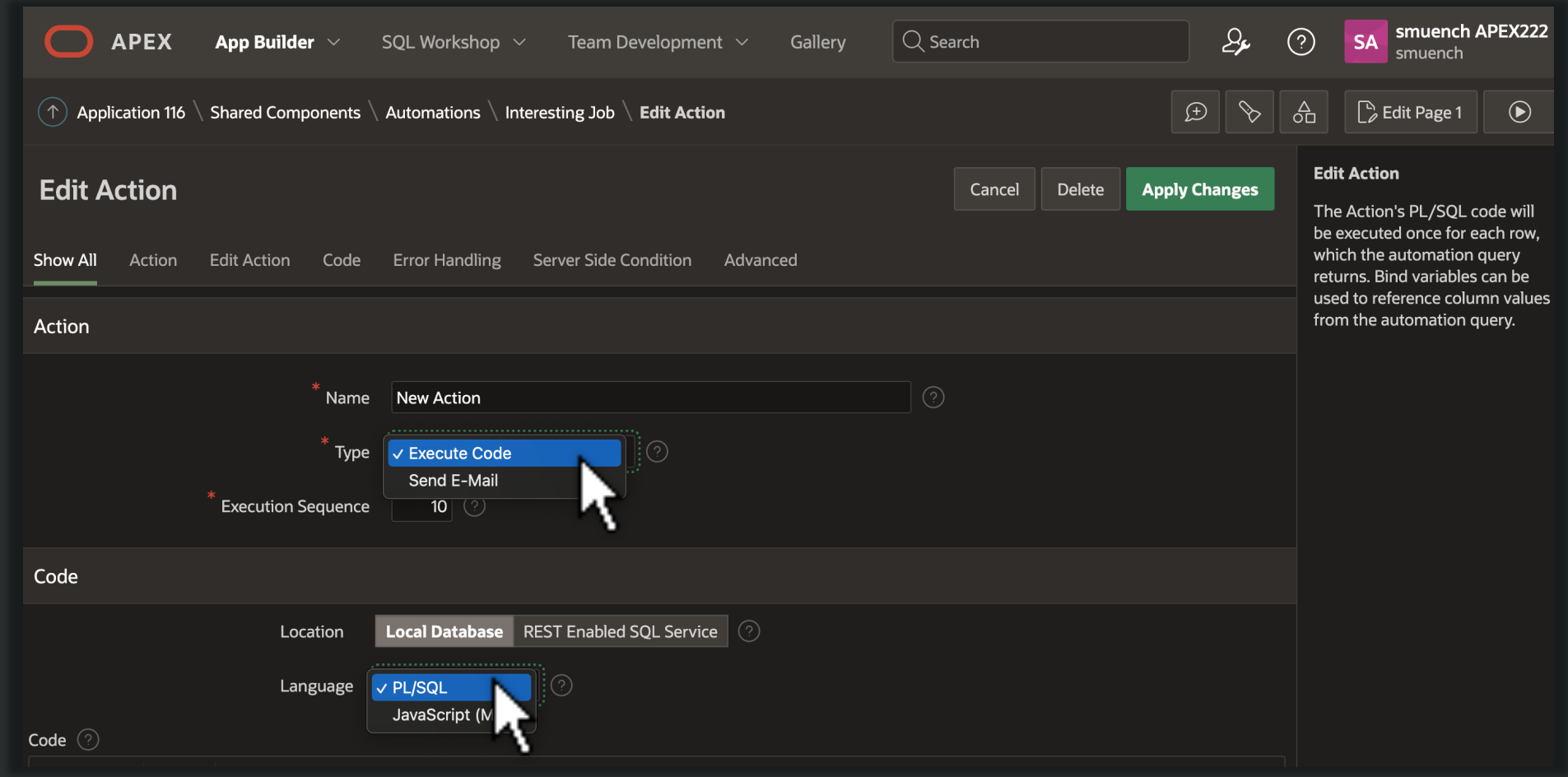
Can We Simplify Development with Page Processes?

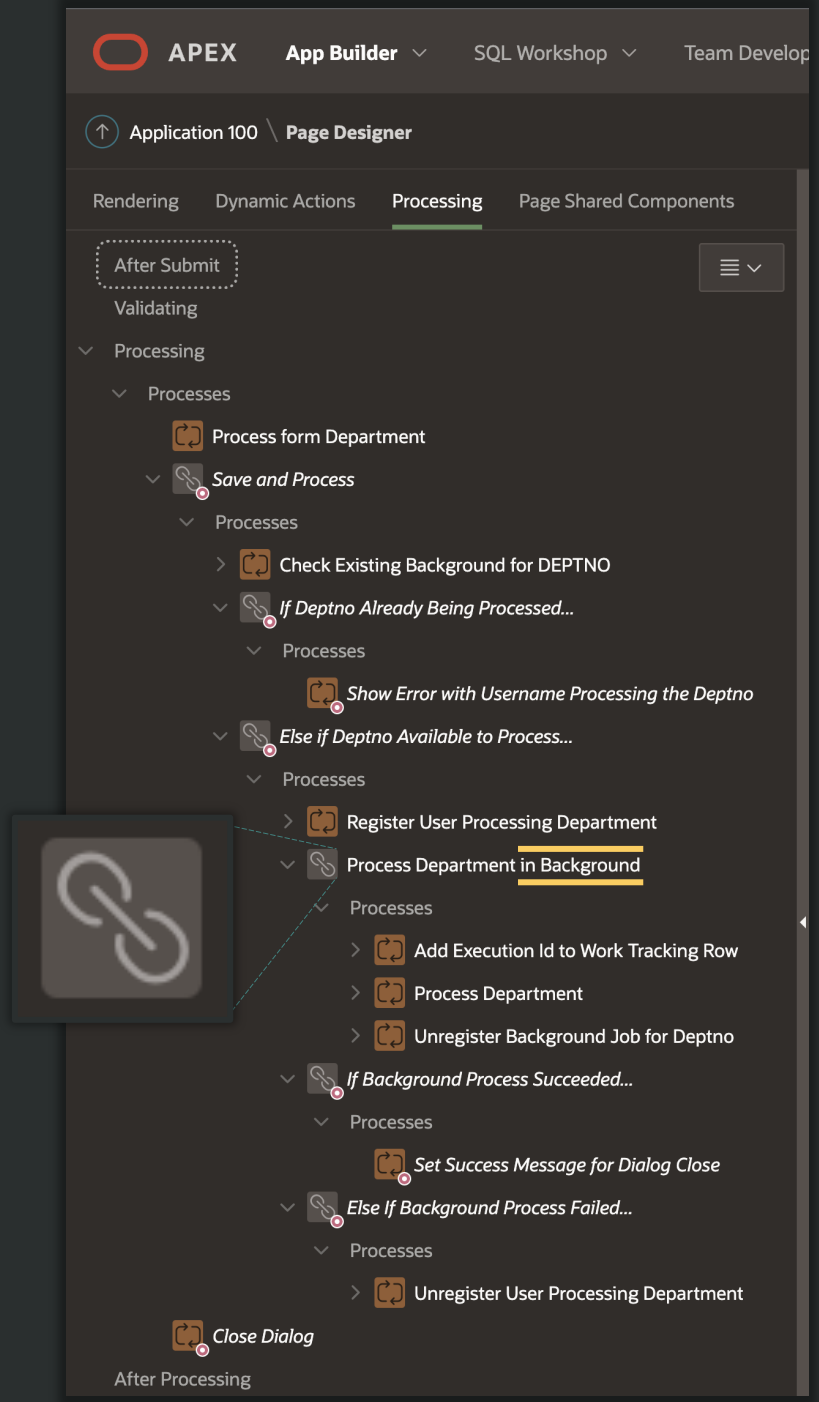
- At a glance, the "flow" of a sequence of conditional page processes is not obvious
- Offloading long-running work to background requires Automations



Can We Further Simplify *Background* Processing?

- APEX Automations simplify running background jobs
- Sending email is declarative, but otherwise you write code

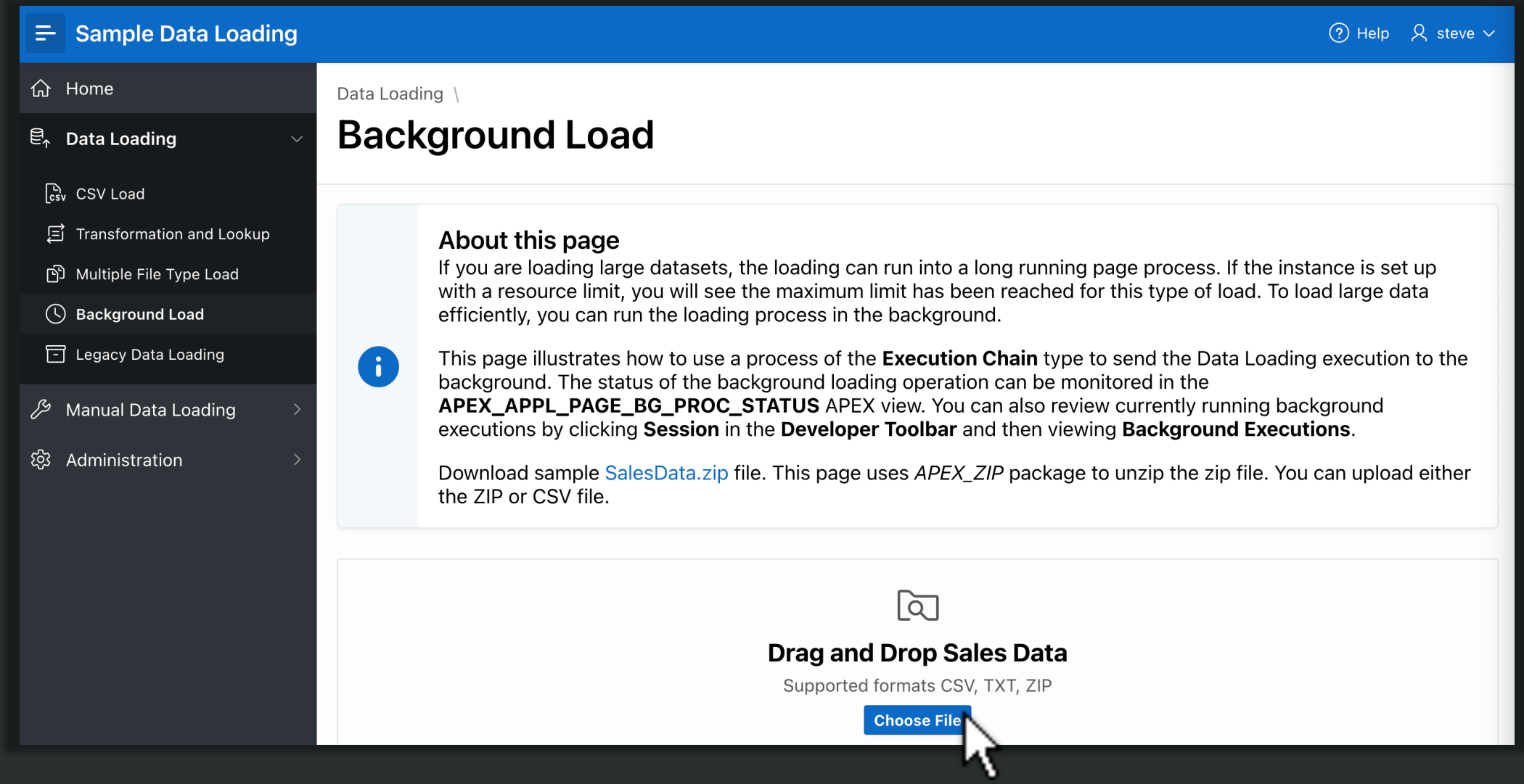




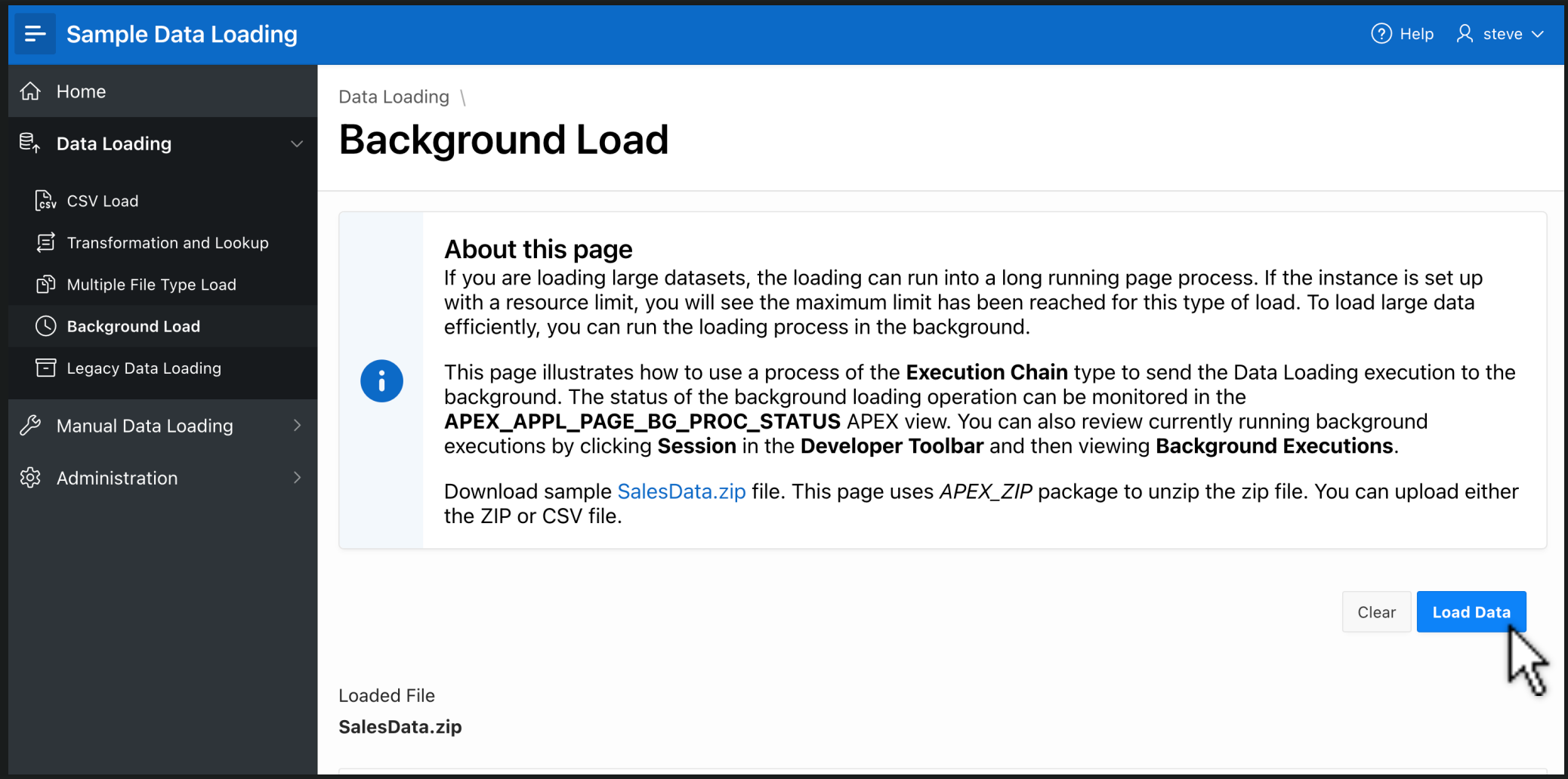
APEX Page Processes: Innovations

- Group sequence of page processes into a "chain"
- Child procs run only if parent chain's condition true
- Use parent chain's name for additional *flow* clarity
- Optionally set parent chain to run in background
- Any page process types (incl. custom plugins) work
- Allow background process to report progress

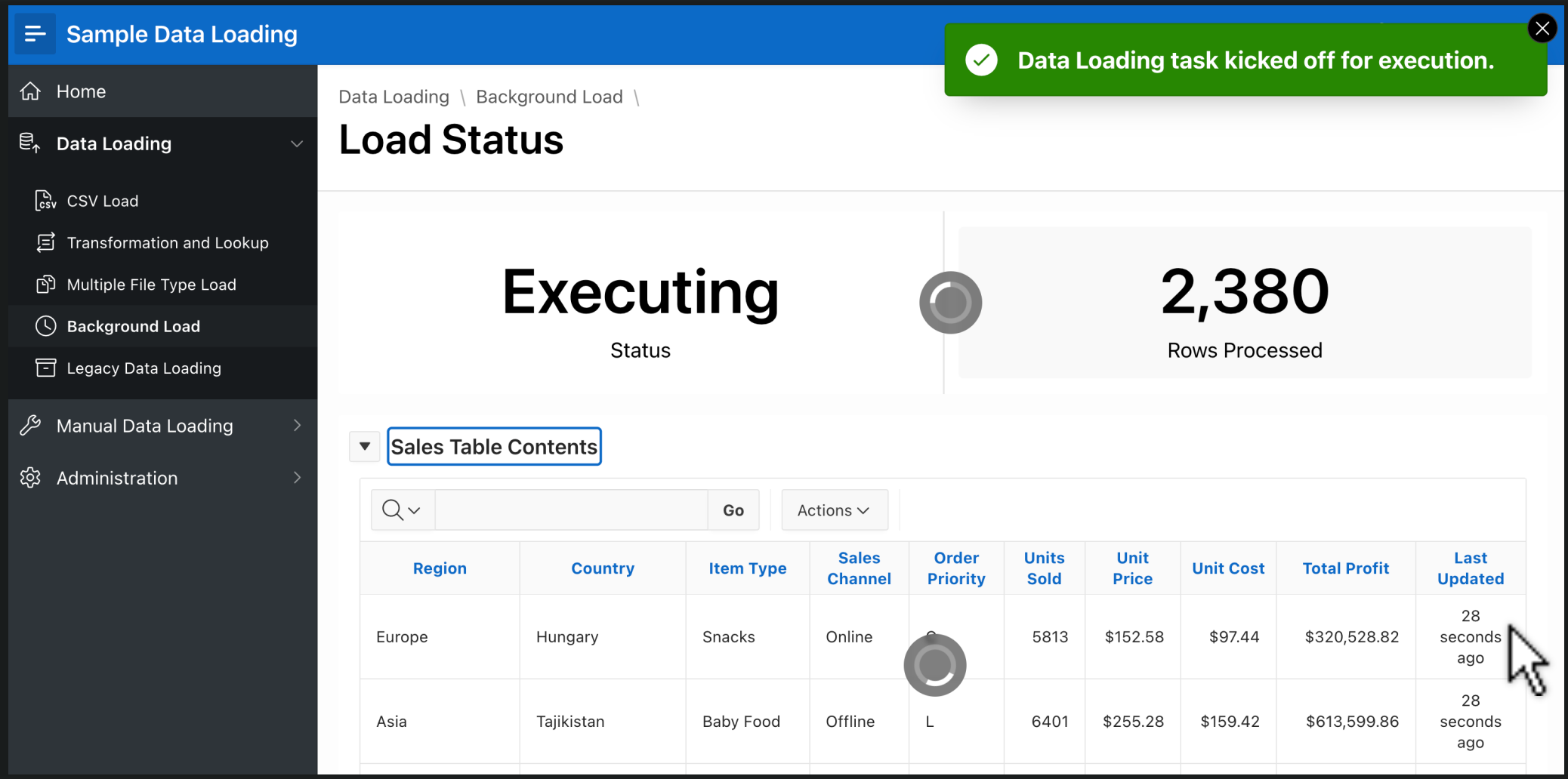
23.1 Sample Data Loading: *Background Load* Page



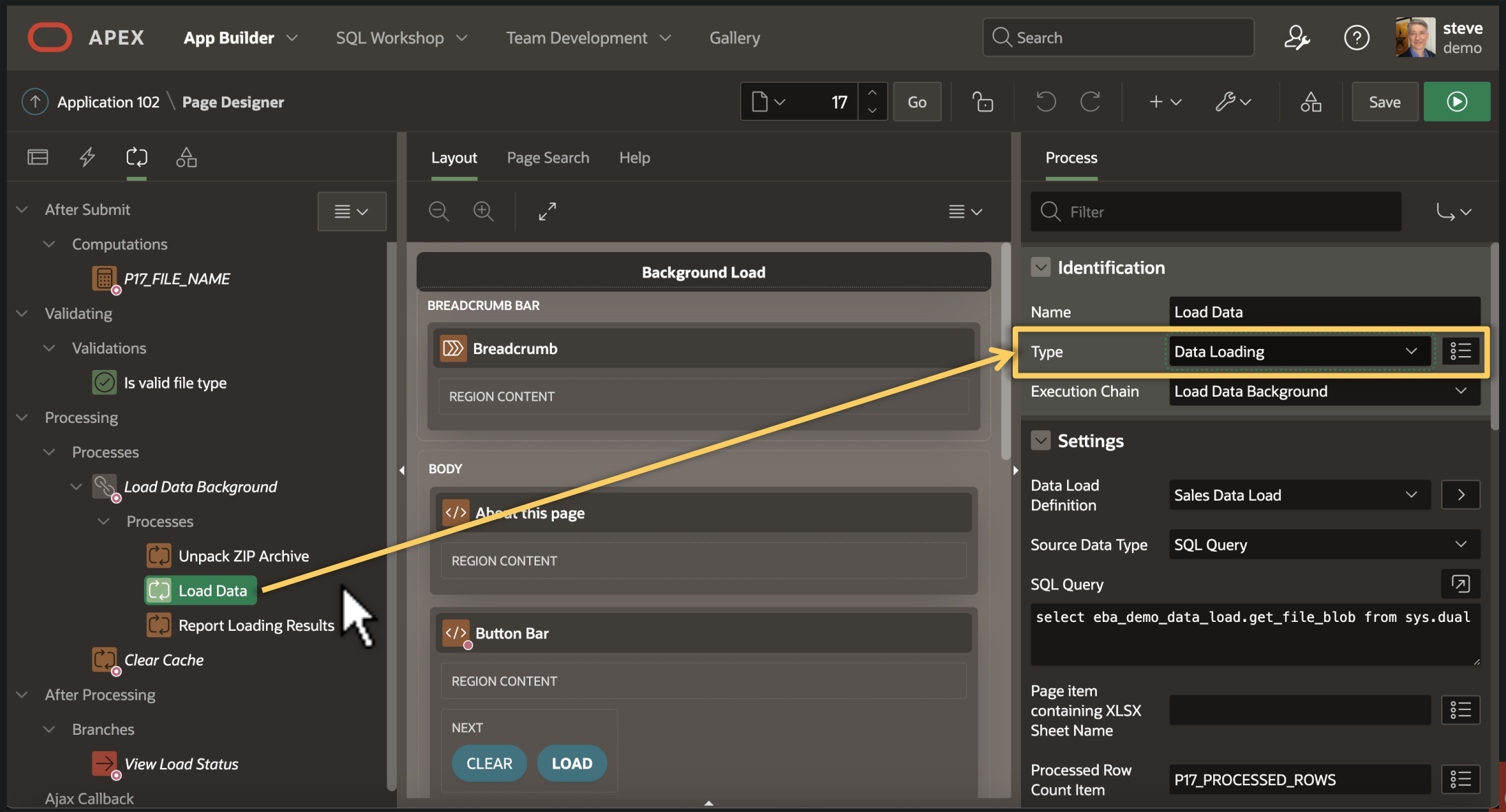
23.1 Sample Data Loading: *Background Load* Page



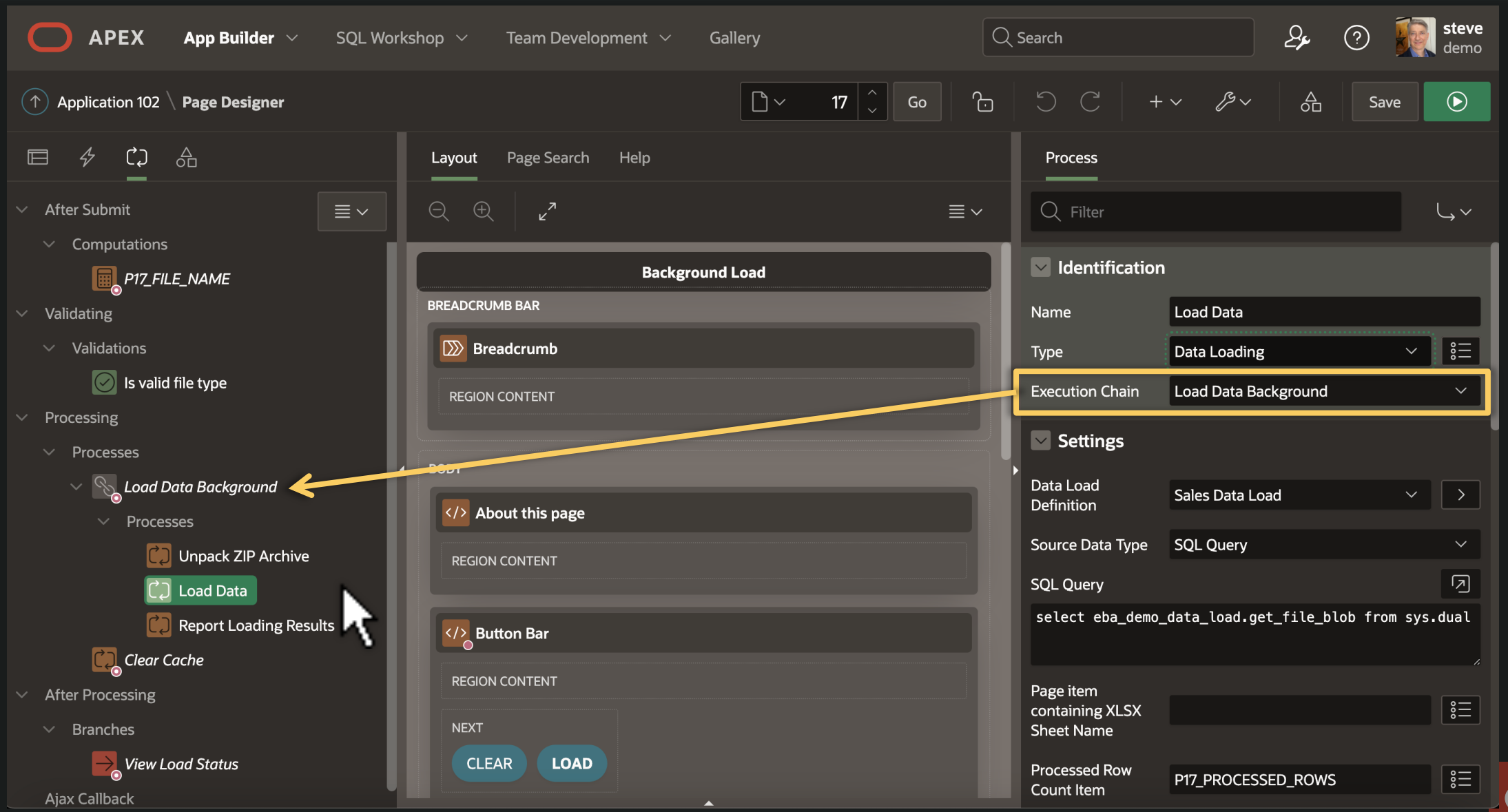
23.1 Sample Data Loading: *Background Load* Page



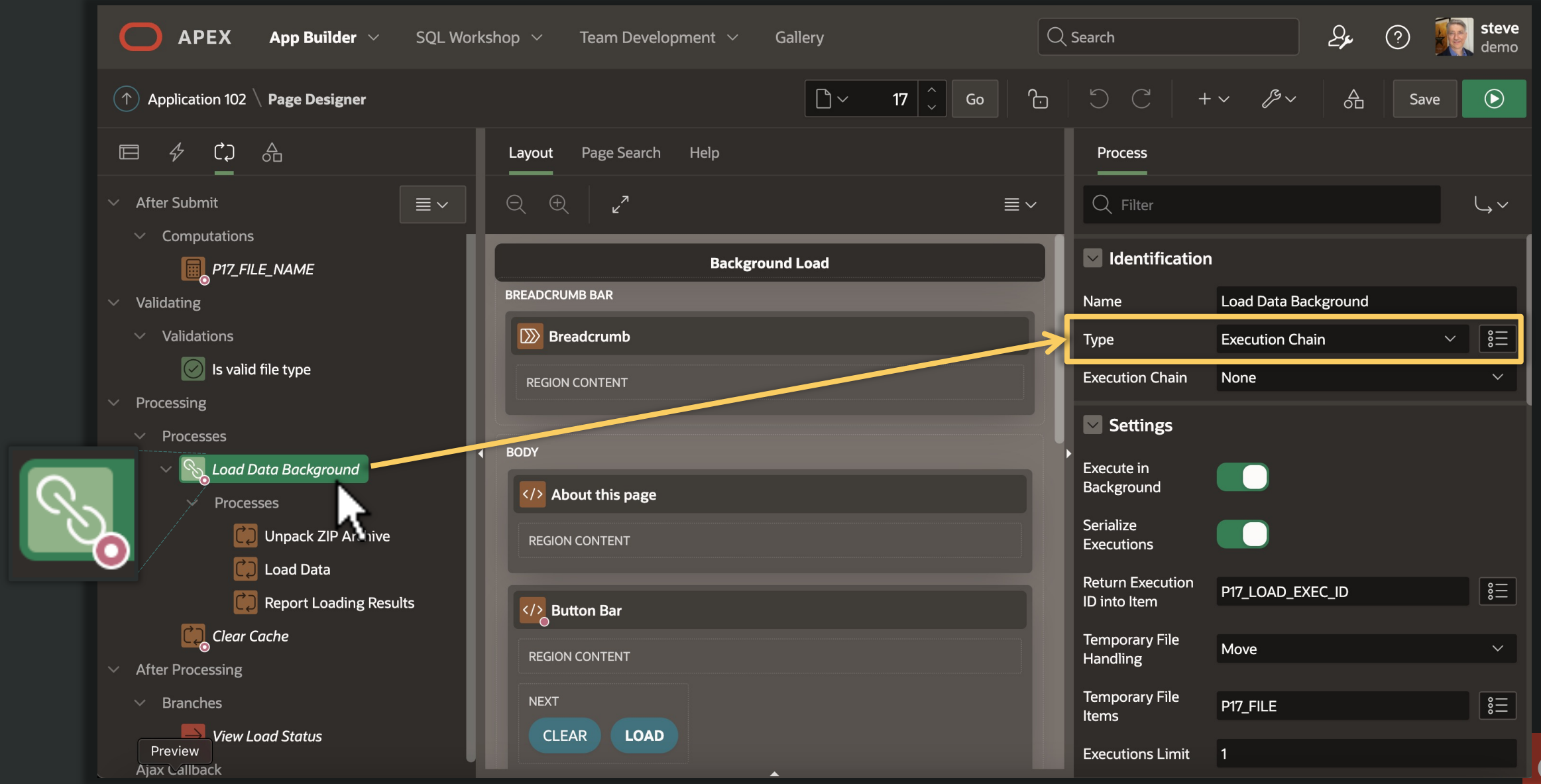
Background Load Page: Data Loading Page Process



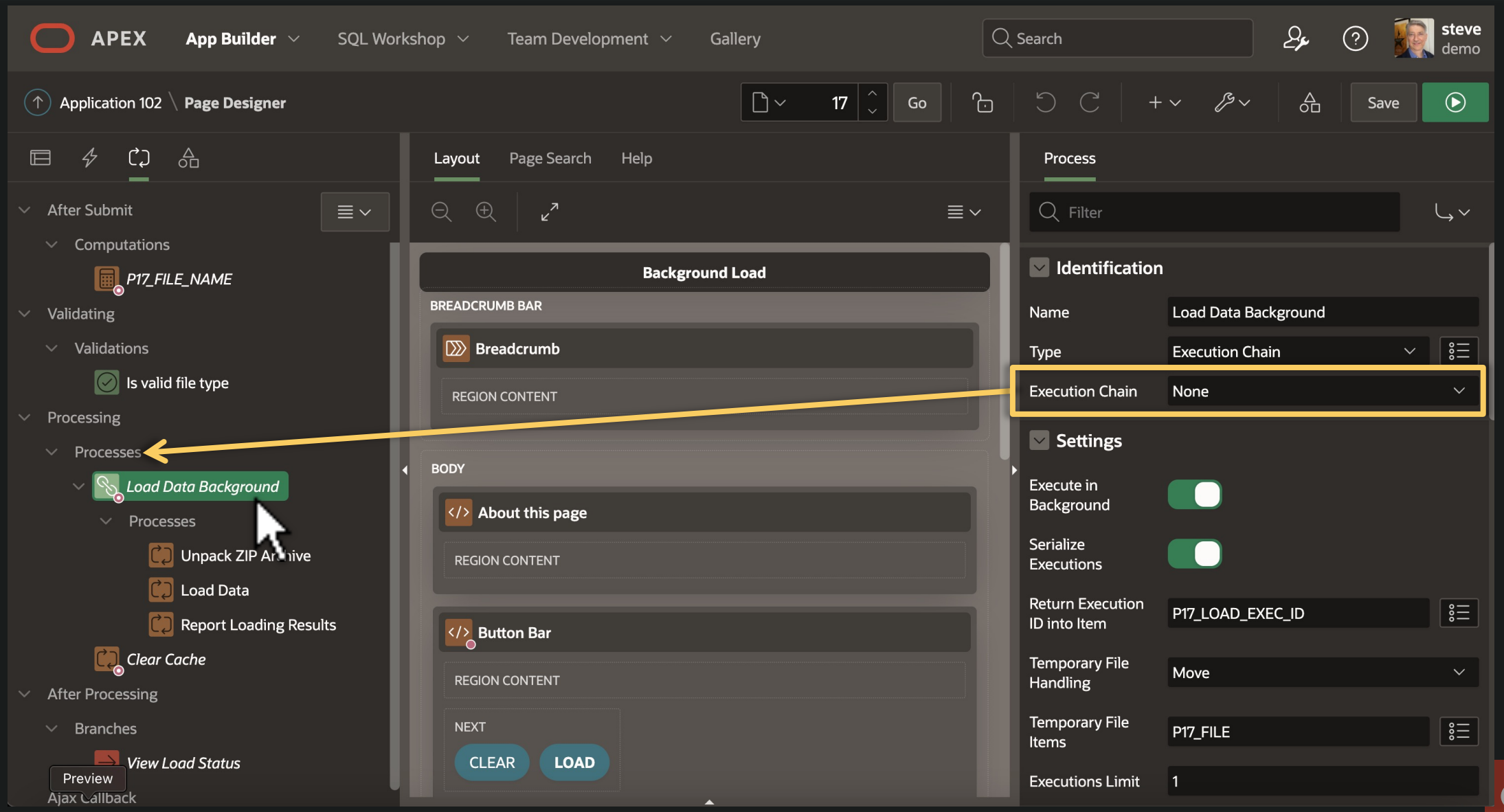
Load Data Child Process In *Load Data Background* Chain



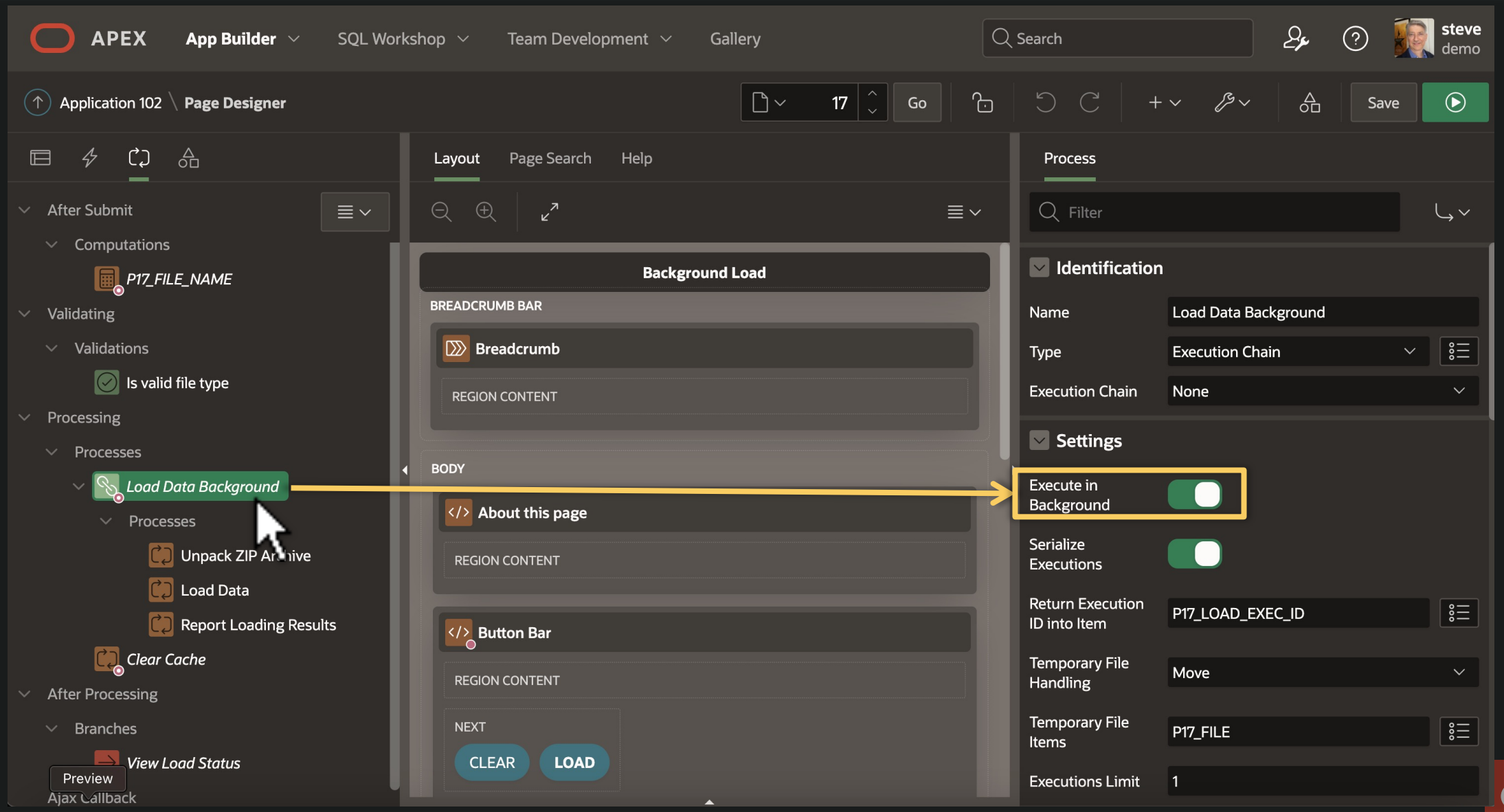
Load Data Background is an *Execution Chain* Type



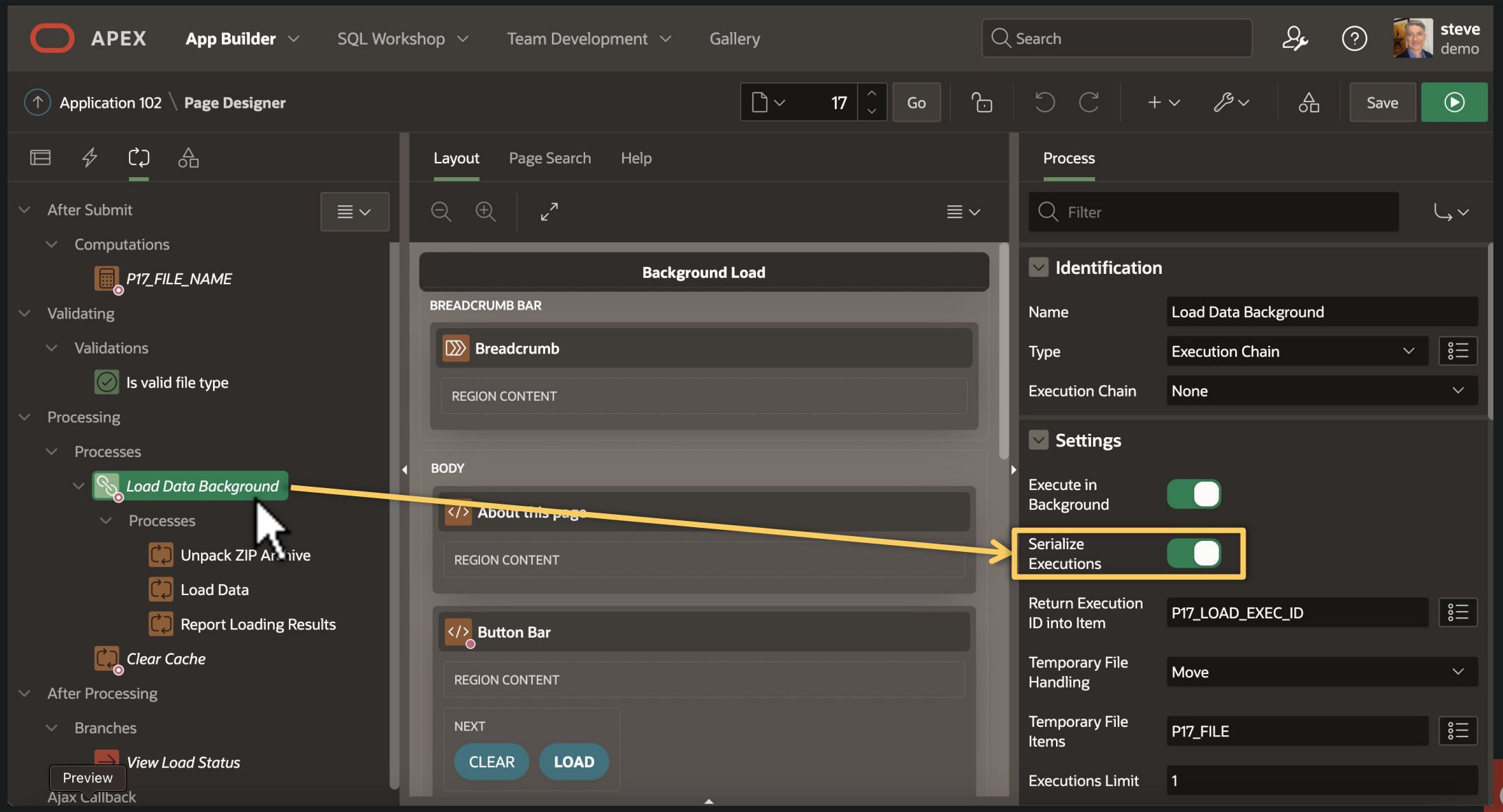
Load Data Background is a Top-Level Execution Chain



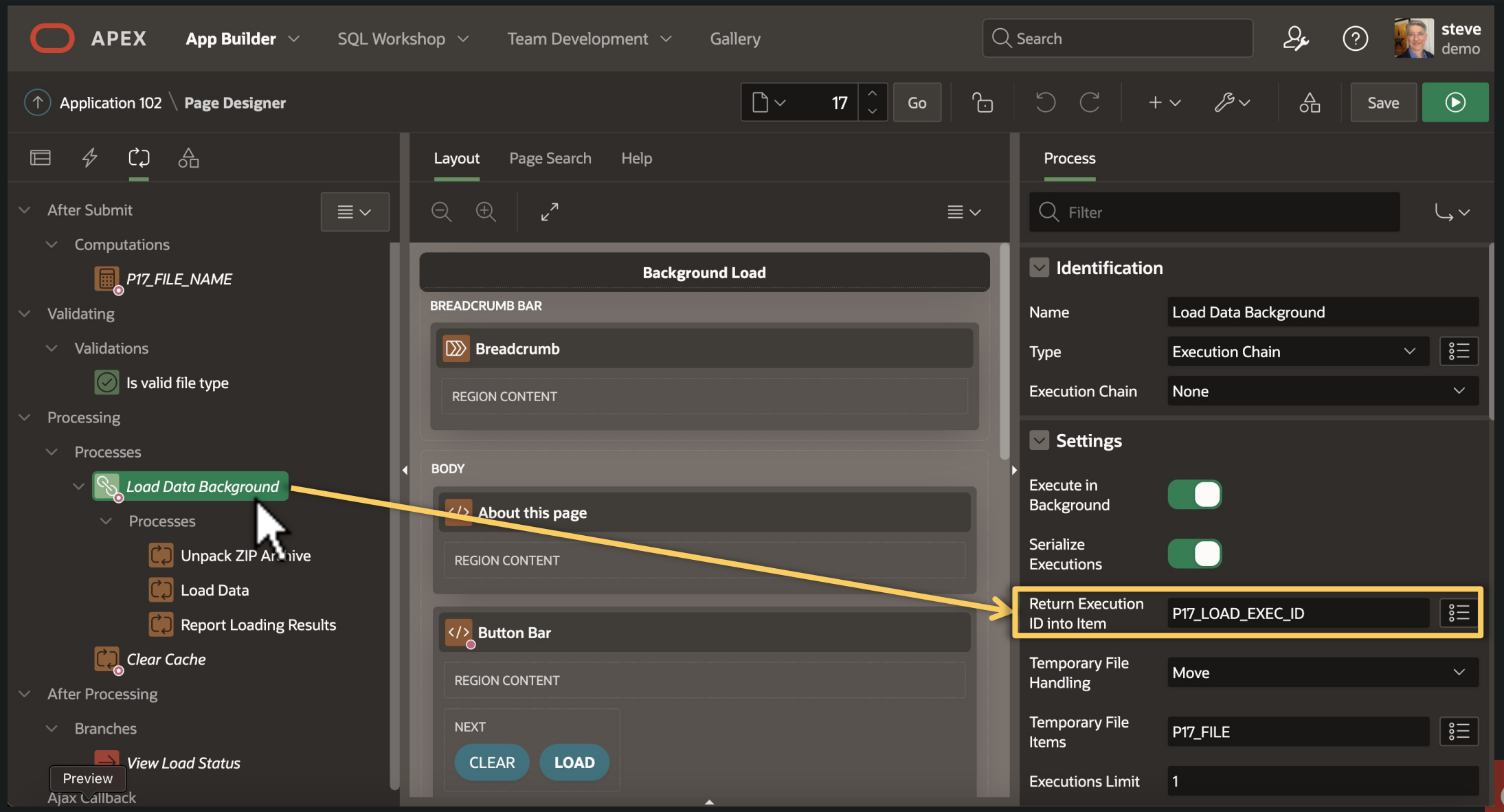
Configuring a Chain to Execute in the Background



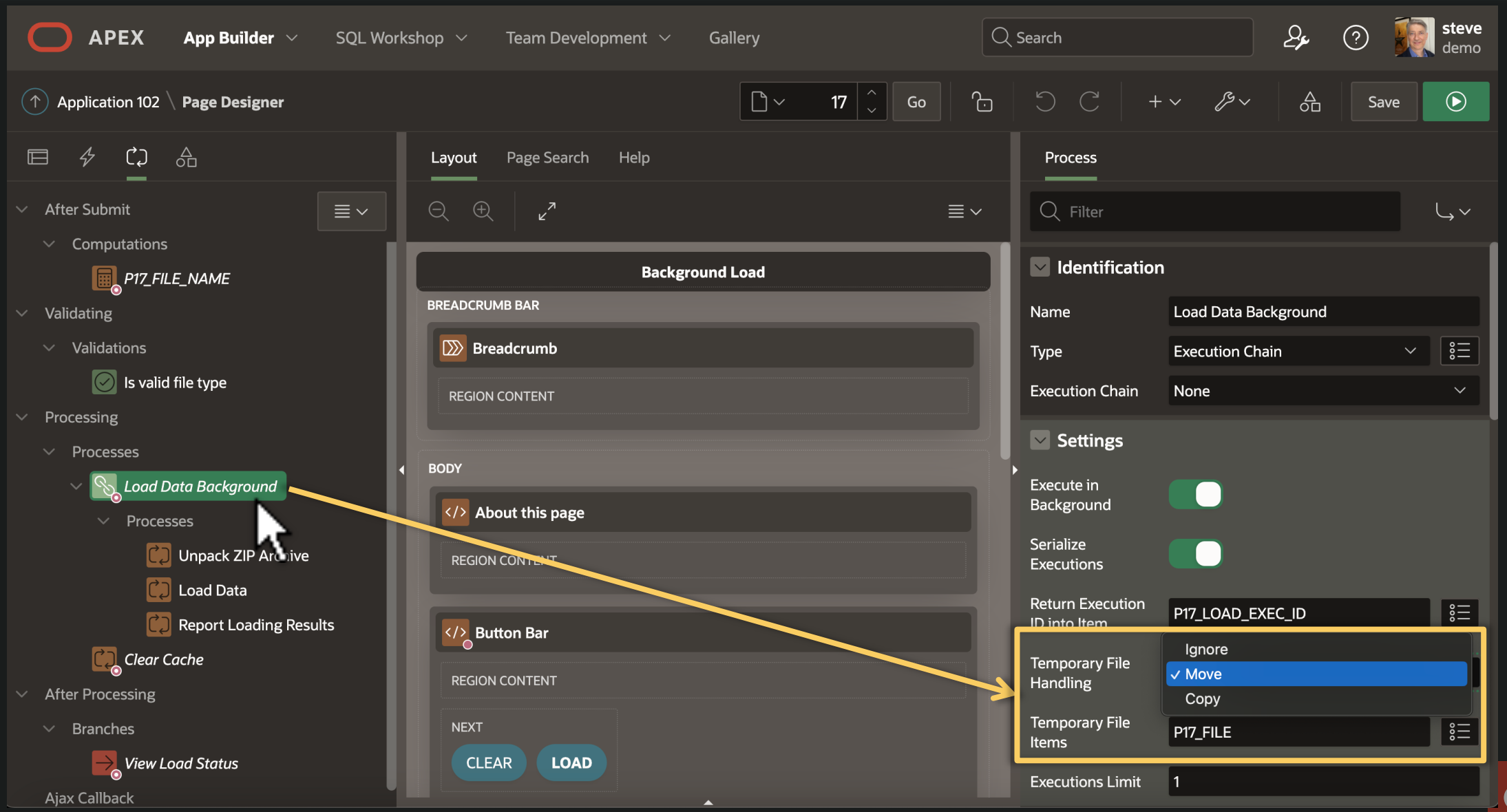
Enforce Single *Instance* of this Execution Chain at a Time



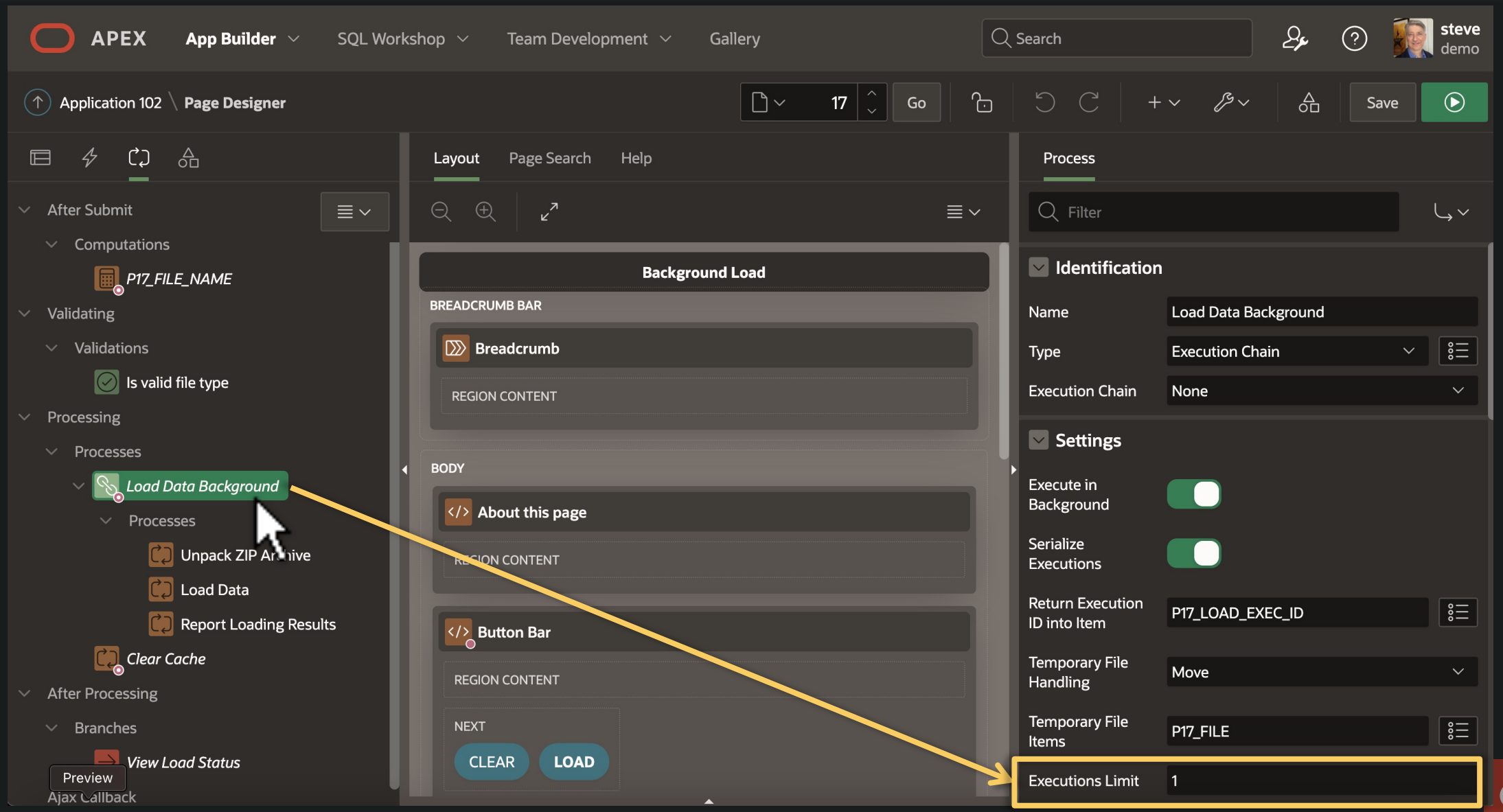
Storing ID of Background Execution in a Page Item



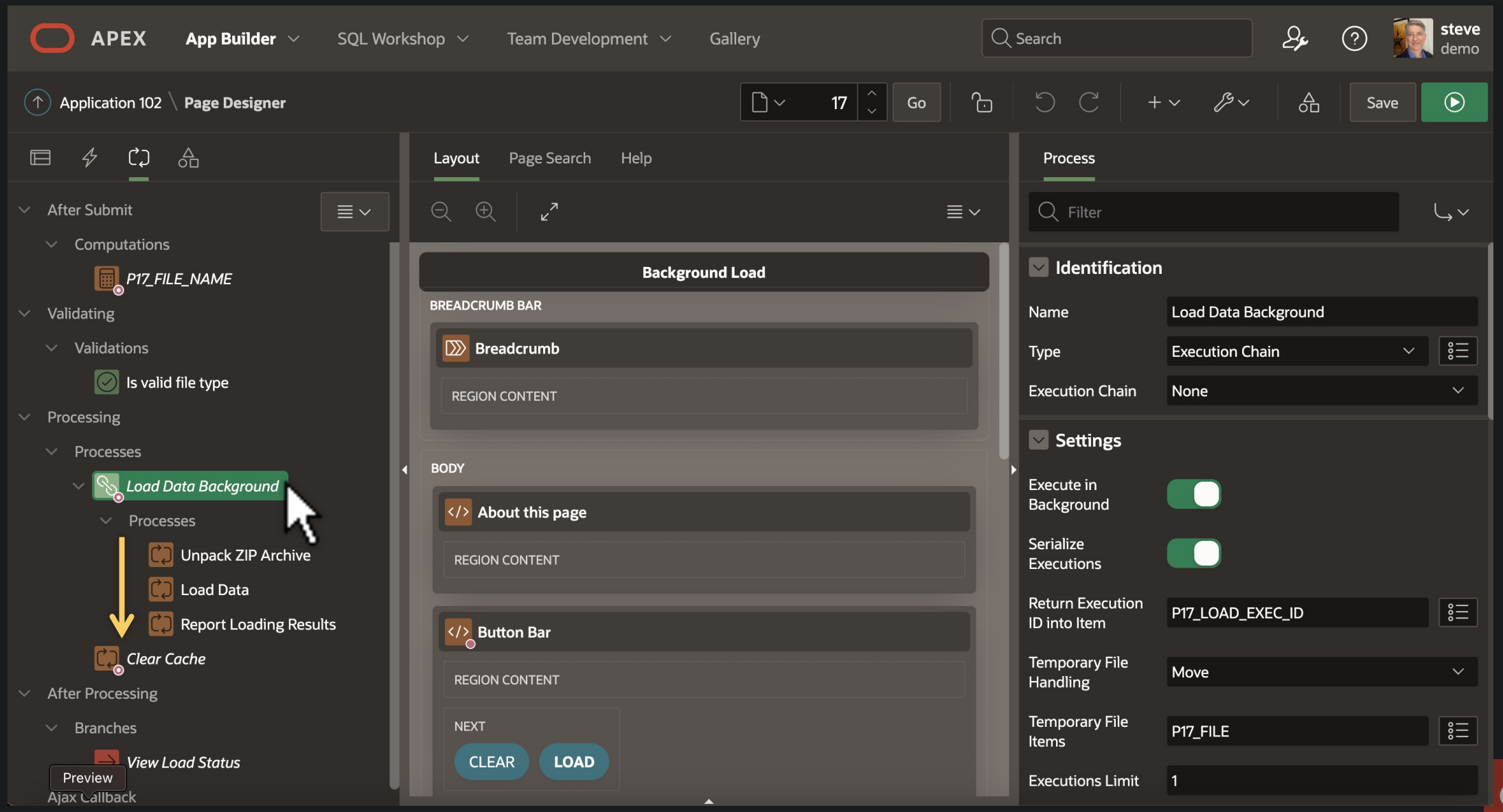
Choose How to Handle Temp Files in Session State Clone



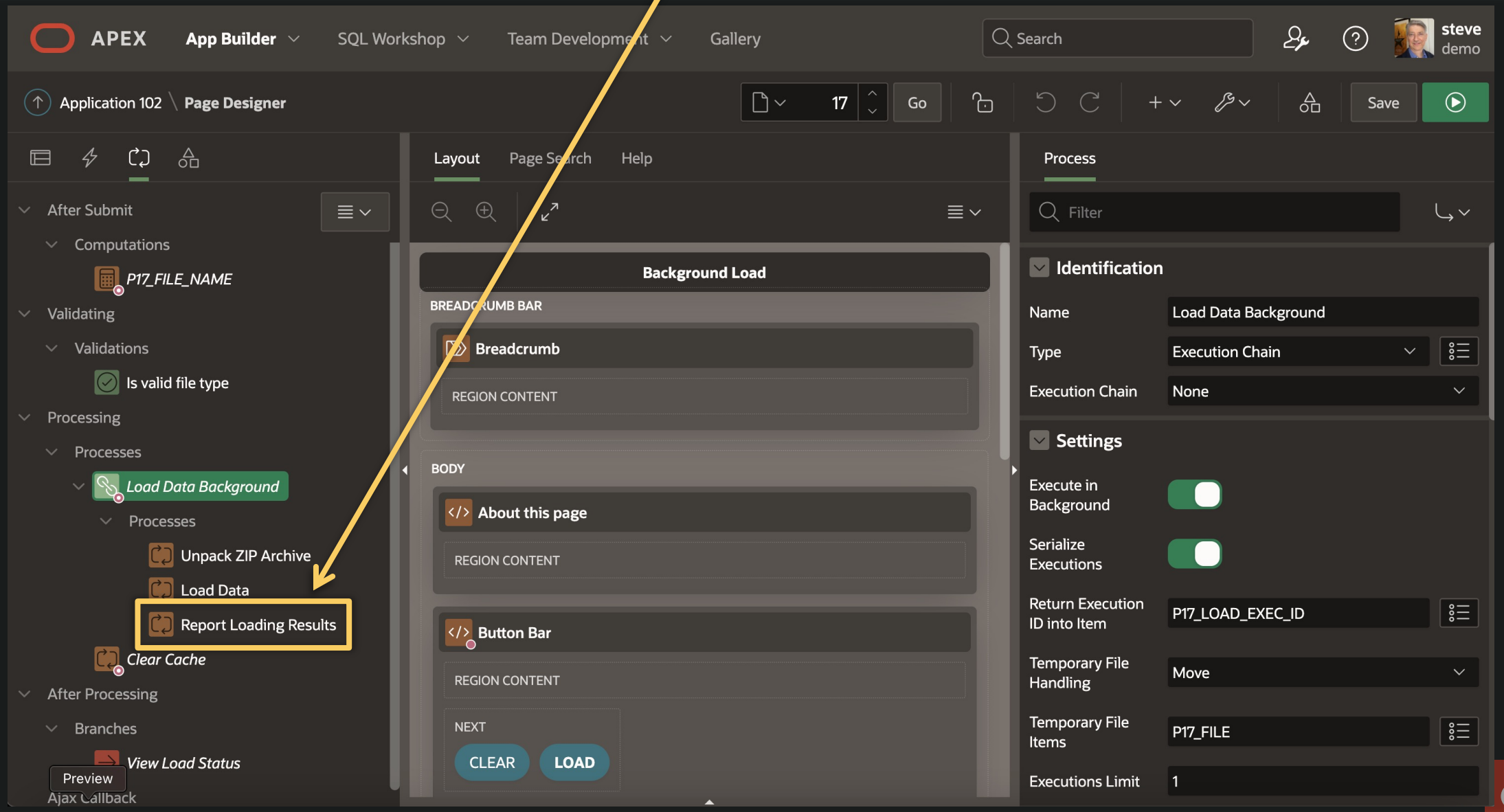
Impose Per-Session Limit on Background Executions



In Any Execution Chain, Child Processes Run Sequentially



So Notification of Completion Can Be Done in the Chain



Session State Cloned for Background Execution Chain

Session 123456

Session State

Name	Value
P1_ID	1234
P1_STATUS	PENDING
P1_RESULT	

Temporary Files

Submit

Session 987654

Session State

Name	Value
P1_ID	1234
P1_STATUS	PENDING
P1_RESULT	

Temporary Files

Ignore

Temporary File Handling

Ignore

Session State Cloned for Background Execution Chain

Session 123456

Session State

Name	Value
P1_ID	1234
P1_STATUS	PENDING
P1_RESULT	

Temporary Files

Session 987654

Session State

Name	Value
P1_ID	1234
P1_STATUS	PENDING
P1_RESULT	

Temporary Files

Copy

Submit

Temporary File Handling: Copy

Temporary File Items: P17_FILE

Session State Cloned for Background Execution Chain

Session 123456

Session State

Name	Value
P1_ID	1234
P1_STATUS	PENDING
P1_RESULT	

Temporary Files

Submit

Session 987654

Session State

Name	Value
P1_ID	1234
P1_STATUS	PENDING
P1_RESULT	

Temporary Files

Move

Background Session State Independent of User Session

Session 123456

Session State

Name	Value
P1_ID	1234
P1_STATUS	PENDING
P1_RESULT	

Temporary Files

Submit

Session 987654

Session State

Name	Value
P1_ID	1234
P1_STATUS	PENDING
P1_RESULT	

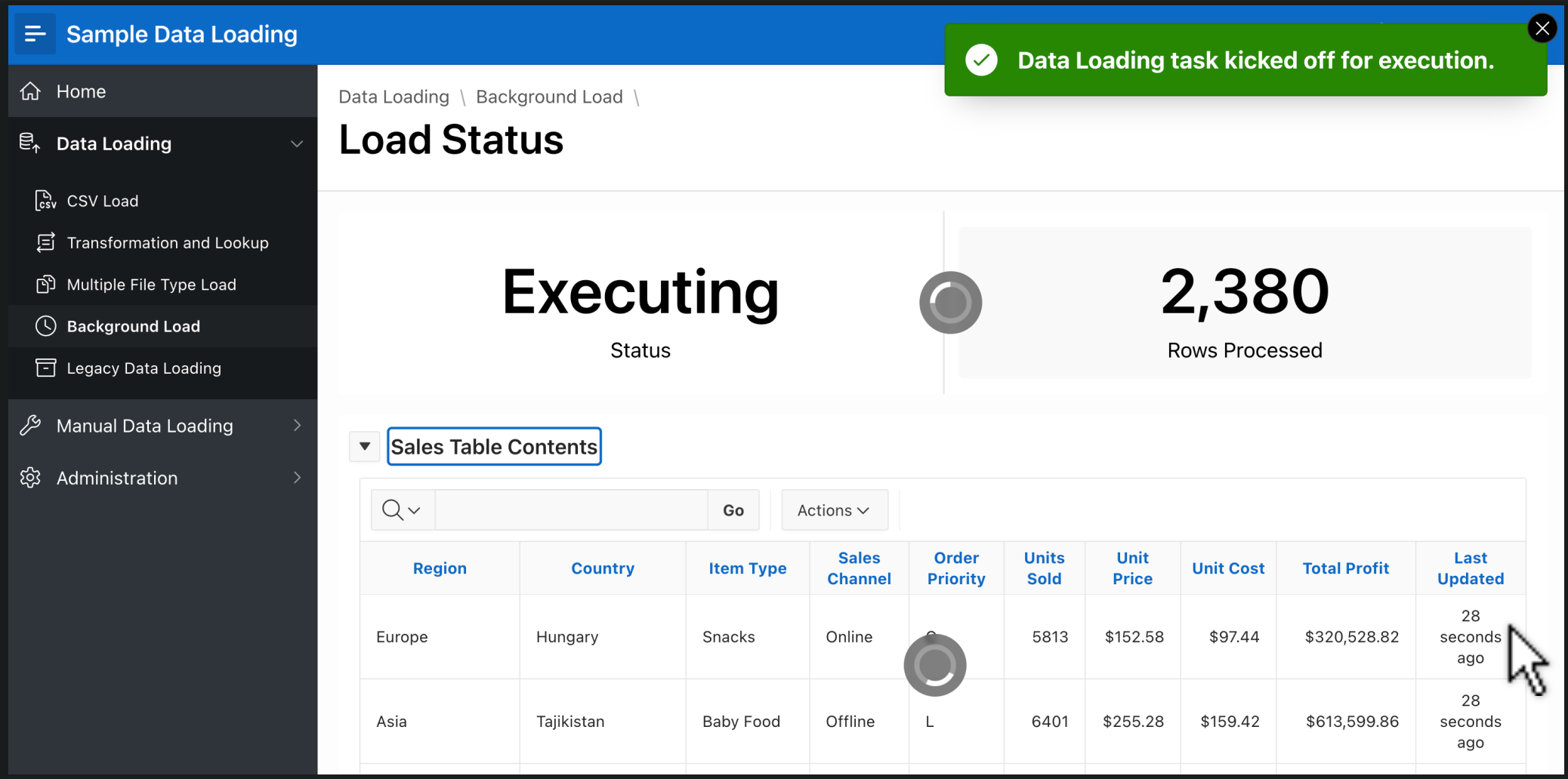
Temporary Files

Session State

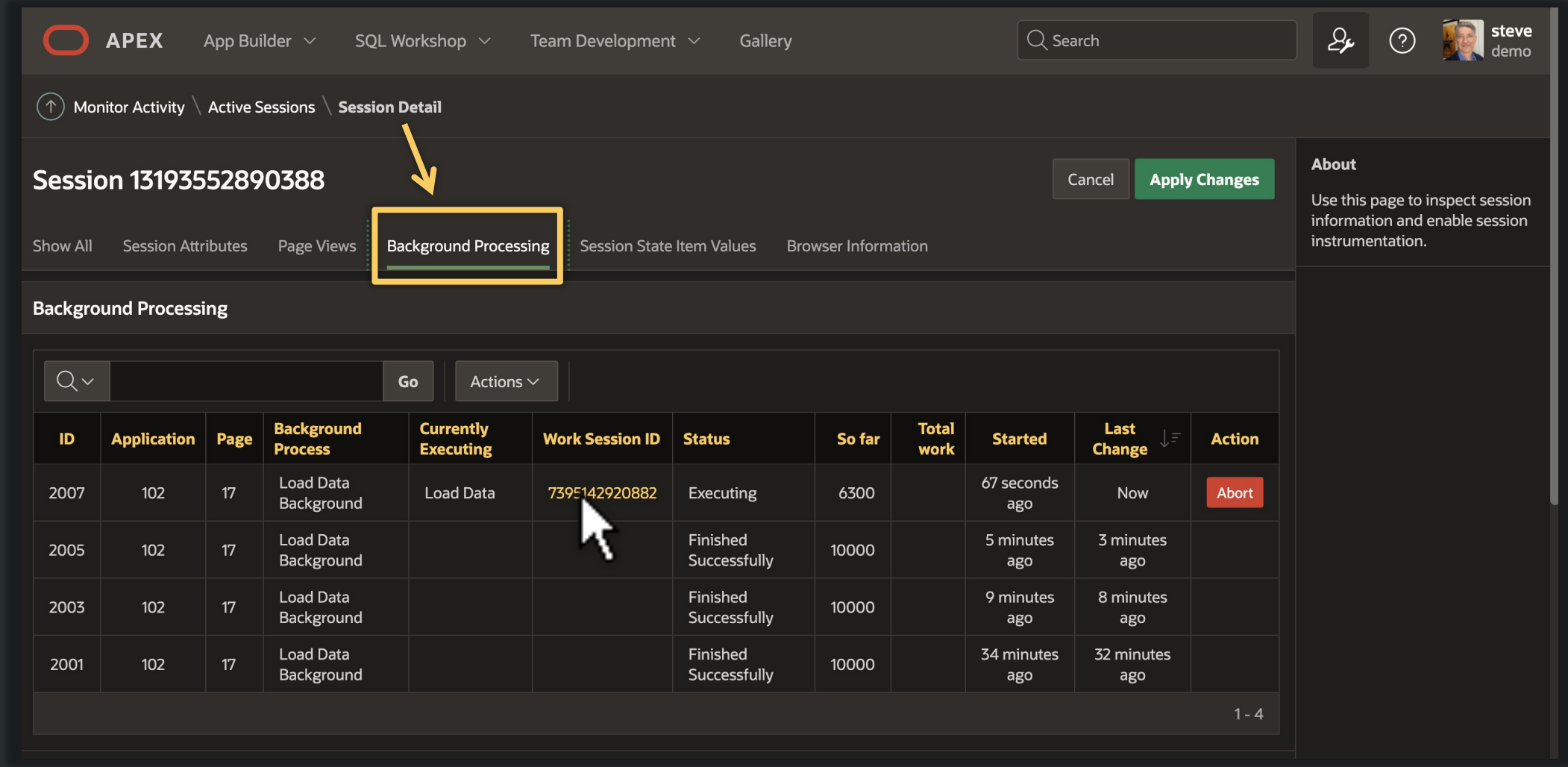
Name	Value
P1_ID	1234
P1_STATUS	*CONFIRMED*
P1_RESULT	*21-APR-2023*

Temporary Files

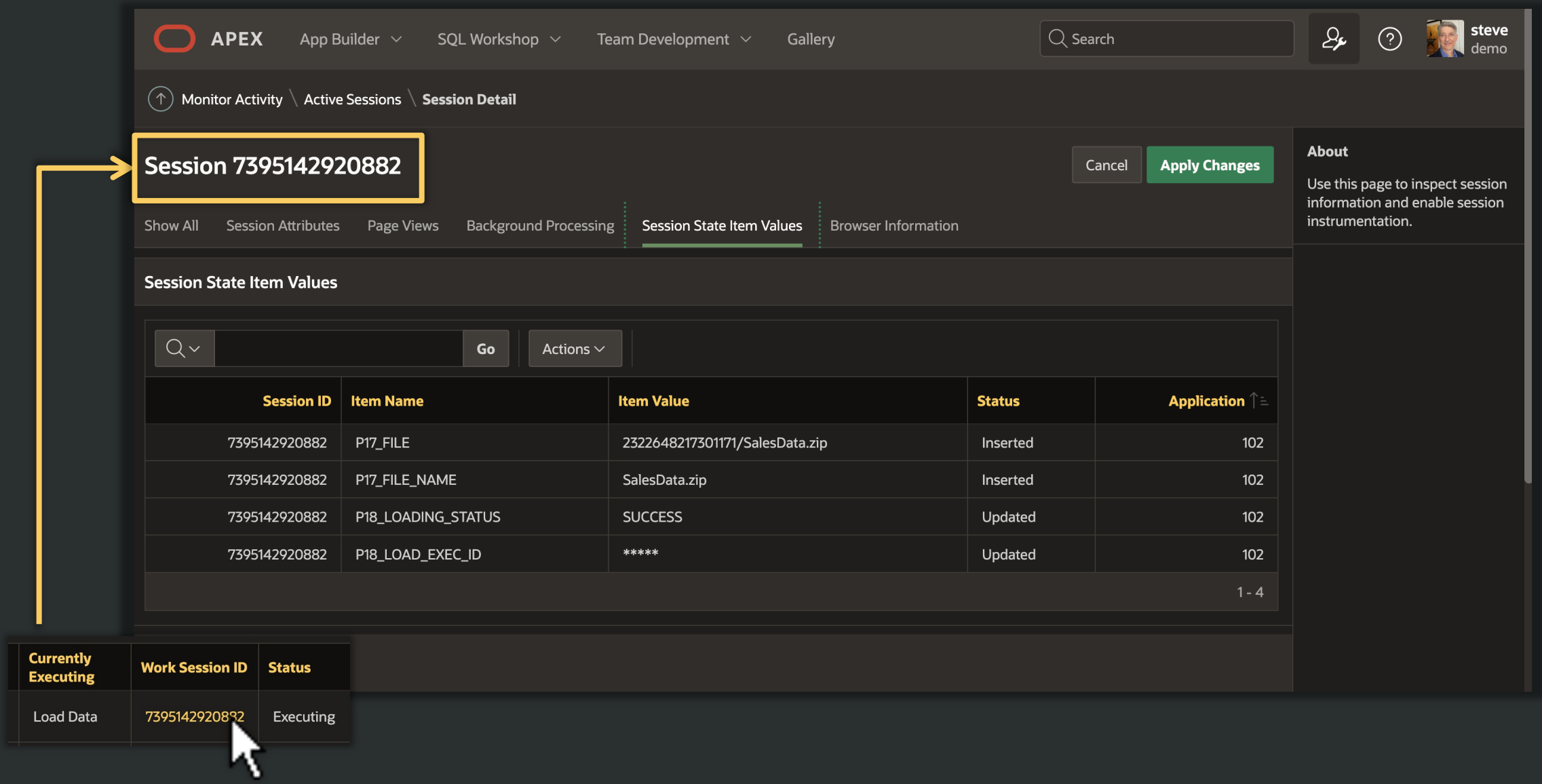
Monitoring Available While Background Processes Run



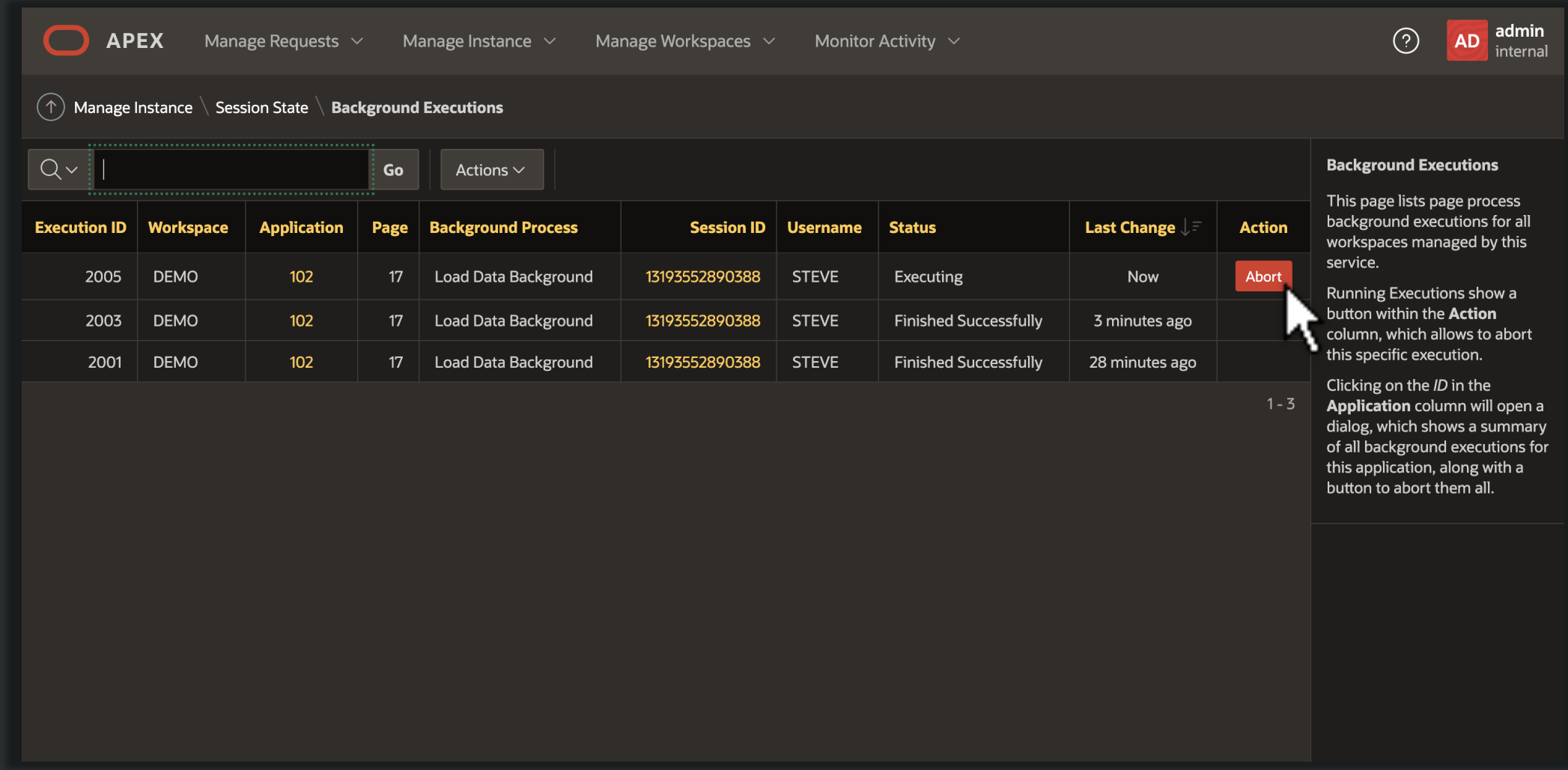
Monitoring Background Processes of an Active Session



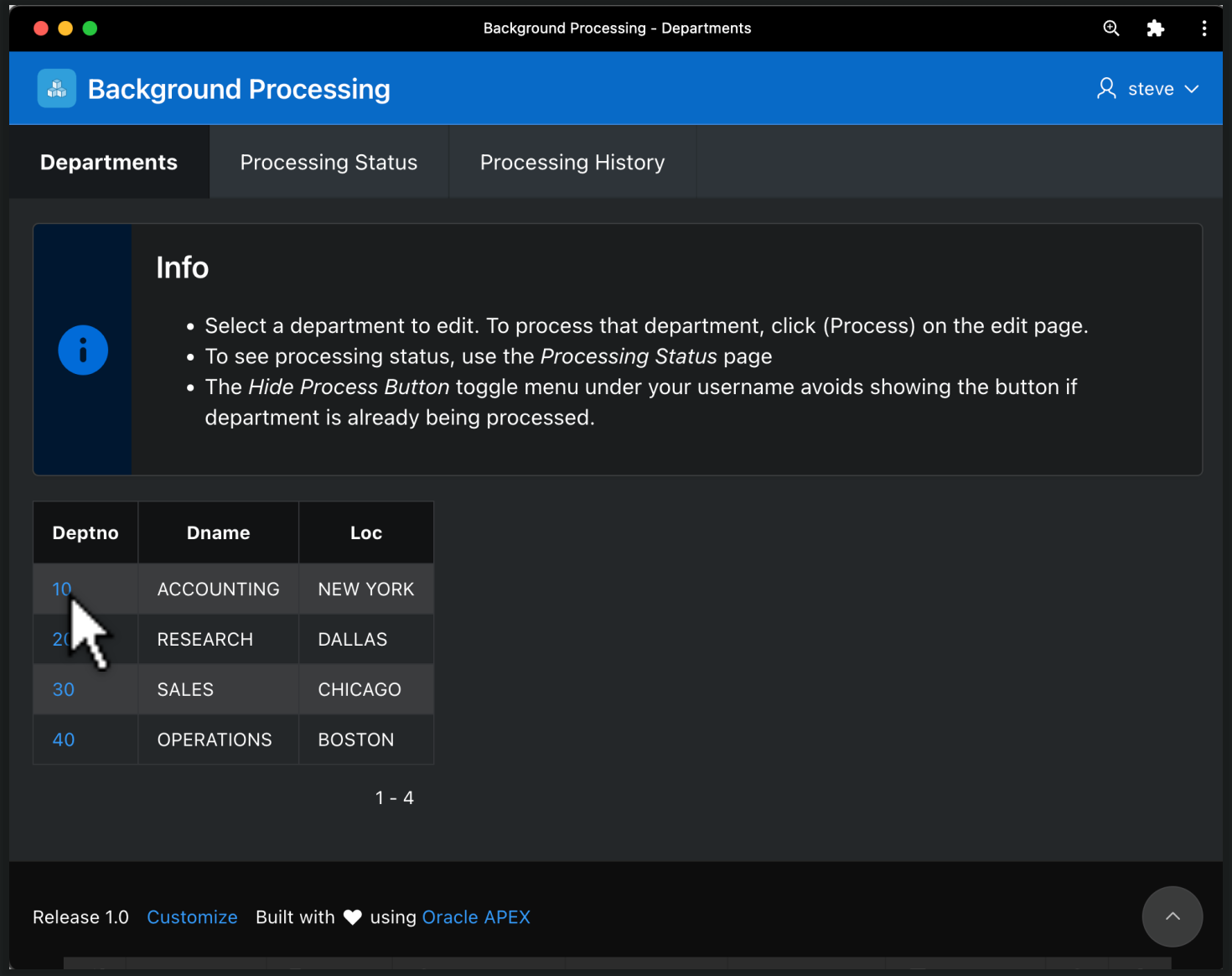
Monitoring Session Detail of a Background Process



Instance Admin Can See, Monitor, Abort Background Executions

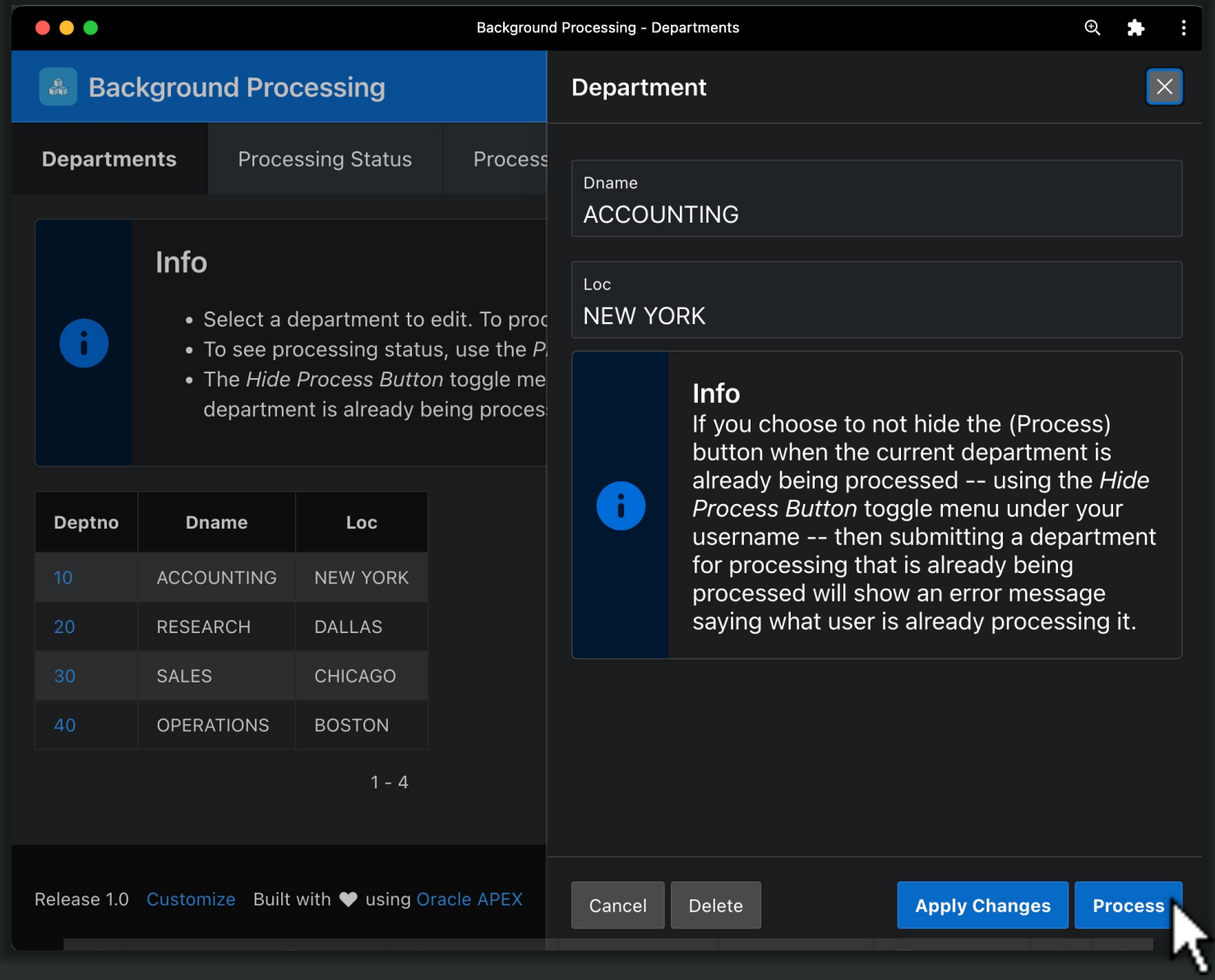


App Does Long-Running Processing on Departments



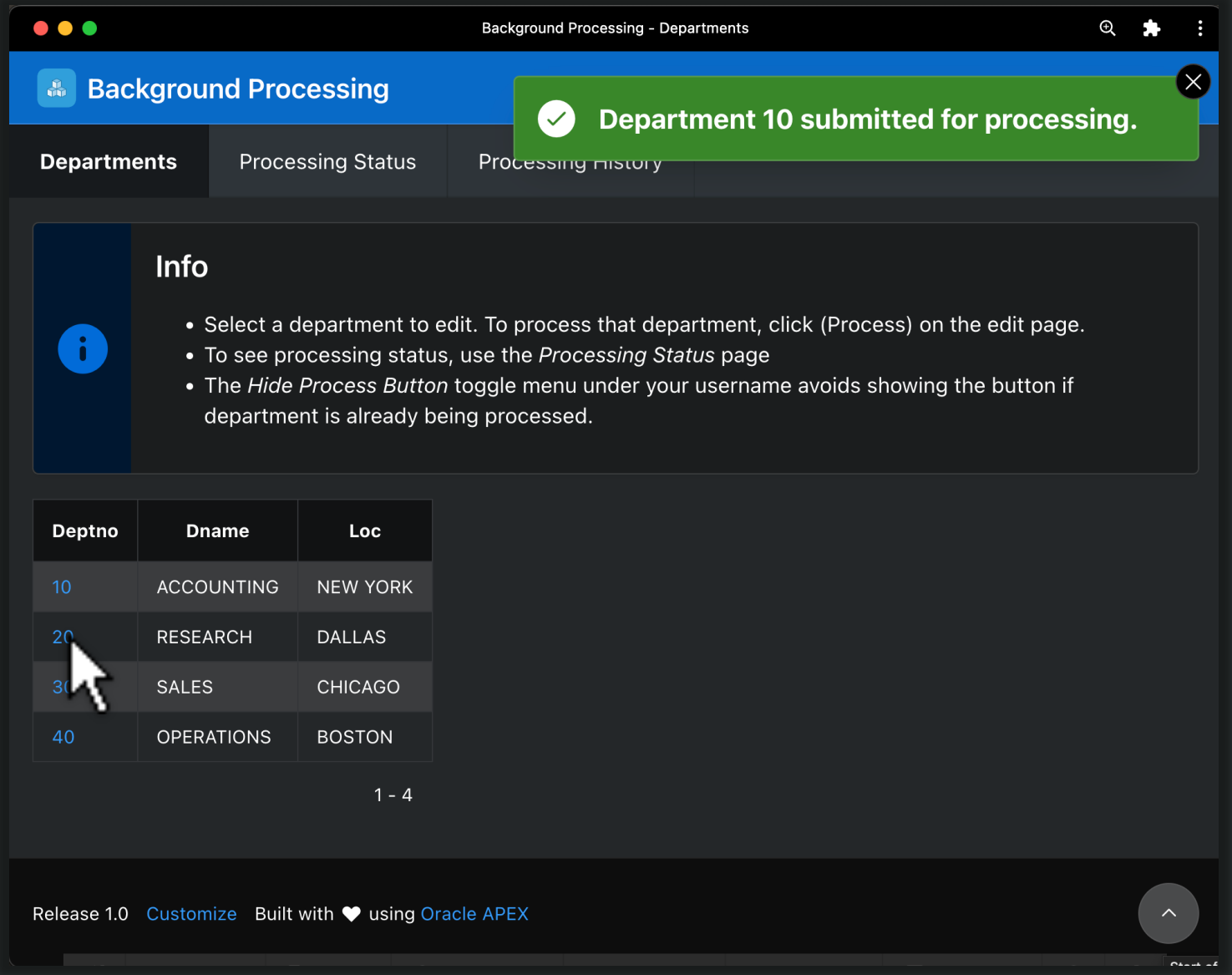
Steve

User Launches Long-Running Process for a Department



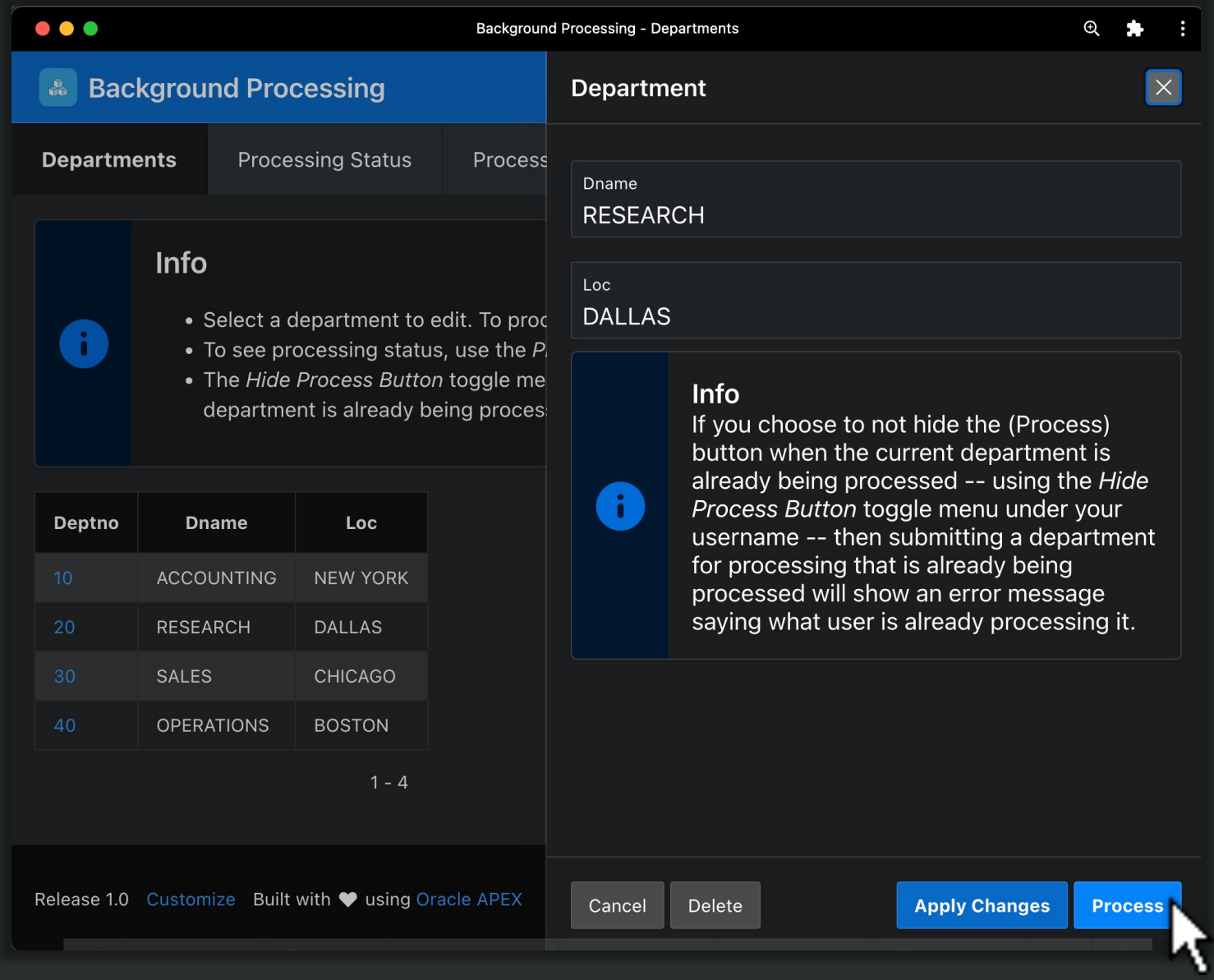
Steve

User Launches Long-Running Process for a Department



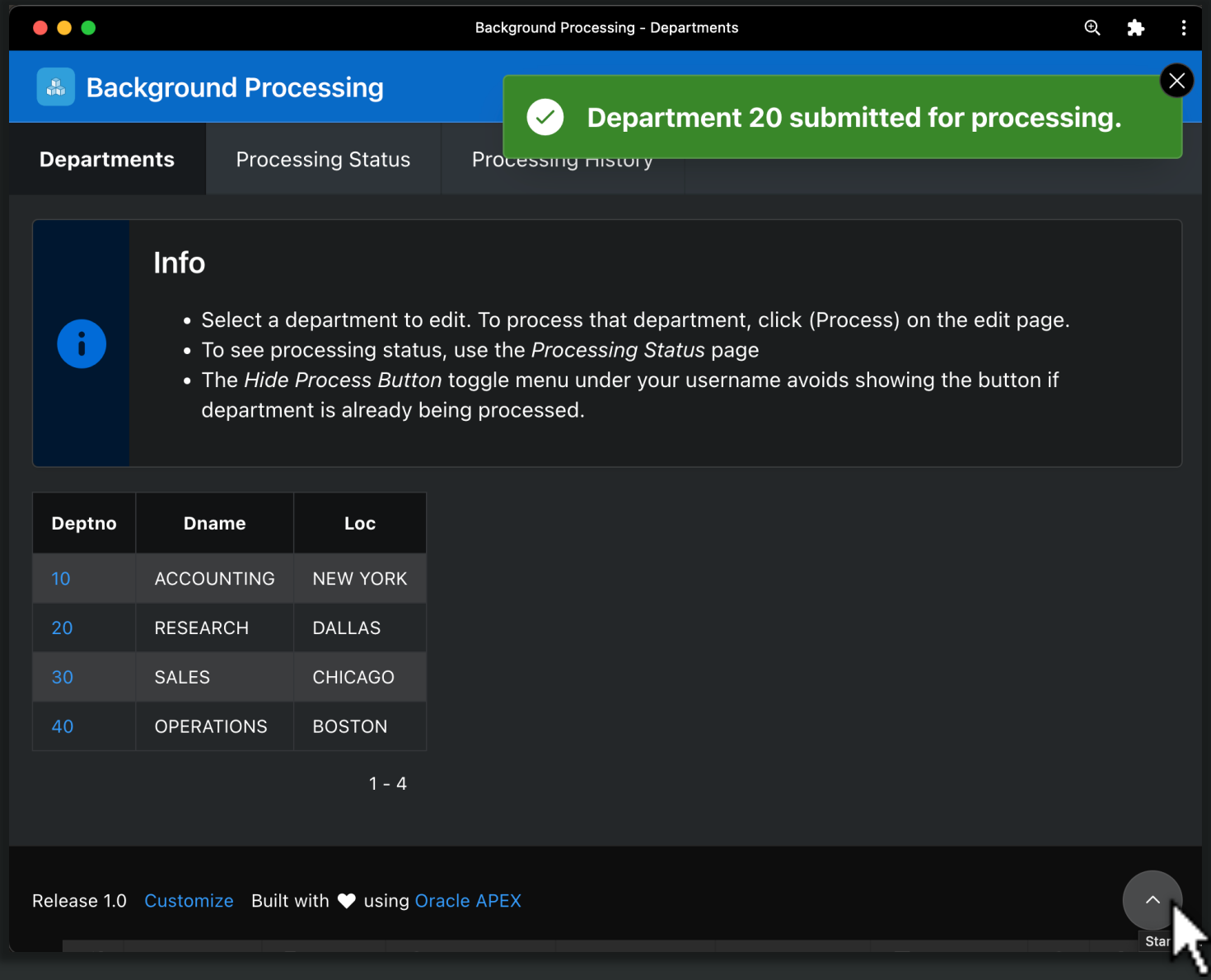
Steve

User Can Process Multiple Departments



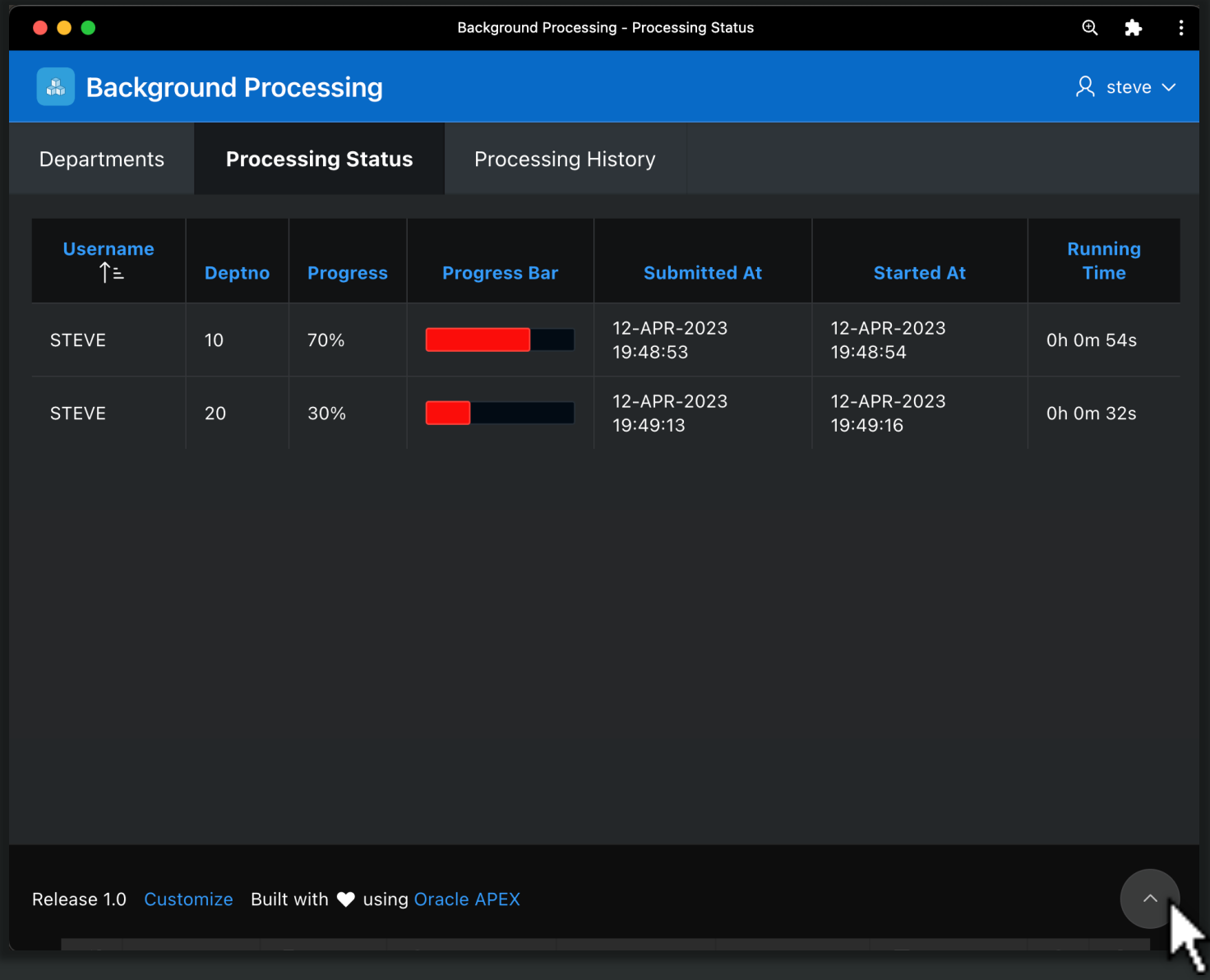
Steve

User Can Process Multiple Departments



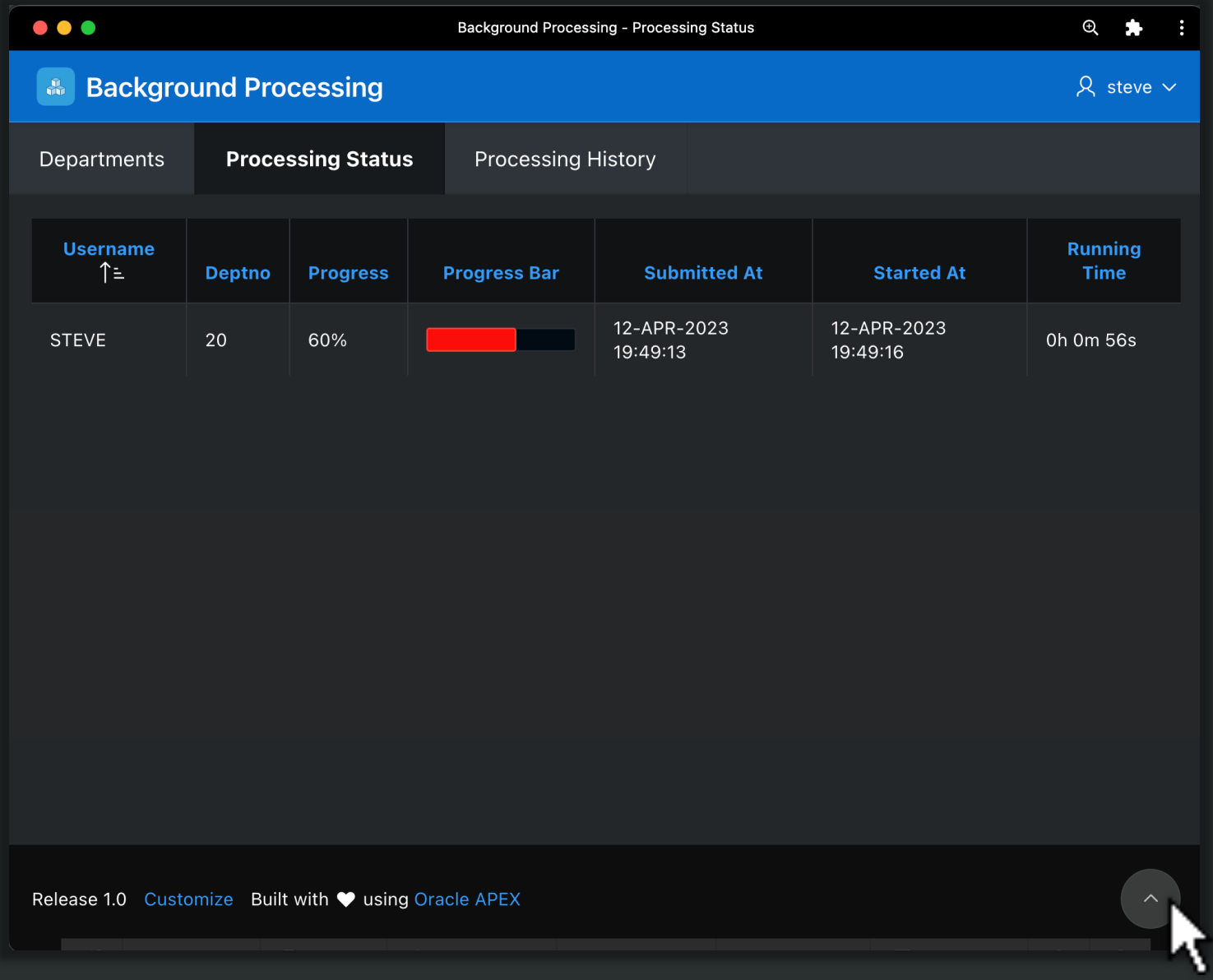
Steve

Users See Progress of Ongoing Background Processing



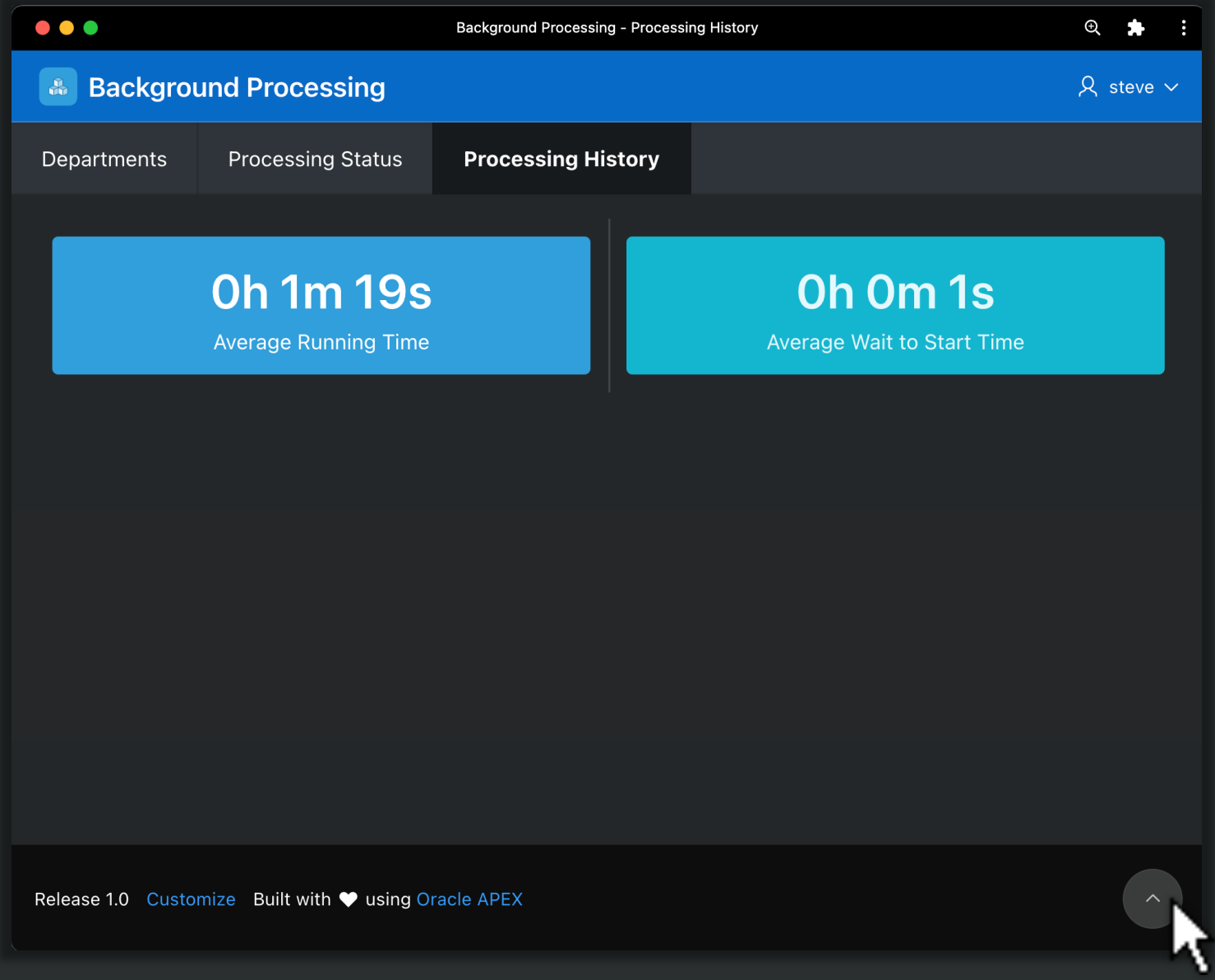
Steve

Users See Progress of Ongoing Background Processing



Steve

Users See Average Running & Wait-to-Start Times



Steve

Multiple Users Can Process Long-Running Processes

Background Processing - Processing Status

Background Processing

pat

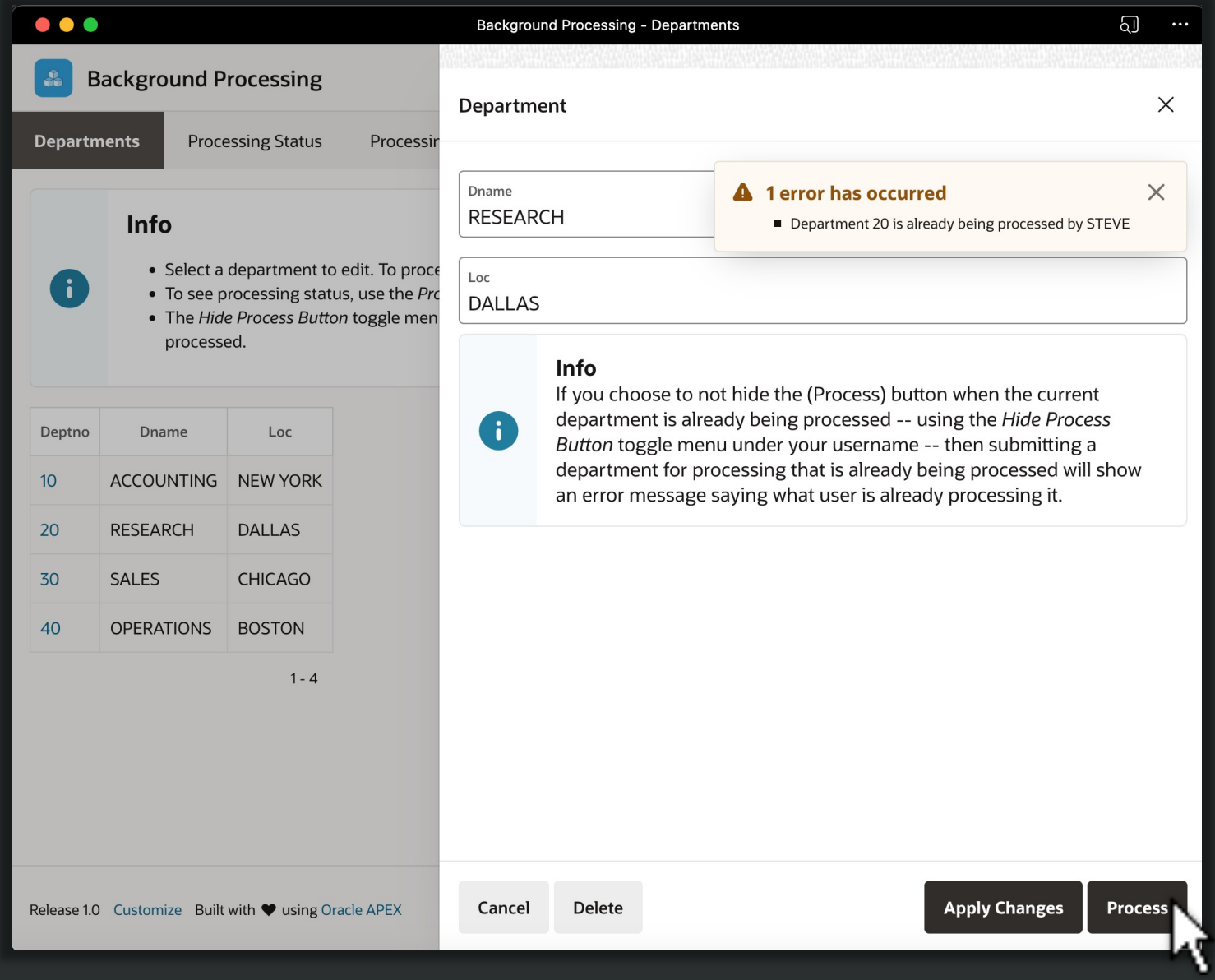
Departments | **Processing Status** | Processing History

Username	Deptno	Progress	Progress Bar	Submitted At	Started At	Running Time
PAT	30	10%		12-APR-2023 19:59:16	12-APR-2023 19:59:19	0h 0m 15s
STEVE	20	40%		12-APR-2023 19:58:58	12-APR-2023 19:59:01	0h 0m 33s
STEVE	10	60%		12-APR-2023 19:58:52	12-APR-2023 19:58:54	0h 0m 40s

Release 1.0 Customize Built with ❤ using Oracle APEX

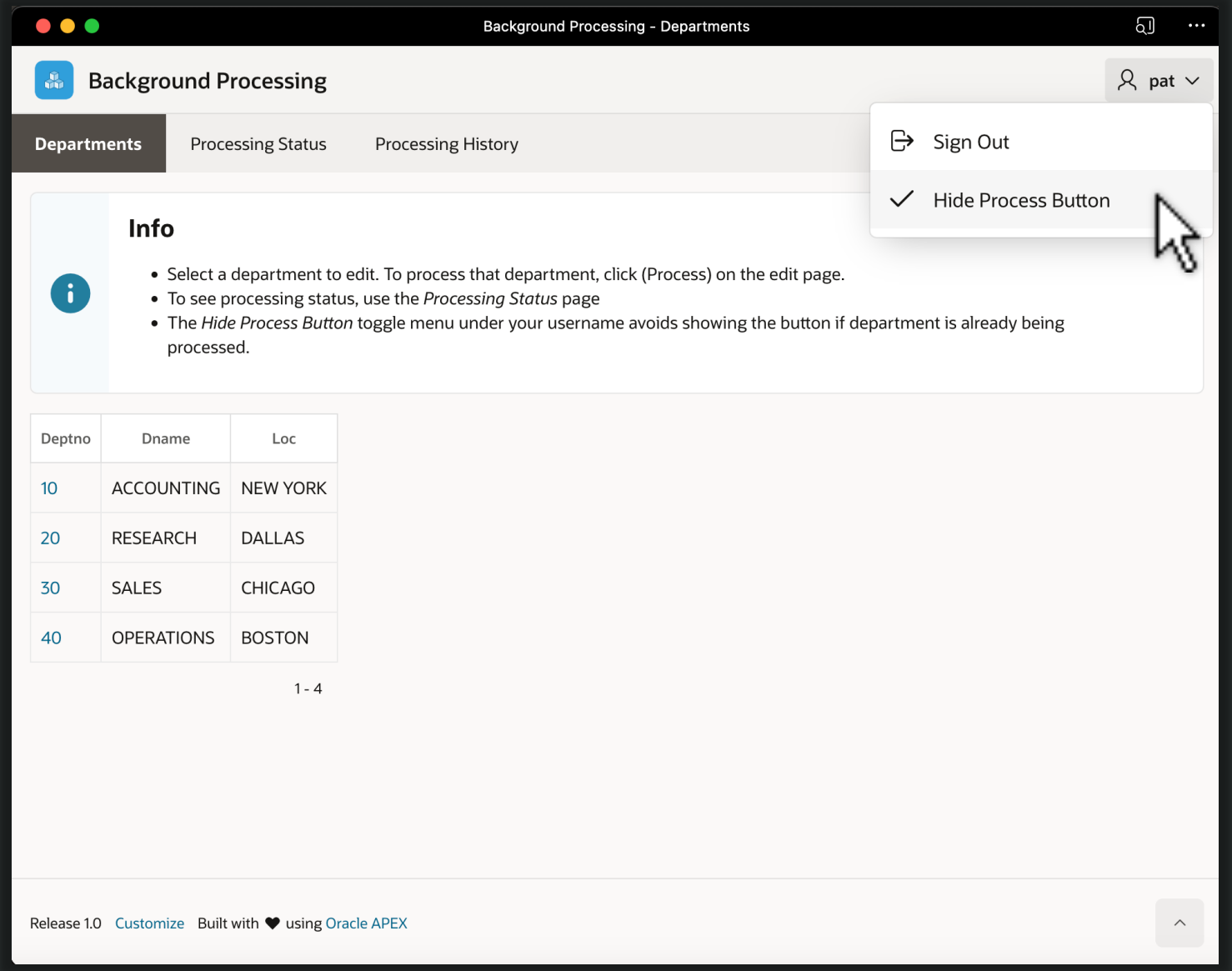
Pat

Department Being Processed Can't Be Processed Again



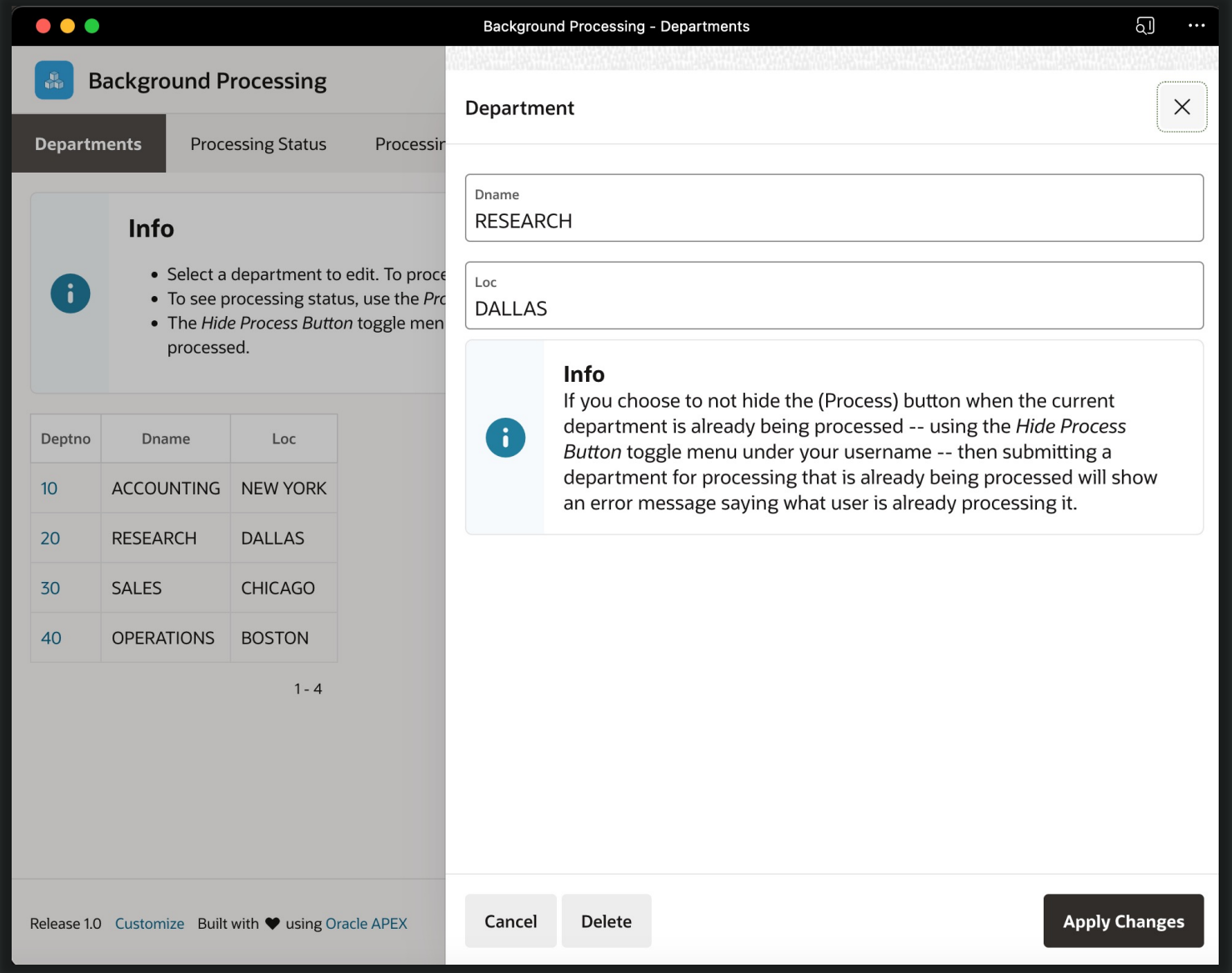
Pat

We Might Opt to Hide the Process Button in This Case



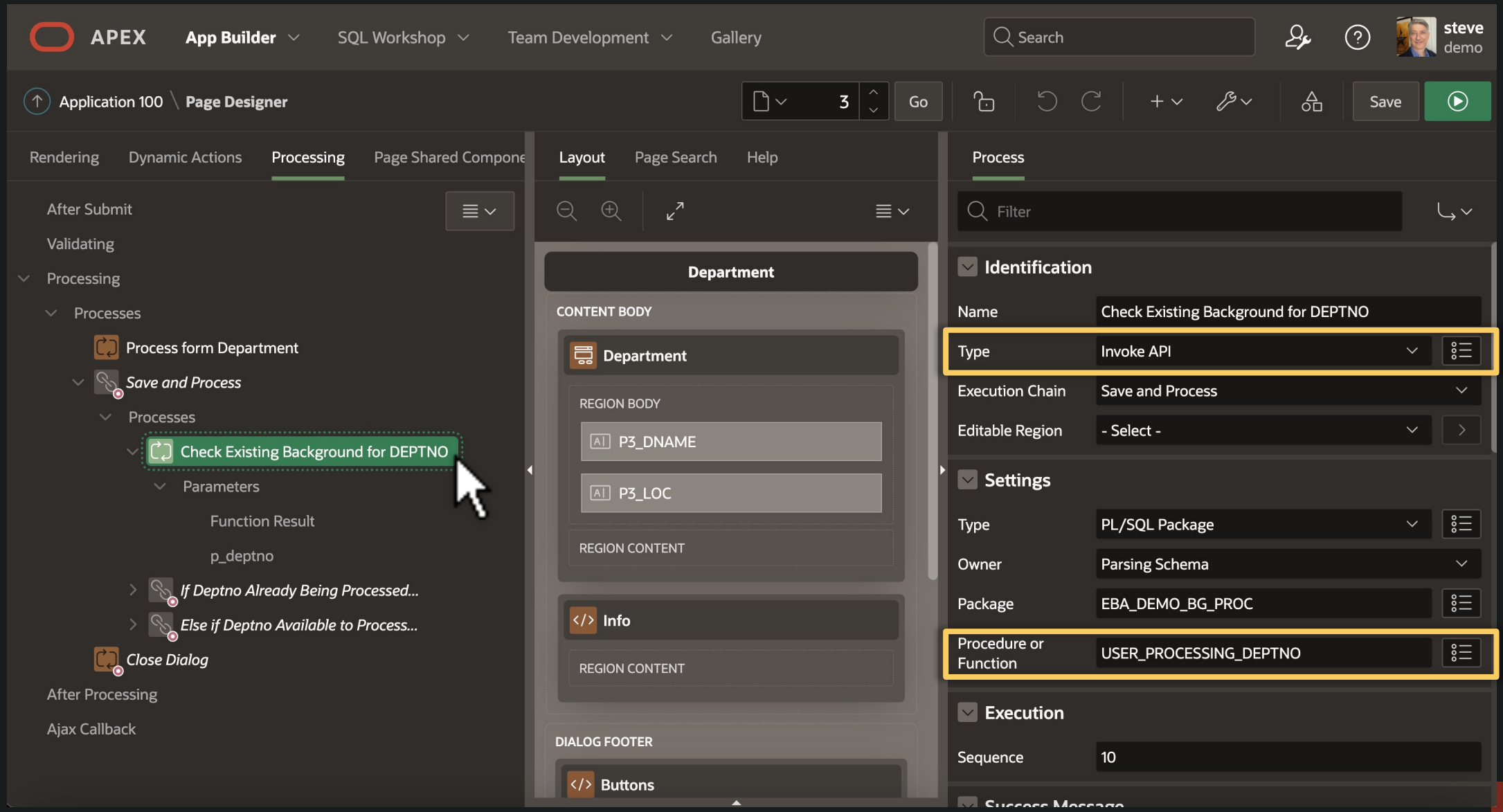
Pat

To Prevent the User from Seeing an Error Message

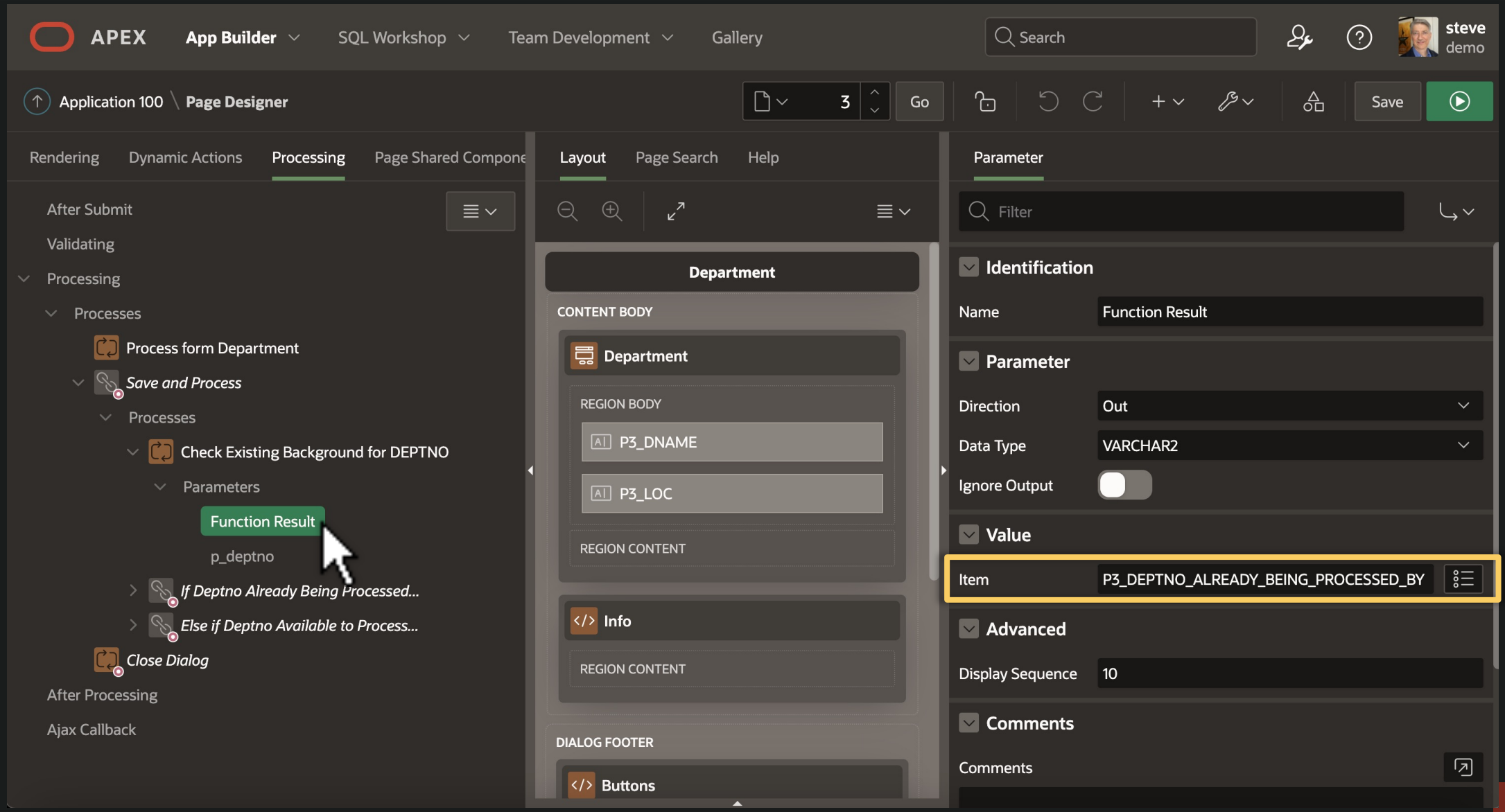


Pat

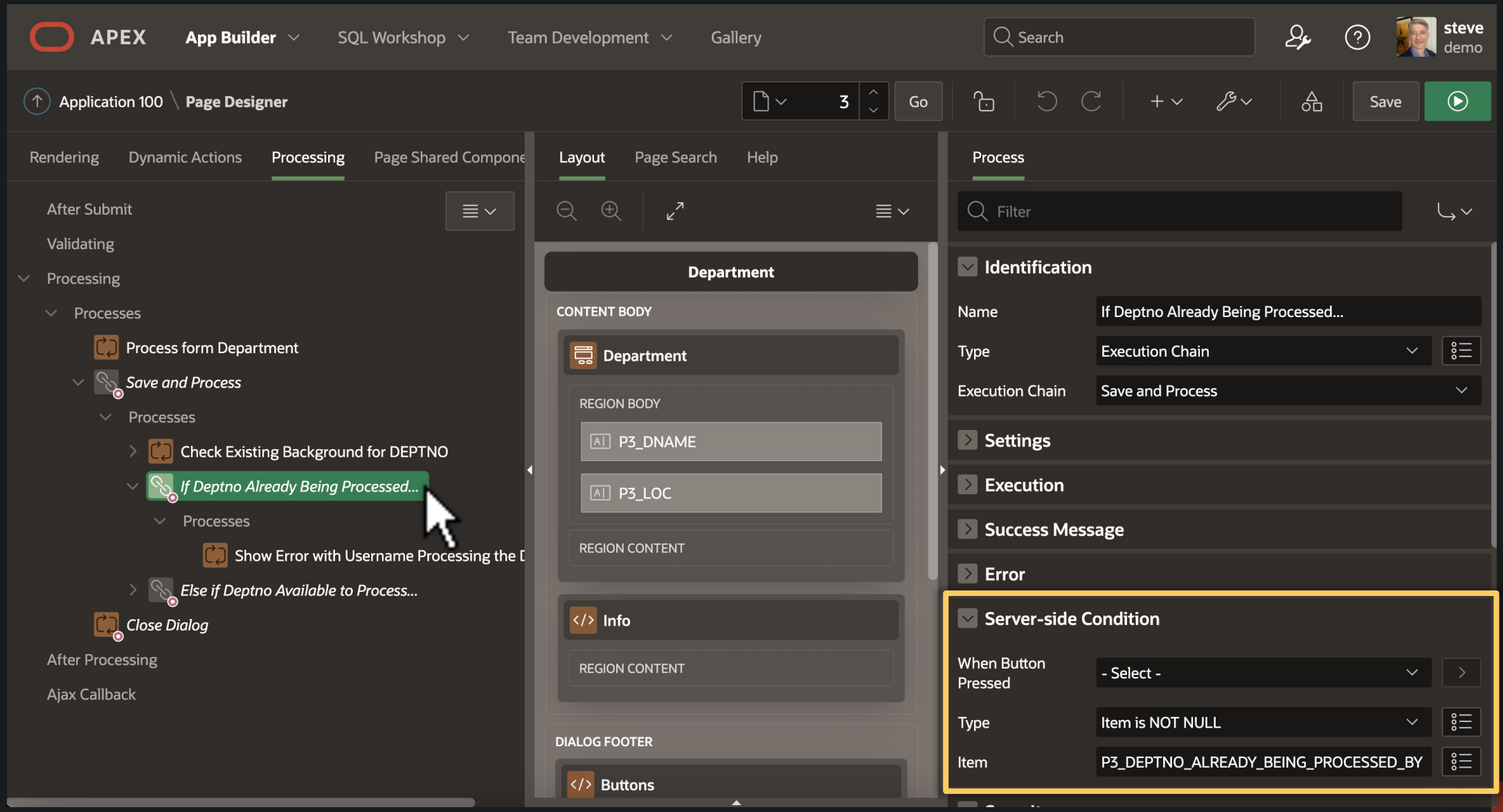
First Check if Department is Already Being Processed



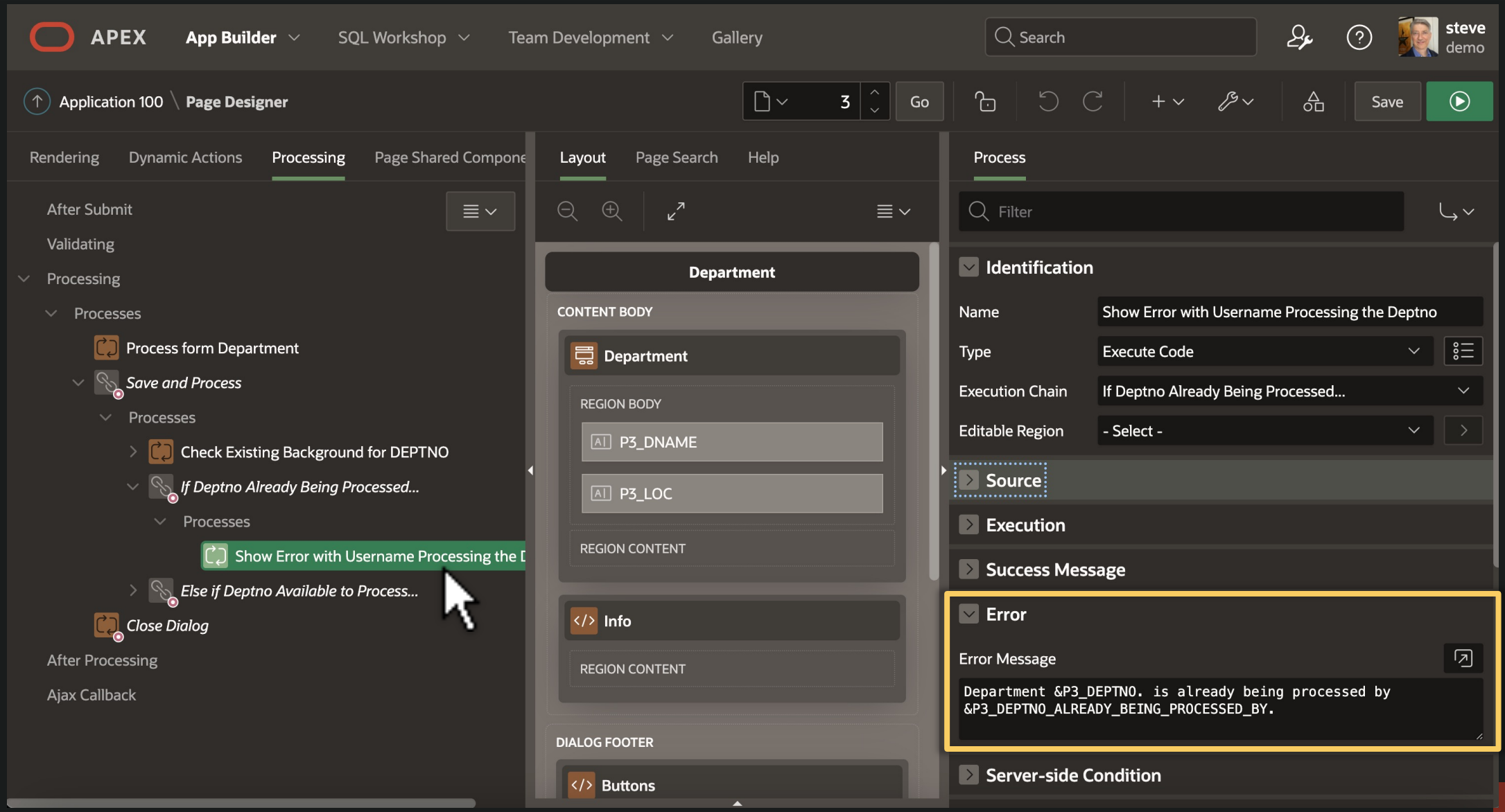
Store the Function Result in a Page Item to Use Later



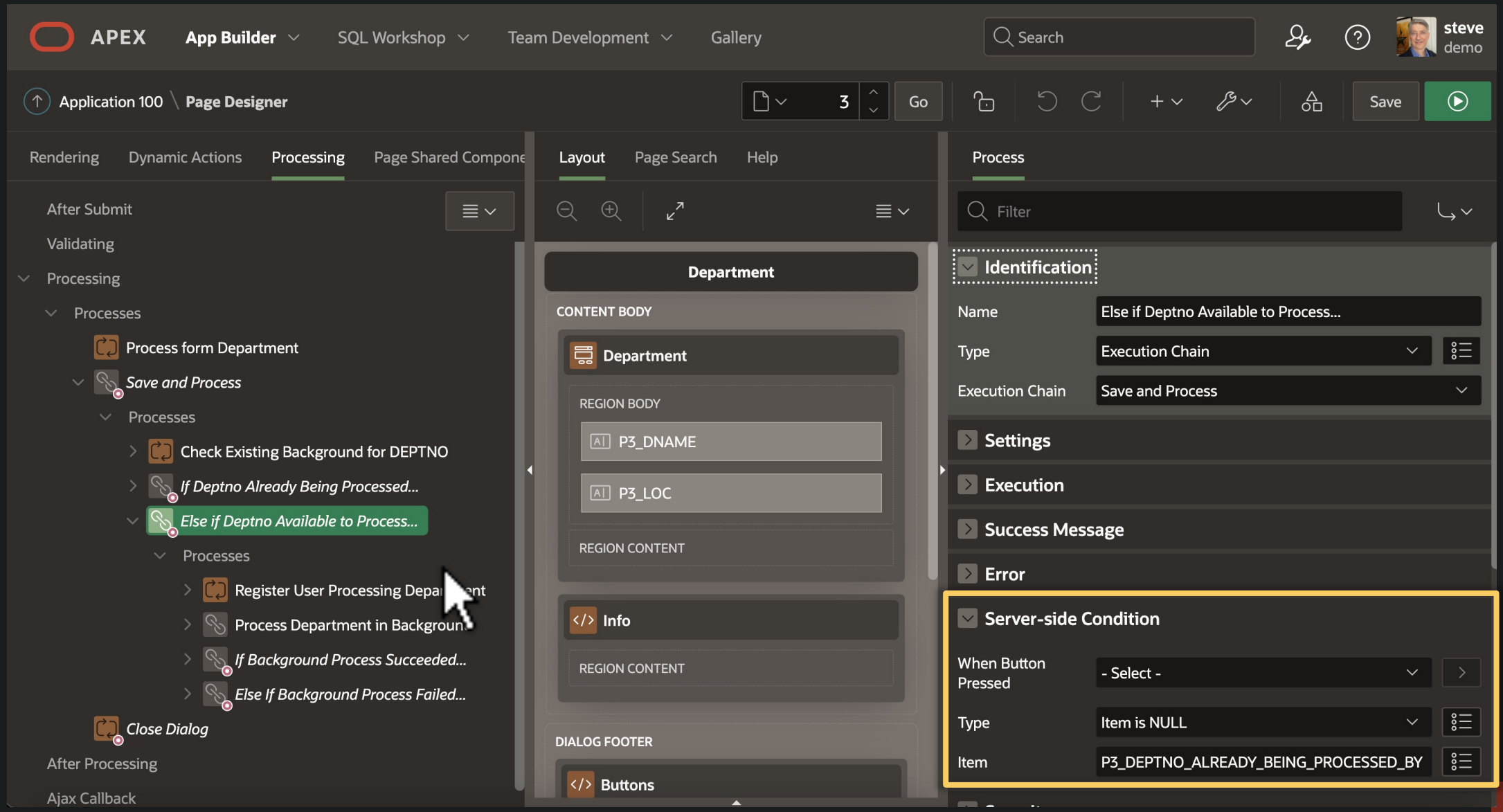
If Department is Already Being Processed...



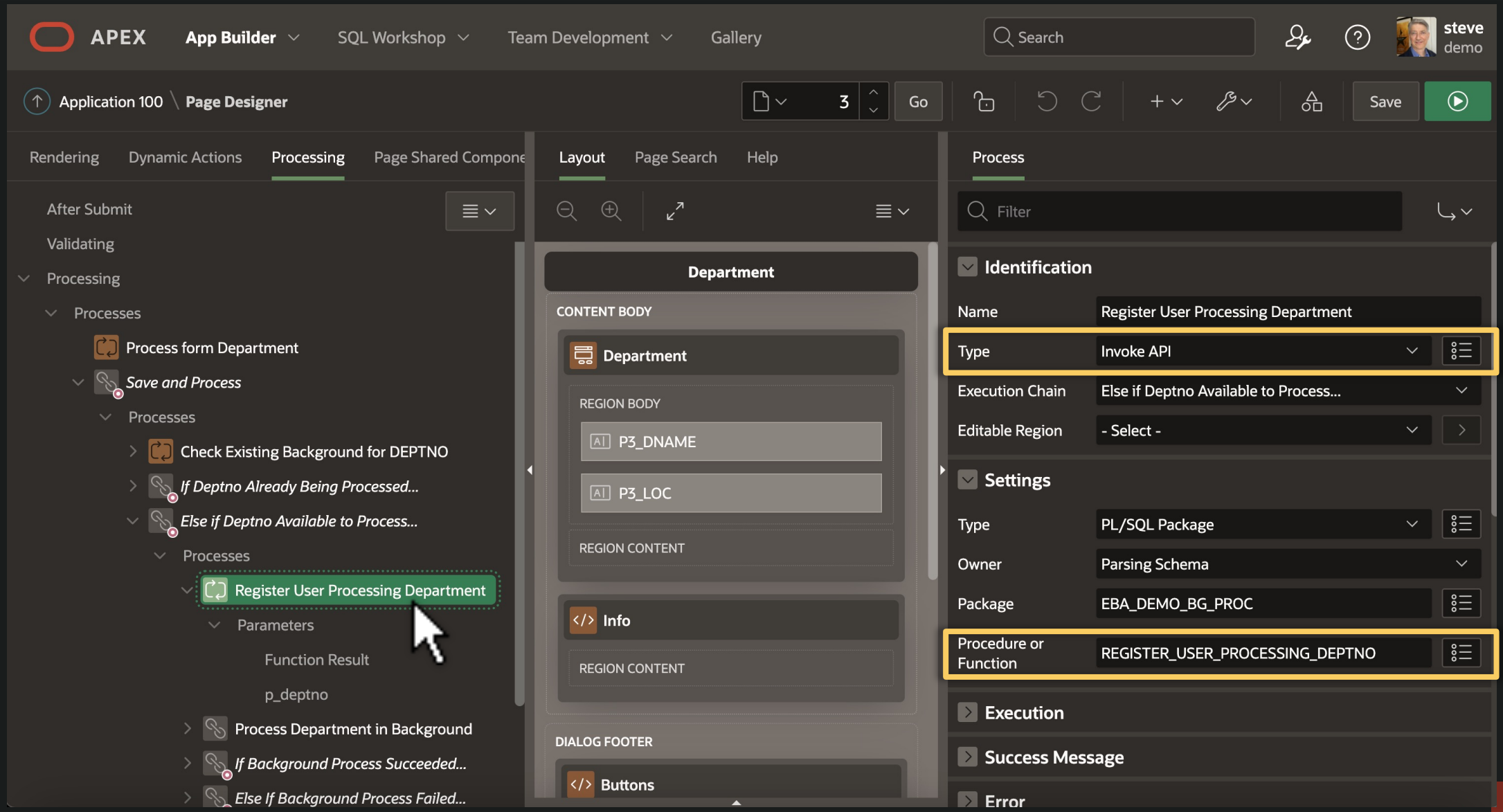
Show a Custom Error Message to the User



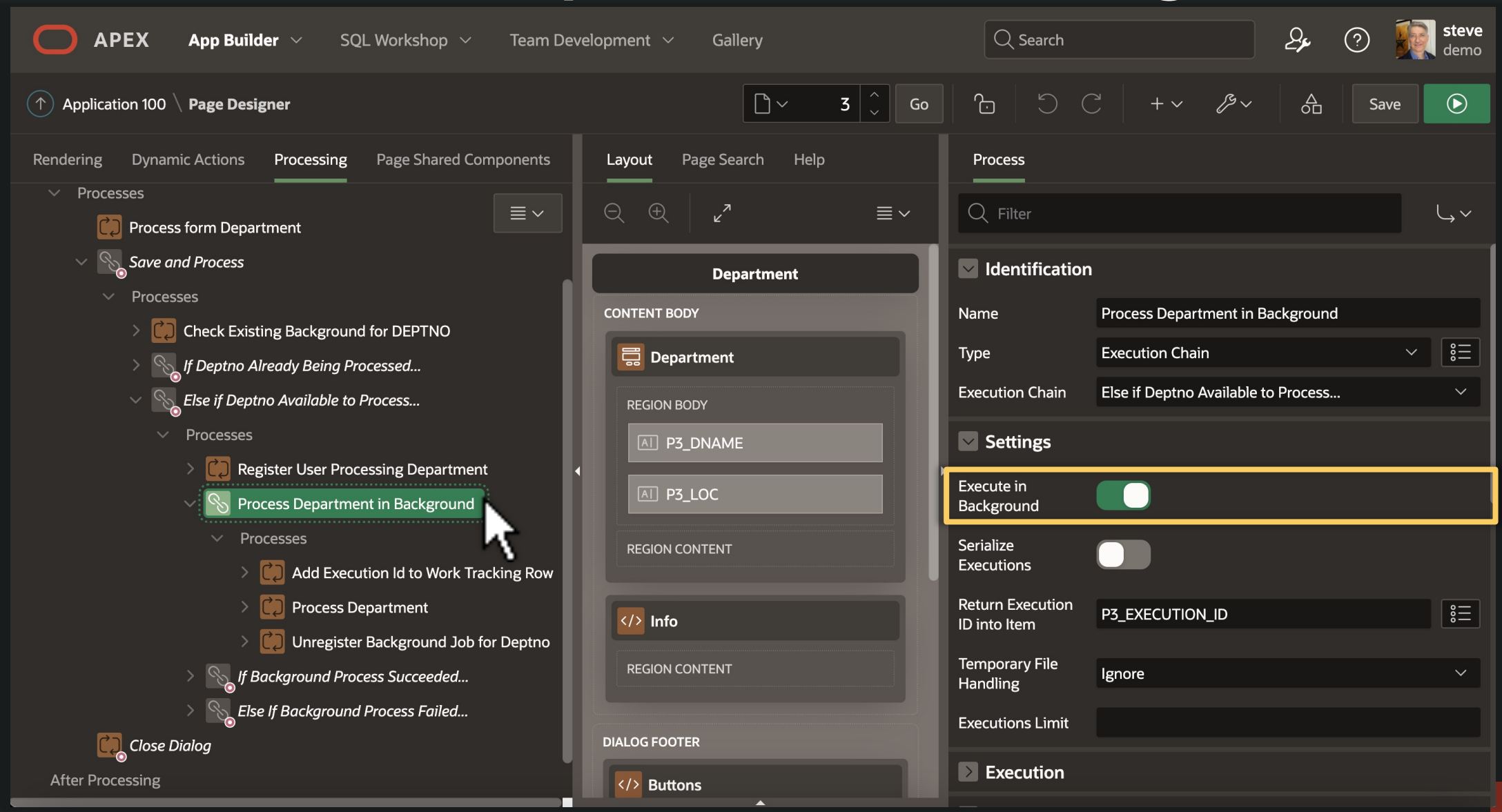
… Else If Department is Available to Process

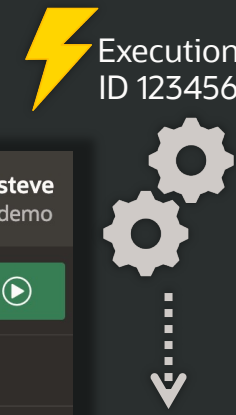


Register the (User,Deptno) in a Custom Tracking Table



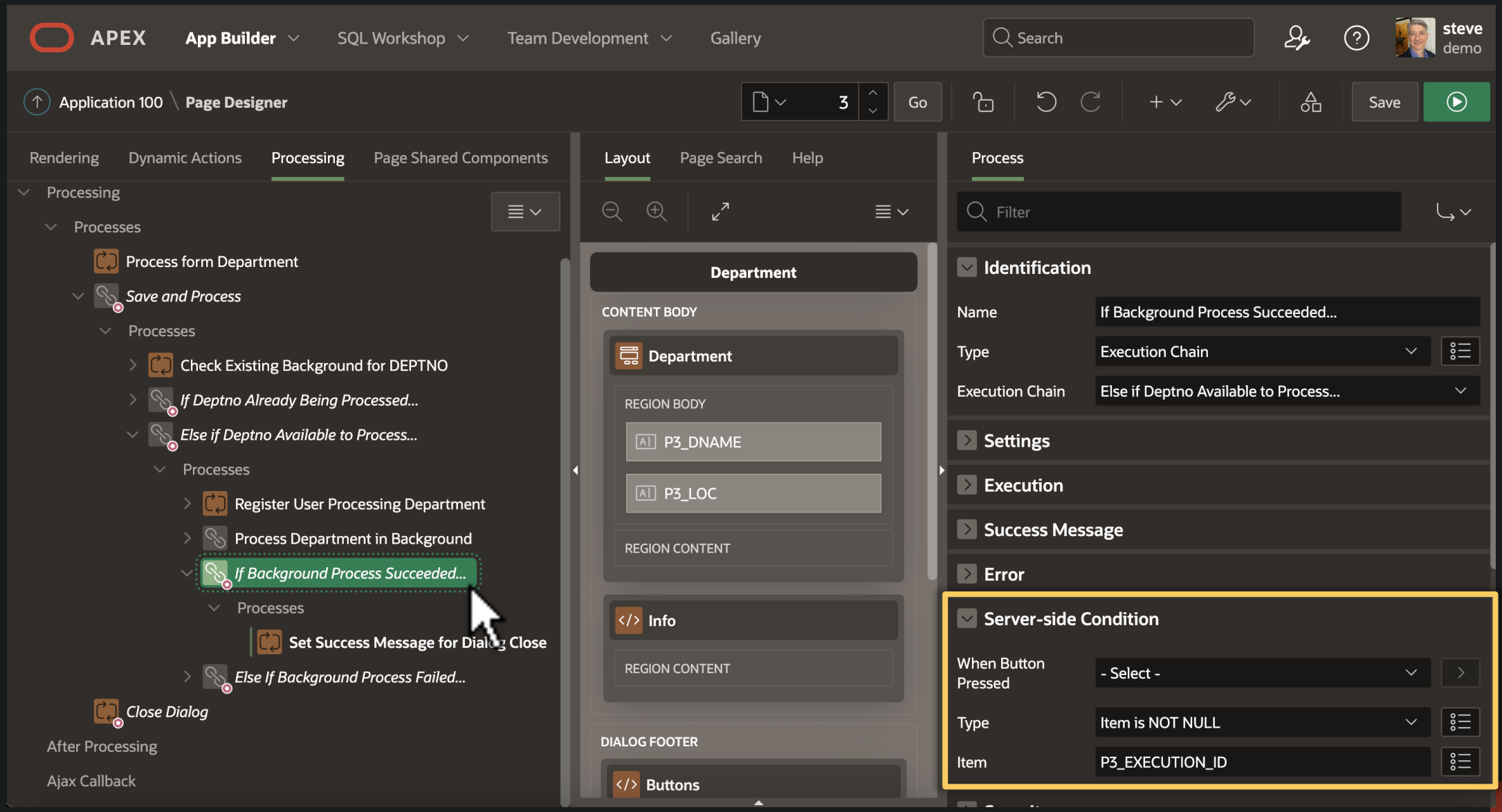
Next, Process the Department in the Background





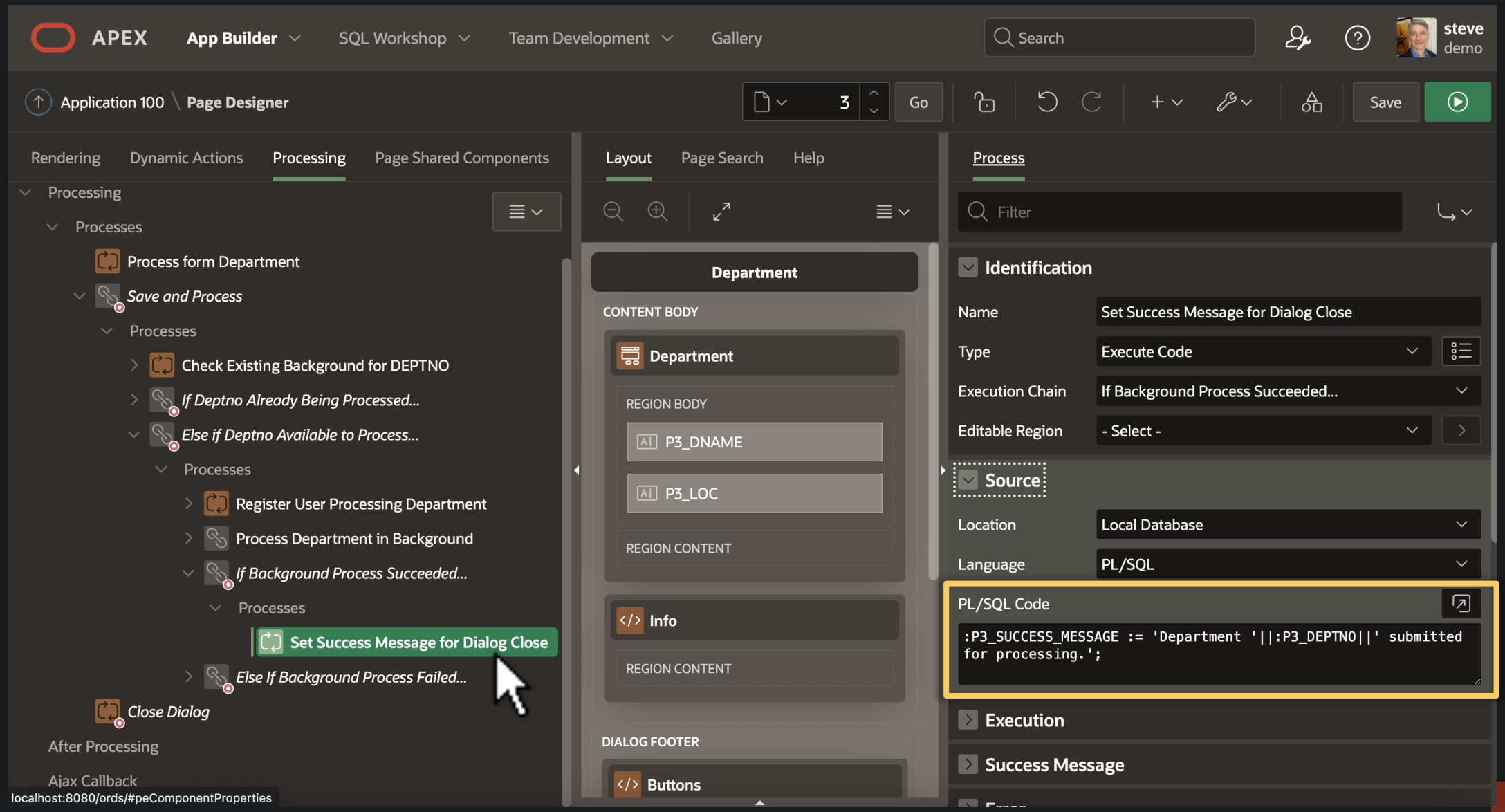
If the Background Execution Started Successfully...

Execution ID 123456



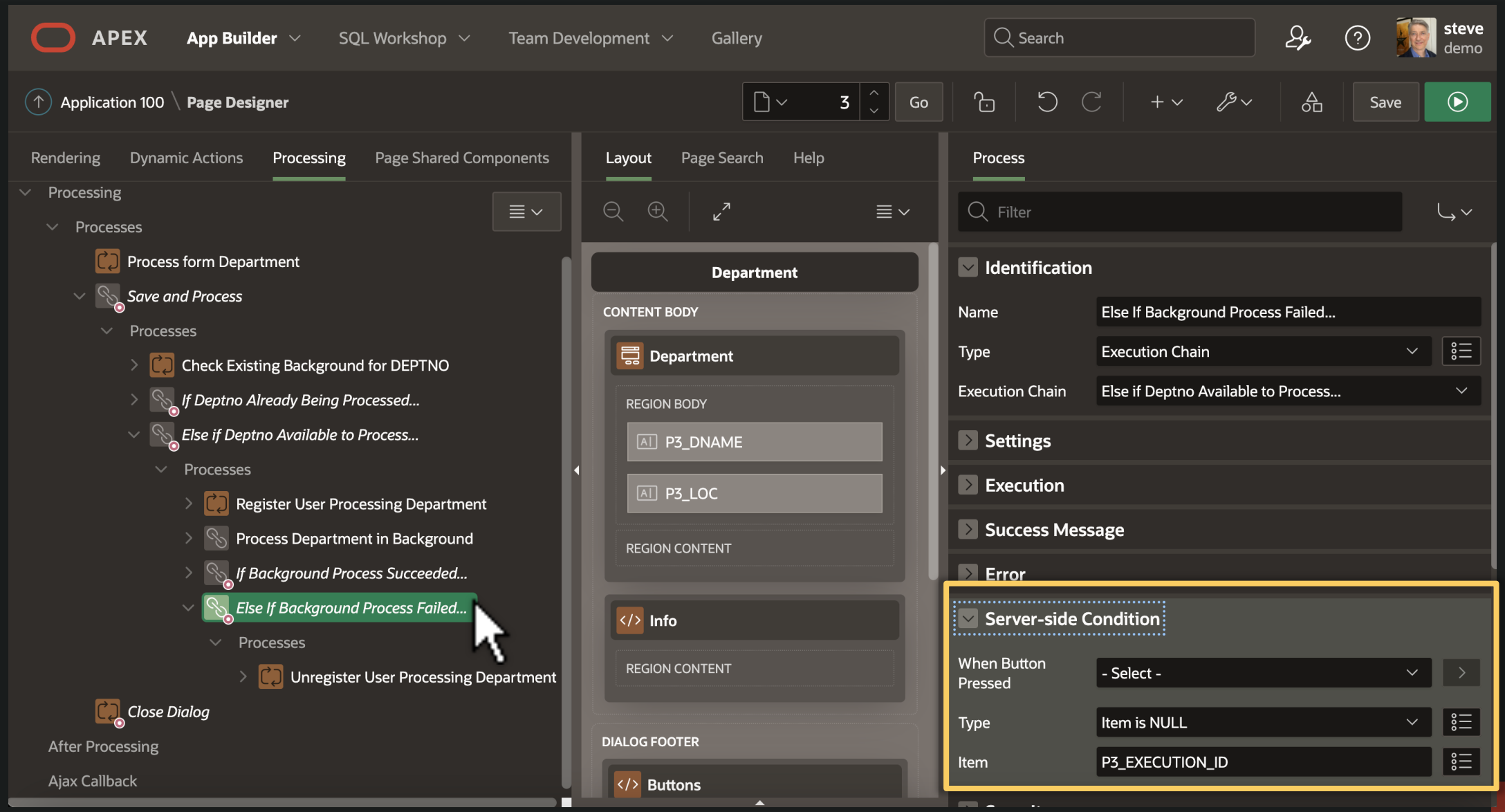
… Set the Success Message to Return to Caller

Execution ID 123456



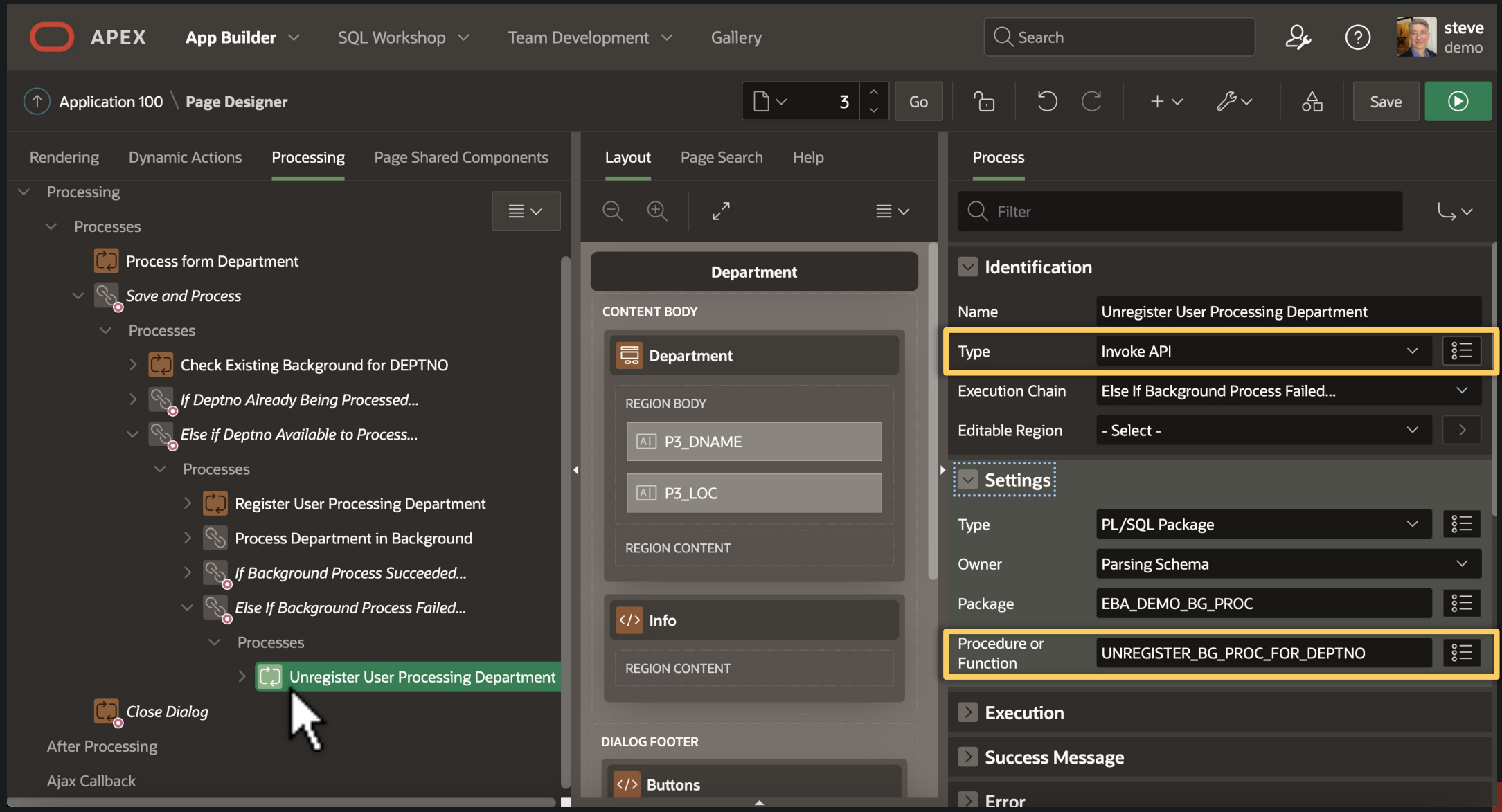
… Else if Background Process Didn't Start as Expected

Execution ID 123456



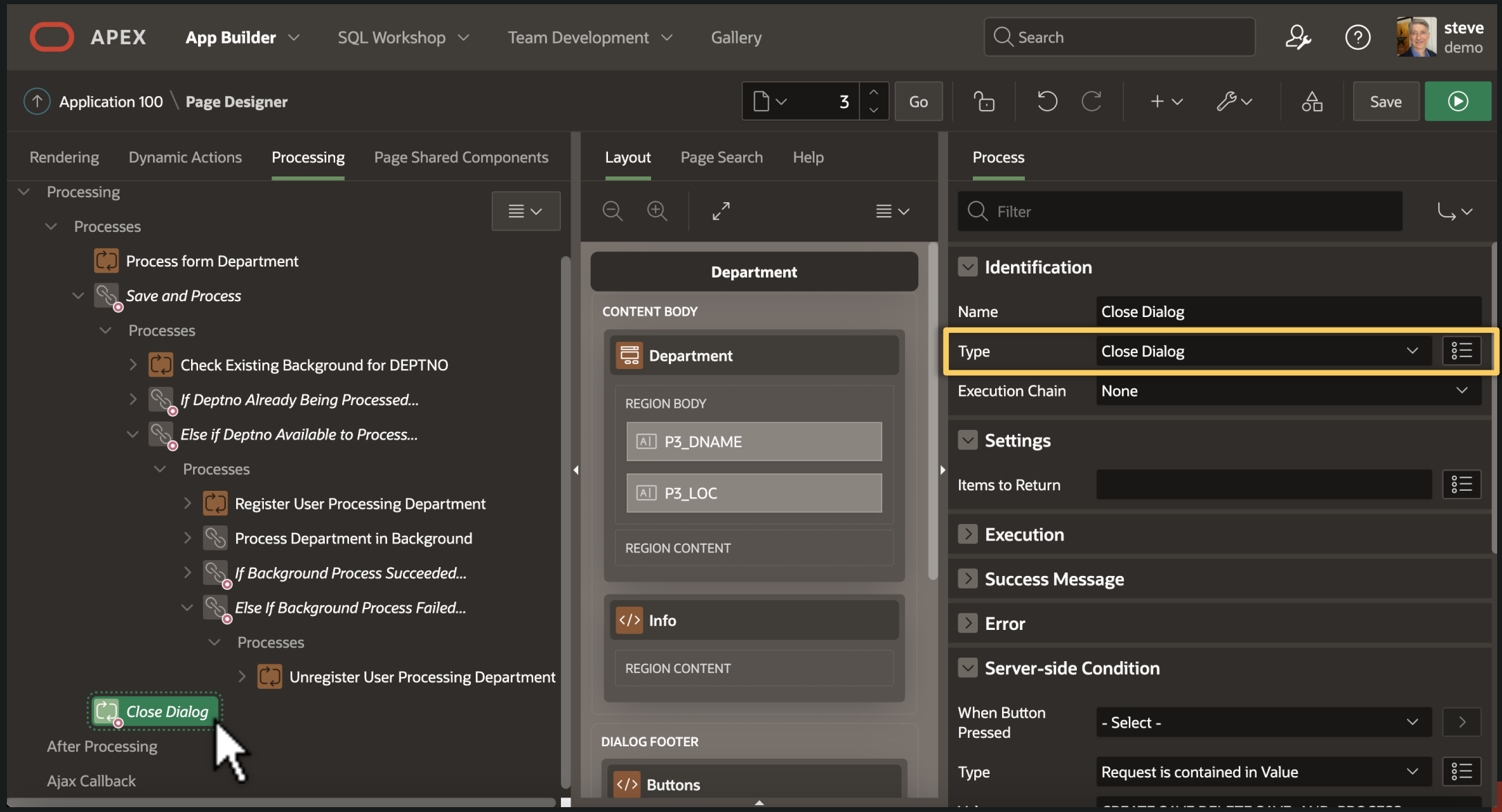
Unregister (User,Deptno) from Custom Tracking Table

Execution ID 123456



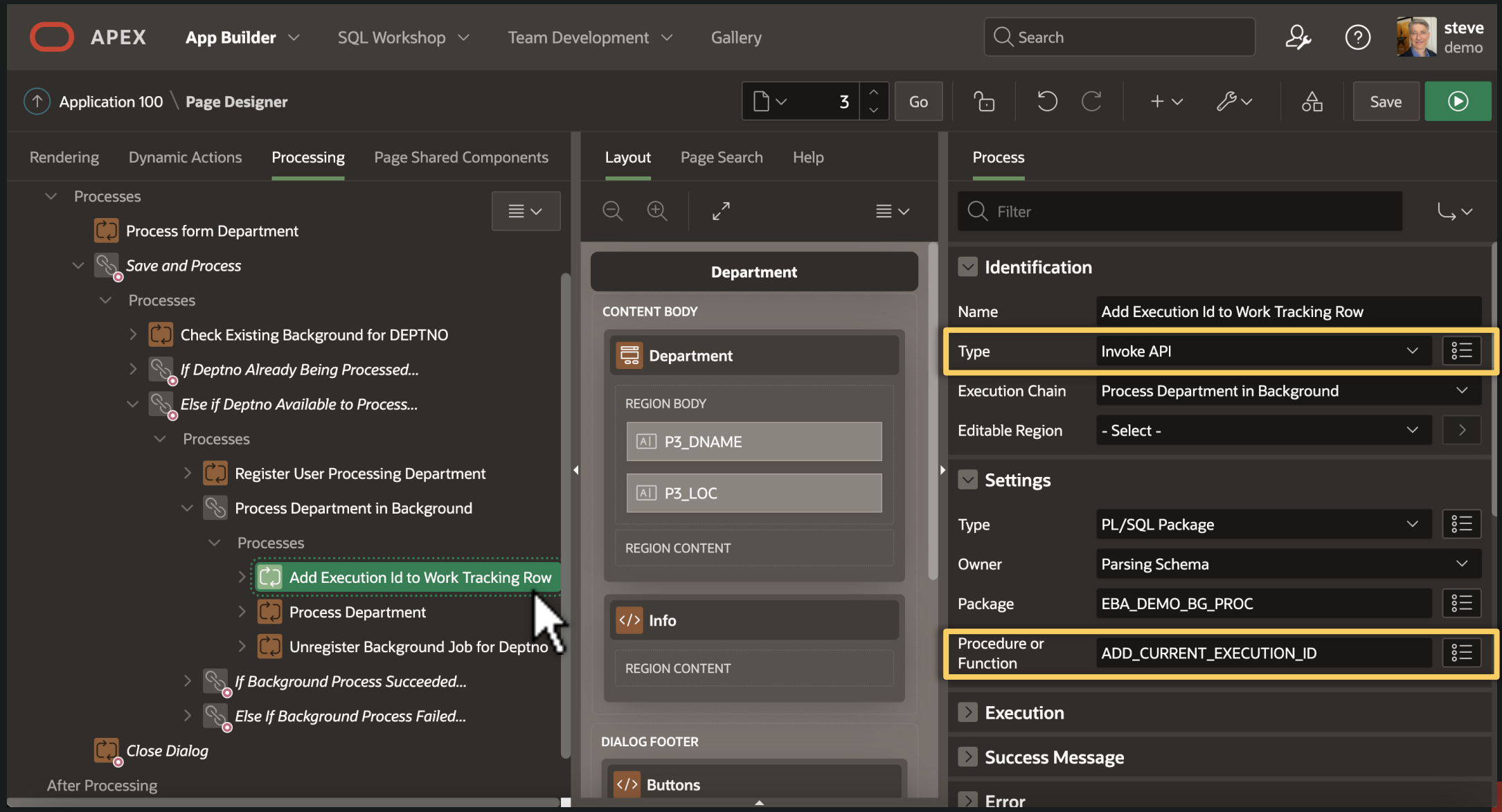
Close the Dialog and Return to Calling Page

Execution ID 123456



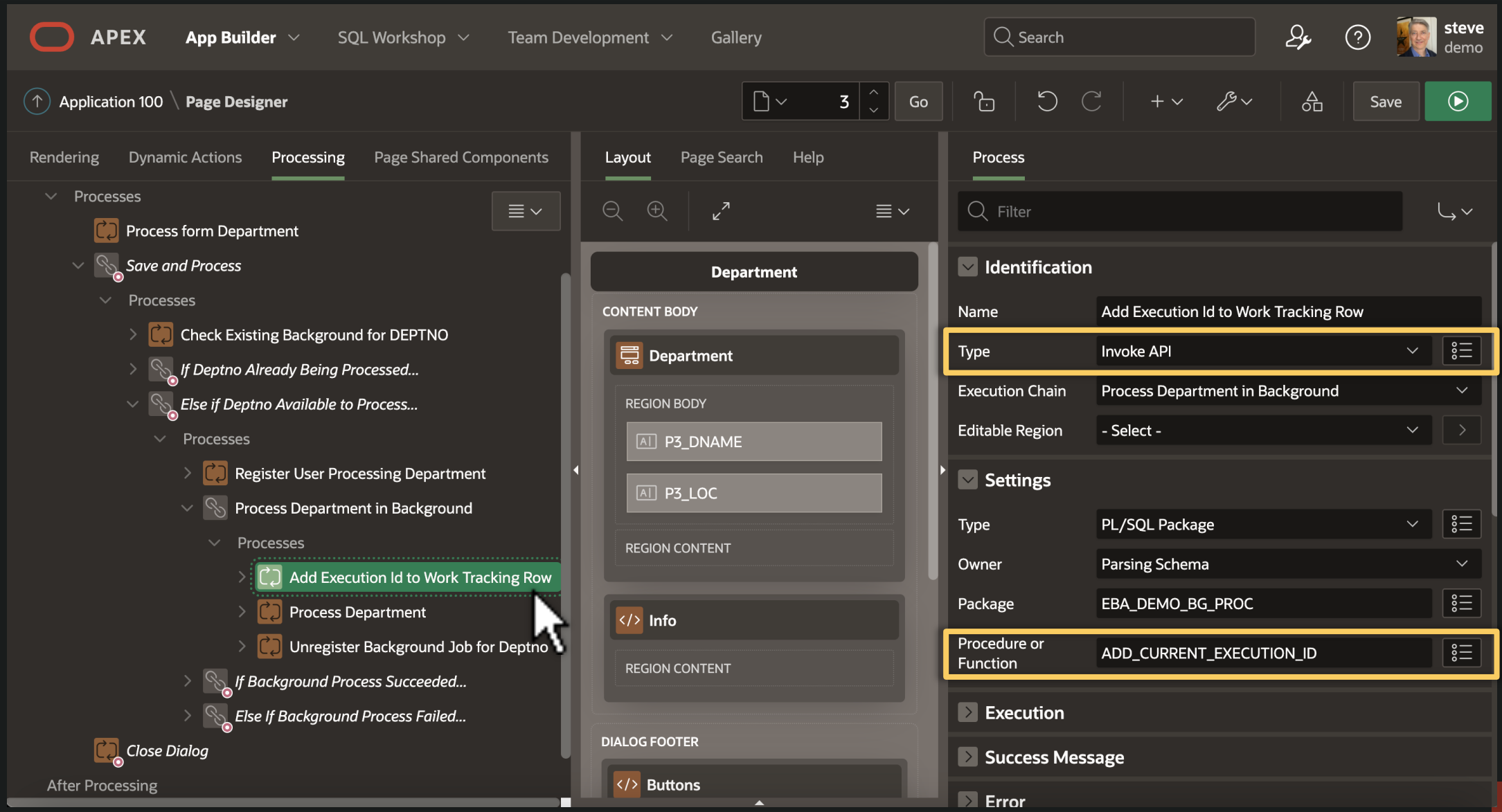
Meanwhile, Back in Our Background Process...

Execution ID 123456



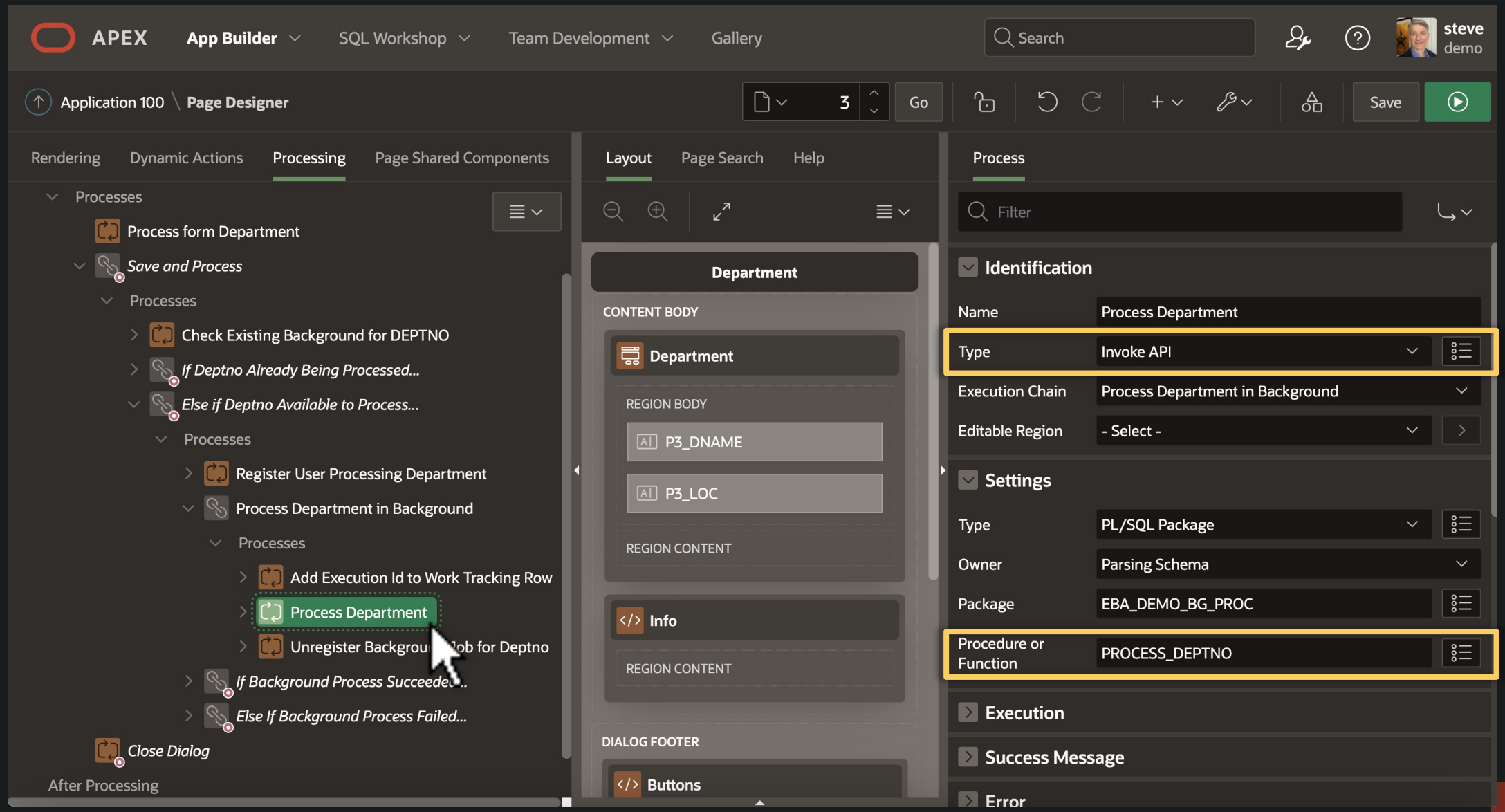
Add Current Execution Id to Custom Tracking Row

Execution ID 123456



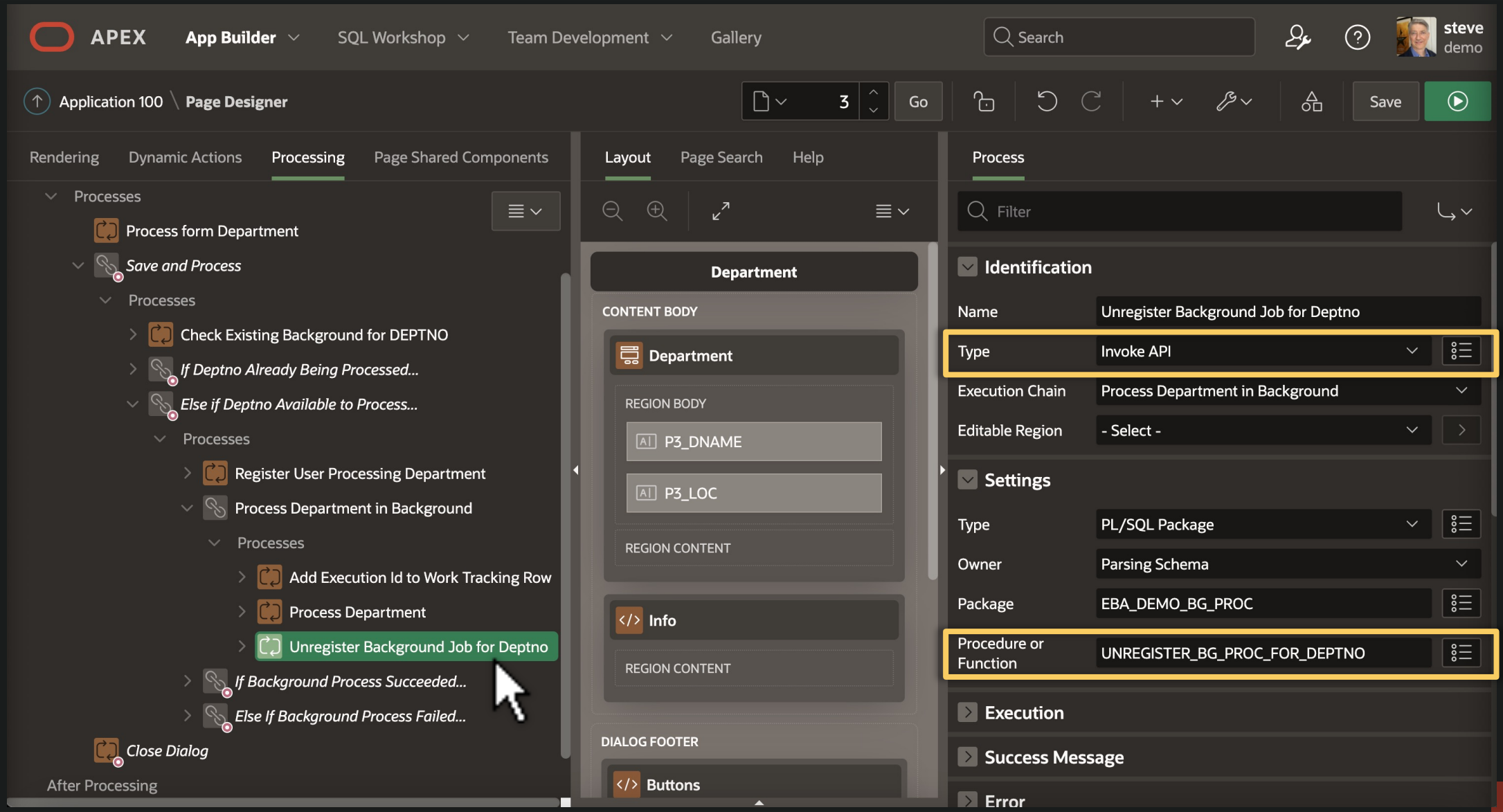
Do the Long-Running Processing of the Department

Execution ID 123456

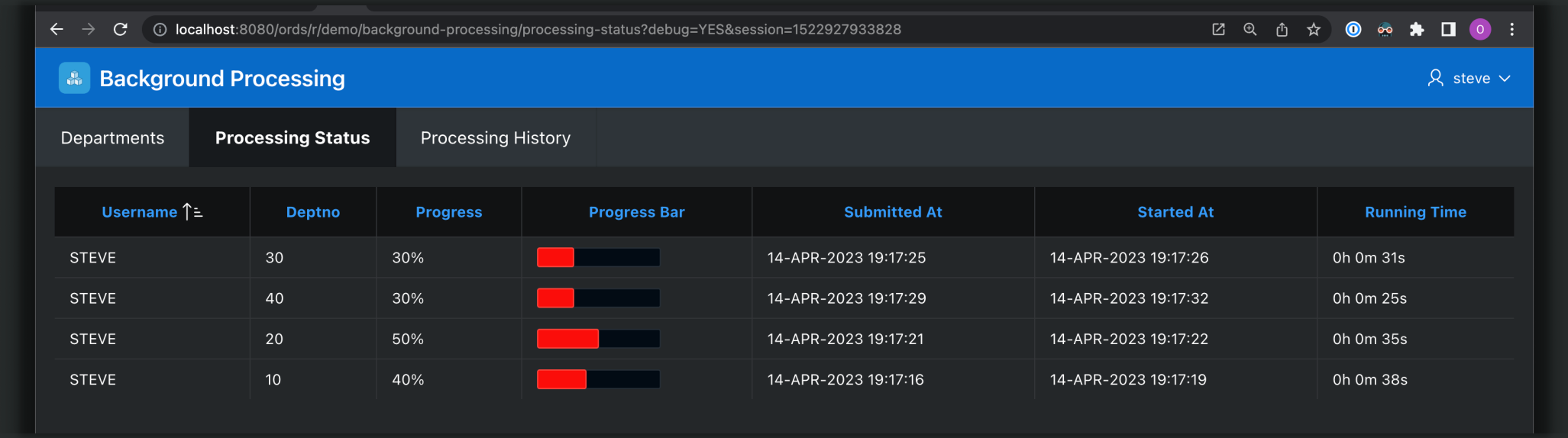


Unregister (User,Deptno) from Custom Tracking Table

Execution ID 123456

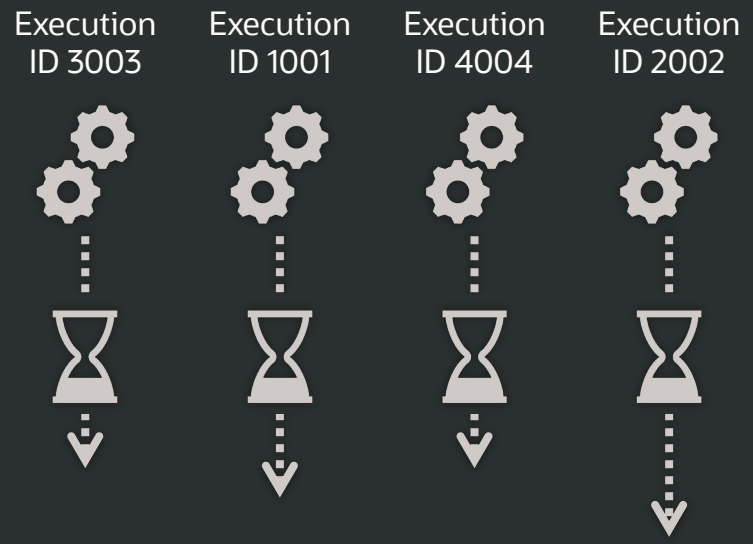


Showing Users Progress of Background Processes

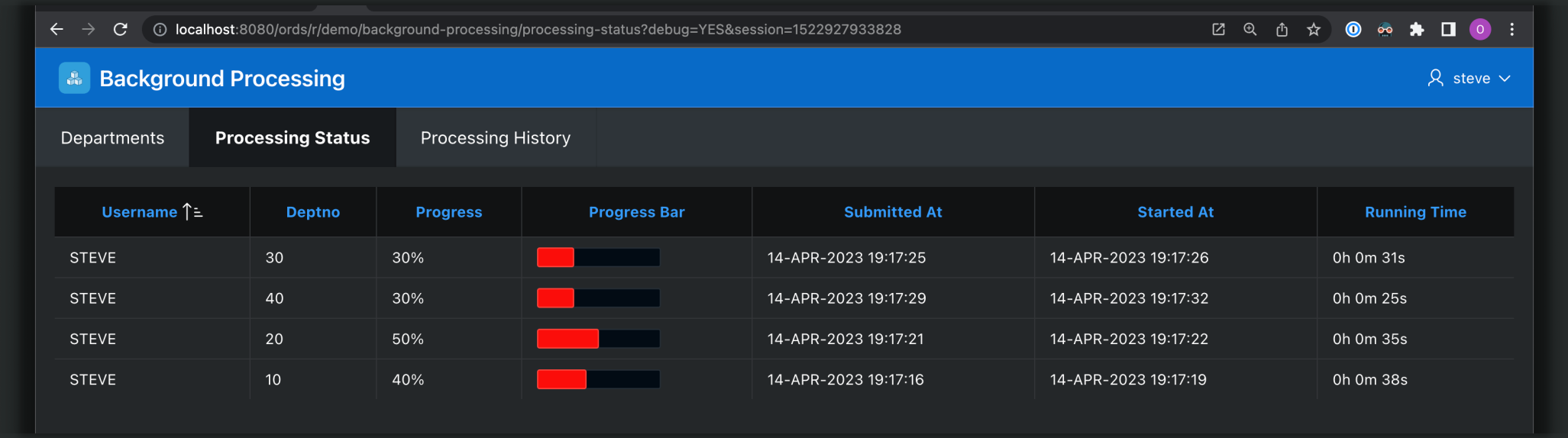


EBA_DEMO_BACKGROUND_PROCESSES

ID	USERNAME	DEPTNO	EXECUTION_ID	STARTED_EXECUTION_AT
1	STEVE	20	2002	2023-04-14 19:17:22
2	STEVE	10	1001	2023-04-14 19:17:19
3	STEVE	30	3003	2023-04-14 19:17:26
4	STEVE	40	4004	2023-04-14 19:17:32



Showing Users Progress of Background Processes

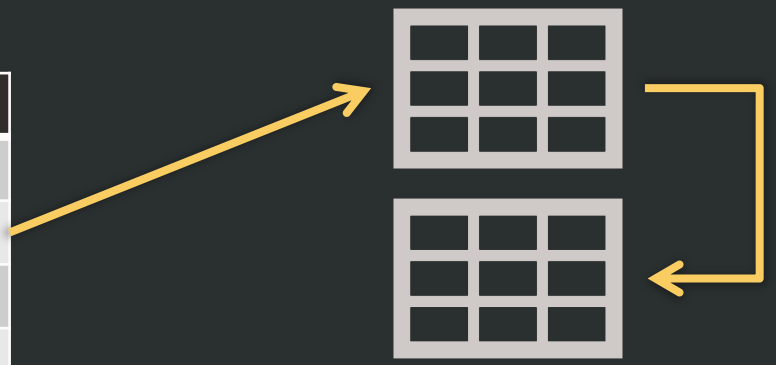


Username	Deptno	Progress	Progress Bar	Submitted At	Started At	Running Time
STEVE	30	30%		14-APR-2023 19:17:25	14-APR-2023 19:17:26	0h 0m 31s
STEVE	40	30%		14-APR-2023 19:17:29	14-APR-2023 19:17:32	0h 0m 25s
STEVE	20	50%		14-APR-2023 19:17:21	14-APR-2023 19:17:22	0h 0m 35s
STEVE	10	40%		14-APR-2023 19:17:16	14-APR-2023 19:17:19	0h 0m 38s

EBA_DEMO_BACKGROUND_PROCESSES

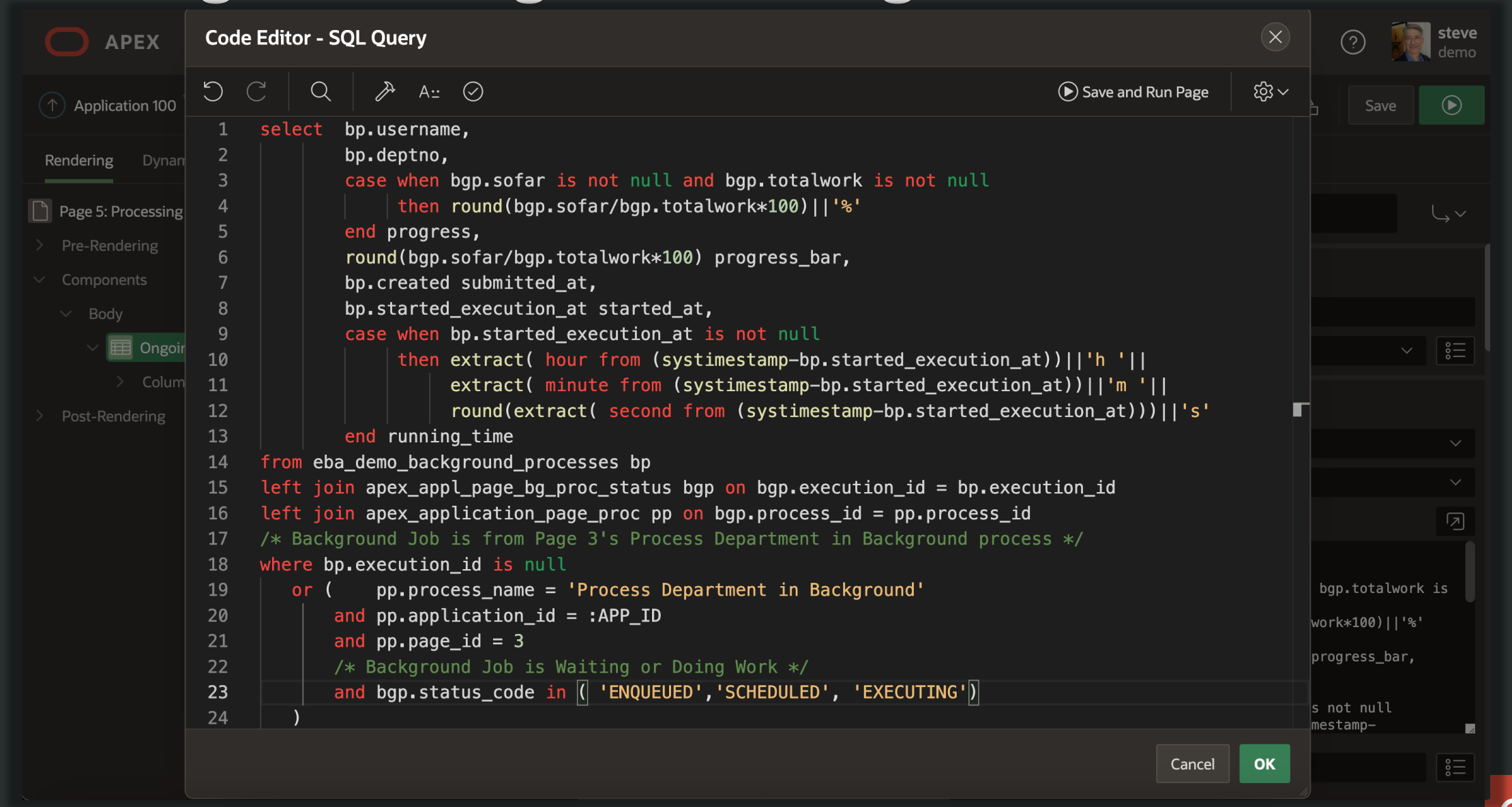
ID	USERNAME	DEPTNO	EXECUTION_ID	STARTED_EXECUTION_AT
1	STEVE	20	2002	2023-04-14 19:17:22
2	STEVE	10	1001	2023-04-14 19:17:19
3	STEVE	30	3003	2023-04-14 19:17:26
4	STEVE	40	4004	2023-04-14 19:17:32

APEX_APPL_PAGE_BG_PROC_STATUS



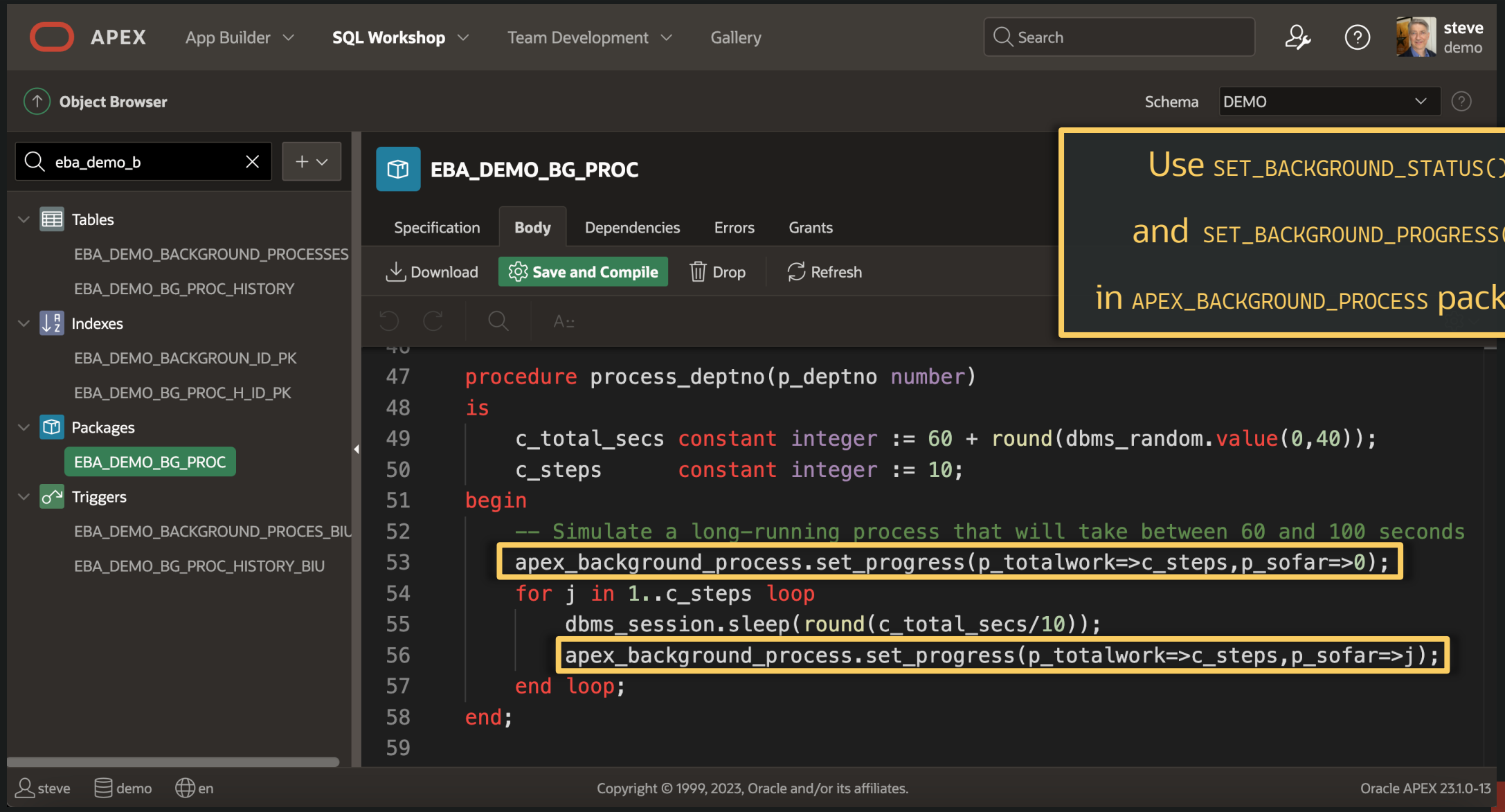
APEX_APPLICATION_PAGE_PROC

Showing Users Progress of Background Processes




```sql
select  bp.username,
        bp.deptno,
        case when bgp.sofar is not null and bgp.totalwork is not null
             then round(bgp.sofar/bgp.totalwork*100)||'%'
        end progress,
        round(bgp.sofar/bgp.totalwork*100) progress_bar,
        bp.created submitted_at,
        bp.started_execution_at started_at,
        case when bp.started_execution_at is not null
             then extract( hour from (systimestamp-bp.started_execution_at))||'h '||
                  extract( minute from (systimestamp-bp.started_execution_at))||'m '||
                  round(extract( second from (systimestamp-bp.started_execution_at)))||'s'
        end running_time
from eba_demo_background_processes bp
left join apex_appl_page_bg_proc_status bgp on bgp.execution_id = bp.execution_id
left join apex_application_page_proc pp on bgp.process_id = pp.process_id
/* Background Job is from Page 3's Process Department in Background process */
where bp.execution_id is null
   or (    pp.process_name = 'Process Department in Background'
       and pp.application_id = :APP_ID
       and pp.page_id = 3
       /* Background Job is Waiting or Doing Work */
       and bgp.status_code in ( 'ENQUEUED','SCHEDULED', 'EXECUTING')
   )
```

Informing APEX Engine of Progress for BG Process

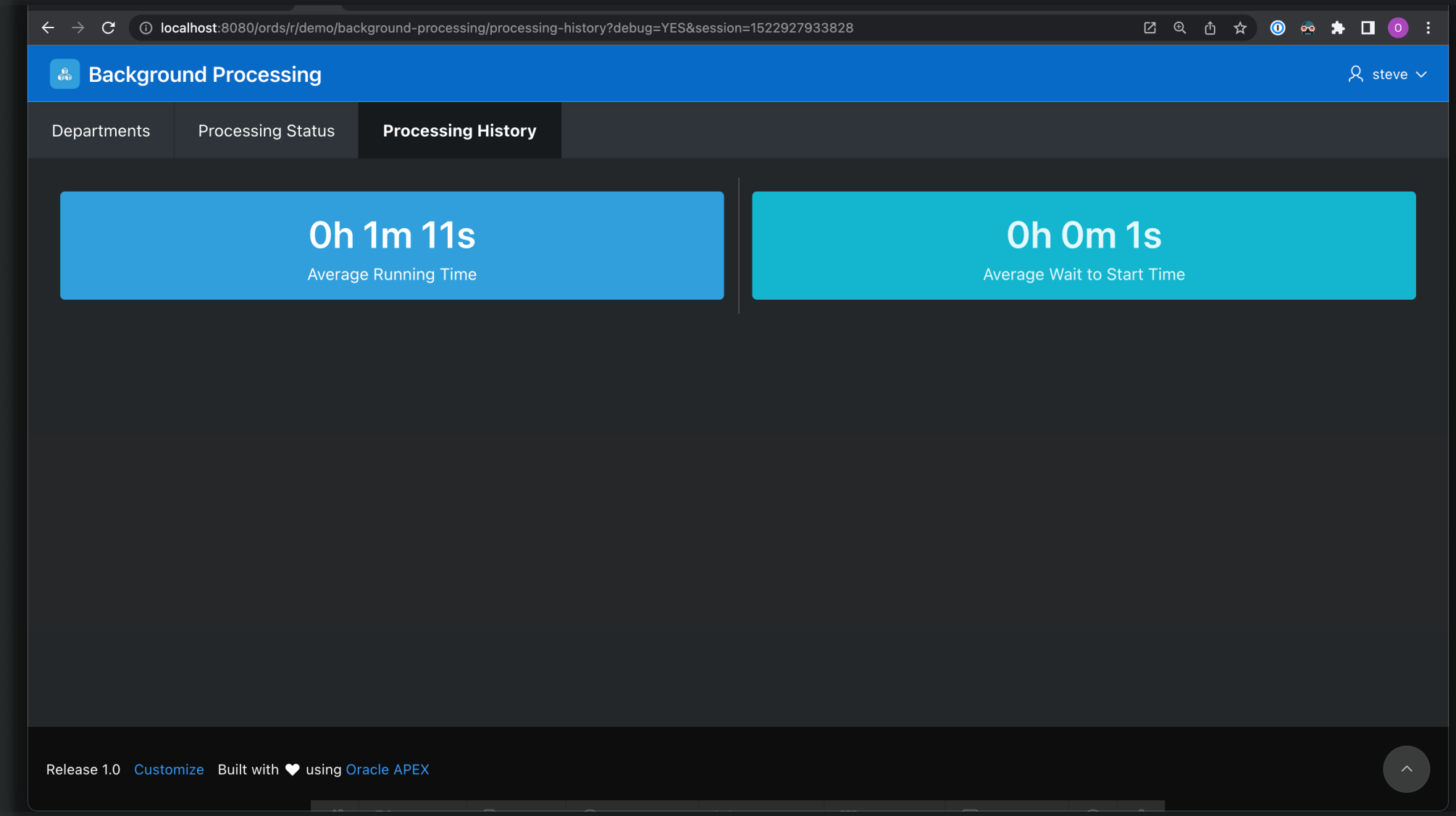


Use `SET_BACKGROUND_STATUS()`

and `SET_BACKGROUND_PROGRESS()`

in `APEX_BACKGROUND_PROCESS` package

Track Run Time and Wait to Start Time to Provide Averages



Getting Information About Background Processes

Background process job *instance*

```
SQL> DESC APEX_APPL_PAGE_BG_PROC_STATUS

Name                          Null?       Type
----------------------------- ----------- ------------------------------
WORKSPACE                     NOT NULL    VARCHAR2(255)
WORKSPACE_DISPLAY_NAME                    VARCHAR2(4000)
APPLICATION_ID                NOT NULL    NUMBER
APPLICATION_NAME              NOT NULL    VARCHAR2(255)
PAGE_ID                       NOT NULL    NUMBER
PAGE_NAME                     NOT NULL    VARCHAR2(255)
EXECUTION_ID                  NOT NULL    NUMBER
PROCESS_ID                    NOT NULL    NUMBER
PROCESS_NAME                  NOT NULL    VARCHAR2(255)
SERIAL_EXECUTION                          VARCHAR2(3)
CURRENT_PROCESS_ID                        NUMBER
CURRENT_PROCESS_NAME                      VARCHAR2(255)
CURRENT_PROCESS_SEQUENCE                  NUMBER
PROCESS_TYPE_PLUGIN_NAME                  VARCHAR2(255)
SESSION_ID                                NUMBER
WORKING_SESSION_ID                        NUMBER
REQUEST                                   VARCHAR2(255)
ECID                                      VARCHAR2(64)
STATUS                                    VARCHAR2(24)
STATUS_CODE                   NOT NULL    VARCHAR2(16)
STATUS_MESSAGE                            VARCHAR2(4000)
SOFAR                                     NUMBER
TOTALWORK                                 NUMBER
CREATED_ON                    NOT NULL    TIMESTAMP(6) WITH TIME ZONE
LAST_UPDATED_ON                           TIMESTAMP(6) WITH TIME ZONE
```

Getting Information About Background Processes

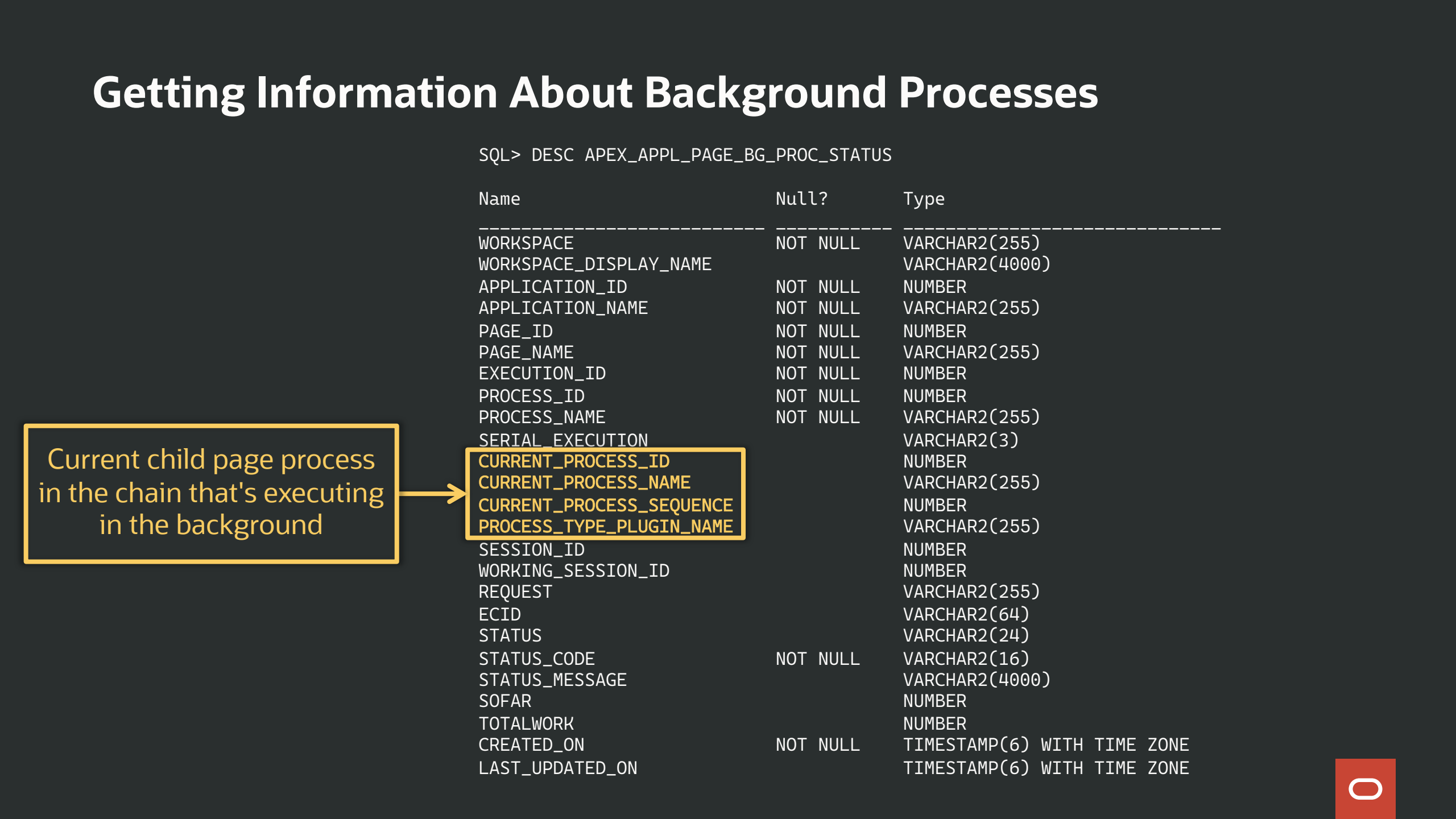
Which execution chain *definition* is this an instance of?

```
SQL> DESC APEX_APPL_PAGE_BG_PROC_STATUS

Name                          Null?       Type
----------------------------- ----------- ------------------------------
WORKSPACE                     NOT NULL    VARCHAR2(255)
WORKSPACE_DISPLAY_NAME                    VARCHAR2(4000)
APPLICATION_ID                NOT NULL    NUMBER
APPLICATION_NAME              NOT NULL    VARCHAR2(255)
PAGE_ID                       NOT NULL    NUMBER
PAGE_NAME                     NOT NULL    VARCHAR2(255)
EXECUTION_ID                  NOT NULL    NUMBER
PROCESS_ID                    NOT NULL    NUMBER
PROCESS_NAME                  NOT NULL    VARCHAR2(255)
SERIAL_EXECUTION                          VARCHAR2(3)
CURRENT_PROCESS_ID                        NUMBER
CURRENT_PROCESS_NAME                      VARCHAR2(255)
CURRENT_PROCESS_SEQUENCE                  NUMBER
PROCESS_TYPE_PLUGIN_NAME                  VARCHAR2(255)
SESSION_ID                                NUMBER
WORKING_SESSION_ID                        NUMBER
REQUEST                                   VARCHAR2(255)
ECID                                      VARCHAR2(64)
STATUS                                    VARCHAR2(24)
STATUS_CODE                   NOT NULL    VARCHAR2(16)
STATUS_MESSAGE                            VARCHAR2(4000)
SOFAR                                     NUMBER
TOTALWORK                                 NUMBER
CREATED_ON                    NOT NULL    TIMESTAMP(6) WITH TIME ZONE
LAST_UPDATED_ON                           TIMESTAMP(6) WITH TIME ZONE
```

Getting Information About Background Processes

```
SQL> DESC APEX_APPL_PAGE_BG_PROC_STATUS

Name                          Null?       Type
----------------------------- ----------- ------------------------------
WORKSPACE                     NOT NULL    VARCHAR2(255)
WORKSPACE_DISPLAY_NAME                    VARCHAR2(4000)
APPLICATION_ID                NOT NULL    NUMBER
APPLICATION_NAME              NOT NULL    VARCHAR2(255)
PAGE_ID                       NOT NULL    NUMBER
PAGE_NAME                     NOT NULL    VARCHAR2(255)
EXECUTION_ID                  NOT NULL    NUMBER
PROCESS_ID                    NOT NULL    NUMBER
PROCESS_NAME                  NOT NULL    VARCHAR2(255)
SERIAL_EXECUTION                          VARCHAR2(3)
CURRENT_PROCESS_ID                        NUMBER
CURRENT_PROCESS_NAME                      VARCHAR2(255)
CURRENT_PROCESS_SEQUENCE                  NUMBER
PROCESS_TYPE_PLUGIN_NAME                  VARCHAR2(255)
SESSION_ID                                NUMBER
WORKING_SESSION_ID                        NUMBER
REQUEST                                   VARCHAR2(255)
ECID                                      VARCHAR2(64)
STATUS                                    VARCHAR2(24)
STATUS_CODE                   NOT NULL    VARCHAR2(16)
STATUS_MESSAGE                            VARCHAR2(4000)
SOFAR                                     NUMBER
TOTALWORK                                 NUMBER
CREATED_ON                    NOT NULL    TIMESTAMP(6) WITH TIME ZONE
LAST_UPDATED_ON                           TIMESTAMP(6) WITH TIME ZONE
```

Current child page process in the chain that's executing in the background



Getting Information About Background Processes

```
SQL> DESC APEX_APPL_PAGE_BG_PROC_STATUS

Name                          Null?       Type
----------------------------- ----------- ------------------------------
WORKSPACE                     NOT NULL    VARCHAR2(255)
WORKSPACE_DISPLAY_NAME                    VARCHAR2(4000)
APPLICATION_ID                NOT NULL    NUMBER
APPLICATION_NAME              NOT NULL    VARCHAR2(255)
PAGE_ID                       NOT NULL    NUMBER
PAGE_NAME                     NOT NULL    VARCHAR2(255)
EXECUTION_ID                  NOT NULL    NUMBER
PROCESS_ID                    NOT NULL    NUMBER
PROCESS_NAME                  NOT NULL    VARCHAR2(255)
SERIAL_EXECUTION                          VARCHAR2(3)
CURRENT_PROCESS_ID                        NUMBER
CURRENT_PROCESS_NAME                      VARCHAR2(255)
CURRENT_PROCESS_SEQUENCE                  NUMBER
PROCESS_TYPE_PLUGIN_NAME                  VARCHAR2(255)
SESSION_ID                                NUMBER
WORKING_SESSION_ID                        NUMBER
REQUEST                                   VARCHAR2(255)
ECID                                      VARCHAR2(64)
STATUS                                    VARCHAR2(24)
STATUS_CODE                   NOT NULL    VARCHAR2(16)
STATUS_MESSAGE                            VARCHAR2(4000)
SOFAR                                     NUMBER
TOTALWORK                                 NUMBER
CREATED_ON                    NOT NULL    TIMESTAMP(6) WITH TIME ZONE
LAST_UPDATED_ON                           TIMESTAMP(6) WITH TIME ZONE
```

Session *initiating* the execution chain instance background process

Getting Information About Background Processes

```
SQL> DESC APEX_APPL_PAGE_BG_PROC_STATUS

Name                          Null?       Type
----------------------------- ----------- ------------------------------
WORKSPACE                     NOT NULL    VARCHAR2(255)
WORKSPACE_DISPLAY_NAME                    VARCHAR2(4000)
APPLICATION_ID                NOT NULL    NUMBER
APPLICATION_NAME              NOT NULL    VARCHAR2(255)
PAGE_ID                       NOT NULL    NUMBER
PAGE_NAME                     NOT NULL    VARCHAR2(255)
EXECUTION_ID                  NOT NULL    NUMBER
PROCESS_ID                    NOT NULL    NUMBER
PROCESS_NAME                  NOT NULL    VARCHAR2(255)
SERIAL_EXECUTION                          VARCHAR2(3)
CURRENT_PROCESS_ID                        NUMBER
CURRENT_PROCESS_NAME                      VARCHAR2(255)
CURRENT_PROCESS_SEQUENCE                  NUMBER
PROCESS_TYPE_PLUGIN_NAME                  VARCHAR2(255)
SESSION_ID                                NUMBER
WORKING_SESSION_ID                        NUMBER
REQUEST                                   VARCHAR2(255)
ECID                                      VARCHAR2(64)
STATUS                                    VARCHAR2(24)
STATUS_CODE                   NOT NULL    VARCHAR2(16)
STATUS_MESSAGE                            VARCHAR2(4000)
SOFAR                                     NUMBER
TOTALWORK                                 NUMBER
CREATED_ON                    NOT NULL    TIMESTAMP(6) WITH TIME ZONE
LAST_UPDATED_ON                           TIMESTAMP(6) WITH TIME ZONE
```

Cloned session used by the execution chain instance background job

Getting Information About Background Processes

Status	Status Code
Added to Execution Queue	ENQUEUED
Scheduled for Execution	SCHEDULED
Executing	EXECUTING
Executed Successfully	SUCCESS
Executed with Failure	FAILED
Aborted	ABORTED

Status of the background process

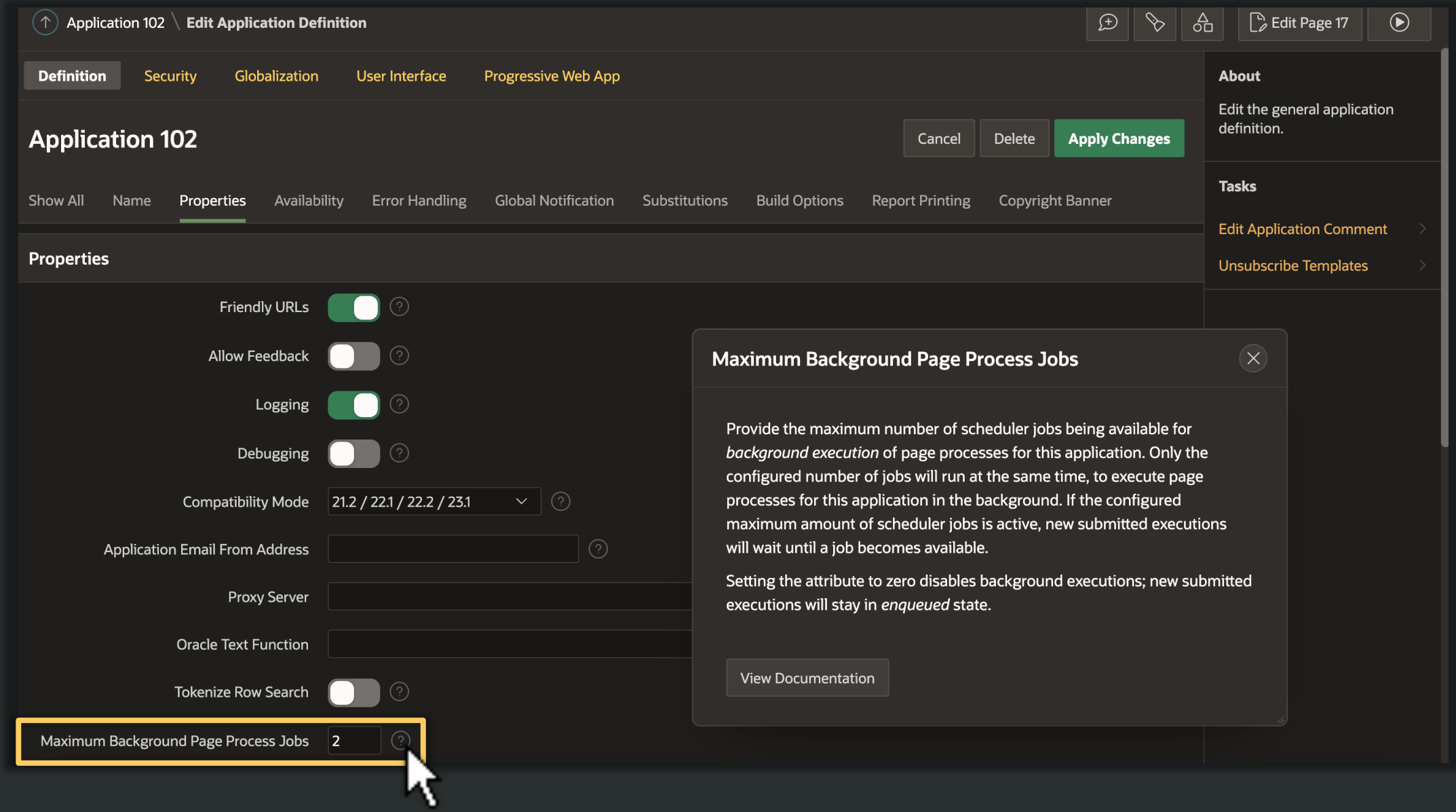
```
SQL> DESC APEX_APPL_PAGE_BG_PROC_STATUS

Name                          Null?       Type
----------------------------- ----------- ------------------------------
WORKSPACE                     NOT NULL    VARCHAR2(255)
WORKSPACE_DISPLAY_NAME                    VARCHAR2(4000)
APPLICATION_ID                NOT NULL    NUMBER
APPLICATION_NAME              NOT NULL    VARCHAR2(255)
PAGE_ID                       NOT NULL    NUMBER
PAGE_NAME                     NOT NULL    VARCHAR2(255)
EXECUTION_ID                  NOT NULL    NUMBER
PROCESS_ID                    NOT NULL    NUMBER
PROCESS_NAME                  NOT NULL    VARCHAR2(255)
SERIAL_EXECUTION                          VARCHAR2(3)
CURRENT_PROCESS_ID                        NUMBER
CURRENT_PROCESS_NAME                      VARCHAR2(255)
CURRENT_PROCESS_SEQUENCE                  NUMBER
PROCESS_TYPE_PLUGIN_NAME                  VARCHAR2(255)
SESSION_ID                                NUMBER
WORKING_SESSION_ID                        NUMBER
REQUEST                                   VARCHAR2(255)
ECID                                      VARCHAR2(64)
STATUS                                    VARCHAR2(24)
STATUS_CODE                   NOT NULL    VARCHAR2(16)
STATUS_MESSAGE                            VARCHAR2(4000)
SOFAR                                     NUMBER
TOTALWORK                                 NUMBER
CREATED_ON                    NOT NULL    TIMESTAMP(6) WITH TIME ZONE
LAST_UPDATED_ON                           TIMESTAMP(6) WITH TIME ZONE
```

Getting Information About Background Processes

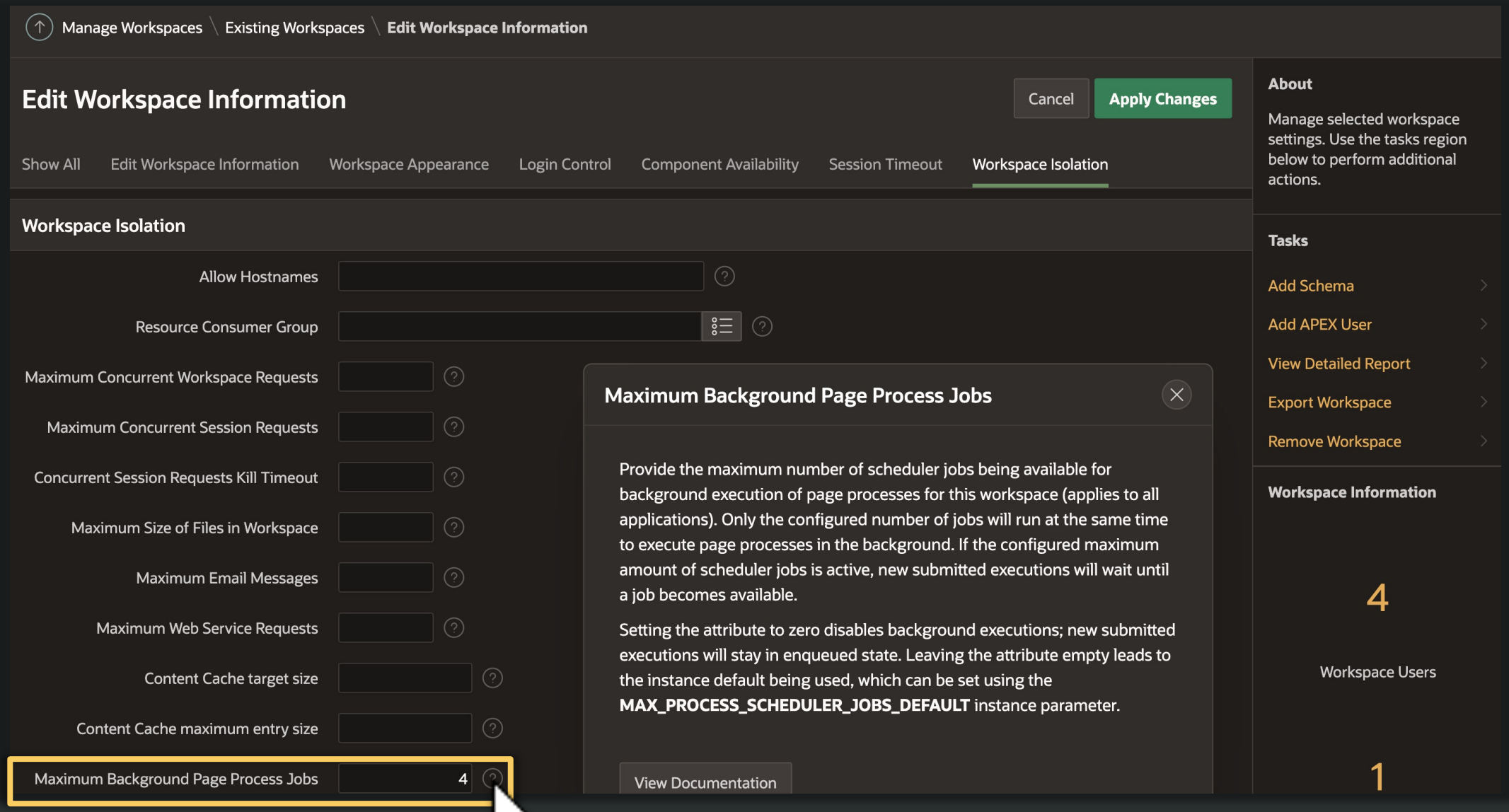
```
SQL> DESC APEX_APPL_PAGE_BG_PROC_STATUS

Name                          Null?       Type
----------------------------- ----------- ------------------------------
WORKSPACE                     NOT NULL    VARCHAR2(255)
WORKSPACE_DISPLAY_NAME                    VARCHAR2(4000)
APPLICATION_ID                NOT NULL    NUMBER
APPLICATION_NAME              NOT NULL    VARCHAR2(255)
PAGE_ID                       NOT NULL    NUMBER
PAGE_NAME                     NOT NULL    VARCHAR2(255)
EXECUTION_ID                  NOT NULL    NUMBER
PROCESS_ID                    NOT NULL    NUMBER
PROCESS_NAME                  NOT NULL    VARCHAR2(255)
SERIAL_EXECUTION                          VARCHAR2(3)
CURRENT_PROCESS_ID                        NUMBER
CURRENT_PROCESS_NAME                      VARCHAR2(255)
CURRENT_PROCESS_SEQUENCE                  NUMBER
PROCESS_TYPE_PLUGIN_NAME                  VARCHAR2(255)
SESSION_ID                                NUMBER
WORKING_SESSION_ID                        NUMBER
REQUEST                                   VARCHAR2(255)
ECID                                      VARCHAR2(64)
STATUS                                    VARCHAR2(24)
STATUS_CODE                   NOT NULL    VARCHAR2(16)
STATUS_MESSAGE                            VARCHAR2(4000)
SOFAR                                     NUMBER
TOTALWORK                                 NUMBER
CREATED_ON                    NOT NULL    TIMESTAMP(6) WITH TIME ZONE
LAST_UPDATED_ON                           TIMESTAMP(6) WITH TIME ZONE
```

Latest progress as reported by `SET_BACKGROUND_STATUS()` `SET_BACKGROUND_PROGRESS()` in `APEX_BACKGROUND_PROCESS` package

Throttling Concurrent Background Executions per *Application*

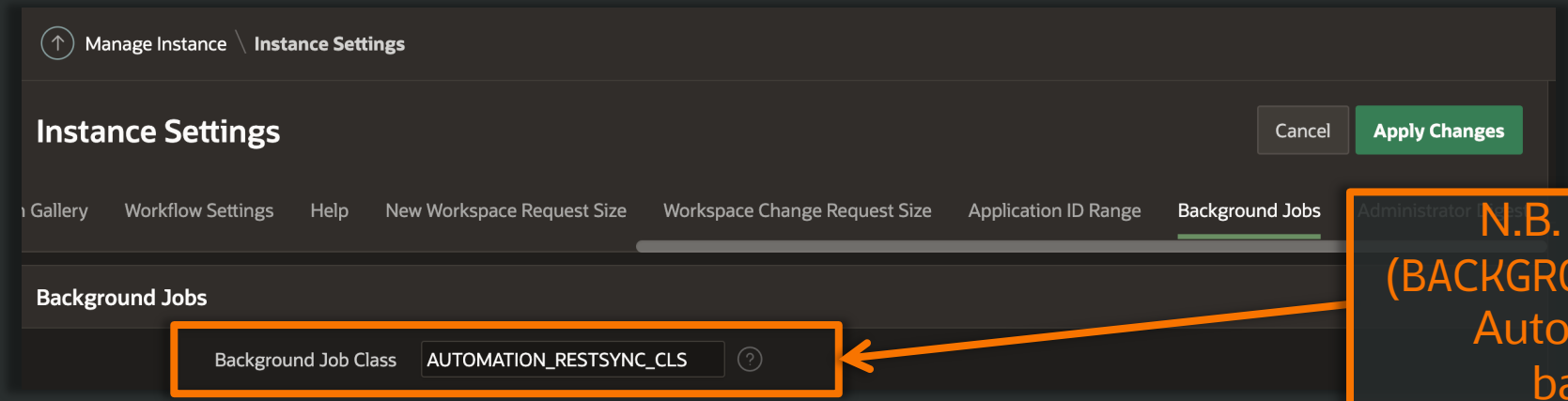


Throttling Concurrent Background Executions per *Workspace*



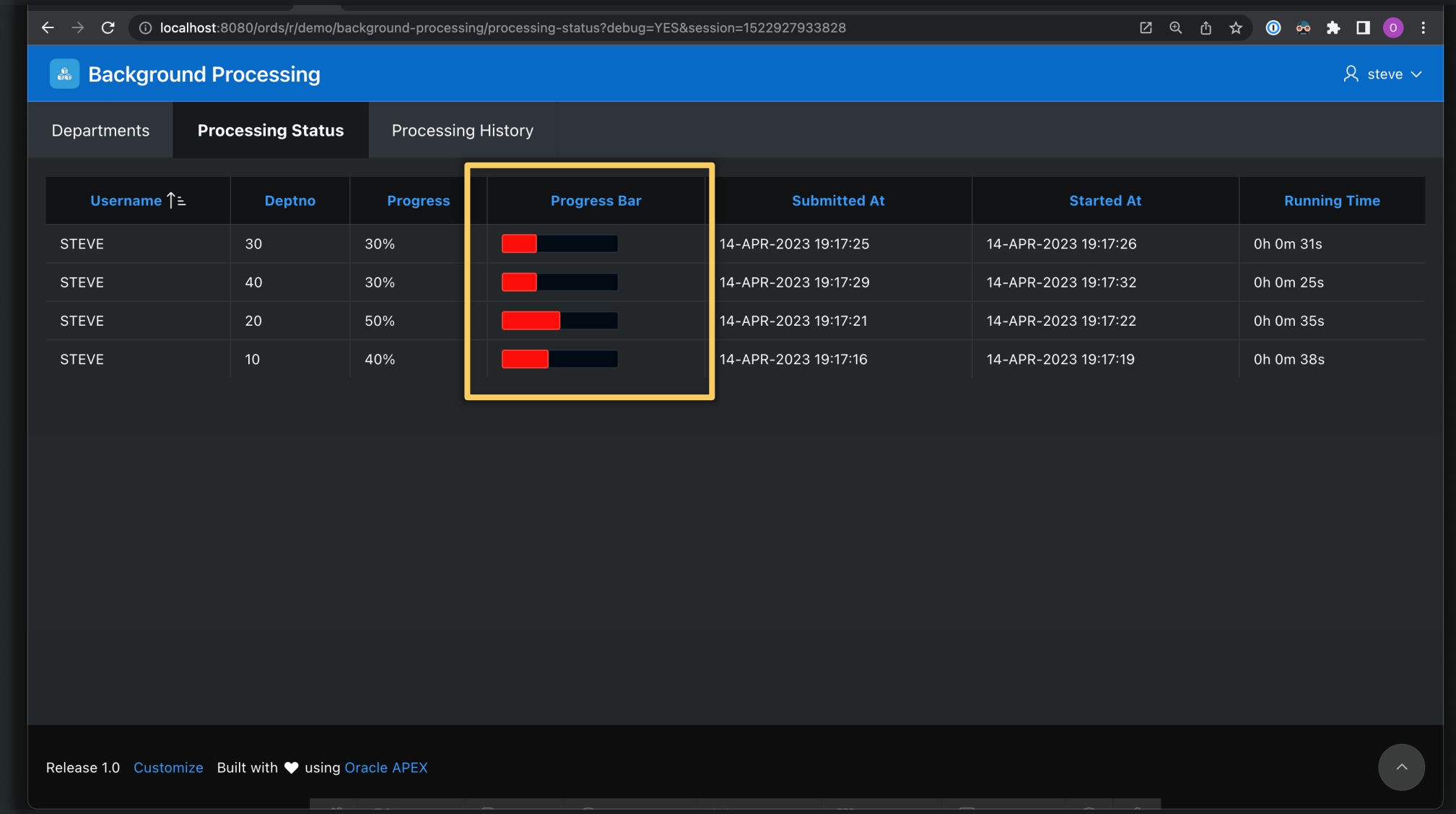
Associating Custom Resource Manager Job Class to BG Processes

```
-- Run as SYS or user with APEX_ADMINISTRATOR_ROLE
begin
    apex_instance_admin.set_parameter(
        p_parameter => 'BACKGROUND_PROCESS_JOB_CLASS',
        p_value     => 'CUSTOM_BG_PROC_CLASS'
    );
end;
```

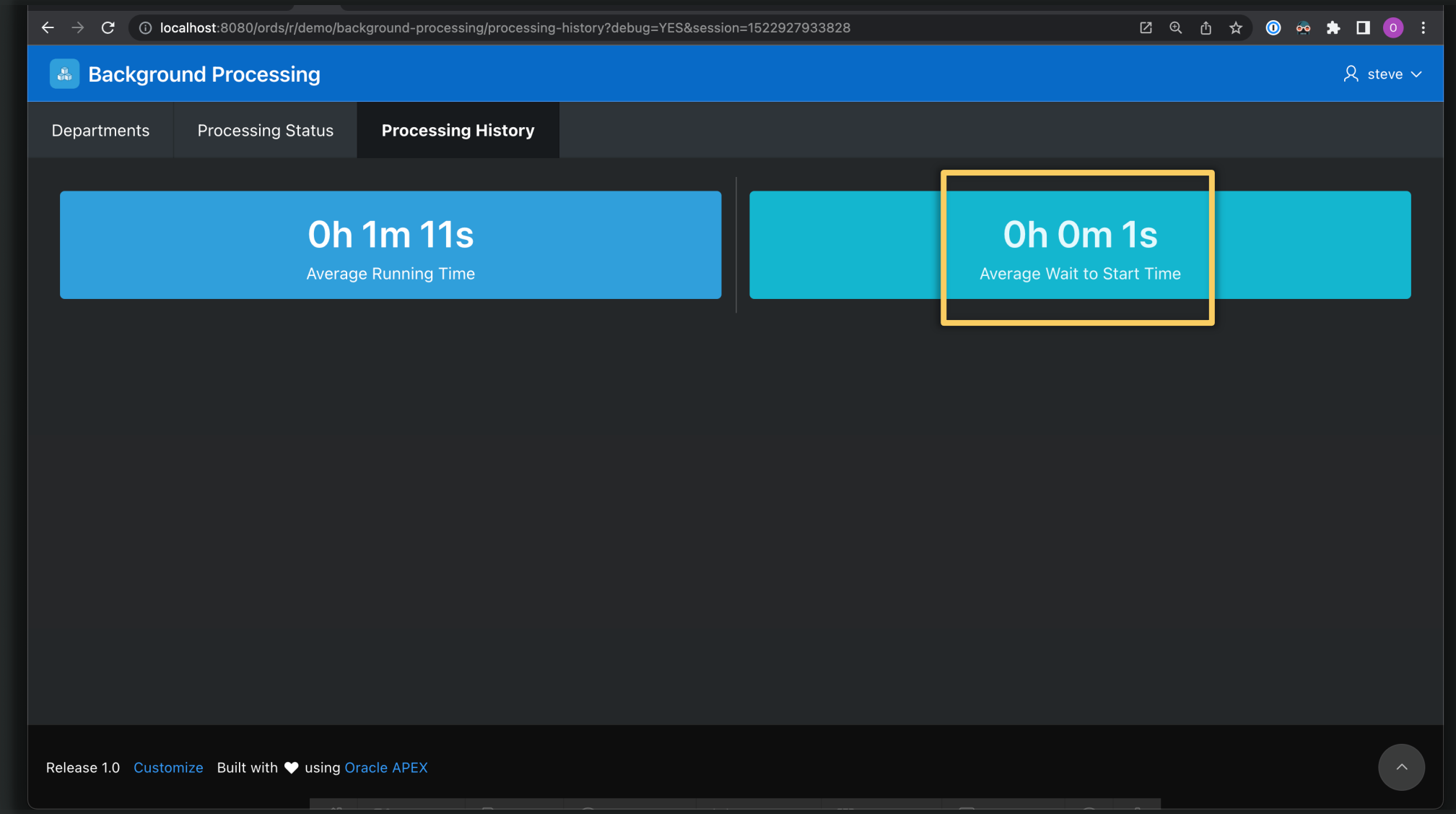


N.B. This *different* setting (BACKGROUND_JOB_CLASS) affects Automations + REST Sync background process

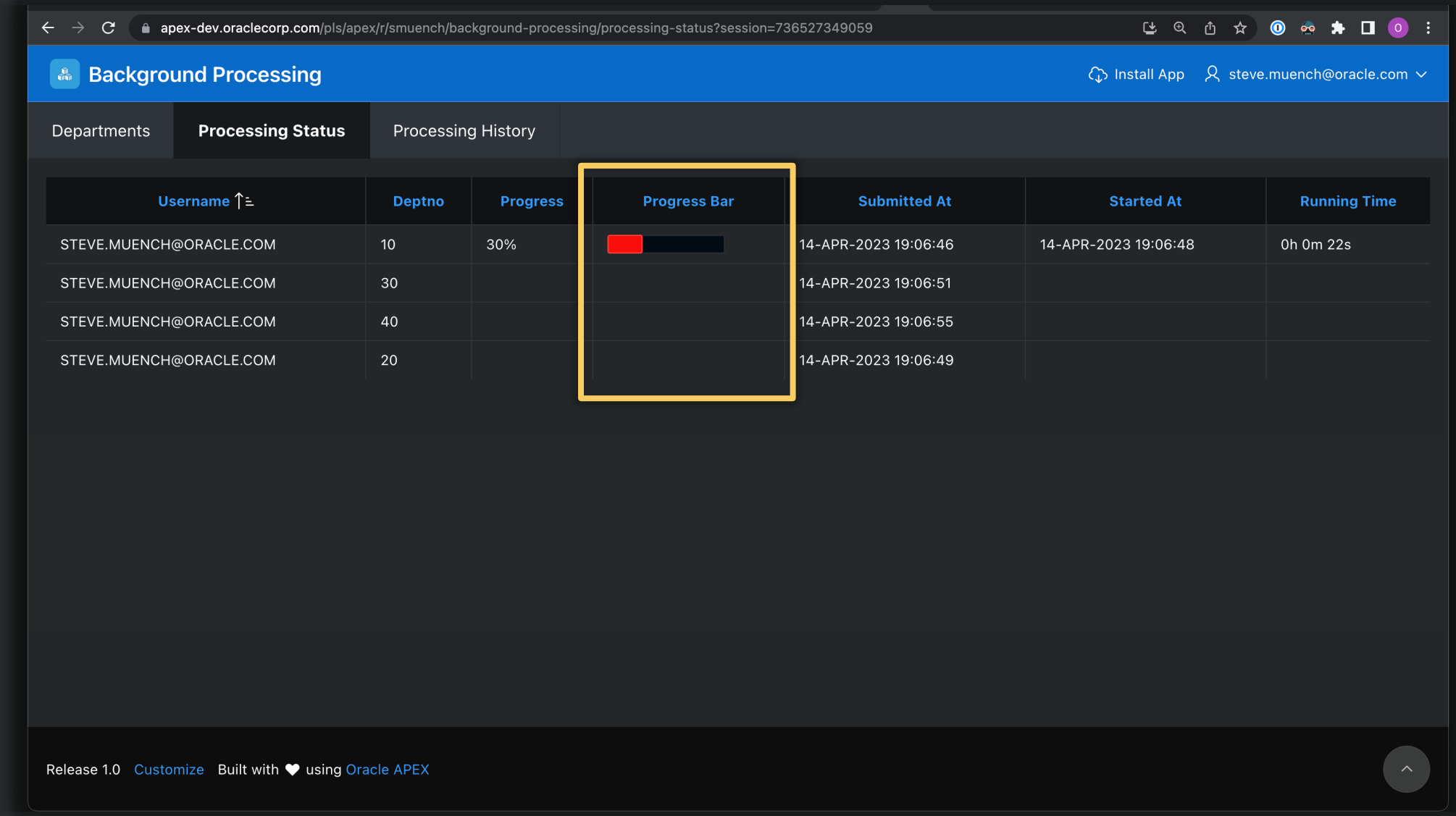
Limit >= 4 → Four Submitted Background Processes Can Run



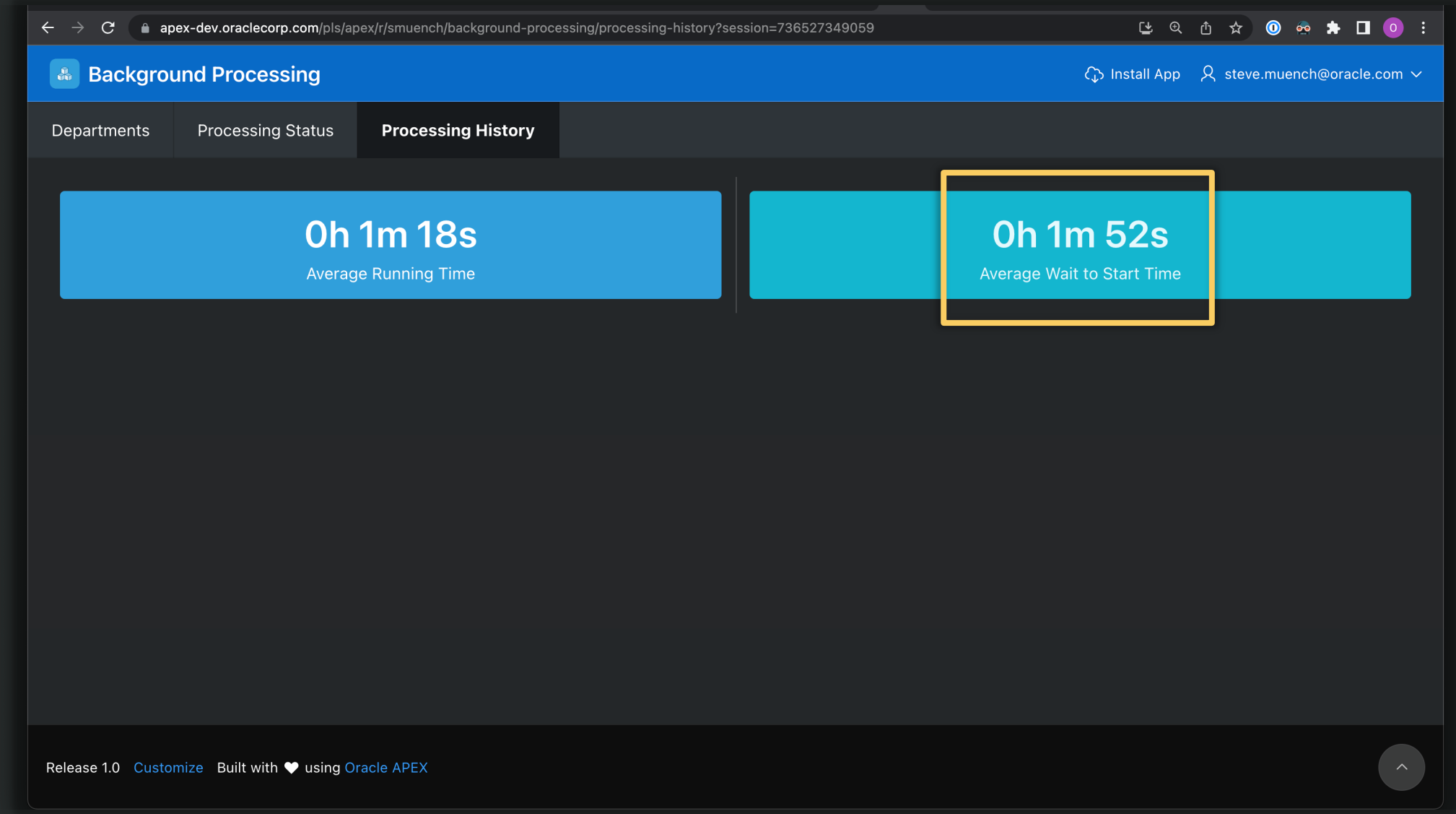
Limit >= 4 → Background Processes Start Almost Immediately



Limit = 1 → Only One of Four Submitted BG Procs Runs at a Time



Limit = 1 → Background Processes Wait Before Starting to Execute



Anticipating Common Developer Questions

- Can I associate a context value with the background process?
  - ➢ Your own table can link execution id to context value
- How long do rows "hang around" in `APEX_APPL_PAGE_BG_PROC_STATUS`?
  - ➢ Until both user and background sessions are cleaned up
- Can an execution chain in the background contain other background chains?
  - ➢ Yes

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Thank You! Questions?

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