

Package ‘Rcwl’

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Title An R interface to the Common Workflow Language

Version 1.8.1

Description The Common Workflow Language (CWL) is an open standard for development of data analysis workflows that is portable and scalable across different tools and working environments. Rcwl provides a simple way to wrap command line tools and build CWL data analysis pipelines programmatically within R. It increases the ease of usage, development, and maintenance of CWL pipelines.

Depends R (>= 3.6), yaml, methods, S4Vectors

Imports utils, stats, BiocParallel, batchtools, DiagrammeR, shiny,
R.utils, codetools, basilisk

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Description

An R package to wrap command line tools and build pipelines with Common Workflow Language (CWL).

See Also

- [cwlProcess](#)
- [cwlWorkflow](#)
- [cwlStep](#)
- [runCWL](#)

cwl-requirements

*CWL requirements functions***Description**

`requireDocker`: If a workflow component should be run in a Docker container, this function specifies how to fetch or build the image.

`requireJS`: Indicates that the workflow platform must support inline Javascript expressions. If this requirement is not present, the workflow platform must not perform expression interpolation.

`requireSoftware`: A list of software packages that should be configured in the environment of the defined process.

`InitialWorkDirRequirement`: Define a list of files and subdirectories that must be created by the workflow platform in the designated output directory prior to executing the command line tool.

`: Dirent`: Define a file or subdirectory that must be placed in the designated output directory prior to executing the command line tool. May be the result of executing an expression, such as building a configuration file from a template.

Create manifest for configure files.

Usage

```
requireDocker(
  docker = NULL,
  Load = NULL,
  File = NULL,
  Import = NULL,
  ImageId = NULL,
  OutputDir = NULL
)

requireJS(expressionLib = list())

requireSoftware(packages = list())

requireInitialWorkDir(listing = list())

Dirent(entryname = character(), entry, writable = FALSE)

requireManifest(inputID, sep = "\\n")

requireSubworkflow()

requireScatter()

requireMultipleInput()
```

```
requireStepInputExpression()
```

```
requireRscript(rscript)
```

Arguments

<code>docker</code>	Character. Specify a Docker image to retrieve using docker pull.
<code>Load</code>	Character. Specify a HTTP URL from which to download a Docker image using docker load.
<code>File</code>	Character. Supply the contents of a Dockerfile which will be built using docker build.
<code>Import</code>	Character. Provide HTTP URL to download and gunzip a Docker images using 'docker import'.
<code>ImageId</code>	Character. The image id that will be used for docker run. May be a human-readable image name or the image identifier hash. May be skipped if <code>dockerPull</code> is specified, in which case the <code>dockerPull</code> image id must be used.
<code>OutputDir</code>	Character. Set the designated output directory to a specific location inside the Docker container.
<code>expressionLib</code>	optional list. Additional code fragments that will also be inserted before executing the expression code. Allows for function definitions that may be called from CWL expressions.
<code>packages</code>	The list of software to be configured.
<code>listing</code>	The list of files or subdirectories that must be placed in the designated output directory prior to executing the command line tool.
<code>entryname</code>	Character or Expression. The name of the file or subdirectory to create in the output directory. The name of the file or subdirectory to create in the output directory. If entry is a File or Directory, the <code>entryname</code> field overrides the value of <code>basename</code> of the File or Directory object. Optional.
<code>entry</code>	Character or expression. Required.
<code>writable</code>	Logical. If true, the file or directory must be writable by the tool. Changes to the file or directory must be isolated and not visible by any other <code>CommandLineTool</code> process. Default is FALSE (files and directories are read-only). Optional.
<code>inputID</code>	The input ID from corresponding 'InputParam'.
<code>sep</code>	The separator of the input files in the manifest config.
<code>rscript</code>	An R script to run.

Details

More details about 'requireDocker', see: <https://www.commonwl.org/v1.0/CommandLineTool.html#DockerRequirement>

More details about 'requireJS', see: <https://www.commonwl.org/v1.0/CommandLineTool.html#InlineJavascriptRequirement>

More details about 'requireSoftware', see: <https://www.commonwl.org/v1.0/CommandLineTool.html#SoftwareRequirement>

More details about 'requireInitialWorkDir', See: <https://www.commonwl.org/v1.0/CommandLineTool.html#InitialWorkDirRequirement>

More details about 'Dirent', See: <https://www.commonwl.org/v1.0/CommandLineTool.html#Dirent>

Value

requireDocker: A list of docker requirement to fetch or build the image.

requireJS: A list of inline Javascript requirement.

requireSoftware: A list of software requirements.

requireInitialWorkDir: A list of initial work directory requirements.

Dirent: A list.

requireSubworkflow: A SubworkflowFeatureRequirement list.

requireScatter: A ScatterFeatureRequirement list.

requireMultipleInput: A MultipleInputFeatureRequirement list.

requireStepInputExpression: A StepInputExpressionRequirement list.

A requirement list with Rscript as manifest entry.

Examples

```
p1 <- InputParam(id = "ifiles", type = "File[]?", position = -1)
CAT <- cwlProcess(baseCommand = "cat",
  requirements = list(requireDocker("alpine"), requireManifest("ifiles"), requireJS()),
  arguments = list("ifiles"),
  inputs = InputParamList(p1))
```

cwlProcess

Parameters for CWL

Description

The main CWL parameter class and constructor for command tools. More details: <https://www.commonwl.org/v1.0/CommandLineTool>

Usage

```
cwlProcess(
  cwlVersion = "v1.0",
  cwlClass = "CommandLineTool",
  baseCommand = character(),
  requirements = list(),
  hints = list(),
  arguments = list(),
  id = character(),
  label = character(),
  inputs = InputParamList(),
  outputs = OutputParamList(),
  stdout = character(),
  stdin = character(),
  expression = character(),
```

```

    extensions = list(),
    intent = list()
  )

```

Arguments

cwlVersion	CWL version
cwlClass	"CommandLineTool"
baseCommand	Specifies the program or R function to execute
requirements	A list of requirements that apply to either the runtime environment or the workflow engine that must be met in order to execute this process.
hints	Any or a list for the workflow engine.
arguments	Command line bindings which are not directly associated with input parameters.
id	The unique identifier for this process object.
label	A short, human-readable label of this process object.
inputs	A object of 'InputParamList'.
outputs	A object of 'OutputParamList'.
stdout	Capture the command's standard output stream to a file written to the designated output directory.
stdin	A path to a file whose contents must be piped into the command's standard input stream.
expression	Javascripts for ExpressionTool class.
extensions	A list of extensions and metadata
intent	An identifier for the type of computational operation, of this Process.

Details

<https://www.commonwl.org/v1.0/CommandLineTool.html>

Value

A 'cwlProcess' class object.

Examples

```

input1 <- InputParam(id = "sth")
echo <- cwlProcess(baseCommand = "echo", inputs = InputParamList(input1))

```

cwlProcess-methods	<i>cwlProcess methods</i>
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Description

Some useful methods for 'cwlProcess' objects.

'\$': Extract input values for 'cwlProcess' object. (Can auto-complete the input names using tab)

'\$<-' : Set input values for 'cwlProcess' object by name.

outputs: The outputs of a 'cwlProcess' object.

stdOut: stdout of 'cwlProcess' object.

extensions: Extensions and metadata of 'cwlProcess' object.

short: The function to show a short summary of 'cwlProcess' or 'cwlWorkflow' object.

Usage

```
cwlVersion(cwl)
```

```
cwlVersion(cwl) <- value
```

```
cwlClass(cwl)
```

```
cwlClass(cwl) <- value
```

```
baseCommand(cwl)
```

```
baseCommand(cwl) <- value
```

```
arguments(cwl, step = NULL)
```

```
arguments(cwl, step = NULL) <- value
```

```
hints(cwl)
```

```
hints(cwl) <- value
```

```
requirements(cwl, step = NULL)
```

```
requirements(cwl, step = NULL) <- value
```

```
inputs(cwl)
```

```
## S4 method for signature 'cwlProcess'  
x$name
```

```
## S4 replacement method for signature 'cwlProcess'
```

```

x$name <- value

outputs(cwl)

stdOut(cwl)

stdOut(cwl) <- value

extensions(cwl)

extensions(cwl) <- value

short(cwl)

```

Arguments

cwl	A 'cwlProcess' (or 'cwlWorkflow') object.
value	To assign a list of 'requirements' value.
step	To specify a step ID when 'cwl' is a workflow.
x	A 'cwlProcess' object.
name	One of input list.

Value

cwlVersion: cwl document version
 cwlClass: CWL class of 'cwlProcess' or 'cwlWorkflow' object.
 baseCommand: base command for the 'cwlProcess' object.
 arguments: CWL arguments.
 hints: CWL hints.
 requirements: CWL requirements.
 inputs: A list of 'InputParam'.
 '\$': the 'InputParam' value for 'cwlProcess' object.
 outputs: A list of 'OutputParam'.
 stdOut: CWL stdout.
 extensions: A list of extensions or metadata.
 short: A short summary of an object of 'cwlProcess' or 'cwlWorkflow'.

Examples

```

ip <- InputParam(id = "sth")
echo <- cwlProcess(baseCommand = "echo", inputs = InputParamList(ip))
cwlVersion(echo)
cwlClass(echo)
baseCommand(echo)
hints(echo)

```

```

requirements(echo)
inputs(echo)
outputs(echo)
stdOut(echo)
extensions(echo)

s1 <- cwlWorkflow()
runs(s1)
s1
short(s1)

```

cwlShiny

cwlShiny

Description

Function to generate shiny app automaticlly for a ‘cwlProcess’ object.

Usage

```
cwlShiny(cwl, inputList = list(), upload = FALSE, ...)
```

Arguments

cwl	A cwlProcess object.
inputList	a list of choices for the inputs of cwl object. The name of the list must match the inputs of the cwl object.
upload	Whether to upload file. If FALSE, the upload field will be text input (file path) instead of file input.
...	More options for ‘runCWL’.

Value

A shiny webapp.

Examples

```

input1 <- InputParam(id = "sth")
echo <- cwlProcess(baseCommand = "echo", inputs = InputParamList(input1))
echoApp <- cwlShiny(echo)

```

cwlStep

*cwlStep function***Description**

Constructor function for ‘cwlStep’ object.

Usage

```
cwlStep(
  id,
  run = cwlProcess(),
  In = list(),
  Out = list(),
  scatter = character(),
  scatterMethod = character(),
  label = character(),
  doc = character(),
  requirements = list(),
  hints = list(),
  when = character()
)
```

Arguments

id	A user-defined unique identifier for this workflow step.
run	A ‘cwlProcess’ object for command line tool, or path to a CWL file.
In	A list of input parameters which will be constructed into ‘stepInParameterList’.
Out	A list of outputs.
scatter	character or a list. The inputs to be scattered.
scatterMethod	required if scatter is an array of more than one element. It can be one of "dot-product", "nested_crossproduct" and "flat_crossproduct".
label	A short, human-readable label of this object.
doc	A documentation string for this object, or an array of strings which should be concatenated.
requirements	Requirements that apply to either the runtime environment or the workflow engine.
hints	Hints applying to either the runtime environment or the workflow engine.
when	If defined, only run the step when the expression evaluates to true. If false the step is skipped.

Details

For more details: <https://www.commonwl.org/v1.0/Workflow.html#WorkflowStep>

Value

An object of class ‘cwlStep‘.

See Also

[cwlWorkflow](#)

Examples

```
s1 <- cwlStep(id = "s1")
```

cwlWorkflow

cwlWorkflow function

Description

The constructor function for ‘cwlWorkflow‘ object, which connects multiple command line steps into a workflow.

steps: Function to extract and assign workflow step slots.

Usage

```
cwlWorkflow(
  cwlVersion = "v1.0",
  cwlClass = "Workflow",
  requirements = list(),
  id = character(),
  label = character(),
  doc = list(),
  intent = list(),
  hints = list(),
  arguments = list(),
  extensions = list(),
  inputs = InputParamList(),
  outputs = OutputParamList(),
  steps = cwlStepList()
)

## S4 method for signature 'cwlWorkflow,cwlStep'
e1 + e2

steps(cwl)

steps(cwl) <- value
```

Arguments

cwlVersion	CWL version
cwlClass	"Workflow".
requirements	Requirements that apply to either the runtime environment or the workflow engine.
id	A user-defined unique identifier for this workflow.
label	A short, human-readable label of this object.
doc	A documentation string for this object.
intent	An identifier for the type of computational operation, of this Process.
hints	Any or a list for the workflow engine.
arguments	Command line bindings which are not directly associated with input parameters.
extensions	A list of extensions and metadata.
inputs	An object of 'InputParamList'.
outputs	An object of 'OutputParamList'.
steps	A list of 'cwlStepList'.
e1	A 'cwlWorkflow' object.
e2	A 'cwlStep' object.
cwl	A 'cwlWorkflow' object.
value	A list of 'cwlSteps' to assign.

Value

cwlWorkflow: An object of class 'cwlWorkflow'.

steps: A list of 'cwlStep' objects.

See Also

[stepInParamList](#)

Examples

```
input1 <- InputParam(id = "sth")
echo1 <- cwlProcess(baseCommand = "echo",
  inputs = InputParamList(input1))
input2 <- InputParam(id = "sthout", type = "File")
echo2 <- cwlProcess(baseCommand = "echo",
  inputs = InputParamList(input2),
  stdout = "out.txt")
i1 <- InputParam(id = "sth")
o1 <- OutputParam(id = "out", type = "File", outputSource = "echo2/output")
wf <- cwlWorkflow(inputs = InputParamList(i1),
  outputs = OutputParamList(o1))
s1 <- cwlStep(id = "echo1", run = echo1, In = list(sth = "sth"))
s2 <- cwlStep(id = "echo2", run = echo2, In = list(sthout = "echo1/output"))
wf <- wf + s1 + s2
```

cwlWorkflow-methods	<i>cwlWorkflow methods</i>
---------------------	----------------------------

Description

runs: The function to access all runs of a ‘cwlWorkflow’ object.

Usage

```
runs(object)
```

Arguments

object A ‘cwlWorkflow’ object.

Value

‘cwlProcess’ objects or paths of CWL file.

Examples

```
s1 <- cwlWorkflow()
runs(s1)
s1
short(s1)
```

InputArrayParam-class *All classes defined in the package of ‘Rcwl’ and the class constructor functions.*

Description

InputArrayParam: Parameters for array inputs. To specify an array parameter, the array definition is nested under the type field with ‘type: array’ and items defining the valid data types that may appear in the array.

InputParam: parameter for a command line tool.

InputParamList: A list of ‘InputParam’ objects.

OutputArrayParam: Parameters for array outputs.

OutputParam: An output parameter for a Command Line Tool.

OutputParamList: A list of ‘InputParam’ objects.

stepInParam: The input parameter of a workflow step.

stepInParamList: A list of ‘stepInParam’ objects.

cwlStepList: A list of ‘cwlStep’ objects.

Usage

```
InputArrayParam(  
    label = "",  
    type = "array",  
    items = character(),  
    prefix = "",  
    separate = TRUE,  
    itemSeparator = character(),  
    valueFrom = character()  
)  
  
InputParam(  
    id,  
    label = "",  
    type = "string",  
    doc = character(),  
    secondaryFiles = character(),  
    streamable = logical(),  
    format = character(),  
    loadListing = character(),  
    loadContents = logical(),  
    position = 0L,  
    prefix = "",  
    separate = TRUE,  
    itemSeparator = character(),  
    valueFrom = character(),  
    shellQuote = logical(),  
    default = character(),  
    value = character()  
)  
  
InputParamList(...)  
  
OutputArrayParam(  
    label = character(),  
    type = "array",  
    items = character(),  
    glob = character(),  
    loadContents = logical(),  
    outputEval = character()  
)  
  
OutputParam(  
    id = "output",  
    label = character(),  
    doc = character(),  
    type = "stdout",  
    format = character(),
```

```

    secondaryFiles = character(),
    streamable = logical(),
    glob = character(),
    loadContents = logical(),
    outputEval = character(),
    outputSource = character()
)

OutputParamList(out = OutputParam(), ...)

stepInParam(
  id,
  source = character(),
  linkMerge = character(),
  default = character(),
  valueFrom = character()
)

stepInParamList(...)

cwlStepList(...)

```

Arguments

label	A short, human-readable label of this object.
type	Specify valid types of data that may be assigned to this parameter.
items	Defines the type of the array elements.
prefix	Command line prefix to add before the value.
separate	If true (default), then the prefix and value must be added as separate command line arguments; if false, prefix and value must be concatenated into a single command line argument.
itemSeparator	Join the array elements into a single string with the elements separated by by itemSeparator.
valueFrom	value from string or expression.
id	A unique identifier for this workflow input parameter.
doc	A documentation string for this object, or an array of strings which should be concatenated.
secondaryFiles	Provides a pattern or expression specifying files or directories. Only valid when type: File or is an array of items: File.
streamable	A value of true indicates that the file is read or written sequentially without seeking. Only valid when type: File or is an array of items: File.
format	Only valid when type: File or is an array of items: File. This is the file format that will be assigned to the output File object.
loadListing	Only valid when type: Directory or is an array of items: Directory.
loadContents	Read text from globbed file.

position	The position for this parameter.
shellQuote	If ShellCommandRequirement is in the requirements for the current command, this controls whether the value is quoted on the command line (default is true).
default	The default value for this parameter to use if either there is no source field, or the value produced by the source is null.
value	Assigned value for this parameter
...	A list of 'cwlStep' objects.
glob	Pattern to find files relative to the output directory.
outputEval	Evaluate an expression to generate the output value.
outputSource	Specifies one or more workflow parameters that supply the value of to the output parameter.
out	The default stdout parameter.
source	Specifies one or more workflow parameters that will provide input to the underlying step parameter.
linkMerge	The method to use to merge multiple inbound links into a single array.

Details

More details of 'InputArrayParam', see: <https://www.commonwl.org/v1.0/CommandLineTool.html#CommandInputArraySc>

More details for 'InputParam', see: <https://www.commonwl.org/v1.0/CommandLineTool.html#CommandInputParameter>

More details for 'OutputArrayParam', see: <https://www.commonwl.org/v1.0/CommandLineTool.html#CommandOutputArra>

More details for 'OutputParam', see: <https://www.commonwl.org/v1.0/CommandLineTool.html#CommandOutputParameter>

More details for 'stepInParam', see: <https://www.commonwl.org/v1.0/Workflow.html#WorkflowStepInput>

Value

InputArrayParam: An object of class 'InputArrayParam'.

An object of class 'InputParam'.

InputParamList: An object of class 'InputParamList'.

An object of class 'OutputArrayParam'.

OutputParam: An object of class 'OutputParam'.

OutputParamList: An object of class 'OutputParamList'.

stepInParam: An object of class 'stepInParam'.

An object of class 'stepInParamList'.

cwlStepList: An object of class 'cwlStepList'.

Examples

```

InputArrayParam(items = "string", prefix="-B=", separate = FALSE)
input1 <- InputParam(id = "sth")
InputParamList(input1)
OutputParam(id = "b", type = OutputArrayParam(items = "File"), glob = "*.txt")
o1 <- OutputParam(id = "file", type = "File", glob = "*.txt")
o1

o1 <- OutputParam(id = "file", type = "File", glob = "*.txt")
OutputParamList(o1)
s1 <- stepInParam(id = "s1")

s1 <- stepInParam(id = "s1")
stepInParamList(s1)
s1 <- cwlStep(id = "s1")
cwlStepList(s1)

```

install_udocker	<i>install udocker</i>
-----------------	------------------------

Description

To download and install udocker for python3.

Usage

```
install_udocker()
```

plotCWL	<i>plotCWL</i>
---------	----------------

Description

Function to plot cwlWorkflow object.

Usage

```
plotCWL(cwl, output = "graph", layout = "tree", ...)
```

Arguments

cwl	A cwlWorkflow object to plot
output	A string specifying the output type. An option inherits from 'render_graph' and can also be "mermaid".
layout	Layout from 'render_graph'.
...	other parameters from 'mermaid' or 'render_graph' function

Value

A workflow plot.

Examples

```
input1 <- InputParam(id = "sth")
echo1 <- cwlProcess(baseCommand = "echo",
  inputs = InputParamList(input1))
input2 <- InputParam(id = "sthout", type = "File")
echo2 <- cwlProcess(baseCommand = "echo",
  inputs = InputParamList(input2),
  stdout = "out.txt")
i1 <- InputParam(id = "sth")
o1 <- OutputParam(id = "out", type = "File", outputSource = "echo2/output")
wf <- cwlWorkflow(inputs = InputParamList(i1),
  outputs = OutputParamList(o1))
s1 <- cwlStep(id = "echo1", run = echo1, In = list(sth = "sth"))
s2 <- cwlStep(id = "echo2", run = echo2, In = list(sthout = "echo1/output"))
wf <- wf + s1 + s2
plotCWL(wf)
```

readCWL

Read CWL Function to read CWL command or workflow files.

Description

Read CWL Function to read CWL command or workflow files.

Usage

```
readCWL(cwlfile)
```

Arguments

cwlfile The cwl file to read.

Value

A object of class ‘cwlProcess’ or ‘cwlWorkflow’.

Examples

```
input1 <- InputParam(id = "sth")
echo <- cwlProcess(baseCommand = "echo",
  inputs = InputParamList(input1))
tf <- writeCWL(echo)
readCWL(tf[1])
```

runCWL

*run cwlProcess***Description**

Execute a cwlProcess object with assigned inputs.

Usage

```
runCWL(
  cwl,
  cwlRunner = "cwltool",
  outdir = ".",
  cwlTemp = NULL,
  cwlArgs = character(),
  stdout = TRUE,
  stderr = TRUE,
  showLog = FALSE,
  docker = TRUE,
  yml_prefix = deparse(substitute(cwl)),
  yml_outdir = tempfile(),
  ...
)
```

Arguments

cwl	A 'cwlProcess' or 'cwlWorkflow' object.
cwlRunner	The path to the 'cwltool' or 'cwl-runner'. If not exists, the cwltool package will be installed by 'reticulate'.
outdir	Output directory, default is current working directory.
cwlTemp	File path to keep intermediate files. If a directory path is given, the intermediate files will be kept in the directory. Default is NULL to remove all intermediate files.
cwlArgs	The arguments for 'cwltool' or 'cwl-runner'. For example, "--debug" can work with 'cwltool' to show debug information.
stdout	standard output from 'system2'.
stderr	standard error from 'system2'. By setting it to "", the detailed running logs will return directly.
showLog	Whether to show log details to standard out. i.e. stderr = "".
docker	Whether to use docker, or "singularity" if use Singularity runtime to run container.
yml_prefix	The prefix of '.cwl' and '.yaml' files that are to be internally executed.
yml_outdir	The output directory for the '.cwl' and '.yaml' files.
...	The other options from 'writeCWL' and 'system2'.

Value

A list of outputs from tools and logs from cwltool.

Examples

```
input1 <- InputParam(id = "sth")
echo <- cwlProcess(baseCommand = "echo",
                  inputs = InputParamList(input1))
echo$sth <- "Hello World!"
## res <- runCWL(echo)
```

runCWLBatch

run CWL with batchtools

Description

run CWL with batchtools

Usage

```
runCWLBatch(
  cwl,
  outdir = getwd(),
  inputList,
  paramList = list(),
  BPPARAM = BatchtoolsParam(workers = lengths(inputList)[1]),
  ...
)
```

Arguments

cwl	A ‘cwlProcess’ or ‘cwlWorkflow’ object.
outdir	Directory to output results
inputList	An input list to run in parallel. The list names must be in the inputs of cwl. Jobs will be submitted in parallel for each element in the list. The output directory of each job will be made using the name of each element under the ‘outdir’.
paramList	A parameter list for the cwl. The list names must be in the inputs of cwl.
BPPARAM	The options for ‘BiocParallelParam’.
...	The options from runCWL.

Value

Results from computing nodes and logs from cwltool.

`writeCWL`*Write CWL*

Description

write ‘cwlProcess’ to cwl and yml.

Usage

```
writeCWL(  
  cwl,  
  prefix = deparse(substitute(cwl)),  
  outdir = tempfile(),  
  docker = TRUE,  
  libPaths = TRUE,  
  ...  
)
```

Arguments

<code>cwl</code>	A ‘cwlProcess’ or ‘cwlWorkflow’ object.
<code>prefix</code>	The prefix of ‘.cwl’ and ‘.yaml’ files to be generated.
<code>outdir</code>	The output directory for the ‘.cwl’ and ‘.yaml’ files.
<code>docker</code>	Whether to use docker.
<code>libPaths</code>	Whether to add local R library paths to R script.
<code>...</code>	Other options from ‘yaml::write_yaml’.

Value

A CWL file and A YAML file.

Examples

```
input1 <- InputParam(id = "sth")  
echo <- cwlProcess(baseCommand = "echo",  
                   inputs = InputParamList(input1))  
writeCWL(echo)
```

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