



Intel® Endpoint Management Assistant (Intel® EMA)

JavaScript Libraries Guide

Intel® EMA Version: 1.12.1

Document update date: Tuesday, November 21, 2023

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1 Introduction

Intel® Endpoint Management Assistant (Intel® EMA) is a software application that provides an easy way to manage Intel vPro® platform-based devices in the cloud, both inside and outside the firewall. Intel EMA is designed to make Intel® AMT easy to configure and use so that IT can manage devices equipped with Intel vPro platform technology without disrupting workflow. This in turn simplifies client management and can help reduce management costs for IT organizations.

Intel EMA and its management console offer IT a sophisticated and flexible management solution by providing the ability to remotely and securely connect Intel AMT devices over the cloud. Benefits include:

- Intel EMA can configure and use Intel AMT on Intel vPro platforms for out-of-band, hardware-level management
- Intel EMA can manage systems using its software-based agent, while the OS is running, on non-Intel vPro® platforms or on Intel vPro® platforms where Intel AMT is not activated
- Intel EMA can be installed on premises or in the cloud
- You can use Intel EMA's built-in user interface or call Intel EMA functionality from APIs

1.1 Overview

This document describes how to use various JavaScript libraries to perform different actions for Intel EMA. This is used alongside with Intel EMA REST API. The developer should use Intel EMA REST API first whenever it is possible, and then use these JavaScript libraries for the features not supported by Intel EMA REST API.

Refer to the following documents:

- *Intel® EMA Server Installation and Maintenance Guide* for the description of different Intel® EMA servers and the overview of Intel® EMA architecture.
- *Intel® EMA Administration and Usage Guide* for the description of different features and user roles and naming conventions.

1.2 High-level flow of operation

The flow of performing an operation is listed in order:

1. Use the AJAX cookie to connect to Intel EMA AJAX server.
2. Depending on the target operations, the flow varies:
 - For the operation (remote desktop, remote terminal, or remote file browsing) that needs a continuous tunnel between the web browser and the target endpoint, this tunnel (web browser - Intel EMA AJAX server - Intel EMA Swarm server - endpoint) will be established. Then the web browser can send the request and get the response.
 - For Intel® AMT power operations, the web browser is sending the WSMAN command to the target endpoint. Intel EMA servers are simply forwarding the WSMAN command to the target endpoint and forwarding the response back to the web browser.
 - For the operation (remote WMI, remote file search, etc.) that can be sent to multiple endpoints at the same time,
 - Intel EMA AJAX server is broadcasting this request to all Intel EMA Swarm servers. Then Intel EMA Swarm servers will send the request to the target endpoints.
 - The response is also broadcasted by Intel EMA Swarm server to all Intel EMA AJAX servers, and then the source Intel EMA AJAX server will send the response back to the web browser.
 - For the remaining operation (getting endpoint information, uploading files to server, etc.), Intel EMA AJAX server is processing it directly.

1.3 File list

The JavaScript libraries (ema*.js) are automatically installed in the Intel EMA website root folder (e.g., C:\inetpub\wwwroot) during Intel EMA server installation. These libraries are not included in the Samples folder with the sample files described below.

The sample files are in the folder [Intel EMA installation package folder] \Samples. These files are not automatically hosted on the Intel EMA website during installation. These sample files are implemented using bare-minimum code to demonstrate how to use the API and do not use secure coding practices to guard against security concerns like cross-site scripting.



IMPORTANT: These samples should *never* be hosted in a production environment.

For hosting in a test environment for development purposes, copy the Samples folder to the Intel EMA website root folder (e.g., C:\inetpub\wwwroot).

JavaScript libraries:

Name	Comments
ema.js	This is the main library and is always required. This needs to be referenced before other library. This handles the connection to Intel EMA AJAX server and all other operations not covered by the libraries below.
ema_desktop.js	This is the library that performs the remote in-band desktop for a single endpoint.
ema_desktop_oob.js	This is the library that performs the remote out-of-band desktop for a single endpoint.
ema_terminal.js	This is the library that performs the remote in-band or out-of-band terminal for a single endpoint.
ema_files.js	This the library that performs the remote file browsing for a single endpoint.

Sample files:

Name	Comments
EndpointAMTWebPage.html	This is the sample file for redirecting to Intel® AMT web site on the endpoint. This uses ema.js.
EndpointFileOps.html	This is the sample file for remote file browsing. This uses ema.js and ema_files.js.
EndpointFileSearch.html	This is the sample file for remote file search. This uses ema.js.
EndpointFileShortOps.html	This is the sample file for remote file short operations. This uses ema.js.
EndpointProcessesOps.html	This is the sample file for getting process list and launching/terminating a process. This uses ema.js.
EndpointRDPIband.html	This is the sample file for remote in-band desktop. This uses ema.js and ema_desktop.js.
EndpointKVMOutOfBand.html	This sample file contains the sample HTML interface for out-of-band remote desktop. This uses ema.js and the companion sample file EndpointKVMOutOfBand.js.
EndpointKVMOutOfBand.js	This sample file contains sample Javascript for out-of-band remote desktop. This uses ema_desktop_OOB.js.
EndpointKVMOutOfBand.html	This is the sample file for remote out-of-band desktop. This uses ema.js and ema_desktop_oob.js.
EndpointTerminal.html	This the sample file for remote in-band and out-of-band terminal. This uses ema.js

	and ema_terminal.js.
EndpointWMIQuery.html	This is the sample file for running WMI queries and methods. This uses ema.js.

1.4 Authentication

To get authenticated and connected to Intel EMA AJAX server, use the stored AJAX cookie generated using Rest API. Intel EMA AJAX server will find the mapped user account for this cookie if this cookie is valid.

For Intel AMT power operations, the Intel AMT credential is stored with encryption in Intel EMA database. To perform an Intel AMT power operation, the flow in order is as follows:

1. The web browser is authenticated and connected to Intel EMA AJAX server.
2. The web browser gets the encrypted routing cookie for the target endpoint. The encrypted routing cookie contains the Intel AMT credential for that endpoint. This routing cookie expires after 60 minutes from the creating time.
3. The web browser sends the power operation request with the routing cookie to Intel EMA AJAX server. Intel EMA AJAX server will parse it send it to the endpoint via Intel EMA Swarm server.

1.5 Authorization

There are two different types of authorization checking.

User access:

- The access control is done by user's primary role and the endpoint group's access list (in the form of user group). Please see the *Intel® EMA Administration and Usage Guide* for details.

Endpoint group's policy set:

- An endpoint is belonging to one and only one endpoint group.
- Each endpoint group has a predefined policy set.
- The policy set defined policies that allow or disallow certain type of operation. Please see the *Intel® EMA Server Installation and Maintenance Guide* for details.

2 ema.js

This is the main library and is always required. This needs to be referenced before other library. This handles the connection to Intel® EMA AJAX server and many other operations.

2.1 Main entry point

EMA_SERVER() function:

Input / Output in order	Type	Comments
Output	EMA_SERVER	This is the main object to be used for connecting to Intel EMA AJAX server and for passing to the main entry points of other libraries.

Flow after getting the EMA_SERVER object:

1. (Optional) Use browser (type: string) and browserVer (type: number) members to check the current hosting web browser. Currently, these two members will show correct information for Internet Explorer, Chrome, and Firefox. The developer can use this information to limit the supported web browsers.
2. Set the applicationId (type: string) of that object. This is used by the browser to send application id string so that Intel EMA AJAX server knows what application is connecting.
3. Set the callback to the events that one wants to handle.
4. Start the connection.
5. Then call the target method for the target feature.

Sample files that use this:

- All sample files.

2.2 Starting/stopping the connection to the Intel® EMA AJAX server

Flow after getting the EMA_SERVER object, one should start connecting to Intel EMA AJAX server:

1. Get the AJAX cookie using Rest API.
2. Use connect method with the stored AJAX cookie to connect to Intel EMA AJAX server.
3. When one needs to disconnect from Intel® EMA AJAX server, use disconnect method.

connect method

Input / Output in order	Type	Comments
Input 1	string	This is the AJAX cookie used for connection.
Input 2	string	This is the path to the AJAX server. <ul style="list-style-type: none">• For websocket connection, this is "https://[ema.com]/ajax/,wss://[ema.-com]/ajax/", replacing [ema.com] with the correct server URL.• For normal AJAX connection, this is "https://[ema.com]/ajax/", replacing [ema.com] with the correct server URL.
Input 3	Boolean	"allowWSCrossOrigin". Values True or False (Default). By default (False), if the web socket request's target URL does not match the URL on the web browser, Intel EMA will reject the request before sending. If set to True, Intel EMA will not

Input / Output in order	Type	Comments
		perform this URL check. Setting this to True can be useful for cases of third-party websites using Intel EMA JavaScript libraries to communicate with the Intel EMA server, where the third-party website and the Intel EMA web server have different URLs.
Output	none	This will trigger onStateChanged event to be fired. The connection result is returned in that event.

disconnect method

Disconnect from Intel EMA AJAX server. This will trigger onStateChanged event to be fired. The connection result is returned in that event.

Sample files that use this:

- All sample files.

2.3 WMI queries and methods

Call sendWmiQueryToEndpoints method:

This sends a WMI invocation to one or more endpoints.

Input / Output in order	Type	Comments
Input 1	string	These are endpoints' IDs, each in HEX without hyphen. Each ID is directly appended after the other. Each endpoint ID string length is 64. If the string length of endpoints % 64 is not 0, this request will be dropped.
Input 2	number	This is the ID of this request, which can be any number. This is used at the onWmiResponse event callback to associate a WMI response to the original WMI request.
Input 3	number	This is only meaningful for "W" (query). This is the number of starting "rows" to skip reporting for the WMI query result.
Input 4	string	This is W or M appended with the WMI namespace. For example, WROOT\CIMV2. Use "W" when this is a WMI query. Use "M" when this is a WMI method.
Input 5	string	For "W" (query), this is the query string. For "M", this is the target WMI object.
Input 6	string	This is only defined for "M" (method). This is the WMI method.
Input 7	object	This is only defined for "M" (method). This are the WMI arguments in JSON format. Name is the argument name. Value is the argument value. Value can be of 3 types: string, number, and Boolean.
Output	Boolean	True if it is successful. The result will be at the onWmiResponse event. For policy checking, for the endpoint where MANAGE and TCPRELAY policies are not allowed, <ul style="list-style-type: none"> • Intel EMA AJAX server's Alert session's AlertCommands.MultiTargetHopMessage flow will filter it out and not send the request to that endpoint. For user access checking, for the endpoint that the user does not have Execute right,

Input / Output in order	Type	Comments
		<ul style="list-style-type: none"> Intel EMA AJAX server's Alert session's AlertCommands.MultiTargetHopMessage flow will add audit log to Intel® EMA database, filter it out, and not send the request to that endpoint.

Sample files that use this:

- EndpointProcessesOps.html.
- EndpointWMIQuery.html.

2.4 Processes list and operations

These are all done via WMI queries.

For enumerate, terminate, and launch, the result is all in onWmiResponse event. We need a way to differentiate them in onWmiResponse event. One can use the request ID input of sendWmiQueryToEndpoints method to associate the onWmiResponse event with the initial request. Please the sample codes for more details.

Sample files that use this:

- EndpointProcessesOps.html

2.5 File search

Current limitation:

- This feature depends on Windows Indexing. It will only find files that are in the "indexed" locations.
- "filter" input only accepts characters from a to z, from A to Z, from 0 to 9, *, and ?. All other characters will be filtered out.
- The maximum returned search result is about 20,000 characters. Any results after the limit will be truncated. In the future, we will support "pagination" type of request and result.

Call sendSearchToEndpoints method:

Send a file search query to a list of endpoints.

Input / Output in order	Type	Comments
Input 1	string	This is an array of string. Each item is the endpoint ID in HEX without hyphen. Each endpoint ID string length is 64. If some endpoints' ID string length is not 64, this request will be dropped.
Input 2	string	This is the search filter. Despite that we only search for file/folder name, the search syntax is similar to Windows search with the wildcard = * or ?. <ul style="list-style-type: none"> Search for ABC and ABC* : It finds "ABC", "ABCDE", "ABC DEF", "XYZ ABC DEF", but it does not find "XYZABC". Search for *ABC* and *ABC: It finds "ABC", "ABCDE", "ABC DEF", "XYZ ABC DEF", and "XYZABC". Search for "ABC": It finds "ABC", "ABC DEF", and "XYZ ABC DEF", but it does not find "ABCDE" and "XYZABC".
Input 3	number	This is the request ID, which can be any number. This is used at the onSearchResponse event callback to associate a response to the original request
Output	Boolean	True if it is successful.

Input / Output in order	Type	Comments
		<p>The result will be at onSearchResponse event.</p> <p>For policy checking, for the endpoint where FILES and TCPRELAY policies are not allowed,</p> <ul style="list-style-type: none"> Intel EMA AJAX server's Alert session's AlertCommands.MultiTargetHopMessage flow will filter it out and not send the request to that endpoint. <p>For user access checking, for the endpoint that the user does not have Execute right,</p> <ul style="list-style-type: none"> Intel EMA AJAX server's Alert session's AlertCommands.MultiTargetHopMessage flow will add audit log to Intel EMA database, filter it out, and not send the request to that endpoint.

For sending to all endpoints in an endpoint group, call sendSearchToEndpointGroup method:

The result will be at onSearchResponse event. The only difference from sendSearchToEndpoints is the 1st input. For this method, the 1st string input is an endpointGroupId, which is the ID of the target endpoint group in HEX form without hyphen.

Sample files that use this:

- EndpointFileSearch.html

2.6 Event callbacks

This subsection is a summary of all the events that will be used in each feature provided by ema.js. The reader can go to each feature description directly and then refer back to this section when needed.

2.6.1 onDebugMessage event

This event will be fired when some debugging information is needed.

Parameter in order	Type	Comments
Parameter	string	This is the debug information.

2.6.2 onStateChanged event

This event will be fired when the connection (to AJAX server) state is changed. This event should always be handled in the user's codes.

Call connect or connectWithPassword method to start receiving this event.

Parameter in order	Type	Comments
Parameter	number	<p>This is the connection state. Check the definitions of EMA_GLOBAL.EMA_CONNECTION object for more details.</p> <p>If one receives EMA_GLOBAL.EMA_CONNECTION.DISCONNECTED before reaching EMA_GLOBAL.EMA_CONNECTION.CONNECTED_LOGIN_COMPLETE, it means that AJAX server is not reachable, or user credential is not valid (if using connectWithPassword method) and AJAX cookie is not valid (if using connect method).</p>

2.6.3 onWmiResponse event

This will be triggered by `sendWmiQueryToEndpoints` method. This is the result of the WMI query or method.

Parameter in order	Type	Comments
Parameter 1	string	This is the target endpoint ID in HEX format without hyphen.
Parameter 2	number	This is the request ID number passed when we sent the WMI request, used at the <code>onWmiResponse</code> event callback to associate a WMI response to the original WMI request.
Parameter 3	number	This is the number of rows returned in <code>WMI_DATA</code> , and is meaningful only for WMI query, not for WMI method. For a failed WMI query or method, this number is the Windows error code.
Parameter 4	WMI_DATA	This is the WMI result. For a failed WMI query or method, this is null.

2.6.4 onSearchResponse event

This will be triggered by `sendSearchToEndpoints` method and by `sendSearchToEndpointGroup` method.

Parameter in order	Type	Comments
Parameter 1	string	This is the target endpoint ID in HEX format without hyphen.
Parameter 2	number	This is the request ID number passed when we sent the request, used at the <code>onSearchResponse</code> event callback to associate a response to the original request.
Parameter 3	number	This is the number of rows returned in <code>FILE_SEARCH_DATA</code> .
Parameter 4	FILE_SEARCH_DATA	This is the file search result.

2.7 JSON object definitions

This subsection is a summary of all the JSON objects that will be used in each feature provided by `ema.js`. The reader can go to each feature description directly and then refer back to this section when needed.

2.7.1 WMI_DATA object

The overall data is in a table format with the number of columns and the number of rows. The 1st row defines all the captions/names of the table.

Name	Type	Comments
<code>rdata</code>	string	This is the whole data content of <code>WMI_DATA</code> .
<code>totalLength</code>	number	This is the byte size of the whole WMI response data, not just <code>WMI_DATA</code> .
<code>count</code>	number	This is the total number of entries in the WMI result. This should be <code>column count * row count</code> .

Name	Type	Comments
colCount	number	This is the number of columns for the WMI result.
rowCount	number	This is the number of rows for the WMI result.
valType	number	This is the data type of this table cell. Check the definition of EMA_GLOBAL.EMA_WMI_DBTYPE object.
valTypeStr	string	This is the data type of this table cell based on valType.
valLen	string	This is the byte size for this table cell.
valRaw	string	This is the raw data for this table cell.
val	string number boolean	This is the translated value for this table cell, based on valTypeStr and valRaw.
getNext	function	Use this method to get the next table cell in the WMI result. This needs to be called first to get the first cell. When it returns false, then it does not have any more cell.

At the onWmiResponse event, WMI_DATA is passed. Then the flow is

1. Use getNext method to move to the next table cell entry.
2. Then read the valXXX members which store the value of the cell entry. One can use colCount member to determine when the result is on a new row.
3. Go back to step 1 and repeat, until getNext returns false.

2.7.2 FILE_SEARCH_DATA object

Name	Type	Comments
data	string	This is the data content of this object.
totalLength	number	This is the length of data.
fileName	string	This is the file name of the current item in the results.
filePath	string	This is the file path of the current item in the results.
fileSize	number	This is the file size of the current item in the results. If this is 0, then this entry should be a folder.
getNext	function	Use this method to get the next item in the search result. This needs to be called first to get the first item. When it returns false, then it does not have any more item.

At the onSearchResponse event, FILE_SEARCH_DATA is passed. Then the flow is

1. Use getNext method to move to the next entry.
2. Then read the fileName, filePath, and fileSize members for the entry.
3. Go back to step 1 and repeat, until getNext returns false.

2.7.3 FILE_OPERATOR object

Name	Type	Comments
readFile	function	This is to enter operation information for reading the remote file. The only string parameter is the file path on the target endpoint. For example, C:\codes\settings.txt or C:\codes\settings.txt.

Name	Type	Comments
writeFile	function	<p>This is to enter operation information for creating a new remote file (or replacing the old one with the new file).</p> <p>The first string parameter is the file path on the target endpoint. For example, C:\codes\settings.txt or C:\codes\settings.txt.</p> <p>The second string parameter is the data to write to the file. We only take the first 60KB data.</p>
appendFile	function	<p>This is to enter operation information for appending the remote file with the new data. It creates a new file if the file does not exist.</p> <p>The first string parameter is the file path on the target endpoint. For example, C:\codes\settings.txt or C:\codes\settings.txt.</p> <p>The second string parameter is the data to append to the file. We only take the first 60KB data.</p>
deleteFile	function	<p>This is to enter operation information for deleting the remote file.</p> <p>The only string parameter is the file path on the target endpoint. For example, C:\codes\settings.txt or C:\codes\settings.txt.</p>
checkDir	function	<p>This is to enter operations information for checking if the folder exists.</p> <p>The only string parameter is the directory to check. For example, C:\codes or C:\codes.</p>
execute	function	<p>This is to really send out the request. For example, to do a "read file", one run readFile and then run execute.</p>
getNextResult	function	<p>This is used at the operation result callback to go through all results. The result is a FILE_OPERATOR_RESULT object.</p> <p>To get all the results in onShortFileOperation result callback, use a while loop until getNextResult returns null.</p>

2.7.4 FILE_OPERATOR_RESULT object

Name	Type	Comments
operation	string	This is the target operation in the original request.
file	string	This is the target file or directory in the original request.
result	number	<p>This is the result status of the request.</p> <p>For read (readFile), if it is successful, the result is the same as the datalen. If the file to read does not exist or it is not a file, the result and datalen are 0.</p> <p>For delete (deleteFile), if it is successful, the result is 0. If the result is not 0, the request failed (e.g., due to file not existing).</p> <p>For checkdir (checkDir), if the folder exists, the result is 1. Otherwise, it is 0.</p> <p>For write or append (writeFile or appendFile), if it is successful, the result is 1. Otherwise, it is 0.</p>
datalen	number	This is the data length of the result data. This is only meaningful for readFile.

Name	Type	Comments
data	string	This is the data of the result. This is only meaningful for readFile.

2.8 Enumeration object definitions

This subsection is a summary of all the objects used as enumeration. The user can skip this subsection and go to each feature directly. Then refer back to this subsection later.

All of them are defined in EMA_GLOBAL object.

2.8.1 AJAX server connection state

```
EMA_GLOBAL.EMA_CONNECTION: {
    DISCONNECTED: 0,
    CONNECTING: 1,
    CONNECTED_LOGIN_COMPLETE: 2,
    ERROR: 3
}
```

2.8.2 Swarm server tunnel connection state

```
EMA_GLOBAL.EMA_TUNNEL: {
    DISCONNECTED: 0,
    CONNECTING: 1,
    GOT_TUNNEL: 2,
    CONNECTED: 3
}
```

2.8.3 Swarm server tunnel connection's error code

```
EMA_GLOBAL.EMA_TUNNEL_ERRORCODE: {
    NONE: -1,
    UNKNOWN: 0,
    NOLEADERFOUND: 1,
    TARGETNOTFOUND: 2,
    TLS_FAILED: 3,
    REMOTE_DISCONNECT: 4,
    EXCEPTION: 5,
    LEADER_DISCONNECT: 6,
    CONSOLE_DISCONNECT: 7,
    BADCOMMAND: 8,
}
```

```
AUTH_FAILED: 9,  
AUTH_REQUIRED: 10,  
FORCE_DISCONNECT: 11,  
DUPLICATE_AGENT: 12,  
MAXSOCKETS_REACHED: 13,  
DATAOVERFLOW: 14,  
AUTOCLOSE: 15,  
ACCESSDENIED: 16,  
HTTPREQUEST: 17,  
LICENSELIMIT: 18,  
DIRECTCONNECTFAIL: 19,  
UNKNOWNCOMMAND: 20,  
TIMEOUT: 21,  
POLICYNOTALLOWED: 22,  
UNSUPPORTED: 23  
}
```

2.8.4 AJAX server connection mode

```
EMA_GLOBAL.EMA_CONNECTMODE: {  
    HTTP: 0,  
    WEBSOCKET: 1,  
    WEBRTC: 2 // currently not supported anymore  
}
```

2.8.5 User's allowed action on endpoint group

```
EMA_GLOBAL.EMA_USER_ALLOWED_ACTION: {  
    NONE: 0,  
    READ: 1,  
    CREATE: 2,  
    UPDATE: 3,  
    DELETE: 4  
}
```

2.8.6 File browsing object type

```
EMA_GLOBAL.EMA_FILES_CONTENT_TYPE: {  
    DRIVE: 1,  
    FOLDER: 2,
```

```
        FILE: 3
    }
```

2.8.7 File upload state

```
EMA_GLOBAL.EMA_FILE_UPLOAD_STATE: {
    DONE: 0,
    INPROGRESS: 1,
    ERROR: 2
}
```

2.8.8 WMI result data type

```
EMA_GLOBAL.EMA_WMI_DBTYPE: {
    EMPTY: 0,
    NULL: 1,
    I2: 2,
    I4: 3,
    R4: 4,
    R8: 5,
    CY: 6,
    DATE: 7,
    BSTR: 8,
    IDISPATCH: 9,
    ERROR: 10,
    BOOL: 11,
    VARIANT: 12,
    IUNKNOWN: 13,
    DECIMAL: 14,
    I1: 16,
    UI1: 17,
    UI2: 18,
    UI4: 19,
    I8: 20,
    UI8: 21,
    GUID: 72,
    VECTOR: 0x1000,
    ARRAY: 0x2000,
    BYREF: 0x4000,
```

```
RESERVED: 0x8000,  
BYTES: 128,  
STR: 129,  
WSTR: 130,  
NUMERIC: 131,  
UDT: 132,  
DBDATE: 133,  
DBTIME: 134,  
DBTIMESTAMP: 135  
}
```

2.8.9 Intel® AMT AJAX path error type

```
EMA_GLOBAL.EMA_GETROUTINGCOOKIE_ERROR: {  
  NONE: 0,  
  NO_AJAXCOOKIE: 1,  
  INVALID_AJAXCOOKIE: 2,  
  NO_ENDPOINTID: 3,  
  NO_JSONINPUT: 4,  
  NO_ENDPOINTINFO: 5,  
  ACTIONFORBIDDEN_POLICY: 6,  
  ACTIONFORBIDDEN_USERACCESS: 7,  
  NO_USERNAME: 8,  
  NO_ENCRYPTEDCOOKIE: 9,  
  CANNOT_WRITE_RESPONSE: 10  
}
```

2.8.10 Remote desktop related enumeration

```
EMA_GLOBAL.EMA_DESKTOP_STATE: {  
  DISCONNECTED: 0,  
  CONNECTING: 1,  
  PAUSED: 2,  
  UNPAUSED: 3  
}  
EMA_GLOBAL.EMA_DESKTOP_TOUCH: {  
  DISABLED: 0,  
  ENABLED: 1  
}
```

```
EMA_GLOBAL.EMA_DESKTOP_TUNNEL: {  
  DISCONNECTED: 0,  
  CONNECTED: 1  
}
```

2.8.11 Remote terminal related enumeration

```
EMA_GLOBAL.EMA_TERMINAL_STATE: {  
  DISCONNECTED: 0,  
  CONNECTING: 1,  
  CONNECTED: 2  
}  
EMA_GLOBAL.EMA_TERMINAL_TUNNEL: {  
  DISCONNECTED: 0,  
  CONNECTED: 1  
}
```

3 ema_files.js

This library is used together with ema.js. It provides the following features: file/folder browsing, files upload, file download, file/folder removal, file/folder renaming, and folder creation.

Since the endpoint ID is passed at the object constructor, remember to create a new EMA_SERVER_REMOTE_FILES object when you have a different endpoint.

Beginning with Intel EMA 1.12.0 file names support Unicode characters. Previous versions of Intel EMA only support ASCII characters.

3.1 Access and policy checking

Policy checking is done based on the following order:

1. When the front-end tries to get the best Swarm server for the target endpoint, AJAX server's Alert session checks if the target endpoint group has TCPRELAY policy.
 - If it fails, AJAX server sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.POLICYNOTALLOWED) back and disconnects the tunnel connection.
2. For remote (in-band, out-of-band) terminal, remote file, and remote RDP operations, when the initial setup message is sent to the target endpoint (via Intel® EMA servers), the endpoint agent checks Command, FILES, and KVM policies.
 - If they are all disabled, endpoint will reject this operation and AJAX server sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.REMOTE_DISCONNECT) back and disconnects the tunnel connection.
3. When the starting "file prompt" message is sent to AJAX server, AJAX server's Alert session checks if the target endpoint group has FILES policy.
 - If it fails, AJAX server sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.POLICYNOTALLOWED) back and disconnects the tunnel connection.

User access checking:

- When the front-end tries to get the best Swarm server for the target endpoint, AJAX server's Alert session checks the following
 - If the user does not have the Files access right for the endpoint, AJAX server adds audit log, sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.POLICYNOTALLOWED) back, and disconnects the tunnel connection.
 - If the endpoint ID has correct format but does not exist, AJAX server adds audit log to the Intel® EMA database, sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.TARGETNOTFOUND) back, and disconnects the tunnel connection.
 - If Intel® EMA server cannot get the correct information for this endpoint, AJAX server adds audit log to the Intel® EMA database, sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.TARGETNOTFOUND) back, and disconnects the tunnel connection.
 - If AJAX server cannot find the Swarm server for this endpoint, AJAX server sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.NOLEADERFOUND) back, and disconnects the tunnel connection.

3.2 Main entry point

EMA_SERVER_REMOTE_FILES function:

Input / Output in order	Type	Comments
Input 1	EMA_SERVER	This is the object returned by the main entry point of ema.js. When we call EMA_SERVER_REMOTE_FILES function, the connection to AJAX server (performed by ema.js) should be established already.
Input 2	string	The value is the target endpoint ID, in HEX format (without hyphen).
Output	EMA_SERVER_REMOTE_FILES	This is the main object to be used for files/folders operations.

Sample files that use this:

- EndpointFileOps.html

3.3 Starting the tunnel connection to endpoint via Swarm server

Call start method:

This should be called before calling other file operation methods.

Input / Output in order	Type	Comments
Output	none	If the method is successful, it returns true (type: Boolean); otherwise, it returns false (type: Boolean). This will trigger firing onStateChanged event. If the method works, start monitoring the onStateChanged event.

Sample files that use this:

- EndpointFileOps.html

3.4 Files browsing

Call the requestDirectoryPath(path) method:

Input / Output in order	Type	Comments
Input 1	string	For Windows endpoint, it needs to have *.* to get all the folder contents. For example, C:\Codes*.* or C:\Codes*.*. This can also be a file. The file information will be returned.
Output	none	The result event onFilesResponse will be fired when it is ready. If the showHidden member is true before this method is called, then the hidden files will also be returned. If the directory does not exist, it will return the list of drives for this endpoint.

Sample files that use this:

- EndpointFileOps.html

3.5 Files uploading

Call `sendFiles` method:

Wait till the current files uploading request is done before sending a new files uploading request.

Input / Output in order	Type	Comments
Input 1	FileList	This is the standard JavaScript FileList object, returned by the files property of the HTML <input> element.
Input 2	string	This is the target path on the endpoint. For Windows endpoint, this needs to end with path separator, e.g., C:\\temp\\ or C:\\temp\\.
Output	none	The result will be at <code>onUploadState</code> event. If the target path already has a file with the same name, that original file will be replaced. If the target path does not exist, <code>onUploadState</code> does not return an error. The file upload will continue until it is all transmitted; however, the file will not be generated.

Sample files that use this:

- EndpointFileOps.html

3.6 Files upload cancellation

Call `cancelSendFiles` method:

This will trigger `onUploadState` event to report `EMA_GLOBAL.EMA_FILE_UPLOAD_STATE.DONE` state.

Sample files that use this:

- EndpointFileOps.html

3.7 File downloading

Call `fileDownloadStart` method:

This method only handles a single file download. One should wait till the current downloading is done, before sending a new downloading request.

Files of size 0 bytes are not supported.

Input / Output in order	Type	Comments
Input 1	string	This is the target file to download.
Input 2	function	This is the callback when the downloading response is sent back. It is called <code>onFileDownload</code> .
Output	number	This is the ID of this current downloading request. This can be used to cancel this downloading.

The callback function `onFileDownload`:

Parameter in order	Type	Comments
Parameter 1	EMA_SERVER_REMOTE_FILES	This is the EMA_SERVER_REMOTE_FILES object.
Parameter 2	string	This is the target file, including path.
Parameter 3	number	This is the current download position in bytes. Based on position and size, one can calculate the downloading percentage.
Parameter 4	number	This is the total file size in bytes. If this is 0, then there is no file to be downloaded. When position == size, the download is done.
Parameter 5	string	This is the data in transit in the format of string. This is the aggregated data downloaded so far. When the download is done, this data can be saved into a file. Check the sample codes for example.

Sample files that use this:

- EndpointFileOps.html

3.8 File downloading cancellation

Call `cancelFileDownload` method:

Input / Output in order	Type	Comments
Input	number	This is the ID of this current downloading request. This is returned by <code>fileDownloadStart</code> method.

Sample files that use this:

- EndpointFileOps.html

3.9 File/folder moving/renaming

Call `fileMove` method:

Input / Output in order	Type	Comments
Input 1	string	This is the target file or folder.
Input 2	string	This is the new file or folder.
Input 3	function	This is the callback function when the moving/renaming response is sent back. It is called <code>onFileMove</code> .

The callback function `onFileMove`:

Parameter in order	Type	Comments
Parameter 1	EMA_SERVER_REMOTE_FILES	This is the EMA_SERVER_REMOTE_FILES object.

Parameter in order	Type	Comments
Parameter 2	string	This is the old file or folder.
Parameter 3	string	This is the new file or folder.
Parameter 4	number	This is return code. This is 1 if it succeeded, and error code if it failed. For agent on Windows, it returns system error code.

Sample files that use this:

- EndpointFileOps.html

3.10 File/folder removal

Call fileDelete method:

Input / Output in order	Type	Comments
Input 1	string	This is the target file or the target folder to be deleted.
Input 2	Boolean	This is meaningful if the target is a folder. This indicates if we should do recursive removal for folder content.
Input 3	function	This is the callback function when the removal response is sent back. It is called onFileDelete.

The callback function onFileDelete:

Parameter in order	Type	Comments
Parameter 1	EMA_SERVER_REMOTE_FILES	This is the EMA_SERVER_REMOTE_FILES object.
Parameter 2	string	This is the target file or the target folder to be deleted.
Parameter 3	Boolean	This is meaningful if the target is a folder. This indicates if we should do recursive removal for folder content.
Parameter 4	number	This is return code. This is 1 if it succeeded, and 0 if it failed. If the target path is a folder with content, fileDelete() will fail without doing recursive removal.

Sample files that use this:

- EndpointFileOps.html

3.11 Folder creation

Call createDirectory method:

Input / Output in order	Type	Comments
Input 1	string	This is the target folder to create.
Input 2	function	This is the callback function when the creating response is sent back. It is called onFileCreateDir.

The callback function onFileCreateDir:

Parameter in order	Type	Comments
Parameter 1	EMA_SERVER_REMOTE_FILES	This is the EMA_SERVER_REMOTE_FILES object.
Parameter 2	string	This is the target folder to create.
Parameter 3	number	This is return code. This is 1 if it succeeded, and error code if it failed. For agent on Windows, it returns system error code.

Sample files that use this:

- EndpointFileOps.html

3.12 Event callbacks

This subsection is a summary of all the events that will be used in each feature provided by this library. The reader can go to each feature description directly and then refer back to this section when needed

3.12.1 onDebugMessage event

This event will be fired when some debugging information is needed.

Parameter in order	Type	Comments
Parameter	string	This is the debug information.

3.12.2 onStateChanged event

This event will be fired when the connection (to endpoint via Swarm server) state changes.

Parameter in order	Type	Comments
Parameter 1	EMA_SERVER_REMOTE_FILES	This is the event source.
Parameter 2	number	This is the tunnel (web page via Swarm server to endpoint) connection state. Check EMA_GLOBAL.EMA_TUNNEL object on ema.js for details.

If you get EMA_GLOBAL.EMA_TUNNEL.DISCONNECTED before EMA_GLOBAL.EMA_TUNNEL.CONNECTED, then we cannot get the tunnel to the endpoint correctly.

When the new state is EMA_GLOBAL.EMA_TUNNEL.DISCONNECTED, you should check if tunnelErrorCode member > EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.NONE for tunnel failure. For the error value mapping, check EMA_GLOBAL.EMA_TUNNEL_ERRORCODE object definition of ema.js for details.

3.12.3 onFilesResponse event

This event will be fired when we get the result of the files browsing operation.

Parameter in order	Type	Comments
Parameter 1	EMA_SERVER_REMOTE_FILES	This is the event source.
Parameter 2	FILE_ITEM[]	This is the array FILE_ITEM objects.

3.12.4 onUploadState event

This event will be fired when we get the progress result of the files uploading operation.

Parameter in order	Type	Comments
Parameter 1	EMA_SERVER_REMOTE_FILES	This is the event source.
Parameter 2	number	This is the file upload state. It can be EMA_GLOBAL.EMA_FILE_UPLOAD_STATE.DONE, EMA_GLOBAL.EMA_FILE_UPLOAD_STATE.INPROGRESS, or EMA_GLOBAL.EMA_FILE_UPLOAD_STATE.ERROR.
Parameter 3	string	This is the file name. This is null if state == EMA_GLOBAL.EMA_FILE_UPLOAD_STATE.DONE or EMA_GLOBAL.EMA_FILE_UPLOAD_STATE.ERROR.
Parameter 4	number	This is the total file size of the current file in bytes. This is 0 if state == EMA_GLOBAL.EMA_FILE_UPLOAD_STATE.DONE or EMA_GLOBAL.EMA_FILE_UPLOAD_STATE.ERROR.
Parameter 5	number	This is the current upload position of this file in bytes. This is 0 if state == EMA_GLOBAL.EMA_FILE_UPLOAD_STATE.DONE or EMA_GLOBAL.EMA_FILE_UPLOAD_STATE.ERROR.
Parameter 6	number	This is the current in-progress file index among the files list. This is only defined if state == EMA_GLOBAL.EMA_FILE_UPLOAD_STATE.INPROGRESS.
Parameter 7	number	This is the total files count in the files list. This is only defined if state == EMA_GLOBAL.EMA_FILE_UPLOAD_STATE.INPROGRESS.

3.13 JSON object definitions

This subsection is a summary of all the JSON objects that will be used in each feature provided by this library. The reader can go to each feature description directly and then refer back to this section when needed.

3.13.1 FILE_ITEM object

Name	Type	Comments
name	string	This is the file/folder/drive name.
date	Date	This is the last modified date, JavaScript Date object.

Name	Type	Comments
size	number	This is the low order bits of the overall size (first 32 bits). (It is 0 for non-file type.)
sizeh	number	This is the high order bits of the overall size (second 32 bits). (It is 0 for non-file type.)
type	number	This is the type. See the definition of EMA_GLOBAL.EMA_FILES_CONTENT_TYPE object.

4 ema_desktop.js

This library is used together with ema.js. This library will perform in-band remote desktop connection to the target endpoint.

Since the endpoint ID is passed at the object constructor, remember to create a new EMA_SERVER_REMOTE_DESKTOP object when you have a different endpoint.

4.1 Access and policy checking

Policy checking is done based on the following order:

1. When the front-end tries to get the best Swarm server for the target endpoint, AJAX server's Alert session checks if the target endpoint group has TCPRELAY policy.
 - If it fails, AJAX server sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.POLICYNOTALLOWED) back and disconnects the tunnel connection.
2. For remote (in-band, out-of-band) terminal, remote file, and remote RDP operations, when the initial setup message is sent to the target endpoint (via Intel® EMA servers), the endpoint agent checks Command, FILES, and KVM policies.
 - If they are all disabled, endpoint will reject this operation and AJAX server sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.REMOTE_DISCONNECT) back and disconnects the tunnel connection.
3. When the starting "RDP prompt" message is sent to AJAX server, AJAX server's Alert session checks if the target endpoint group has KVM policy.
 - If it fails, AJAX server sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.POLICYNOTALLOWED) back and disconnects the tunnel connection.

User access checking:

- When the front-end tries to get the best Swarm server for the target endpoint, AJAX server's Alert session checks the following
 - If the user does not have the KVM access right for the endpoint, AJAX server adds audit log to the Intel® EMA database, sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.POLICYNOTALLOWED) back, and disconnects the tunnel connection.
 - If the endpoint Id has correct format but does not exist, AJAX server adds audit log to the Intel® EMA database, sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.TARGETNOTFOUND) back, and disconnects the tunnel connection.
 - If the Intel EMA server cannot get the correct information for this endpoint, AJAX server adds audit log to Intel EMA database, sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.TARGETNOTFOUND) back, and disconnects the tunnel connection.
 - If AJAX server cannot find the Swarm server for this endpoint, AJAX server sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.NOLEADERFOUND) back, and disconnects the tunnel connection.

4.2 Web page requirements

Required element:

- A <canvas> element.

Required canvas style set-up:

Need a function to set up <canvas> element's width, max-width, and height styles.

When EMA_SERVER_REMOTE_DESKTOP is connected (by checking EMA_SERVER_REMOTE_DESKTOP object's state), these style values should be based on EMA_SERVER_REMOTE_DESKTOP object's targetScreenWidth and targetScreenHeight.

If full screen mode is supported, call EMA_SERVER_REMOTE_DESKTOP object's isCanvasInFullScreenMode function to check if the canvas is in full screen mode or not. If it is in the full screen mode, call EMA_SERVER_REMOTE_DESKTOP object's getTargetCanvasRenderingSizeInFullScreenMode function to get the width and height, instead of using EMA_SERVER_REMOTE_DESKTOP object's targetScreenWidth and targetScreenHeight.

This canvas style set-up function will be called at:

- Web page start up.
- Web browser's window.onresize event callback.
- Main EMA_SERVER object's onStateChanged event callback.
- EMA_SERVER_REMOTE_DESKTOP object's onStateChanged event callback.
- EMA_SERVER_REMOTE_DESKTOP object's onScreenResize event callback.

Required HTML event handler:

- window.onresize: At this event, run the canvas style set-up function.

Sample files that use this:

- EndpointRDPInband.html

4.3 Main entry point

EMA_SERVER_REMOTE_DESKTOP function:

Input / Output in order	Type	Comments
Input 1	EMA_SERVER	This is the object returned by the main entry point of ema.js. The connection to AJAX server (performed by ema.js) should be established already.
Input 2	string	The value is the target endpoint ID, in HEX format (without hyphen).
Input 3	string	This is the HTML id of the canvas element on the HTML page that is hosting this remote desktop.
Output	EMA_SERVER_REMOTE_DESKTOP	This is the main object to be used for connecting to Intel EMA tunnels and for controlling the remote desktop.

The high-level operations flow after the object creation is:

1. Create EMA_SERVER object and connect to AJAX server.
2. Create EMA_SERVER_REMOTE_DESKTOP object.
3. Assign the event callbacks for EMA_SERVER_REMOTE_DESKTOP object.
4. Set EMA_SERVER_REMOTE_DESKTOP object's compression and scaling.
5. Grab the mouse and touch events from HTML canvas, and keyboard events from HTML document.
6. Use start method to start the tunnel connection to endpoint agent via Swarm server.
7. At the onStateChanged event callback, if the event is UNPAUSED, after some delay, use sendCompressionAndScaling function to send the settings to the endpoint.

The high-level operations flow for disconnect from terminal is:

1. Use stop method.
2. Un-grab the mouse and touch events from HTML canvas, and keyboard events from HTML document.

3. When the EMA_SERVER object is disconnected from AJAX server, this disconnect flow should be run also.

Sample files that use this:

- EndpointRDPInband.html.

4.4 Start the remote desktop

Check tunnelMode first. If it is not EMA_GLOBAL.EMA_DESKTOP_TUNNEL.DISCONNECTED, then do not continue.

Call setCompression method:

This sets the percentage of the screen bitmap's compression level on the target endpoint's display. This does not send the new configuration to the target endpoint yet.

Input / Output in order	Type	Comments
Input	number	This is (0, 0.75]. 0.5 or less is best for speed concern. 1 means that there is no compression.
Output	Boolean	True if it is successful.

Call setScaling method:

This sets the percentage of the render resolution reduction on the target endpoint's display. This does not send the new configuration to the target endpoint.

Input / Output in order	Type	Comments
Input	number	This is (0, 1]. 1 means that there is no reduction. 0.5 and 1.0 result in best performance. If you use other value, the display area may be cut off a bit.
Output	Boolean	True if it is successful.

Call grabMouseInput method:

Intercept the mouse and touch inputs of the HTML canvas element. This should be called before calling start method, and also when we need to intercept the inputs again.

Call grabKeyInput method:

Intercept the keyboard inputs of the HTML document. This should be called before calling start method, and also when we need to intercept the inputs again.

Call start method:

Start the tunnel connection to endpoint agent via Swarm server, and start the flow of remote desktop.

Input / Output in order	Type	Comments
Output	Boolean	True if it is successful. If the return is false (type: Boolean), this method fails, and remember to un-grab the mouse, touch, and key inputs. If the method works, monitor the onStateChanged event.

Sample files that use this:

- EndpointRDPInband.html

4.5 Stop the remote desktop

This flow should also be run when the main EMA_SERVER object disconnects from the AJAX server.

Call stop method:

Un-grab the input events from the HTML, and stop the tunnel connection to endpoint agent via Swarm server.

Call unGrabMouseEvent method:

Stop intercepting the mouse and touch inputs of the HTML canvas element. This should be called when onStateChanged fires with EMA_GLOBAL.EMA_DESKTOP_STATE.DISCONNECTED state, and also when we need to yield the inputs back to HTML again.

Call unGrabKeyInput method:

Stop intercepting the keyboard inputs of the HTML document. This should be called when onStateChanged fires with EMA_GLOBAL.EMA_DESKTOP_STATE.DISCONNECTED state, and also when we need to yield the inputs back to HTML again.

Sample files that use this:

- EndpointRDPInband.html

4.6 Set compression and scaling

Call sendCompressionAndScaling method:

This sets the bitmap compression level and the desktop resolution reduction level.

If this is a “scaling” change and there is a rotation, then

1. Set the rotation back to 0 (unrotated).
2. After some delay (setTimeout), then do the sendCompressionAndScaling method.

Input / Output in order	Type	Comments
Input 1	number	This is the percentage of the screen bitmap's compression level on the target endpoint's display. It is (0, 0.75]. 0.5 or less is best for speed consideration. 1 means that there is no compression. If the value is not in the valid range, this method returns false. If the value is negative, we will use the recorded previous value.
Input 2	number	This is the percentage of the render resolution reduction on the target display resolution. It is (0, 1]. 1 means no reduction. If the value is not in the valid range, this method returns false. 0.5 and 1.0 result in best performance. If the value is negative, we will use the recorded previous value.
Output	Boolean	True if it is successful. This will trigger onScreenResize event.

Sample files that use this:

- EndpointRDPInband.html

4.7 Rotate the rendered remote desktop

One can use EMA_SERVER_REMOTE_DESKTOP object's rotation variable, and then plus or minus one to determine the input value of the following method to do 90 degree CW or CCW rotation.

Call setRotation method:

Rotate the rendering of the remote desktop.

Input / Output in order	Type	Comments
Input	number	This is the rotation to set. Internally, while the value is < 0, the value += 4. Then the rotation value is the value % 4. The final internal rotation value can be 0, 1, 2, and 3. 0 is no rotation. Each is a 90 degree clock-wise rotation from the previous.
Output	none	This will trigger onScreenResize event.

Sample files that use this:

- EndpointRDPIband.html

4.8 Refresh the rendering of remote desktop

Call `sendRefresh` method:

Instruct the target endpoint agent to refresh all remote desktop data, which triggers a rendering refresh on the canvas element.

Sample files that use this:

- EndpointRDPIband.html

4.9 Send text message to other remote desktop connections to this endpoint

Call `sendMessage` method:

Send a message to all other connected remote RDPs to this endpoint, excluding self.

Input / Output in order	Type	Comments
Input	string	This is the message. < and > character will be replaced with encoded version < and >.
Output	none	This will trigger onMessage event on other connected RDPs.

Sample files that use this:

- EndpointRDPIband.html

4.10 Send Ctrl-Alt-Del to endpoint

Call `sendCtrlAltDelMsg` method:

This will run Ctrl + Alt + Del on the endpoint to bring up Windows task manager.

Sample files that use this:

- EndpointRDPIband.html

4.11 Get displays from remote endpoint

Call `getDisplayNumbers` method:

Get the displays from the remote endpoint. The result will be at onGetDisplays event.

Sample files that use this:

- EndpointRDPInband.html

4.12 Set the target display to render on the canvas element

Call setDisplay method:

Choose the display on the remote endpoint to display on the canvas element.

Input / Output in order	Type	Comments
Input	number	This is the target display number. The choice of display numbers should be obtained from getDisplayNumbers method. To choose all displays, use 65535 or 0. If the number is not in the list of numbers returned by onGetDisplays event and not 0, this call will be ignored.
Output	none	If the display selection changes after this call, it will trigger onGetDisplays event.

Sample files that use this:

- EndpointRDPInband.html

4.13 Expand the KVM canvas to full screen mode

Call requestFullScreen method:

This will use web browser's full screen API to put the KVM canvas into full screen mode.

Call isCanvasInFullScreenMode method:

This will return true if the KVM canvas is in full screen mode.

Call getTargetCanvasRenderingSizeInFullScreeMode method:

Return the target canvas rendering size in full screen mode. If the canvas is in full screen mode, this returns an array of 2 elements for width and height. If the canvas is not in full screen mode, the width and size will be 0.

Sample files that use this:

- EndpointRDPInband.html

4.14 Send clipboard string as keystrokes

Call sendStringAsKeyStroke method:

This will send the clipboard contents of the system running the Intel EMA web based user interface as a series of keycodes to the endpoint, simulating keystrokes typed at the endpoint's keyboard.

4.15 Get clipboard text from Internet Explorer

Call getClipboardTextFromIE method:

This method is for use when the browser running the Intel EMA web based user interface is Internet Explorer. It will send the clipboard contents to the target endpoint, but with special consideration for the Internet Explorer browser.

4.16 Releasing the Alt-key

Call `releaseFocusCanvas` method:

During a remote desktop session, if an Alt-key sequence is sent to the remote desktop, it is possible for the character sequence to be truncated so that only the Alt-key character code is sent. This leaves the endpoint in a state where the Alt-key is pressed, so that subsequent character codes are interpreted as part of an Alt-key sequence. This method releases the Alt-key on the remote endpoint.

4.17 Event callbacks

This subsection is a summary of all the events that will be used in each feature provided by this library. The reader can go to each feature description directly and then refer back to this section when needed.

4.17.1 onStateChanged event

This will be triggered when state is changed.

Parameter in order	Type	Comments
Parameter 1	EMA_SERVER_REMOTE_DESKTOP	This is the event source.
Parameter 2	number	This is the new state. Please see definitions of EMA_GLOBAL.EMA_DESKTOP_STATE object.
Parameter 3	object	This is the HTML canvas element on the calling web page.

When the new state is EMA_GLOBAL.EMA_DESKTOP_STATE.DISCONNECTED,

- The user should un-grab the mouse, touch, and keyboard events from the HTML.
- The user should check if tunnelErrorCode member > EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.NONE for tunnel failure. For the error value mapping, check EMA_GLOBAL.EMA_TUNNEL_ERRORCODE object definition of ema.js for details.

4.17.2 onDebugMessage event

This event will be fired when some debugging information is needed.

Parameter in order	Type	Comments
Parameter 1	string	This is the debug information.

4.17.3 onScreenResize event

This will be triggered when the rendering set up is changed (e.g., rotation change, render resolution reduction change, etc.). The callback handler should update the HTML canvas element.

Parameter in order	Type	Comments
Parameter 1	EMA_SERVER_REMOTE_DESKTOP	This is the event source.

Parameter in order	Type	Comments
Parameter 2	number	This is the target screen width.
Parameter 3	number	This is the target screen height.
Parameter 4	object	This is the HTML canvas element on the calling web page.

4.17.4 onMessage event

This will be triggered when someone uses `sendMessage` to send a message to all other connected remote RDPs.

Parameter in order	Type	Comments
Parameter 1	string	This is the message.
Parameter 2	EMA_SERVER_REMOTE_DESKTOP	This is the event source.

4.17.5 onConnectCountChanged event

This will be triggered when the number of remote desktop connections on the target endpoint changes.

Parameter in order	Type	Comments
Parameter 1	number	This is the number of remote desktop connections on the target endpoint.
Parameter 2	EMA_SERVER_REMOTE_DESKTOP	This is the event source.

4.17.6 onGetDisplays event

This will be triggered by `getDisplayNumbers` method.

Parameter in order	Type	Comments
Parameter 1	number	This is the number of displays on the target endpoint plus 1. If there is only 1 display, the value is 0. Else, the value is the number of displays plus 1. The extra 1 is with value 65535, which means "all displays".
Parameter 2	number	This is the currently-selected display. If this is 65535, then we are selecting "all displays".
Parameter 3	number[]	This is an array of numbers. Each number is the display index (starting from 1) available on the target endpoint. For example, for an endpoint with 2 displays, the array is [65535, 1, 2]. 65535 means "all displays". If there is only 1 display, then this is empty array.

5 ema_desktop_oob.js

This library is used together with ema.js. This library will perform out-of-band remote desktop connection to the target endpoint.

5.1 Limitation

- The video encoding method cannot be changed and is set to RLE8.
- The screen cannot be rotated.
- If the endpoint you are managing has two or more monitors and you want to switch to another monitor, you will need to disconnect and reconnect the remote control session
- You cannot make the remote control window/canvas full screen.

5.2 Access and policy checking

Policy checking is done based on the following order:

1. When the front-end tries to get the best Swarm server for the target endpoint, AJAX server's Alert session checks if the target endpoint group has TCPRELAY policy.
 - If it fails, AJAX server sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.POLICYNOTALLOWED) back and disconnects the tunnel connection.
2. For remote (in-band, out-of-band) terminal, remote file, and remote hardware KVM operations, when the initial setup message is sent to the target endpoint (via Intel® EMA servers), the endpoint agent checks Command, FILES, and KVM policies.
 - If they are all disabled, endpoint will reject this operation and AJAX server sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.REMOTE_DISCONNECT) back and disconnects the tunnel connection.
3. When the starting "Hardware KVM prompt" message is sent to AJAX server, AJAX server's Alert session checks if the target endpoint group has KVM policy.
 - If it fails, AJAX server sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.POLICYNOTALLOWED) back and disconnects the tunnel connection.

User access checking:

- When the front-end tries to get the best Swarm server for the target endpoint, AJAX server's Alert session checks the following
 - If the user does not the Hardware Manageability permission for the endpoint, AJAX server adds audit log to the Intel® EMA database, sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.POLICYNOTALLOWED) back, and disconnects the tunnel connection.
 - If the endpoint Id has correct format but does not exist, AJAX server adds audit log to the Intel® EMA database, sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.TARGETNOTFOUND) back, and disconnects the tunnel connection.
 - If the Intel EMA server cannot get the correct information for this endpoint, AJAX server adds audit log to Intel EMA database, sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.TARGETNOTFOUND) back, and disconnects the tunnel connection.
 - If AJAX server cannot find the Swarm server for this endpoint, AJAX server sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.NOLEADERFOUND) back, and disconnects the tunnel connection.

5.3 Web page requirements

Required element:

- A <canvas> element.

Sample files that use this:

- EndpointKVMOutOfBand.html

5.4 Main entry point

EMA_SERVER_REMOTE_DESKTOP_OOB function:

Input / Output in order	Type	Comments
Input 1	canvasid	This is the HTML id of the canvas element on the HTML page that is hosting this remote desktop.
Input 2	scrolldiv	This is the HTML id of the div element on the HTML page that contains the canvas
Input 3	focusoolid	This is the HTML id of the div element that will support the focus tool, this is not implemented yet
Input 4	EMA_SERVER	This is the object returned by the main entry point of ema.js. The connection to AJAX server (performed by ema.js) should be established already.
Output	EMA_SERVER_REMOTE_DESKTOP_OOB	This is the main object to be used for connecting to Intel EMA tunnels and for controlling the remote desktop.

The high-level operations flow after the object creation is:

1. Create EMA_SERVER object and connect to AJAX server.
2. Create EMA_SERVER_REMOTE_DESKTOP_OOB object.
3. Assign the event callbacks for EMA_SERVER_REMOTE_DESKTOP_OOB object.
4. Use startDesktop method to start the tunnel connection to endpoint agent via Swarm server.
5. Grab the mouse and touch events from HTML canvas, and keyboard events from HTML document.

The high-level operations flow for disconnect from terminal is:

1. Use stop method.
2. Un-grab the mouse and touch events from HTML canvas, and keyboard events from HTML document. This is automatically done when the stop method is performed.
3. When the EMA_SERVER object is disconnected from AJAX server, this disconnect flow should be run also.

Sample files that use this:

- EndpointKVMOutOfBand.js

5.5 Start the remote desktop

Check tunnelMode first. If it is not EMA_GLOBAL.EMA_DESKTOP_TUNNEL.DISCONNECTED, then do not continue.

Call start method:

Start the tunnel connection to endpoint agent via Swarm server, and start the flow the hardware KVM session

Call grabMouseInput method:

Intercept the mouse and touch inputs of the HTML canvas element. This should be called before calling start method, and also when we need to intercept the inputs again.

Call grabKeyInput method:

Intercept the keyboard inputs of the HTML document. This should be called before calling start method, and also when we need to intercept the inputs again.

Input / Output in order	Type	Comments
Input	targetEndpointId (HEX)	The value is the target endpoint ID, in HEX format (without hyphens).
Input	isCiraConnected (Boolean)	True if the endpoint is connected using CIRA, false if it is using TLS communications
Input	user-amt	
Input	pass-amt	
Output	Boolean	True if it is successful. If the return is false (type: Boolean), this method fails, and remember to un-grab the mouse, touch, and key inputs. If the method works, monitor the onStateChanged event.

Sample files that use this:

- EndpointKVMOutOfBand.js

5.6 Stop the remote desktop

This flow should also be run when the main EMA_SERVER object disconnects from the AJAX server.

Call stop method:

Un-grab the input events from the HTML, and stop the tunnel connection to endpoint agent via Swarm server. Calling the stop method will also stop the interception of keyboard and mouse input.

Sample files that use this:

- EndpointKVMOutOfBand.js

5.7 Send key combinations to the remote endpoint

Call parseAndSendKeyCombo method:

This will send specified key combinations to the endpoint, simulating keystrokes typed at the endpoint's keyboard. These are the available key combinations that can be accepted as a parameter.

Available Key Combination Parameters:

- ctrlAltDelete: Ctrl + Alt + Delete
- altTab: Alt + Tab
- altTabStart: Alt[Hold] + Tab - can be used to display Windows task switching menu
- releaseAlt: Alt[Release] - can be used to release the Alt key or exit the Windows task switching menu
- win: Windows Key
- winL: Win + L

- winM: Win + M
- winR: Win + R
- shiftWinM: Win + Shift + M
- winUp: Win + Up Arrow
- winDown: Win + Down Arrow
- winLeft: Win + Left Arrow
- winRight: Win + Right Arrow
- altF4: Alt + F4
- ctrlW: Ctrl + W

Sample files that use this:

- EndpointKVMOutOfBand.js

5.8 Event callbacks

This subsection is a summary of all the events that will be used in each feature provided by this library. The reader can go to each feature description directly and then refer back to this section when needed.

5.8.1 onStateChanged event

This will be triggered when state is changed.

Parameter in order	Type	Comments
Parameter 1	EMA_SERVER_REMOTE_DESKTOP_OOB	This is the event source.
Parameter 2	number	This is the new state. Please see definitions of EMA_GLOBAL.EMA_DESKTOP_STATE object.
Parameter 3	object	This is the HTML canvas element on the calling web page.

When the new state is EMA_GLOBAL.EMA_DESKTOP_STATE.DISCONNECTED,

- The user should un-grab the mouse, touch, and keyboard events from the HTML.
- The user should check if tunnelErrorCode member > EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.NONE for tunnel failure. For the error value mapping, check EMA_GLOBAL.EMA_TUNNEL_ERRORCODE object definition of ema.js for details.

5.8.2 onDebugMessage event

This event will be fired when some debugging information is needed.

Parameter in order	Type	Comments
Parameter 1	string	This is the debug information.

6 ema_terminal.js

This library is used together with ema.js. It provides the methods to create a terminal html element that can perform remote terminal on the target endpoint.

6.1 Limitation

The terminal only displays the last 80 by 25 characters.

6.2 Access and policy checking

Policy checking is done based on the following order:

1. For both in-band and out-of-band terminal, when the front-end tries to get the best Swarm server for the target endpoint, AJAX server's Alert session checks if the target endpoint group has TCPRELAY policy.
 - If it fails, AJAX server sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.POLICYNOTALLOWED) back and disconnects the tunnel connection.
2. For remote (in-band, out-of-band) terminal, remote file, and remote RDP operations, when the initial setup message is sent to the target endpoint (via Intel® EMA servers), the endpoint agent checks Command, FILES, and KVM policies.
 - If they are all disabled, endpoint will reject this operation and AJAX server sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.REMOTE_DISCONNECT) back and disconnects the tunnel connection.
3. When sending the start message:
 - For in-band terminal, when the starting "terminal prompt" message is sent to AJAX server, AJAX server's Alert session checks if the target endpoint group has Command policy. If it fails, AJAX server sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.POLICYNOTALLOWED) back and disconnects the tunnel connection.
 - For out-of-band terminal, when the starting "terminal/desktop Intel® AMT authentication" message is sent to AJAX server, AJAX server's Alert session checks if the target endpoint group has Command or KVM policy. If it fails, AJAX server sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.POLICYNOTALLOWED) back and disconnects the tunnel connection.

User access checking:

- For both in-band and out-of-band, when the front-end tries to get the best Swarm server for the target endpoint, AJAX server's Alert sessions checks the following
 - If the user does not have the Terminal access right for the endpoint, AJAX server adds audit log to the Intel® EMA database, sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.POLICYNOTALLOWED) back, and disconnects the tunnel connection.
 - If the endpoint Id has correct format but does not exist, AJAX server adds audit log to the Intel® EMA database, sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.TARGETNOTFOUND) back, and disconnects the tunnel connection.
 - If the Intel® EMA server cannot get the correct information for this endpoint, AJAX server adds audit log to the Intel® EMA database, sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.TARGETNOTFOUND) back, and disconnects the tunnel connection.
 - If AJAX server cannot find the Swarm server for this endpoint, AJAX server sends tunnel error (EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.NOLEADERFOUND) back, and disconnects the tunnel connection.

6.3 Main entry point

EMA_SERVER_REMOTE_TERMINAL function:

Input / Output in order	Type	Comments
Input	string	This is the id of the HTML element (where terminal will be displayed) of the web page. The library will use document.getElementById to find the element.
Output	EMA_SERVER_REMOTE_TERMINAL	This is the main object to be used for connecting to Intel EMA tunnels and for controlling the terminal HTML element.

The high-level operations flow after the object creation is:

1. Use termResetScreen, processVt100String, and termDraw methods to set the Terminal HTML element to initial state. For an example of such HTML element, please see the sample codes.
2. Create EMA_SERVER object and connect to AJAX server.
3. Use start method to start the tunnel connection to endpoint agent via Swarm server.
4. Use grabKeyInput method to start intercepting the user key press and sending to Intel EMA.

The high-level operations flow for disconnect from terminal is:

1. Use stop and unGrabKeyInput methods.
2. Use termResetScreen, processVt100String, and termDraw methods to set the Terminal HTML element to initial state.

Sample files that use this:

- EndpointTerminal.html

6.4 Initialize the terminal HTML element

Call termResetScreen method. This reset the internal variables.

Call processVt100String method. The only input is the string message that the user wants to display on the terminal HTML element. This puts the string message in the corresponding variables.

Call termDraw method. This renders the terminal HTML element based on the internal variables.

Sample files that use this:

- EndpointTerminal.html

6.5 Start the terminal

Check tunnelMode member first. If it is not EMA_GLOBAL.EMA_TERMINAL_TUNNEL.DISCONNECTED, then do not continue.

Call start method:

This will start the tunnel connection to endpoint agent via Swarm server, and start the flow of remote terminal.

Input / Output in order	Type	Comments
Input 1	EMA_SERVER	This is the object returned by the main entry point of ema.js. The connection to AJAX server (performed by ema.js) should be established already.
Input 2	string	The value is the target endpoint ID, in HEX format (without hyphen).
Output	Boolean	True if it is successful. If this method works, start monitoring onStateChanged event.

Call grabKeyInput method:

This intercepts the keyboards event on the HTML document.

Input / Output in order	Type	Comments
Input	object	This is the HTML document object. If this is not defined, then we use the "document" object.

Sample files that use this:

- EndpointTerminal.html

6.6 Stop the terminal

Call stop method:

This will stop the tunnel connection.

Call unGrabKeyInput method:

This releases the HTML document's key events handlers

Input / Output in order	Type	Comments
Input	object	This is the HTML document object. If this is not defined, then we use the "document" object.

Sample files that use this:

- EndpointTerminal.html

6.7 Start the out-of-band Intel® AMT terminal

This is very similar to section "Start the terminal". The only difference is to call startAMT, instead of start method.

The Intel AMT credential for this endpoint is obtained internally from the Intel EMA database.

This is a Serial-Over-LAN terminal. After you are connected, you need to boot to BIOS with Serial-over-LAN turned on and the BIOS will send a text version of the BIOS into the Intel AMT serial port. Then you can see the BIOS displayed.

startAMT method:

Input / Output in order	Type	Comments
Input 1	EMA_SERVER	This is the object returned by the main entry point of ema.js. The connection to AJAX server (performed by ema.js) should be established already.
Input 2	string	The value is the target endpoint ID, in HEX format (without hyphen).
Input 3	number	This is the port for Intel® AMT connection. This is either 16994 (if not using TLS) or 16995 (if using TLS).
Output	Boolean	True if it is successful. If this method works, start monitoring onStateChanged event.

Sample files that use this:

- EndpointTerminal.html

6.8 Event callbacks

This subsection is a summary of all the events that will be used in each feature provided by this library. The reader can go to each feature description directly and then refer back to this section when needed.

6.8.1 onStateChanged event

This will be triggered when state is changed.

Parameter in order	Type	Comments
Parameter 1	EMA_SERVER_REMOTE_TERMINAL	This is the event source.
Parameter 2	number	This is the new state. Please see definitions of EMA_GLOBAL.EMA_TERMINAL_STATE object.

When the new state is EMA_GLOBAL.EMA_TERMINAL_STATE.DISCONNECTED,

- The user should un-grab the keyboard input.
- The user should check if tunnelErrorCode member > EMA_GLOBAL.EMA_TUNNEL_ERRORCODE.NONE for tunnel failure. For the error value mapping, check EMA_GLOBAL.EMA_TUNNEL_ERRORCODE object definition of ema.js for details.

6.8.2 onDebugMessage event

This event will be fired when some debugging information is needed.

Parameter in order	Type	Comments
Parameter	string	This is the debug information.