Introduction to Node.js

HBD260

Exercises / Solutions

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SAP TECHED

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BEFORE YOU START

System Host: wdflbmt0749.wdf.sap.corp
System Instance Number: 00
System User ID: HBD260
All Passwords: Welcome17
XSA Organization: XS
XSA Development Space: DEV

Getting Help

If you need addition help resources beyond this document, we would suggest the following content:

- The Online Help at https://help.sap.com/viewer/4505d0bdaf4948449b7f7379d24d0f0d/2.0.01/en-US

Source Code Solutions

All source code solutions and templates for all exercises in this document can be found in the following webpage.
https://github.com/I809764/TechEd2017.HBD260/tree/snippets/

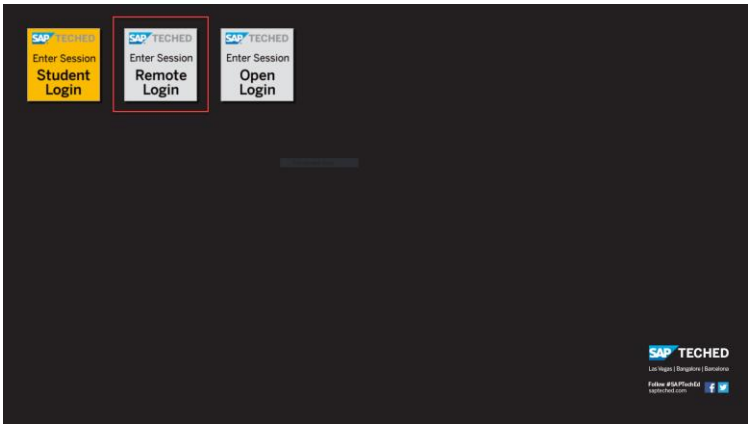
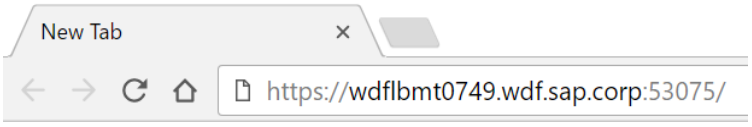
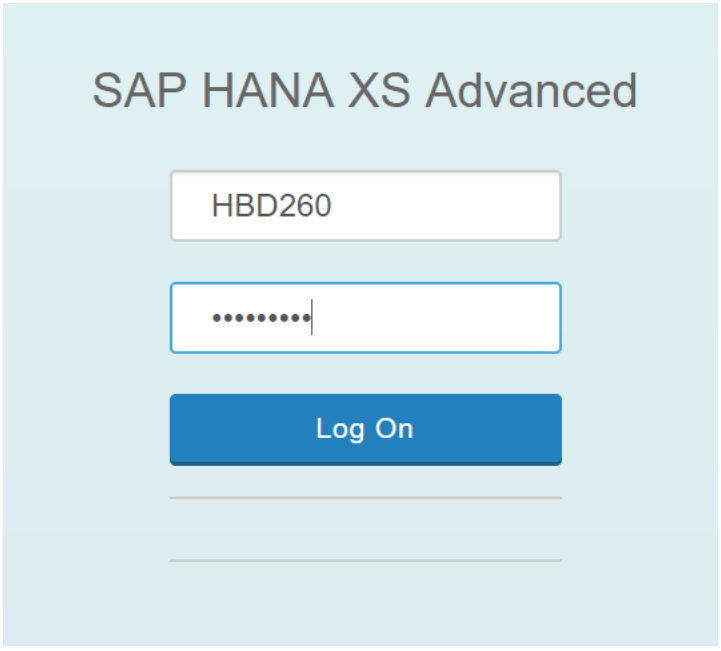
In some cases, it might be a little easier to copy and paste the coding instead of typing it all manually. If copying/pasting, I would suggest that you make sure to understand what is being copied/pasted before moving on.

Open the browser and enter the following URL to access the solutions web page (or you can use the bookmark shortcut we have created for you in Google Chrome). You can access the source code for each exercise by clicking on the appropriate exercise in the navigation bar.
https://github.com/I809764/TechEd2017.HBD260/tree/snippets/

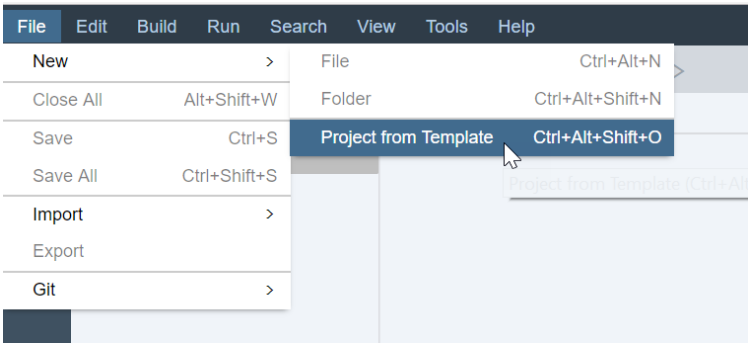
EXERCISE 1

In this first exercise, we will connect to the SAP Web IDE for SAP HANA, run the new project wizard, and then create a Node.js module. At the end of this exercise you will be able to connect to your server via web browser and see a Hello World message from your Node.js service.

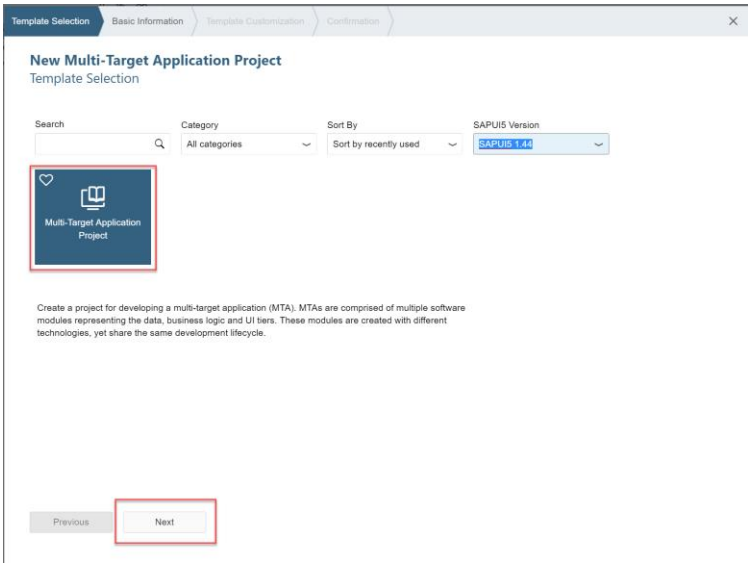
Exercise 1.1: Node.js Module - Hello World

Explanation	Screenshot
1. Please click on the Remote Login tile. You will be asked for username and password – please enter: **.\student** with password: **Welcome17**	
2. Launch the Google Chrome browser, and enter the following URL. https://wdflbmt0749.wdf.sap.corp:53075/	
3. User: HBD260 Password: Welcome17	

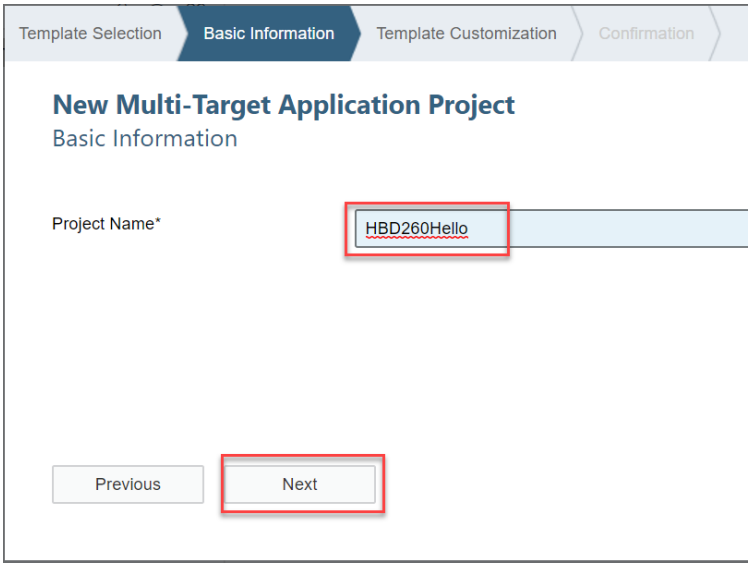
4. We will begin by creating a new project from template. Use **File->New->Project from Template**



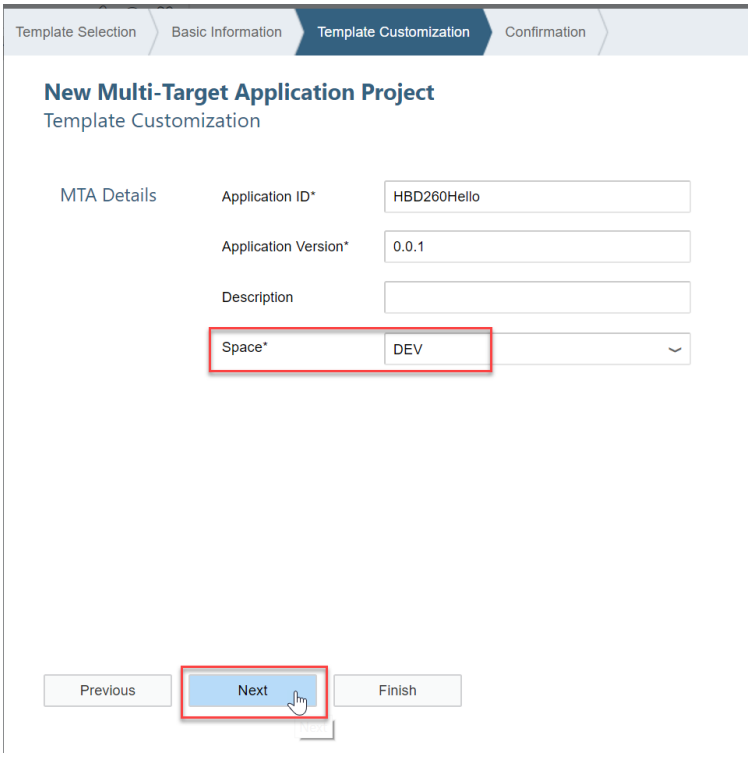
5. Choose Multi-Target Application Project and then press **Next**.



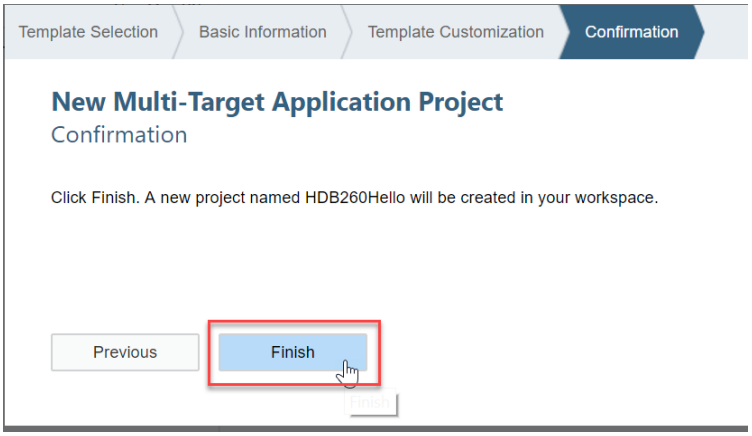
6. Enter the project name HBD260Hello. Press **Next**.



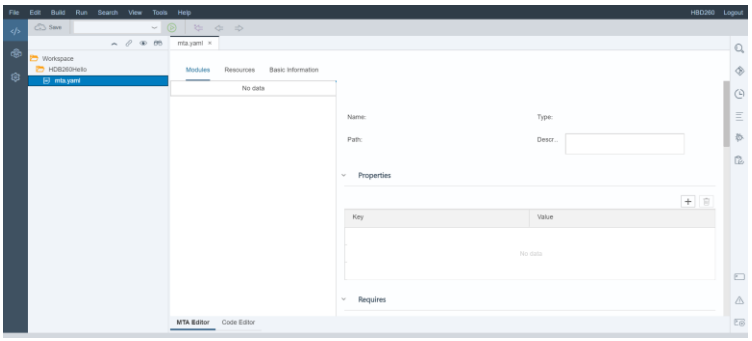
7. You can optionally enter a description for your new application. Set the Space to DEV then press **Next**.



8. Press **Finish** to complete the wizard and generate your new project.



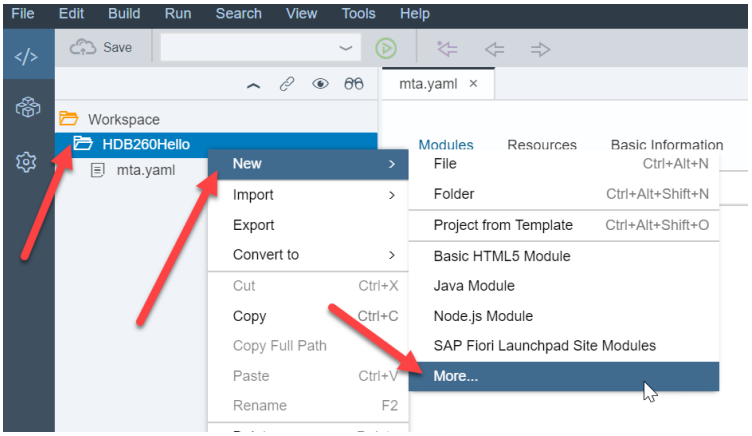
9. Your empty project has been created.

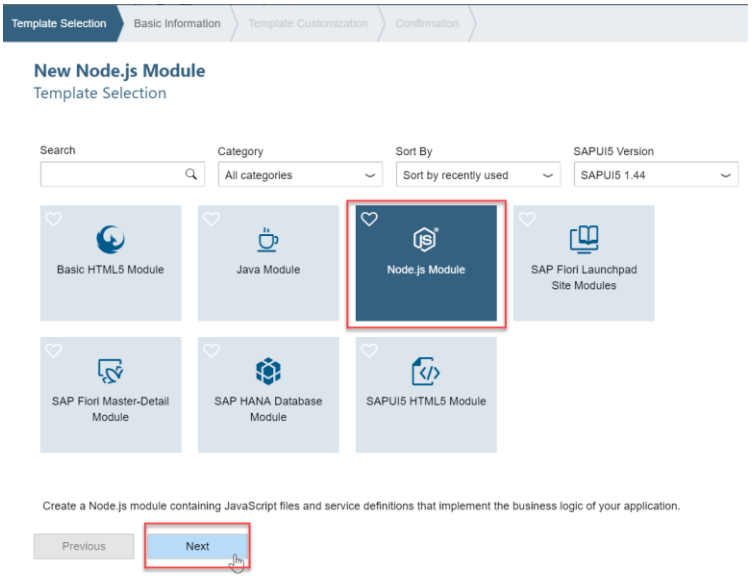


10. Next we need to create the Node.js module.

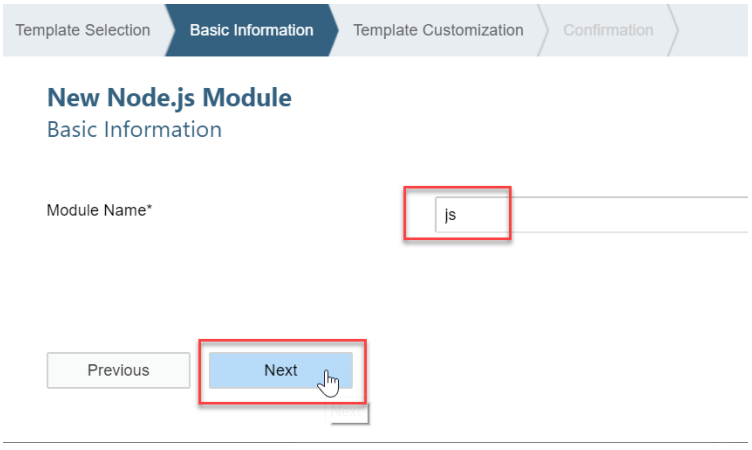
    Begin by selecting your project and then choosing **New -> More**

    Then choose **Node.js Module** from the Template Selection and then choose **Next**.

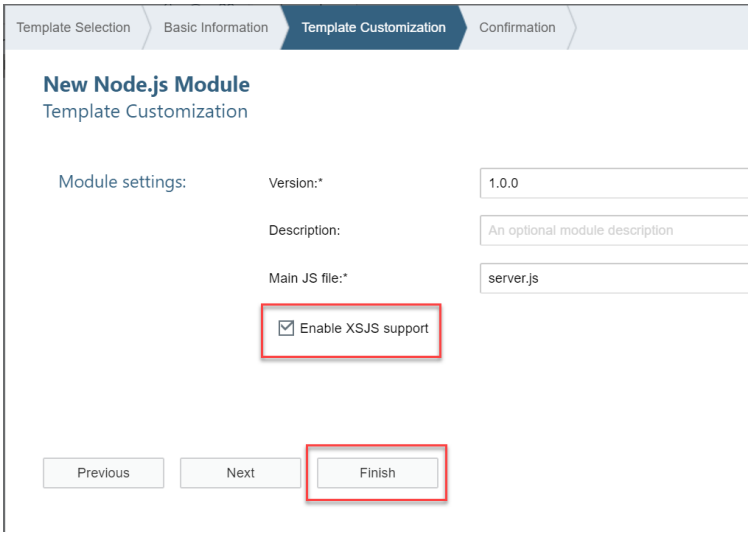




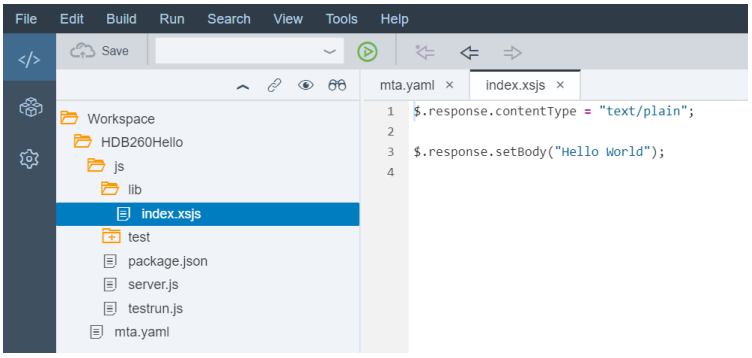
11. Name the module **js**. Press **Next**.



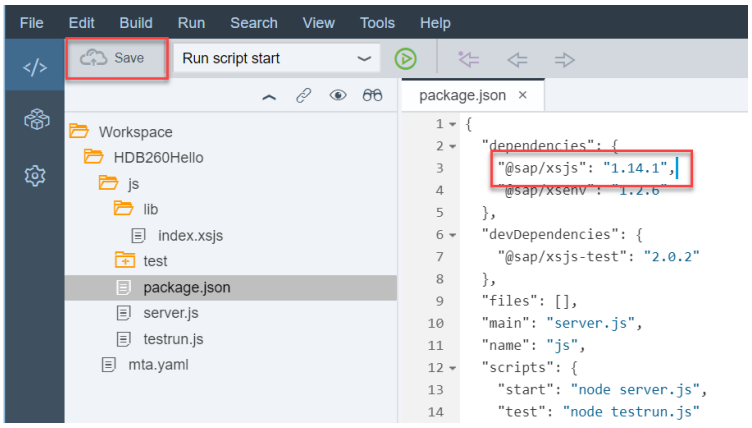
12. Select **Enable XSJS support** and then press **Finish**.



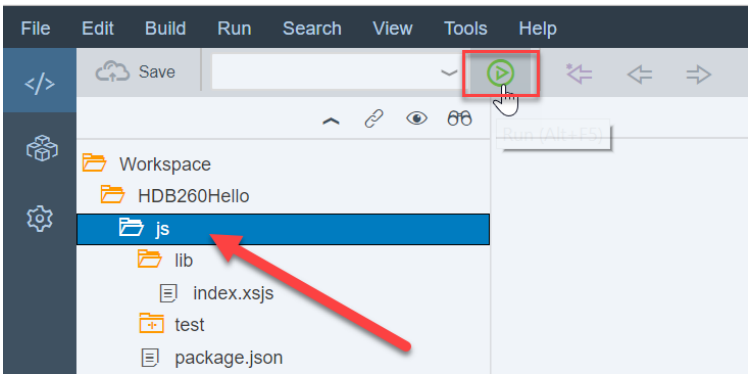
13. The Node.js module wizard created a folder structure starting with **js**. Expand **js** and the **lib** folder and double click on the **index.xsjs** file. This is our hello world service which was generated for us by the wizard.



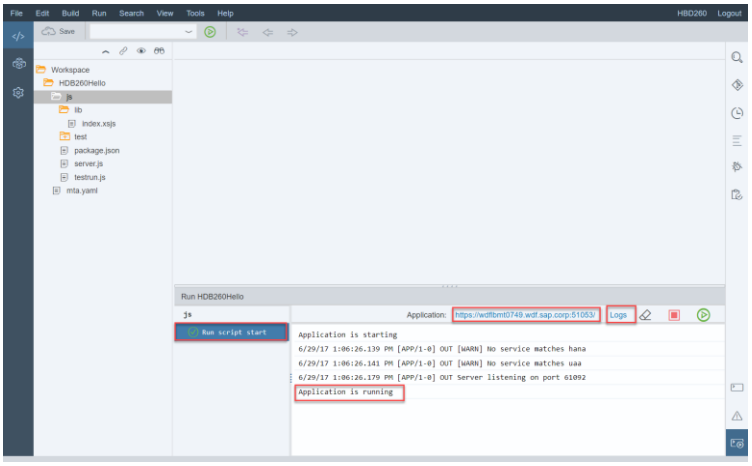
14. One manual update we need to make is the **package.json** file in the **/js** folder. Change the version of **@sap/xsjs** from 1.13.1 to 1.14.1. Save the file after the edit.



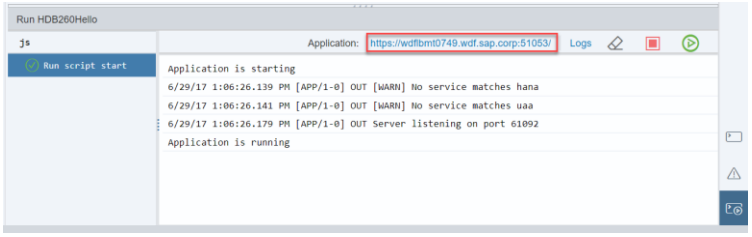
15. Our initial development is done and we are ready to deploy our application onto the XS Advanced server. Highlight the **js** folder and press **Run**. This will perform a build, then deploy the service onto the server. If successful it will open a new browser tab to the default page of this Node.js service.



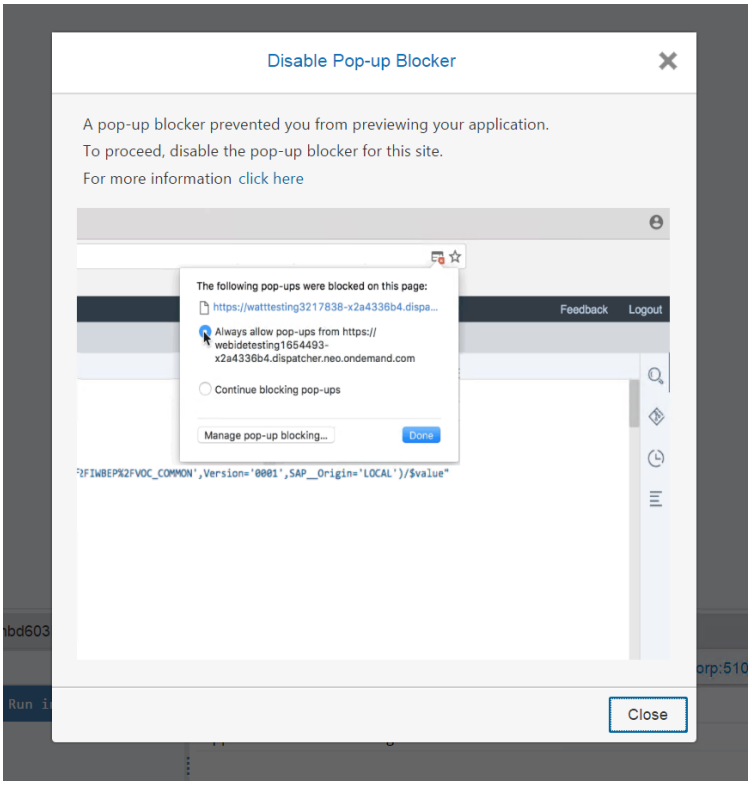
16. It can take a minute or two for the first build/deploy/run operation to complete. Upon completion, you should see that the service status has changed to Running and there is a hyper link to the application URL and the logs.

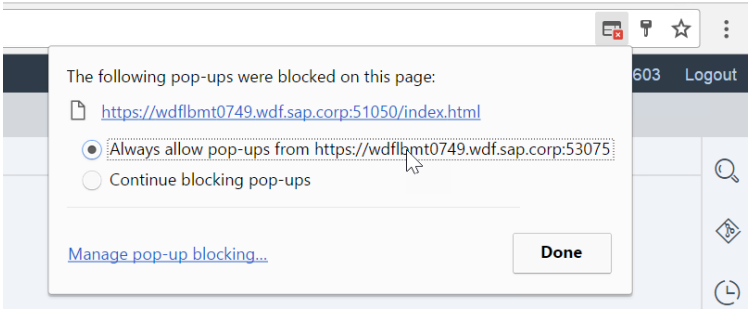


17. Click the hyperlink for the application URL in the Run window to open it in a new browser tab. Please note the port number for the URL shown in the screenshots might be different than what you see in your system since these ports are handed out at runtime.



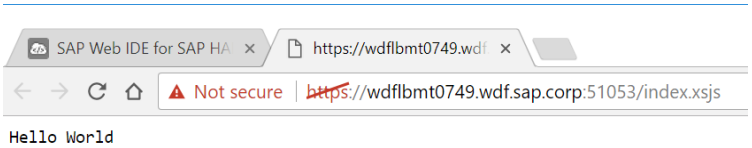
18. You might receive a message about the browser pop-up blocker. If you do receive this message press **Close**. Then click the pop-up configuration button on the right side of the browser address bar. Choose the **Always allow pop-ups from …** option.





19. Depending upon the amount of time since you began the exercise you might be asked to re-authentication. After successful authentication (if needed), you should see your **index.xsjs** with the Hello World message.

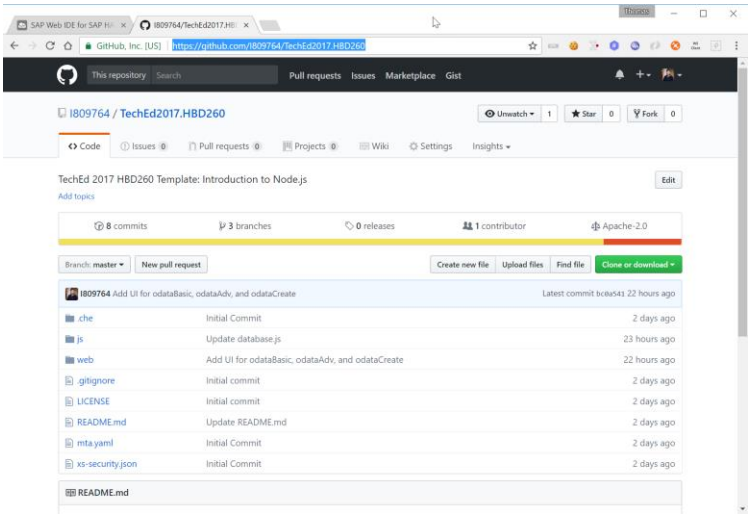
    Congratulations! You just wrote your first XS Advanced / Node.js application.



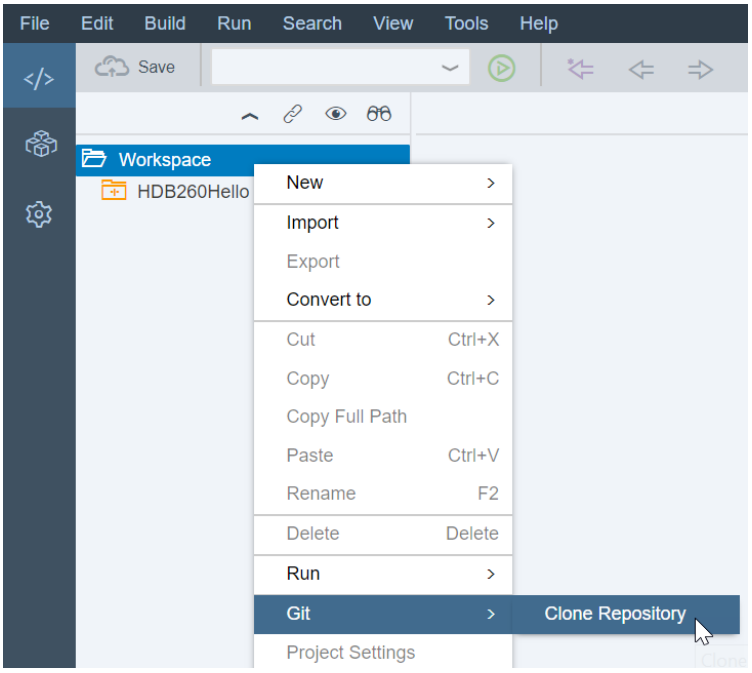
Exercise 1.2: Clone a Repository from Git

With XSA/HDI based development we no longer use the HANA database as the design time repository. We use a central Git to store all design time artifacts. Therefore, when you launch the Web IDE for SAP HANA, you only see the projects which have been pulled from Git or which you have created locally in your workspace. There is no repository browser. In this exercise, we will see how we can clone a project from Git to bring it into our local SAP Web IDE for SAP HANA workspace. You can alternatively import the project from the file system which will be shown in Exercise 1.3.

By cloning a skeleton project, we can setup all the basic configuration and add some test SAPUI5 applications allowing the remainder of the workshop to focus on JavaScript and Node.js coding.

Explanation	Screenshot
1. In a new browser tab, please navigate to this URL: https://github.com/I809764/TechEd2017.HBD260 This is the skeleton project for this course which we will use to get started with the remainder of the exercises.	

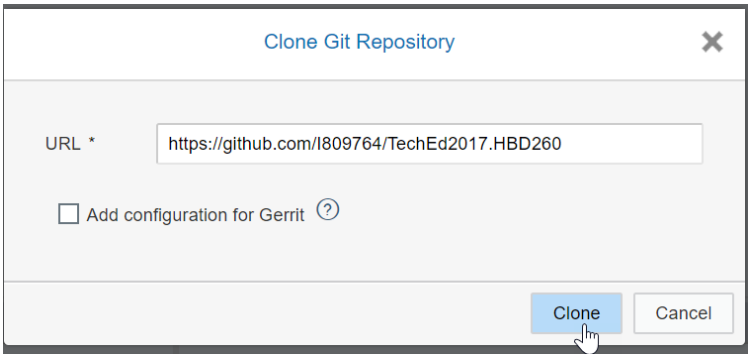
2. Return to the SAP Web IDE for SAP HANA. Right mouse click on the Workspace and choose Git->Clone Repository.



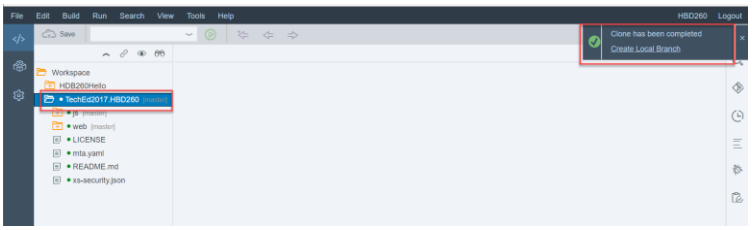
3. In the Clone Repository dialog, please use the following values.

   URL: https://github.com/I809764/TechEd2017.HBD260

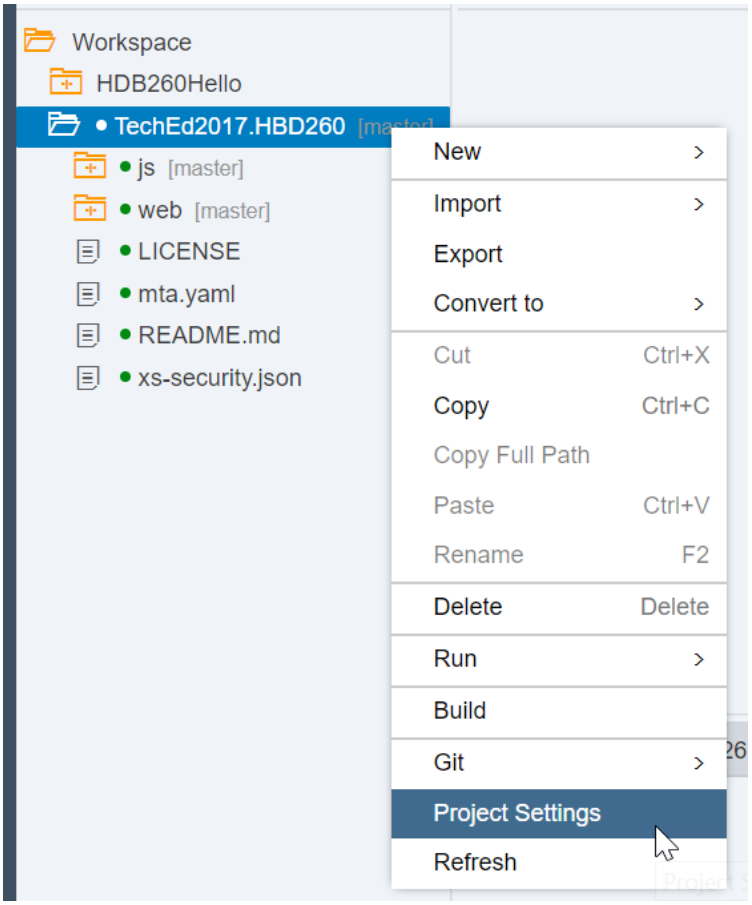
   Press **Clone**.



4. If successful, the TechEd2017.HBD260 project will now appear in your workspace and is connected to the git repository.

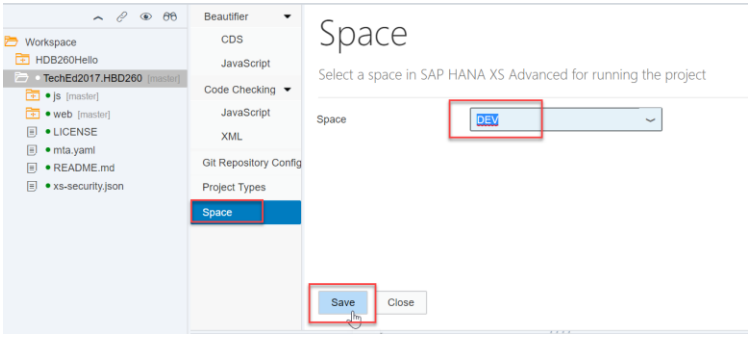


5. Right mouse click on your project and choose **Project Settings**.

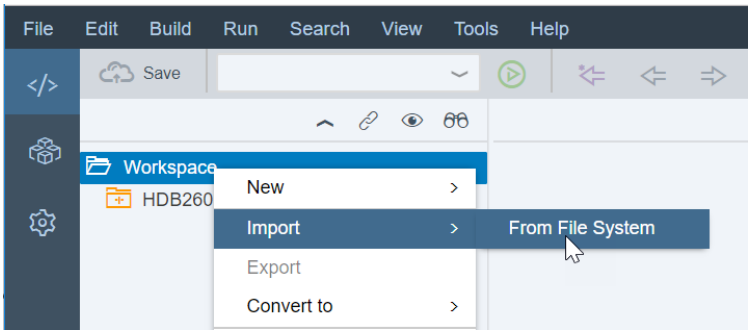
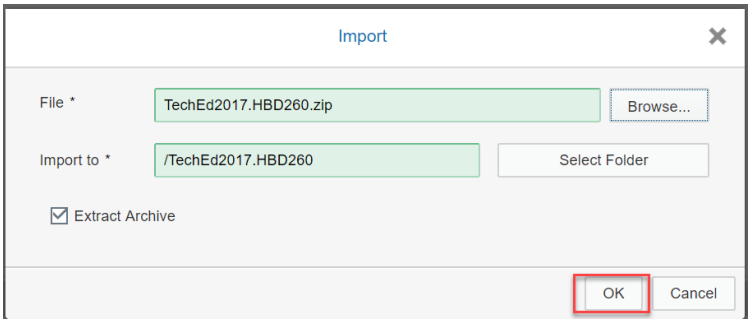


6. Choose the Space section and then choose DEV as the Development Space. Press **Save**.

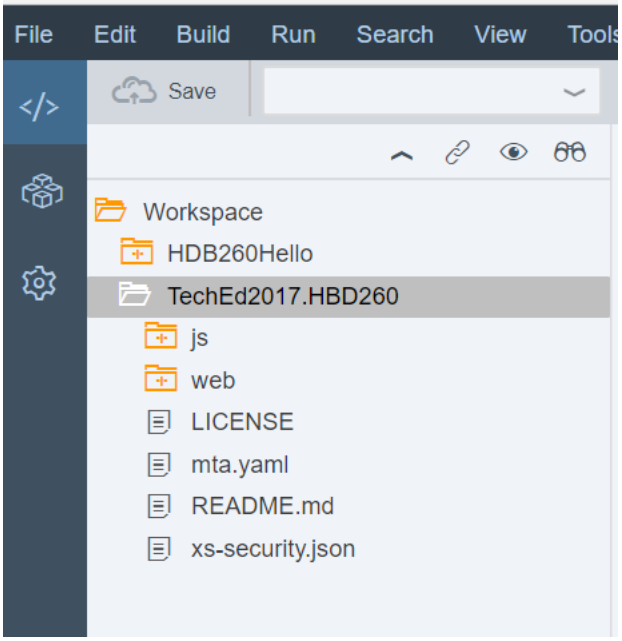
   If you have reached this step you can move ahead to Exercise 2. If you were not able to complete it for whatever reason, please move onto Exercise 1.3.



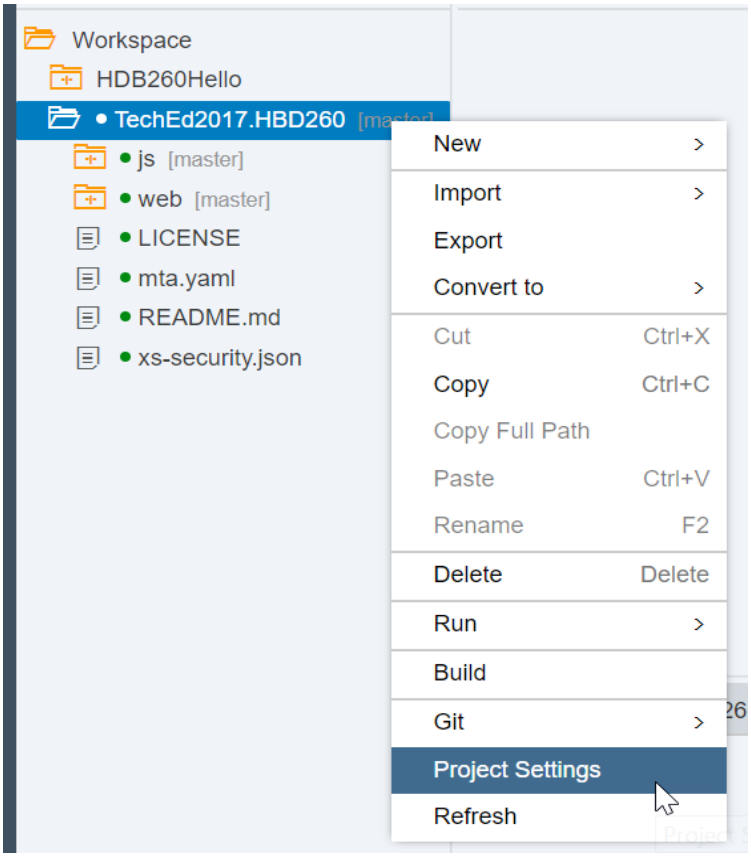
Exercise 1.3: Alternative: Import Project from File System

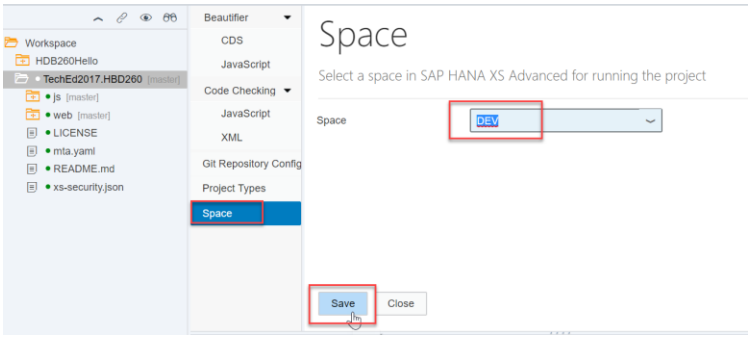
Explanation	Screenshot
1. Download a zip file with the complete project contents from the following location: Z:\HBD260\	
2. Return to the SAP Web IDE for SAP HANA. Right mouse click on the Workspace and choose Import -> From File System.	
3. Click the browse button and from the File Open dialog choose the location where you download the file in step 1 of this exercise. Select the file and click **Open**. Press the OK button to import the template project.	

4. If successful, the TechEd2017.HBD260 project will now appear in your workspace.



5. Right mouse click on your project and choose



6. Choose the Space section and then choose DEV as the Development Space. Press **Save**.	

EXERCISE 2

For this exercise, we will now build the XSJS and XSODATA services used to expose our data model to the user interface. Although XS Advanced runs on Node.js, SAP has added modules to Node.js to provide XSJS and XSODATA backward compatibility. Therefore, you can use the same programming model and much of the same APIs from XS, classic even within this new environment.

Exercise 2.1: XSJS and XSODATA

Explanation	Screenshot

1. In the **js/lib** folder, create a sub-folder called **xsodata**. Create a file named **purchaseOrder.xsodata**. Here is the source code for this file.
 	
Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex2/ex2_1
 	
Here we expose both the Header and Item tables from our HDI container as separate entities and build a navigation association between the two.
 	
Note: If you receive a syntax error on Line 2, you can ignore this. It is a bogus error because our target tables do not use Namespaces.
	service {
	"PurchaseOrder.Header"
	as "POHeader" navigates ("Items" as "POItem");
	
	"PurchaseOrder.Item"
	as "POItem";
	
	association "Items" principal "POHeader"("PURCHASEORDERID")
	multiplicity "1" dependent "POItem"("PURCHASEORDERID") multiplicity "*";
	}

2. In the **lib** folder, create a sub-folder called **xsjs**. Create a file named **hdb.xsjs**. Here is the source code for this file.
 	
Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex2/ex2_2
 	
This logic reads data from our item table and sends it to the frontend as JSON.
	/*eslint no-console: 0, no-unused-vars: 0, dot-notation: 0*/
	"use strict";
	
	var conn = $.hdb.getConnection();
	var query = "SELECT FROM PurchaseOrder.Item { " +
	" POHeader.PURCHASEORDERID as \"PurchaseOrderId\", " +
	" PRODUCT as \"ProductID\", " +
	" GROSSAMOUNT as \"Amount\" " +
	" } ";
	
	var rs = conn.executeQuery(query);
	
	$.response.setBody(JSON.stringify(rs));
	$.response.contentType = "application/json";
	$.response.status = $.net.http.OK;

3. Create a second file named **exercisesMaster.xsjs**. Here is the source code for this file.

   Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex2/ex2_3

   It sends the current user and language back to the client for filling in the header of the UI. This shows how the $ apis still work and have been adapted to the new Node.js environment.

```
/*eslint no-console: 0, no-unused-vars: 0, dot-notation: 0*/
"use strict";

function fillSessionInfo(){
	var body = "";
	body = JSON.stringify({
		"session" : [{"UserName":
$.session.getUsername(), "Language": $.session.language}]
	});
	$.response.contentType = "application/json";
	$.response.setBody(body);
	$.response.status = $.net.http.OK;
}


var aCmd = $.request.parameters.get("cmd");
switch (aCmd) {
case "getSessionInfo":
	fillSessionInfo();
	break;
default:
	$.response.status =
$.net.http.INTERNAL_SERVER_ERROR;
	$.response.setBody("Invalid Request Method");
}
```

4. Create a forth file named **procedures.xsjs**. This example shows you how to call a stored procedure from XSJS.

   Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex2/ex2_4

```
/*eslint no-console: 0, no-unused-vars: 0, dot-notation: 0, no-
use-before-define: 0*/
"use strict";

/**
@function JSON as returned by hdb
*/
function hdbDirectTest(){
  var results = _selection();
//Pass output to response
$.response.status = $.net.http.OK;
$.response.contentType = "application/json";
$.response.setBody(JSON.stringify(results));

}

/**
@function Flattended JSON structure
*/
function hdbFlattenedTest(){
	outputJSON(_selection().EX_TOP_3_EMP_PO_COM
BINED_CNT);
}

/**
@function load/call the procedure
*/
```

```
function _selection(){
	var connection = $.hdb.getConnection();

	var getPOHeaderData = connection.loadProcedure(
		"get_po_header_data");

	var results = getPOHeaderData();
	return results;
}

/**
@function Puts a JSON object into the Response Object
@param {object} jsonOut - JSON Object
*/
function outputJSON(jsonOut){
	var out = [];
	for(var i=0; i<jsonOut.length;i++){
		out.push(jsonOut[i]);
	}
	$.response.status = $.net.http.OK;
	$.response.contentType = "application/json";
	$.response.setBody(JSON.stringify(out));
}


var aCmd = $.request.parameters.get("cmd");
switch (aCmd) {
case "direct":
	hdbDirectTest();
	break;
case "flattened":
	hdbFlattenedTest();
	break;
default:
	hdbDirectTest();
	break;
}
```

5. Create a 5th file called **os.xsjs**. This example shows you how you can call to Node.js from XSJS using the **$.require** API. We will learn more about Node.js modules, like os, in subsequent exercises.

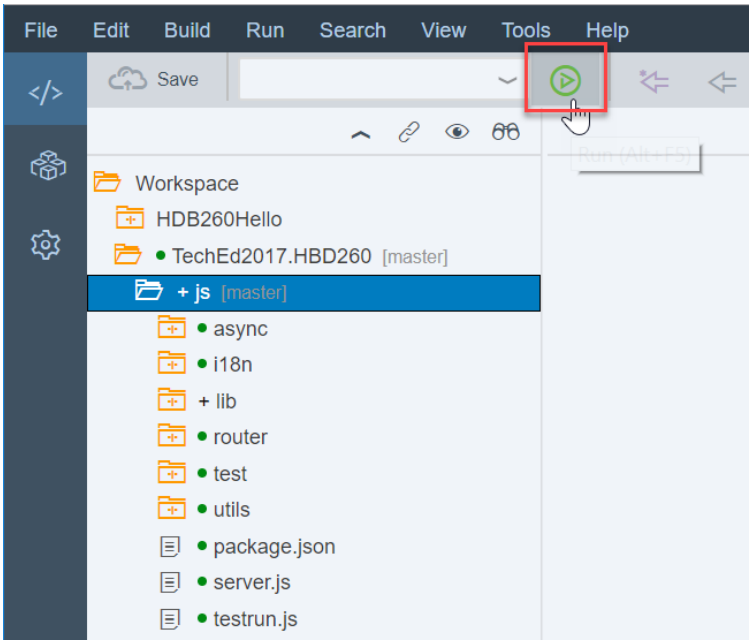
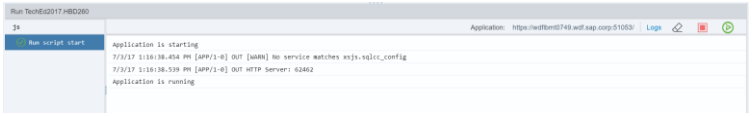
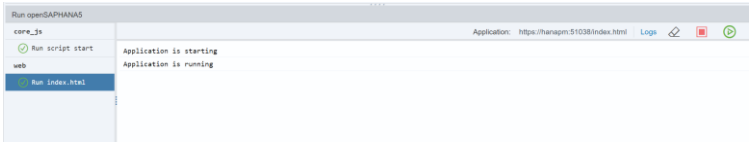
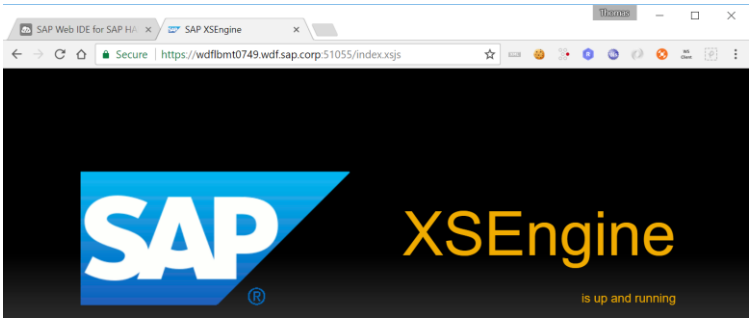
   Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex2/ex2_5

```
/*eslint no-console: 0, no-unused-vars: 0*/
"use strict";

var os = $.require("os");
var output = {};

output.tmpdir = os.tmpdir();
output.endianness = os.endianness();
output.hostname = os.hostname();
output.type = os.type();
output.platform = os.platform();
output.arch = os.arch();
output.release = os.release();
output.uptime = os.uptime();
output.loadavg = os.loadavg();
```

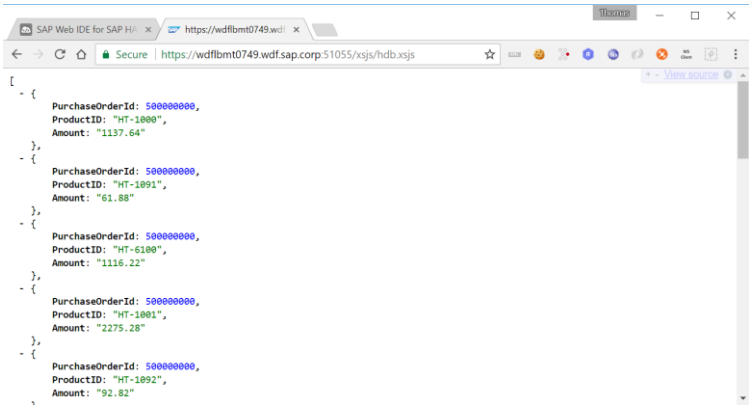
	output.totalmem = os.totalmem();
	output.freemem = os.freemem();
	output.cpus = os.cpus();
	output.networkInfraces = os.networkInterfaces();
	
	$.response.status = $.net.http.OK;
	$.response.contentType = "application/json";
	$.response.setBody(JSON.stringify(output));

6. Create a 6th file called **whoAmI.xsjs**. This example shows how we now use a different user at the DB and XS layers, but also how the XS user (Application User) can be accessed from within the DB by reading the Session Context.
 	
Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex2/ex2_6
	var connection = $.hdb.getConnection();
	
	var query = "SELECT CURRENT_USER FROM \"DUMMY\"";
	var rs = connection.executeQuery(query);
	var currentUser = rs[0].CURRENT_USER;
	
	query = "SELECT
	SESSION_CONTEXT('APPLICATIONUSER')
	\"APPLICATION_USER\" FROM \"DUMMY\"";
	rs = connection.executeQuery(query);
	var applicationUser = rs[0].APPLICATION_USER;
	
	var greeting = "XS Layer Session User: " +
	$.session.getUsername() +
	"</br>Database Current User: " + currentUser +
	"</br> Database Application User: " + applicationUser
	+
	"</br>Welcome to HANA ";
	
	$.response.contentType = "text/html; charset=utf-8";
	$.response.setBody(greeting);

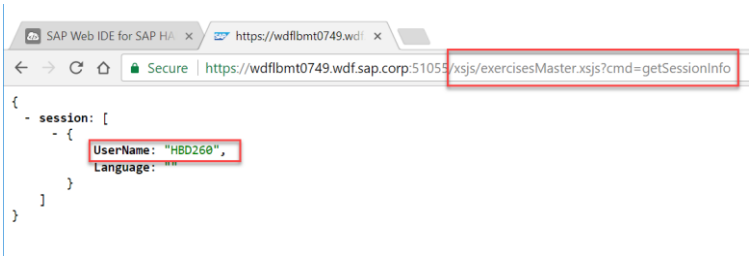
7. Create a 7th file called **whoAmI_SQLCC.xsjs**. This example is very like the previous example but shows how we can still use the concept of SQLCC from XS Classic to force a different Database User. Here we are forcing our database connection to use the SQLCC named SQLCC_CONFIG. We no longer setup the SQLCC_CONFIG as a file, however. It is instead configured in the bootstrap of XSJS startup to point to an XSA User Provided Service for actual connection parameters.
 	
Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex2/ex2_7
	var connection = $.hdb.getConnection({"sqlcc":
	"xsjs.sqlcc_config", "pool": true });
	
	var query = "SELECT CURRENT_USER FROM \"DUMMY\"";
	var rs = connection.executeQuery(query);
	var currentUser = rs[0].CURRENT_USER;
	
	query = "SELECT
	SESSION_CONTEXT('APPLICATIONUSER')
	\"APPLICATION_USER\" FROM \"DUMMY\"";
	rs = connection.executeQuery(query);
	var applicationUser = rs[0].APPLICATION_USER;
	
	var greeting = "XS Layer Session User: " +
	$.session.getUsername() +
	"</br>Database Current User: " + currentUser +
	"</br> Database Application User: " + applicationUser
	+
	"</br>Welcome to HANA ";

	$.response.contentType = "text/html; charset=utf-8"; $.response.setBody(greeting);
8. Save any unsaved/open files. We can now run the **js** module. Like in Exercise 1, the first run of a new module will take a minute or two.	
9. You should see that the build and deploy was successful. The initial build can take a few minutes.	
10. So now run the web module. All our authentication and access will run through this module and act as a reverse proxy to the Node.js module.	
11. A new tab will open and you might be asked for authentication again (HBD260/Welcome17). It will load a small Hello World SAPUI5 page. We can change the url to our xsjs service **/index.xsjs** in the browser. You will see that our xsjs service is accessible via the HTML5 module runtime. The HTML5 module functions as a proxy and performs the routing to the other service internally.	

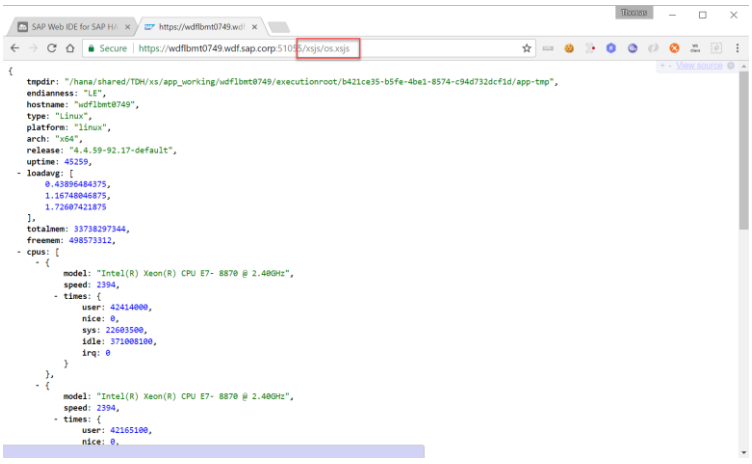
12. **/xsjs/hdb.xsjs** reads data from our Purchase Order table and exports it as a JSON string (formatted on the client side by a browser plug-in).



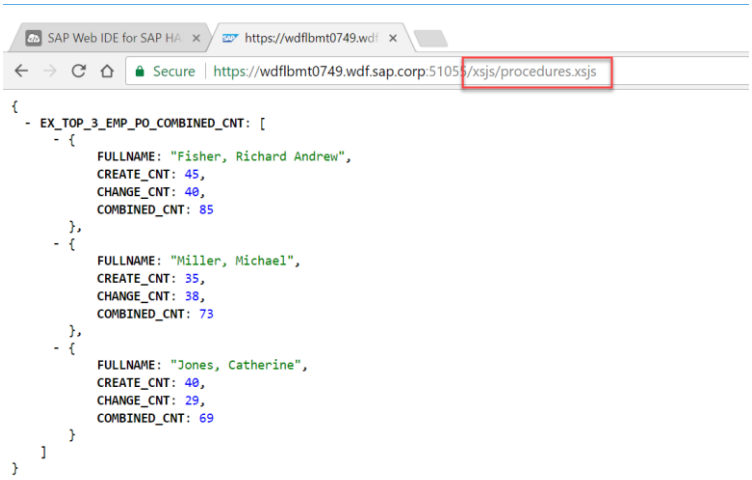
13. **/xsjs/exercisesMaster.xsjs** shows the typical approach to have multiple REST actions in one XSJS. Change the URL to **/xsjs/exercisesMaster.xsjs?cmd=getSessionInfo**. You should see your User Name returned from the XSJS session layer.



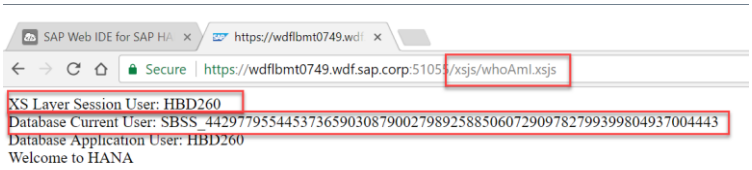
14. **/xsjs/os.xsjs** demonstrates the new **$.require** feature to access Node.js modules.



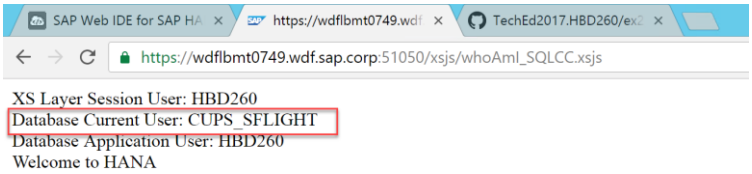
15. **/xsjs/procedures.xsjs** shows the results from calling the stored procedure, **get_po_header_data**.



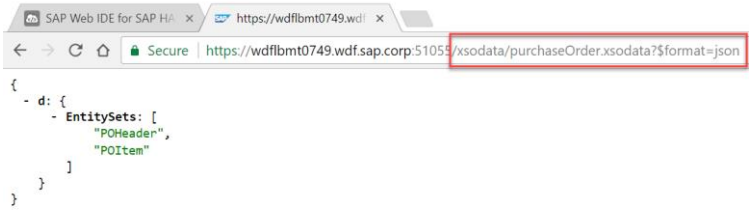
16. **/xsjs/whoAmI.xsjs** demonstrates the separation between application user and database user as well as how the application user can be accessed from both the XSJS and Database layers.



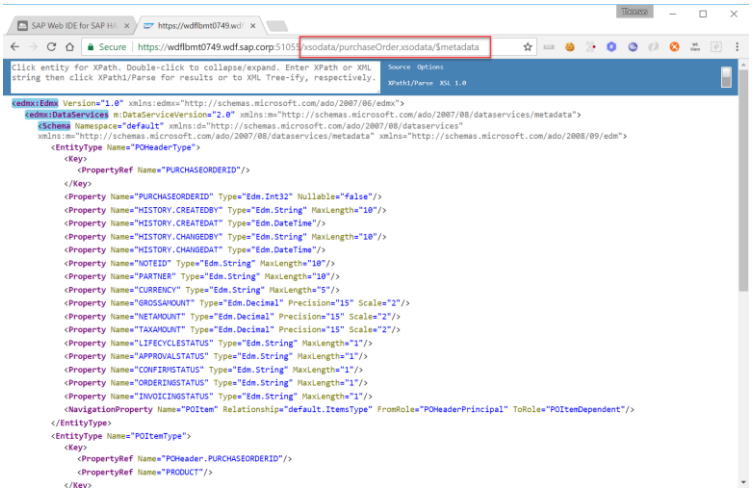
17. And **/xsjs/whoAmI_SQLCC.xsjs** demonstrates how we can use User Provided Service to provide the same functionating as SQLCC and force a particular DB User (CUPS_SFLIGHT).



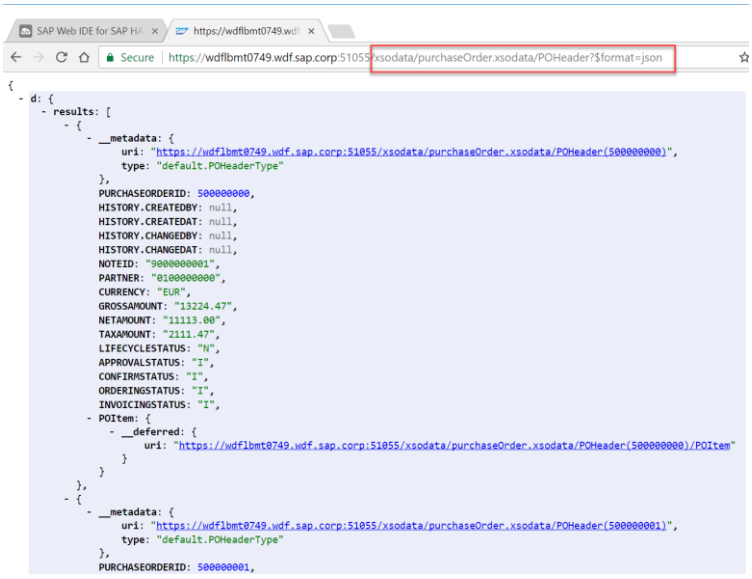
18. **/xsodata/purchaseOrder.xsodata?$format=json** gives you access to a full OData service for the Purchase Order header and item tables we created in the previous exercise.



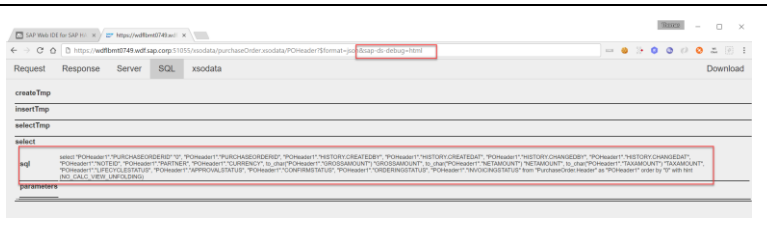
19. We can also see the metadata about the OData interface we created by changing the URL to **/xsodata/purchaseOrder.xsodata/$metadata**



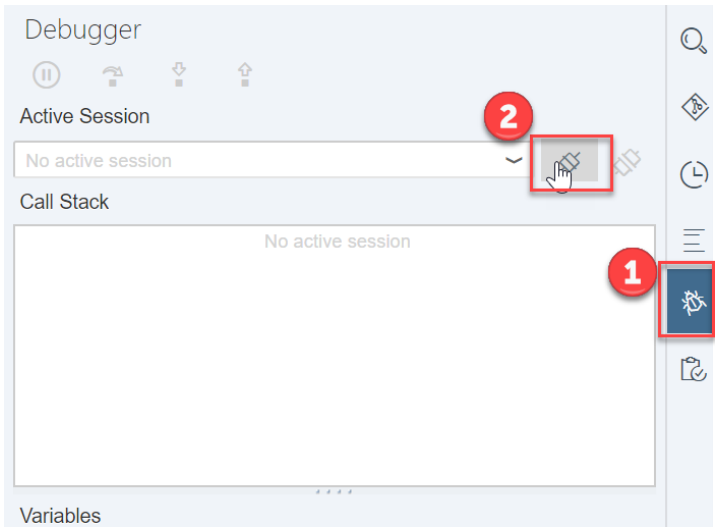
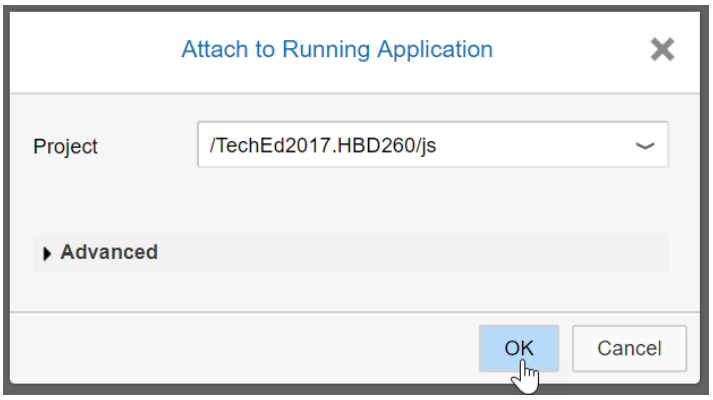
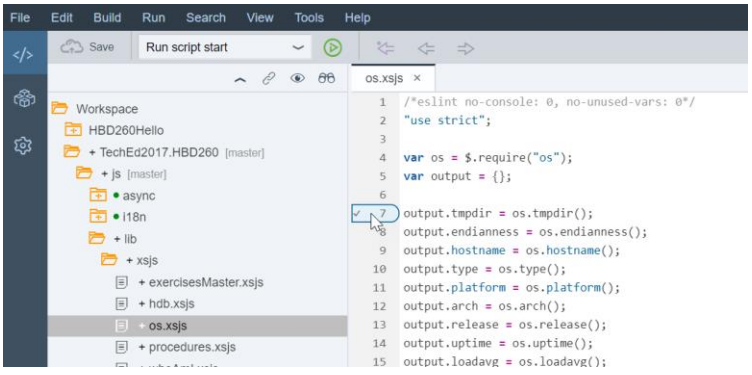
20. Change the URL again to point to the **POHeader** entity and we will see the data details. **/xsodata/purchaseOrder.xsodata/POHeader?$format=json**



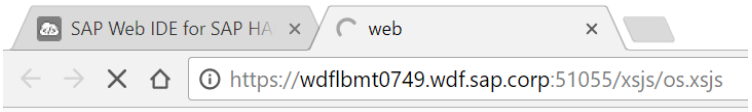
21. Finally, we can debug XSODATA requests if we add the URL parameter **sap-ds-debug** with either the value json or html. We can use this to see internal request, response, processing time, or even the generated SQL statements.



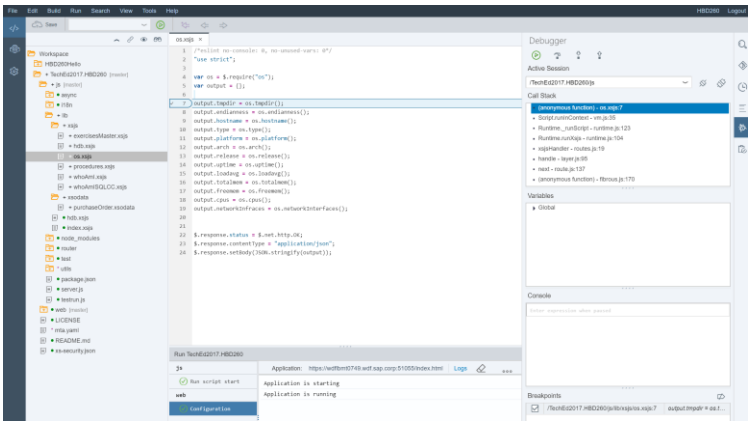
Exercise 2.2: Debugging XSJS or Node.js

Explanation	Screenshot
1. Return to the SAP Web IDE for SAP HANA. Click the debug link in the left side of the SAP Web IDE for SAP HANA. Then click the Attach Debugger button.	
2. Confirm the module you want to debug and then press **OK**.	
3. Click in the left side of the editor of the **os.xsjs** file to set a breakpoint on line 7.	

4. Switch the browser window to the where the web module is running and change the url path to **/xsjs/os.xsjs**

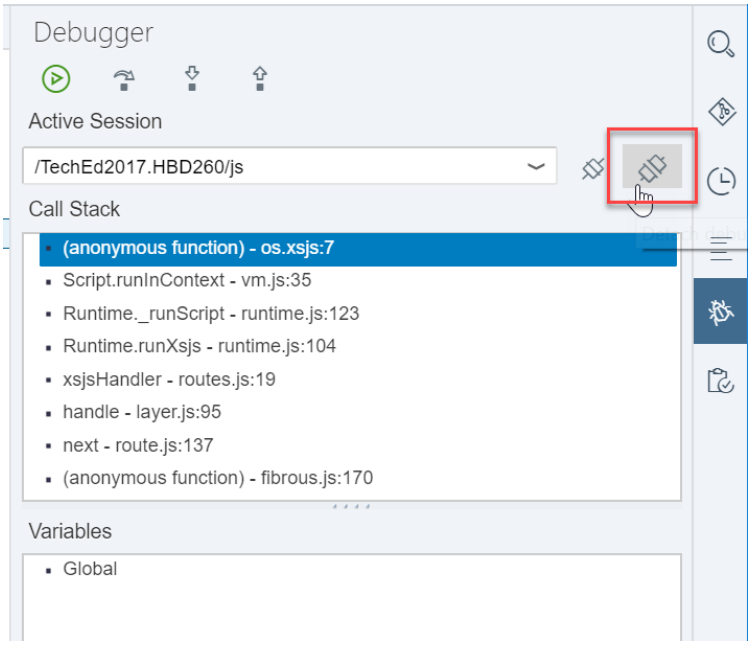


5. Switch back to the Web IDE tab in the browser. The debugger should attach and open in the editor.

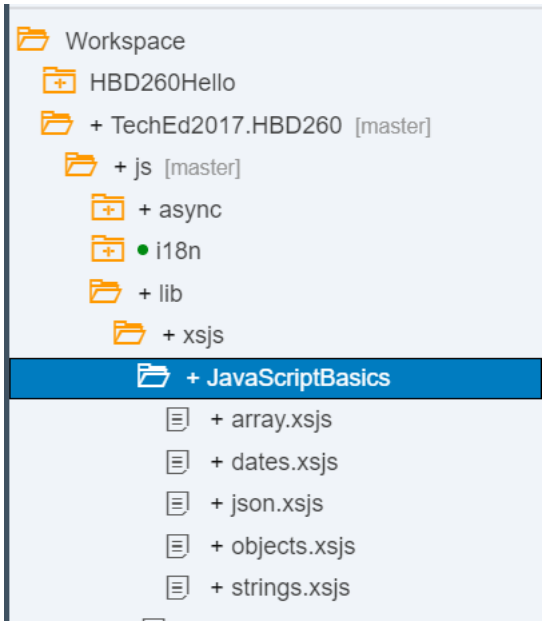
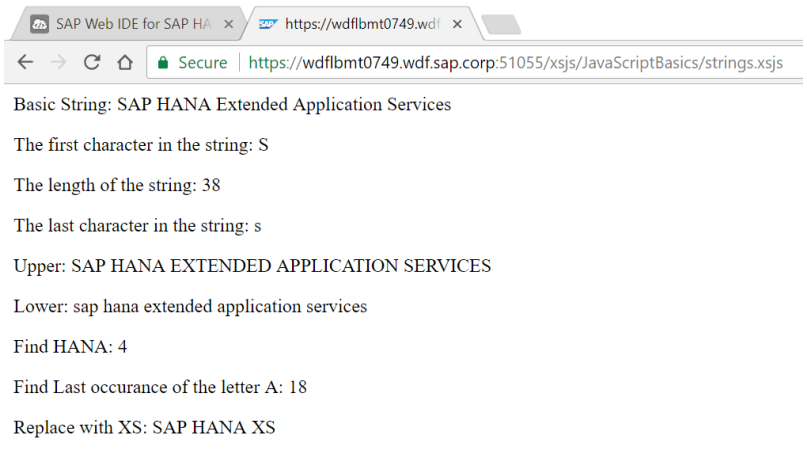


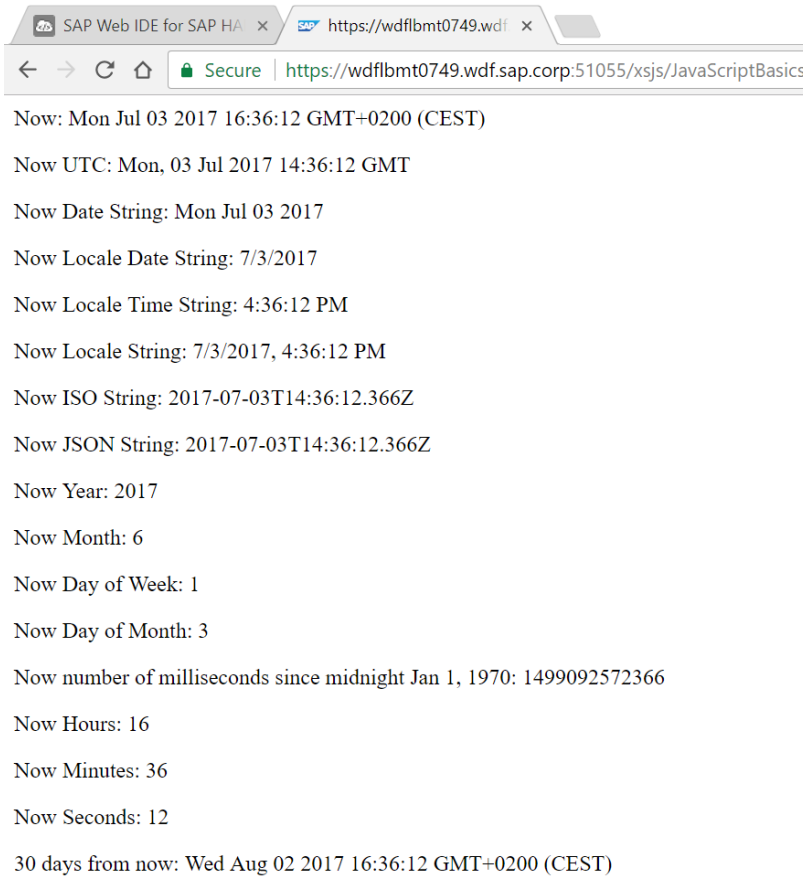
6. You can now spend a moment exploring the debugger. Step over some statements. Try adding the output variable to the Console.

   When you are finished, you can detach the debugger by clicking the Detach debugger button.



Exercise 2.3: Exploring JavaScript Language Features

Explanation	Screenshot
1) This exercise will be a bit different from all others. Instead of following along step-by-step or working toward a very specific final product; this exercise will instead allow you to explore various JavaScript language features. There is no strict right or wrong solution to many of these exercise parts. However, you can view sample solutions from: https://github.com/I809764/TechEd2017.HBD260/tree/solution/js/lib/xsjs/JavaScriptBasics Feel free to create similar xsjs files to explore these language features. However, the main point of this exercise is to focus on general JavaScript language constructs and not anything XSJS or HANA specific.	
2) First we will learn about strings in JavaScript. Create a string with some sample text in it (hint: =). Access the first character of the string. (hint: offsets are zero based and specified via []) Access the last character in the string (hint: slice). Output the length of the string (hint: length). Convert the string to all upper and all lower case (hint: toUpperCase). Find the position of a text part of the string (hint: indexOf). Find the last occurrence of a character in the string. Perform a find and replace operation on the string (hint: lastIndexOf).	

Sample implementation: strings.xsjs	
3) Create a Data object with the current date (hint: new Date()). Convert the data to various other formats (UTC, Local Data, Local Time, ISO, JSON (hint: to*String with various modifies UTC, Date, LocalDate, LocaleTime, etc). Access the sub-parts of the date: Year, Month, Day, Hours, Minutes, and Seconds (hint: get* with modifiers for FullYear, Month, Day, Date, Time, Hours, Minutes, Seconds). Perform math on a date, adding 30 days to the current date (hint: setDate and simple math). Sample implementation: dates.xsjs	

4) Create two arrays: one with the colors Red, Green, and Blue and one with Black, White, Orange, and Purple (hint: [“one”, “two, “three”]).

   Output the first array as a string (hint: toString).

   Access the first element by index (hint: zero based).

   Get the number of elements in the first array (hint: length).

   Get the index of Blue in the first array (hint: indexOf).

   Loop over the first array and output each element (hint: for(var i; i < length; i++).

   Combine the two arrays (hint: concat).

   Reverse Sort and then Sort Ascending (hint: reverse, sort).

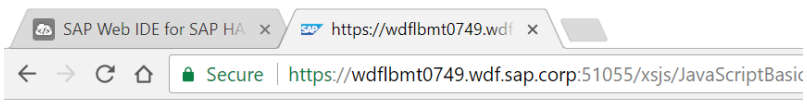
   Remove the last and then first element (hint: pop, shift).

   Slice out the 3rd and 4th element (hint: slice).

   Add two new colors (Malachite and Fallow) at the 3rd position (hint: splice).

   Add Brown to the start of the Array (hint: unshift).

   Sample implementation: array.xsjs



Complete Array: Red,Green,Blue

First Element: Red

Number of Elements: 3

Position of Blue: 2

Loop of Elements: Red Green Blue

Combined Array: Red,Green,Blue,Black,White,Orange,Purple

Reverse Sort: Purple,Orange,White,Black,Blue,Green,Red

Sort Ascending: Black,Blue,Green,Orange,Purple,Red,White

Remove the last element: Black,Blue,Green,Orange,Purple,Red

Remove the last element: Blue,Green,Orange,Purple,Red

Slice out the 3rd and 4th element: Orange,Purple

Add two values at position 3: Blue,Green,Malachite,Fallow,Red

Add element to the beginning of the array: Brown,Blue,Green,Malachite,Fallow,Red

5) Select 10 records from **PO.Header** and convert the results to JSON (hint: $.hdb).

   Loop over the elements in the JSON object and create a new **DISCOUNTAMOUNT** attribute by discounting the **GROSSAMOUNT** by 10% (hint: for (var i; i < length; i++).

   Convert the JSON object to a string and output it to the frontend (hint: JSON.stringify).

   Sample implementation: json.xsjs

6) Create an object literal called colors. Give it three properties – red with the value #FF0000, green with the value #00FF00, and blue with the value #0000FF. Give the object a function named favoriteColor. On Monday, it should return blue, all other days it returns red (hint: var colors = {}).

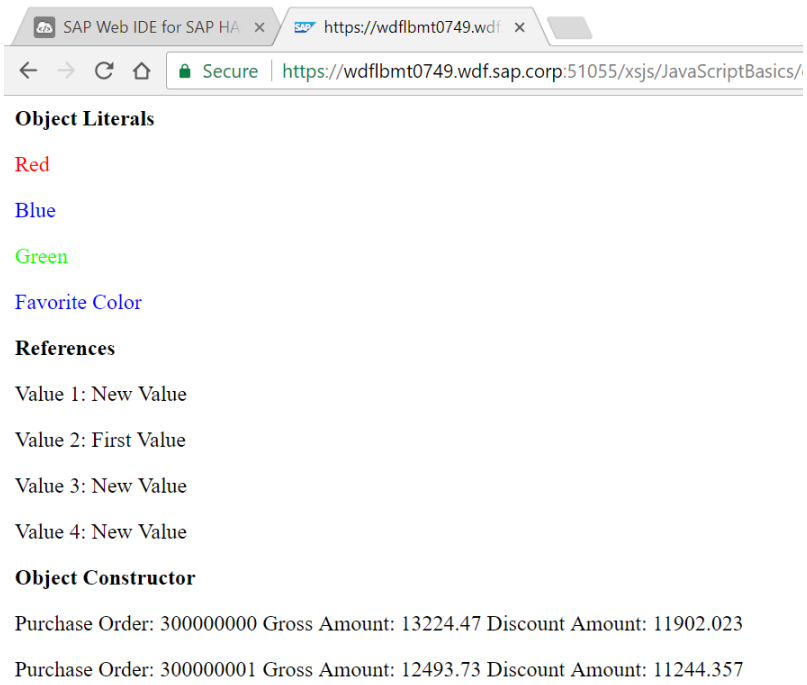
   Access the colors in the object including the Favorite color (hint: object.<variable>).

   Prove that objects are assign by reference and not assign by value (hint: just set a value to a regular variable and an object and see the difference).

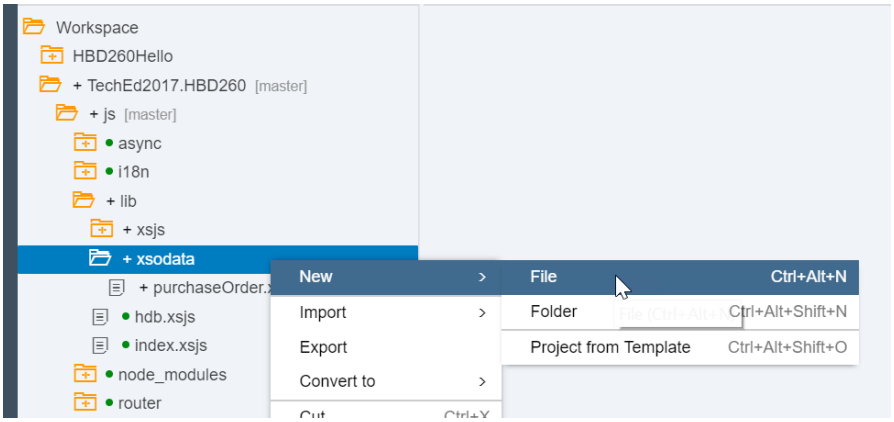
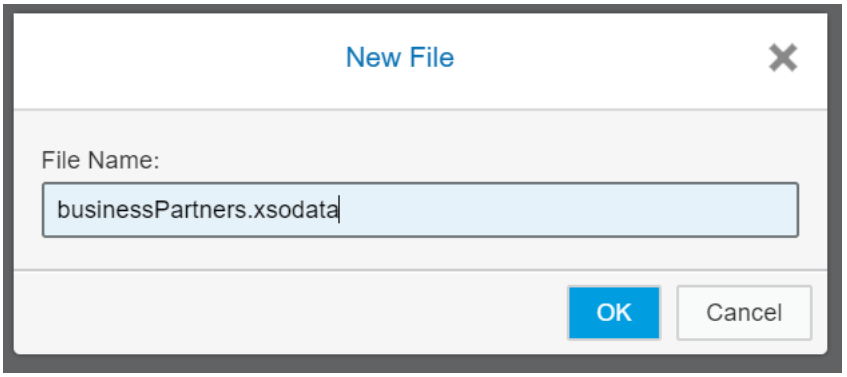
   Create a purchase order object for **PO.Header** which returns PO Id, gross amount, and a calculated discount amount (10% off gross amount) (hint: function with logic from last step – json.xsjs).

   Create two instances of this object – one for PO 300000000 and one for 300000001

   Sample implementation: objects.xsjs

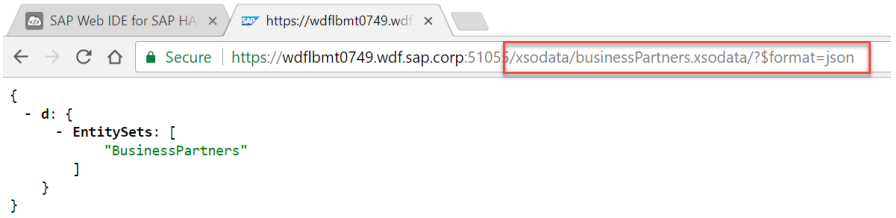


Exercise 2.4: Creating a Simple OData Service

Explanation	Screenshot
1) Right mouse click on the **js/lib/xsodata** folder and choose **New->File**.	
2) Enter the name as **businessPartners.xsodata** and click “OK”.	
3) We want to define an OData service to expose the business partner table. The syntax of the XSODATA service is relative easy for this use case. We need only define the name of the HANA Table we will base the service from (**MD.BusinessPartner**) and the name of the OData entity (**BusinessPartners**).	

4) Save the file. Run the Node.js module. Then return to the running html5 module. Change the url path to **/xsodata/businessPartners.xsodata/?$format=json** to test this new service.

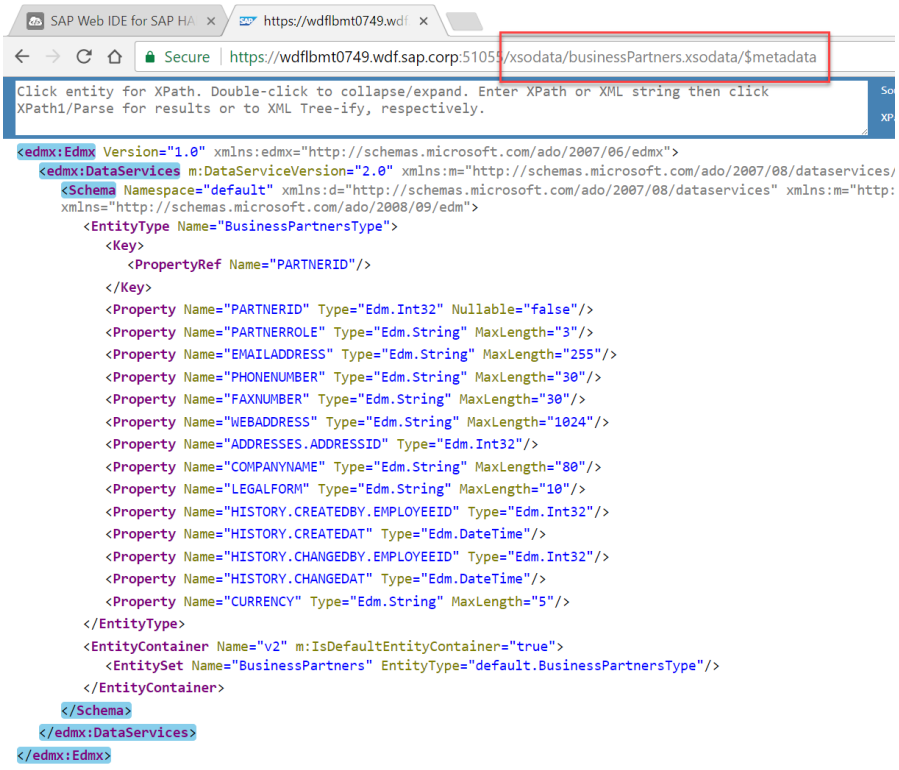
   The resulting document describes the service entities. We only had the one entity named **BusinessPartners**.



5) You can now adjust the URL slightly and add the /$metadata parameter to the end of it.

   For Example: **/xsodata/businessPartners.xsodata/$metadata**

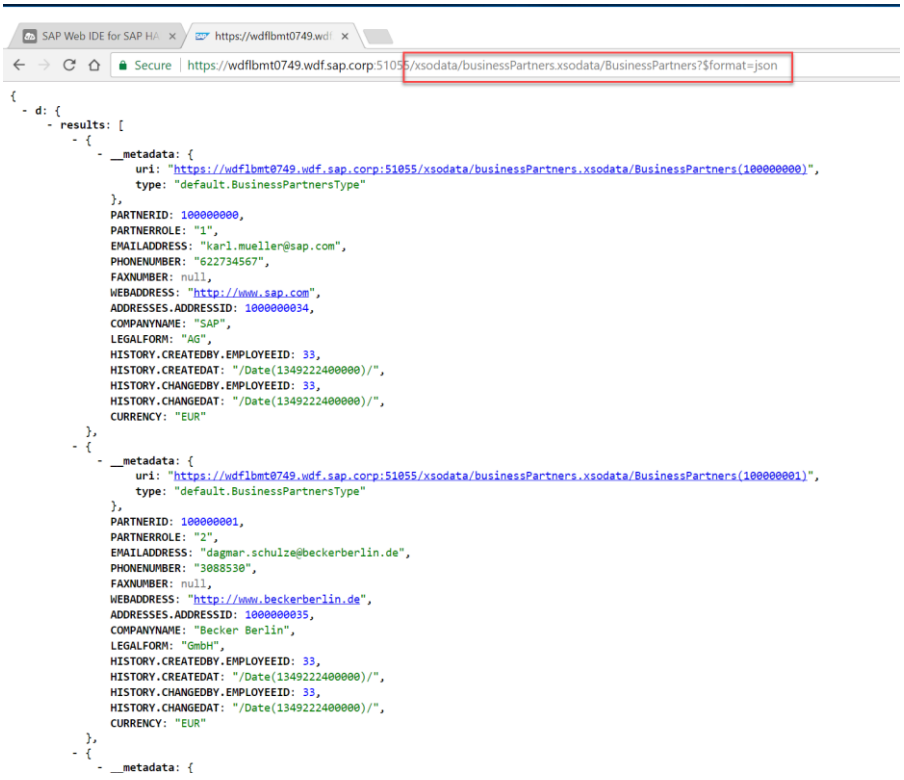
   You can see the field details for all the attributes of the OData service.



6) In order to view the data of the entity, you would append **BusinessPartners** to the end of the URL:

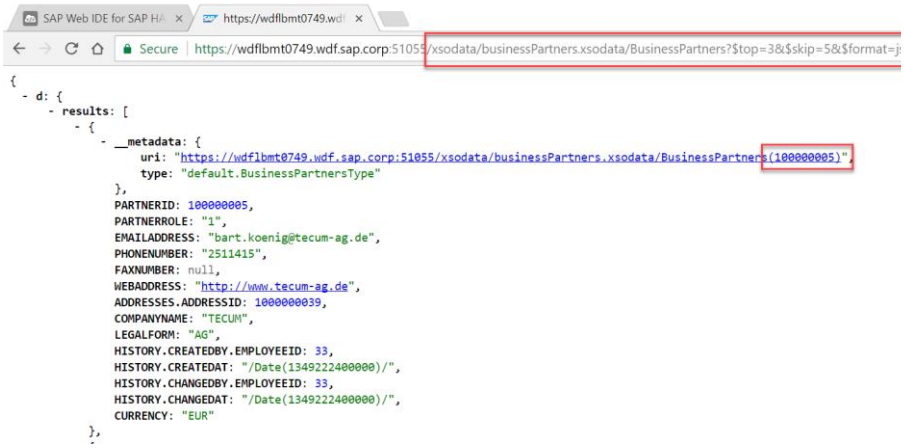
   For Example:
   /xsodata/businessPartners.xsodata/BusinessPartners?$format=json

   You are now able to see the data from the businessPartner table.

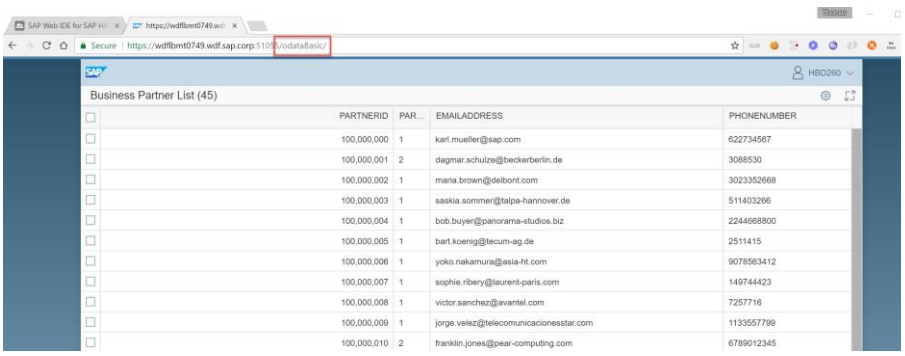


7) You can also experiment with standard OData URL parameters like $top, $skip, or $filter. These options are interpreted and handled by the OData service of XS for you. You get complex service handling without any coding. For example, the following URL would return only three business partner records and would skip the first five records. Such parameters are helpful when implementing server side scrolling, filtering, or sorting in table UI elements.

   For Example:
   /xsodata/businessPartners.xsodata/BusinessPartners?$top=3&$skip=5&$format=json



8) In our web module, we also already have an SAPUI5 application ready to consume and test this OData service. Change the URL to **/odataBasic/** and you should see this same business partner data in a nice table control.

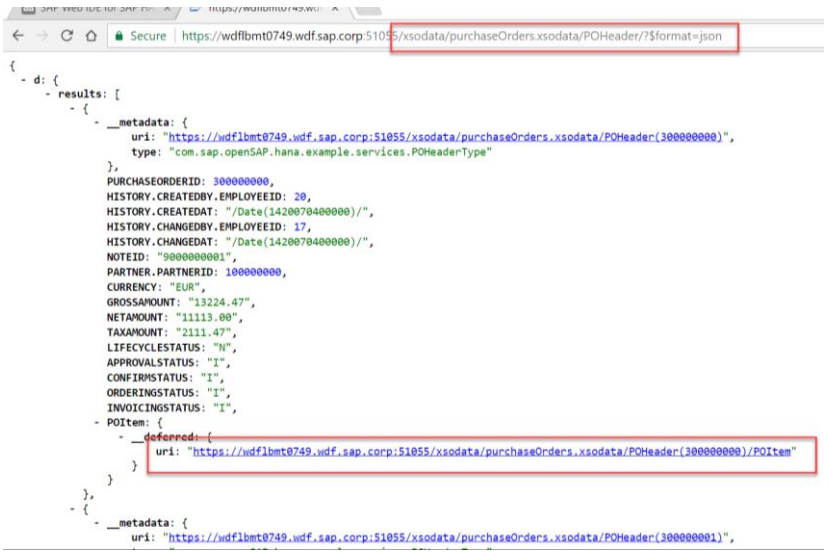


Exercise 2.5: Creating an OData Service with an Entity Relationship

Explanation	Screenshot
1) The previous step of this exercise was very simplistic because it only exposed one database table as a single entity. Often you need to also represent relationships between multiple entities. For example, we might want to build an OData service which has both the Purchase Order Header and Items. For this we would build a one-to-many relationship between the two entities.	
2) Returning to the editor, you should now create a new OData service named **purchaseOrders.xsodata** and extend it to include the **PO.Header** and **PO.Item** tables. Next create a navigation 1:many association. The new content of the definition file should look like this: **Note**: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex2/ex2_8	purchaseOrders.xsodata 1 service namespace "com.sap.openSAP.hana.example.services" { 2 "PO.Header" 3 as "POHeader" navigates ("Items" as "POItem"); 4 5 "PO.Item" 6 as "POItem"; 7 8 association "Items" 9 principal "POHeader"("PURCHASEORDERID") 10 multiplicity "1" 11 dependent "POItem"("HEADER.PURCHASEORDERID") 12 multiplicity "*"; 13 }

3) Save, run and test using the same steps as in the previous section of this exercise.
 	
Notice that the base service definition now has two entities
	SAP Web IDE for SAP HA
	https://wdflbmt0749.wdf
	Secure https://wdflbmt0749.wdf.sap.corp:51055/xsodata/purchaseOrders.xsodata?$format=json
	{
	- d: {
	- EntitySets: [
	"POHeader",
	"POItem"
	]
	}
	}

4) The Header data now has a hyperlink relationship to the item entity

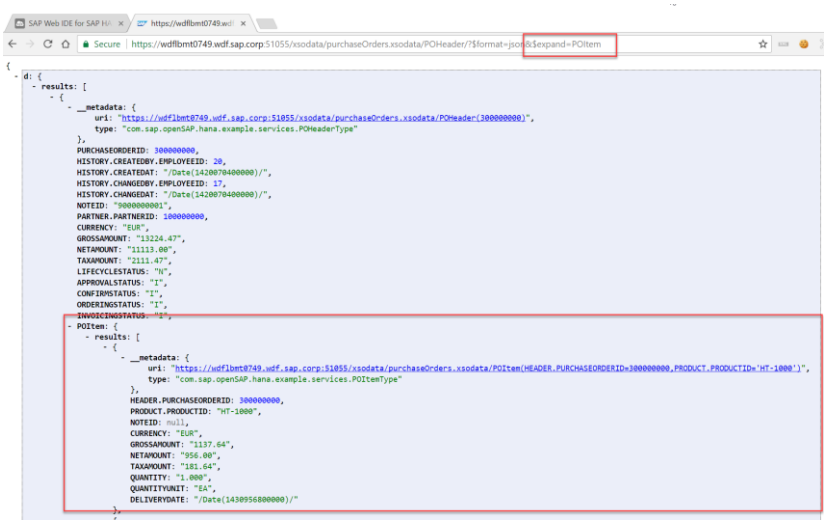


5) Associations can be an excellent way to load child elements on demand; however, there is also an option to expand the children details in place so that all levels can be retrieved with one request.

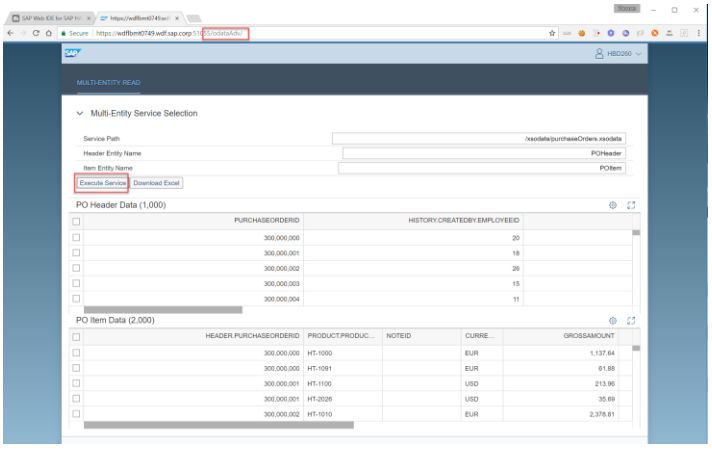
   Test the service again using the same steps as in the previous section of this exercise.

   This time add **&$expand=POItem** to the end of the URL.

   You will then see that all the items are embedded within each header record.



6) In our web module, we also already have an SAPUI5 application ready to consume and test this OData service and show us both entities. Change the URL to **/odataAdv/** and you should see tables with details from both entities in the service.



Exercise 2.6: Creating an OData Service with Create Operation and XSJS Exit

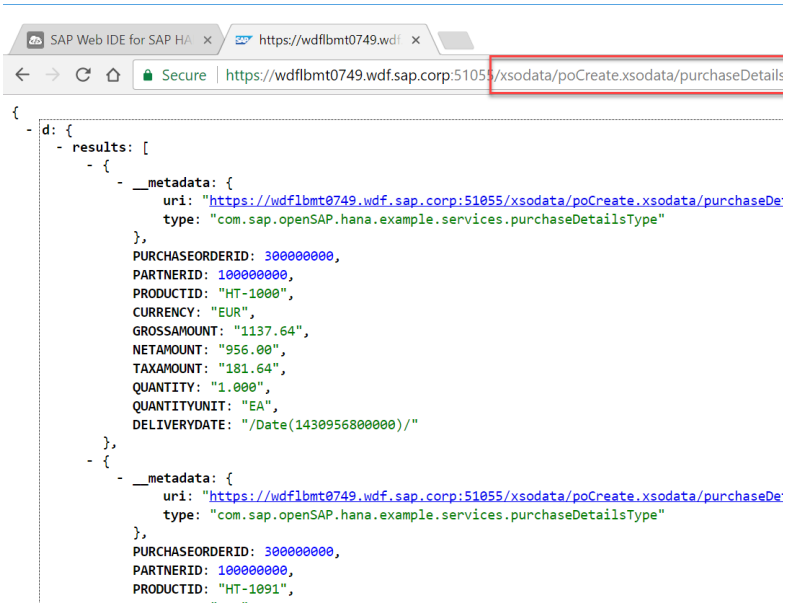
Explanation	Screenshot

1) Odata services aren't limited to read-only operations. They can create, update and delete records as well. We also have exit mechanisms in order to add custom code and validations to these write operations.
 	
Create another OData service named **poCreate.xsodata** for **PO.POView** in the **/js/lib/xsodata folder**.
 	
This time, also link the create operation to the Server Side JavaScript Library (XSJSLIB) **xsjs:poExits.xsjslib** and the function **po_create**. This will be the exit code that performs the insert of the new record. We will also link to **xsjs:poExits.xsjslib** and the function **po_create_before_exit** to validate the incoming data before we pass to the actual insertion function.
 	
Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex2/ex2_9
	service namespace "com.sap.openSAP.hana.example.services"
	{
	"PO.POView" as "purchaseDetails" key ("PURCHASEORDERID")
	create using "xsjs:poExits.xsjslib::po_create"
	events(before "xsjs:poExits.xsjslib::po_create_before_exit");
	}

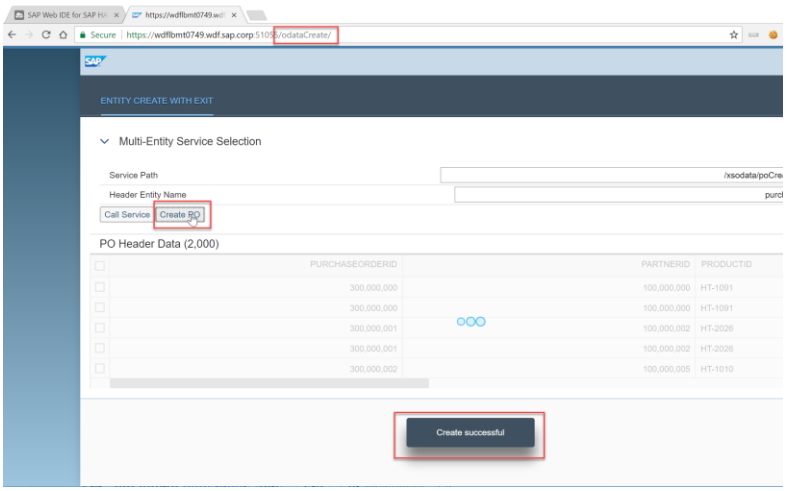
2) In the **js/lib/xsjs** folder create the file **poExits.xsjslib**. Here is the code for this file.
 	
Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex2/ex2_10
	function po_create_before_exit(param) {
	$.trace.error("Start of Exit");
	var after = param.afterTableName;
	var pStmt = null;
	var poid = "";
	
	try {
	pStmt = param.connection .prepareStatement("select \"purchaseOrderSeqId\".NEXTVAL from \"DUMMY\"");
	var rs = pStmt.executeQuery();
	while (rs.next()) {
	poid = rs.getInteger(1);
	}
	$.trace.error(poid);
	pStmt.close();

```
        pStmt = param.connection.prepareStatement("update\"" +
after + "\"set PURCHASEORDERID = ?");
        pStmt.setInteger(1, poid);
        pStmt.execute();
        pStmt.close();
    } catch (e) {
            $.trace.error(e.message);
        pStmt.close();
    }

}

function po_create(param){
            $.trace.error("Insert");
}
```

3) Save and run the js and then the web module. Change the URL to **/xsodata/poCreate.xsodata/purchaseDetails/?$format=json**



4) In our web module, we also already have an SAPUI5 application ready to consume and test this OData service which is especially useful to test Create or Update operations which are difficult to simulate from a browser alone. Change the URL to **/odataCreate/** and you hit the create button to invoke the validation and create exits in the XSODATA service.



EXERCISE 3

Objective

In exercise 2 we worked in a Node.js module, but didn't do much Node.js specific programming. We only were using Node.js to run XSJS and XSODATA services. The support for XSJS and XSODATA is an important feature for XS Advanced. It not only allows backward compatible support for much of your existing development; but it provides a simplified programming model as an alternative to the non-block I/O event driven programming model normally used by Node.js.

But we certainly aren't limited to only the functionality provided by XSJS and XSODATA. We have access to the full programming model of Node.js as well. In this exercise, we will learn how to extend our existing Node.js module in the SAP Web IDE for SAP HANA.

You will learn about how to create and use reusable code in the form of node.js modules. You will use packages.json to define dependencies to these modules which make the installation of them quite easy. You will use one of the most popular modules – **express**; which helps with the setup the handling of the request and response object. You will use **express** to handle multiple HTTP handlers in the same service by using routes.

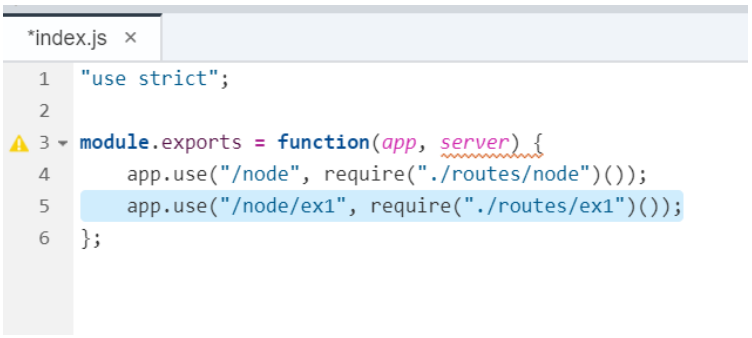
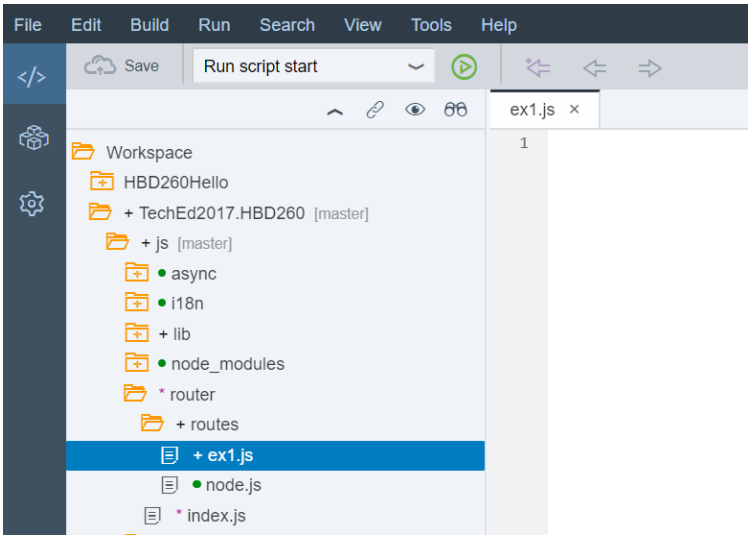
You will learn about the fundamentals of the asynchronous nature of nodel.js. We will so see how this asynchronous capability allows for non-blocking input and output. This technique is one of the basic things that makes Node.js development different from other JavaScript development and creates one of the reasons for its growing popularity. We will see how these techniques are applied to common operations like HTTP web service calls or even SAP HANA database access. We will also see how to create language translatable text strings and HANA database queries from Node.js.

Our final part of this exercise will demonstrate the ease at which you can tap into the powerful web sockets capabilities of Node.js. We will use web sockets to build a simple chat application. Any message sent from the SAPUI5 client side application will be propagated by the server to all listening clients.

Exercise Description

- Modules
- Express Module and package.json
- Local Modules
- SAP HANA database access from node.js
- Basic asynchronous processing
- Non-blocking I/O
- Non-blocking HTTP requests
- Non-blocking database requests
- JavaScript basics
- Text bundles
- Web Sockets chat application

Exercise 3.1: Modules and Express

Explanation	Screenshot
1. We want to create a good Node.js project structure that can accommodate many different Express route requests. To follow some Express best practices, we created a folder in **js** called **router** with an **index.js** file in it within the template project you cloned in Exercise 2. This is the root route handler. Add a second route for the path /node/ex1 to this file. The handler for this route will be called ex1.	
2. Notice that in the previous additions we added a reference to a module called **./routes/ex1**. This is a Node.js module which will be local to our project. Modules don't all have to come from central repositories. They can also be a way of modularizing your own code (like XSJSLIB files). That is exactly what we will do here. Rather than filling up our server.js with application specific logic, we will break that out into its own Node.js module named **ex1.js**.	
3. Inside the folder **js/router/routes** create a file called **ex1.js**.	

4. Add the following code to your ex1.js file. This will add a simple GET handler that returns a “Hello World” message when requested.

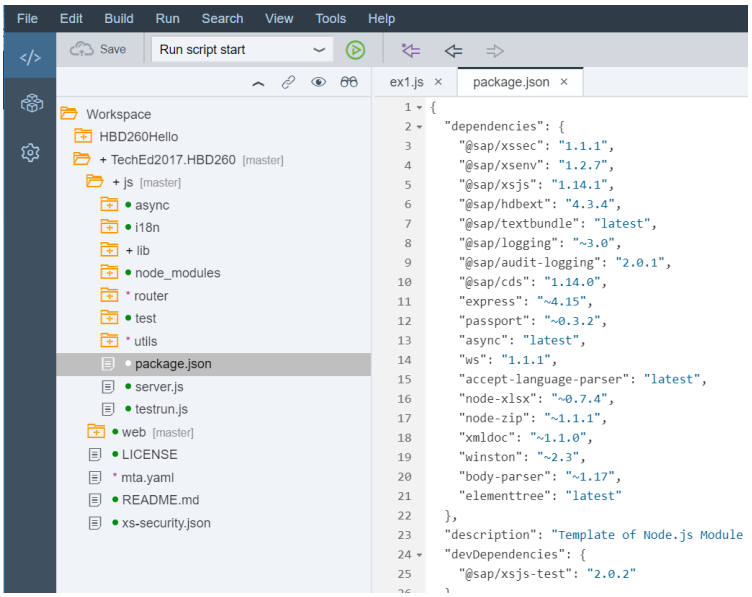
   Notice express in this module has a root route handler. But this will relatively to where it is attached in router/index.js. Therefore, this logic will still respond relative to the /node route handler base we specified earlier.

   Note: if you don’t want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex3/ex3_1

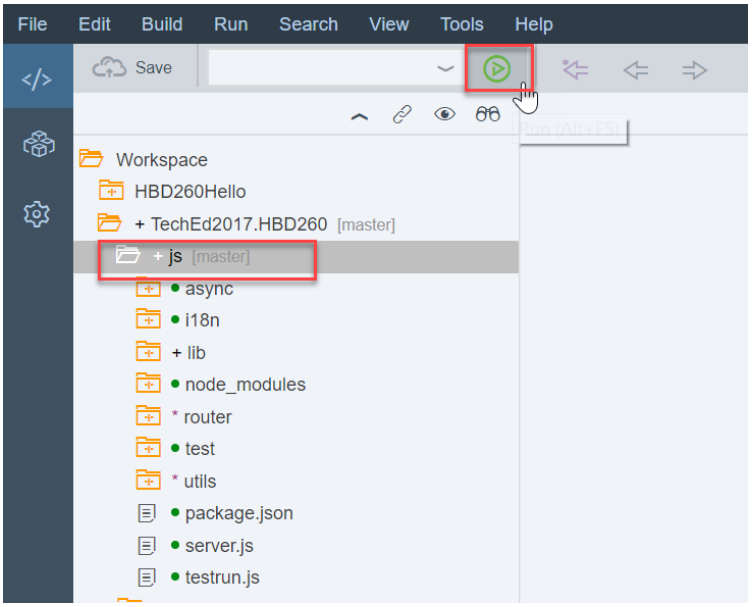
```
/*eslint no-console: 0, no-unused-vars: 0, no-shadow: 0, new-cap: 0*/
"use strict";
var express = require("express");

module.exports = function() {
	var app = express.Router();

	//Hello Router
	app.get("/", function(req, res) {
		res.send("Hello World Node.js");
	});
	return app;
};
```

5. Look at the **js/package.json** file in the editor. You will see the dependencies section which lists all required libraries and their versions.

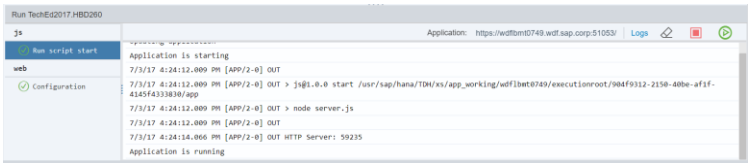
   We manually added the express Node.js module to our project, so we also need to extend the dependencies section here. The skeleton project we cloned/imported in Exercise 1 already had all necessary dependencies, but we want everyone to be aware of how the system knows to pull in these external and open source modules.



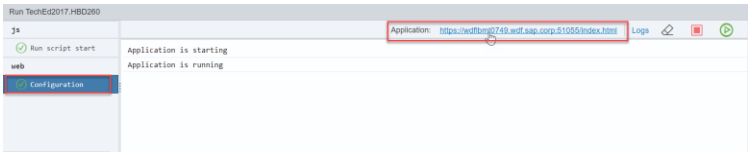
6. We can now run the **js** module.



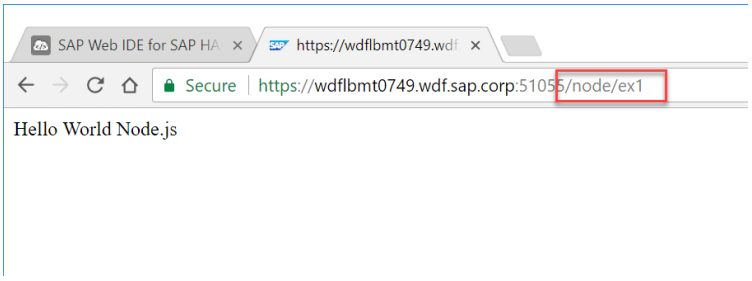
7. You should see that the application was updated successfully is running again.



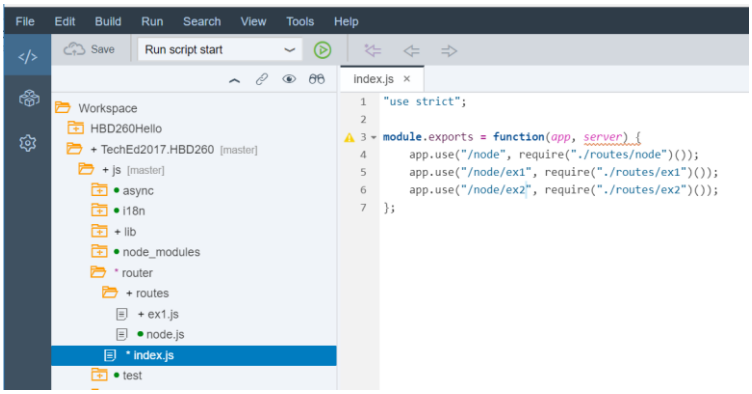
8. If you closed the tab in the browser for the web module, you can reopen from the link in the run console.



9. Now change the path in the browser to **/node/ex1**. You should see Hello World Node.js this is being returned from the new route handler and Node.js module we just implemented in this exercise.



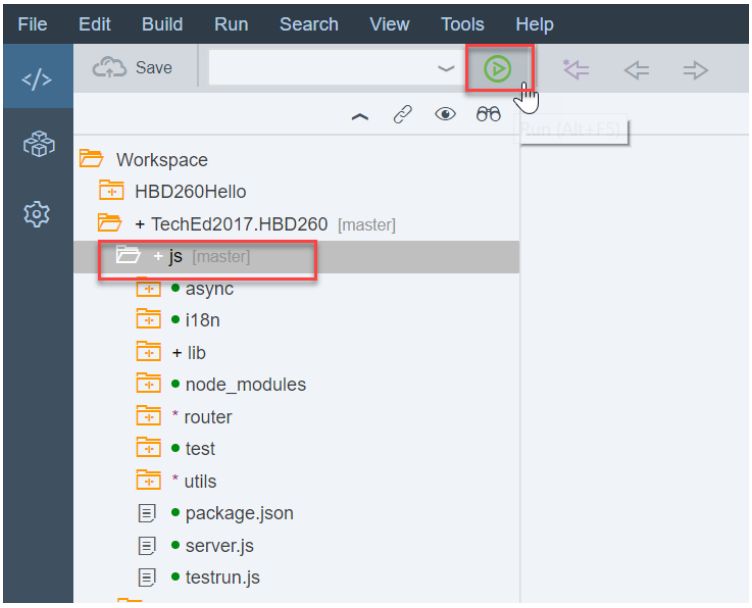
Exercise 3.2: HANA Database Access from Node.js

Explanation	Screenshot
1. In this exercise, we will look at how to use the HANA database access library to send queries to the database. Return to the **js** module and using what you learned in the previous 5.1 exercise create a new route called **ex2**. Let's extend the logic here with a URL handler for **/node/ex2** which will issue a database SELECT statement against the DUMMY table and return the current database user.	

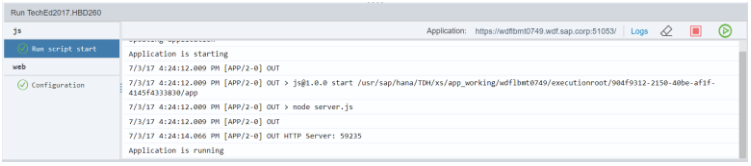
2. Now add a new route handler for **/ex2** in the file **ex2.js** that gets the database connection/client from the express request object (req.db). Then create a prepared statement for the SELECT of SESSION_USER from dummy. Execute the statement and send the results as JSON in the response object.
 	
Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex3/ex3_2
	/*eslint no-console: 0, no-unused-vars: 0, no-shadow: 0, new-cap: 0*/
	"use strict";
	var express = require("express");
	
	module.exports = function() {
	var app = express.Router();
	
	//Simple Database Select - In-line Callbacks
	app.get("/", function(req, res) {
	var client = req.db;
	client.prepare(
	"select SESSION_USER from \"DUMMY\" ",
	function(err, statement) {
	if (err) {
	
	res.type("text/plain").status(500).send("ERROR: " + err.toString());
	return;
	}
	statement.exec([],
	function(err, results) {
	if (err) {
	
	res.type("text/plain").status(500).send("ERROR: " + err.toString());
	return;
	} else {
	var result = JSON.stringify({
	
	Objects: results
	});

```
        res.type("application/json").status(200).send(result);
                                                    }
                                                });
                                    });
        });

        return app;
};
```

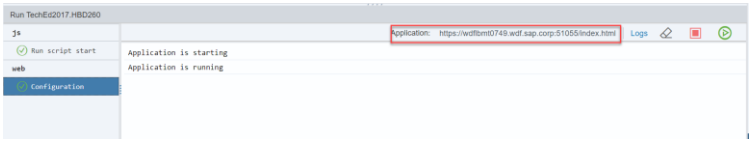
3. We can now run the **js** module.



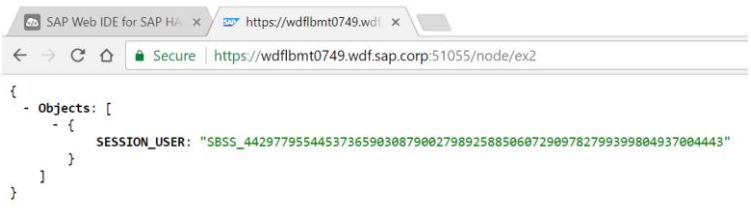
4. You should see that the application was updated successfully is running again.



5. Click on the web folder and the run window should change to the details of the running HTML5 module. Since its already running and we didn't make any changes to it, you can just click on the Application link in the top right corner of the window to reopen it in your web browser if you closed it from the previous step.



6. Now change the path in the browser to **/node/ex2**. You should see the output of your successful SELECT statement.



7. You might have noticed that the default Node.js programming approach is to use callbacks/event handlers for each operation. This is because even the different parts of a database request (connection, prepared statement, execution, etc) are all non-blocking operations.

   While this provides considerable parallelization and performance opportunities; it can also make the code more difficult to read. As the next part of this exercise you can return to **ex2.js** and add a second route handler, **/waterfall,** that performs the same select but uses the **async** module.

   This module doesn't change the runtime aspects of the code, but organizes the callback functions in an easier to read array instead of in-lining them within each other.

   Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex3/ex3_3

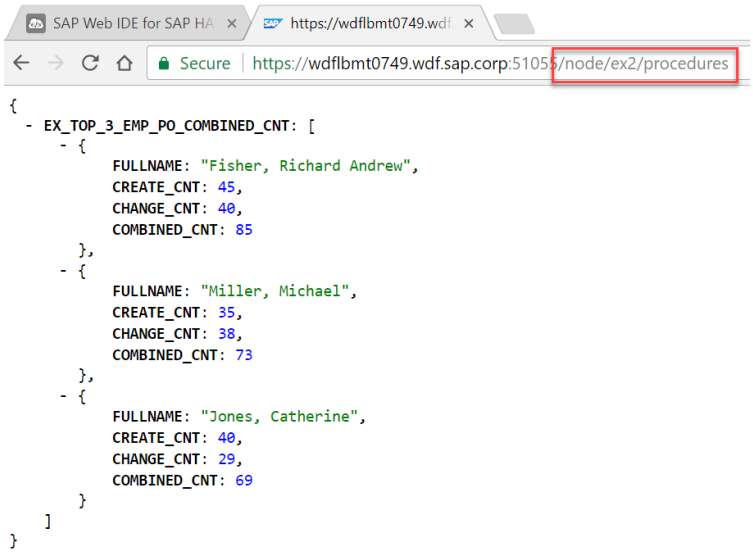
   Then run the **js** module and test again at **/node/ex2/waterfall**

```
var async = require("async");
	//Simple Database Select - Async Waterfall
	app.get("/waterfall", function(req, res) {
		var client = req.db;
		async.waterfall([

			function prepare(callback) {
				client.prepare("select
SESSION_USER from \"DUMMY\" ",
					function(err,
statement) {
						callback(null,
err, statement);
					});
			},

			function execute(err, statement,
callback) {
				statement.exec([],
function(execErr, results) {
					callback(null, execErr,
results);
				});
			},
			function response(err, results,
callback) {
				if (err) {

	res.type("text/plain").status(500).send("ERROR: " +
err.toString());
					return;
				} else {
					var result =
JSON.stringify({
						Objects:
results
					});

	res.type("application/json").status(200).send(result);
				}
				callback();
			}
		]);
```

	});

8. Next we want to see how to call Stored Procedures from Node.js. The logic needed is different from selects as you call the **loadProcedure** function and then pass a specific interface structure to call the procedure.
 	
As the next part of this exercise you can return to **ex2.js** and add a third route handler, **/procedures,** that performs calls the stored procedure, **get_po_header_data**.
 	
Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex3/ex3_4
	//Simple Database Call Stored Procedure
	app.get("/procedures", function(req, res) {
	var client = req.db;
	var hdbext = require("@sap/hdbext");
	//(client, Schema, Procedure, callback)
	hdbext.loadProcedure(client, null, "get_po_header_data", function(err, sp) {
	if (err) {
	res.type("text/plain").status(500).send("ERROR: " + err.toString());
	return;
	}
	//(Input Parameters, callback(errors, Output Scalar Parameters, [Output Table Parameters])
	sp({}, function(err, parameters, results) {
	if (err) {
	res.type("text/plain").status(500).send("ERROR: " + err.toString());
	}
	var result = JSON.stringify({
	EX_TOP_3_EMP_PO_COMBINED_CNT: results
	});
	res.type("application/json").status(200).send(result);
	});
	});
	});

9. Then run the **js** module and test again at **/node/ex2/procedures**



10. Let's add another path that calls a stored procedure but this time we have input parameters on the procedure.

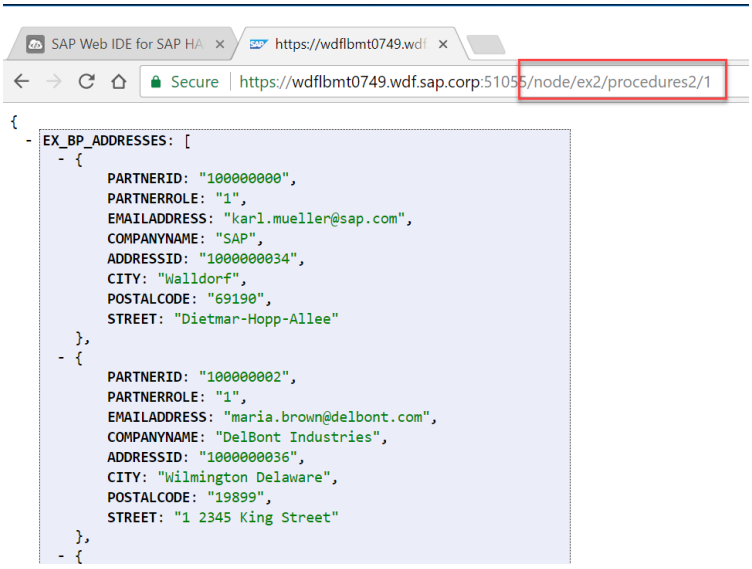
    As the next part of this exercise you can return to **ex2.js** and add a fourth route handler, **/procedures2,** that calls the stored procedure, **get_bp_addresses_by_role**. Notice how we add :partnerRole? To the express route definition to process this as a URL parameter.

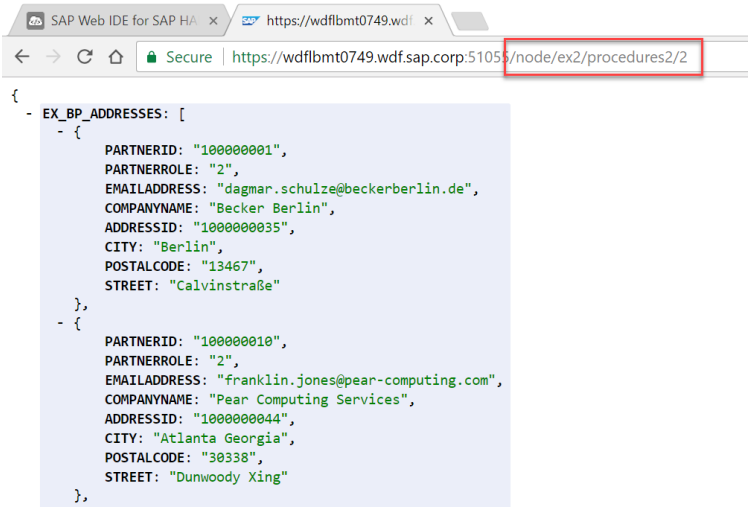
    Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex3/ex3_5

```
        //Database Call Stored Procedure With Inputs
        app.get("/procedures2/:partnerRole?", function(req,
res) {
                var client = req.db;
                var hdbext = require("@sap/hdbext");
                var partnerRole = req.params.partnerRole;
                var inputParams = "";
                if (typeof partnerRole === "undefined" ||
partnerRole === null) {
                        inputParams = {};
                } else {
                        inputParams = {
                                IM_PARTNERROLE:
partnerRole
                        };
                }
                //(cleint, Schema, Procedure, callback)
                hdbext.loadProcedure(client, null,
"get_bp_addresses_by_role", function(err, sp) {
                        if (err) {

        res.type("text/plain").status(500).send("ERROR: " +
err.toString());
                                return;
                        }
                        //(Input Parameters, callback(errors,
Output Scalar Parameters, [Output Table Parameters])
                        sp(inputParams, function(err,
parameters, results) {
                                if (err) {
```

```
        res.type("text/plain").status(500).send("ERROR: " +
err.toString());
                                }
                                var result = JSON.stringify({

        EX_BP_ADDRESSES: results
                                });

        res.type("application/json").status(200).send(result);
                        });
                });
        });
```

11. Then run the **js** module and test again at **/node/ex2/procedures2/1** and **/node/ex2/procedures2/2** to test both partner types – 1=customers and 2=suppliers





12. But we can also take advantage of the parallelization capabilities of Node.js and call two stored procedures in parallel with two separate requests to the database.

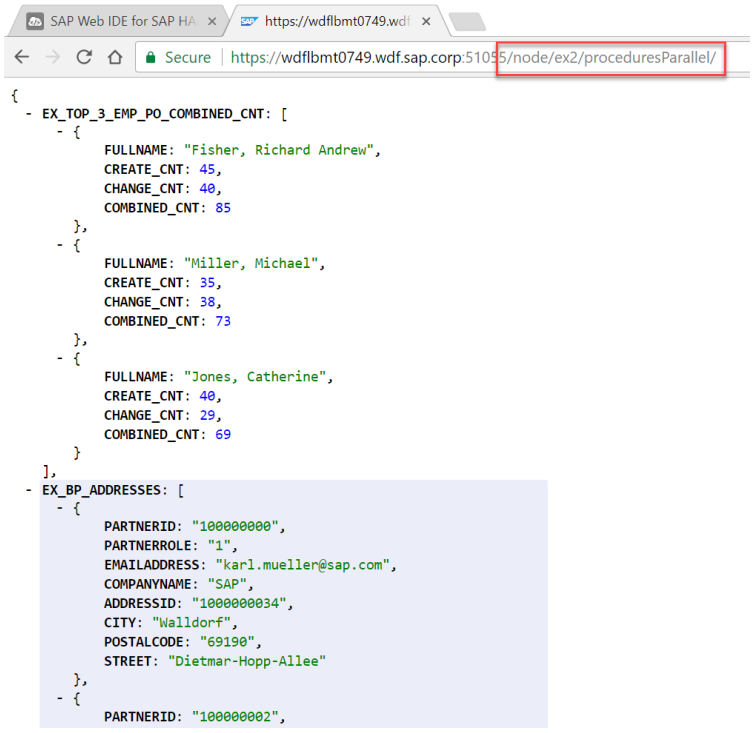
    As the next part of this exercise you can return to **ex2.js** and add a fifth route handler, **/proceduresParallel,** that calls both two previous stored procedures in parallel requests.

    Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex3/ex3_6

```
//Call 2 Database Stored Procedures in Parallel
app.get("/proceduresParallel/", function(req, res) {
	var client = req.db;
	var hdbext = require("@sap/hdbext");
	var inputParams = {
		IM_PARTNERROLE: "1"
	};
	var result = {};
	async.parallel([

		function(cb) {
			hdbext.loadProcedure(client, null, "get_po_header_data", function(err, sp) {
				if (err) {
					cb(err);
					return;
				}
				//(Input Parameters, callback(errors, Output Scalar Parameters, [Output Table Parameters])
				sp(inputParams, function(err, parameters, results) {

	result.EX_TOP_3_EMP_PO_COMBINED_CNT = results;
					cb();
				});
			});

		},
		function(cb) {
			//(client, Schema, Procedure, callback)
			hdbext.loadProcedure(client, null, "get_bp_addresses_by_role", function(err, sp) {
				if (err) {
					cb(err);
					return;
				}
				//(Input Parameters, callback(errors, Output Scalar Parameters, [Output Table Parameters])
				sp(inputParams, function(err, parameters, results) {

	result.EX_BP_ADDRESSES = results;
					cb();
				});
			});
		}
	], function(err) {
		if (err) {
```

```
        res.type("text/plain").status(500).send("ERROR: " +
err);
                } else {

        res.type("application/json").status(200).send(JSON.stri
ngify(result));
                }

            });

        });
```

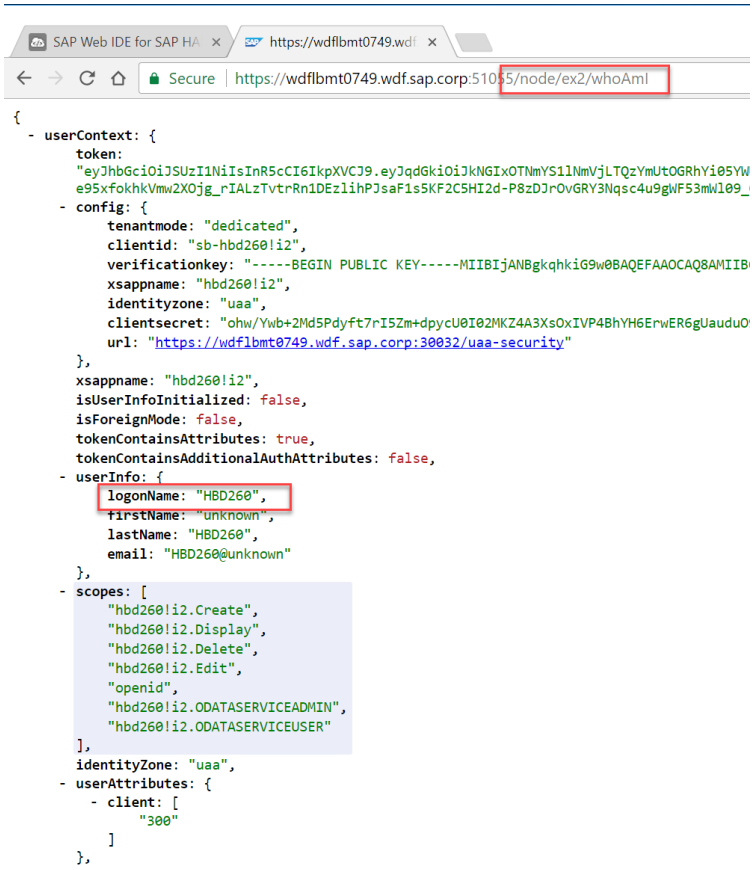
13. Then run the **js** module and test again at **/node/ex2/proceduresParallel**



14. Now let's recreate a few of the XSJS samples from Exercise 2.1. We will begin with the **whoAmI** exercise. In 2.1 we used the **$.session** to get the current user. However, in pure Node.js we don't have the $ APIs. Instead we can read the same information, and more, from the request **authInfo** object.

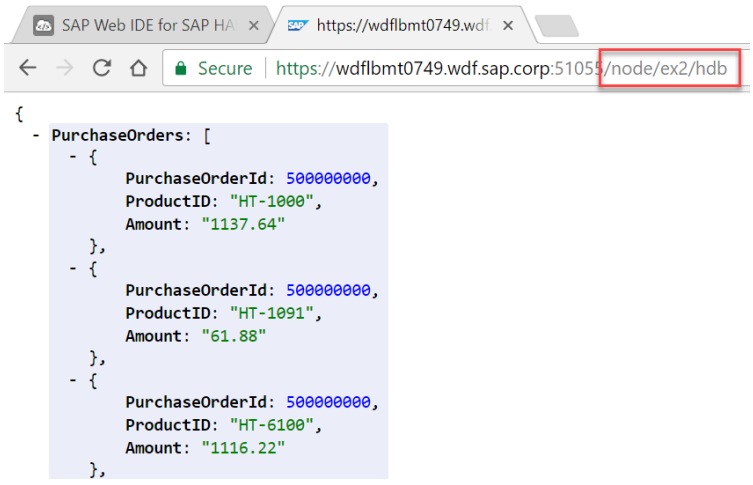
    As the next part of this exercise you can return to **ex2.js** and add a sixth route handler, **/whoAmI,** that outputs the **req.authInfo**.

```
app.get("/whoAmI", function(req, res) {
        var userContext = req.authInfo;
        var result = JSON.stringify({
                userContext: userContext
        });

res.type("application/json").status(200).send(result);
});
```

Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex3/ex3_7	
15. Then run the **js** module and test again at **/node/ex2/whoAmI**	

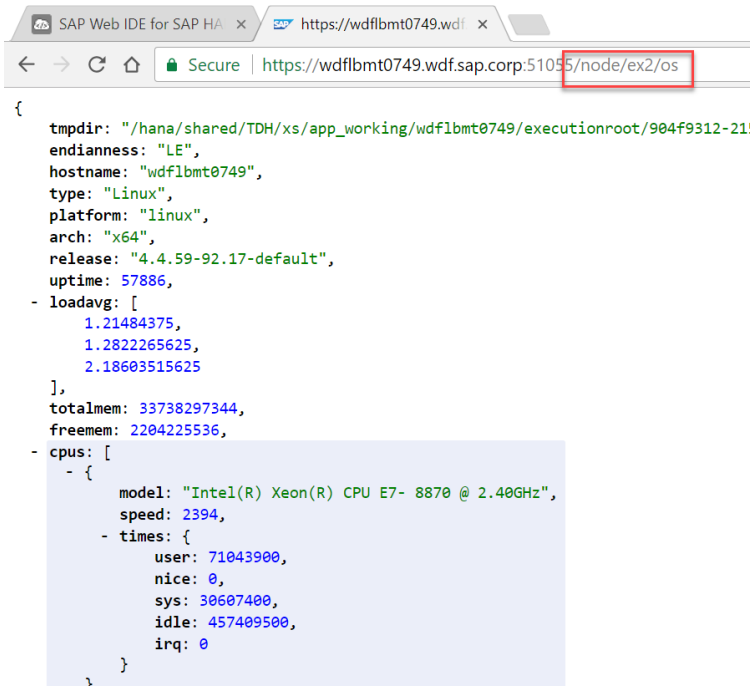
16. We will continue converting xsjs exercise from earlier. For this step, convert the hdb.xsjs example that read from the Purchase Order table and output the results as JSON.
 	
As the next part of this exercise you can return to **ex2.js** and add a seventh route handler, **/hdb,** that outputs the results of a selection from **PurchaseOrder.Item**.
 	
Note: if you don't want to type this code, we recommend that you cut
	app.get("/hdb", function(req, res) {
	var client = req.db;
	client.prepare(
	"SELECT FROM PurchaseOrder.Item { " +
	" POHeader.PURCHASEORDERID as \"PurchaseOrderId\", " +
	" PRODUCT as \"ProductID\", " +
	" GROSSAMOUNT as \"Amount\" " +
	" } ",
	function(err, statement) {
	if (err) {

and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex3/ex3_8	res.type("text/plain").status(500).send("ERROR: " + err.toString());
	return;
	}
	statement.exec([],
	function(err, results) {
	if (err) {
	res.type("text/plain").status(500).send("ERROR: " + err.toString());
	return;
	} else {
	var result = JSON.stringify({
	PurchaseOrders: results
	});
	res.type("application/json").status(200).send(result);
	}
	});
	});
	});

17. Then run the **js** module and test again at **/node/ex2/hdb**	

18. For the final conversion, let's bring over **os.xsjs**. From pure Node.js we can simply require the **os** module.
 	
As the next part of this exercise you can return to **ex2.js** and add an eight route handler, **/os,** that outputs the results from a call to the **os** module.
 	
Note: if you don't want to type this
	app.get("/os", function(req, res) {
	var os = require("os");
	var output = {};
	
	output.tmpdir = os.tmpdir();
	output.endianness = os.endianness();
	output.hostname = os.hostname();
	output.type = os.type();
	output.platform = os.platform();
	output.arch = os.arch();
	output.release = os.release();

code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex3/ex3_9	output.uptime = os.uptime();
	output.loadavg = os.loadavg();
	output.totalmem = os.totalmem();
	output.freemem = os.freemem();
	output.cpus = os.cpus();
	output.networkInfraces = os.networkInterfaces();
	
	var result = JSON.stringify(output);
	
	res.type("application/json").status(200).send(result);
	});

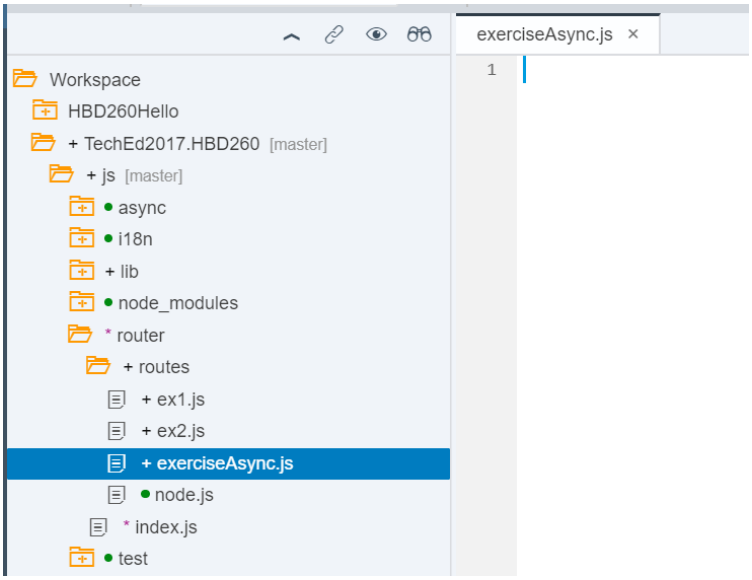
19. Then run the **js** module and test again at **/node/ex2/os**	

Exercise 3.3: Asynchronous Non-Blocking I/O

In this exercise, you will learn about the fundaments of the asynchronous nature of Node.js. We will also see how this asynchronous capability allows for non-blocking input and output. This technique is one of the basic things that makes Node.js development different from other JavaScript development and creates one of the reasons for its growing popularity. We will see how these techniques are applied to common operations like HTTP web service calls or even SAP HANA database access.

Explanation	Screenshot

1. Return to the **js** module and the **router/index.js** source file. Add a second module require statement for ./exerciseAsync	"use strict";
	
	module.exports = function(app, server) {
	app.use("/node", require("./routes/node")());
	app.use("/node/ex1", require("./routes/ex1")());
	app.use("/node/ex2", require("./routes/ex2")());
	app.use("/node/excAsync", require("./routes/exerciseAsync")(server));
	};

2. Create a new file in your router/routes folder called **exerciseAsync.js**.	

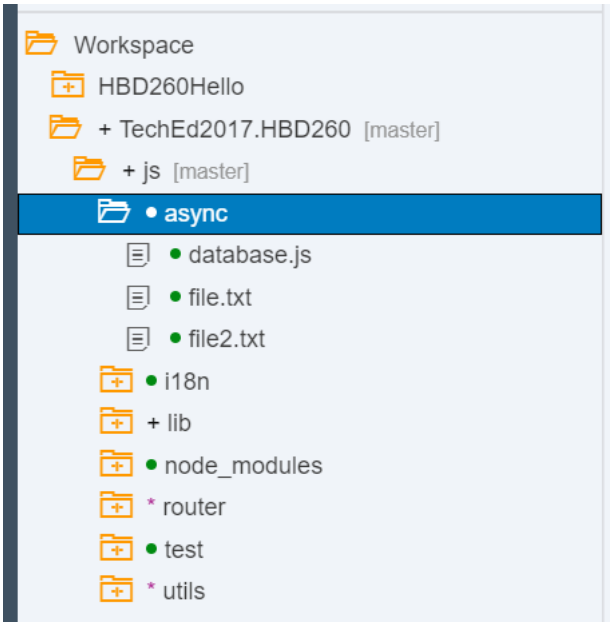
3. Add the following code to your **exerciseAsync.js file**. You can look at this code if you want, but isn't what we want you to focus on for this exercise. Instead this is just a test framework.
 	
We will instead write the important parts of this exercise in a series of additional Node.js modules – each focusing on a different Node.js asynchronous aspect.
	/*eslint no-console: 0, no-unused-vars: 0, new-cap:0 */
	"use strict";
	var express = require("express");
	var WebSocketServer = require("ws").Server;
	
	module.exports = function(server) {
	var app = express.Router();
	var asyncLib = require(global.__base + "async/async.js");
	var dbAsync = require(global.__base + "async/databaseAsync.js");

Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex3/ex3_10

```
	var dbAsync2 = require(global.__base +
"async/databaseAsync2.js");
	var fileSync = require(global.__base +
"async/fileSync.js");
	var fileAsync = require(global.__base +
"async/fileAsync.js");
	var httpClient = require(global.__base +
"async/httpClient.js");

	app.use(function(req, res) {
		var output = "<H1>Asynchronous
Examples</H1></br>" +
			"<a
href=\"/exerciseAsync\">/exerciseAsync</a> - Test Framework
for Async Examples</br>";
		res.type("text/html").status(200).send(output);
	});
	var wss = new WebSocketServer({
		server: server,
		path: "/node/excAsync"
	});

	wss.broadcast = function(data) {
		var message = JSON.stringify({
			text: data
		});
		wss.clients.forEach(function each(client) {
			try {
				client.send(message);
			} catch (e) {
				console.log("Broadcast Error:
%s", e.toString());
			}
		});
		console.log("sent: %s", message);

	};
	wss.on("connection", function(ws) {
		console.log("Connected");

		ws.on("message", function(message) {
			console.log("received: %s", message);
			var data = JSON.parse(message);
			switch (data.action) {
				case "async":

	asyncLib.asyncDemo(wss);
					break;
				case "fileSync":

	fileSync.fileDemo(wss);
					break;
				case "fileAsync":
```

```
        fileAsync.fileDemo(wss);
                                        break;
                                case "httpClient":

        httpClient.callService(wss);
                                        break;
                                case "dbAsync":
                                        dbAsync.dbCall(wss);
                                        break;
                                case "dbAsync2":
                                        dbAsync2.dbCall(wss);
                                        break;
                                default:
                                        wss.broadcast("Error:
Undefined Action: " + data.action);
                                        break;
                        }
                });
                ws.send(JSON.stringify({
                        text: "Connected to Exercise 3"
                }));
        });

        return app;
};
```

4. Our skeleton project we imported in Exercise 1 had a folder under **js** called **async**. This is where we will create the rest of the files in this exercise part.



5. In the **js/async** folder, create a file named **async.js**. In this code, we will output a start message, then set a timer which will issue a message after 3

```
"use strict";
module.exports = {
  asyncDemo: function(wss){
                wss.broadcast("Start");
```

seconds. Finally, we will issue an ending message.

Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex3/ex3_11

Perhaps a timer seemed like an obvious asynchronous operation. However, this asynchronous nature of node.js is often used when programs must wait on input or output. When asynchronous processing is applied to these operations, we can keep from blocking execution of other logic while we wait on things like file access, http requests or even database query execution.

```
                setTimeout(function(){
                        wss.broadcast("Wait Timer
Over");
                }, 3000);
                wss.broadcast("End");
  }
};
```

6. Let's first look at the difference between synchronous and asynchronous file operations.

   In the **js/async** folder, create a file named **fileSync.js**. The **fileSync.js** is using the fs library and the function **readFileSync** to read each of the two text files. After each read operation output there is a message.

   Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex3/ex3_12

```
"use strict";
var fs = require("fs");

module.exports = {
        fileDemo: function(wss) {
                var text = fs.readFileSync("./async/file.txt",
"utf8");
                wss.broadcast(text);

                wss.broadcast("After First Read\n");

                text = fs.readFileSync("./async/file2.txt",
"utf8");
                wss.broadcast(text);

                wss.broadcast("After Second Read\n");

        }
};
```

7. In the **js/async** folder, create a file named **fileAsync.js**. Notice that the **message output** now is embedded as an in-line callback function. It doesn't get executed until the read operation is complete, but the rest of the program flow continues and isn't blocked by the file operation.

   Note: if you don't want to type this code, we recommend that you cut and paste it

```
"use strict";
var fs = require("fs");

module.exports = {
        fileDemo: function(wss) {
                fs.readFile("./async/file.txt", "utf8",
function(error, text) {
                        wss.broadcast(text);
                });
                wss.broadcast("After First Read\n");
```

from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex3/ex3_13

```
		fs.readFile("./async/file2.txt", "utf8",
function(error, text) {
			wss.broadcast(text);
		});
		wss.broadcast("After Second Read\n");

	}
};
```

8. In the **js/async** folder, create a file named **httpClient.js**.

   Similar to file operations, HTTP requests are another area where our programs must often wait on an external response. In this exercise let's see how node.js also makes calling external HTTP services non-blocking.

   The **http** library we used in earlier exercises can also be used to make HTTP requests. Use the **get** function of the **http** library to call to http://www.loc.gov/pictures/search/?fo=json&q=SAP. This will call the US Library of Congress Image Search (a REST API which requires no authentication or API Key to keep the exercise simple). Issue a message before and after the HTTP request.

   Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex3/ex3_14

```
"use strict";
var http = require("http");

module.exports = {
	callService: function(wss) {

		wss.broadcast("Before HTTP Call\n");

		try {

			http.get({
					path:
"http://www.loc.gov/pictures/search/?fo=json&q=SAP&",
					host:
"proxy.wdf.sap.corp",
					port: "8080",
					headers: {
						host:
"www.loc.gov"
					}
				},
				function(response) {

	response.setEncoding("utf8");
					response.on("data",
function(data) {

	wss.broadcast(data.substring(0, 100));
					});
					response.on("error",
wss.broadcast);
				});
		} catch (err) {
			wss.broadcast(err.toString());
		}
		wss.broadcast("After HTTP Call\n");

	}
};
```

9. In the **js/async** folder, create a file named **databaseAsync.js.**

   Perhaps most interesting to us is that this non-blocking concept can also be extended to database access. This allows us to issue multiple requests to the underlying HANA database in parallel and without stopping the processing flow of the JavaScript application logic.

   Earlier in this exercise, you learned about making database access to HANA. For this exercise, we've already coded the database requests in a reusable module for you, so you can concentrate on the asynchronous flow.

   First we have **databaseAsync.js**. This Issues a message, then calls two functions (**callHANA1** and **callHANA2**), then issues another message. This will execute two different queries in the HANA database.

   Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex3/ex3_15

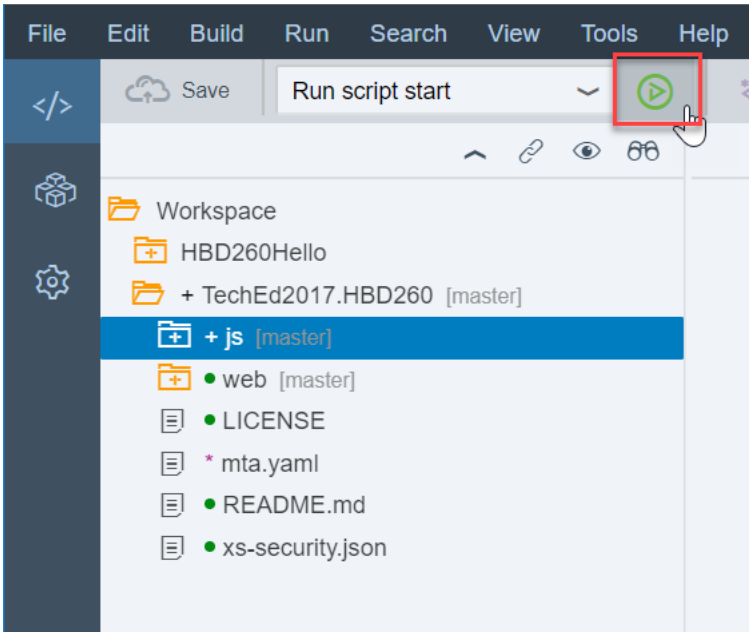
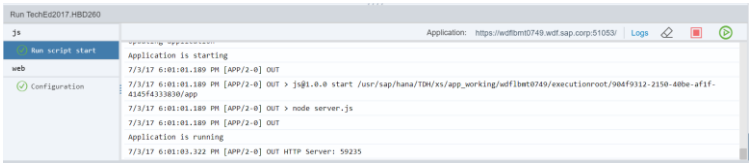
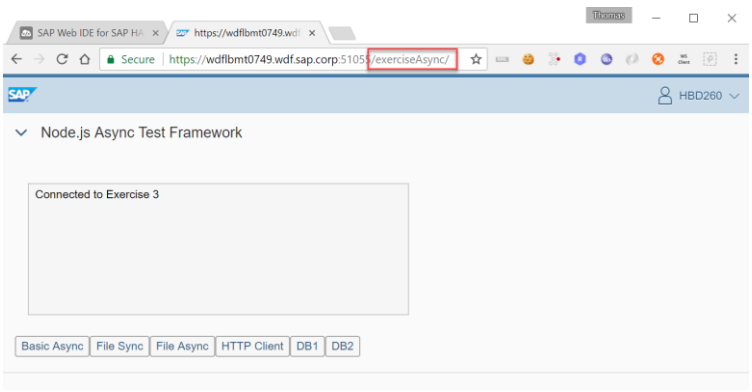
```
"use strict";
var hana = require("./database");
module.exports = {
  dbCall: function(wss){
            function dummy(){}
          wss.broadcast("Before Database Call");
          hana.callHANA1(dummy, wss);
          hana.callHANA2(dummy, wss);
          wss.broadcast("After Database Call");
  }
};
```

10. In the **js/async** folder, create a file named **databaseAsync2.js.**

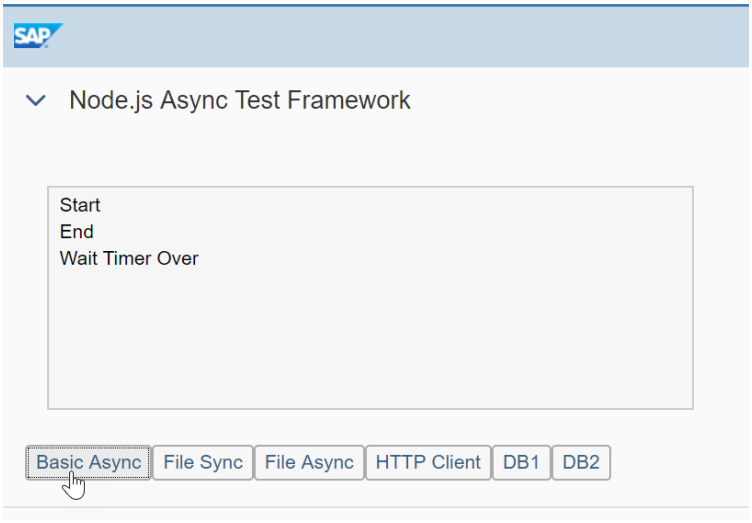
    But what if you want more control over the flow of program execution. Maybe you want several database operations to happen in parallel, but then some logic to execute only after all queries are complete. This is one of things the **async** library in node.js can make easier.

    In databaseAsync2.js we adjust the logic to use the **async.parallel** function. This allows some of the commands to execute in parallel as before, but then have a sync point once all operations are complete to allow further processing. We will output one final message after everything is done.

```
/*eslint no-console: 0, no-unused-vars: 0, no-undef: 0, no-
shadow: 0*/
"use strict";
var hana = require("./database");
var async = require("async");

module.exports = {
  dbCall: function(wss){
async.parallel([
          function(cb){wss.broadcast("Before Database Call");
cb();},
          function(cb){hana.callHANA1(cb, wss); },
          function(cb){hana.callHANA2(cb, wss); },
          function(cb){wss.broadcast("After Database Call");
cb();}
],        function(err){
                  wss.broadcast("---Everything's Really Done
Now. Go Home!---");
          });

  }
```

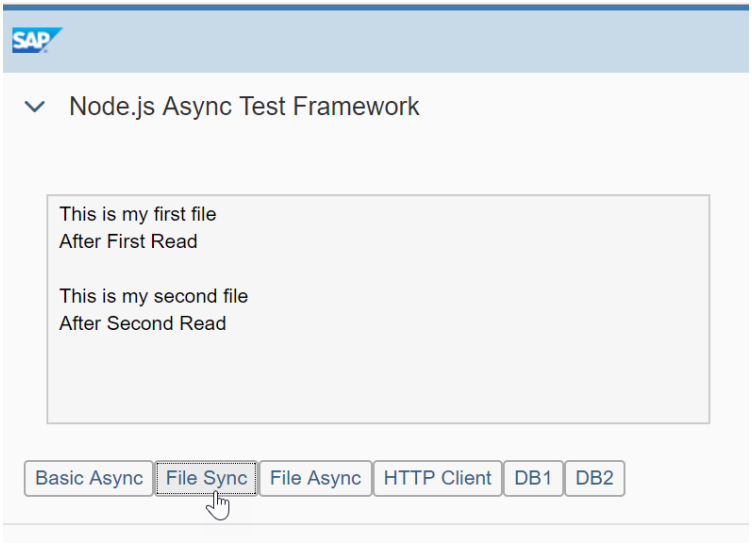
Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex3/ex3_16	};
11. We can now run the js module.	
12. You should see that the build and deploy was successful.	
13. In the other browser tab, you should still have the web module URL from the previous exercises. Now change the path in the browser to **/exerciseAsync**. You should see the test framework for this exercise.	

14. *Basic Async* button runs the **async.js** code. What do you expect this code will output? From many other programming languages, we would expect sequential processing and therefore the End output wouldn't come until after the timer expired. However, part of the power of node.js is asynchronous non-blocking execution of many core elements.



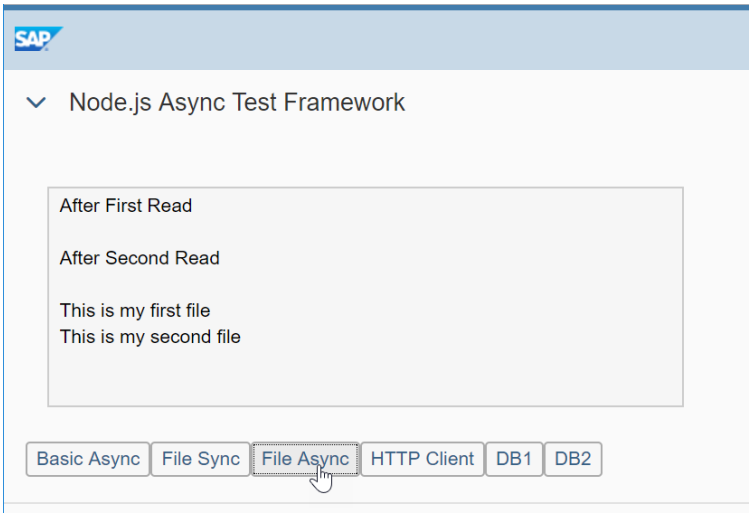
15. Test your **fileSync.js** from the UI test tool.

    As you might expect, everything is output in the same order as the lines of code were listed in the application because all operations were synchronous. Program execution didn't continue until each read operation had finished.



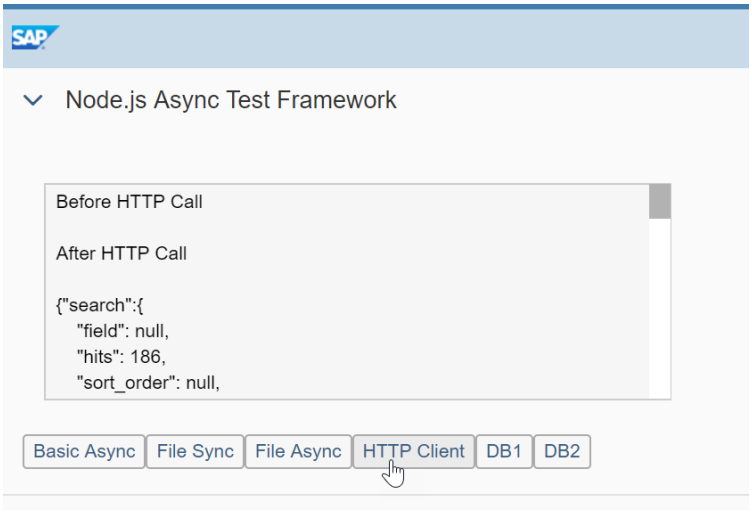
16. Now run **fileAsync.js** from the test UI. The output of this exercise gives us very different results. Both after comments are output before either of the file contents. Also if the first file had been significantly larger than the second, it's possible that the second might have finished and output first.

    This has powerful implications to how we code applications.



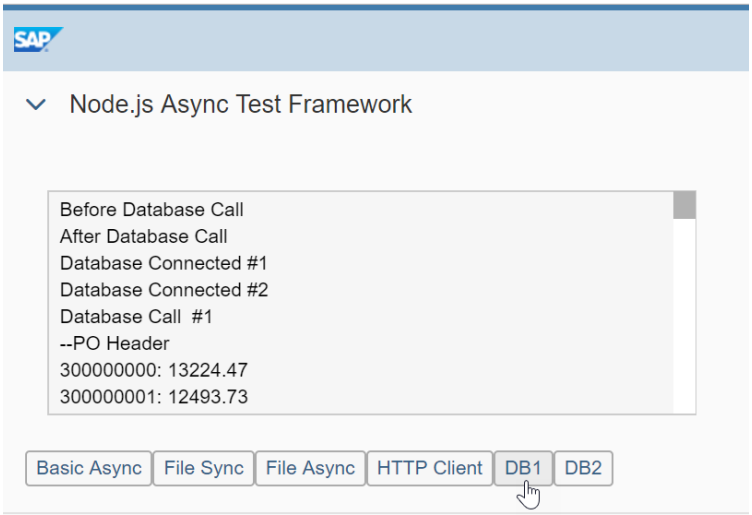
17. Test your **httpClient.js** from the test UI.

    Like the earlier file exercise, the after-http call console message is output before the response from the HTTP request.



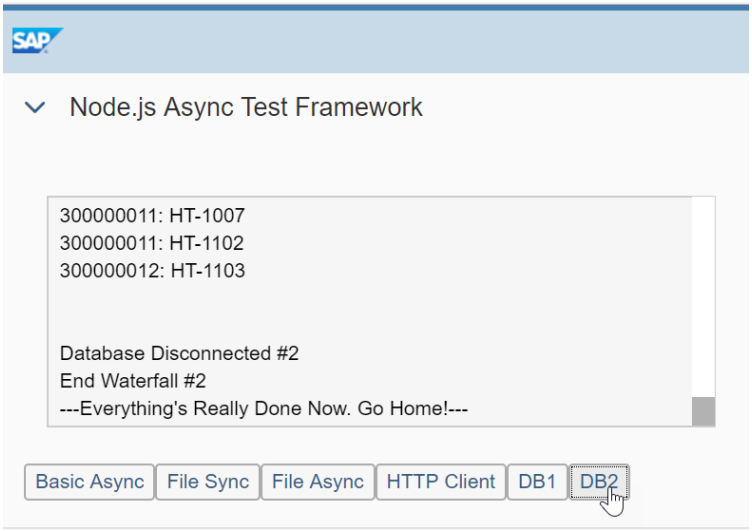
18. Test your **databaseAsync.js** from test UI.

    As you are hopefully learning to expect, the messages you issued after the database requests are output first. Only then are the database query results returned. There is also no guarantee that query 1 will finish before query 2.



19. Test your **databaseAsync2.js** from the test UI.

    The execution is like before, but now we have the final message after all queries are complete. Because we have a sync point after all parallel execution is complete, we can output this final message after both queries are complete.

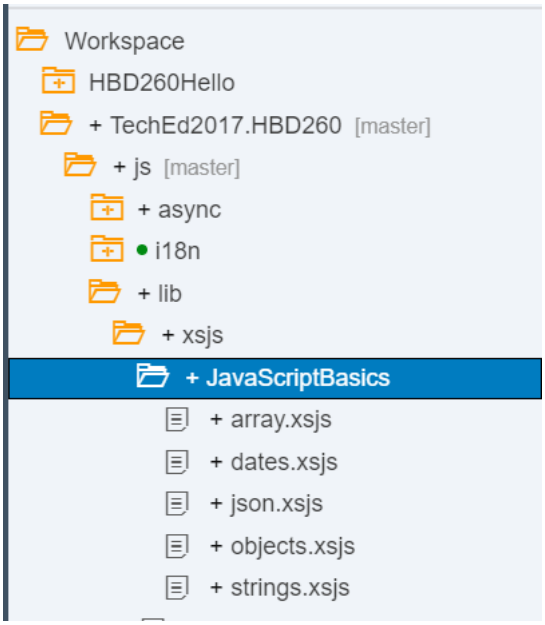


Exercise 3.4: Exploring JavaScript Language Features

Explanation	Screenshot

1) Using what you have learned already, let's migrate the JavaScript Basics in Exercise 2.3 from XSJS to pure Node.js. Extend the router index.js with a path for **JavaScriptBasics**.	"use strict";
	
	module.exports = function(app, server) {
	app.use("/node", require("./routes/node")());
	app.use("/node/ex1", require("./routes/ex1")());
	app.use("/node/ex2", require("./routes/ex2")());
	app.use("/node/excAsync",
	require("./routes/exerciseAsync")(server));
	app.use("/node/JavaScriptBasics",
	require("./routes/JavaScriptBasics")());
	};

2) In the **js/router/routes** folder add the file JavaScriptBasics.js with the same express router structure we've used throughout Exercise 3.	/*eslint no-console: 0, no-unused-vars: 0, no-shadow: 0, new-cap: 0*/
	"use strict";
	var express = require("express");
	
	module.exports = function() {
	var app = express.Router();
	
	//Hello Router
	app.get("/", function(req, res) {
	res.send("JavaScript Basics Exercise");
	});
	
	return app;
	};

3) This exercise will be a bit different from all others. Instead of following along step-by-step or working toward a very specific final product; this exercise will instead allow you to explore various JavaScript language features. Specifically we use what we've just learned about Node.js non-blocking, callback nature to adjust the XSJS exercises from earlier to pure Node.js There is no strict right or wrong solution to many of these exercise parts. However, you can view sample solutions from: https://github.com/I809764/TechEd2017.HBD260/tree/solution/js	

/router/routes/JavaScriptBasics.js

Feel free to create similar Node.js routes to explore these language features. However, the main point of this exercise is to focus on general JavaScript language constructs and how to adapt them to unique aspects of Node.js.

4) First we will learn about strings in JavaScript.

   Create a string with some sample text in it (hint: =).

   Access the first character of the string. (hint: offsets are zero based and specified via [])

   Access the last character in the string (hint: slice).

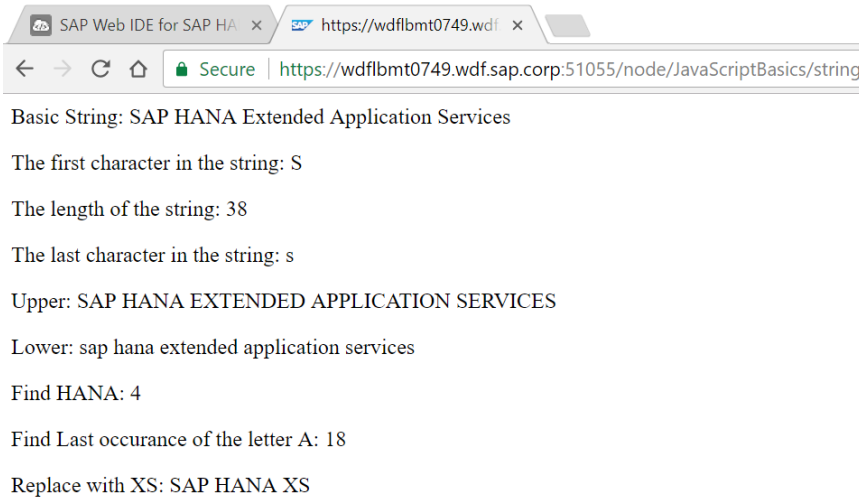
   Output the length of the string (hint: length).

   Convert the string to all upper and all lower case (hint: toUpperCase).

   Find the position of a text part of the string (hint: indexOf).

   Find the last occurrence of a character in the string. Perform a find and replace operation on the string (hint: lastIndexOf).

   Sample implementation: /strings



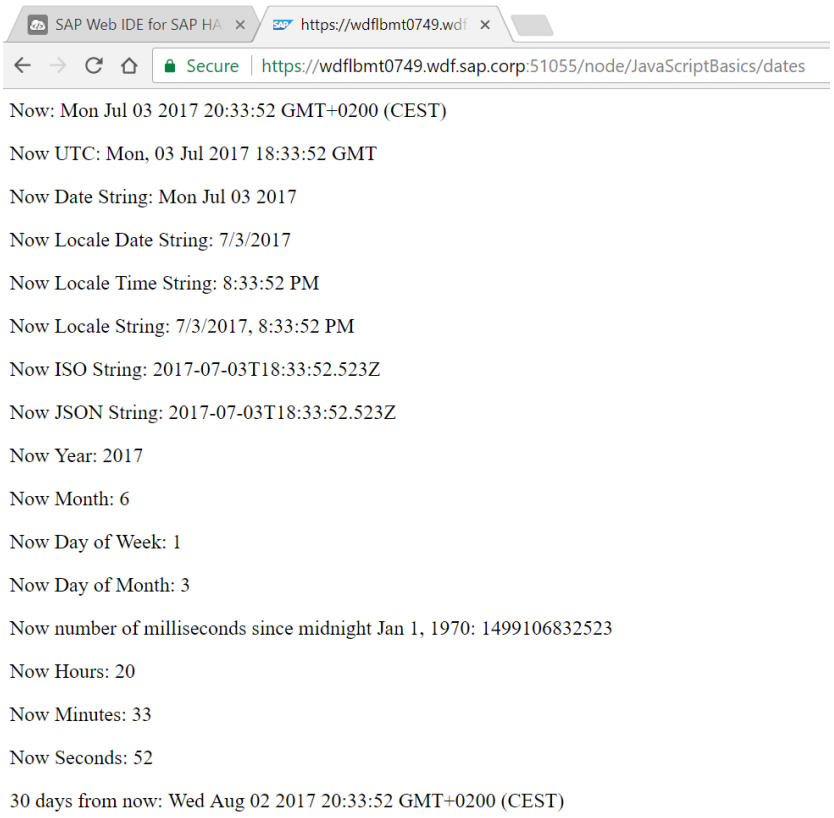
5) Create a Data object with the current date (hint: new Date()).

   Convert the data to various other formats (UTC, Local Data, Local Time, ISO, JSON (hint: to*String with various modifies UTC, Date, LocalDate, LocaleTime, etc).

   Access the sub-parts of the date: Year, Month, Day, Hours, Minutes, and Seconds (hint: get* with modifiers for FullYear, Month, Day, Date, Time, Hours, Minutes, Seconds).

   Perform math on a date, adding 30 days to the current date (hint: setDate and simple math).

   Sample implementation: /dates



6) Create two arrays: one with the colors Red, Green, and Blue and one with Black, White, Orange, and Purple (hint: [“one”, “two, “three”]).

   Output the first array as a string (hint: toString).

   Access the first element by index (hint: zero based).

   Get the number of elements in the first array (hint: length).

   Get the index of Blue in the first array (hint: indexOf).

   Loop over the first array and output each element (hint: for(var i; i < length; i++).

   Combine the two arrays (hint: concat).

   Reverse Sort and then Sort Ascending (hint: reverse, sort).

   Remove the last and then first element (hint: pop, shift).

   Slice out the 3rd and 4th element (hint: slice).

   Add two new colors (Malachite and Fallow) at the 3rd position (hint: splice).

   Add Brown to the start of the Array (hint: unshift).

   Sample implementation: /array

Complete Array: Red,Green,Blue

First Element: Red

Number of Elements: 3

Position of Blue: 2

Loop of Elements: Red Green Blue

Combined Array: Red,Green,Blue,Black,White,Orange,Purple

Reverse Sort: Purple,Orange,White,Black,Blue,Green,Red

Sort Ascending: Black,Blue,Green,Orange,Purple,Red,White

Remove the last element: Black,Blue,Green,Orange,Purple,Red

Remove the last element: Blue,Green,Orange,Purple,Red

Slice out the 3rd and 4th element: Orange,Purple

Add two values at position 3: Blue,Green,Malachite,Fallow,Red

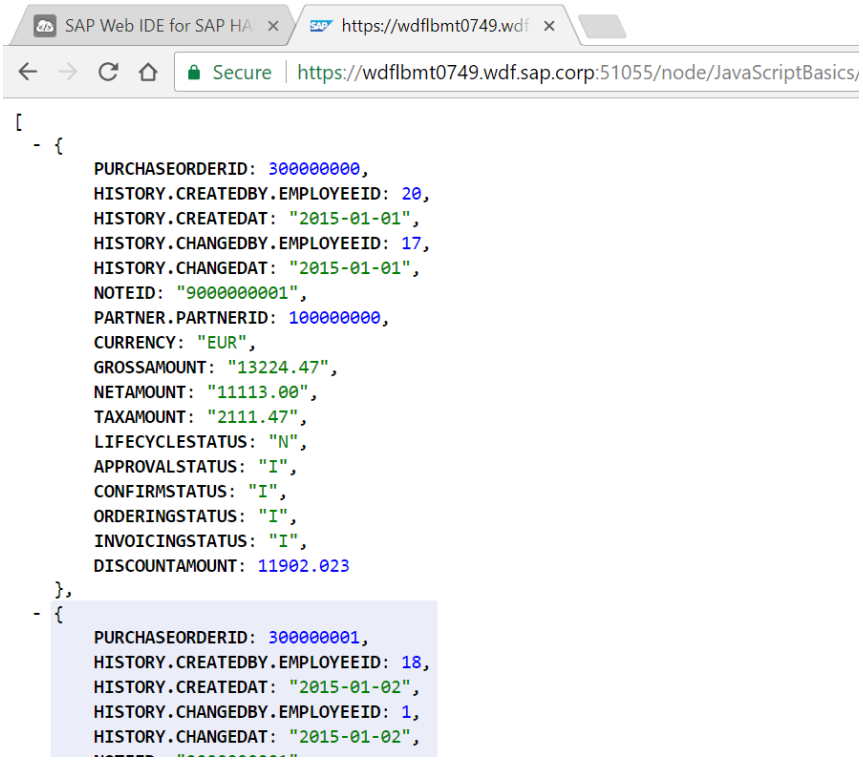
Add element to the beginning of the array: Brown,Blue,Green,Malachite,Fallow,Red

7) Select 10 records from **PO.Header** and convert the results to JSON (hint: req.db and callbacks).

Loop over the elements in the JSON object and create a new **DISCOUNTAMOUNT** attribute by discounting the **GROSSAMOUNT** by 10% (hint: for (var i; i < length; i++).

Convert the JSON object to a string and output it to the frontend (hint: JSON.stringify).

Sample implementation: /json

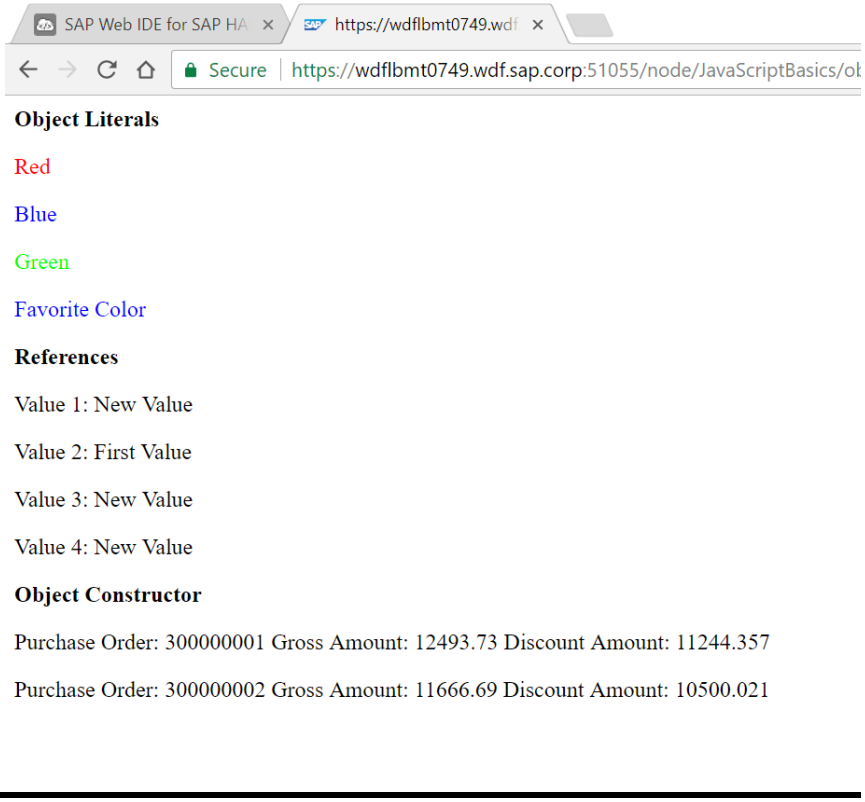


8) Create an object literal called colors. Give it three properties – red with the value #FF0000, green with the value #00FF00, and blue with the value #0000FF. Give the object a function named favoriteColor. On Monday, it should return blue, all other days it returns red (hint: var colors = {}).

Access the colors in the object including the Favorite color (hint: object.<variable>).

Prove that objects are assign by reference and not assign by value (hint: just set a value to a regular variable and an object and see the difference).

Create a purchase order object for **PO.Header** which returns PO Id, gross amount, and a calculated discount amount (10% off gross amount) (hint:

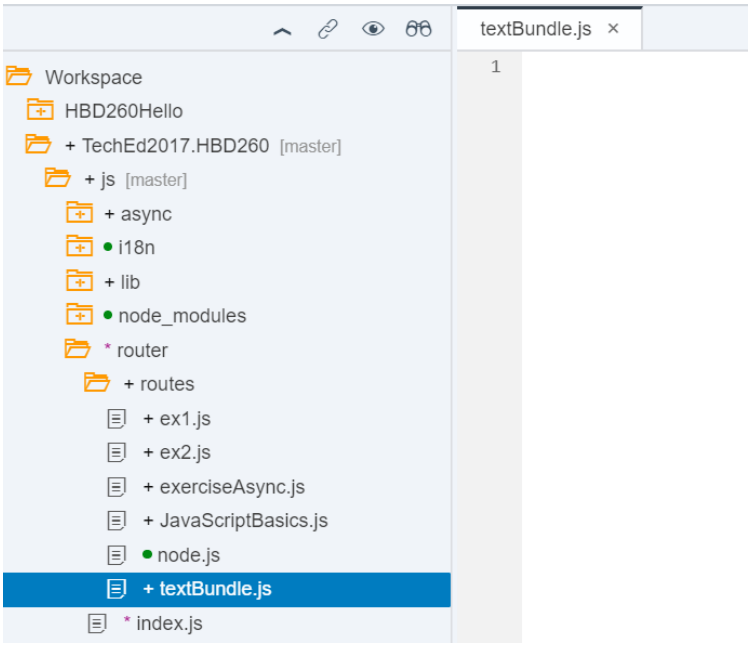


function with logic from last step – json.xsjs). Create two instances of this object – one for PO 300000000 and one for 300000001 (hint: use async.parallel so you have a sync point after both objects are finished) Sample implementation: /objects	

Exercise 3.5: Text Bundles

Explanation	Screenshot
1. Return to the **js** module.	

2. Add a route for a new module named **textBundle** that corresponds to **/node/textBundle** in the **router/index.js**	"use strict";
	
	module.exports = function(app, server) {
	app.use("/node", require("./routes/node")());
	app.use("/node/ex1", require("./routes/ex1")());
	app.use("/node/ex2", require("./routes/ex2")());
	app.use("/node/excAsync", require("./routes/exerciseAsync")(server));
	app.use("/node/JavaScriptBasics", require("./routes/JavaScriptBasics")());
	app.use("/node/textBundle", require("./routes/textBundle")());
	};

3. Create a new file in your **router/routes** folder called **textBundle.js**.	

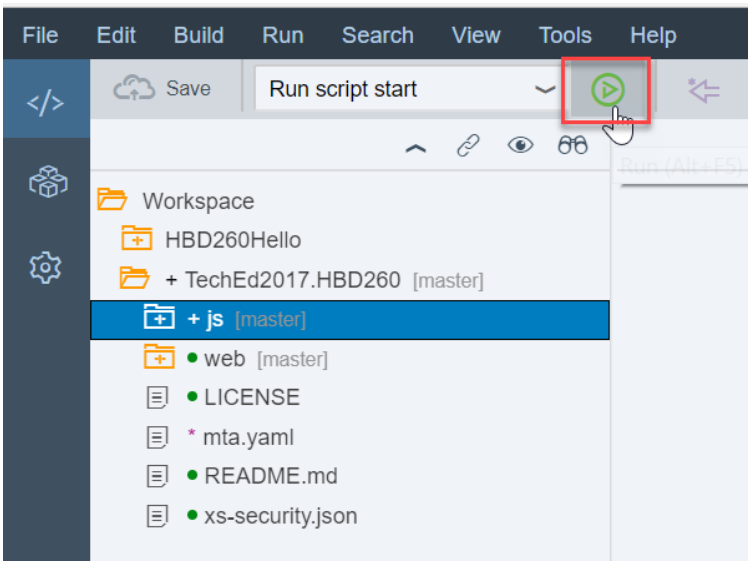
4. Add the following code to your **textBundle.j**s file. It has implemented an HTTP handler for the root URL using **express**. In the processing of this handler use the **TextBundle** library. When creating a new **TextBundle** instance the input are **path** (value messages to point to your message.properties file) and **locale** which should call **getLocale** passing in	/*eslint no-console: 0, no-unused-vars: 0, consistent-return: 0, new-cap: 0*/
	"use strict";
	var express = require("express");
	var app = express.Router();
	var os = require("os");
	var TextBundle = require("@sap/textbundle").TextBundle;
	var langparser = require("accept-language-parser");
	
	function getLocale(req) {

the **req** object. Then write into the **res** object with the **TextBundle getText** function (passing in the text ID of greeting and two parameters of **os.hostname()** and **os.type().**

Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex3/ex3_17

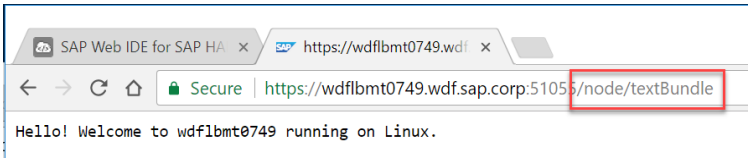
```
	var lang = req.headers["accept-language"];
	if (!lang) {
		return;
	}
	var arr = langparser.parse(lang);
	if (!arr || arr.length < 1) {
		return;
	}
	var locale = arr[0].code;
	if (arr[0].region) {
		locale += "_" + arr[0].region;
	}
	return locale;
}

module.exports = function() {

	app.get("/", function(req, res) {
		var bundle = new TextBundle(global.__base +
"i18n/messages", getLocale(req));
		res.writeHead(200, {
			"Content-Type": "text/plain;
charset=utf-8"
		});
		var greeting = bundle.getText("greeting",
[os.hostname(), os.type()]);
		res.end(greeting, "utf-8");
	});
	return app;
};
```

5. We can now run the **js** module.

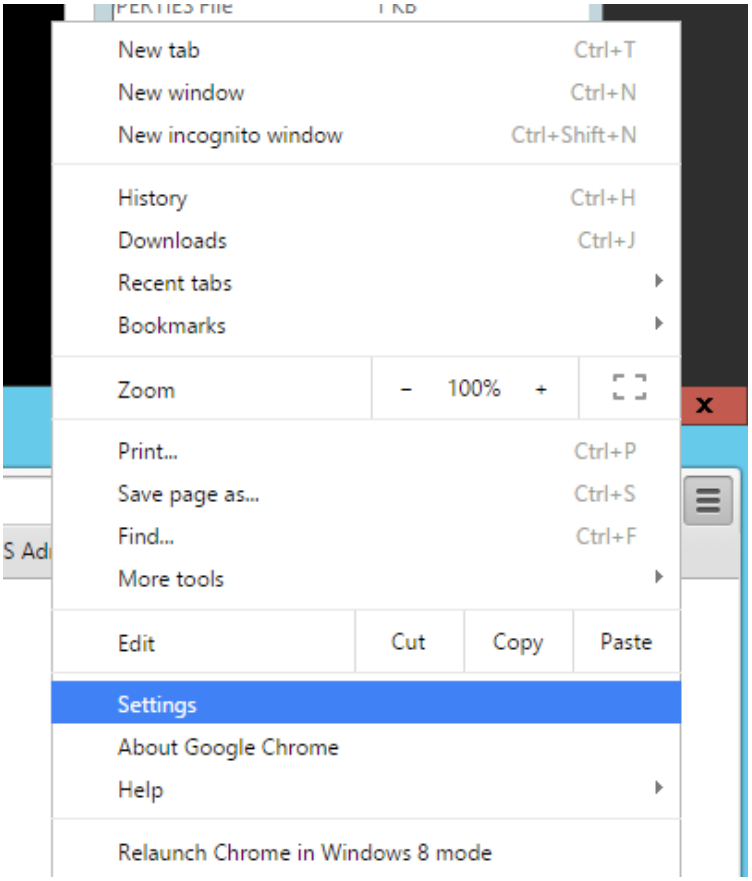


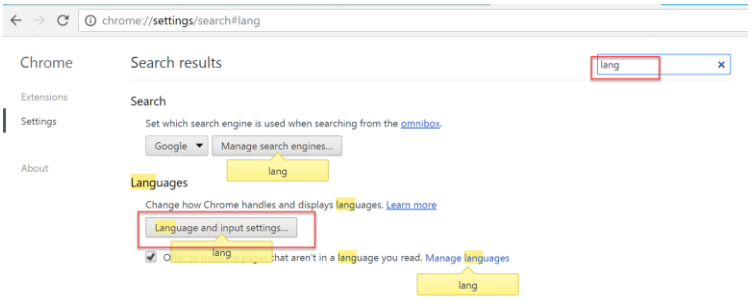
6. You should see that the build and deploy was successful.

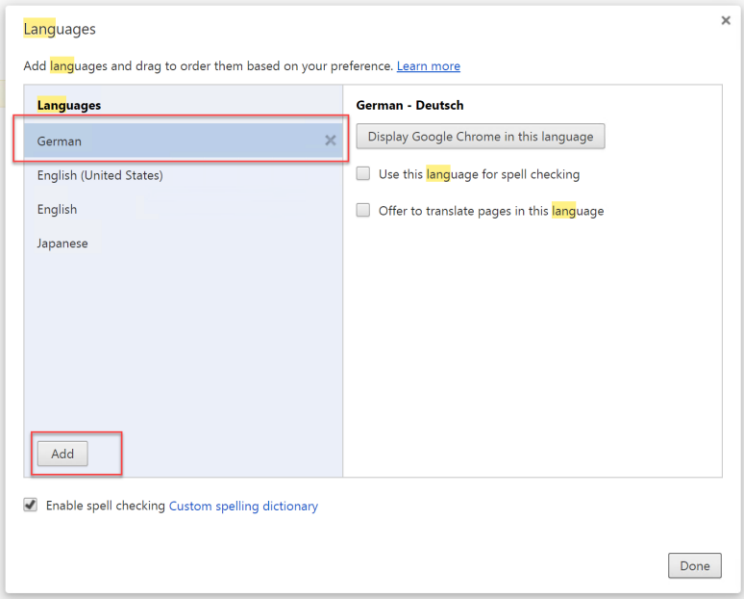
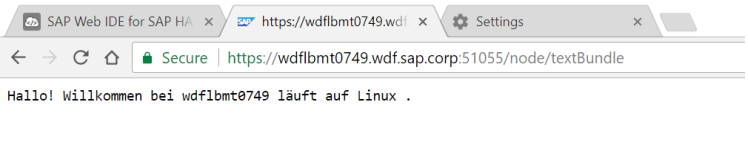
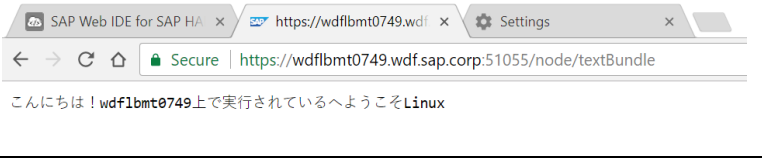
7. In your other browser tab where we've been testing, change the path in the browser to **/node/textBundle**. You should see the English message output from your text file in the i18n folder.



8. To test the translated strings, go into the browser Settings. Search for Lang and then choose the Language and input settings button.





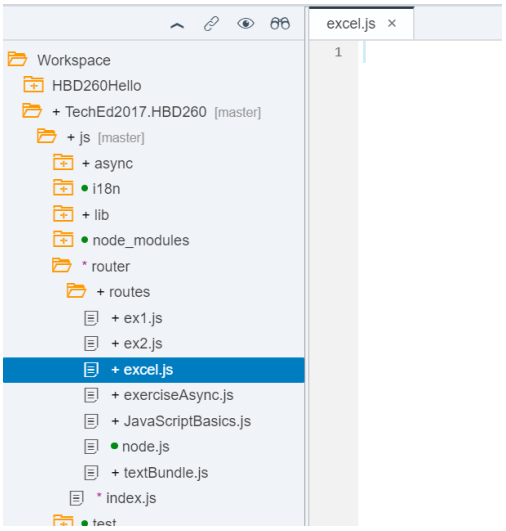
9. Add German and Japanese to the language list. Drag and drop to raise German to the top of the list	
10. Refresh the web browser and you should now see the German text.	
11. Repeat the process raising Japanese [ja] to the top of the list and refresh the web page	
12. Please return the browser settings to English at the top.	

Exercise 3.6: Open Source Modules

We've already seen how key Node.js functionality is provided by non-SAP open source modules. You've used express, async, and others already in this exercise. Now we will see other common programming tasks can be accomplished without the need of SAP provided APIs. We will convert database query results to Microsoft Excel, utilize ZIP compression, and XML parsing – all using existing open source Node.js Modules.

Explanation	Screenshot
1. Return to the **js** module.	

2. Add a route for a new module named **excel** that corresponds to **/node/excel** in the **router/index.js**	"use strict";
	
	module.exports = function(app, server) {
	app.use("/node", require("./routes/node")());
	app.use("/node/ex1", require("./routes/ex1")());
	app.use("/node/ex2", require("./routes/ex2")());
	app.use("/node/excAsync", require("./routes/exerciseAsync")(server));
	app.use("/node/JavaScriptBasics", require("./routes/JavaScriptBasics")());
	app.use("/node/textBundle", require("./routes/textBundle")());
	app.use("/node/excel", require("./routes/excel")());
	};

3. Create a new file in your **router/routes** folder called **excel.js**.	

4. Add the following code to your **excel.js** file. We are using the node-xlsx module. With one call to a function in this module we can pass in query results as JSON and receive back the binary string that	/*eslint no-console: 0, no-unused-vars: 0, no-shadow: 0, dot-notation: 0, new-cap: 0*/
	"use strict";
	var express = require("express");
	var excel = require("node-xlsx");

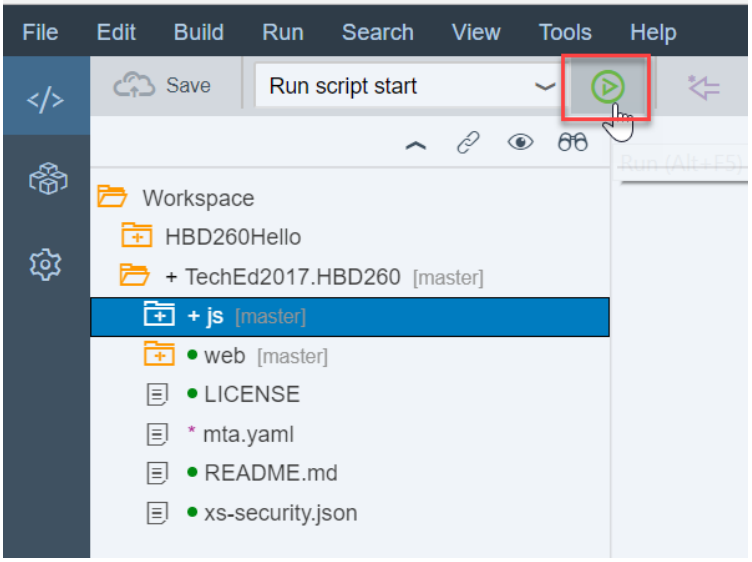
contains the true Excel content format (not just tab or comma delimited string).

Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex3/ex3_18

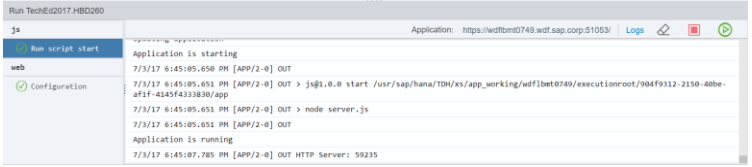
```
var fs = require("fs");
var path = require("path");

module.exports = function() {
	var app = express.Router();

	//Hello Router
	app.get("/", function(req, res) {
		var output = "<H1>Excel Examples</H1></br>" +
			"<a href=\"" + req.baseUrl + "/download\">/download</a> - Download data in Excel XLSX format</br>";
		res.type("text/html").status(200).send(output);
	});

	//Simple Database Select - In-line Callbacks
	app.get("/download", function(req, res) {
		var client = req.db;
		var query = "SELECT TOP 10 " +
			" \"HEADER.PURCHASEORDERID\" as \"PurchaseOrderItemId\", " +
			" \"PRODUCT.PRODUCTID\" as \"ProductID\", " +
			" GROSSAMOUNT as \"Amount\" " +
			" FROM \"PO.Item\"  ";
		client.prepare(
			query,
			function(err, statement) {
				if (err) {

	res.type("text/plain").status(500).send("ERROR: " + err.toString());
					return;
				}
				statement.exec([],
					function(err, rs) {
						if (err) {

	res.type("text/plain").status(500).send("ERROR: " + err);
						} else {
							var out = [];
							for (var i = 0; i < rs.length; i++) {

	out.push([rs[i]["PurchaseOrderItemId"], rs[i]["ProductID"], rs[i]["Amount"]]);
							}
							var result = excel.build([{
```

```
        name: "Purchase Orders",

        data: out
                                                                }]);

        res.header("Content-Disposition", "attachment;
filename=Excel.xlsx");

        res.type("application/vnd.ms-
excel").status(200).send(result);
                                                        }
                                                    });
                                                });
        });

        return app;
};
```

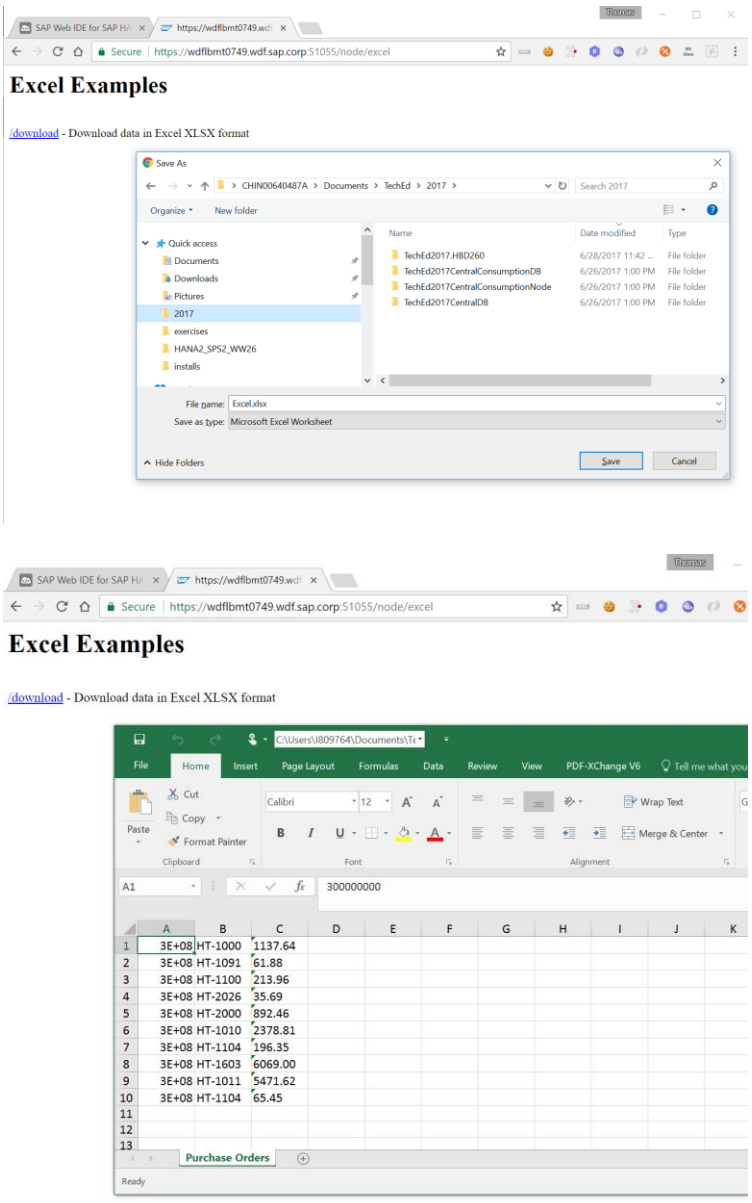
5. We can now run the **js** module.



6. You should see that the build and deploy was successful.



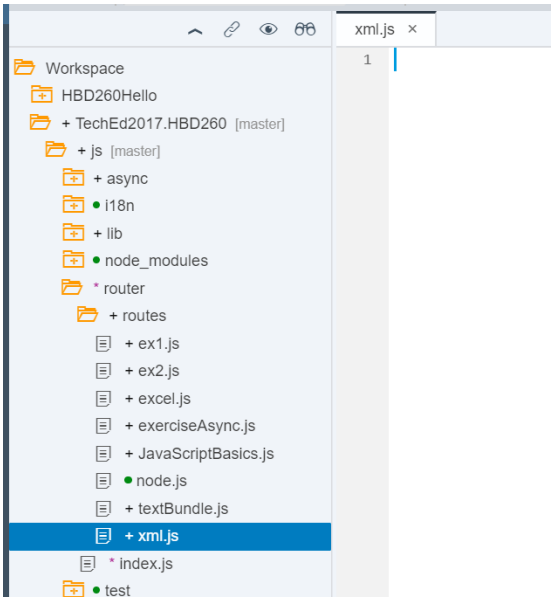
7. In your other browser tab where we've been testing, change the path in the browser to **/node/excel/download**. You should receive the file save dialog of the browser for a file named Excel.xlsx.



8. Return to the **js** module. Add a route for a new module named **xml** that corresponds to **/node/xml** in the **router/index.js**

```
"use strict";

module.exports = function(app, server) {
        app.use("/node", require("./routes/node")());
        app.use("/node/ex1", require("./routes/ex1")());
        app.use("/node/ex2", require("./routes/ex2")());
        app.use("/node/excAsync",
require("./routes/exerciseAsync")(server));
        app.use("/node/JavaScriptBasics",
require("./routes/JavaScriptBasics")());
        app.use("/node/textBundle",
require("./routes/textBundle")());
```

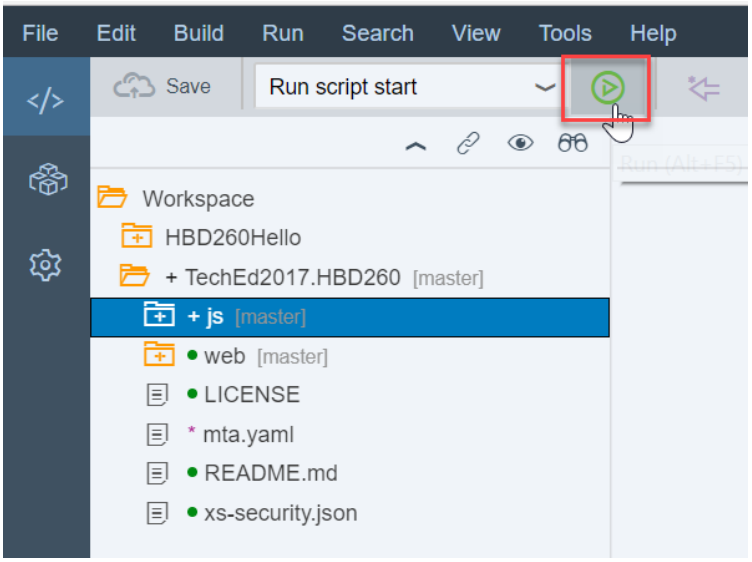
	app.use("/node/excel", require("./routes/excel")());
	app.use("/node/xml", require("./routes/xml")());
	};

9. Create a new file in your **router/routes** folder called **xml.js**.	

10. Add the following code to your **xml.js** file. We are using the **xmldoc** module. This module provides XML parsing and rendering functions. We will provide a simple, hardcoded XML string and use this module to parse it and output results for each child of the root node we find.
 	
Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex3/ex3_19
	/*eslint no-console: 0, no-unused-vars: 0, no-shadow: 0, quotes: 0, new-cap: 0*/
	"use strict";
	var express = require("express");
	var XmlDocument = require("xmldoc").XmlDocument;
	
	module.exports = function() {
	var app = express.Router();
	
	//Hello Router
	app.get("/", function(req, res) {
	var output = "<H1>XML Examples</H1></br>" +
	"/example1 - Simple XML parsing</br>";
	
	res.type("text/html").status(200).send(output);
	});
	
	//Simple Database Select - In-line Callbacks
	app.get("/example1", function(req, res) {
	var xml = '<?xml version="1.0" encoding="UTF-8" standalone="yes"?>\n' +
	'<!-- this is a note -->\n' +

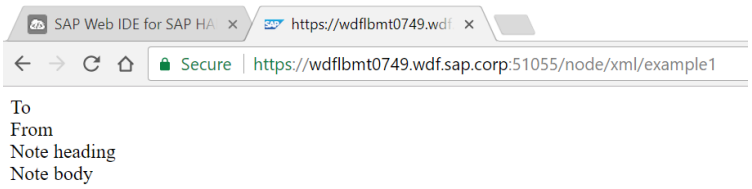
```
                                        '<note
noteName="NoteName">' +
                                        '<to>To</to>' +
                                        '<from>From</from>' +
                                        '<heading>Note
heading</heading>' +
                                        '<body>Note body</body>' +
                                        '</note>';
                                var body = "";
                                var note = new XmlDocument(xml);
                                note.eachChild(function(item) {
                                        body += item.val + '</br>';
                                });

        res.type("text/html").status(200).send(body);

                });

        return app;
};
```

11. We can now run the **js** module.



12. You should see that the build and deploy was successful.

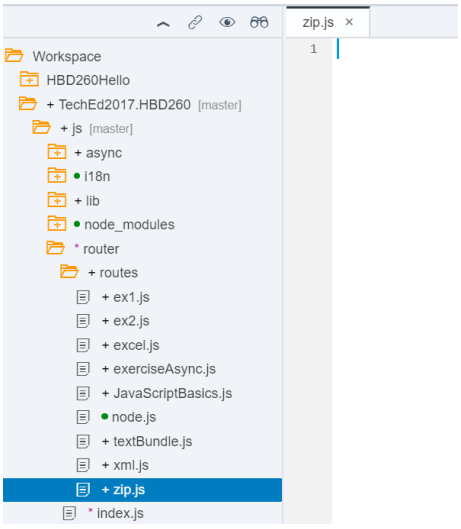
13. In your other browser tab where we've been testing, change the path in the browser to **/node/xml/example1**. You should see the results of parsing the sample XML content.



14. Return to the **js** module. Add a route for a new module named **zip** that corresponds to **/node/zip** in the **router/index.js**

```
"use strict";

module.exports = function(app, server) {
        app.use("/node", require("./routes/node")());
        app.use("/node/ex1", require("./routes/ex1")());
        app.use("/node/ex2", require("./routes/ex2")());
        app.use("/node/excAsync",
require("./routes/exerciseAsync")(server));
        app.use("/node/JavaScriptBasics",
require("./routes/JavaScriptBasics")());
        app.use("/node/textBundle",
require("./routes/textBundle")());
        app.use("/node/excel", require("./routes/excel")());
        app.use("/node/xml", require("./routes/xml")());
        app.use("/node/zip", require("./routes/zip")());

};
```

15. Create a new file in your **router/routes** folder called **zip.js**.



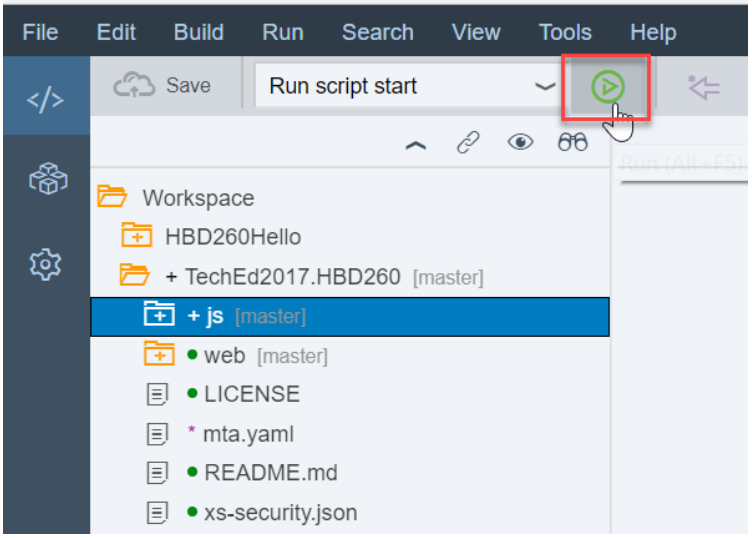
16. Add the following code to your **zip.js** file. We are using the **node-zip** module. With one call to a function in this module can create zip content; adding files, folders, or any content to the output zip archive.

    Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex3/ex3_20

```
/*eslint no-console: 0, no-unused-vars: 0, no-shadow: 0, dot-notation: 0, new-cap: 0*/
"use strict";
var express = require("express");

module.exports = function() {
	var app = express.Router();

	//Hello Router
	app.get("/", function(req, res) {
		var output = "<H1>ZIP Examples</H1></br>" +
			"<a href=\"" + req.baseUrl + "/example1\">/example1</a> - Download data in ZIP format - folder and files</br>";
		res.type("text/html").status(200).send(output);
	});

	//Simple Database Select - In-line Callbacks
	app.get("/example1", function(req, res) {

		var zip = new require("node-zip")();
		zip.file("folder1/demo1.txt", "This is the new ZIP Processing in Node.js");
		zip.file("demo2.txt", "This is also the new ZIP Processing in Node.js");
		var data = zip.generate({
			base64: false,
			compression: "DEFLATE"
		});

		res.header("Content-Disposition", "attachment; filename=ZipExample.zip");

	res.type("application/zip").status(200).send(new Buffer(data, "binary"));

	});

	//Simple Database Select - In-line Callbacks
	app.get("/zipPO", function(req, res) {
		var client = req.db;
		var query =
			"SELECT TOP 25000 \"PurchaseOrderId\", \"PartnerId\", \"CompanyName\", \"CreatedByLoginName\", \"CreatedAt\", \"GrossAmount\" " +
			"FROM \"PO.HeaderView\" order by \"PurchaseOrderId\" ";
		client.prepare(
			query,
			function(err, statement) {
				if (err) {

	res.type("text/plain").status(500).send("ERROR: " + err.toString());
```

```
                                        return;
                                    }
                                    statement.exec([],
                                        function(err, rs) {
                                            if (err) {

        res.type("text/plain").status(500).send("ERROR: " +
err);
                                            } else {
                                                var out
= "";
                                                for
(var i = 0; i < rs.length; i++) {

        out += rs[i].PurchaseOrderId + "\t" + rs[i].PartnerId +
"\t" + rs[i].CompanyName + "\t" + rs[i].CreatedByLoginName +
"\t" + rs[

                i].CreatedAt + "\t" + rs[i].GrossAmount + "\n";
                                                }

                                                var zip
= new require("node-zip")();

        zip.file("po.txt", out);
                                                var
data = zip.generate({

        base64: false,

        compression: "DEFLATE"
                                                });


        res.header("Content-Disposition", "attachment;
filename=poWorklist.zip");

        res.type("application/zip").status(200).send(new
Buffer(data, "binary"));
                                            }
                                        });
                                });
        });

        return app;
};
```

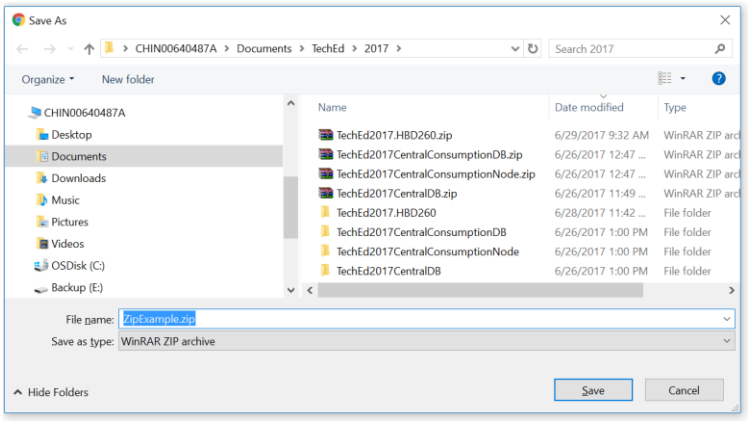
17. We can now run the **js** module.

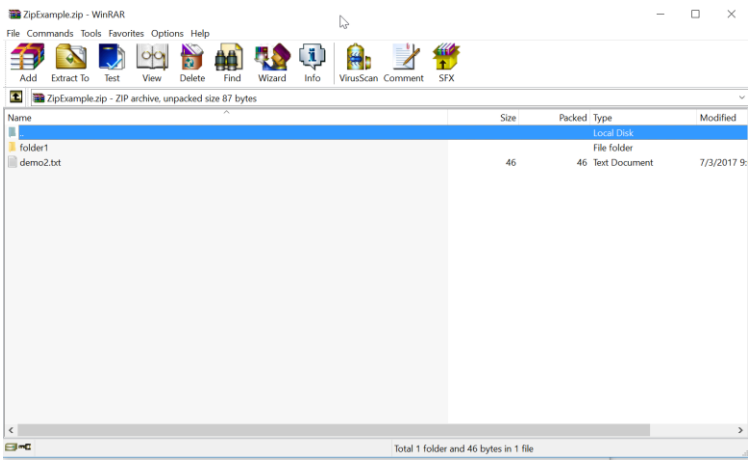


18. You should see that the build and deploy was successful.

19. In your other browser tab where we've been testing, change the path in the browser to **/node/zip/example1**. You should receive the file save dialog of the browser for a file named ZipExample.zip.

    This zip file has a folder named, folder1, with a file named demo1.txt. It also has a file named demo2.txt in the root.



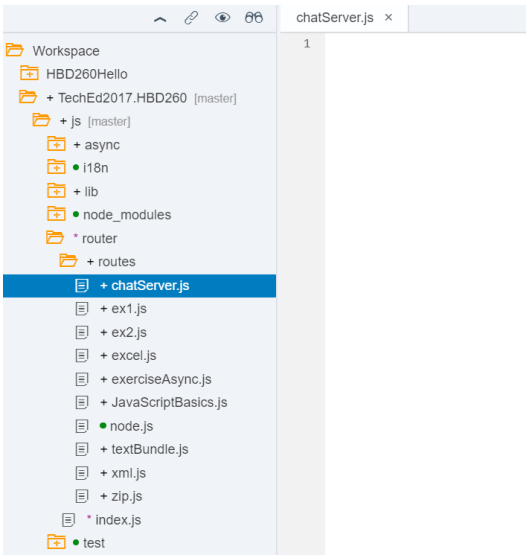


Exercise 3.7: Web Sockets

Our final exercise part in this section will demonstrate the ease at which you can tap into the powerful web sockets capabilities of Node.js. We will use web sockets to build a simple chat application. Any message sent from the SAPUI5 client side application will be propagated by the server to all listening clients.

Explanation	Screenshot
1. Return to the **js** module.	

2. Add an express route handler for this chatServer module in the router/index.js and pass the server variable in as well.	"use strict";
	
	module.exports = function(app, server) {
	app.use("/node", require("./routes/node")());
	app.use("/node/ex1", require("./routes/ex1")());
	app.use("/node/ex2", require("./routes/ex2")());
	app.use("/node/excAsync", require("./routes/exerciseAsync")(server));
	app.use("/node/JavaScriptBasics", require("./routes/JavaScriptBasics")());
	app.use("/node/textBundle", require("./routes/textBundle")());
	app.use("/node/excel", require("./routes/excel")());
	app.use("/node/xml", require("./routes/xml")());
	app.use("/node/zip", require("./routes/zip")());
	app.use("/node/chat", require("./routes/chatServer")(server));
	};

3. Create a new file in your js/router/routes folder called chatServer.js.	

4. Add the following code to your chatServer.js file.

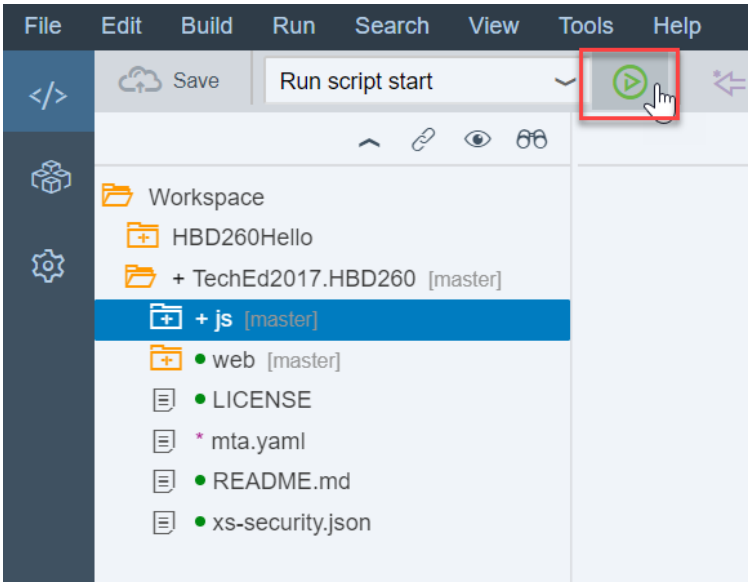
   The Node.js module for Web Sockets which we are going to use is **ws**. Require it and create a new instance of the **WebSocketServe**r.

   This is then a recommended implementation for the remainder of the Web Sockets functionality to both receive and send messages.

   Note: if you don't want to type this code, we recommend that you cut and paste it from this web address https://github.com/I809764/TechEd2017.HBD260/blob/snippets/ex3/ex3_21

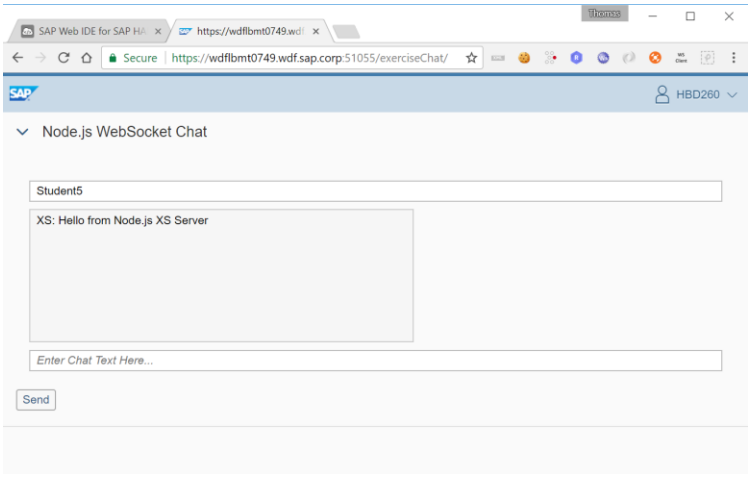
```
/*eslint no-console: 0, no-unused-vars: 0, new-cap: 0*/
"use strict";
var WebSocketServer = require("ws").Server;
var express = require("express");

module.exports = function(server) {
	var app = express.Router();
	app.use(function(req, res) {
		var output = "<H1>Node.js Web Socket Examples</H1></br>" +
			"<a href=\"/exerciseChat\">/exerciseChat</a> - Chat Application for Web Socket Example</br>";
		res.type("text/html").status(200).send(output);
	});
	var wss = new WebSocketServer({
		server: server,
		path: "/node/chatServer"
	});

	wss.broadcast = function(data) {
		wss.clients.forEach(function each(client) {
			try {
				client.send(data);
			} catch (e) {
				console.log("Broadcast Error: %s", e.toString());
			}
		});
		console.log("sent: %s", data);

	};

	wss.on("connection", function(ws) {
		ws.on("message", function(message) {
			console.log("received: %s", message);
			wss.broadcast(message);
		});
		ws.send(JSON.stringify({
			user: "XS",
			text: "Hello from Node.js XS Server"
		}));
	});

	return app;
};
```

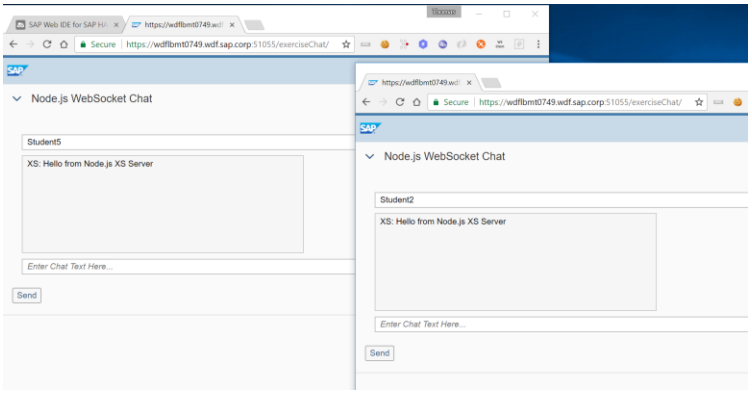
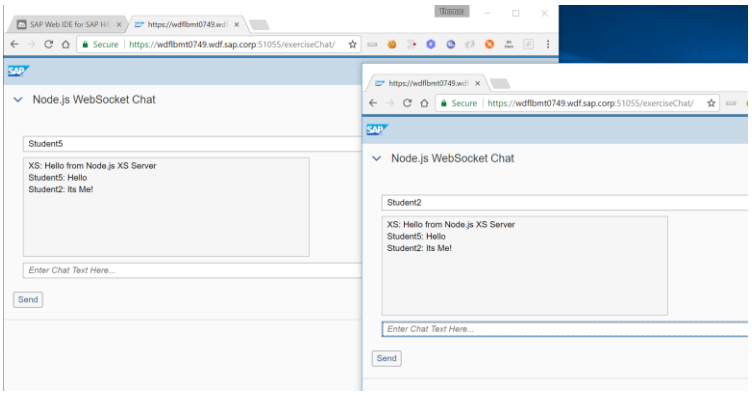
5. We can now run the **js** module.



6. You should see that the build and deploy was successful.

7. In the browser tab, we've been using for testing, change the path in the browser to **/exerciseChat**. You should see the simple chat user interface.



8. Open a second browser window and cut and paste the chat application URL into it.	
9. Anything you type into either window is sent to the server and then pushed out to all listeners. If you want to test further open more than two browser windows.	

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