

FICO® Xpress Optimization

Last update 21 November, 2019

8.9.0

REFERENCE MANUAL

Executor Library for Mosel

FICO® **Decisions**

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FICO® Xpress Optimization

Deliverable Version: A

Last Revised: 21 November, 2019

Version 8.9.0

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CHAPTER 1

Introduction

1.1 Xpress Executor in FICO Decision Management Platform

FICO Xpress Executor is a component that allows users to deploy optimization as a service within the FICO Decision Management Platform (DMP). The component owner can configure the Xpress Executor component either with a fixed Mosel model, or to accept optimization problems in standard LP or XMPS formats, and the optimizations will be executed asynchronously in response to SOAP or REST webservice requests. For more information about Xpress Executor and the FICO Decision Management Platform, see

www.ficoanalyticcloud.com

This document assumes that the reader is a registered user of the FICO Analytic Cloud and has access to at least one Xpress Executor component. For general information about DMP solutions, components, lifecycle stages and more, please consult the Decision Management Platform help by clicking the "Help" link on the DMP website. Below are summary definitions of some DMP terminology used in this document, but please consult the DMP help for full information.

- **Solution** - a named collection of Components and Services.
- **Component** - a component provides capabilities that can be added to solutions. Components typically expose a UI that can be interacted with directly, or webservices that can be called from an external application.
- **Component Lifecycle** - a component has three lifecycle stages - design, staging and production. You will edit your configuration in the design stage, submit the configuration to staging for testing, and deploy to production once you are satisfied. There is a different webservice URL for interacting with each lifecycle stage of a component.
- **DMP Manager** - the web site that allows you to manage your solutions and components.

1.2 Executor package for Mosel

The package *executor* allows the user to send commands to an Xpress Executor component running in DMP, from either a local Mosel process or from an Xpress Insight component in the same DMP solution. The package can be used to run model executions in the Xpress Executor component, as well as modify the Xpress Executor design instance configuration to a limited extent.

The package does not support direct promotion of configuration to staging or production instances; this must be done by submitting, approving and then deploying the configuration through the DMP UI.

CHAPTER 2

Basic Principles

The *executor* library should be loaded into your model or package as follows:

```
uses "executor"
```

When you want to interact with an Xpress Executor component instance (design, staging or production), you should declare a variable of the 'Executor' type to represent the Executor component instance.

```
declarations
  myexecutor: Executor
end-declarations
```

Once the 'Executor' variable has been initialized with your component's location and credentials (see chapter 3), it can be used with Executor functions such as `executorexecute`, `executorwaitfor` and `executorfetchresult`. If you need to access more than one Executor component instance, you can declare multiple Executor variables.

After calling each function on the *executor* library, you should check the value of `Executor.status` for any errors - if this is any value other than `EXECUTOR_OK` then an error has occurred. In an error case, `Executor.status` will contain an error code and `Executor.lasterror` will return a description of the error.

CHAPTER 3

Authenticating

3.1 Using Executor Properties

The simplest way to define the corresponding properties of your Executor entity, for example:

```
model DirectInitExample
  uses "executor"
  declarations
    myexecutor: Executor
  end-declarations

  myexecutor.componenturl := "https://vm65j75lqh-vm65j75lqh.dms.usw2.ficoanalyticcloud.com/"
  myexecutor.bearertokenurl := "https://iam-svc.dms.usw2.ficoanalyticcloud.com/registration/rest/cli
  myexecutor.clientid := "vm5qh0y37c"
  myexecutor.secret := "wdS97u648BVoI#d3e4g2Z4mP780Y1DLdSDKm"
  ! myexecutor now initialized and can be used
end-model
```

To find the component URL, bring up the drop-down menu beside the component name in DMP and select "View Links". Use the value from the 'REST' field but remove everything after the domain name. For example, if the link displayed is:

```
https://vm65j75lqh-vm65j75lqh.dms.usw2.ficoanalyticcloud.com/rest/
runtime/execution?solutionID=vm5qh0y37c
```

then use

```
https://vm65j75lqh-vm65j75lqh.dms.usw2.ficoanalyticcloud.com/
```

The clientid and secret values for your solution can be found on the "Client Apps" page of the solution screen in DMP. Finally, the `bearertokenurl` will be the URL from where we will obtain DMP authentication tokens - consult the "Requesting a Bearer Token" page of the DMP documentation for more details.

If you prefer to manage the authentication with DMP yourself, you can alternately initialize the Executor with the component URL and a DMP bearer token, e.g.:

```
model DirectInitExample
  uses "executor"
  declarations
    myexecutor: Executor
  end-declarations

  myexecutor.componenturl := "https://vm65j75lqh-vm65j75lqh.dms.usw2.ficoanalyticcloud.com/"
  myexecutor.bearertoken := "xyfuehdsoguihUGHifsihf7hi"
  ! myexecutor now initialized and can be used
end-model
```

However, note you will need to refresh the 'bearertoken' value periodically as the tokens will expire. If you initialize with clientid and secret, the 'executor' module will request new bearer tokens when it needs to.

3.2 Using a JSON Configuration File

As an alternative to setting credentials in the model, you can specify them in a JSON document, the contents of which you assign to the `executor_components` parameter. The document should be in the following format:

```
{
  "<component-id>": {
    "componentUrl": "<URL of component>",
    "bearerTokenUrl": "<URL of DMP authentication service, optional>",
    "clientId": "<clientId of DMP solution, optional>",
    "secret": "<secret of DMP solution, optional>",
    "bearerToken": "<DMP bearer token, optional>"
  }
}
```

The "<component-id>" string is a key that you use to refer to the component in the JSON and has no other meaning. You can specify multiple components in the same JSON file so long as they have different "<component-id>" strings, e.g.:

```
{
  "main": {
    "componentUrl": "https://vm65j75lqh-vm65j75lqh.dms.usw2.ficoanalyticcloud.com/",
    "bearerTokenUrl": "https://iam-svc.dms.usw2.ficoanalyticcloud.com/registration/rest/client/token",
    "clientId": "vm5qh0y37c",
    "secret": "wdS97u648BVoI#d3e4g2Z4mP780Y1DLdSDKm"
  },
  "dev": {
    "componentUrl": "https://6tk0a8qheb-6tk0a8qheb.dms.usw2.ficoanalyticcloud.com/",
    "bearerTokenUrl": "https://iam-svc.dms.usw2.ficoanalyticcloud.com/registration/rest/client/token",
    "clientId": "vm5qh0y37c",
    "secret": "wdS97u648BVoI#d3e4g2Z4mP780Y1DLdSDKm"
  }
}
```

The JSON document must always specify the `componentUrl`, and either the `bearerToken` or all of the `bearerTokenUrl`, `clientId` and `secret` values. If you do specify your own bearer token, be aware that it will eventually expire.

Then you can initialize an `Executor` in the model with the credentials from the JSON by calling the `executorinit` procedure. For example, if you save the above sample JSON in a file called "executors.json":

```
model InitExample
  uses "executor", "mmsystem"
  declarations
    public jsoncfg: text
    myexecutor: Executor
  end-declarations

  ! Load executors.json into a variable so it can be passed to a parameter
  fcopy("executors.json", "text:jsoncfg")
  setparam("executor_components", string(jsoncfg))

  ! Initialize myexecutor using the 'main' set of credentials
  executorinit(myexecutor, "main")
  if myexecutor.status<>EXECUTOR_OK then
```

```

        writeln("Executor initialization error: ", myexecutor.lasterror)
    exit(1)
end-if
! myexecutor now initialized and can be used
end-model

```

The `executor_components` parameter is special in that it has a single value shared by all models within the Mosel instance - this means that if, for example, you set it for your master model, then the same value will be used for all submodels that you start in the same Mosel process.

3.3 Using from Xpress Insight in DMP

When using Xpress Insight within DMP, the Mosel instance will automatically be configured to access any Xpress Executor components in the same solution. To use this, simply call `executorinit`, passing the name of your Xpress Executor component:

```

model DmpInitExample
  uses "executor"
  declarations
    myexecutor: Executor
  end-declarations

  ! Initialize myexecutor for the component called "My Executor"
  executorinit(myexecutor, "My Executor")
  if myexecutor.status<>EXECUTOR_OK then
    writeln("Executor initialization error: ", myexecutor.lasterror)
    exit(1)
  end-if
  ! myexecutor now initialized and can be used
end-model

```

Alternatively, if you call `executorinit` without a name, it will access the an Xpress Executor component it finds in your solution:

```

model DmpInitExample
  uses "executor"
  declarations
    myexecutor: Executor
  end-declarations

  ! Initialize myexecutor for the an Xpress Executor component we find
  executorinit(myexecutor)
  if myexecutor.status<>EXECUTOR_OK then
    writeln("Executor initialization error: ", myexecutor.lasterror)
    exit(1)
  end-if
  ! myexecutor now initialized and can be used
end-model

```

The Insight component instance will access Executor instances in the same lifecycle stage (for example, an Insight in the staging environment will access the staging environment of Executor, not production or design). You can override this by specifying the environment on the 'executorinit' line, for example:

```

model DmpInitExample
  uses "executor"
  declarations
    myexecutor: Executor
  end-declarations

  ! Initialize myexecutor for the an Xpress Executor component we find

```

```
executorinit(myexecutor,"My Executor","STAGING")
if myexecutor.status<>EXECUTOR_OK then
    writeln("Executor initialization error: ", myexecutor.lasterror)
    exit(1)
end-if
! myexecutor now initialized and can be used
end-model
```

3.4 Using local development mode

An `Executor` can also be initialized in a 'local' mode that does not require a DMP component. In this configuration, `Executor` will run any submitted executions locally using Mosel submodels. This can be configured as follows:

```
model LocalInitExample
    uses "executor"
    declarations
        myexecutor: Executor
    end-declarations

    ! Initialize myexecutor to simulate a Xpress Executor component using local submodels
    executorinitlocal(myexecutor)
    if myexecutor.status<>EXECUTOR_OK then
        writeln("Executor initialization error: ", myexecutor.lasterror)
        exit(1)
    end-if
    ! myexecutor now initialized and can be used
end-model
```

After being initialized, the 'local' executor will always have an empty configuration, so you should call `executorsetmodelfile` and `executorsetexecmode` to configure it.

Once configured, you can interact with the local execution using the same functions as you would use for a true Xpress Executor component (e.g. `executorexecute`, `executorwaitfor`, `executorfetchresult`, ...). Local execution is supplied as an aid in developing your model and there may be small differences between how your model reacts to errors locally and how it behaves in a real Xpress Executor.

Note that the local Xpress Executor does not support the MPS or LP file execution mode, and the progress field of the `ModelExecution` record will always contain 0 regardless of the progress events emitted by your models.

CHAPTER 4

Usage example

This example demonstrates running an execution in an already-configured Xpress Executor component. You will need to fill in the model parameters with your Xpress Executor component details.

```
model ExecutorExecuteExample
uses "executor"

parameters
  COMPONENT_URL = ""
  BEARER_TOKEN_URL = ""
  CLIENT_ID = ""
  SECRET = ""
end-parameters

declarations
  INPUT_FILE="MyExecutionInputFile.dat"
  RESULT_FILE="MyExecutionResultFile.dat"
  myexecutor: Executor
  myexecution: ModelExecution
  EXECUTION_TIMEOUT = 10*60 ! Timeout in seconds
end-declarations

! Configure 'myexecutor' with our Xpress Executor component details
myexecutor.componenturl := COMPONENT_URL
myexecutor.bearertokenurl := BEARER_TOKEN_URL
myexecutor.clientid := CLIENT_ID
myexecutor.secret := SECRET

! Start execution passing local input data
myexecution := executorexecute(myexecutor, INPUT_FILE)
if myexecutor.status<>EXECUTOR_OK then
  writeln("Error from Executor when starting execution: ",myexecutor.lasterror)
  exit(1)
end-if

! Wait for execution to complete
executorwaitfor(myexecutor,myexecution,EXECUTION_TIMEOUT)
if myexecutor.status<>EXECUTOR_OK then
  writeln("Error from Executor when waiting for completion: ",myexecutor.lasterror)

! If execution did not complete within time limit, display error
elif not myexecution.iscompleted then
  writeln("Execution failed to complete within ",EXECUTION_TIMEOUT,"s")

! If execution completed with error, display error
elif myexecution.status<>EXECUTION_STATUS_OK or myexecution.exitcode<>0 then
  writeln("Execution failed with status ",myexecution.status," and exit code ",myexecution.exitcode)
  ! In error cases, execution run log will contain valuable information
  executorfetchrunlog(myexecutor,myexecution,"runlog.txt")
  if myexecutor.status<>EXECUTOR_OK then
    writeln("Error from Executor when fetching run log: ",myexecutor.lasterror)
  else
```

```
        writeln("Run log saved in file runlog.txt")
    end-if

    ! If execution completed ok, download result
else
    ! Completed okay, download results
    executorfetchresult(myexecutor,myexecution,RESULT_FILE)
    if myexecutor.status<>EXECUTOR_OK then
        writeln("Error from Executor when fetching results: ",myexecutor.lasterror)
    else
        writeln("Result data saved in file ",RESULT_FILE)
    end-if
end-if

    ! Delete execution from server
    executordeldelete(myexecutor,myexecution)
    if myexecutor.status<>EXECUTOR_OK then
        writeln("Error from Executor when deleting execution: ",myexecutor.lasterror)
        exit(1)
    end-if

end-model
```

CHAPTER 5

Types

ModelExecution : record

Record type representing information about the status of an execution in an Xpress Executor component

id : text

The unique identifier of the execution

iscompleted : boolean

Whether the execution has completed (successfully or with errors), or not (not started or currently executing)

hasinput : boolean

Whether the execution has input data.

hasresult : boolean

Whether the execution has result data.

isexecuting : boolean

Whether the execution is currently running (not completed and not waiting to start)

executionnode : text

The name of the gear on which the execution was executed

progress : real

Progress value as set by the model being executed. Always 0 in local mode.

status : string

Status of the execution. One of: EXECUTION_STATUS_OK, EXECUTION_STATUS_MATHERR, EXECUTION_STATUS_ERROR, EXECUTION_STATUS_IOERR, EXECUTION_STATUS_NIFCT, EXECUTION_STATUS_NULL, EXECUTION_STATUS_LICERR, EXECUTION_STATUS_STOP, EXECUTION_STATUS_LOAD_ERROR, EXECUTION_STATUS_INTERNAL_ERROR, EXECUTION_STATUS_NOT_COMPLETED

exitcode : integer

The exit code of the model - the value passed to the Mosel exit() procedure, or 0. This will always be 0 when execution status is not EXECUTION_STATUS_OK.

creationtimestamp : real

Timestamp when the execution was created, expressed as milliseconds since 1/1/1970 00:00 UTC

starttimestamp : real

Timestamp when the execution started to execute, expressed as milliseconds since 1/1/1970 00:00 UTC, or 0 if unset

finishtimestamp : real

Timestamp when the execution finished executing, expressed as milliseconds since 1/1/1970 00:00 UTC, or 0 if unset

modelparams : **dynamic array(ExecutorParamNames) of text**
Additional model parameters used with this execution

MoselInstanceConfig : **record**

Record type representing the Mosel instance (process) re-use policy configured in the Xpress Executor component

reuse : **boolean**

If false, every execution will run in a separate Mosel process. If true, Xpress Executor will re-use a Mosel process after the execution completes, in some cases. In neither case will Xpress Executor run two executions in the same Mosel process at the same time.

maxexecutions : **integer**

When reuse is true, the maximum number of executions that can be run using each Mosel process before it is automatically terminated.

reuseaftererror : **boolean**

If reuse is true, flag indicating whether to allow a Mosel process to be re-used if the previous execution terminated with an error code.

reuseafternonzeroexit : **boolean**

If reuse is true, flag indicating whether to allow a Mosel process to be re-used if the previous execution terminated with a non-zero exit code.

RepositoryStatus : **record**

Record type representing a summary of the Xpress Executor component's repository status

componentid : **string**

The ID string of the Xpress Executor DMP component

componentenv : **string**

The component environment / lifecycle stage, either "design", "staging" or "production", or "LOCAL" in local mode.

numgears : **integer**

The number of gears assigned to the DMP component in this environment

numexecutions : **integer**

The total number of executions currently in the repository

numqueued : **integer**

The number of executions in the repository that have not yet started to execute

numinprogress : **integer**

The number of executions in the repository that are currently executing

numcompleted : **integer**

The number of executions in the repository that have completed (either successfully or with errors)

binarydatasize : **integer**

The approximate number of megabytes of binary data stored in the database

binarydataquota : **integer**

The maximum number of megabytes of binary data that may be stored in the

database

dbsize : integer

The current size of the database, in megabytes

RunLogFragment : record

Record type representing part of the run log of a model execution

id : text

The ID of the execution in the Xpress Executor component

logversion : text

A version string for the run log. When Executor restarts an execution from the beginning, the run log version will change.

firstlinenum : integer

The index of the first line in this fragment of the run log, where the first line of the run log has index 1.

numavailablelines : integer

The total number of lines in the run log.

lines : list of text

Individual lines in this fragment of the run log.

CHAPTER 6

Variables

ExecutorParamNames: `set of string`

Set of all parameter names used in model executions

CHAPTER 7

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executorddelete

Purpose

Deletes an execution from the Xpress Executor component

Synopsis

```
procedure executorddelete(exec:Executor, execution:ModelExecution)
```

Arguments

<code>exec</code>	The Executor on which the execution resides
<code>execution</code>	The execution to delete

Example

```
executorddelete( myexecutor, myexecution )
if myexecutor.status<>EXECUTOR_OK then
    writeln("Error returned by Executor: ",myexecutor.lasterror)
    exit(1)
end-if
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. The procedure will not return until the execution has been marked for deletion or an error was detected.
3. Only the `id` field of the ModelExecution record is read by this procedure.
4. If the execution is still running, Xpress Executor will cancel it.
5. Once deleted, the execution result, status and run log will not be available.

Related topics

[getstatus](#)

executordeteall

Purpose

Deletes all executions from the Xpress Executor component

Synopsis

```
procedure executordeteall(exec:Executor)
```

Argument

`exec` The Executor with which to interact

Example

```
executordeteall( myexecutor )
if myexecutor.status<>EXECUTOR_OK then
    writeln("Error returned by Executor: ",myexecutor.lasterror)
    exit(1)
end-if
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. The procedure will not return until all executions have been marked for deletion or an error was detected.
3. If any executions are still running, Xpress Executor will cancel them.
4. Once deleted, the execution result, status and run log will not be available.

Related topics

`getstatus`

executorexecute

Purpose

Submits a new execution to the Xpress Executor component.

Synopsis

```
function executorexecute(exec:Executor, inputfname:text,  
    modelparams:array(set of string) of text):ModelExecution  
function executorexecute(exec:Executor, inputfname:text):ModelExecution
```

Arguments

exec	The Executor with which to interact
inputfname	The filename containing the input data to submit to the execution. If an empty string, execution will be submitted with an empty input data file. May reference a Mosel I/O driver, e.g. "mmsystem.text:myinputdata"
modelparams	Values of any additional model parameter to set for this execution. Module parameters such as <code>mmxprs.xprs_verbose</code> may not be set using this array.

Return value

A record containing the execution id and the initial status.

Example

```
myexecution := executorexecute( myexecutor, "inputdata.dat" )  
if myexecutor.status<>EXECUTOR_OK then  
    writeln("Error returned by Executor: ",myexecutor.lasterror)  
    exit(1)  
end-if
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. The procedure will not return until the execution has been submitted to the component or an error was detected.
3. Once submitted, the execution will be executed asynchronously. Use `executortpoll` or `executortwaitfor` to check the execution status.
4. Once deleted, the execution result, status and run log will not be available.

Related topics

`getstatus`, `executortdelete`, `executortwaitfor`, `executortpoll`, `executortfetchinput`,
`executortfetchresult`, `executortfetchrunlog`

executorfetchinput

Purpose

Downloads the input data file of the given execution

Synopsis

```
procedure executorfetchinput(exec:Executor, execution:ModelExecution,  
                             dstfile:text)
```

Arguments

exec	The Executor on which the execution resides
execution	The execution whose input we should request
dstfile	The filename to which to save the input.

Example

```
executorfetchinput(myexecutor, myexecution, "text:inputdata" )  
if myexecutor.status<>EXECUTOR_OK then  
    writeln("Error returned by Executor: ",myexecutor.lasterror)  
    exit(1)  
end-if
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. The procedure will not return until the execution input data has been downloaded or an error was detected.
3. Only the `id` field of the `ModelExecution` record is read by this procedure.

Related topics

`getstatus`, `executorexecute`

executorfetchresult

Purpose

Downloads the result data file of the given execution

Synopsis

```
procedure executorfetchresult(exec:Executor, execution:ModelExecution,  
                             dstfile:text)
```

Arguments

<code>exec</code>	The Executor on which the execution resides
<code>execution</code>	The execution whose result we should request
<code>dstfile</code>	The filename to which to save the result.

Example

```
executorfetchresult( myexecutor, myexecution, "text:resultdata" )  
if myexecutor.status<>EXECUTOR_OK then  
    writeln("Error returned by Executor: ",myexecutor.lasterror)  
    exit(1)  
end-if
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. The procedure will not return until the execution result data has been downloaded or an error was detected.
3. Only the `id` field of the `ModelExecution` record is read by this procedure.
4. The execution results will not be available until the execution completes (`ModelExecution.iscompleted` is true)

Related topics

`getstatus`, `executorwaitfor`

executorfetchrunlog

Purpose

Downloads the run log of the given execution

Synopsis

```
procedure executorfetchrunlog(exec:Executor, execution:ModelExecution,  
                             dstfile:text)
```

Arguments

<code>exec</code>	The Executor on which the execution resides
<code>execution</code>	The execution whose run log we should request
<code>dstfile</code>	The filename to which to save the run log

Example

```
executorfetchrunlog( myexecutor, myexecution, "text:runlog" )  
if myexecutor.status<>EXECUTOR_OK then  
    writeln("Error returned by Executor: ",myexecutor.lasterror)  
    exit(1)  
end-if
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. The procedure will not return until the execution run log has been downloaded or an error was detected.
3. Only the `id` field of the ModelExecution record is read by this procedure.
4. If the execution has not completed, this procedure will download whatever run log it has output so far.

Related topics

`getstatus executorfetchrunlogfragment`

executorfetchrunlogfragment

Purpose

Downloads a fragment of the run log of the given execution.

Synopsis

```
function executorfetchrunlogfragment(exec:Executor,  
    execution:ModelExecution, firstline:integer,  
    maxlines:integer):RunLogFragment
```

Arguments

<code>exec</code>	The Executor on which the execution resides
<code>execution</code>	The execution whose run log we should request
<code>firstline</code>	The index of the first line of the run log to fetch, where the first line of the run log has index 1
<code>maxlines</code>	The maximum number of lines to return in the fragment

Example

```
frag := executorfetchrunlogfragment( myexecutor, myexecution, 10, MAX_INT )  
if myexecutor.status<>EXECUTOR_OK then  
    writeln("Error returned by Executor: ",myexecutor.lasterror)  
    exit(1)  
end-if  
forall (line in frag.lines) do  
    writeln(line)  
end-do
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. The procedure will not return until the execution run log fragment has been downloaded or an error was detected.
3. Only the `id` field of the `ModelExecution` record is read by this function.
4. If the execution has not completed, this procedure will download a fragment based on however much of the run log is available.
5. When passing a value of `firstline` greater than 1, always check the `logversion` of the returned fragment; if this value is different from the `logversion` of previously fetched fragments then the execution has been restarted and you should re-fetch the run log from line 1.

Related topics

`getstatus` `executorfetchrunlog`

executorgetconcurrencylevel

Purpose

Fetch the currently configured concurrency level of the Xpress Executor component.

Synopsis

```
function executorgetconcurrencylevel(exec:Executor):integer
```

Argument

`exec` The Executor to query

Return value

The number of executions that can be performed concurrently on a single Xpress Executor gear

Example

```
declarations
  concurrencylevel: integer
end-declarations
concurrencylevel := executorgetconcurrencylevel( myexecutor )
if myexecutor.status<>EXECUTOR_OK then
  writeln("Error returned by Executor: ",myexecutor.lasterror)
  exit(1)
end-if
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. "Concurrency Level" is the number of executions that can be performed concurrently on a single gear; if the Xpress Executor component is scaled over multiple gears then the total number of concurrent executions will be `concurrencylevel*numgears`
3. If you start an execution when the maximum number of executions are concurrently executing, new executions are queued and will start when other executions complete.
4. This will always be 1 if the Executor is configured in local mode.

Related topics

`getstatus` `executorsetconcurrencylevel`

executorgetexpiryhours

Purpose

Fetch the configured execution expiry time of the Xpress Executor component.

Synopsis

```
function executorgetexpiryhours (exec:Executor):integer
```

Argument

`exec` The Executor to query

Return value

The number of hours after which a completed execution may be automatically deleted.

Example

```
declarations
    expiryhours: integer
end-declarations
expiryhours := executorgetexpiryhours( myexecutor )
if myexecutor.status<>EXECUTOR_OK then
    writeln("Error returned by Executor: ",myexecutor.lasterror)
    exit(1)
end-if
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. This will always be MAX_INT if the Executor is configured in local mode.

Related topics

`executordel` `executorsetexpiryhours`

executorgetinstanceconfig

Purpose

Fetch the Mosel instance re-use configuration of the Xpress Executor component.

Synopsis

```
function executorgetinstanceconfig(exec:Executor):MoselInstanceConfig
```

Argument

`exec` The Executor to query

Return value

A record describing in what circumstances (if any) Xpress Executor will re-use Mosel processes for multiple executions

Example

```
declarations
  cfg: MoselInstanceConfig
end-declarations
executorgetinstanceconfig( myexecutor, cfg)
if myexecutor.status<>EXECUTOR_OK then
  writeln("Error returned by Executor: ",myexecutor.lasterror)
  exit(1)
end-if
```

Further information

After calling, check the value of `exec.status` for any errors.

Related topics

`getstatus` `executorsetinstanceconfig`

executorgetmodelparams

Purpose

Fetch the model parameters of the Xpress Executor component.

Synopsis

```
procedure executorgetmodelparams(exec:Executor, modelparameters:array(set
    of string) of text)
```

Arguments

exec	The Executor to query
modelparameters	Array into which the model parameters should be written

Example

```
declarations
    myparams: array(set of string) of text
end-declarations
executorgetmodelparams( myexecutor, myparams)
if myexecutor.status<>EXECUTOR_OK then
    writeln("Error returned by Executor: ",myexecutor.lasterror)
    exit(1)
end-if
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. The parameters returned by this procedure will be passed to the model for all subsequent executions with this Executor.
3. Where named model parameters are set both here and in `executorexecute`, the values passed to `executorexecute` shall have priority.

Related topics

`getstatus` `executorsetmodelparams`

executorinit

Purpose

Initialize the given Executor with the details of the indicated component configured in `executor_components`, or in the same DMP solution.

Synopsis

```
procedure executorinit(exec:Executor)
procedure executorinit(exec:Executor, name:text)
procedure executorinit(exec:Executor, name:text, env:text)
```

Arguments

<code>exec</code>	The Executor to initialize
<code>name</code>	The component ID in the configuration JSON, or the component name when running within DMP. Within DMP, empty string to find any Xpress Executor component in the solution.
<code>env</code>	The component lifecycle stage ("DESIGN","STAGING" or "PRODUCTION") when the component name when running within DMP, empty string to use the lifecycle stage of the current component.

Example

```
executorinit( myexecutor )
if myexecutor.status<>EXECUTOR_OK then
    writeln("Error returned by Executor: ",myexecutor.lasterror)
    exit(1)
end-if
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. When no component name is given, and the solution a single Xpress Executor component, that component will be used.
3. When no component name is given, and the solution contains multiple Executor components, an arbitrary one will be chosen.
4. When used from Xpress Insight running in DMP, this will initialize the Executor with the indicated Xpress Executor found within the solution containing the Insight component.

Related topics

`getstatus`, `executor_components`

executorinitlocal

Purpose

Initialize the given Executor in local mode.

Synopsis

```
procedure executorinitlocal(exec:Executor)
```

Argument

exec The Executor to initialize

Example

```
executorinitlocal( myexecutor )
if myexecutor.status<>EXECUTOR_OK then
    writeln("Error returned by Executor: ",myexecutor.lasterror)
    exit(1)
end-if
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. In local mode, submodels are used to simulate an Xpress Executor component.
3. After initializing, the local Executor will have no configuration, so call `executorsetexecmode` and `executorsetmodelfile` to supply some.

Related topics

`getstatus`, `executorinit`, `executor_local_workdir`

executorlist

Purpose

Request a list of all the model executions currently present in the Xpress Executor component

Synopsis

```
function executorlist(exec:Executor):list of ModelExecution
```

Argument

`exec` The Executor to initialize

Return value

a list of the id and status of every execution in the repository.

Example

```
executions := executorlist( myexecutor )
if myexecutor.status<>EXECUTOR_OK then
    writeln("Error returned by Executor: ",myexecutor.lasterror)
    exit(1)
end-if
```

Further information

After calling, check the value of `exec.status` for any errors.

Related topics

`getstatus`, `executorpoll`

executortoll

Purpose

Update the status of the given ModelExecution

Synopsis

```
procedure executortoll(exec:Executor, execution:ModelExecution)
```

Arguments

<code>exec</code>	The Executor to on which the execution resides
<code>execution</code>	The ModelExecution record to update

Example

```
executortoll( myexecutor, myexecution )
if myexecutor.status<>EXECUTOR_OK then
    writeln("Error returned by Executor: ",myexecutor.lasterror)
    exit(1)
end-if
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. Only the `id` field of the ModelExecution record is read by this procedure.
3. When the procedure returns without an error, all fields of the ModelExecution record will have been refreshed with the latest status from the server.

Related topics

`getstatus`, `executorexecute`, `executortoll`

executorrepositorystatus

Purpose

Query the current repository status for the Xpress Executor component

Synopsis

```
function executorrepositorystatus(exec:Executor):RepositoryStatus
```

Argument

`exec` The Executor to query

Example

```
repostatus := executorrepositorystatus( myexecutor )
if myexecutor.status<>EXECUTOR_OK then
    writeln("Error returned by Executor: ",myexecutor.lasterror)
    exit(1)
end-if
if repostatus.binarydataquota - repostatus.binarydatasize < 10 then
    writeln("Warning: Executor is less than 10Mb under binary data quota")
end-if
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. The repository status will summarise how many executions are stored on the component and how close it is to the data storage quota.

Related topics

`getstatus`

executorsetconcurrencylevel

Purpose

Configure the concurrency level of the Xpress Executor component.

Synopsis

```
procedure executorsetconcurrencylevel(exec:Executor, newlevel:integer)
```

Arguments

exec The Executor to configure
level The new concurrency level, must be an integer greater than 1

Example

```
executorsetconcurrencylevel( myexecutor, 4)
if myexecutor.status<>EXECUTOR_OK then
    writeln("Error returned by Executor: ",myexecutor.lasterror)
    exit(1)
end-if
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. "Concurrency Level" is the number of executions that can be performed concurrently on a single gear; if the Xpress Executor component is scaled over multiple gears then the total number of concurrent executions will be `concurrencylevel*numgears`
3. If you start an execution when the maximum number of executions are concurrently executing, new executions are queued and will start when other executions complete.
4. In local mode, the concurrency level cannot be modified and calling this procedure will do nothing.
5. This can only be used with the design instance of the Xpress Executor component, or with an Executor initialized using `executorinitlocal`.

Related topics

`getstatus` `executorgetconcurrencylevel`

executorsetexecmode

Purpose

Configure the execution mode of the Xpress Executor component.

Synopsis

```
procedure executorsetexecmode(exec:Executor, execmode:string)
```

Arguments

<code>exec</code>	The Executor to configure
<code>execmode</code>	The execution mode; one of EXECUTOR_MODE_MODEL_BIM (if modelfile is a single .bim), EXECUTOR_MODE_MODEL_ZIP (if modelfile is a .zip file containing a model.bim), EXECUTOR_MODE_LP_XMPS (if the execution input data is a model in LP or XMPS format).

Example

```
executorsetexecmode( myexecutor, EXECUTOR_MODE_MODEL_ZIP )
if myexecutor.status<>EXECUTOR_OK then
    writeln("Error returned by Executor: ",myexecutor.lasterror)
    exit(1)
end-if
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. This can only be used with the design instance of the Xpress Executor component, or with an Executor initialized using `executorinitlocal`.
3. If the executor has been initialized with `executorinitlocal`, the execution mode may not be EXECUTOR_MODE_LP_XMPS.

Related topics

`getstatus`

executorsetexpiryhours

Purpose

Configure the number of hours after which a completed execution may be automatically deleted.

Synopsis

```
procedure executorsetexpiryhours(exec:Executor, hours:integer)
```

Arguments

exec The Executor to configure
hours The new number of hours after which a completed execution may be automatically deleted,

Example

```
executorsetexpiryhours( myexecutor, 4)
if myexecutor.status<>EXECUTOR_OK then
    writeln("Error returned by Executor: ",myexecutor.lasterror)
    exit(1)
end-if
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. In local mode, executions are never automatically expired so calling this procedure does nothing.
3. This can only be used with the design instance of the Xpress Executor component, or with an Executor initialized using `executorinitlocal`.

Related topics

`getstatus` `executorgetexpiryhours`

executorsetinputxsd

Purpose

Configure the input XSD describing the format of the input data.

Synopsis

```
procedure executorsetinputxsd(exec:Executor, srcfile:text)
```

Arguments

exec	The Executor to configure
srcfile	Filename of the local input XSD file

Example

```
executorsetinputxsd( myexecutor, "input.xsd" )
if myexecutor.status<>EXECUTOR_OK then
    writeln("Error returned by Executor: ",myexecutor.lasterror)
    exit(1)
end-if
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. This cannot only be used with the design instance of the Xpress Executor component.
3. The input XSD will be incorporated into the SOAP WSDL for the Xpress Executor component.
4. If you aren't calling the Xpress Executor SOAP interface from FICO Application Studio, you don't need to set the Input XSD.

Related topics

`getstatus`

executorsetinstanceconfig

Purpose

Configure when Xpress Executor is allowed to re-use a Mosel instance (process) for multiple executions.

Synopsis

```
procedure executorsetinstanceconfig(exec:Executor,  
    newcfg:MoselInstanceConfig)
```

Arguments

<code>exec</code>	The Executor to configure
<code>newcfg</code>	A record describing in what circumstances (if any) Xpress Executor will re-use Mosel processes for multiple executions

Example

```
executorsetexpiryhours( myexecutor, 4)  
if myexecutor.status<>EXECUTOR_OK then  
    writeln("Error returned by Executor: ",myexecutor.lasterror)  
    exit(1)  
end-if
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. In local mode, executions are always run in the same Mosel instance so this procedure has no effect.
3. This can only be used with the design instance of the Xpress Executor component, or with an Executor initialized using `executorinitlocal`.

Related topics

`getstatus` `executorgetinstanceconfig`

executorsetmodelfile

Purpose

Configure the model file of the Xpress Executor component.

Synopsis

```
procedure executorsetmodelfile(exec:Executor, srcfile:text)
```

Arguments

`exec` The Executor to configure
`srcfile` Filename of the local model file

Example

```
executorsetmodelfile( myexecutor, "mymodel.bim" )  
if myexecutor.status<>EXECUTOR_OK then  
  writeln("Error returned by Executor: ",myexecutor.lasterror)  
  exit(1)  
end-if
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. The model file is the Mosel model executed by Xpress Executor executions. It should be a .bim file if the execution mode is "FIXED_MODEL", or a .zip containing a file called model.bim if "FIXED_MODEL_IN_ZIPFILE".
3. This can only be used with the design instance of the Xpress Executor component, or with an Executor initialized using `executorinitlocal`.

Related topics

`getstatus`

executorsetmodelparams

Purpose

Configure the model parameters of the Xpress Executor component.

Synopsis

```
procedure executorsetmodelparams(exec:Executor, modelparameters:array(set
    of string) of text)
```

Arguments

exec	The Executor to configure
modelparameters	The model parameters

Example

```
declarations
    myparams: array(set of string) of text
end-declarations
myparams("VERBOSE") := "true"
myparams("MAX_COST") := "1.5"
executorsetmodelparams(myexecutor, myparams)
if myexecutor.status<>EXECUTOR_OK then
    writeln("Error returned by Executor: ",myexecutor.lasterror)
    exit(1)
end-if
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. The parameters set by this procedure will be passed to the model for all subsequent executions with this Executor.
3. Where named model parameters are set both here and in `executorexecute`, the values passed to `executorexecute` shall have priority.
4. This can only be used with the design instance of the Xpress Executor component, or with an Executor initialized using `executorinitlocal`.

Related topics

`getstatus` `executorgetmodelparams`

executorsetresultxsd

Purpose

Configure the result XSD describing the format of the result data.

Synopsis

```
procedure executorsetresultxsd(exec:Executor, srcfile:text)
```

Arguments

exec	The Executor to configure
srcfile	Filename of the local result XSD file

Example

```
executorsetresultxsd( myexecutor, "result.xsd" )
if myexecutor.status<>EXECUTOR_OK then
    writeln("Error returned by Executor: ",myexecutor.lasterror)
    exit(1)
end-if
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. This cannot only be used with the design instance of the Xpress Executor component.
3. The result XSD will be incorporated into the SOAP WSDL for the Xpress Executor component.
4. If you aren't calling the Xpress Executor SOAP interface from FICO Application Studio, you don't need to set the Result XSD.

Related topics

`getstatus`

executorwaitfor

Purpose

Wait until the given execution has completed

Synopsis

```
procedure executorwaitfor(exec:Executor, execution:ModelExecution,  
    timeoutseconds:integer)
```

Arguments

exec	The Executor to on which the execution resides
execution	The ModelExecution to wait for
timeoutseconds	The maximum number of seconds to wait before returning

Example

```
executorwaitfor( myexecutor, myexecution )  
if myexecutor.status<>EXECUTOR_OK then  
    writeln("Error returned by Executor: ",myexecutor.lasterror)  
    exit(1)  
end-if
```

Further information

1. After calling, check the value of `exec.status` for any errors.
2. Only the `id` field of the ModelExecution record is read by this procedure.
3. When the procedure returns without an error, all fields of the ModelExecution record will have been refreshed with the latest status from the server.
4. Check the `ModelExecution.iscompleted` field to see whether the execution completed within the given timeout period.
5. This procedure will make repeated calls to `executormapoll` with delays in between. You can configure how frequently it should call `executormapoll` by modifying the parameter `executor_poll_interval`.

Related topics

`getstatus`, `executorexecute`, `executormapoll`, `executor_poll_interval`

getlasterror

Purpose

Returns a string describing the error that occurred during the most recent operation on the Executor instance.

Synopsis

```
function getlasterror(exec:Executor):text
```

Return value

A text value containing the error message, which will be empty if the most recent operation on the Executor instance succeeded.

Further information

1. After every call to an Executor-related function or procedure, you should check the value of `getstatus` to see if your request succeeded. If it's unclear why an error is being returned, more troubleshooting output can be generated by setting the parameter `executor_verbose` to true, or inspecting the return value of `getlasterror`.
2. This function returns human-readable English description of the error that may be useful for troubleshooting purposes, but you should not assume that it is in any particular format. To distinguish between different types of error, use `getstatus` instead.

Related topics

`getstatus executor_verbose`

getstatus

Purpose

Indicates the status of the most recent request this model has made using the Executor instance

Synopsis

```
function getstatus(exec:Executor):integer
```

Return value

One of the following constants:

EXECUTOR_OK The operation completed successfully.

EXECUTOR_NOT_FOUND The requested execution was not found in the Xpress Executor service.

EXECUTOR_ACCESS_DENIED User is not authorized to access the Xpress Executor service

EXECUTOR_CONNECTION_ERROR Unable to connect to the Xpress Executor service.

EXECUTOR_SERVICE_ERROR The Xpress Executor service returned an unexpected error code.

EXECUTOR_IO_ERROR The executor module encountered an error reading or writing local files.

EXECUTOR_PARSE_ERROR The executor module did not understand the response from the
Executor component.

EXECUTOR_USAGE_ERROR The executor module did not understand a parameter you passed to it.

Further information

After every call to an Executor-related function or procedure, you should check the value of `getstatus` to see if your request succeeded. If it's unclear why an error is being returned, more troubleshooting output can be generated by setting the parameter 'executor_verbose' to true, or inspecting the return value of `getlasterror`.

Related topics

`getlasterror`

CHAPTER 8

Parameters

Via the `getparam` function and the `setparam` procedure it is possible to access the following control parameters of module `executor` :

<code>executor_bearer_refresh_interval</code>	Maximum age of bearer token to re-use	p. 42
<code>executor_components</code>	Configure component details using JSON format	p. 43
<code>executor_local_workdir</code>	Working directory for local executions	p. 43
<code>executor_max_retries</code>	How many times to retry Executor requests	p. 43
<code>executor_poll_interval</code>	Interval between polls of Execution status	p. 43
<code>executor_retry_error_codes</code>	Which types of error to retry	p. 44
<code>executor_verbose</code>	Activate additional logging	p. 42

executor_verbose

Description	Set to 'true' to activate additional logging of Executor-related actions and errors, to the model's error stream.
Type	Boolean, read/write
Default value	false

executor_bearer_refresh_interval

Description	The interval, in seconds, after which to refresh the bearer token, when a clientid and secret has been supplied to the Executor.
Type	Integer, read/write
Default value	1800
Note	This parameter has no effect when the Executor was initialized with a bearerToken value, or when used from Insight within DMP.

executor_poll_interval

Description	Sets the interval, in milliseconds, between checks of the execution status in the <code>executorwaitfor</code> procedure.
Type	Integer, read/write
Default value	500
Note	Values less than 100 will raise an error from <code>executorwaitfor</code> .

executor_local_workdir

Description	Sets the path under which to store configuration files and model working directories for an executor configured using <code>executorinitlocal</code> .
Type	String, read/write
Default value	<code>tmp:executorlocal</code>

executor_components

Description	This allows Executor component details to be configured using a JSON file. See the chapter on authentication, 3.2 , for more details.
Type	String, write only
Default value	<code>{ }</code>
Note	For security reasons, the value of this parameter cannot be read using <code>getparam</code> .
Note	The value of this parameter will be shared by all Mosel models running in the current process.

executor_max_retries

Description	Set the maximum number of times a 'failed' Executor request will be retried.
Type	Integer, read/write
Default value	8
Note	Each retry will be after an exponentially larger delay (200ms, 400ms, 800ms, etc) so be aware that large values can take a long time to report errors.
Note	The default setting will retry for approximately 52 seconds.
Note	The types of operation that are retried can be controlled using the <code>executor_retry_error_codes</code> parameter.

executor_retry_error_codes

Description	Comma-separated list of the HTTP status codes that should be retried.
Type	String, read/write
Default value	999, 500, 504, 403, 401
Note	Controls which errors to retry when <code>executor_max_retries</code> is non-zero.
Note	Supported error codes are HTTP status codes returned by the Executor HTTP component, with code 999 meaning a communication error.

CHAPTER 9

Deprecated Functionality

9.1 dmpmanagerurl

As an alternative to specifying the `bearer_tokenurl` attribute of the `Executor` variable, you can specify the `dmpmanagerurl` attribute to request the bearer token from DMP Manager, e.g.:

```
model DirectInitExample
  uses "executor"
  declarations
    myexecutor: Executor
  end-declarations

  myexecutor.componenturl := "https://vm65j75lqh-vm65j75lqh.dms.usw2.ficoanalyticcloud.com/"
  myexecutor.dmpmanagerurl := "https://console.dms.usw2.ficoanalyticcloud.com/"
  myexecutor.clientid := "vm5qh0y37c"
  myexecutor.secret := "wdS97u648BV0I#d3e4g2Z4mP780Y1DLdSDKm"
  ! myexecutor now initialized and can be used
end-model
```

Similarly, you can set the `dmpManagerUrl` field of a JSON configuration document:

```
{
  "main": {
    "componentUrl": "https://vm65j75lqh-vm65j75lqh.dms.usw2.ficoanalyticcloud.com/",
    "dmpManagerUrl": "https://console.dms.usw2.ficoanalyticcloud.com/",
    "clientId": "vm5qh0y37c",
    "secret": "wdS97u648BV0I#d3e4g2Z4mP780Y1DLdSDKm"
  }
}
```

Requesting a bearer token from DMP Manager is deprecated functionality in recent versions of DMP and this approach should not be used in new solutions.

APPENDIX A

Contacting FICO

FICO provides clients with support and services for all our products. Refer to the following sections for more information.

Product support

FICO offers technical support and services ranging from self-help tools to direct assistance with a FICO technical support engineer. Support is available to all clients who have purchased a FICO product and have an active support or maintenance contract. You can find support contact information and a link to the Customer Self Service Portal (online support) on the Product Support home page (www.fico.com/en/product-support).

The FICO Customer Self Service Portal is a secure web portal that is available 24 hours a day, 7 days a week from the Product Support home page. The portal allows you to open, review, update, and close cases, as well as find solutions to common problems in the FICO Knowledge Base.

Please include 'Xpress' in the subject line of your support queries.

Product education

FICO Product Education is the principal provider of product training for our clients and partners. Product Education offers instructor-led classroom courses, web-based training, seminars, and training tools for both new user enablement and ongoing performance support. For additional information, visit the Product Education homepage at www.fico.com/en/product-training or email producteducation@fico.com.

Product documentation

FICO continually looks for new ways to improve and enhance the value of the products and services we provide. If you have comments or suggestions regarding how we can improve this documentation, let us know by sending your suggestions to techpubs@fico.com.

Please include your contact information (name, company, email address, and optionally, your phone number) so we may reach you if we have questions.

Sales and maintenance

If you need information on other Xpress Optimization products, or you need to discuss maintenance contracts or other sales-related items, contact FICO by:

- Phone: +1 (408) 535-1500 or +44 207 940 8718
- Web: <http://www.fico.com/optimization> and use the available contact forms

Related services

Strategy Consulting: Included in your contract with FICO may be a specified amount of consulting time to assist you in using FICO Optimization Modeler to meet your business needs. Additional consulting time can be arranged by contract.

Conferences and Seminars: FICO offers conferences and seminars on our products and services. For announcements concerning these events, go to www.fico.com or contact your FICO account representative.

FICO Community

The FICO Community is a great resource to find the experts and information you need to collaborate, support your business, and solve common business challenges. You can get informal technical support, build relationships with local and remote professionals, and improve your business practices. For additional information, visit the FICO Community (community.fico.com/welcome).

About FICO

FICO (NYSE:FICO) powers decisions that help people and businesses around the world prosper. Founded in 1956 and based in Silicon Valley, the company is a pioneer in the use of predictive analytics and data science to improve operational decisions. FICO holds more than 165 US and foreign patents on technologies that increase profitability, customer satisfaction, and growth for businesses in financial services, telecommunications, health care, retail, and many other industries. Using FICO solutions, businesses in more than 100 countries do everything from protecting 2.6 billion payment cards from fraud, to helping people get credit, to ensuring that millions of airplanes and rental cars are in the right place at the right time. Learn more at www.fico.com.

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