ODTUG Kscope19

SEATTLE, WASHINGTON • JUNE 23-27

APEX Interactive Grid API Essentials

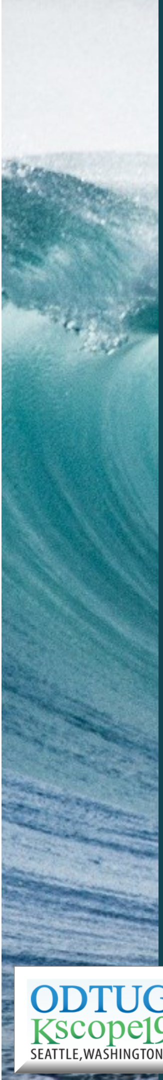
The Stuff You Will Really Use

Karen Cannell
kcannell@thtechnology.com
TH TECHNOLOGY
@thtechnology

About Me ...

- TH Technology – Oracle Consulting Services, APEX Focus
- Mechanical/SW Engineer - Analyzed, designed, developed, converted, upgraded, enhanced legacy & database applications for 30+ years
- Building Web/APEX applications for government, medical, engineering industries since HTMLDB beginnings
- Leveraging Oracle10g,11g,12c,18c suite of tools
- ODTUG Director, Editor Emeritus, ODTUG Technical Journal
- Oracle Ace
- APress Author

ODTUG



About You …

- APEX Versions?
- Grid Experience?
- JavaScript Experts?

I'M SPEAKING AT

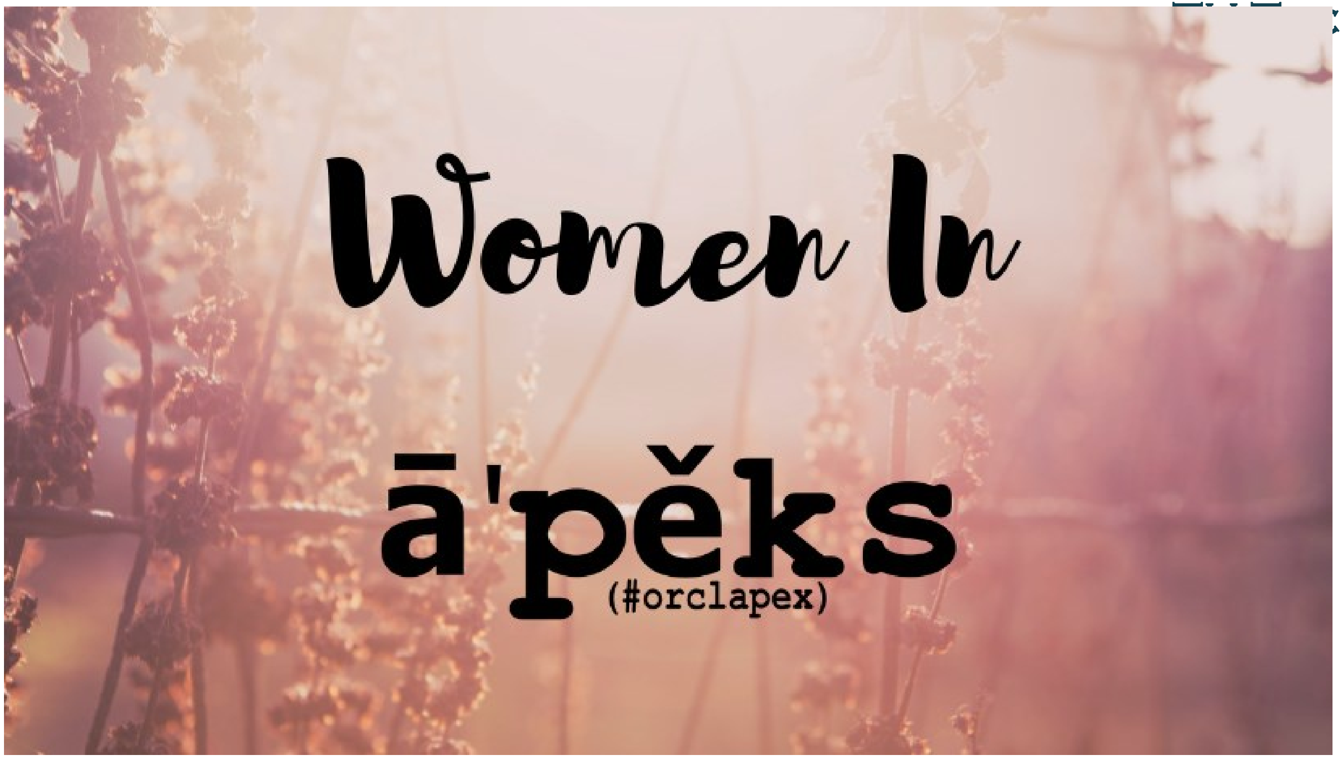
ODTUG Kscope19

SEATTLE, WASHINGTON • JUNE 23-27

www.kscope19.odtug.com

SEATTLE

Washington State Convention Center

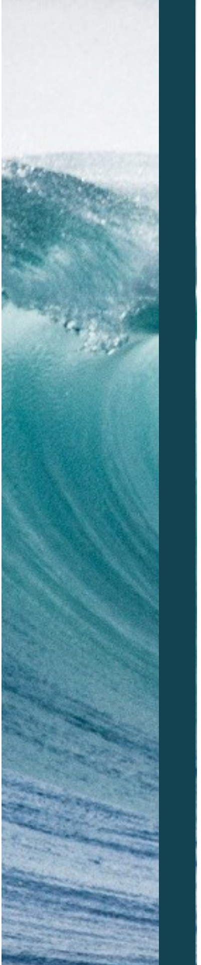


Facebook group: https://www.facebook.com/groups/womeninapex/

https://www.womeninapex.com/

Goal

- Interactive Grid JavaScript APIs
- Understand Use of JS APIs for
  - Validations
  - Customizations
- You Actually Use These APIs



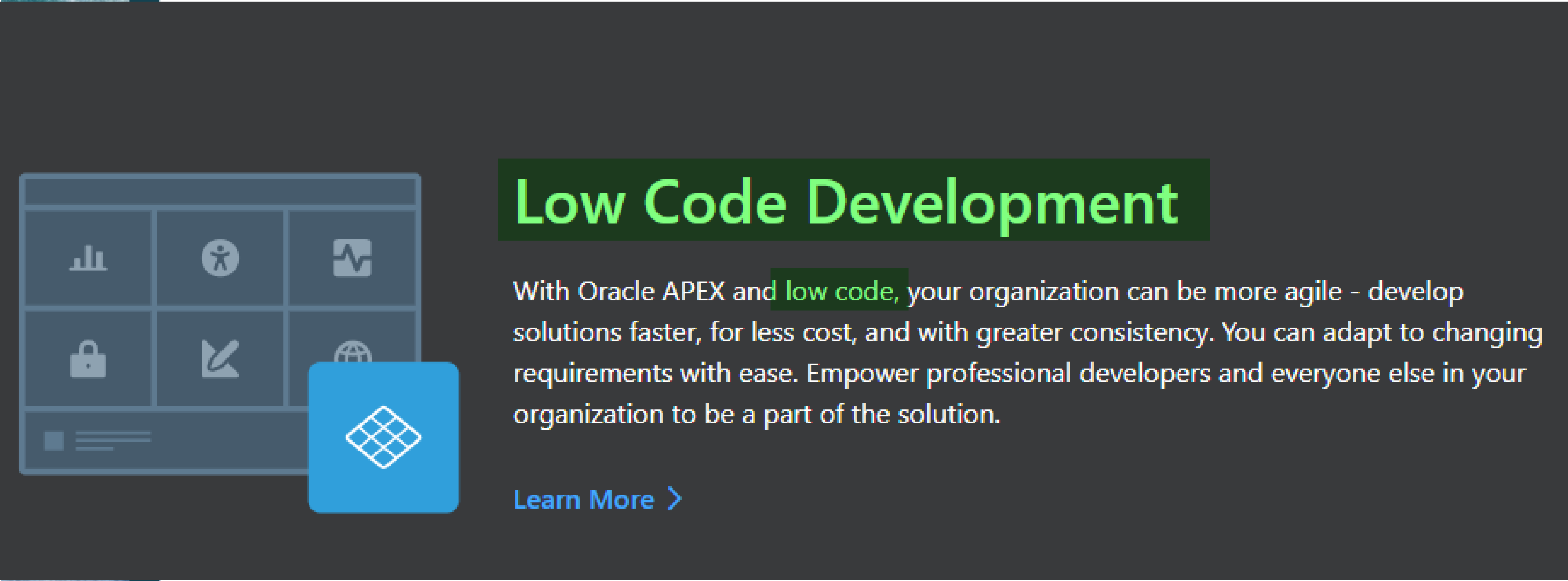
Agenda

- Quick Grid Review
- 19.1 Declarative Enhancements
- Documented Grid APIs
- Examples
    - Validations – Always Edit - Customizations
- Standardizing
- Best Practices / Recommendations

7/1/2019

What is Oracle APEX?

Oracle Application Express (APEX) is a low-code development platform that enables you to build scalable, secure enterprise apps, with world-class features, that can be deployed anywhere.



Low Code Development

With Oracle APEX and low code, your organization can be more agile - develop solutions faster, for less cost, and with greater consistency. You can adapt to changing requirements with ease. Empower professional developers and everyone else in your organization to be a part of the solution.

This Session Leaves

LOW CODE

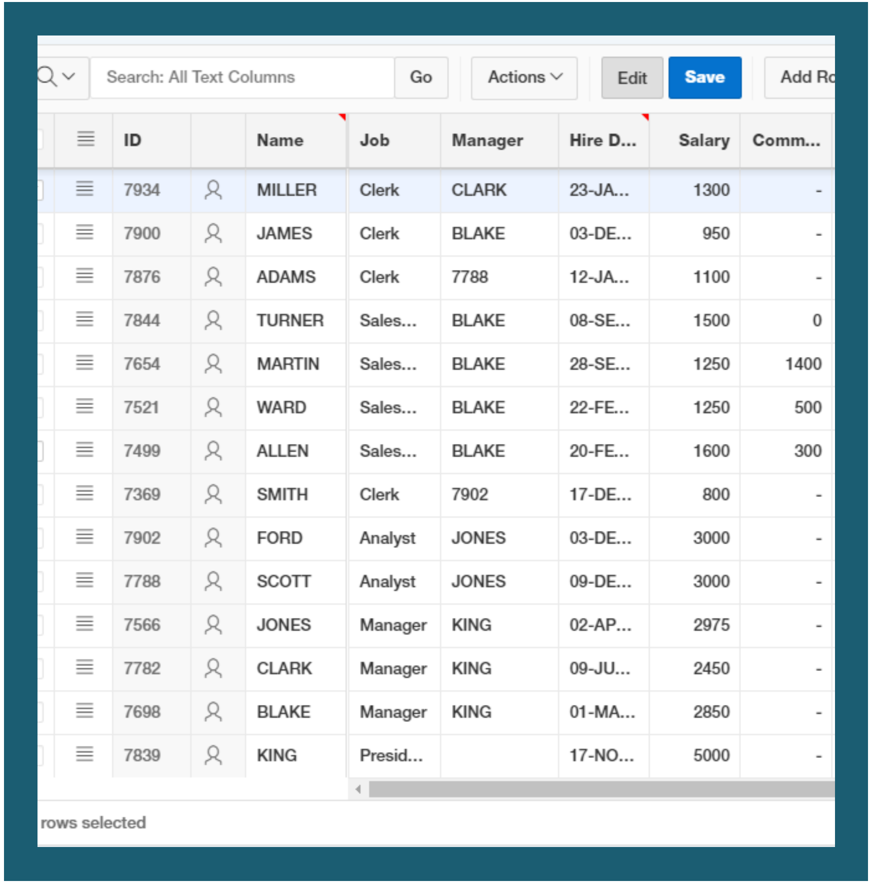
Behind …

The **Supported** Way

This seems so
HARD!

APEX Interactive Grid APIs:

Quick Grid Review



ID	Name	Job	Manager	Hire D...	Salary	Comm...
7934	MILLER	Clerk	CLARK	23-JA...	1300	-
7900	JAMES	Clerk	BLAKE	03-DE...	950	-
7876	ADAMS	Clerk	7788	12-JA...	1100	-
7844	TURNER	Sales...	BLAKE	08-SE...	1500	0
7654	MARTIN	Sales...	BLAKE	28-SE...	1250	1400
7521	WARD	Sales...	BLAKE	22-FE...	1250	500
7499	ALLEN	Sales...	BLAKE	20-FE...	1600	300
7369	SMITH	Clerk	7902	17-DE...	800	-
7902	FORD	Analyst	JONES	03-DE...	3000	-
7788	SCOTT	Analyst	JONES	09-DE...	3000	-
7566	JONES	Manager	KING	02-AP...	2975	-
7782	CLARK	Manager	KING	09-JU...	2450	-
7698	BLAKE	Manager	KING	01-MA...	2850	-
7839	KING	Presid...		17-NO...	5000	-

rows selected

ODTUG Kscope19
SEATTLE, WASHINGTON • JUNE 23-27

Interactive Grid

(Interactive Report or Tabular Form)

+ <All the Features You Ever Wanted>

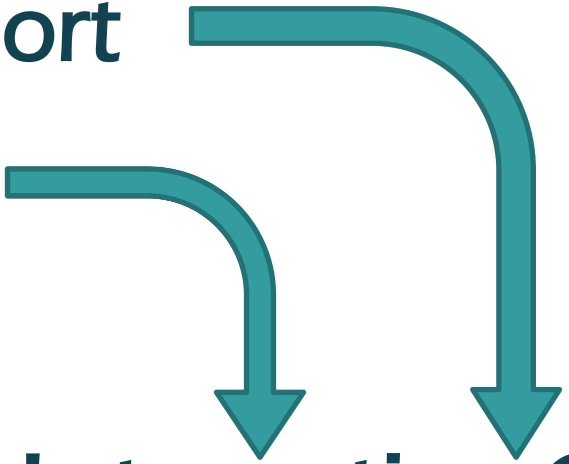
(Thank You APEX Team!)

Interactive Grid

Direction

Inter ve Report

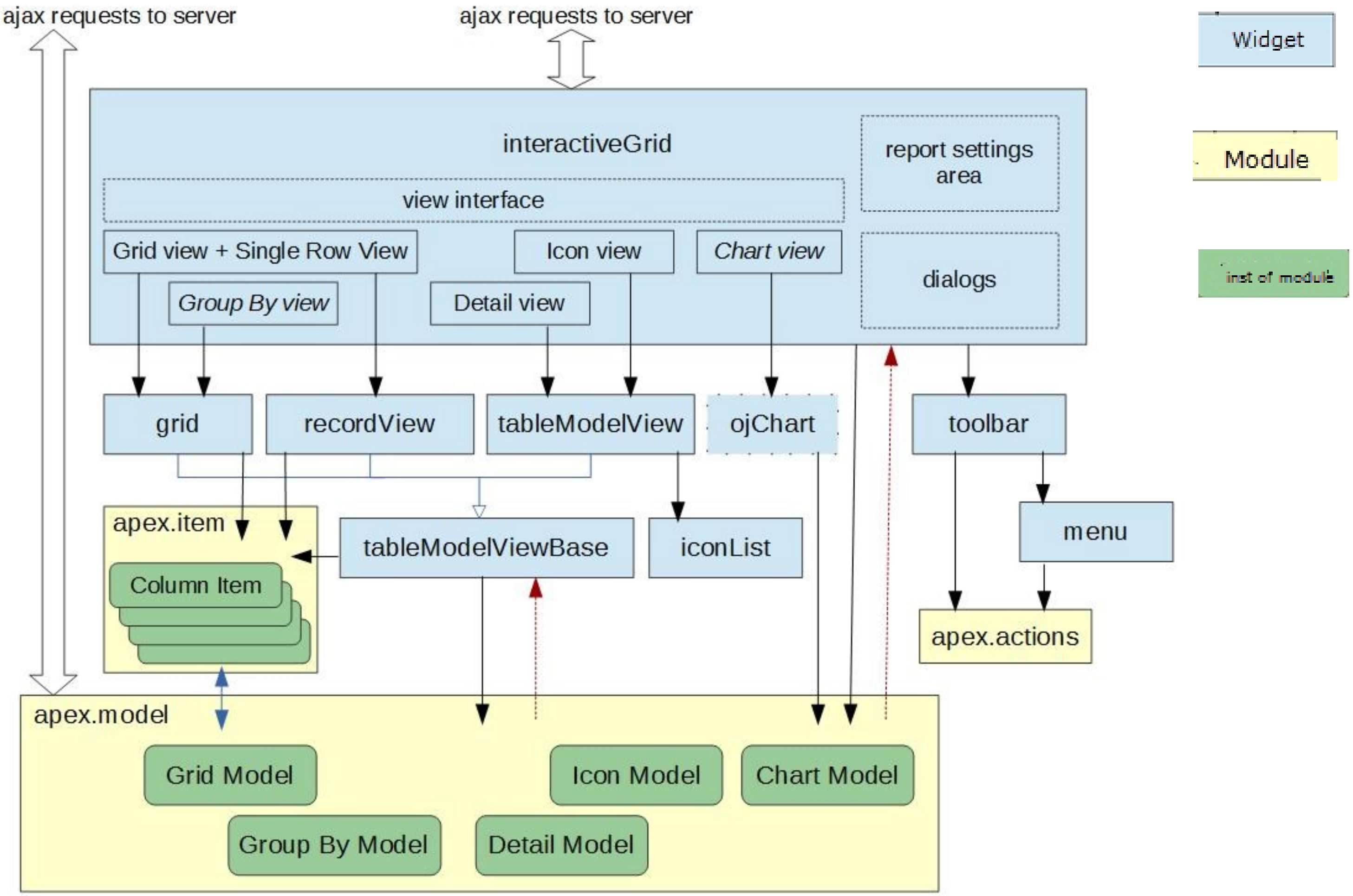
Tabul rm



Future

Now

Interactive Grid



ajax requests to server

ajax requests to server

interactiveGrid

view interface

report settings area

Grid view + Single Row View

Group By view

Detail view

Icon view

Chart view

dialogs

grid

recordView

tableModelView

ojChart

toolbar

apex.item

Column Item

tableModelViewBase

iconList

menu

apex.actions

apex.model

Grid Model

Icon Model

Chart Model

Group By Model

Detail Model

Widget

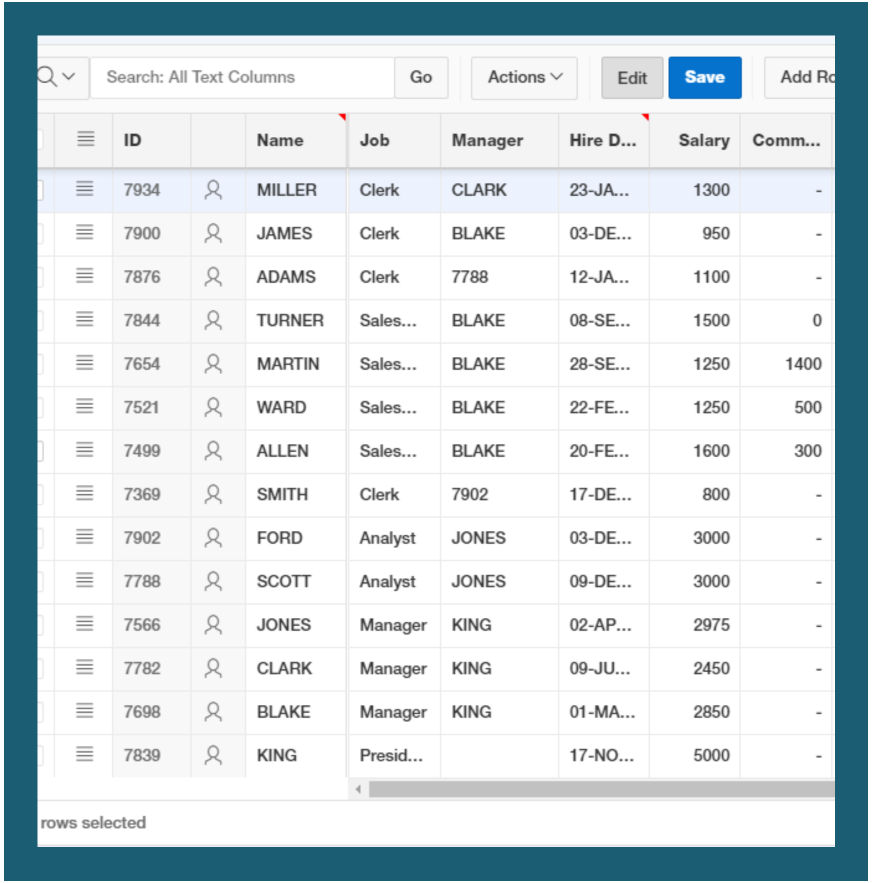
Module

inst of module

APEX Interactive Grid APIs:

19.1

Declarative Enhancements



ID	Name	Job	Manager	Hire D...	Salary	Comm...
7934	MILLER	Clerk	CLARK	23-JA...	1300	-
7900	JAMES	Clerk	BLAKE	03-DE...	950	-
7876	ADAMS	Clerk	7788	12-JA...	1100	-
7844	TURNER	Sales...	BLAKE	08-SE...	1500	0
7654	MARTIN	Sales...	BLAKE	28-SE...	1250	1400
7521	WARD	Sales...	BLAKE	22-FE...	1250	500
7499	ALLEN	Sales...	BLAKE	20-FE...	1600	300
7369	SMITH	Clerk	7902	17-DE...	800	-
7902	FORD	Analyst	JONES	03-DE...	3000	-
7788	SCOTT	Analyst	JONES	09-DE...	3000	-
7566	JONES	Manager	KING	02-AP...	2975	-
7782	CLARK	Manager	KING	09-JU...	2450	-
7698	BLAKE	Manager	KING	01-MA...	2850	-
7839	KING	Presid...		17-NO...	5000	-

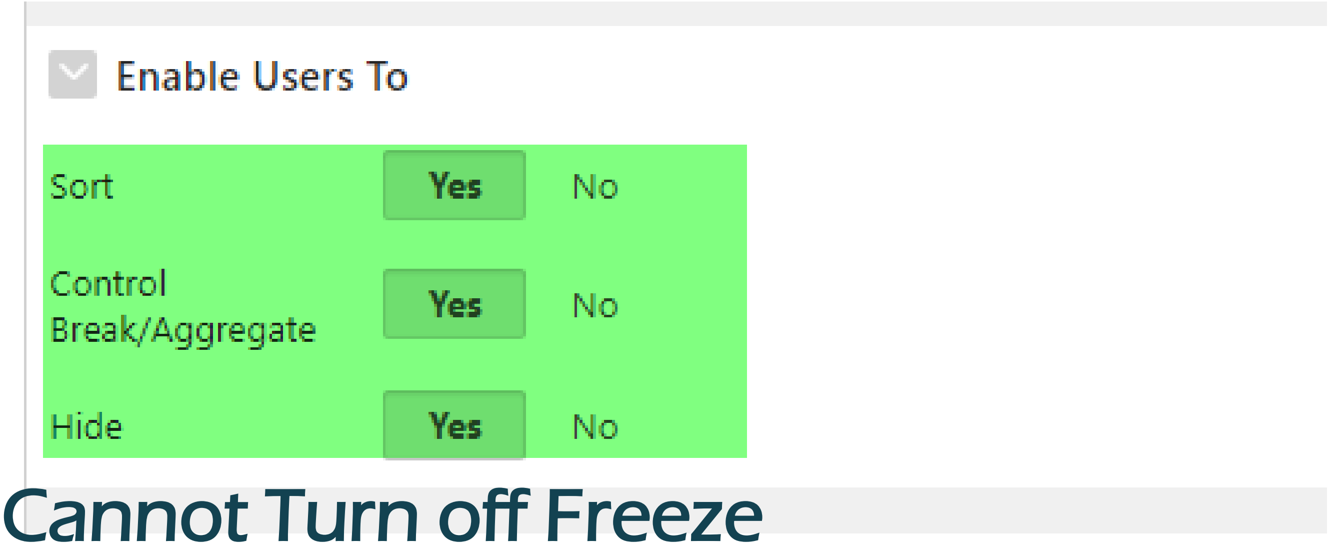
rows selected

- Do It Declaratively First

LOW CODE

APEX 19.1 Grid Declarative Options

- Column Enable Users To



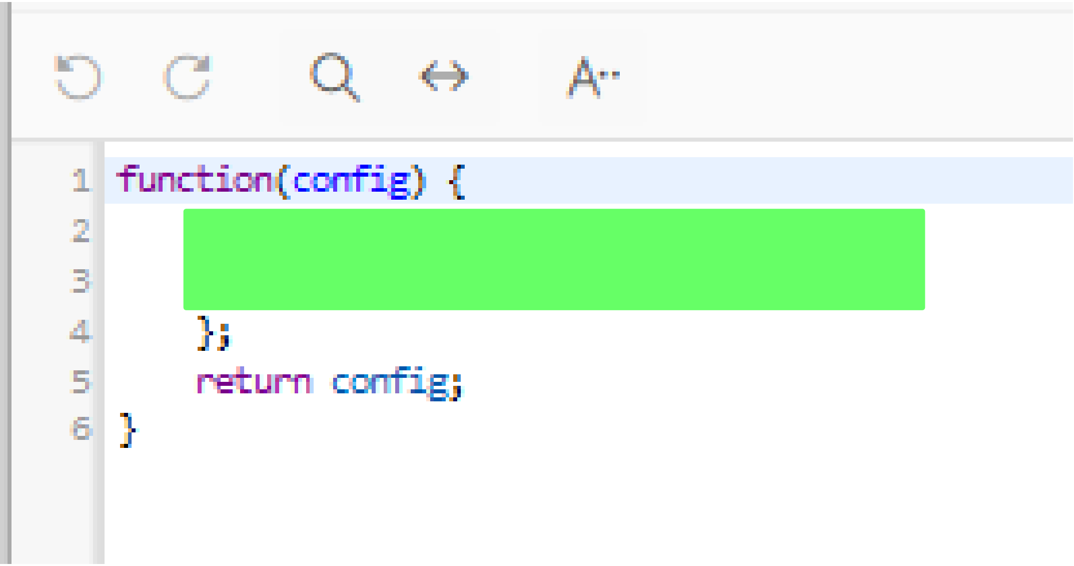
Enable Users To

Sort	[✓ Yes] No
Control Break/Aggregate	[✓ Yes] No
Hide	[✓ Yes] No

- Cannot Turn off Freeze
- Cascading LOV Columns, This is Hidden

To Really Turn Off Column Headers

- In *Column* Advanced JavaScript:



```
function(config) {
        [redacted]
        };
        return config;
}
```

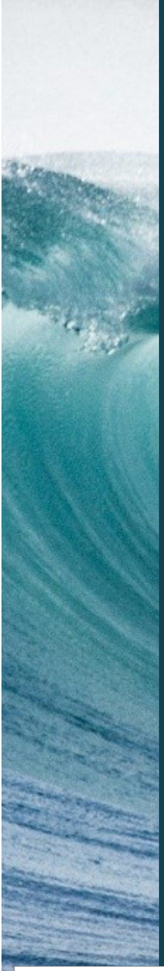
Set Style of a Cell - CSS

- a-GV-row

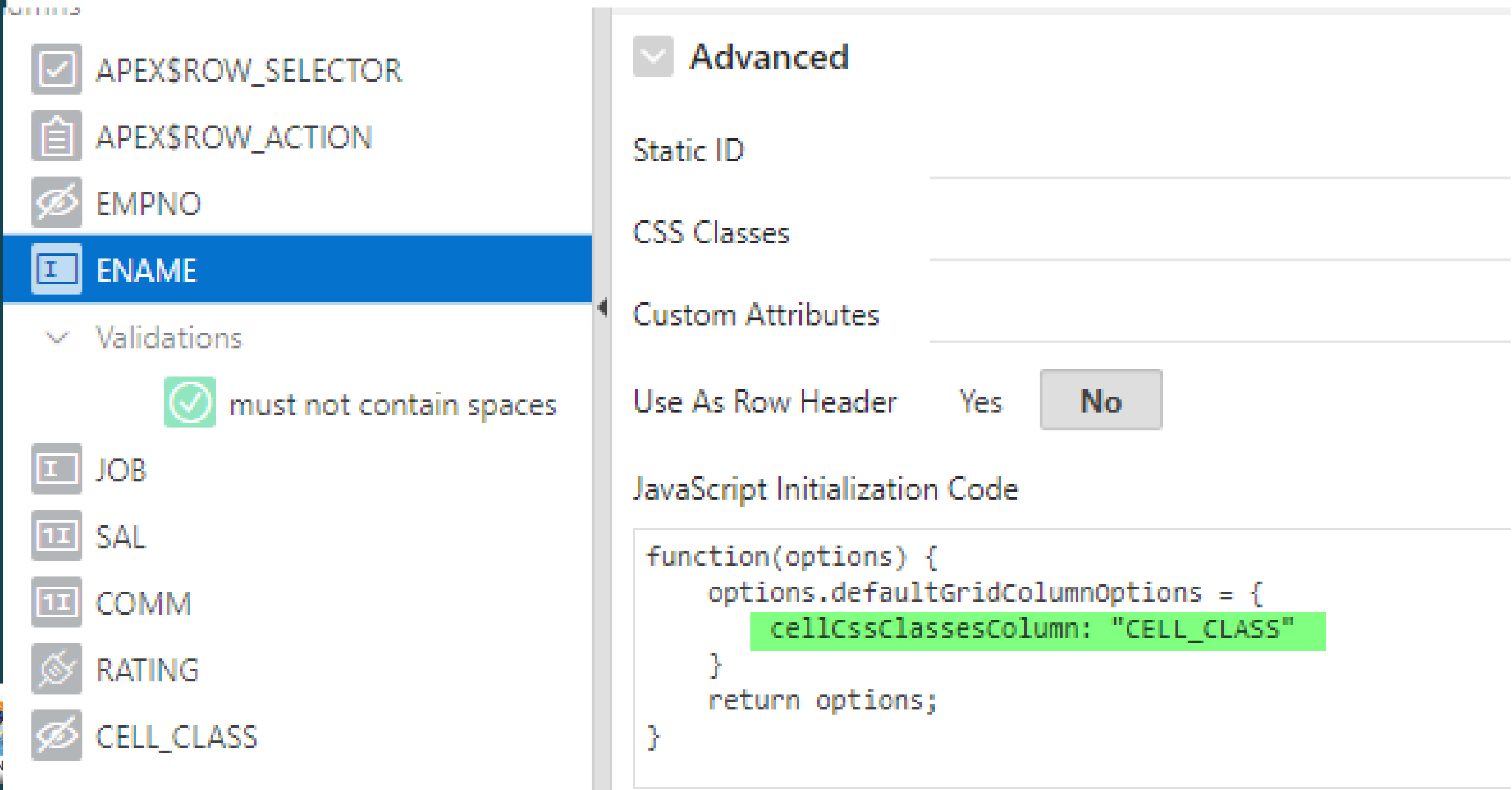
is-selected, is-hover, is-active, is-focused, is-deleted, is-inserted, is-updated, is-error state modifier

- a-GV-cell

is-selected (in cell selection mode), is-changed, is-error state modifier



Set Style of a Cell - Based on Data



- APEX$ROW_SELECTOR
- APEX$ROW_ACTION
- EMPNO
- ENAME
  - Validations
    - must not contain spaces
- JOB
- SAL
- COMM
- RATING
- CELL_CLASS

Advanced

Static ID

CSS Classes

Custom Attributes

Use As Row Header Yes [✓ No]

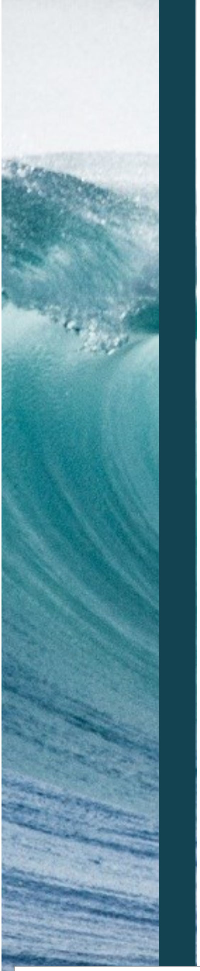
JavaScript Initialization Code

```
function(options) {
    options.defaultGridColumnOptions = {
        cellCssClassesColumn: "CELL_CLASS"
    }
    return options;
}
```

Do It Declaratively First

… but Be Careful w Declarative in Combo w Customizations

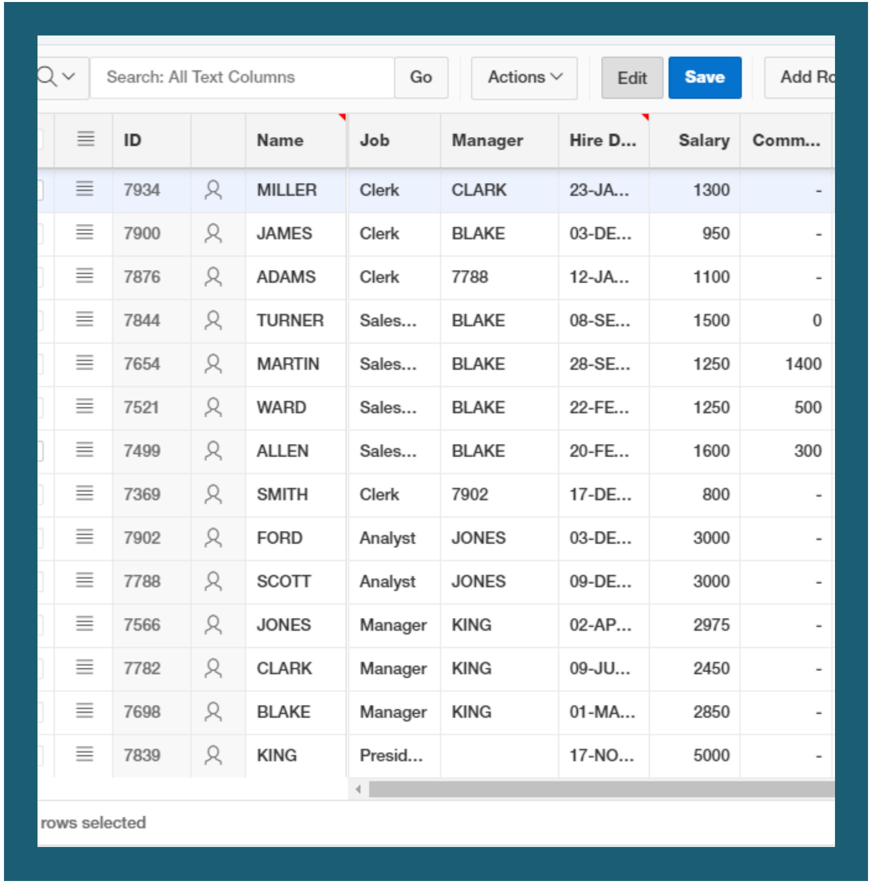
(Don’t Hang Yourself)



- Example of Declaratively Turning Off Edit
- Custom Code to Limit Buttons

APEX Interactive Grid APIs:

JavaScript APIs



	ID		Name	Job	Manager	Hire D...	Salary	Comm...
≡	7934	👤	MILLER	Clerk	CLARK	23-JA...	1300	-
≡	7900	👤	JAMES	Clerk	BLAKE	03-DE...	950	-
≡	7876	👤	ADAMS	Clerk	7788	12-JA...	1100	-
≡	7844	👤	TURNER	Sales...	BLAKE	08-SE...	1500	0
≡	7654	👤	MARTIN	Sales...	BLAKE	28-SE...	1250	1400
≡	7521	👤	WARD	Sales...	BLAKE	22-FE...	1250	500
≡	7499	👤	ALLEN	Sales...	BLAKE	20-FE...	1600	300
≡	7369	👤	SMITH	Clerk	7902	17-DE...	800	-
≡	7902	👤	FORD	Analyst	JONES	03-DE...	3000	-
≡	7788	👤	SCOTT	Analyst	JONES	09-DE...	3000	-
≡	7566	👤	JONES	Manager	KING	02-AP...	2975	-
≡	7782	👤	CLARK	Manager	KING	09-JU...	2450	-
≡	7698	👤	BLAKE	Manager	KING	01-MA...	2850	-
≡	7839	👤	KING	Presid...		17-NO...	5000	-

rows selected

ODTUG Kscope19
SEATTLE, WASHINGTON • JUNE 23-27

End of the
LOW CODE
Part of the Presentation!

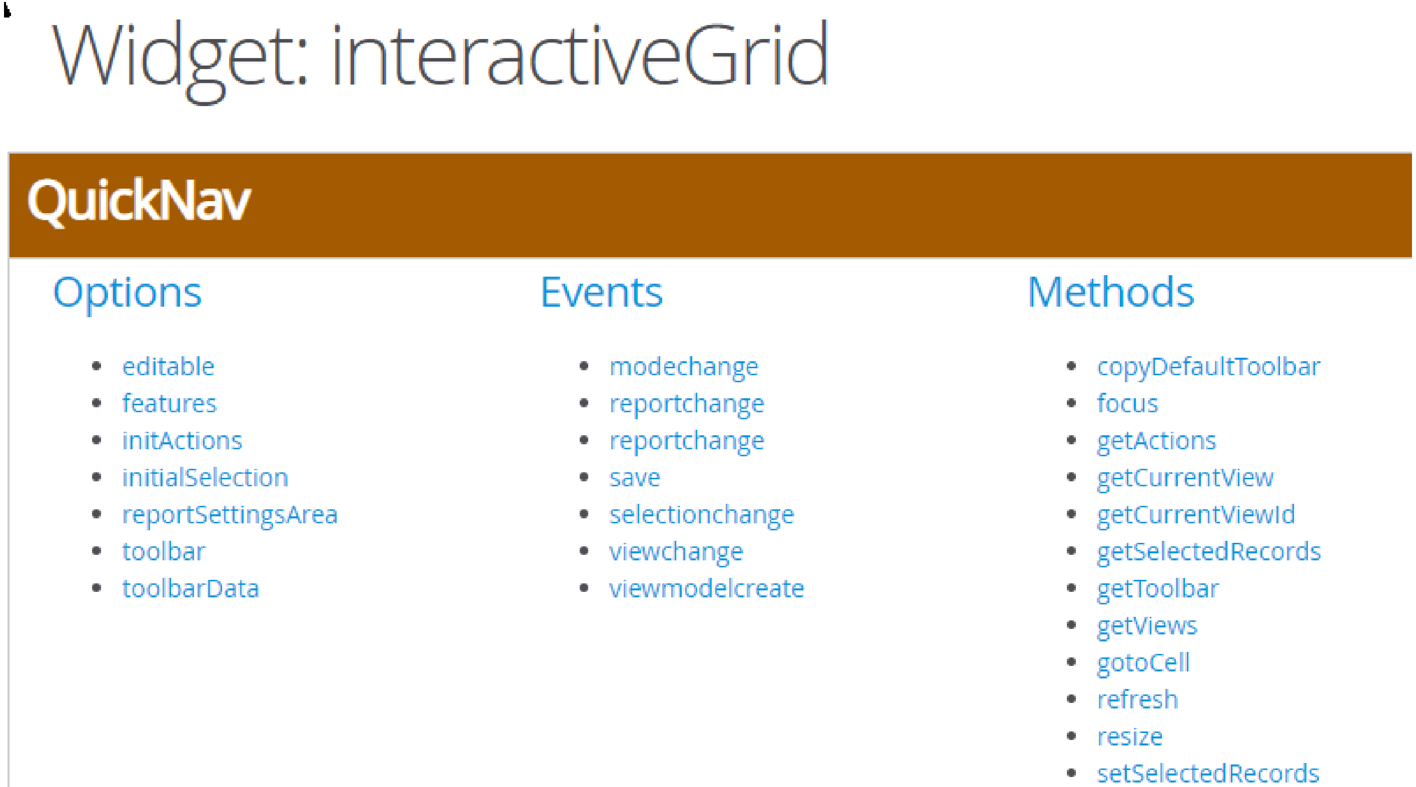
Documented APIs

- APEX 18.1+
- Documented == **Supported**

https://apex.oracle.com/api

#39 JavaScript APIs

interactiveGrid



Widget: interactiveGrid

QuickNav

Options

- editable
- features
- initActions
- initialSelection
- reportSettingsArea
- toolbar
- toolbarData

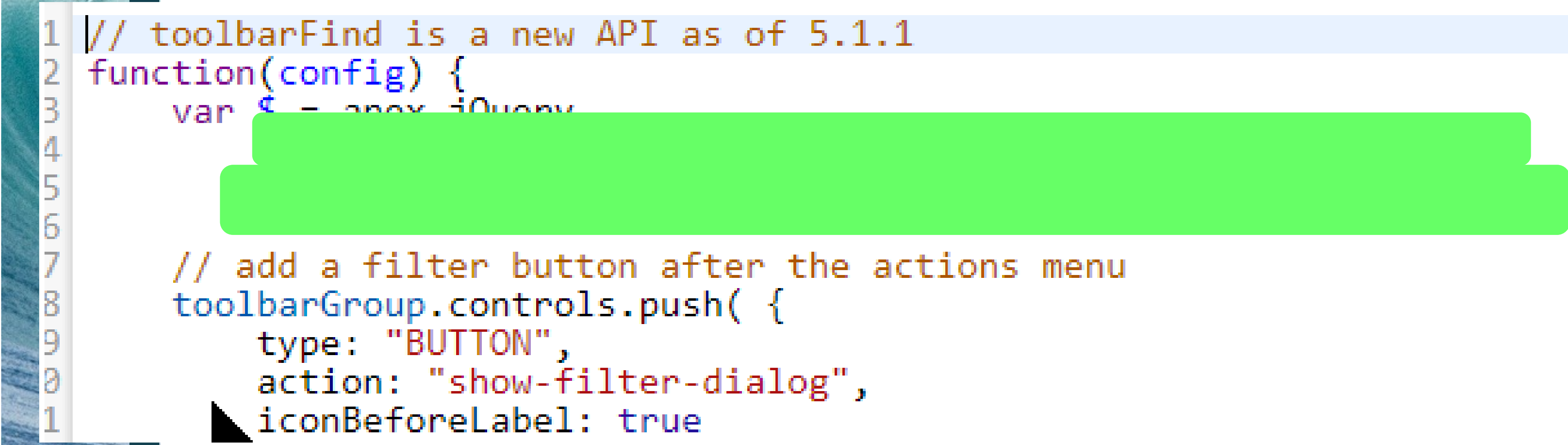
Events

- modechange
- reportchange
- reportchange
- save
- selectionchange
- viewchange
- viewmodelcreate

Methods

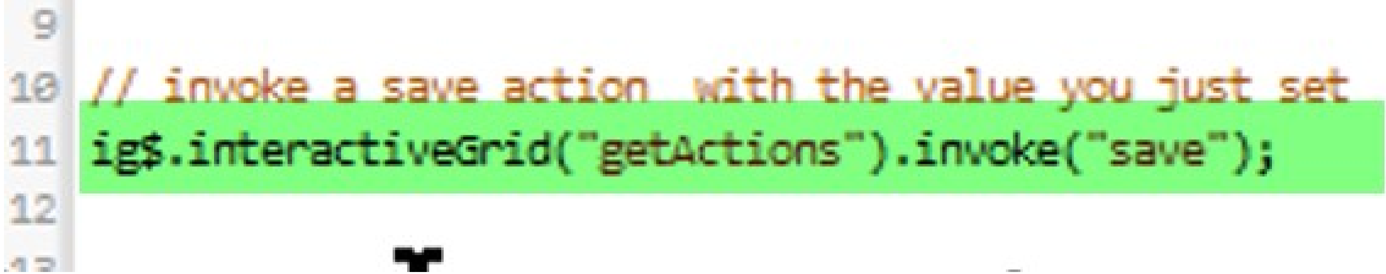
- copyDefaultToolbar
- focus
- getActions
- getCurrentView
- getCurrentViewId
- getSelectedRecords
- getToolbar
- getViews
- gotoCell
- refresh
- resize
- setSelectedRecords

interactiveGrid - Customizations



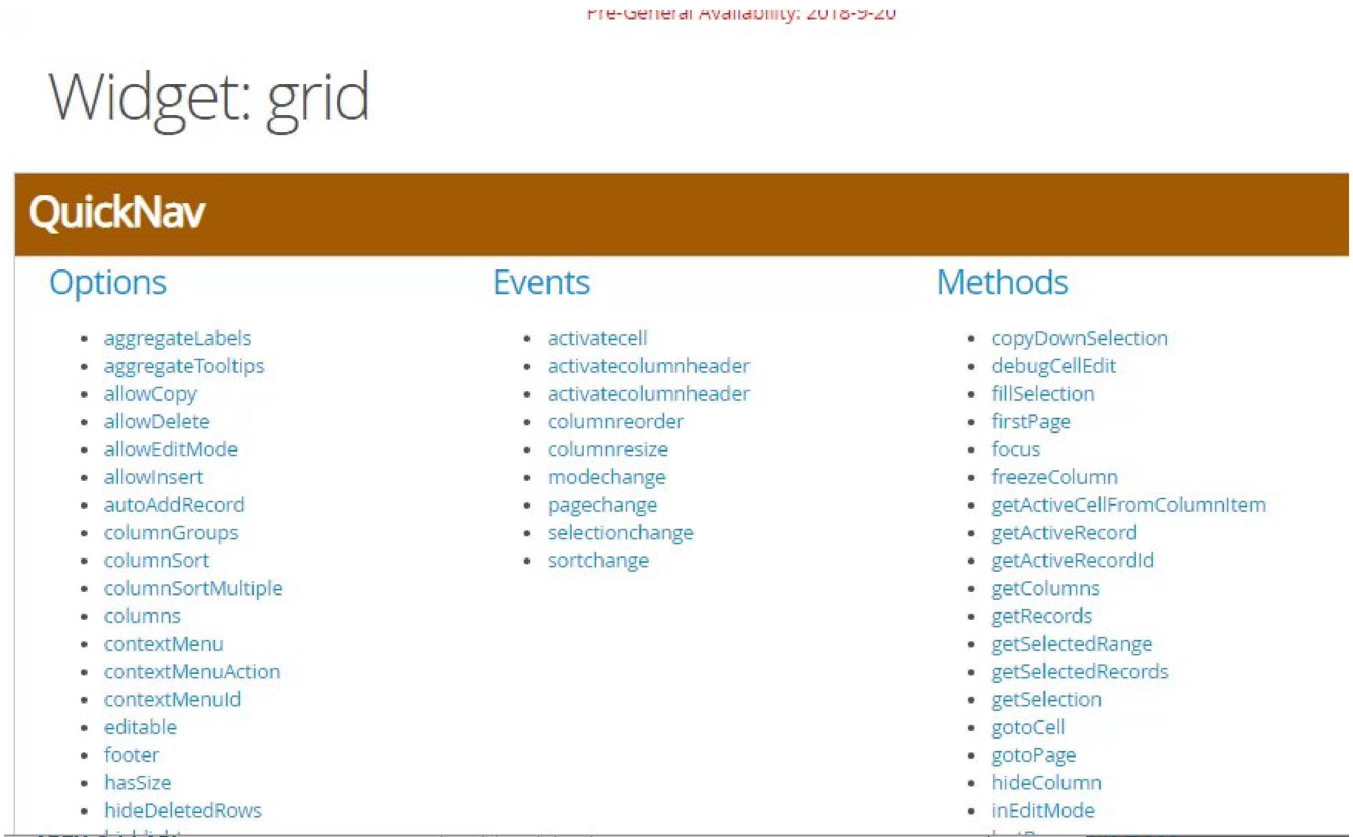
```
// toolbarFind is a new API as of 5.1.1
function(config) {
    var [redacted]

    // add a filter button after the actions menu
    toolbarGroup.controls.push( {
        type: "BUTTON",
        action: "show-filter-dialog",
        iconBeforeLabel: true
```

interactiveGrid – Save



```
// invoke a save action  with the value you just set
ig$.interactiveGrid("getActions").invoke("save");
```

grid



Pre-General Availability: 2018-9-20

Widget: grid

QuickNav

Options

- aggregateLabels
- aggregateTooltips
- allowCopy
- allowDelete
- allowEditMode
- allowInsert
- autoAddRecord
- columnGroups
- columnSort
- columnSortMultiple
- columns
- contextMenu
- contextMenuAction
- contextMenuId
- editable
- footer
- hasSize
- hideDeletedRows

Events

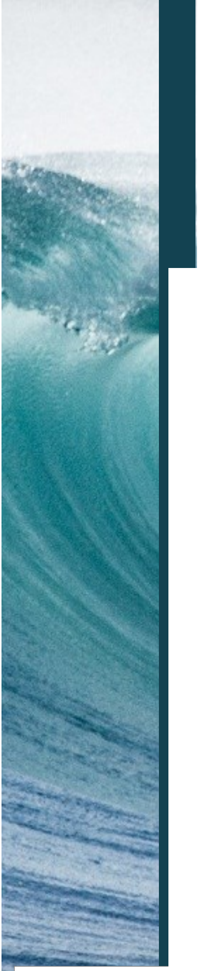
- activatecell
- activatecolumnheader
- activatecolumnheader
- columnreorder
- columnresize
- modechange
- pagechange
- selectionchange
- sortchange

Methods

- copyDownSelection
- debugCellEdit
- fillSelection
- firstPage
- focus
- freezeColumn
- getActiveCellFromColumnItem
- getActiveRecord
- getActiveRecordId
- getColumns
- getRecords
- getSelectedRange
- getSelectedRecords
- getSelection
- gotoCell
- gotoPage
- hideColumn
- inEditMode

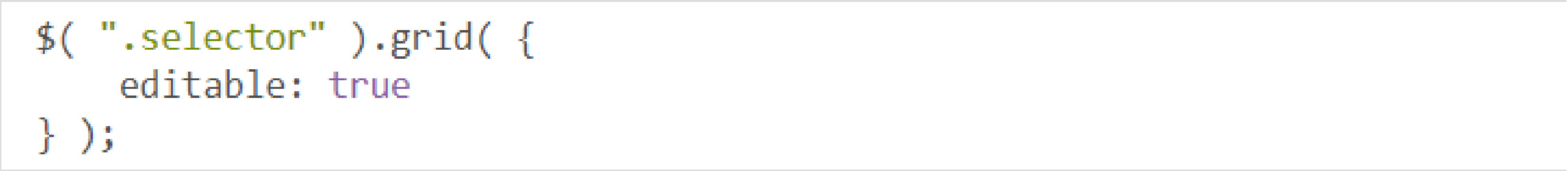
grid – Checking/Manipulating Grid

- Edit Mode On/Off in Background
- Selections Behind the Scenes



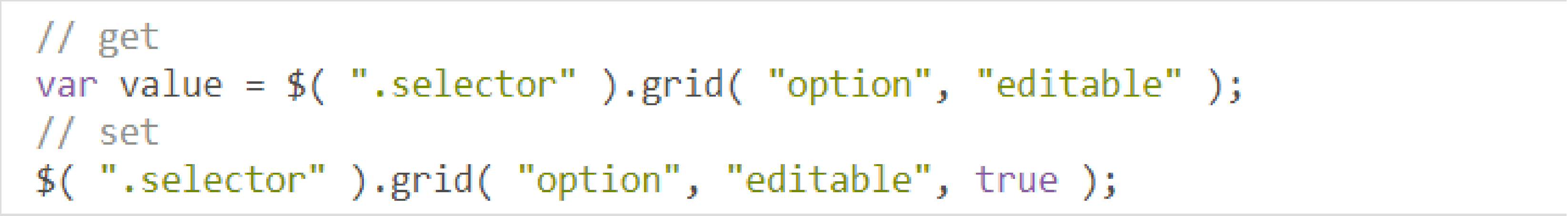
grid Edit Mode Check, On/Off

Initialize the grid with the editable option specified.



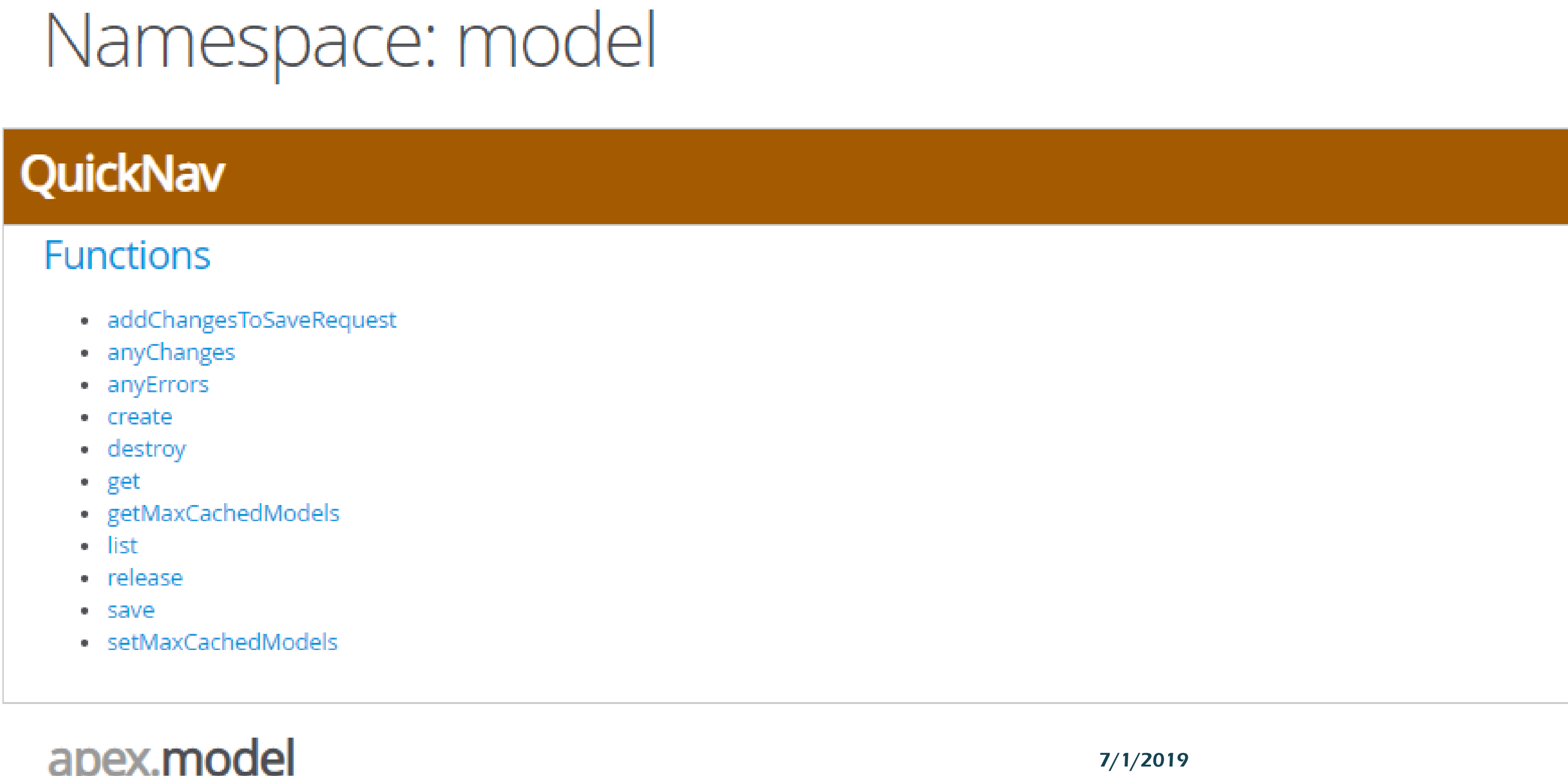
```
$( ".selector" ).grid( {
    editable: true
} );
```

Get or set option editable after initialization.



```
// get
var value = $( ".selector" ).grid( "option", "editable" );
// set
$( ".selector" ).grid( "option", "editable", true );
```

apex.model (Data)



Namespace: model

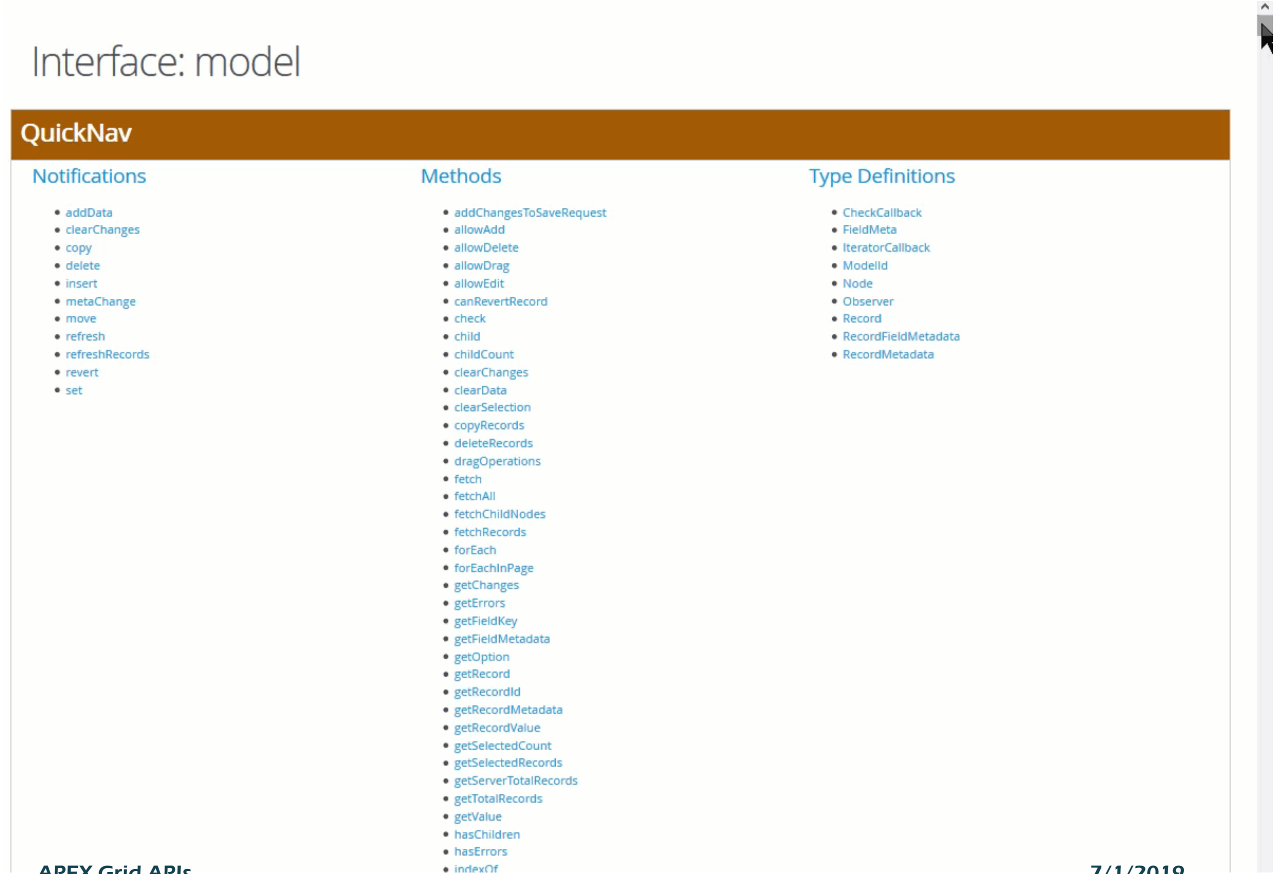
QuickNav

Functions

- addChangesToSaveRequest
- anyChanges
- anyErrors
- create
- destroy
- get
- getMaxCachedModels
- list
- release
- save
- setMaxCachedModels

apex.model

model



Interface: model

QuickNav

Notifications

- addData
- clearChanges
- copy
- delete
- insert
- metaChange
- move
- refresh
- refreshRecords
- revert
- set

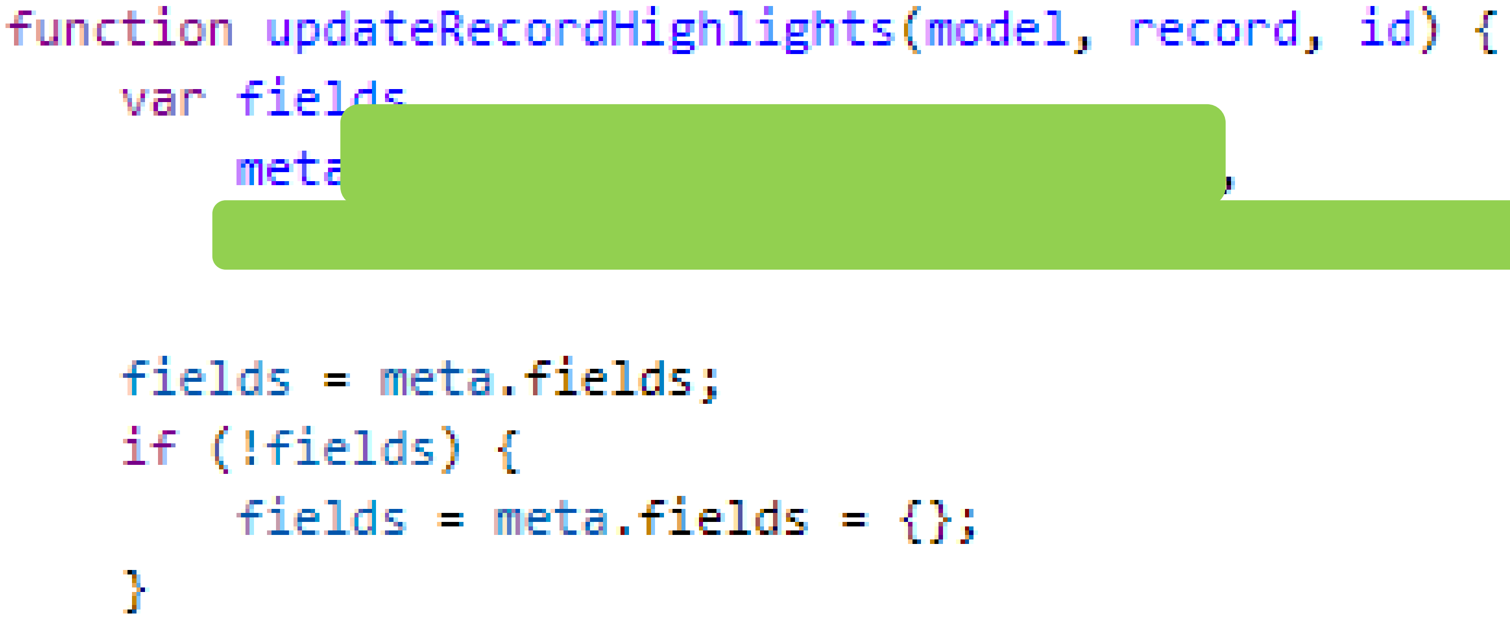
Methods

- addChangesToSaveRequest
- allowAdd
- allowDelete
- allowDrag
- allowEdit
- canRevertRecord
- check
- child
- childCount
- clearChanges
- clearData
- clearSelection
- copyRecords
- deleteRecords
- dragOperations
- fetch
- fetchAll
- fetchChildNodes
- fetchRecords
- forEach
- forEachInPage
- getChanges
- getErrors
- getFieldKey
- getFieldMetadata
- getOption
- getRecord
- getRecordId
- getRecordMetadata
- getRecordValue
- getSelectedCount
- getSelectedRecords
- getServerTotalRecords
- getTotalRecords
- getValue
- hasChildren
- hasErrors
- indexOf

Type Definitions

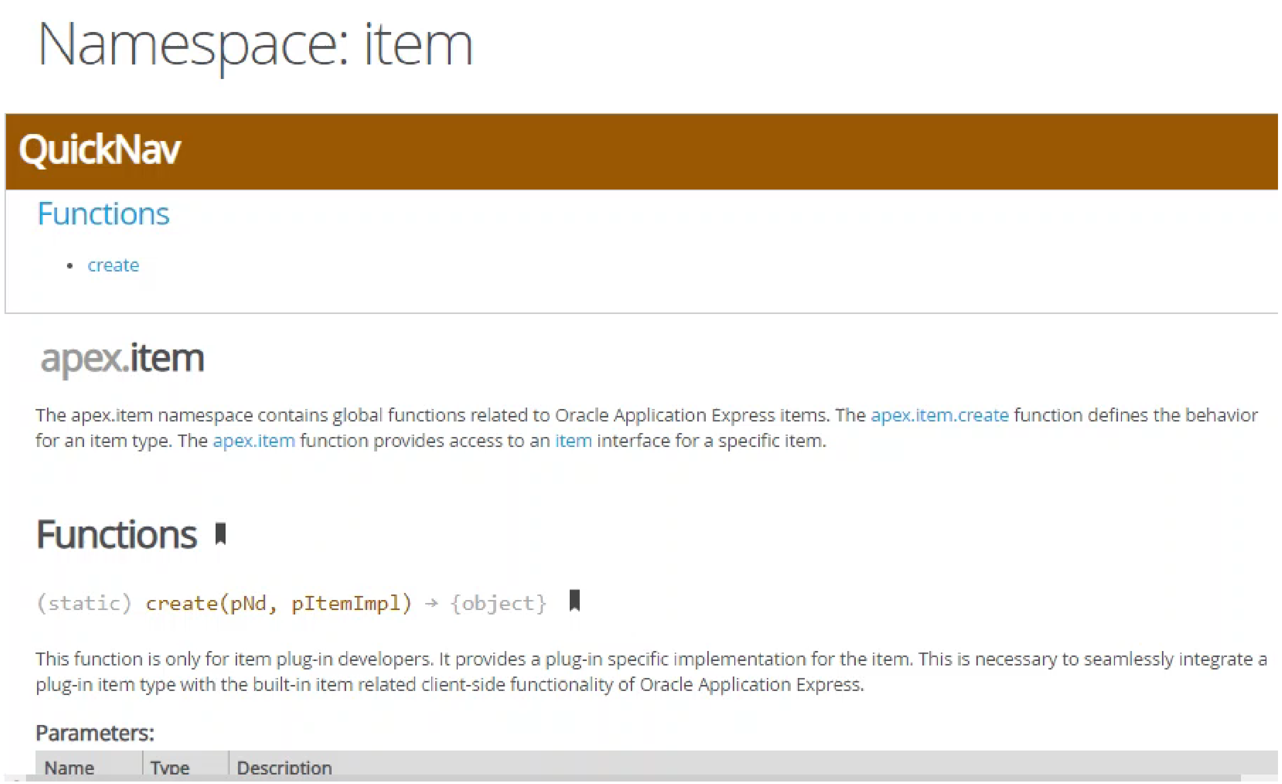
- CheckCallback
- FieldMeta
- IteratorCallback
- ModelId
- Node
- Observer
- Record
- RecordFieldMetadata
- RecordMetadata

model When Accessing Data



```
function updateRecordHighlights(model, record, id) {
    var fields
        meta[redacted],

    fields = meta.fields;
    if (!fields) {
        fields = meta.fields = {};
    }
```

apex.item



Namespace: item

QuickNav

Functions

- create

apex.item

The apex.item namespace contains global functions related to Oracle Application Express items. The apex.item.create function defines the behavior for an item type. The apex.item function provides access to an item interface for a specific item.

Functions

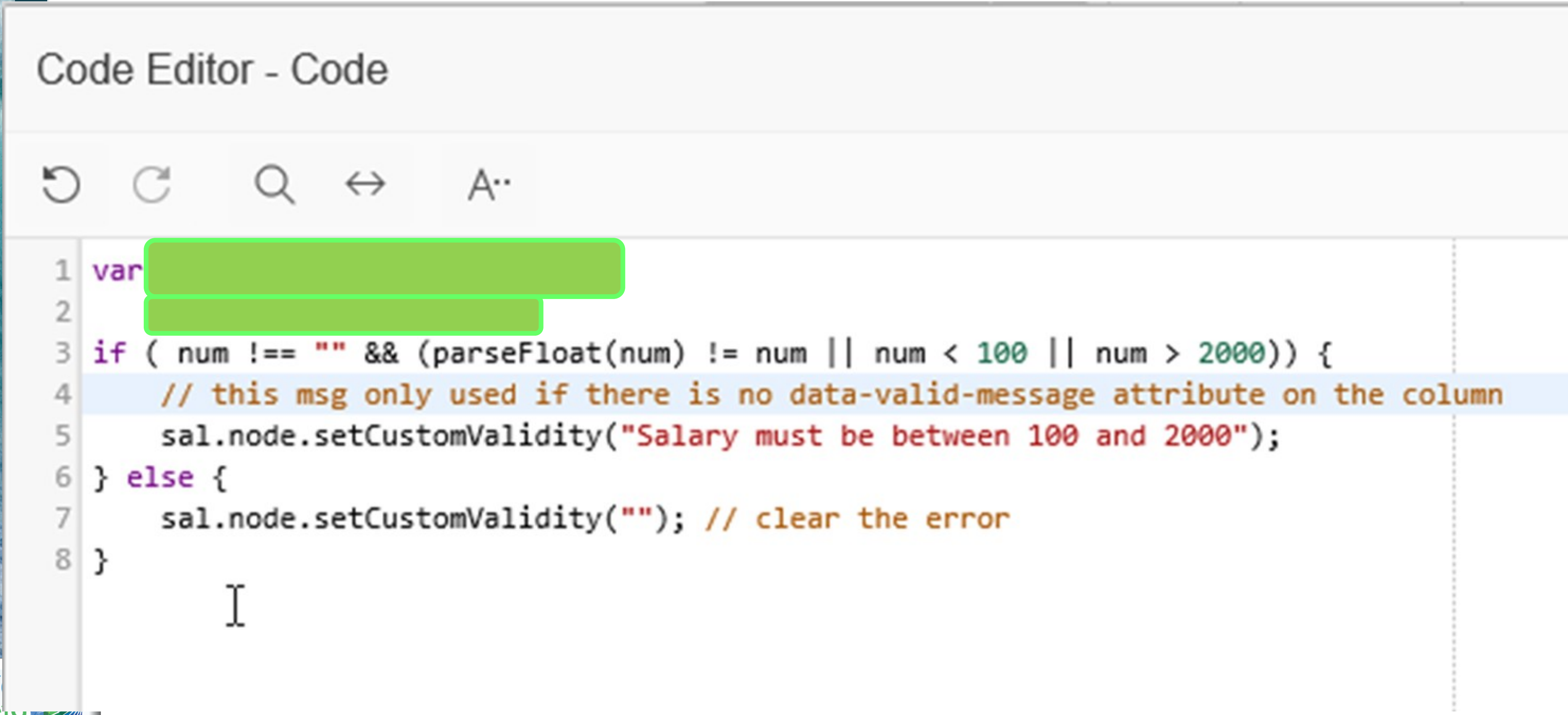
```
(static) create(pNd, pItemImpl) → {object}
```

This function is only for item plug-in developers. It provides a plug-in specific implementation for the item. This is necessary to seamlessly integrate a plug-in item type with the built-in item related client-side functionality of Oracle Application Express.

Parameters:

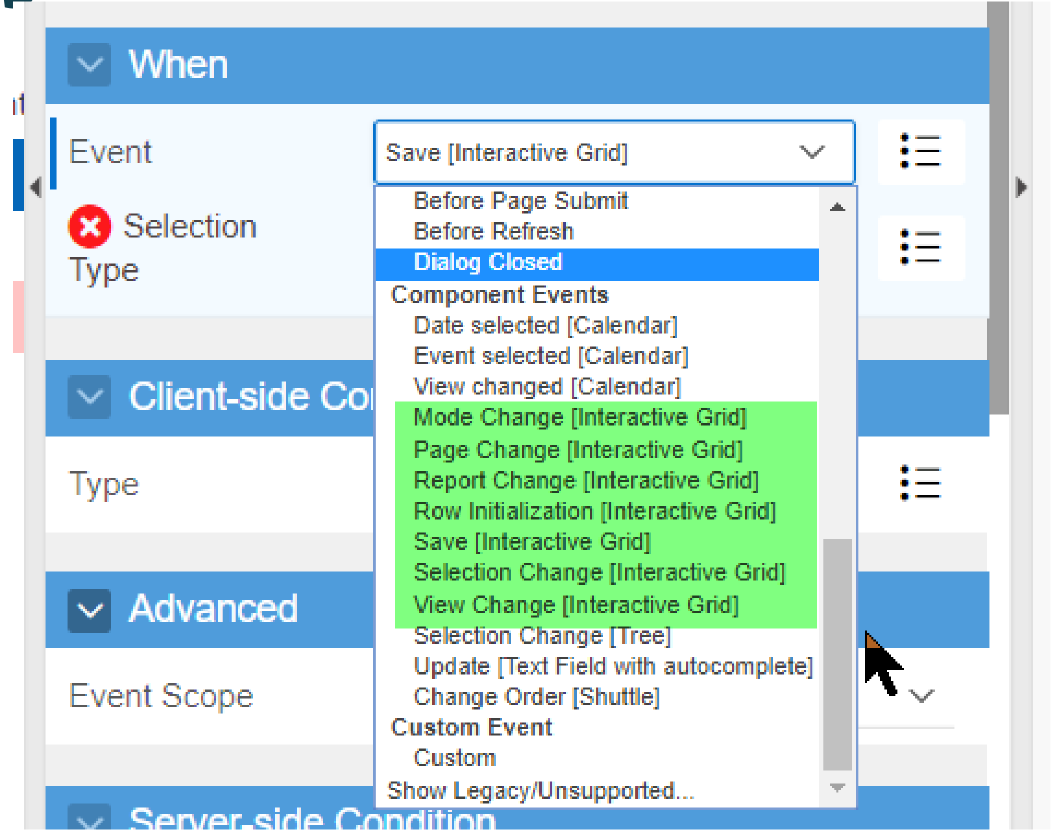
Name	Type	Description

apex.item in Dyn Action Validations



```
var [redacted]

if ( num !== "" && (parseFloat(num) != num || num < 100 || num > 2000)) {
    // this msg only used if there is no data-valid-message attribute on the column
    sal.node.setCustomValidity("Salary must be between 100 and 2000");
} else {
    sal.node.setCustomValidity(""); // clear the error
}
```

Dynamic Action Events



When

Event: Save [Interactive Grid]

Selection Type

- Before Page Submit
- Before Refresh
- Dialog Closed

Component Events

- Date selected [Calendar]
- Event selected [Calendar]
- View changed [Calendar]
- Mode Change [Interactive Grid]
- Page Change [Interactive Grid]
- Report Change [Interactive Grid]
- Row Initialization [Interactive Grid]
- Save [Interactive Grid]
- Selection Change [Interactive Grid]
- View Change [Interactive Grid]
- Selection Change [Tree]
- Update [Text Field with autocomplete]
- Change Order [Shuttle]

Custom Event

- Custom

Show Legacy/Unsupported...

Client-side Co

Type

Advanced

Event Scope

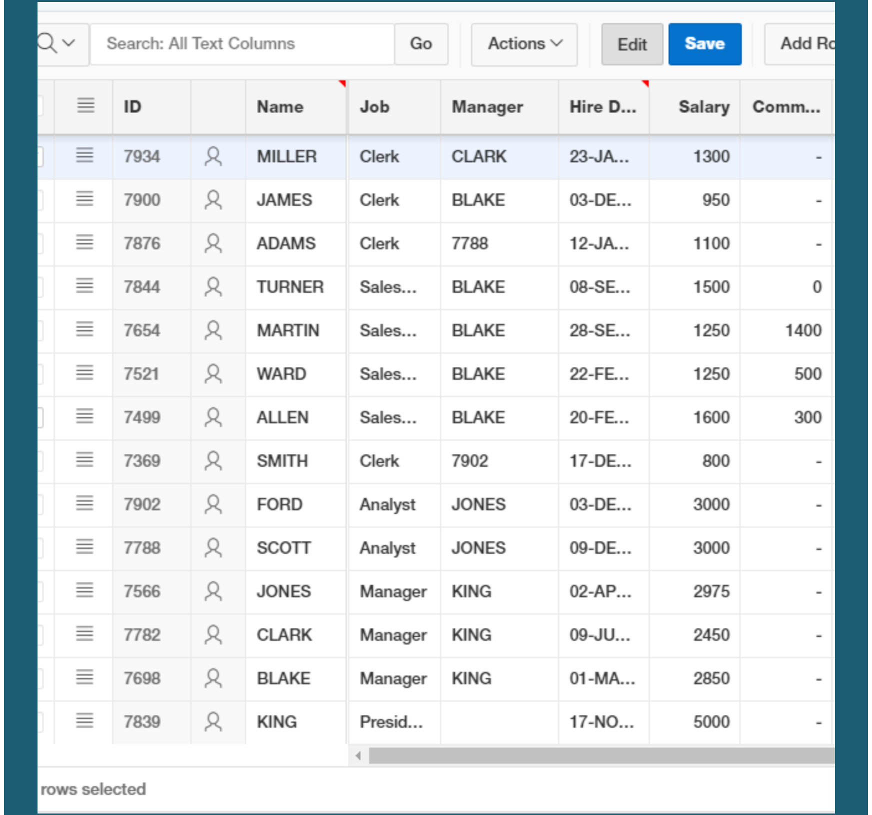
Server-side Condition

Examples …

- Mode Change – Edit/No Edit
- Page Change – Pagination
- Report Change – Public to Private, etc
- Row Initialization
- Selection Change
- View Change – Grid to Chart to Group By

APEX Interactive Grid APIs:

Validations, Processing



≡	ID		Name	Job	Manager	Hire D...	Salary	Comm...
≡	7934		MILLER	Clerk	CLARK	23-JA...	1300	-
≡	7900		JAMES	Clerk	BLAKE	03-DE...	950	-
≡	7876		ADAMS	Clerk	7788	12-JA...	1100	-
≡	7844		TURNER	Sales...	BLAKE	08-SE...	1500	0
≡	7654		MARTIN	Sales...	BLAKE	28-SE...	1250	1400
≡	7521		WARD	Sales...	BLAKE	22-FE...	1250	500
≡	7499		ALLEN	Sales...	BLAKE	20-FE...	1600	300
≡	7369		SMITH	Clerk	7902	17-DE...	800	-
≡	7902		FORD	Analyst	JONES	03-DE...	3000	-
≡	7788		SCOTT	Analyst	JONES	09-DE...	3000	-
≡	7566		JONES	Manager	KING	02-AP...	2975	-
≡	7782		CLARK	Manager	KING	09-JU...	2450	-
≡	7698		BLAKE	Manager	KING	01-MA...	2850	-
≡	7839		KING	Presid...		17-NO...	5000	-

rows selected

ODTUG Kscope19
SEATTLE, WASHINGTON • JUNE 23-27

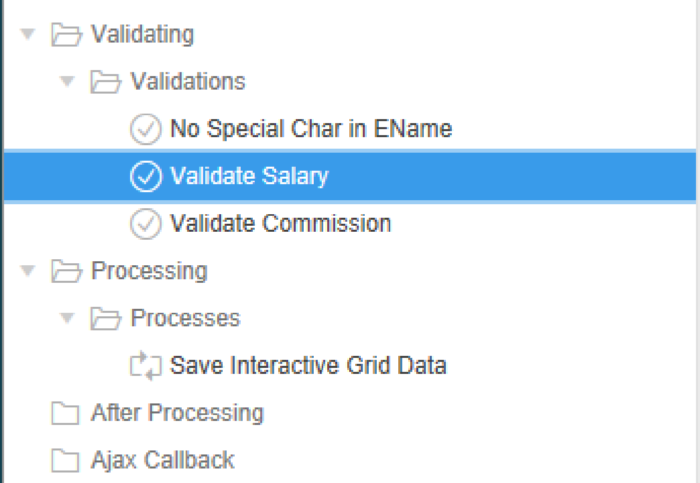
Validations (Review!)

- :COLUMN_NAME References ← Server Side
  - Similar to 4.2 Tab Form
  - On Submit
- Dynamic Actions ← Client Side
  - Column Option
- HTML5 Form Validation ← Client Side
  - Required
  - Pattern – Min, Max (Numbers)
    - In Custom Attributes

Dynamic Action

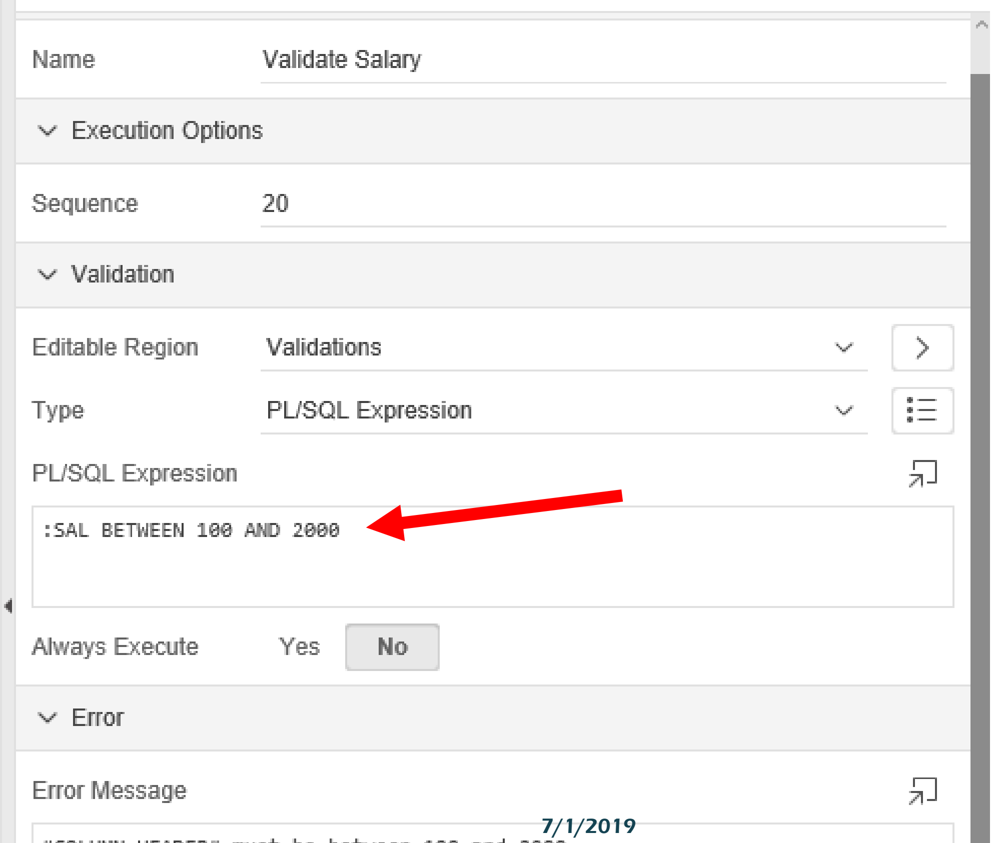
- Just Like On a Page Item
- Conditions/Action Reference Any Column In Row
- Cannot Reference Element in Other Rows

Validation - PL/SQL (On Submit)



- Validating
  - Validations
    - No Special Char in EName
    - Validate Salary
    - Validate Commission
- Processing
  - Processes
    - Save Interactive Grid Data
- After Processing
- Ajax Callback

Server Side



Name: Validate Salary

Execution Options

Sequence: 20

Validation

Editable Region: Validations

Type: PL/SQL Expression

PL/SQL Expression

```
:SAL BETWEEN 100 AND 2000
```

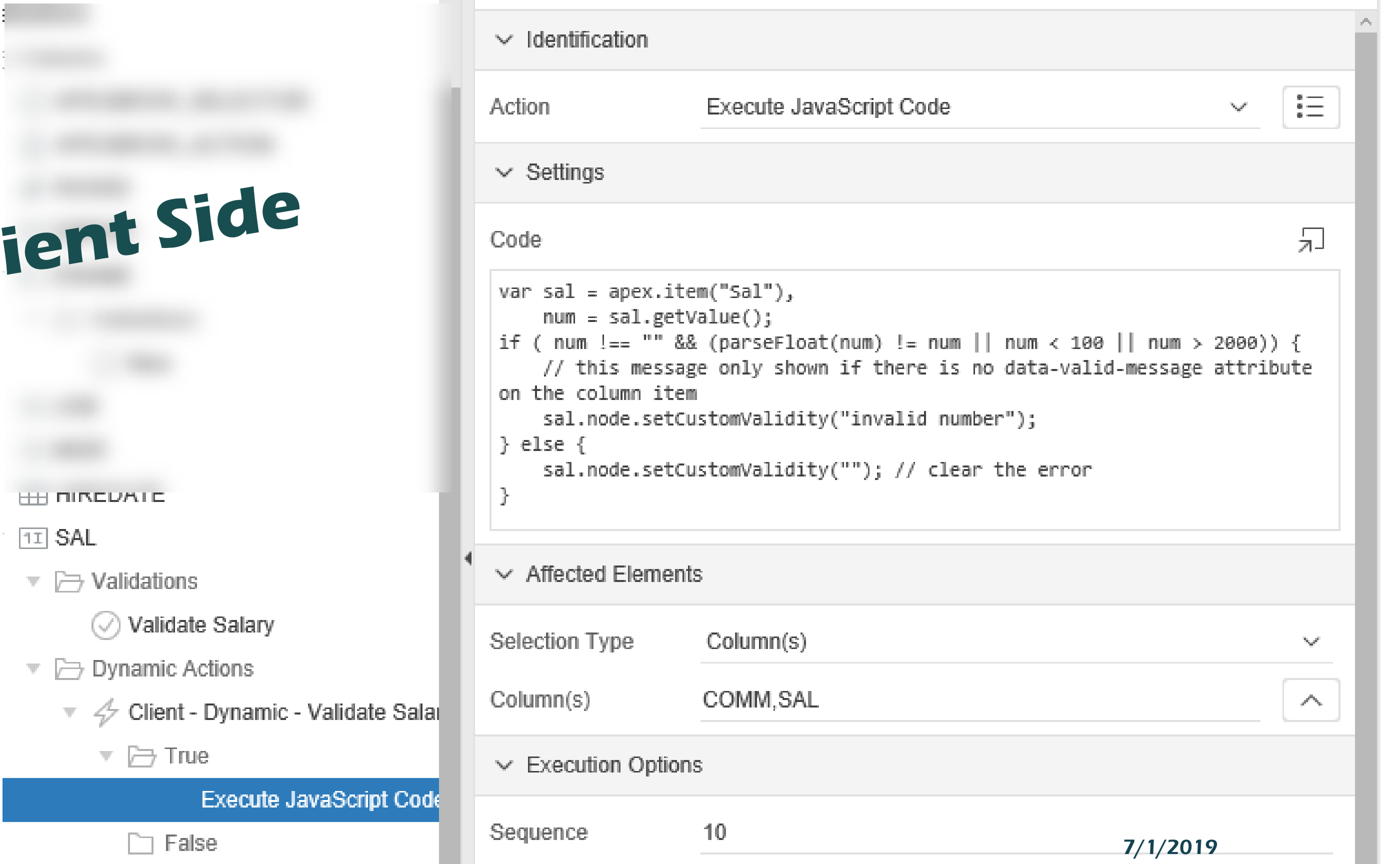
Always Execute: Yes [✓ No]

Error

Error Message

#COLUMN_HEADER# must be between 100 and 2000

Validation – Dyn Action JS



Client Side

Action: Execute JavaScript Code

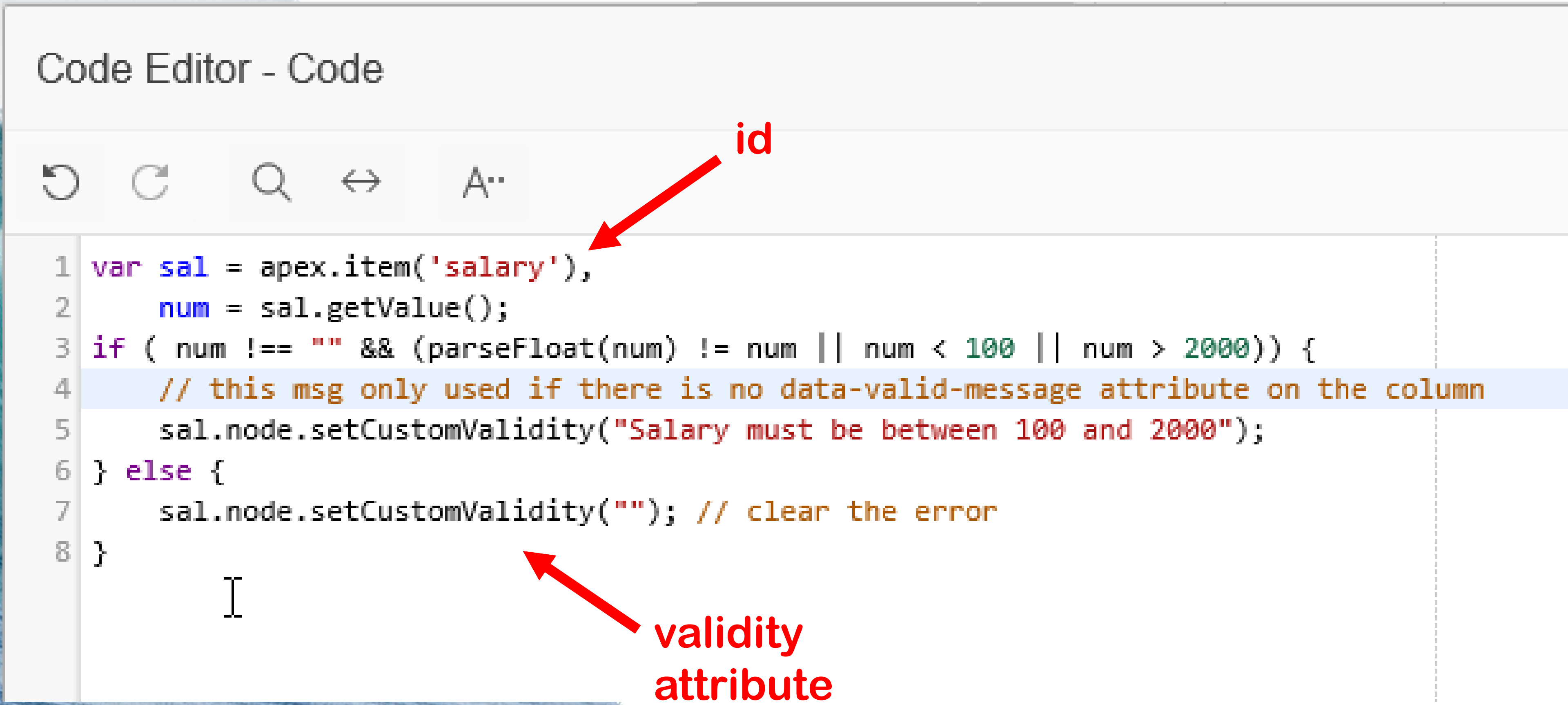
Code

```
var sal = apex.item("Sal"),
    num = sal.getValue();
if ( num !== "" && (parseFloat(num) != num || num < 100 || num > 2000)) {
    // this message only shown if there is no data-valid-message attribute
on the column item
    sal.node.setCustomValidity("invalid number");
} else {
    sal.node.setCustomValidity(""); // clear the error
}
```

Selection Type: Column(s)

Column(s): COMM,SAL

Sequence: 10

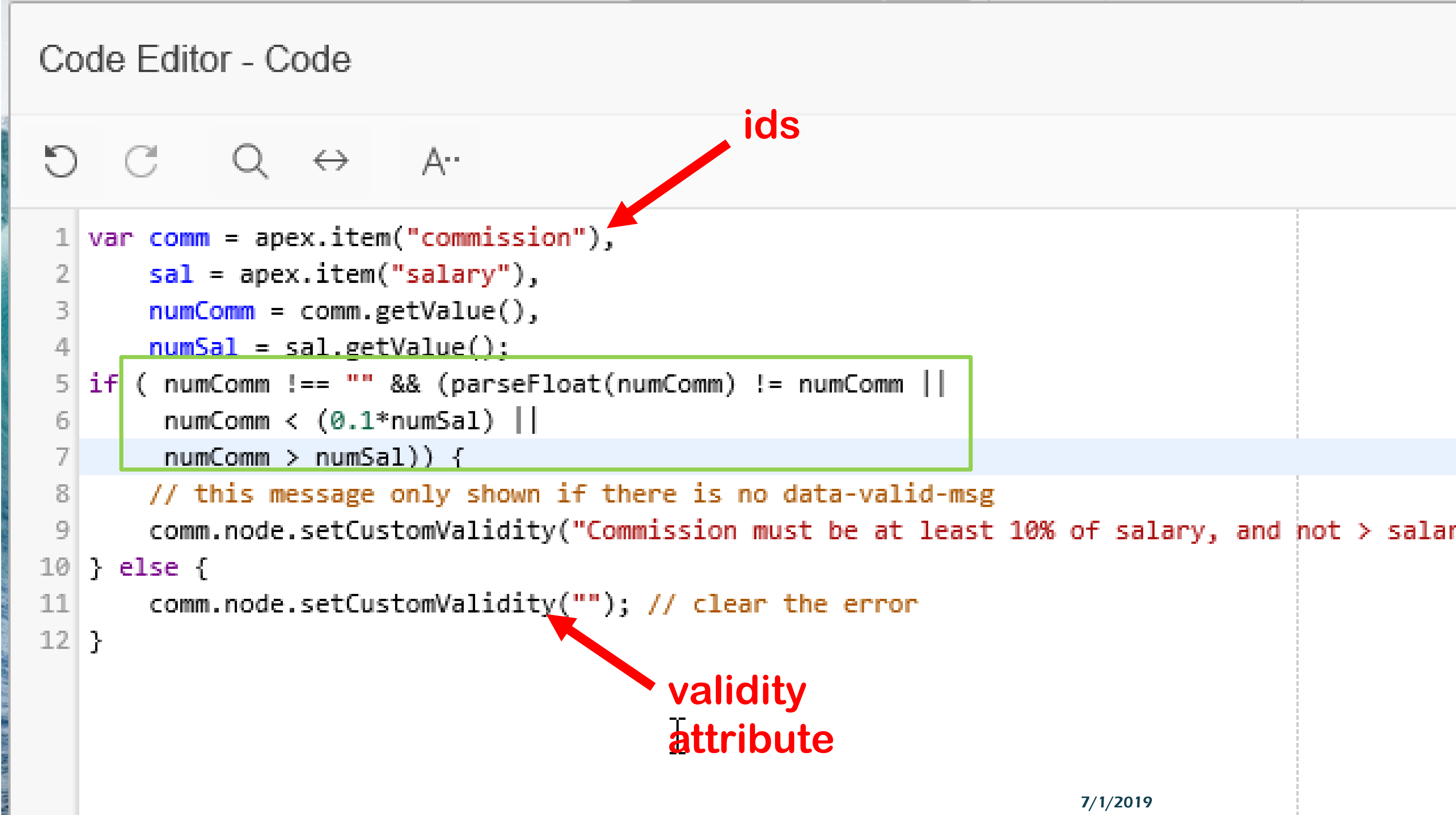


Code Editor - Code

```
var sal = apex.item('salary'),
    num = sal.getValue();
if ( num !== "" && (parseFloat(num) != num || num < 100 || num > 2000)) {
    // this msg only used if there is no data-valid-message attribute on the column
    sal.node.setCustomValidity("Salary must be between 100 and 2000");
} else {
    sal.node.setCustomValidity(""); // clear the error
}
```

id

validity attribute



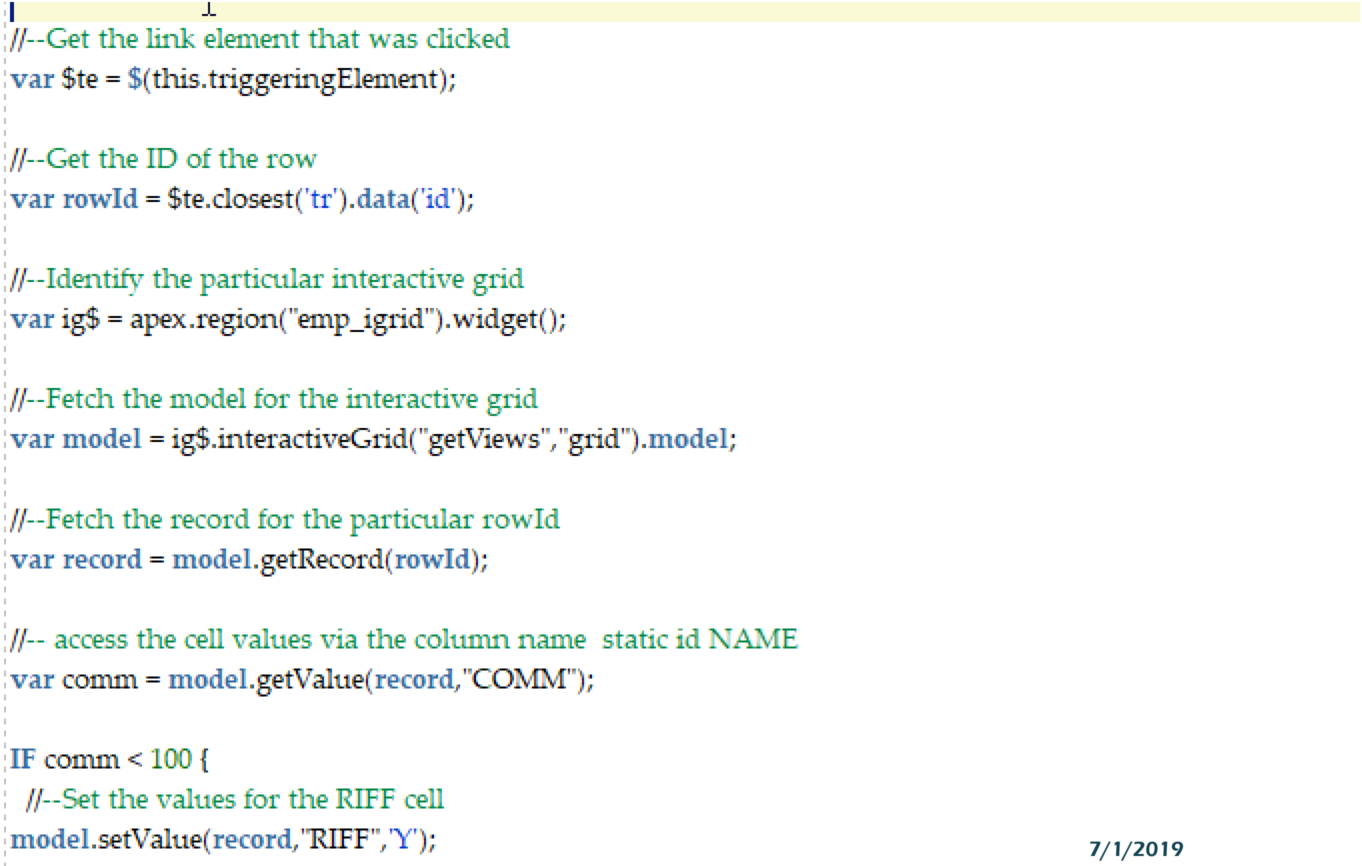
Code Editor - Code

```
var comm = apex.item("commission"),
    sal = apex.item("salary"),
    numComm = comm.getValue(),
    numSal = sal.getValue();
if ( numComm !== "" && (parseFloat(numComm) != numComm ||
     numComm < (0.1*numSal) ||
     numComm > numSal)) {
    // this message only shown if there is no data-valid-msg
    comm.node.setCustomValidity("Commission must be at least 10% of salary, and not > salar
} else {
    comm.node.setCustomValidity(""); // clear the error
}
```

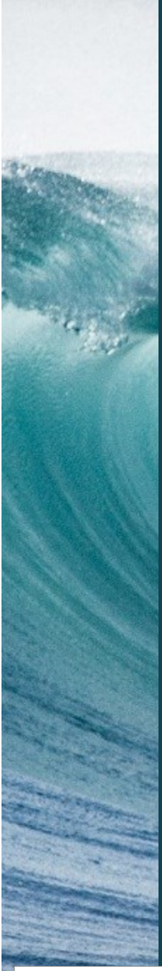
ids

validity attribute

JS: Access Grid, Model, Record…



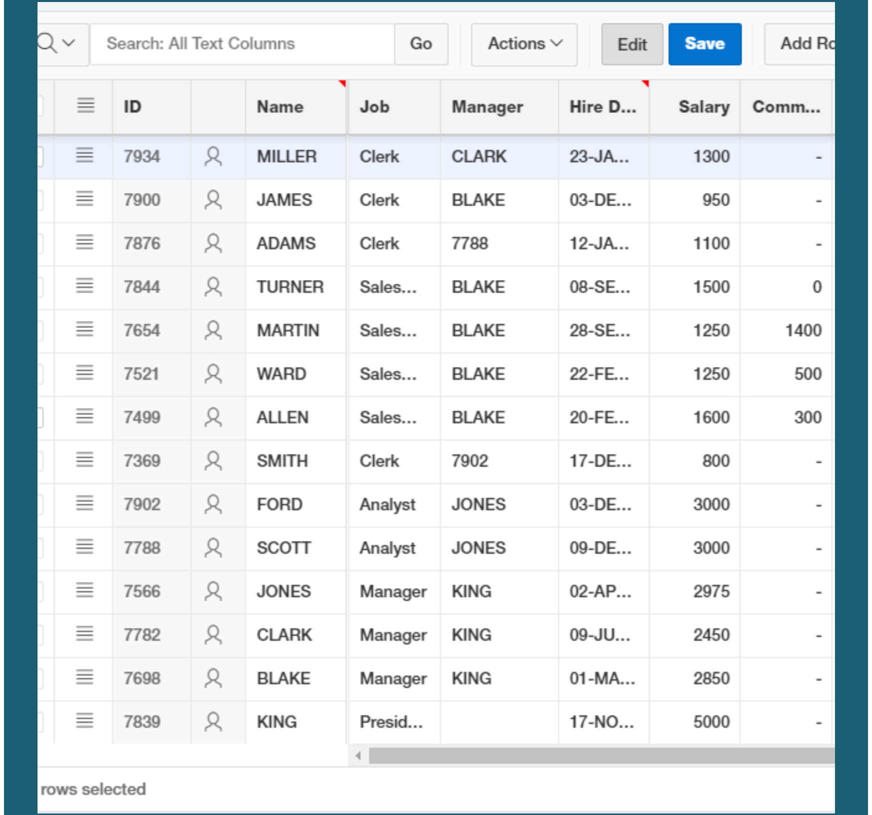
```
//--Get the link element that was clicked
var $te = $(this.triggeringElement);

//--Get the ID of the row
var rowId = $te.closest('tr').data('id');

//--Identify the particular interactive grid
var ig$ = apex.region("emp_igrid").widget();

//--Fetch the model for the interactive grid
var model = ig$.interactiveGrid("getViews","grid").model;

//--Fetch the record for the particular rowId
var record = model.getRecord(rowId);

//-- access the cell values via the column name  static id NAME
var comm = model.getValue(record,"COMM");

IF comm < 100 {
  //--Set the values for the RIFF cell
model.setValue(record,"RIFF",'Y');
```



```
//get value of a select list element
var riff = model.getValue( record, “RIFF”).v

//get display value of a select list element
var riff = model.getValue( record, “RIFF”).d
```

APEX Interactive Grid APIs:

Invoke Actions



	ID		Name	Job	Manager	Hire D...	Salary	Comm...
≡	7934	👤	MILLER	Clerk	CLARK	23-JA...	1300	-
≡	7900	👤	JAMES	Clerk	BLAKE	03-DE...	950	-
≡	7876	👤	ADAMS	Clerk	7788	12-JA...	1100	-
≡	7844	👤	TURNER	Sales...	BLAKE	08-SE...	1500	0
≡	7654	👤	MARTIN	Sales...	BLAKE	28-SE...	1250	1400
≡	7521	👤	WARD	Sales...	BLAKE	22-FE...	1250	500
≡	7499	👤	ALLEN	Sales...	BLAKE	20-FE...	1600	300
≡	7369	👤	SMITH	Clerk	7902	17-DE...	800	-
≡	7902	👤	FORD	Analyst	JONES	03-DE...	3000	-
≡	7788	👤	SCOTT	Analyst	JONES	09-DE...	3000	-
≡	7566	👤	JONES	Manager	KING	02-AP...	2975	-
≡	7782	👤	CLARK	Manager	KING	09-JU...	2450	-
≡	7698	👤	BLAKE	Manager	KING	01-MA...	2850	-
≡	7839	👤	KING	Presid...		17-NO...	5000	-

rows selected

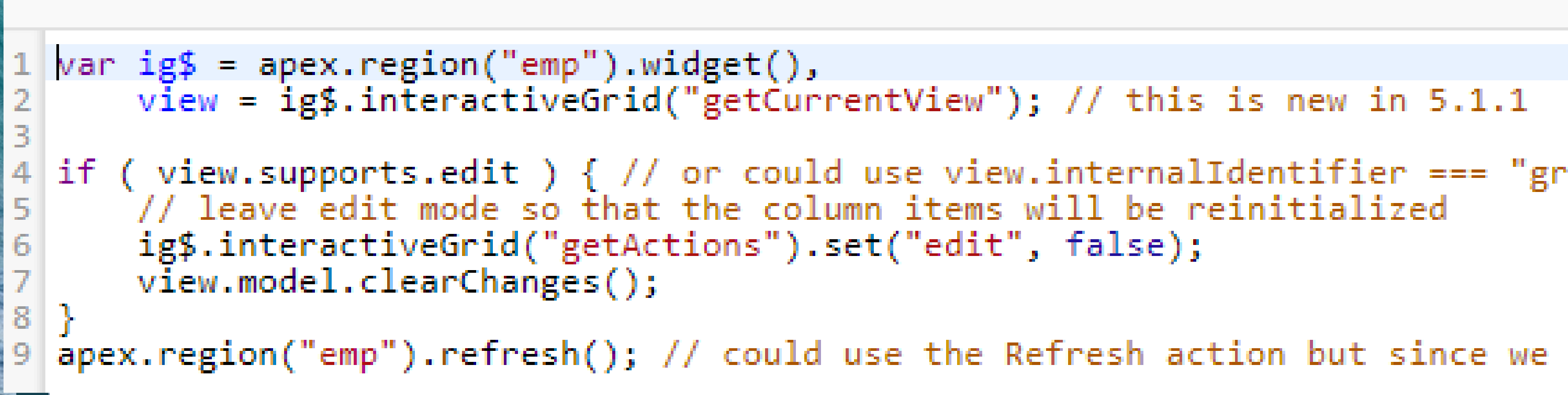
ODTUG Kscope19
SEATTLE, WASHINGTON · JUNE 23-27

```
apex.region(“igrid").call("getActions").invoke("save");

apex.region(“igrid").call("getActions").invoke(“show-sort-dialog");

apex.region(“igrid").call("getActions").invoke(“show-filter-dialog");
```

Cancel ?

Cancel .. Have to Clear The Model

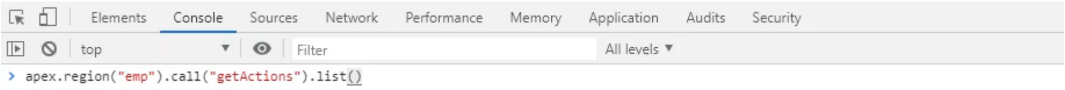
- Set Edit Mode Off
- Clear Changes
- Refresh



```
var ig$ = apex.region("emp").widget(),
    view = ig$.interactiveGrid("getCurrentView"); // this is new in 5.1.1

if ( view.supports.edit ) { // or could use view.internalIdentifier === "gr
    // leave edit mode so that the column items will be reinitialized
    ig$.interactiveGrid("getActions").set("edit", false);
    view.model.clearChanges();
}
apex.region("emp").refresh(); // could use the Refresh action but since we
```

What Else ?

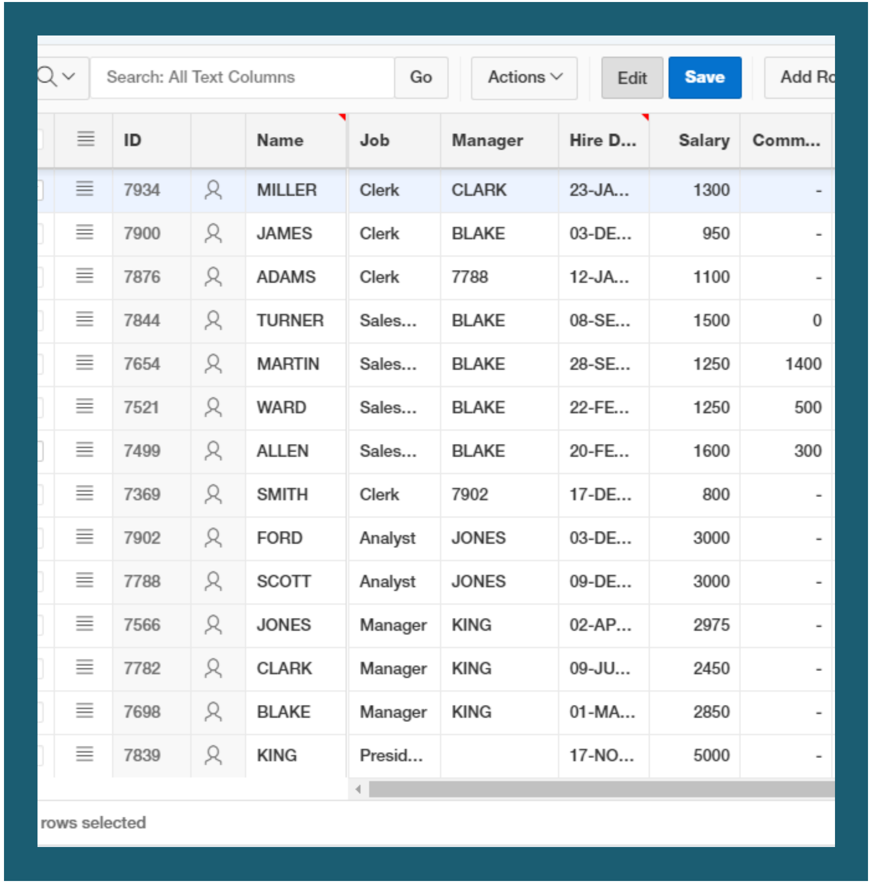
apex.region("emp").call("getActions").list();



```
> apex.region("emp").call("getActions").list()
```

APEX Interactive Grid APIs:

Always Edit, Default Config, Disable Columns

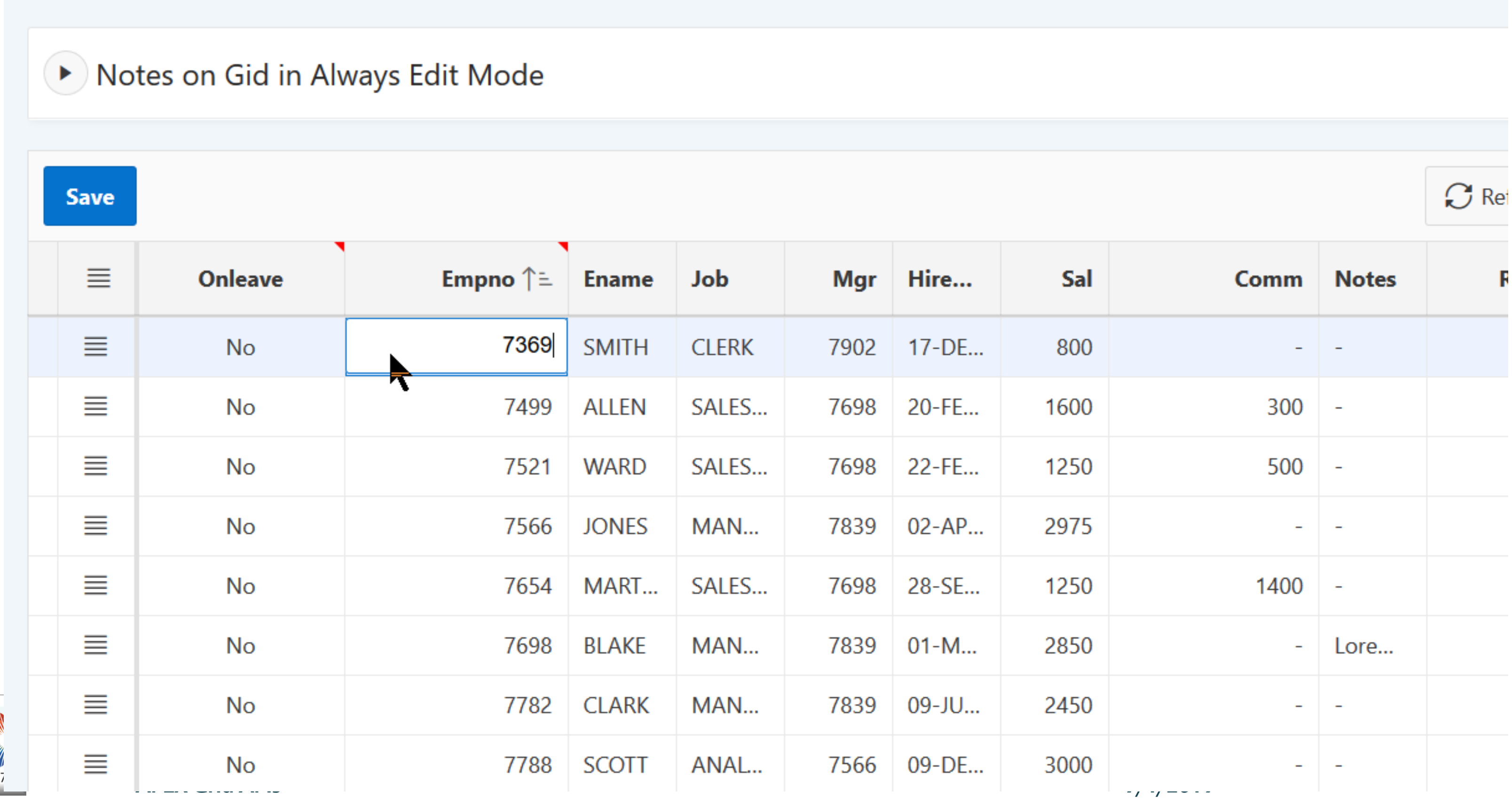


≡	ID		Name	Job	Manager	Hire D...	Salary	Comm...
≡	7934		MILLER	Clerk	CLARK	23-JA...	1300	-
≡	7900		JAMES	Clerk	BLAKE	03-DE...	950	-
≡	7876		ADAMS	Clerk	7788	12-JA...	1100	-
≡	7844		TURNER	Sales...	BLAKE	08-SE...	1500	0
≡	7654		MARTIN	Sales...	BLAKE	28-SE...	1250	1400
≡	7521		WARD	Sales...	BLAKE	22-FE...	1250	500
≡	7499		ALLEN	Sales...	BLAKE	20-FE...	1600	300
≡	7369		SMITH	Clerk	7902	17-DE...	800	-
≡	7902		FORD	Analyst	JONES	03-DE...	3000	-
≡	7788		SCOTT	Analyst	JONES	09-DE...	3000	-
≡	7566		JONES	Manager	KING	02-AP...	2975	-
≡	7782		CLARK	Manager	KING	09-JU...	2450	-
≡	7698		BLAKE	Manager	KING	01-MA...	2850	-
≡	7839		KING	Presid...		17-NO...	5000	-

rows selected

ODTUG Kscope19
SEATTLE,WASHINGTON·JUNE 23-27

Always Edit



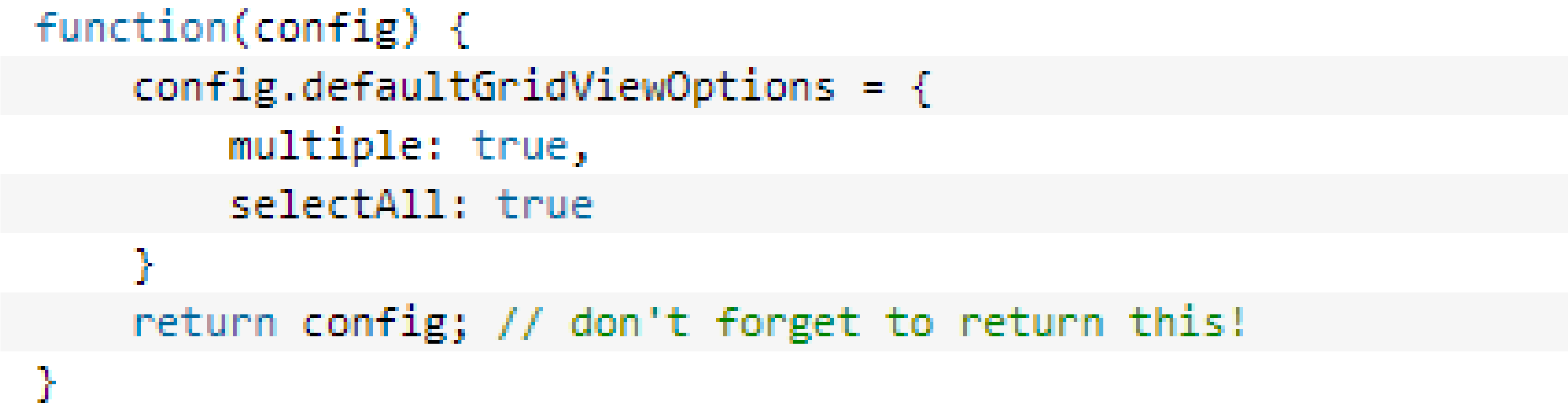
≡	Onleave	Empno ↑	Ename	Job	Mgr	Hire...	Sal	Comm	Notes	R
≡	No	7369	SMITH	CLERK	7902	17-DE...	800	-	-	
≡	No	7499	ALLEN	SALES...	7698	20-FE...	1600	300	-	
≡	No	7521	WARD	SALES...	7698	22-FE...	1250	500	-	
≡	No	7566	JONES	MAN...	7839	02-AP...	2975	-	-	
≡	No	7654	MART...	SALES...	7698	28-SE...	1250	1400	-	
≡	No	7698	BLAKE	MAN...	7839	01-M...	2850	-	Lore...	
≡	No	7782	CLARK	MAN...	7839	09-JU...	2450	-	-	
≡	No	7788	SCOTT	ANAL...	7566	09-DE...	3000	-	-	

Always Edit

- Grid Always in Edit Mode
- Saves a Double-Click to Activate Edit Mode

Default Grid Options

- Advanced →JavaScript

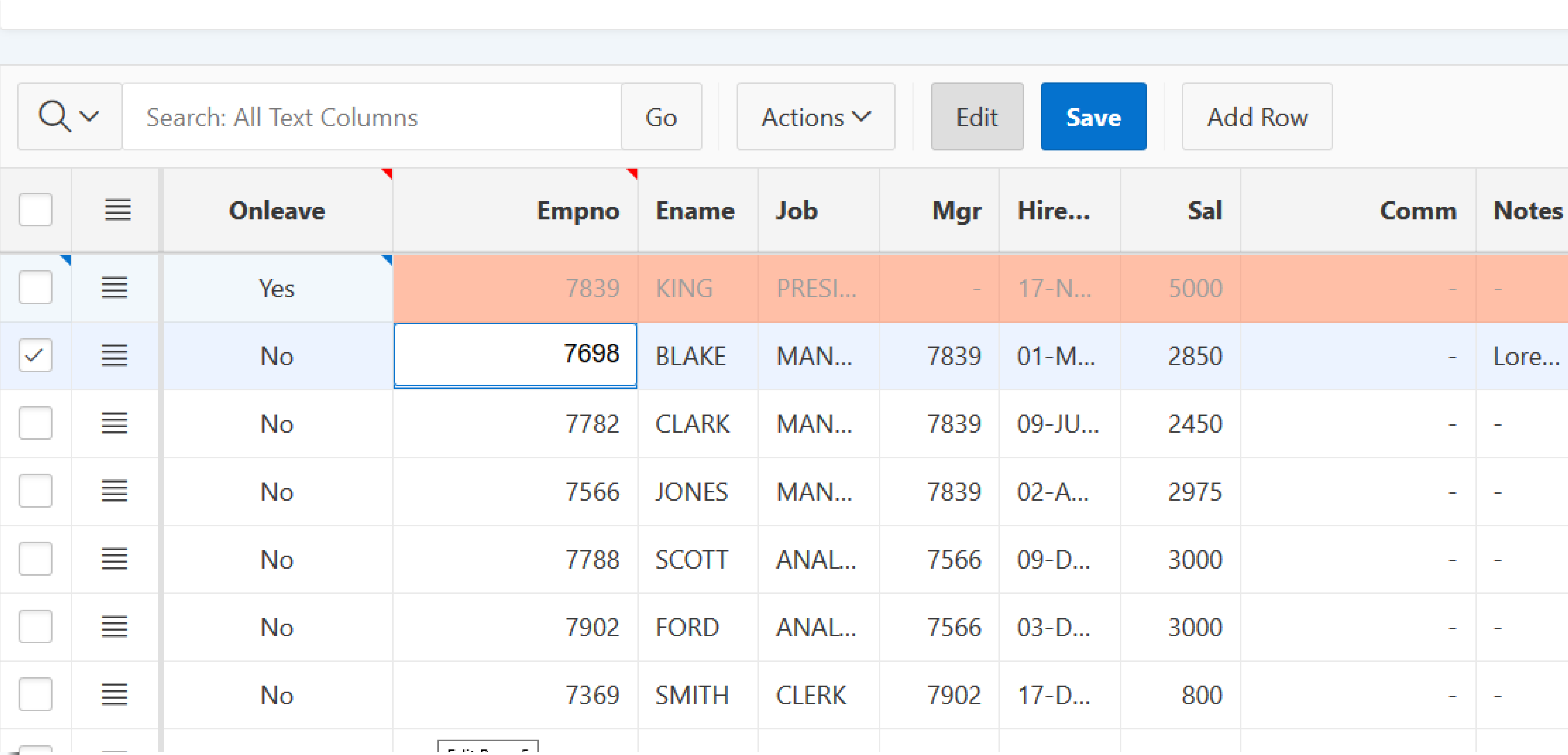


```
function(config) {
    config.defaultGridViewOptions = {
        multiple: true,
        selectAll: true
    }
    return config; // don't forget to return this!
}
```

Default Grid Options

- Refer to API Doc
- Lots of Options Here
  - rowHeader
  - tooltip
  - stickyFooter
  - pagination options

Disable a Row

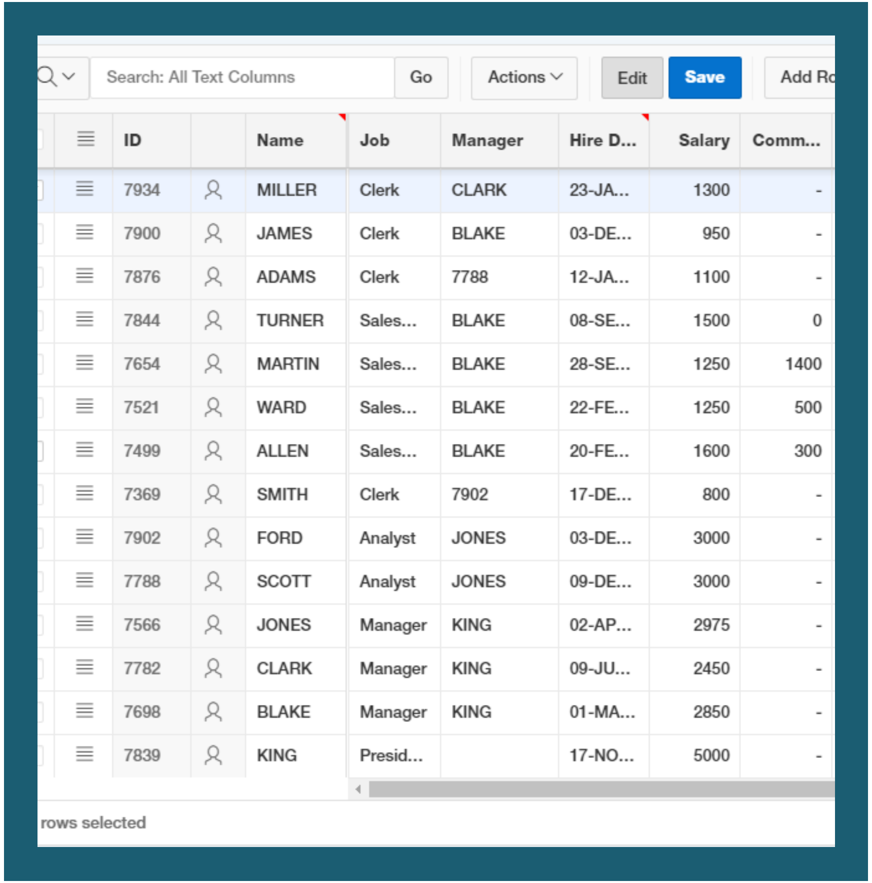


□	≣	Onleave	Empno	Ename	Job	Mgr	Hire...	Sal	Comm	Notes
□	≣	Yes	7839	KING	PRESI...	-	17-N...	5000	-	-
☑	≣	No	7698	BLAKE	MAN...	7839	01-M...	2850	-	Lore...
□	≣	No	7782	CLARK	MAN...	7839	09-JU...	2450	-	-
□	≣	No	7566	JONES	MAN...	7839	02-A...	2975	-	-
□	≣	No	7788	SCOTT	ANAL...	7566	09-D...	3000	-	-
□	≣	No	7902	FORD	ANAL...	7566	03-D...	3000	-	-
□	≣	No	7369	SMITH	CLERK	7902	17-D...	800	-	-

APEX Interactive Grid APIs:

Customizations

for Menus, Toolbars and More



≡	ID		Name	Job	Manager	Hire D...	Salary	Comm...
≡	7934	👤	MILLER	Clerk	CLARK	23-JA...	1300	-
≡	7900	👤	JAMES	Clerk	BLAKE	03-DE...	950	-
≡	7876	👤	ADAMS	Clerk	7788	12-JA...	1100	-
≡	7844	👤	TURNER	Sales...	BLAKE	08-SE...	1500	0
≡	7654	👤	MARTIN	Sales...	BLAKE	28-SE...	1250	1400
≡	7521	👤	WARD	Sales...	BLAKE	22-FE...	1250	500
≡	7499	👤	ALLEN	Sales...	BLAKE	20-FE...	1600	300
≡	7369	👤	SMITH	Clerk	7902	17-DE...	800	-
≡	7902	👤	FORD	Analyst	JONES	03-DE...	3000	-
≡	7788	👤	SCOTT	Analyst	JONES	09-DE...	3000	-
≡	7566	👤	JONES	Manager	KING	02-AP...	2975	-
≡	7782	👤	CLARK	Manager	KING	09-JU...	2450	-
≡	7698	👤	BLAKE	Manager	KING	01-MA...	2850	-
≡	7839	👤	KING	Presid...		17-NO...	5000	-

rows selected

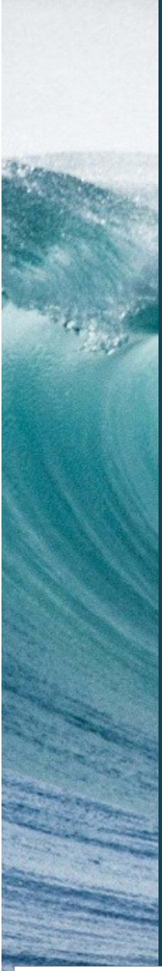
ODTUG Kscope19
SEATTLE, WASHINGTON · JUNE 23-27

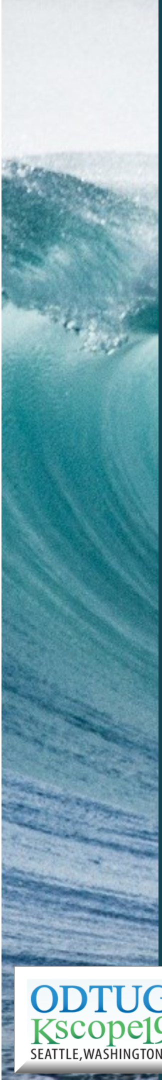
Customizations

- Advanced → JavaScript Code
  - Grid → Grid Menus
  - Column → Column Menu
    (Most of the Time...)

- Read Widget JS Files to Learn What is Possible
- Read Hardlikesoftware.com
- Study IG Cookbook App

No Longer PL/SQL Collections ~ Now JavaScript



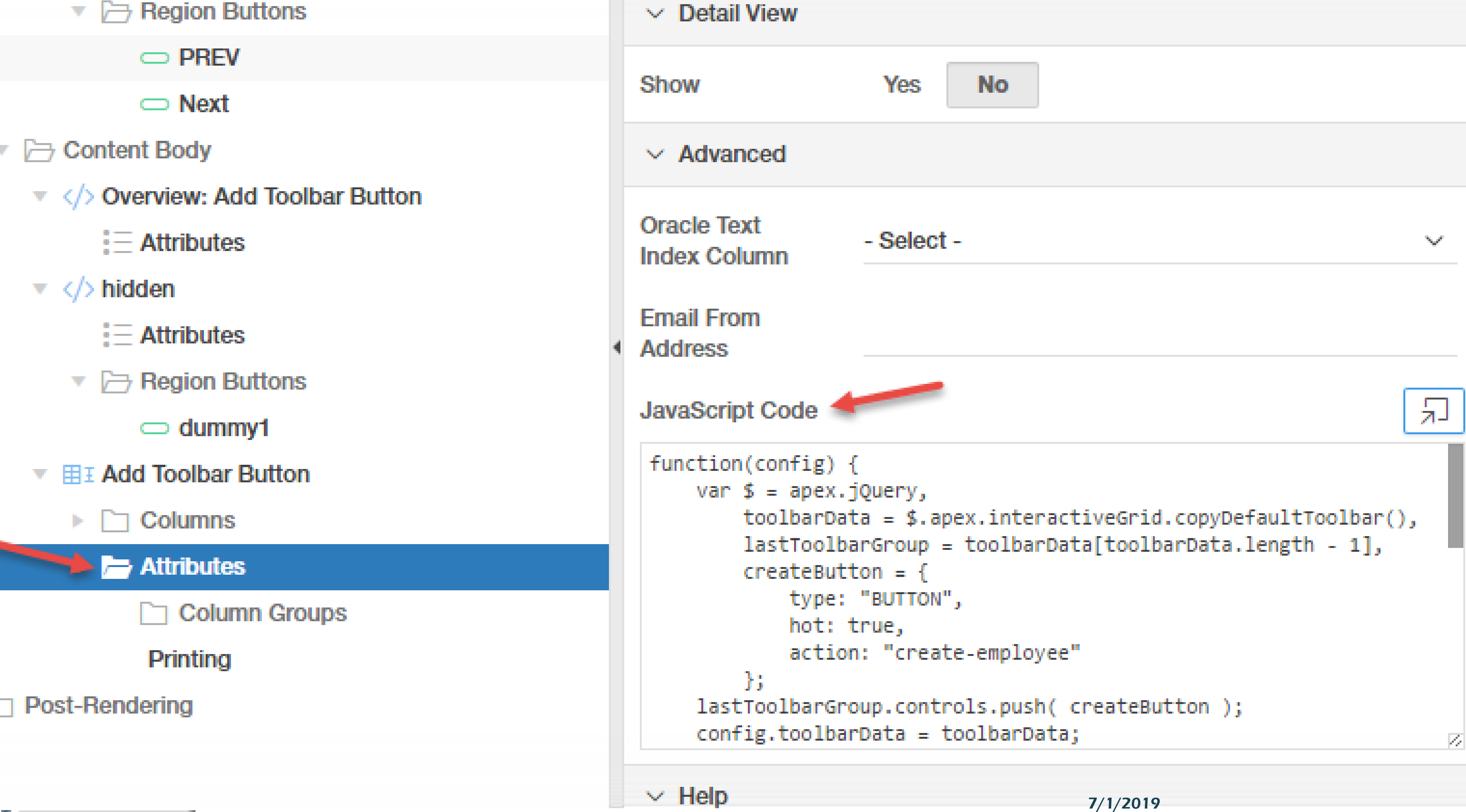


Customization Examples

- Change Toolbar
- Change Column Heading Menu
- Change RowAction Menu
- Change Toolbar Actions Menu
- Standardize w “Global” Settings

There's A Plugin for That …

- Extend IG Toolbar
  - https://apex.oracle.com/pls/apex/f?p=apexbyg:extendigtoolbar



Detail View

Show: Yes [✓ No]

Advanced

Oracle Text Index Column: - Select -

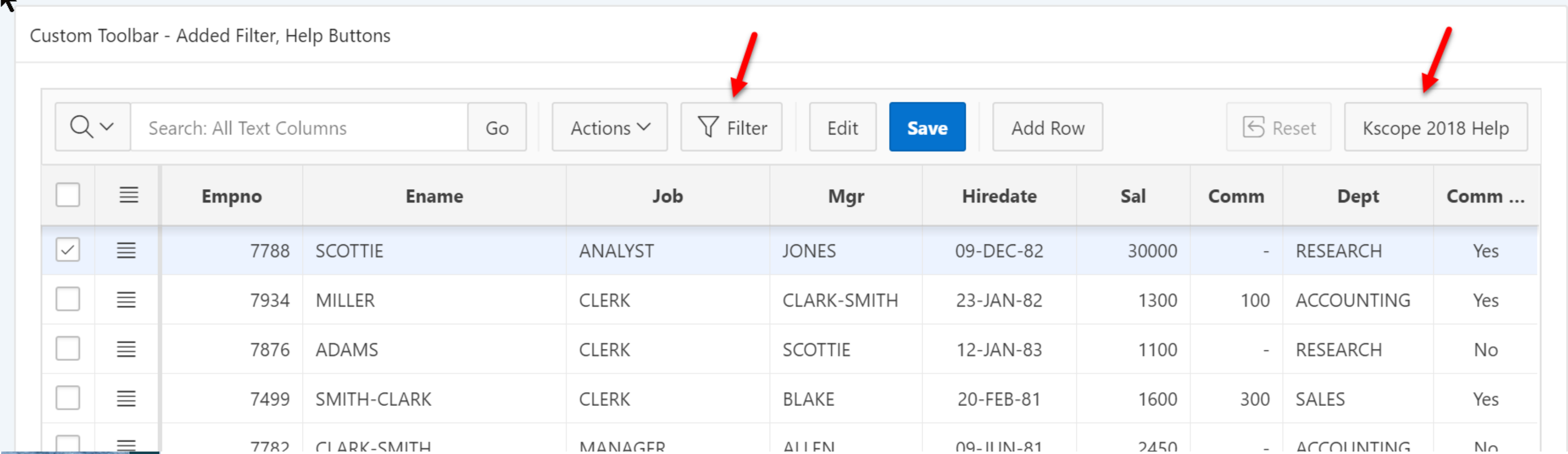
Email From Address:

JavaScript Code

```
function(config) {
    var $ = apex.jQuery,
        toolbarData = $.apex.interactiveGrid.copyDefaultToolbar(),
        lastToolbarGroup = toolbarData[toolbarData.length - 1],
        createButton = {
            type: "BUTTON",
            hot: true,
            action: "create-employee"
        };
    lastToolbarGroup.controls.push( createButton );
    config.toolbarData = toolbarData;
```

Help

Change Toolbar

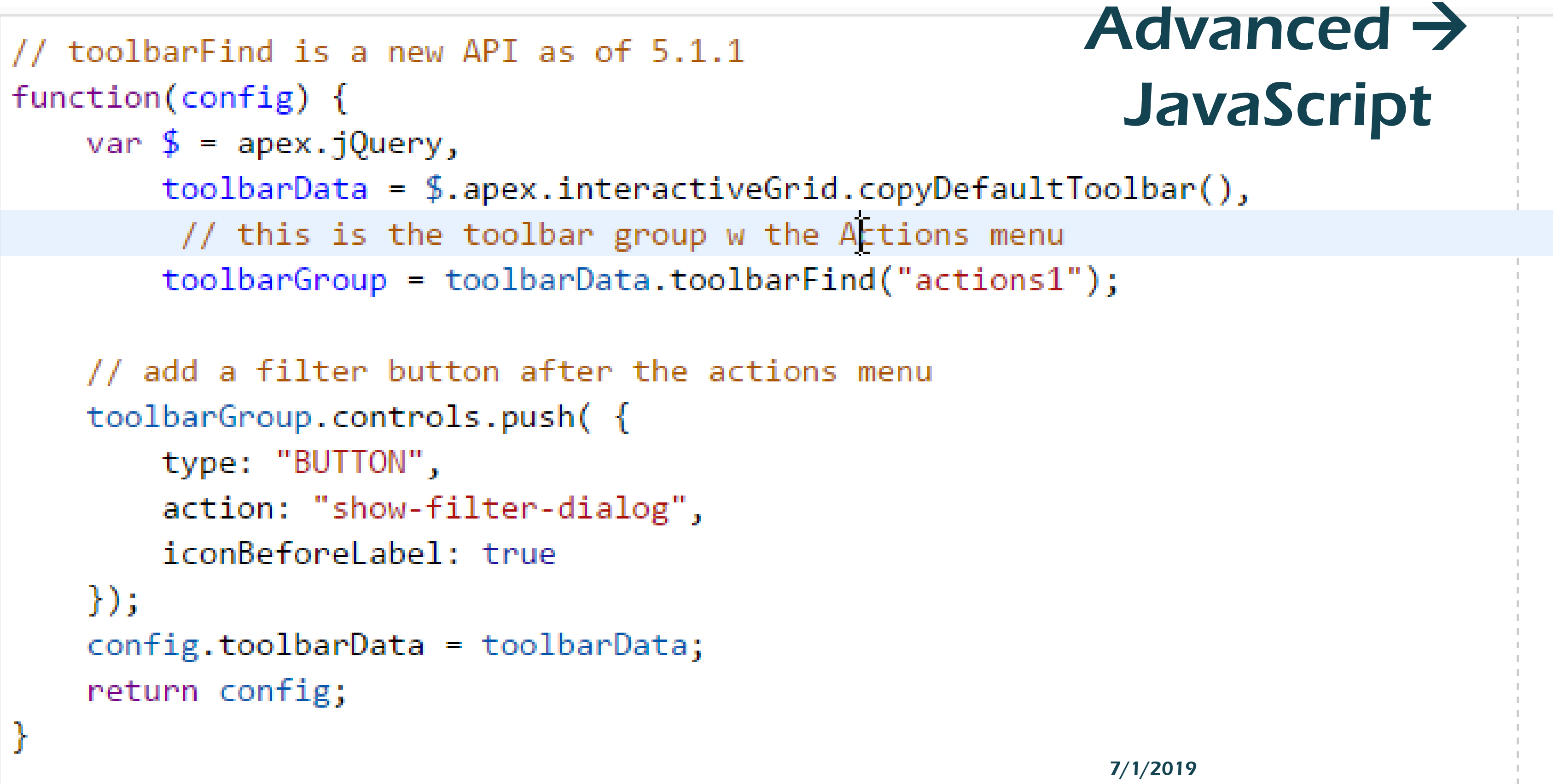


Custom Toolbar - Added Filter, Help Buttons

	Empno	Ename	Job	Mgr	Hiredate	Sal	Comm	Dept	Comm ...
☑	7788	SCOTTIE	ANALYST	JONES	09-DEC-82	30000	-	RESEARCH	Yes
□	7934	MILLER	CLERK	CLARK-SMITH	23-JAN-82	1300	100	ACCOUNTING	Yes
□	7876	ADAMS	CLERK	SCOTTIE	12-JAN-83	1100	-	RESEARCH	No
□	7499	SMITH-CLARK	CLERK	BLAKE	20-FEB-81	1600	300	SALES	Yes
□	7782	CLARK-SMITH	MANAGER	ALLEN	09-JUN-81	2450	-	ACCOUNTING	No

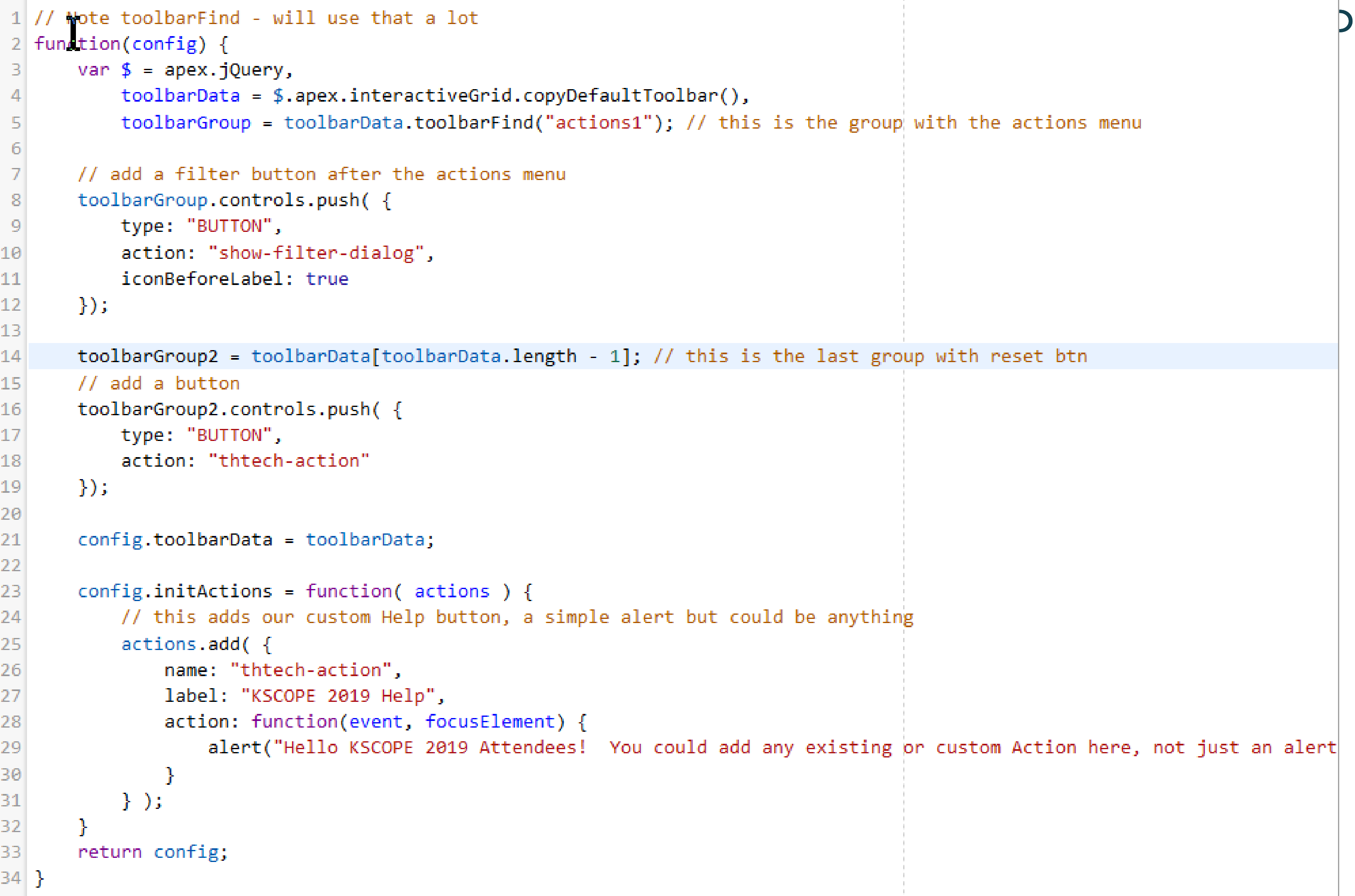
Change Toolbar

Goes in Grid Advanced → JavaScript



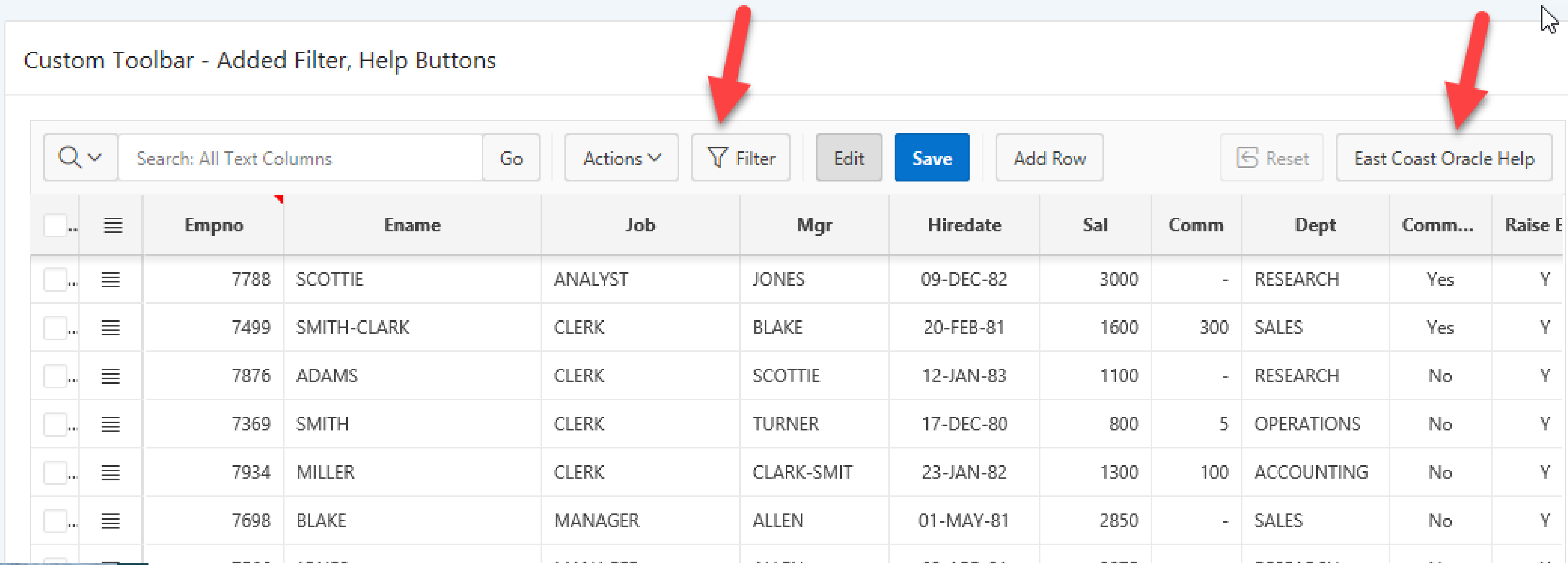
```
// toolbarFind is a new API as of 5.1.1
function(config) {
    var $ = apex.jQuery,
        toolbarData = $.apex.interactiveGrid.copyDefaultToolbar(),
         // this is the toolbar group w the Actions menu
        toolbarGroup = toolbarData.toolbarFind("actions1");

    // add a filter button after the actions menu
    toolbarGroup.controls.push( {
        type: "BUTTON",
        action: "show-filter-dialog",
        iconBeforeLabel: true
    });
    config.toolbarData = toolbarData;
    return config;
}
```

ODTUG Kscope19
SEATTLE, WASHINGTON • JUNE 2



```
// Note toolbarFind - will use that a lot
function(config) {
    var $ = apex.jQuery,
        toolbarData = $.apex.interactiveGrid.copyDefaultToolbar(),
        toolbarGroup = toolbarData.toolbarFind("actions1"); // this is the group with the actions menu

    // add a filter button after the actions menu
    toolbarGroup.controls.push( {
        type: "BUTTON",
        action: "show-filter-dialog",
        iconBeforeLabel: true
    });

    toolbarGroup2 = toolbarData[toolbarData.length - 1]; // this is the last group with reset btn
    // add a button
    toolbarGroup2.controls.push( {
        type: "BUTTON",
        action: "thtech-action"
    });

    config.toolbarData = toolbarData;

    config.initActions = function( actions ) {
        // this adds our custom Help button, a simple alert but could be anything
        actions.add( {
            name: "thtech-action",
            label: "KSCOPE 2019 Help",
            action: function(event, focusElement) {
                alert("Hello KSCOPE 2019 Attendees!  You could add any existing or custom Action here, not just an alert
            }
        } );
    }
    return config;
}
```

Change Toolbar



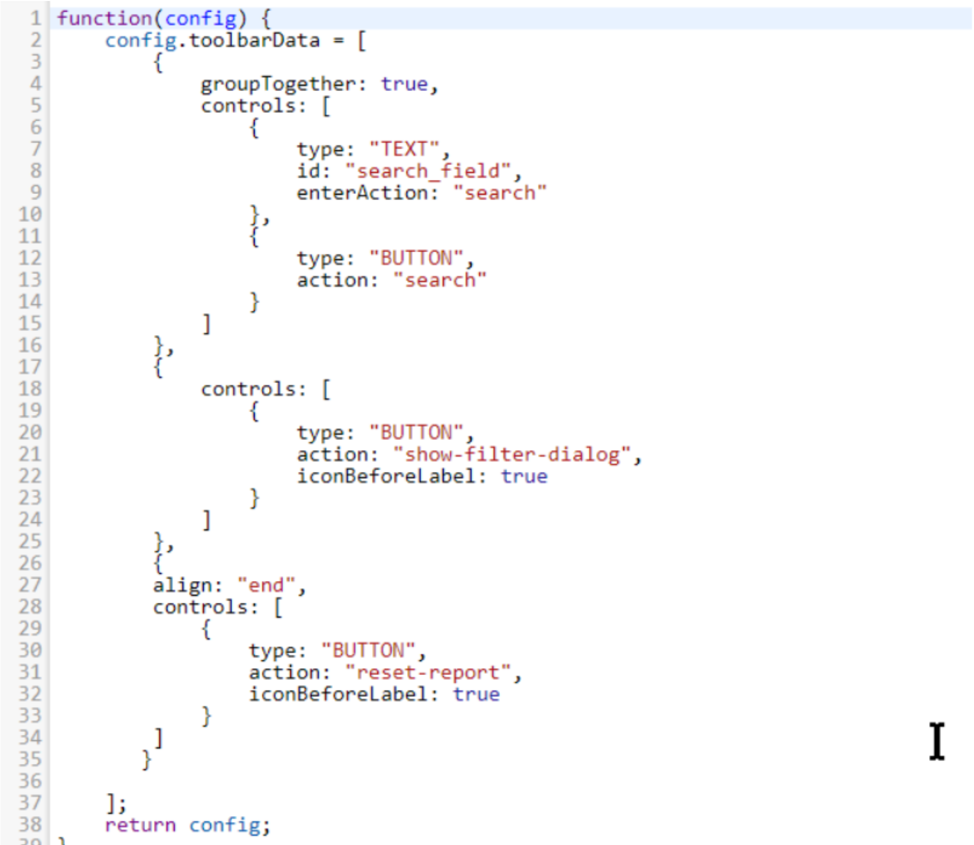
Custom Toolbar - Added Filter, Help Buttons

□	≡	Empno	Ename	Job	Mgr	Hiredate	Sal	Comm	Dept	Comm...	Raise E
□	≡	7788	SCOTTIE	ANALYST	JONES	09-DEC-82	3000	-	RESEARCH	Yes	Y
□	≡	7499	SMITH-CLARK	CLERK	BLAKE	20-FEB-81	1600	300	SALES	Yes	Y
□	≡	7876	ADAMS	CLERK	SCOTTIE	12-JAN-83	1100	-	RESEARCH	No	Y
□	≡	7369	SMITH	CLERK	TURNER	17-DEC-80	800	5	OPERATIONS	No	Y
□	≡	7934	MILLER	CLERK	CLARK-SMIT	23-JAN-82	1300	100	ACCOUNTING	No	Y
□	≡	7698	BLAKE	MANAGER	ALLEN	01-MAY-81	2850	-	SALES	No	Y

Replace Toolbar

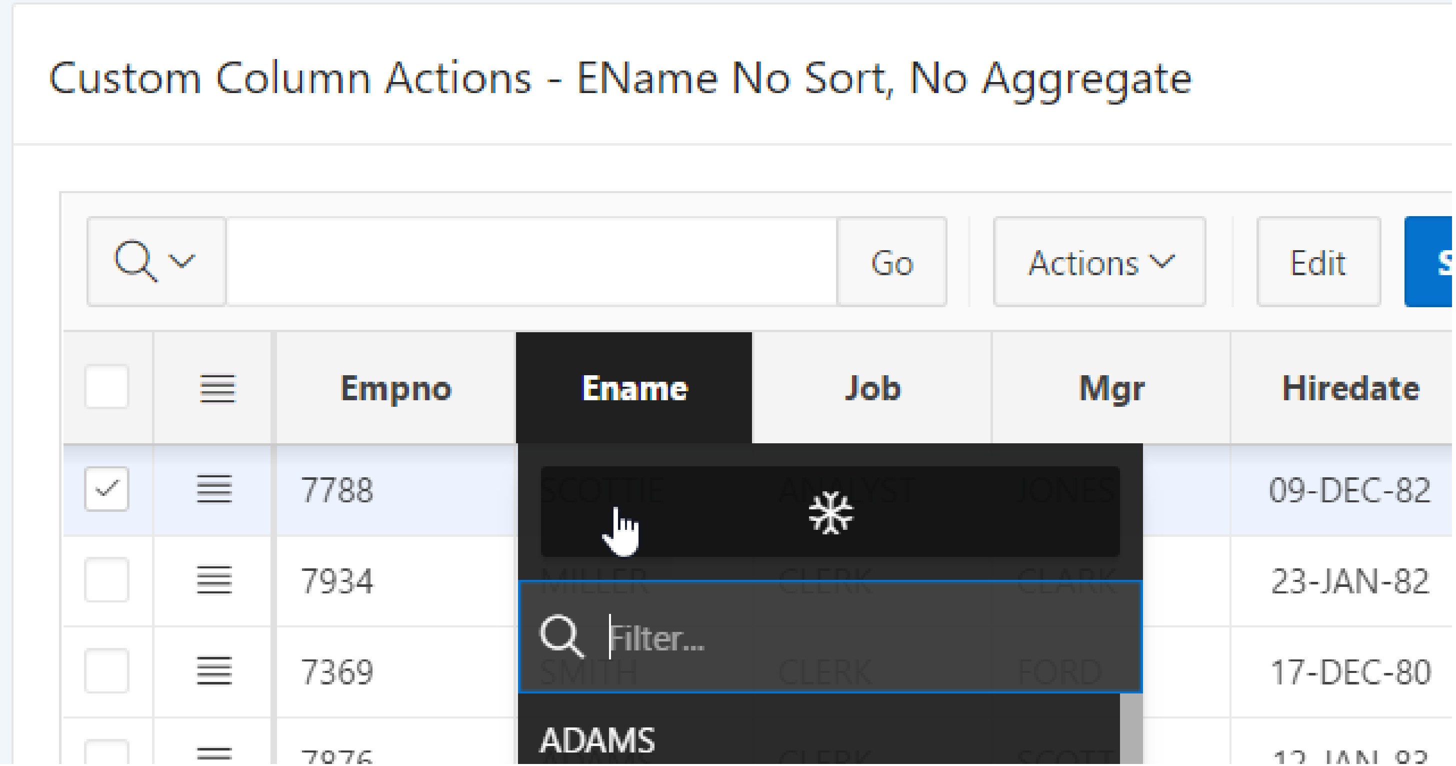
- Sometimes do not want all the buttons, Only a Few.
- Create Your Own Toolbar
  - You Build All
- Ex: Filter Only Grid

Replace Toolbar Code



```
function(config) {
    config.toolbarData = [
        {
            groupTogether: true,
            controls: [
                {
                    type: "TEXT",
                    id: "search_field",
                    enterAction: "search"
                },
                {
                    type: "BUTTON",
                    action: "search"
                }
            ]
        },
        {
            controls: [
                {
                    type: "BUTTON",
                    action: "show-filter-dialog",
                    iconBeforeLabel: true
                }
            ]
        },
        {
        align: "end",
        controls: [
            {
                type: "BUTTON",
                action: "reset-report",
                iconBeforeLabel: true
            }
        ]
       }

    ];
    return config;
}
```

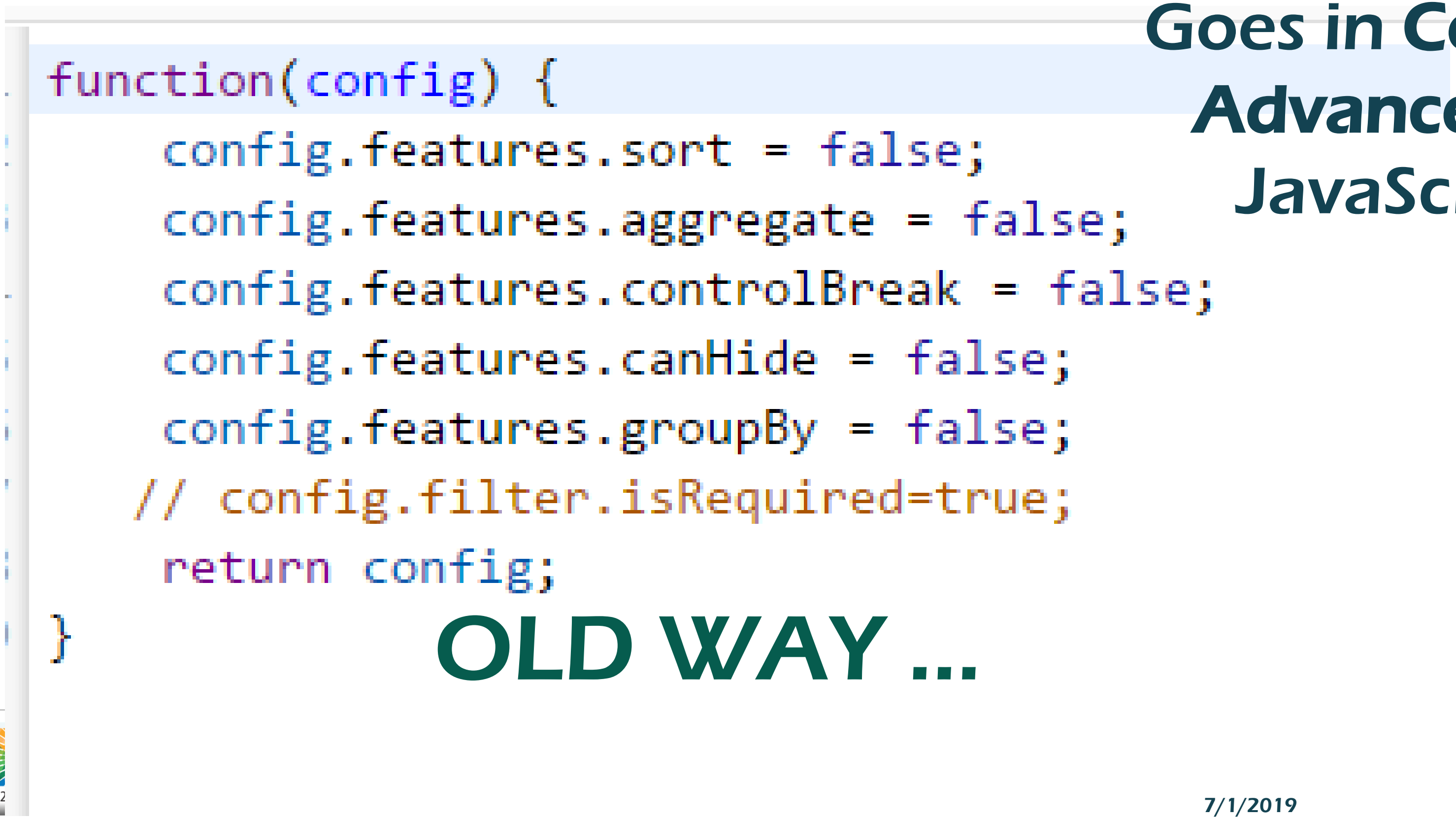
Change Column Heading Menu



Custom Column Actions - EName No Sort, No Aggregate

□		Empno	Ename	Job	Mgr	Hiredate
☑	≡	7788	SCOTTIE	ANALYST	JONES	09-DEC-82
□	≡	7934	MILLER	CLERK	CLARK	23-JAN-82
□	≡	7369	SMITH	CLERK	FORD	17-DEC-80
□	≡	7876	ADAMS	CLERK	SCOTT	12-JAN-83

Change Column Heading Menu



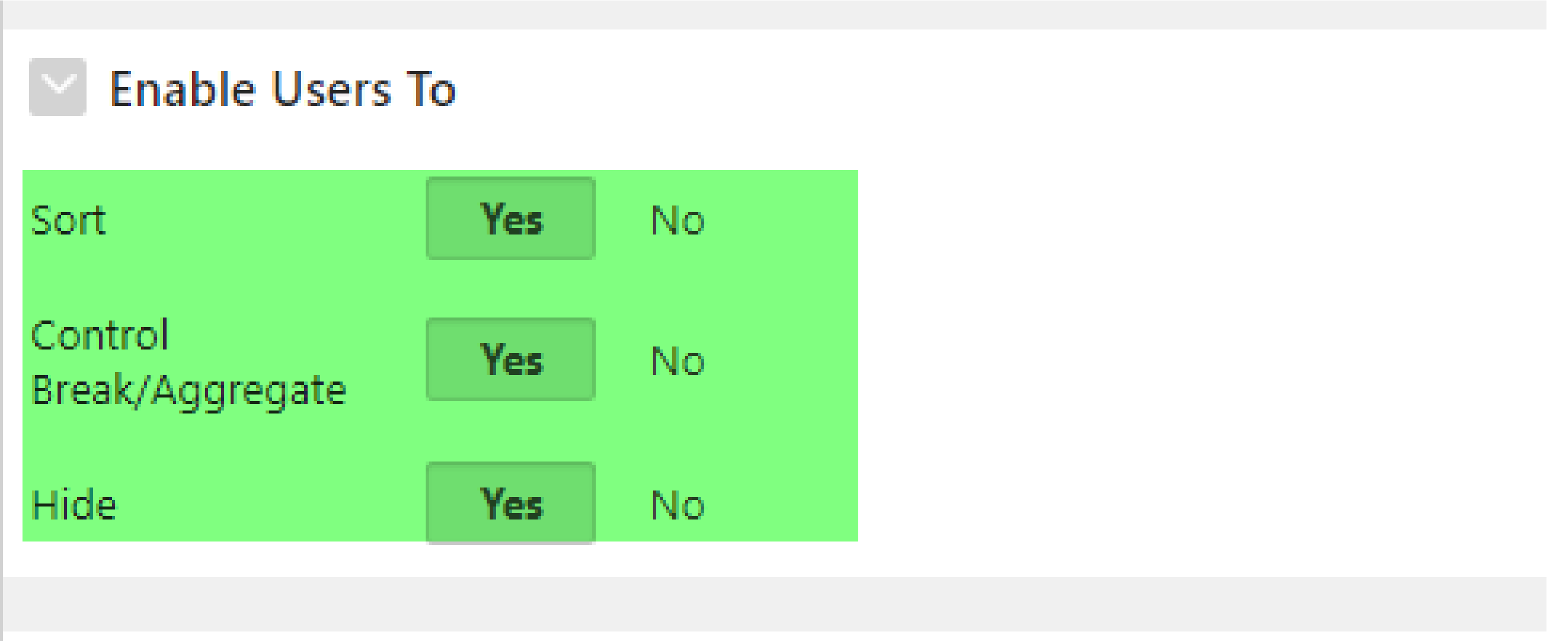
```
function(config) {
    config.features.sort = false;
    config.features.aggregate = false;
    config.features.controlBreak = false;
    config.features.canHide = false;
    config.features.groupBy = false;
   // config.filter.isRequired=true;
    return config;
}
```

Goes in Column Advanced → JavaScript

OLD WAY ...

Change Column Heading Menu

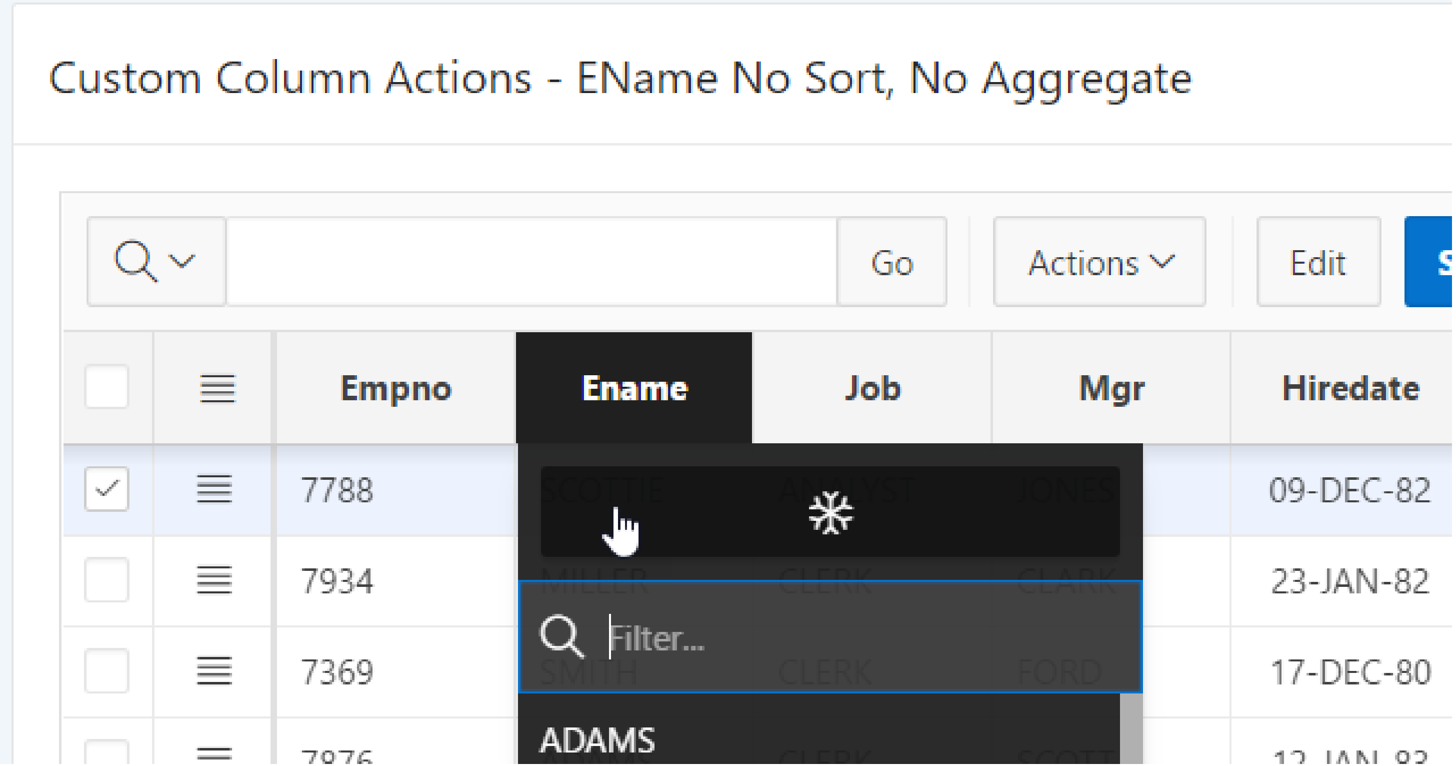
- Wait! Now Declarative … Mostly



Enable Users To

Sort	[✓ Yes] No
Control Break/Aggregate	[✓ Yes] No
Hide	[✓ Yes] No

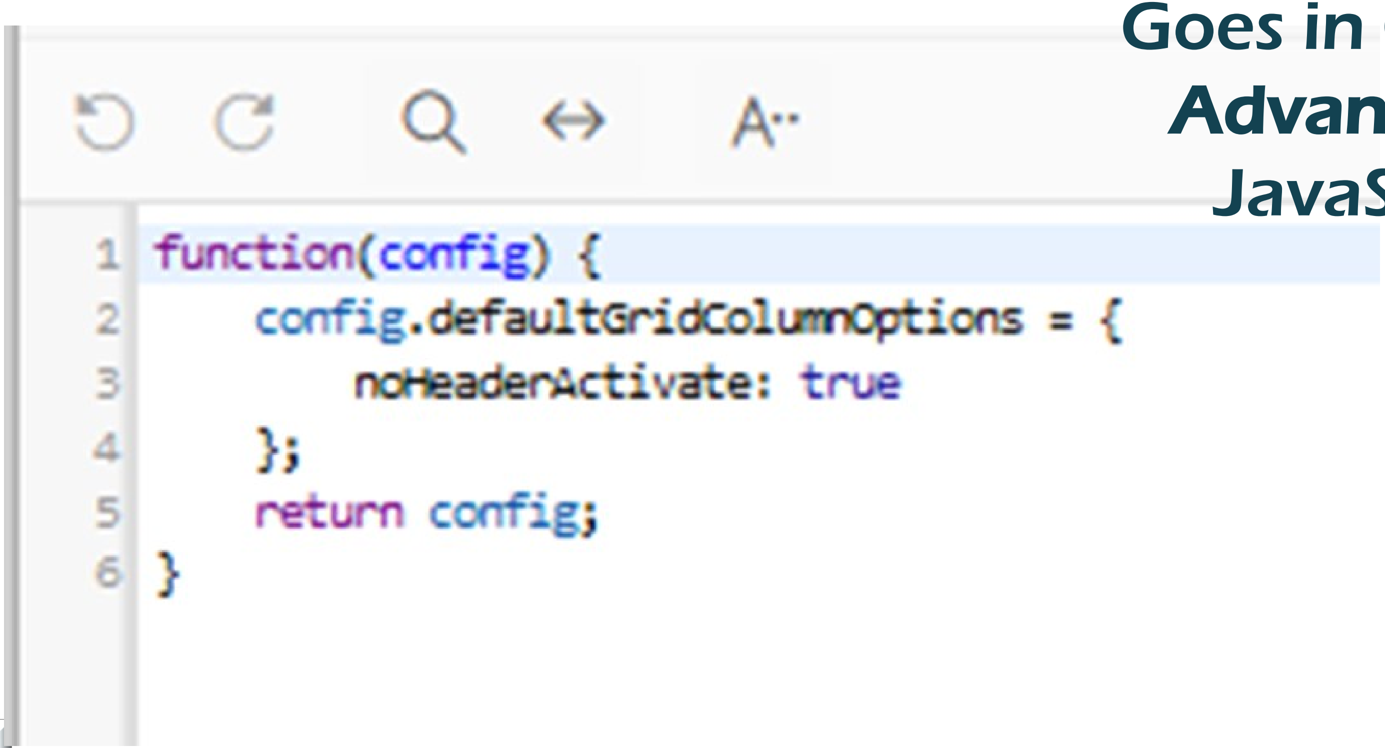
Change Column Heading Menu



Custom Column Actions - EName No Sort, No Aggregate

☐		Empno	Ename	Job	Mgr	Hiredate
☑	≡	7788	SCOTTIE	ANALYST	JONES	09-DEC-82
☐	≡	7934	MILLER	CLERK	CLARK	23-JAN-82
☐	≡	7369	SMITH	CLERK	FORD	17-DEC-80
☐	≡	7876		CLERK	SCOTT	12-JAN-83

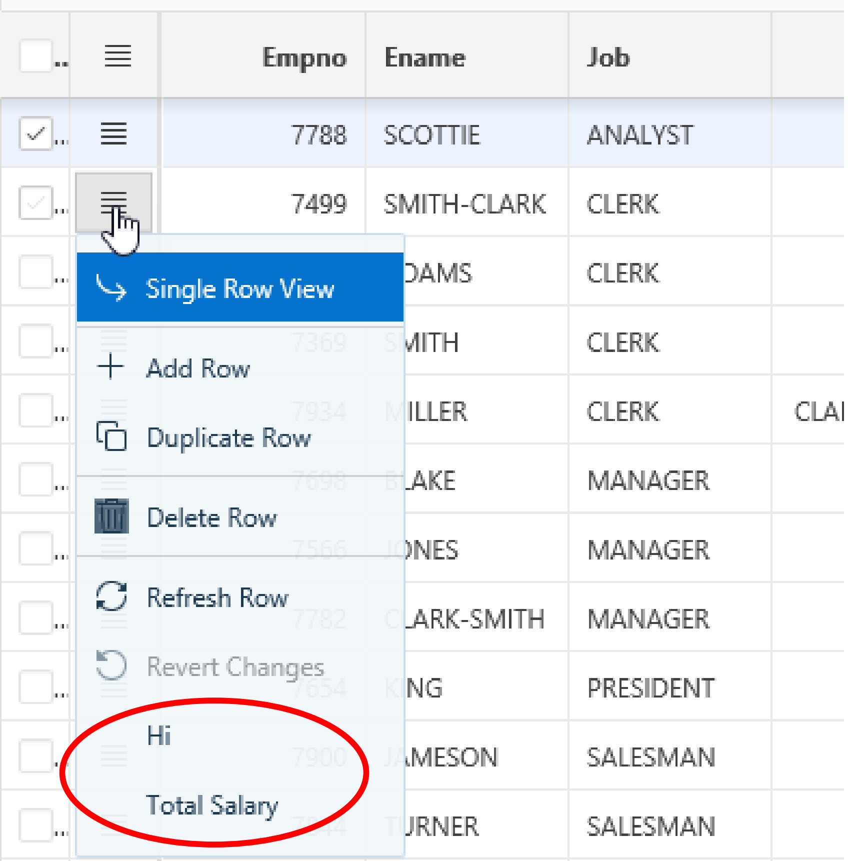
Change Column Heading Menu



```
function(config) {
    config.defaultGridColumnOptions = {
        noHeaderActivate: true
    };
    return config;
}
```

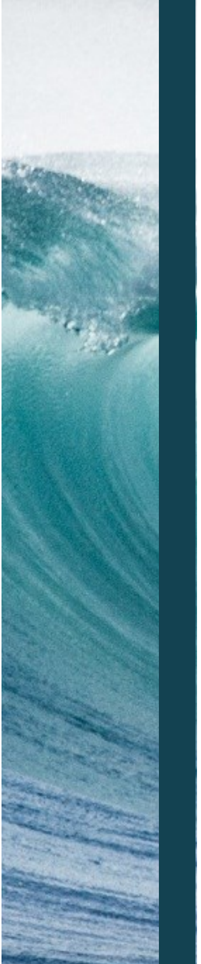
Goes in Column Advanced → JavaScript

Change RowAction Menu

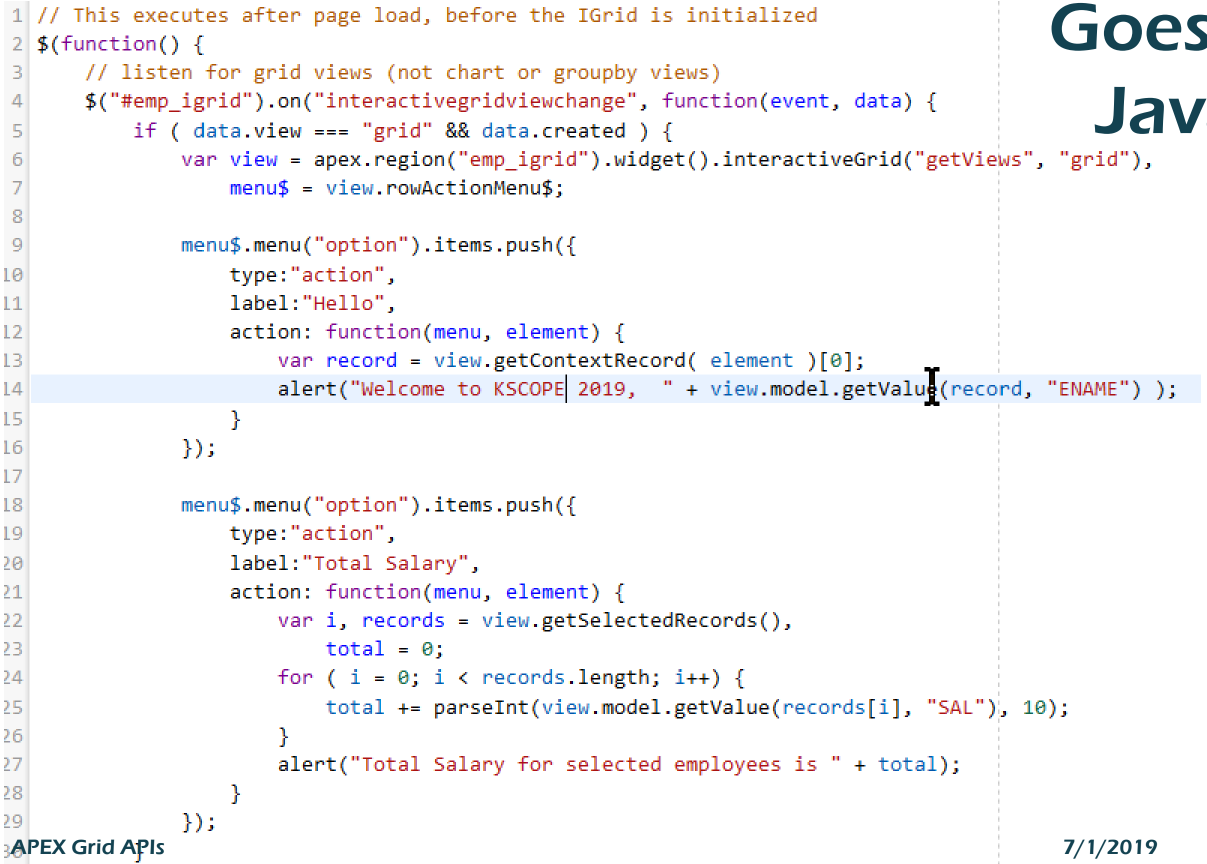


☐	≡	Empno	Ename	Job	
☑	≡	7788	SCOTTIE	ANALYST	
☐	≡	7499	SMITH-CLARK	CLERK	
☐			DAMS	CLERK	
☐	≡	7369	SMITH	CLERK	
☐	≡	7934	MILLER	CLERK	CLAI
☐	≡	7698	BLAKE	MANAGER	
☐	≡	7566	JONES	MANAGER	
☐	≡	7782	CLARK-SMITH	MANAGER	
☐	≡	7654	KING	PRESIDENT	
☐	≡	7900	JAMESON	SALESMAN	
☐	≡	7844	TURNER	SALESMAN	

ODTUG Kscope19
SEATTLE, WASHINGTON • JUNE 23-27



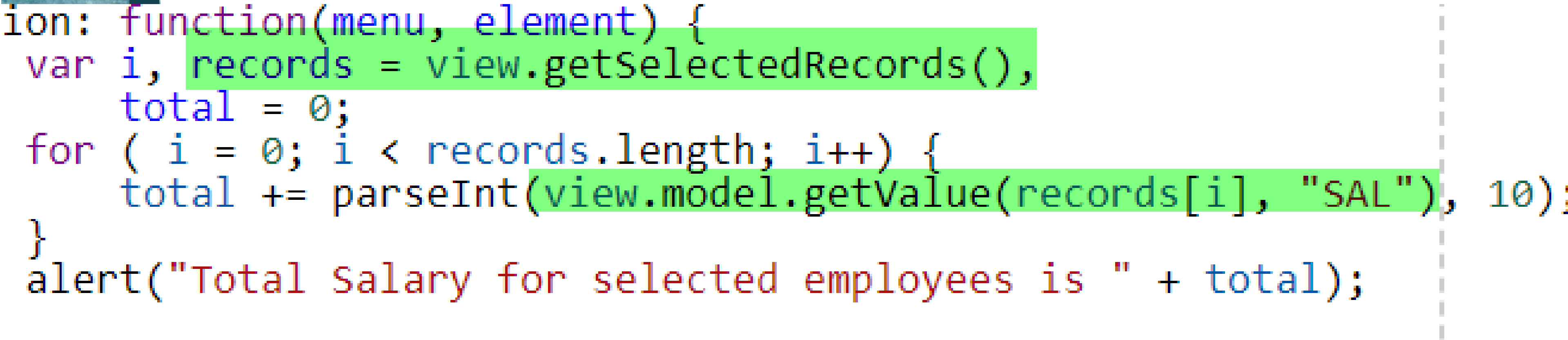
Change RowAction Menu



```
// This executes after page load, before the IGrid is initialized
$(function() {
    // listen for grid views (not chart or groupby views)
    $("#emp_igrid").on("interactivegridviewchange", function(event, data) {
        if ( data.view === "grid" && data.created ) {
            var view = apex.region("emp_igrid").widget().interactiveGrid("getViews", "grid"),
                menu$ = view.rowActionMenu$;

            menu$.menu("option").items.push({
                type:"action",
                label:"Hello",
                action: function(menu, element) {
                    var record = view.getContextRecord( element )[0];
                    alert("Welcome to KSCOPE 2019,  " + view.model.getValue(record, "ENAME") );
                }
            });

            menu$.menu("option").items.push({
                type:"action",
                label:"Total Salary",
                action: function(menu, element) {
                    var i, records = view.getSelectedRecords(),
                        total = 0;
                    for ( i = 0; i < records.length; i++) {
                        total += parseInt(view.model.getValue(records[i], "SAL"), 10);
                    }
                    alert("Total Salary for selected employees is " + total);
                }
            });
        }
```

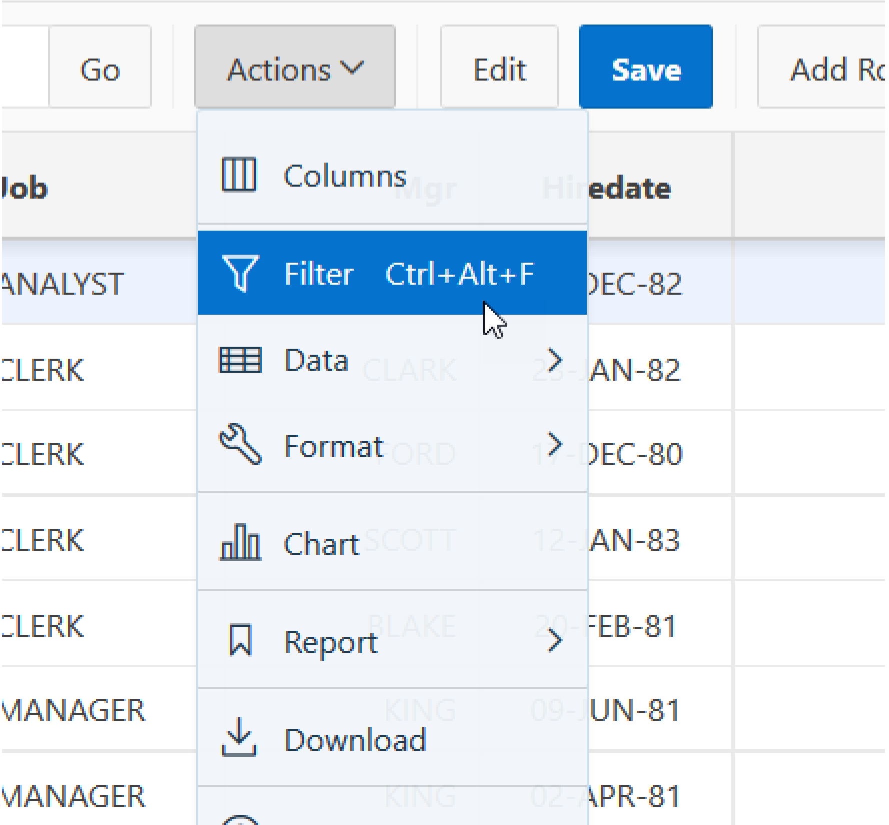
Goes in Page JavaScript

Access the Model …

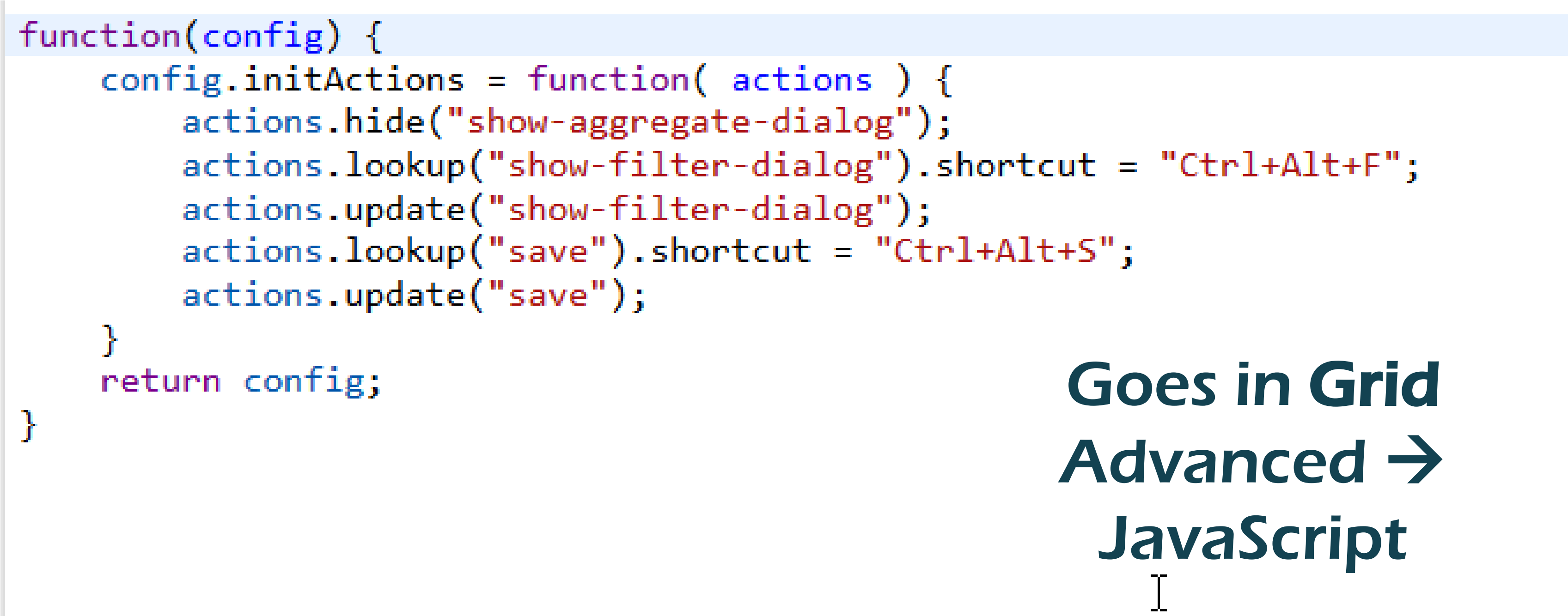


```
ion: function(menu, element) {
 var i, records = view.getSelectedRecords(),
     total = 0;
 for ( i = 0; i < records.length; i++) {
     total += parseInt(view.model.getValue(records[i], "SAL"), 10);
 }
 alert("Total Salary for selected employees is " + total);
```

Change Toolbar Actions Menu



Change Toolbar Actions Menu



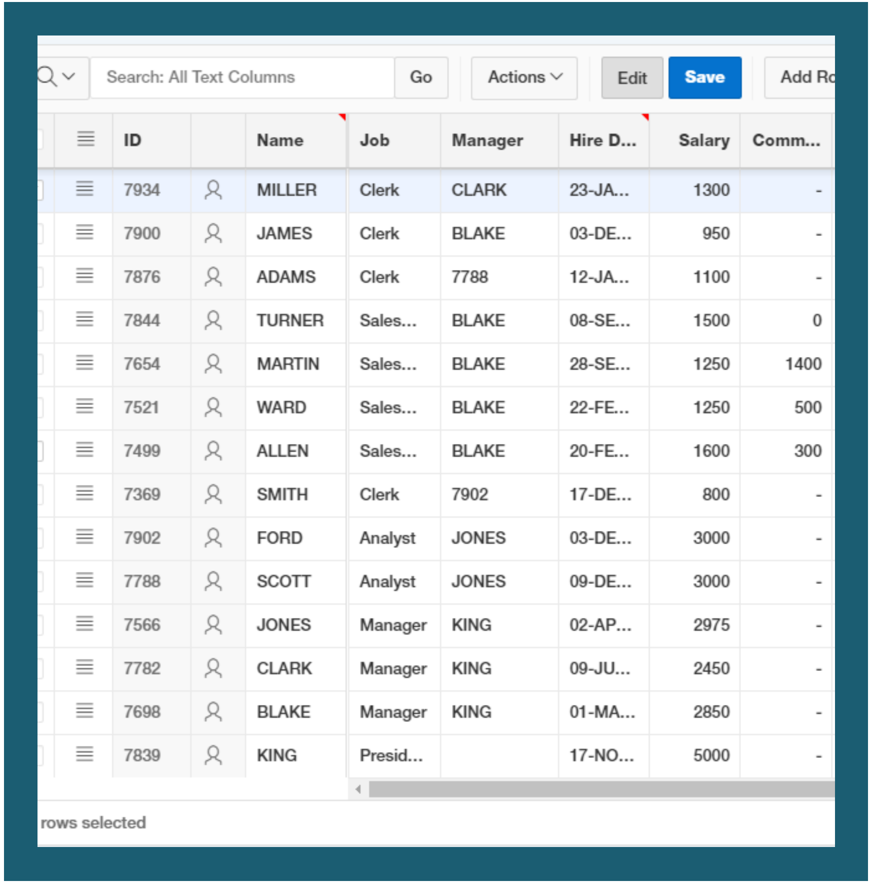
```
function(config) {
    config.initActions = function( actions ) {
        actions.hide("show-aggregate-dialog");
        actions.lookup("show-filter-dialog").shortcut = "Ctrl+Alt+F";
        actions.update("show-filter-dialog");
        actions.lookup("save").shortcut = "Ctrl+Alt+S";
        actions.update("save");
    }
    return config;
}
```

Goes in Grid Advanced → JavaScript

APEX Interactive Grid APIS:

Standardize

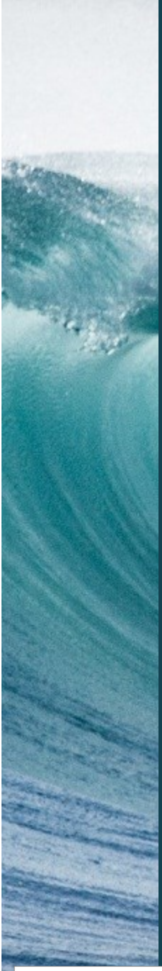
Customizations Across Applications



≡	ID		Name	Job	Manager	Hire D...	Salary	Comm...
≡	7934	👤	MILLER	Clerk	CLARK	23-JA...	1300	-
≡	7900	👤	JAMES	Clerk	BLAKE	03-DE...	950	-
≡	7876	👤	ADAMS	Clerk	7788	12-JA...	1100	-
≡	7844	👤	TURNER	Sales...	BLAKE	08-SE...	1500	0
≡	7654	👤	MARTIN	Sales...	BLAKE	28-SE...	1250	1400
≡	7521	👤	WARD	Sales...	BLAKE	22-FE...	1250	500
≡	7499	👤	ALLEN	Sales...	BLAKE	20-FE...	1600	300
≡	7369	👤	SMITH	Clerk	7902	17-DE...	800	-
≡	7902	👤	FORD	Analyst	JONES	03-DE...	3000	-
≡	7788	👤	SCOTT	Analyst	JONES	09-DE...	3000	-
≡	7566	👤	JONES	Manager	KING	02-AP...	2975	-
≡	7782	👤	CLARK	Manager	KING	09-JU...	2450	-
≡	7698	👤	BLAKE	Manager	KING	01-MA...	2850	-
≡	7839	👤	KING	Presid...		17-NO...	5000	-

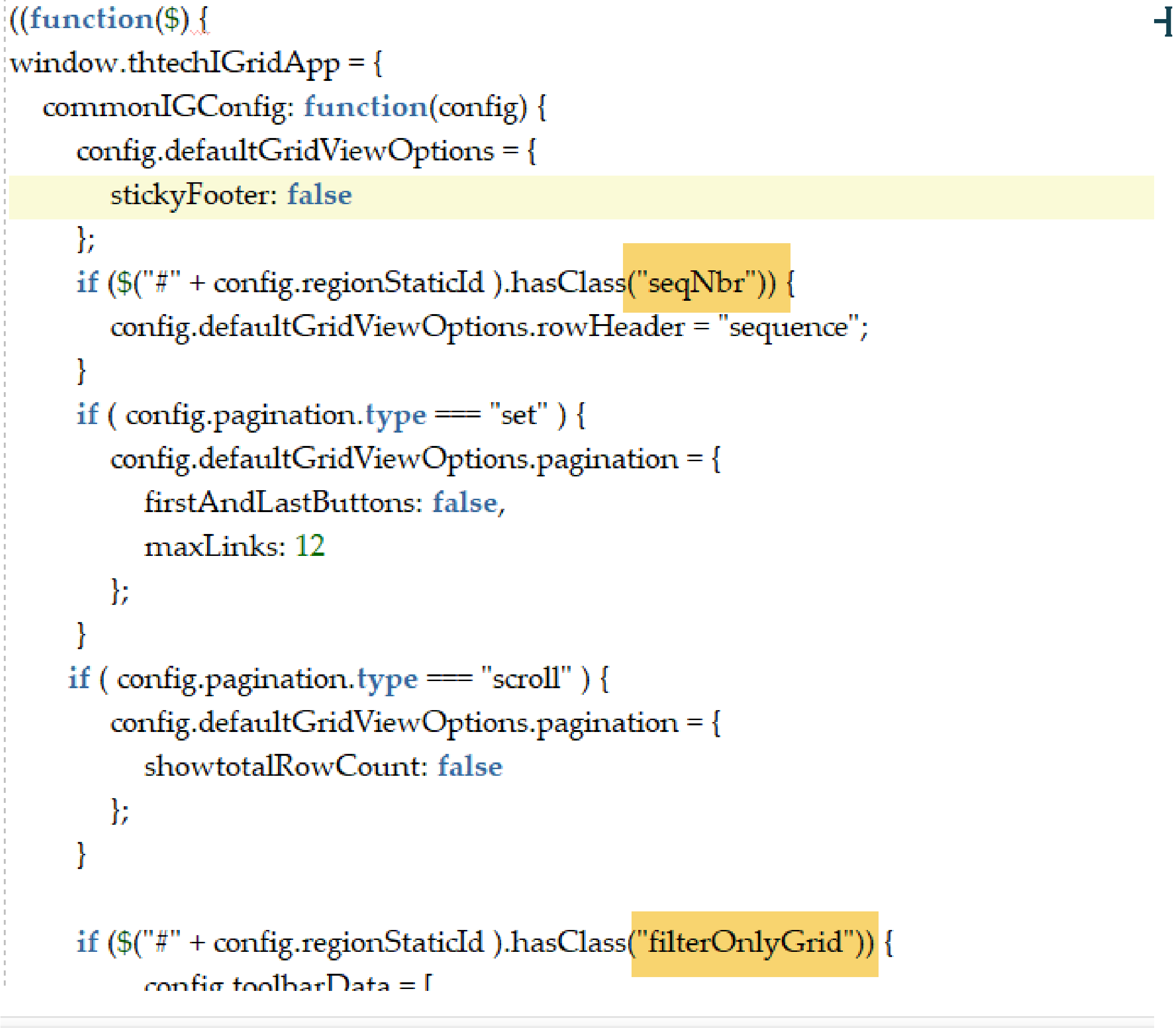
rows selected

ODTUG Kscope19
SEATTLE, WASHINGTON · JUNE 23-27

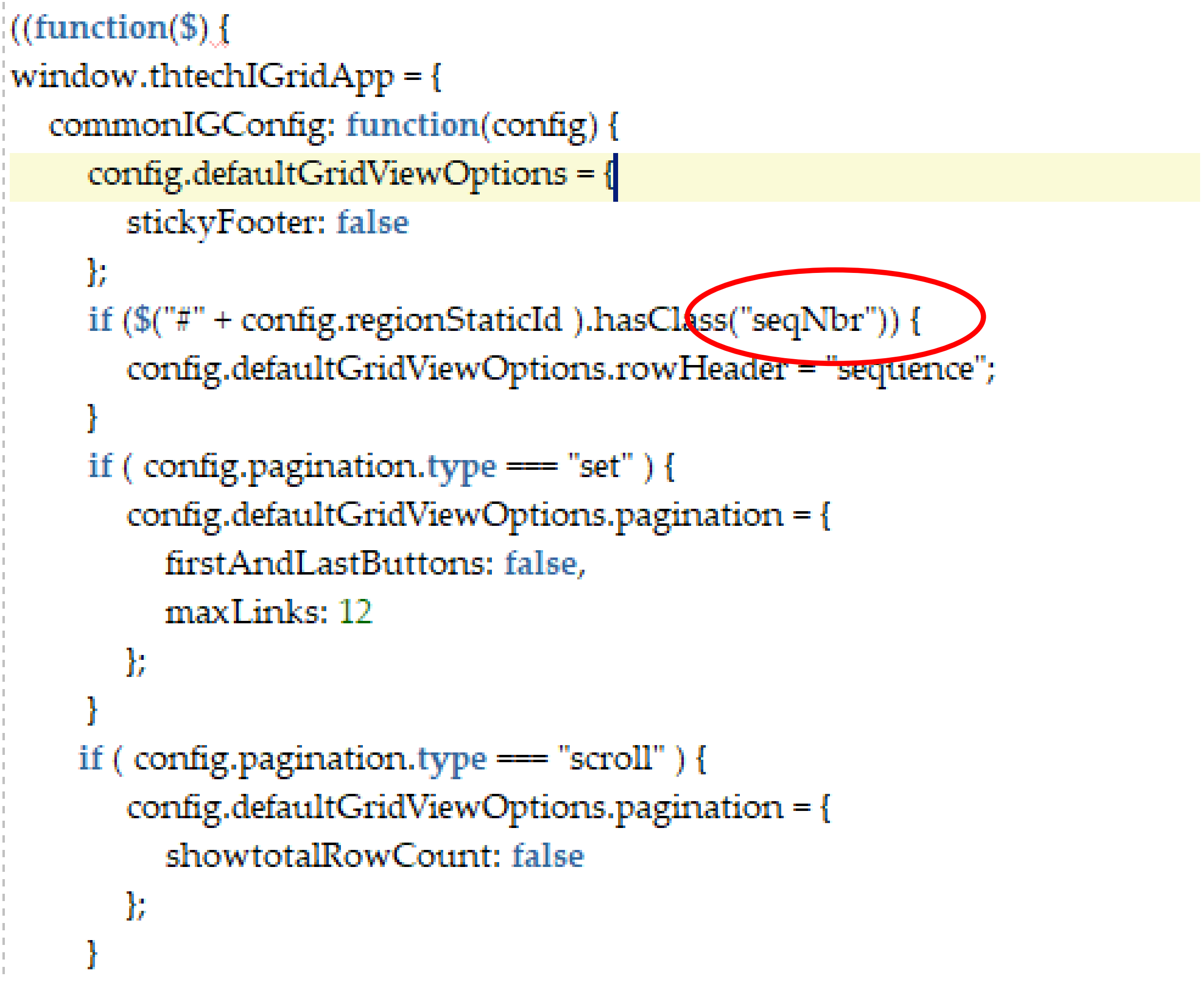


"Global" Settings

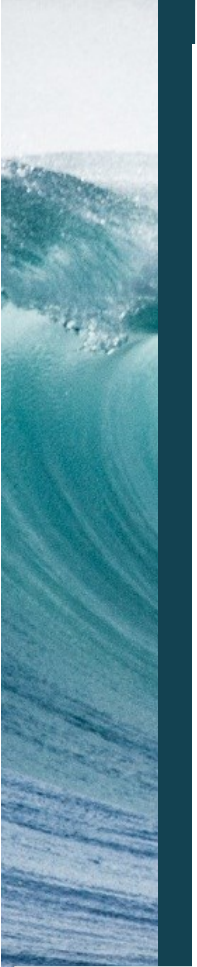
- JS Function in JS File
- Include File
- Reference JS Function in Advanced → JavaScript Code
- Add Classes on Grids

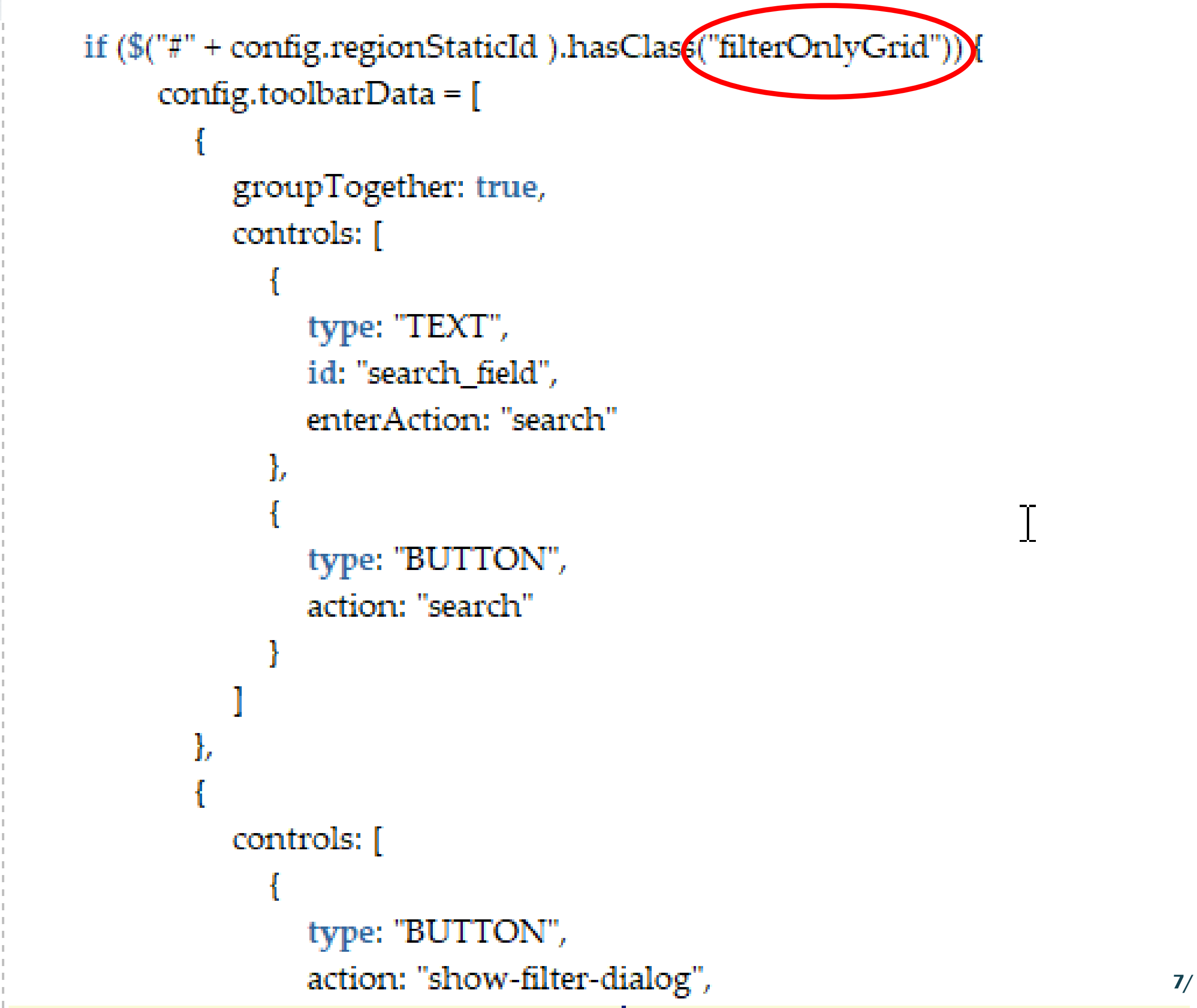


```
((function($) {
window.thtechIGridApp = {
    commonIGConfig: function(config) {
        config.defaultGridViewOptions = {
            stickyFooter: false
        };
        if ($("#" + config.regionStaticId ).hasClass("seqNbr")) {
            config.defaultGridViewOptions.rowHeader = "sequence";
        }
        if ( config.pagination.type === "set" ) {
            config.defaultGridViewOptions.pagination = {
                firstAndLastButtons: false,
                maxLinks: 12
            };
        }
        if ( config.pagination.type === "scroll" ) {
            config.defaultGridViewOptions.pagination = {
                showtotalRowCount: false
            };
        }

        if ($("#" + config.regionStaticId ).hasClass("filterOnlyGrid")) {
            config.toolbarData = [
```

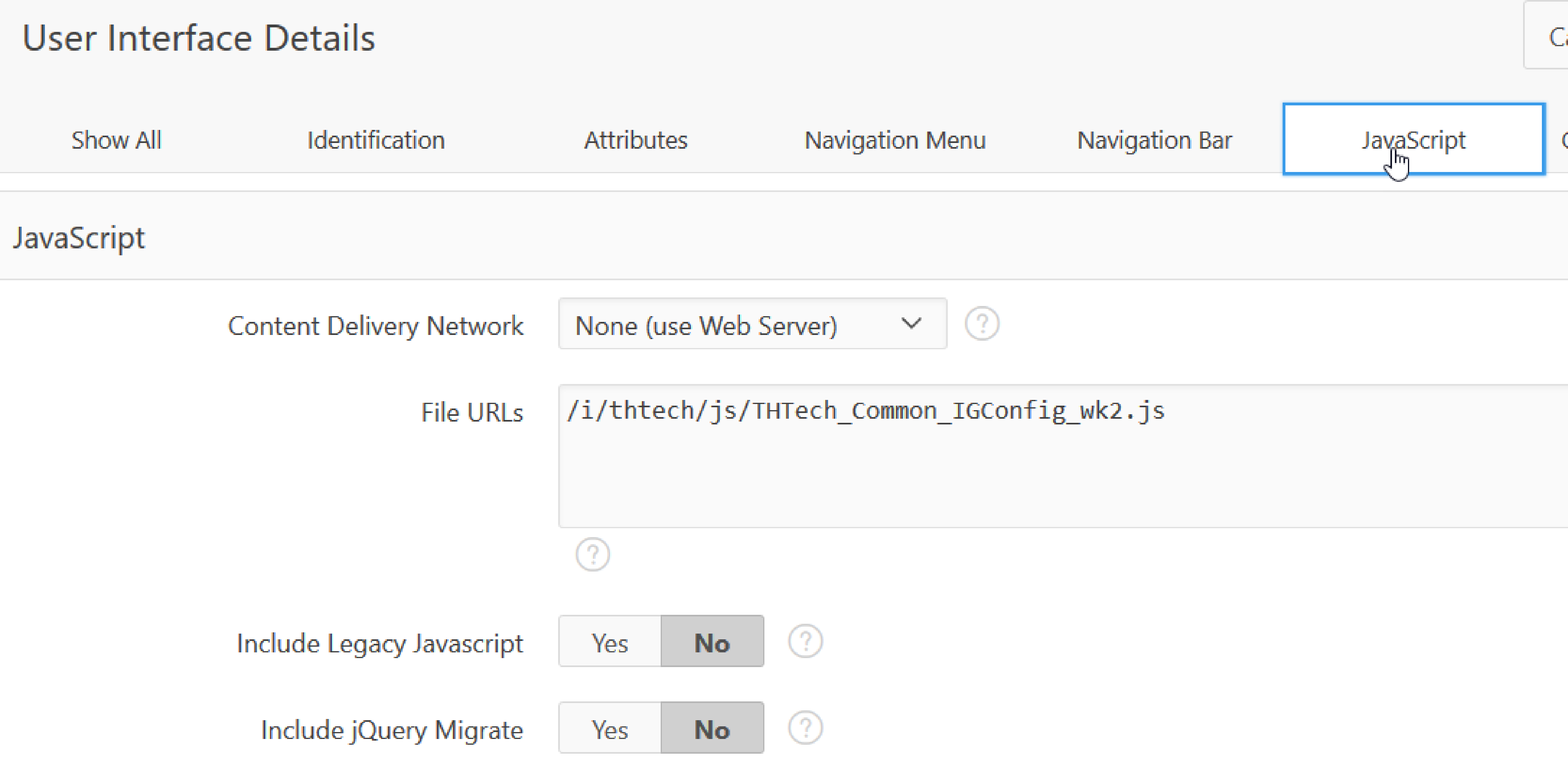


```
((function($) {
window.thtechIGridApp = {
  commonIGConfig: function(config) {
    config.defaultGridViewOptions = {
      stickyFooter: false
    };
    if ($("#" + config.regionStaticId ).hasClass("seqNbr")) {
      config.defaultGridViewOptions.rowHeader = "sequence";
    }
    if ( config.pagination.type === "set" ) {
      config.defaultGridViewOptions.pagination = {
        firstAndLastButtons: false,
        maxLinks: 12
      };
    }
    if ( config.pagination.type === "scroll" ) {
      config.defaultGridViewOptions.pagination = {
        showtotalRowCount: false
      };
    }
```





```
if ($("#" + config.regionStaticId ).hasClass("filterOnlyGrid")){
    config.toolbarData = [
      {
        groupTogether: true,
        controls: [
          {
            type: "TEXT",
            id: "search_field",
            enterAction: "search"
          },
          {
            type: "BUTTON",
            action: "search"
          }
        ]
      },
      {
        controls: [
          {
            type: "BUTTON",
            action: "show-filter-dialog",
```



User Interface Details

JavaScript

Content Delivery Network: None (use Web Server)

File URLs:

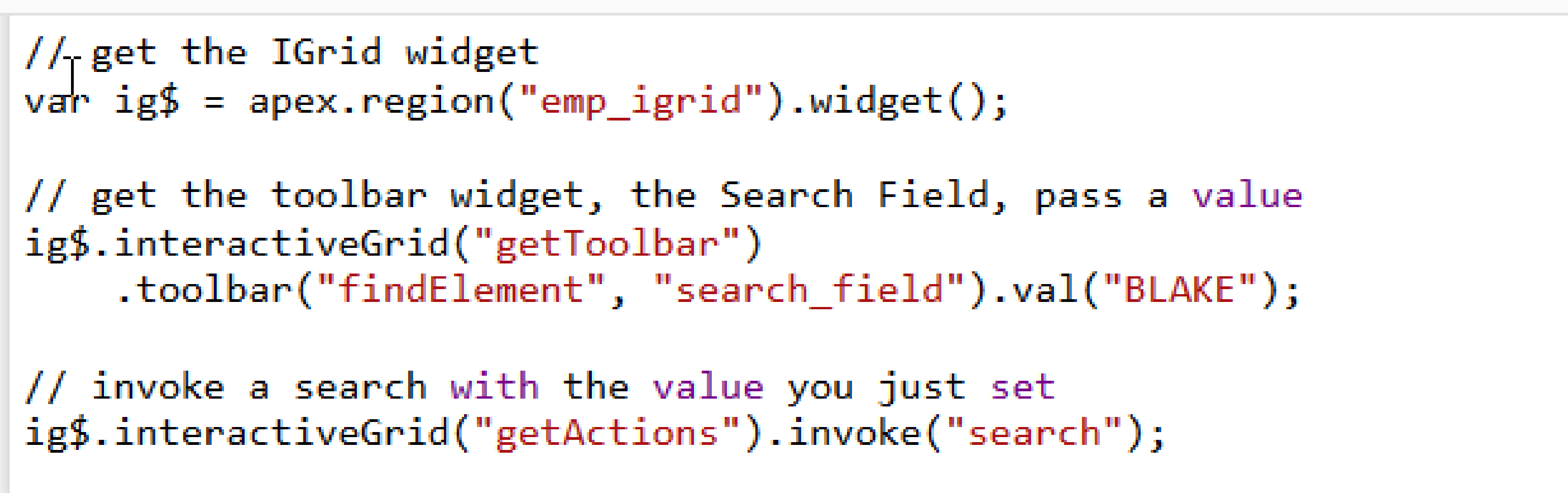
```
/i/thtech/js/THTech_Common_IGConfig_wk2.js
```

Include Legacy Javascript: Yes [✓ No]

Include jQuery Migrate: Yes [✓ No]

Invoke a Search

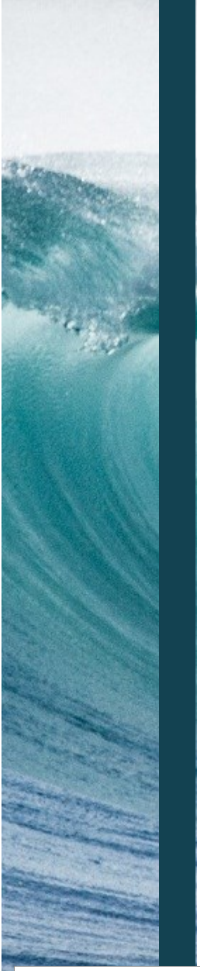
Quiz: What Does This Code Do? (gReport.search Equivalent)



```
// get the IGrid widget
var ig$ = apex.region("emp_igrid").widget();

// get the toolbar widget, the Search Field, pass a value
ig$.interactiveGrid("getToolbar")
    .toolbar("findElement", "search_field").val("BLAKE");

// invoke a search with the value you just set
ig$.interactiveGrid("getActions").invoke("search");
```

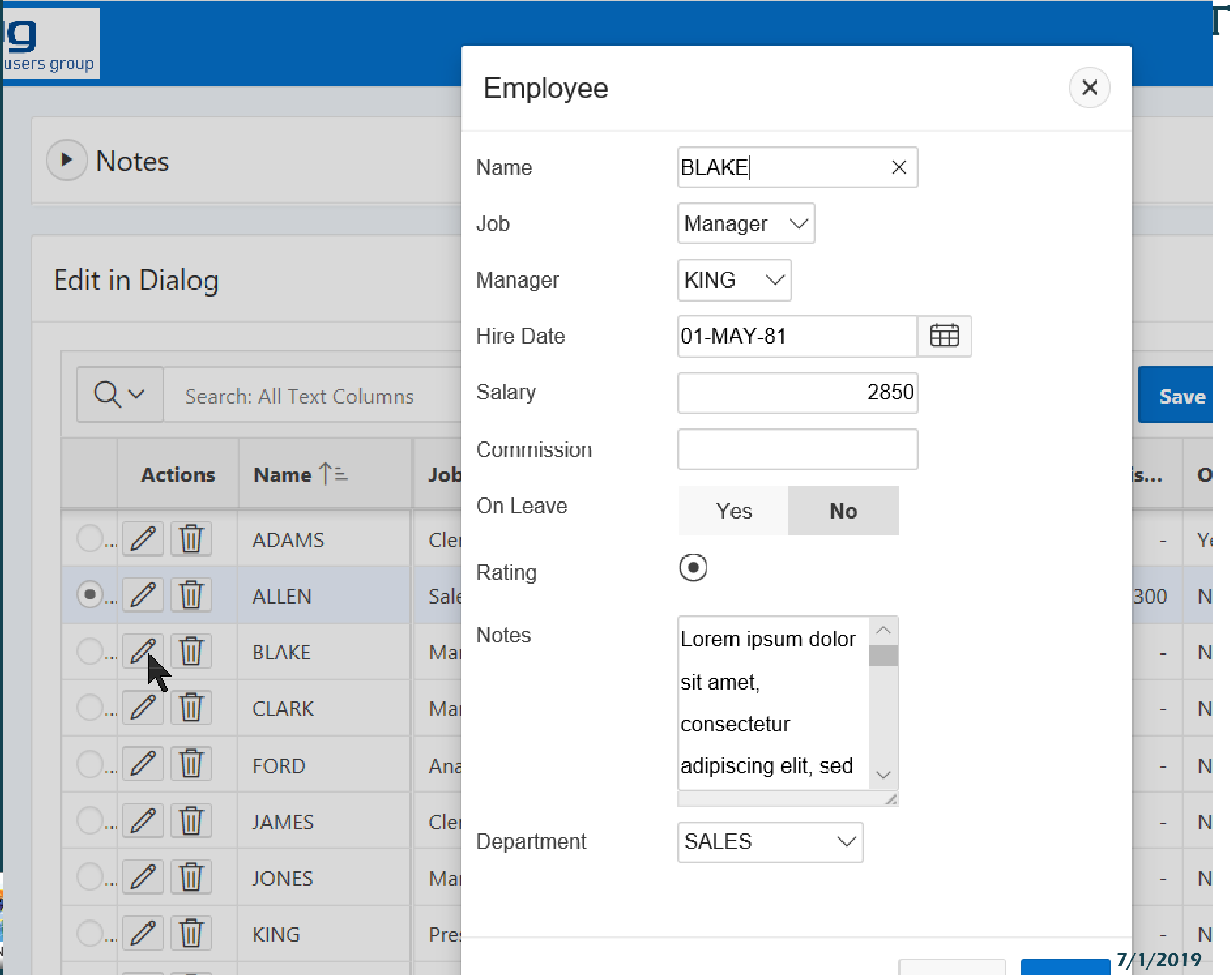
Custom: Edit via Dialog

- IG Cookbook Application
- Edits in Dialog
- Changed Row Actions
- Advanced, Possibilities!



ODTUG Kscope19
SEATTLE, WASHINGTON • JUNE 23-27

TH TECHNOLOGY



Notes

Edit in Dialog

Search: All Text Columns

Save

	Actions	Name	Job	is...	O
○		ADAMS	Cle	-	Y
●		ALLEN	Sale	300	N
○		BLAKE	Ma	-	N
○		CLARK	Ma	-	N
○		FORD	Ana	-	N
○		JAMES	Cle	-	N
○		JONES	Ma	-	N
○		KING	Pre	-	N

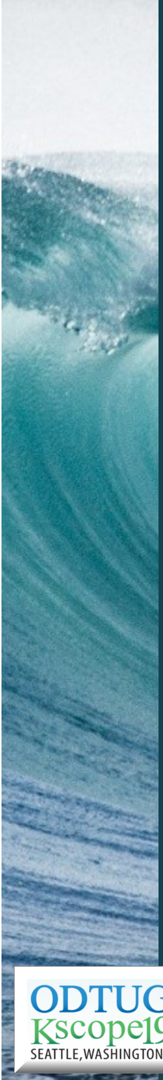
Employee ✕

Name	BLAKE
Job	Manager
Manager	KING
Hire Date	01-MAY-81
Salary	2850
Commission	
On Leave	Yes [✓ No]
Rating	●
Notes	Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed
Department	SALES

ODTUG Kscope19
SEATTLE, WASHINGTON · JUN

7/1/2019

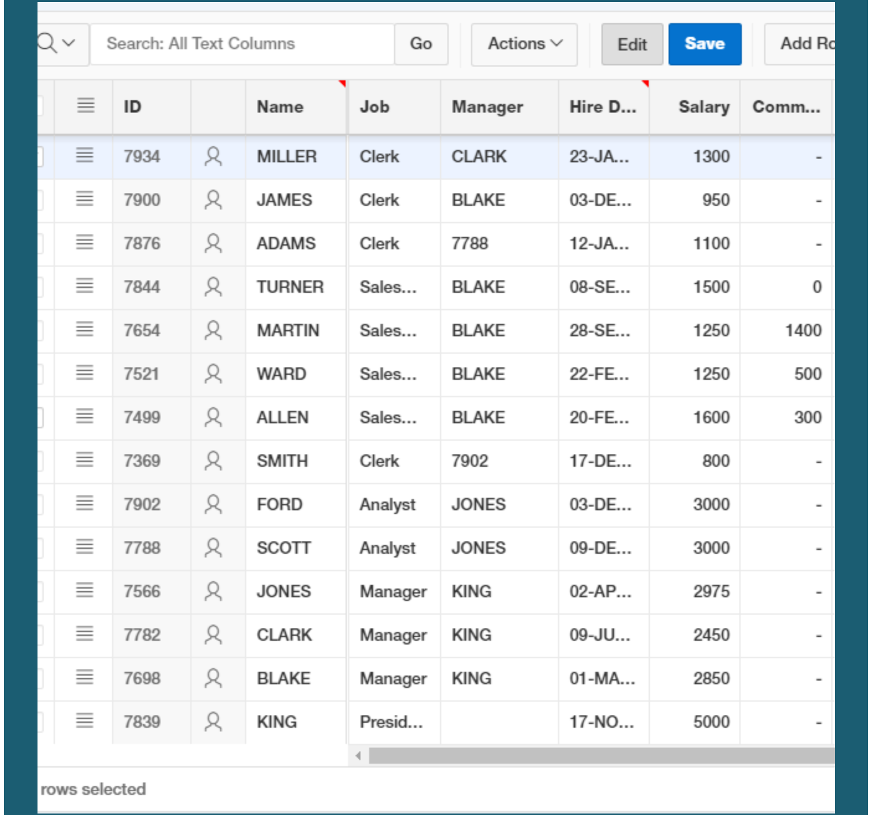
7/1/2019



APEX Interactive Grid APIS:

Best Practices

Recommendations for Adding JavaScript to APEX Applications



	ID		Name	Job	Manager	Hire D...	Salary	Comm...
≣	7934		MILLER	Clerk	CLARK	23-JA...	1300	-
≣	7900		JAMES	Clerk	BLAKE	03-DE...	950	-
≣	7876		ADAMS	Clerk	7788	12-JA...	1100	-
≣	7844		TURNER	Sales...	BLAKE	08-SE...	1500	0
≣	7654		MARTIN	Sales...	BLAKE	28-SE...	1250	1400
≣	7521		WARD	Sales...	BLAKE	22-FE...	1250	500
≣	7499		ALLEN	Sales...	BLAKE	20-FE...	1600	300
≣	7369		SMITH	Clerk	7902	17-DE...	800	-
≣	7902		FORD	Analyst	JONES	03-DE...	3000	-
≣	7788		SCOTT	Analyst	JONES	09-DE...	3000	-
≣	7566		JONES	Manager	KING	02-AP...	2975	-
≣	7782		CLARK	Manager	KING	09-JU...	2450	-
≣	7698		BLAKE	Manager	KING	01-MA...	2850	-
≣	7839		KING	Presid...		17-NO...	5000	-

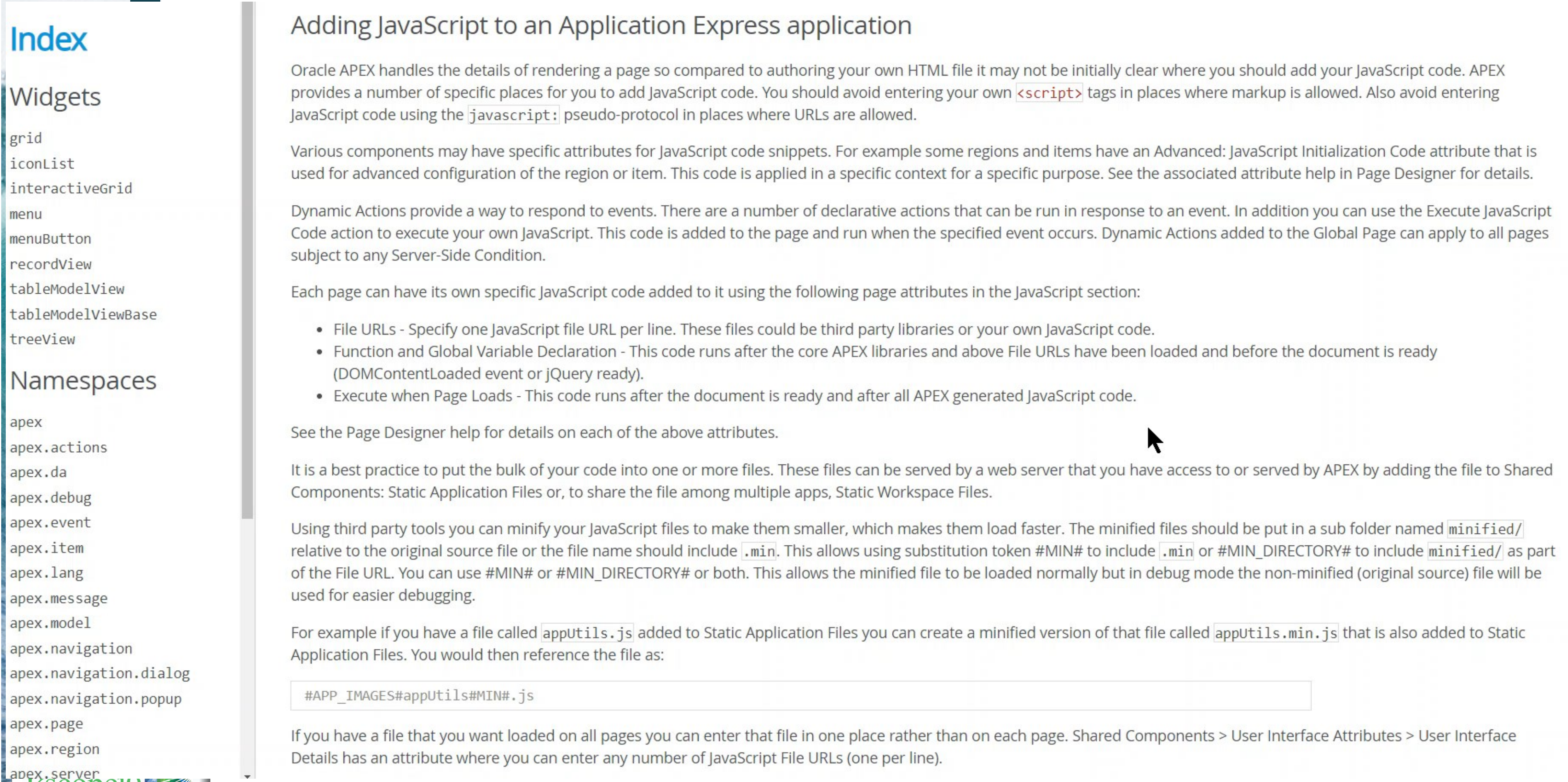
rows selected

ODTUG Kscope19
SEATTLE, WASHINGTON · JUNE 23-27

Adding JS to APEX

- Follow the Usual Best Practicies:
  - Put Bulk of Code in JS Files
  - Minify
  - Read More in the Introduction ot the JS API doc:

  Adding JavaScript to an Application Express application
  https://docs.oracle.com/en/database/oracle/application-express/19.1/aexjs/index.html



Index

Widgets

grid
iconList
interactiveGrid
menu
menuButton
recordView
tableModelView
tableModelViewBase
treeView

Namespaces

apex
apex.actions
apex.da
apex.debug
apex.event
apex.item
apex.lang
apex.message
apex.model
apex.navigation
apex.navigation.dialog
apex.navigation.popup
apex.page
apex.region
apex.server

Adding JavaScript to an Application Express application

Oracle APEX handles the details of rendering a page so compared to authoring your own HTML file it may not be initially clear where you should add your JavaScript code. APEX provides a number of specific places for you to add JavaScript code. You should avoid entering your own `<script>` tags in places where markup is allowed. Also avoid entering JavaScript code using the `javascript:` pseudo-protocol in places where URLs are allowed.

Various components may have specific attributes for JavaScript code snippets. For example some regions and items have an Advanced: JavaScript Initialization Code attribute that is used for advanced configuration of the region or item. This code is applied in a specific context for a specific purpose. See the associated attribute help in Page Designer for details.

Dynamic Actions provide a way to respond to events. There are a number of declarative actions that can be run in response to an event. In addition you can use the Execute JavaScript Code action to execute your own JavaScript. This code is added to the page and run when the specified event occurs. Dynamic Actions added to the Global Page can apply to all pages subject to any Server-Side Condition.

Each page can have its own specific JavaScript code added to it using the following page attributes in the JavaScript section:

- File URLs - Specify one JavaScript file URL per line. These files could be third party libraries or your own JavaScript code.
- Function and Global Variable Declaration - This code runs after the core APEX libraries and above File URLs have been loaded and before the document is ready (DOMContentLoaded event or jQuery ready).
- Execute when Page Loads - This code runs after the document is ready and after all APEX generated JavaScript code.

See the Page Designer help for details on each of the above attributes.

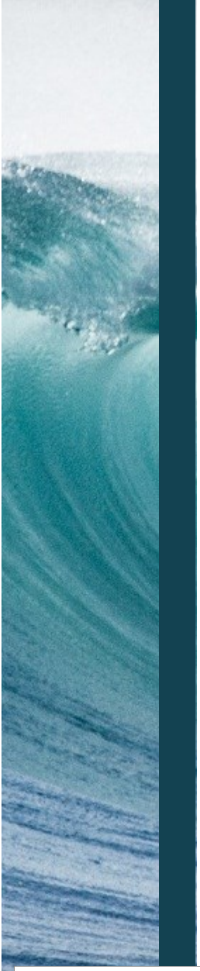
It is a best practice to put the bulk of your code into one or more files. These files can be served by a web server that you have access to or served by APEX by adding the file to Shared Components: Static Application Files or, to share the file among multiple apps, Static Workspace Files.

Using third party tools you can minify your JavaScript files to make them smaller, which makes them load faster. The minified files should be put in a sub folder named `minified/` relative to the original source file or the file name should include `.min`. This allows using substitution token #MIN# to include `.min` or #MIN_DIRECTORY# to include `minified/` as part of the File URL. You can use #MIN# or #MIN_DIRECTORY# or both. This allows the minified file to be loaded normally but in debug mode the non-minified (original source) file will be used for easier debugging.

For example if you have a file called `appUtils.js` added to Static Application Files you can create a minified version of that file called `appUtils.min.js` that is also added to Static Application Files. You would then reference the file as:

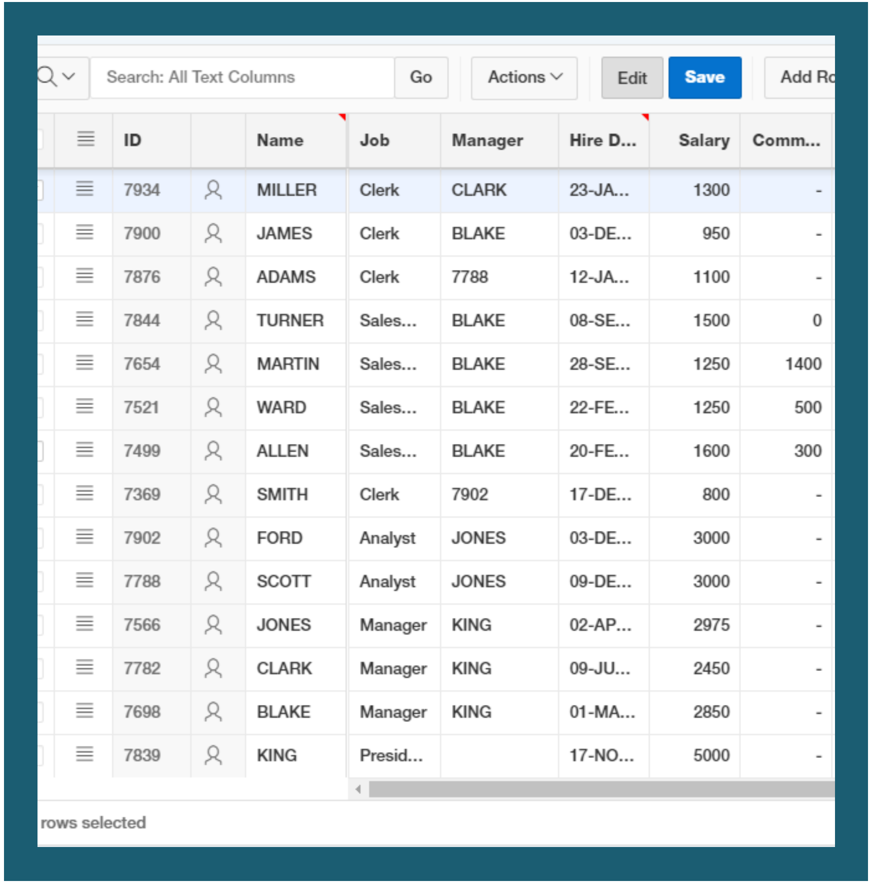
```
#APP_IMAGES#appUtils#MIN#.js
```

If you have a file that you want loaded on all pages you can enter that file in one place rather than on each page. Shared Components > User Interface Attributes > User Interface Details has an attribute where you can enter any number of JavaScript File URLs (one per line).



APEX Interactive Grid APIS:

Wrapup



≡	ID		Name	Job	Manager	Hire D...	Salary	Comm...
≡	7934	👤	MILLER	Clerk	CLARK	23-JA...	1300	-
≡	7900	👤	JAMES	Clerk	BLAKE	03-DE...	950	-
≡	7876	👤	ADAMS	Clerk	7788	12-JA...	1100	-
≡	7844	👤	TURNER	Sales...	BLAKE	08-SE...	1500	0
≡	7654	👤	MARTIN	Sales...	BLAKE	28-SE...	1250	1400
≡	7521	👤	WARD	Sales...	BLAKE	22-FE...	1250	500
≡	7499	👤	ALLEN	Sales...	BLAKE	20-FE...	1600	300
≡	7369	👤	SMITH	Clerk	7902	17-DE...	800	-
≡	7902	👤	FORD	Analyst	JONES	03-DE...	3000	-
≡	7788	👤	SCOTT	Analyst	JONES	09-DE...	3000	-
≡	7566	👤	JONES	Manager	KING	02-AP...	2975	-
≡	7782	👤	CLARK	Manager	KING	09-JU...	2450	-
≡	7698	👤	BLAKE	Manager	KING	01-MA...	2850	-
≡	7839	👤	KING	Presid...		17-NO...	5000	-

rows selected

ODTUG Kscope19
SEATTLE, WASHINGTON · JUNE 23-27

Interactive Grid APIs - Recap

- Essential Grid JavaScript APIs

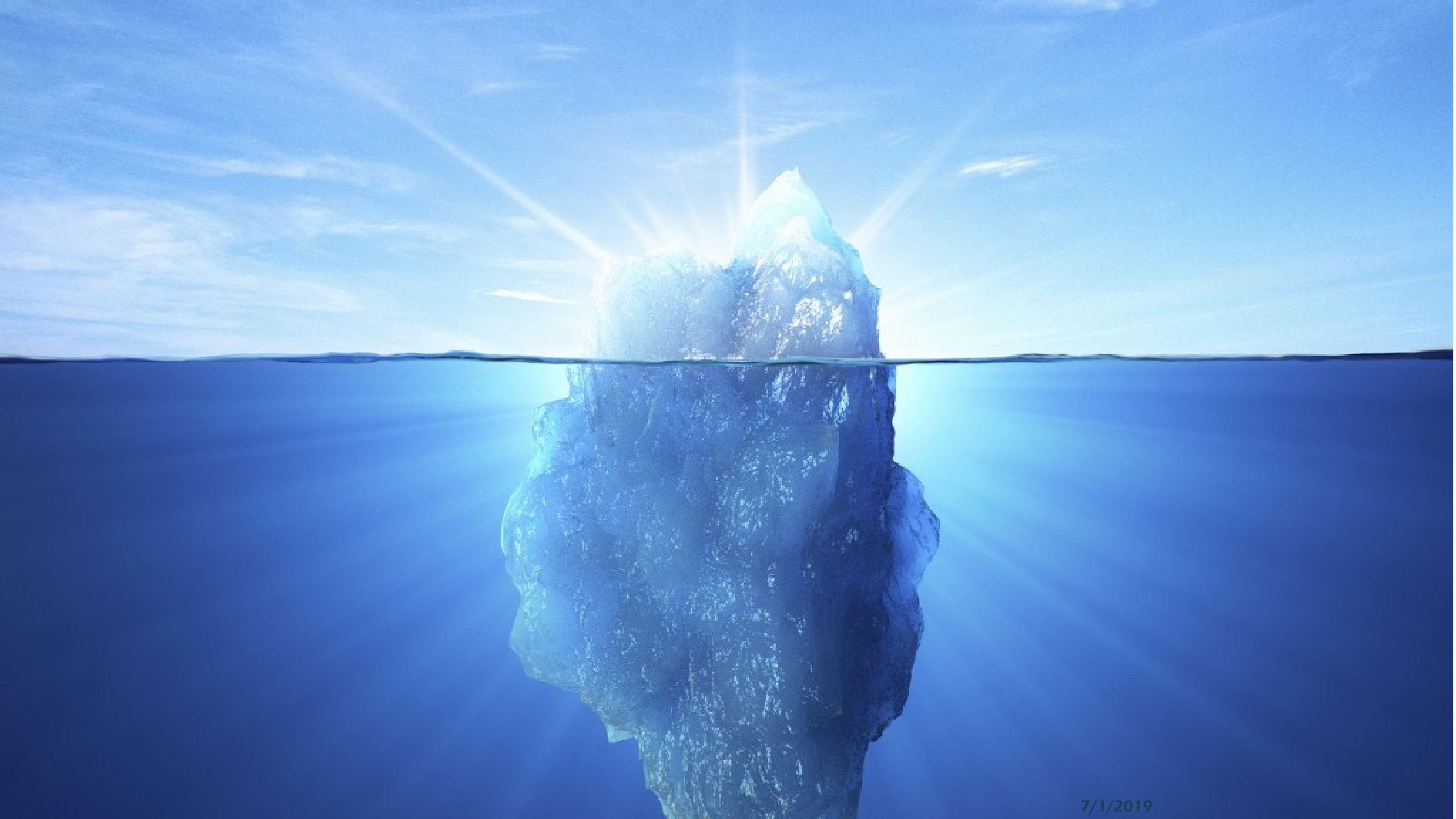
  interactiveGrid grid apex.model apex.item

- Dynamic Actions, Validations

  grid apex.model apex.item

- Customizations

  All of the above



Challenge

Homework

- Sample Interactive Grid App
- IG Cookbook
  http://www.hardlikesoftware.com
- Read the APIs (coffee!!)
- Read the JS Widget Code
  <apex_install_dir>/images/libraries/apex

PLAY

ODTUG Kscope19

SEATTLE,WASHINGTON •JUNE 23-27

Comments?
Questions?

Thank You!

Email for Slides, Demo App

Karen Cannell
kcannell@thtechnology.com
@thtechnology

Resources

- APEX JavaScript Reference

  https://docs.oracle.com/en/database/oracle/application-express/19.1/aexjs/index.html
- Sample Interactive Grids

  APEX 19.1+ Sample Application, Editing section
- Interactive Grid Cookbook, 19.1

  http://hardlikesoftware.com/weblog/2019/03/30/apex-ig-cookbook-update-for-19-1/
- Architecture: Interactive Grids Under the Hood

  http://hardlikesoftware.com/weblog/2016/06/08/interactive-grid-under-the-hood/
- More on Grids: How to Hack Interactive Grids, Parts I thru IV

  http://hardlikesoftware.com/weblog/2017/01/18/how-to-hack-apex-interactive-grid-part-1/

Resources, cont'd

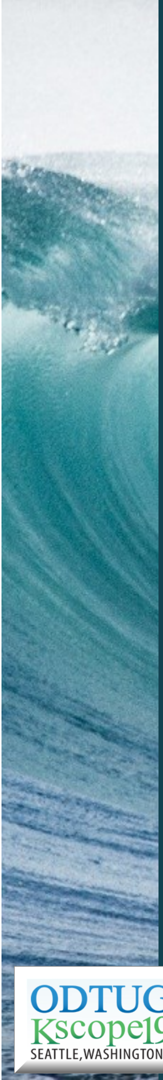
- APEX Client-Side Validation

  http://hardlikesoftware.com/weblog/2017/05/10/apex-client-side-validation/#more-615
- Interactive Grid Extend Toolbar Plugin

  https://github.com/mgoricki/apex-plugin-extend-ig-toolbar

Shortcut to APEX JavaScript APIs:

apex.oracle.com/api
#39 JavaScript APIs
follow the link



Where to Put JS Files

- https://www.talkapex.com/2017/01/how-to-reference-javsscript-and-css-files-for-entire-application/js-storage.gif

ODTUG Kscope19
SEATTLE, WASHINGTON • JUNE 23-27