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# **XBlock API Guide**

**edX Inc.**

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This document provides reference information on the XBlock API. You use this API to build XBlocks.

EdX also provides the [EdX XBlock Tutorial](#), which describes XBlock concepts in depth and guides developers through the process of creating an XBlock.



## CHANGE HISTORY FOR XBLOCK

These are notable changes in XBlock.

### 1.1 1.3.1 - 2020-05-06

- Fixed import error of mock.

### 1.2 1.3.0 - 2020-05-04

- Drop support to python 2.7 and add support to python 3.8. typing package failing on py3.8 so add constraint.

### 1.3 1.2.8 - 2019-10-24

- Ensure the version file is closed after reading its content.

### 1.4 1.2.7 - 2019-10-15

- Changed how illegal XML characters are sanitized, to speed the operation. The old way was removing more characters than are required by the XML specification.

### 1.5 1.2.6 - 2019-09-24

- Add support for relative dates to DateTime fields.

### 1.6 1.2.5 - 2019-09-19

- Changes for Python 2/3 compatibility.

### 1.7 1.2.4 - 2019-08-27

- Added an API for notifying the Runtime when an XBlock's `save()` method is called.
- Added a mechanism for Runtime subclasses to more easily add extra CSS classes to the `<div>` that wraps rendered XBlocks

### 1.8 1.2.3 - 2019-07-24

Allow Mixologist class to consume both class objects and string paths to classes as a part of initialization.

### 1.9 1.2.1 - 2018-09-05

Add a method to get completion mode for a block.

### 1.10 1.2.1 - 2018-06-25

Suppress a spurious warning when using lazily-translated text as the default value of a String field.

### 1.11 1.2.0 - Aside filtering

- Add capability for XBlockAsides to apply only to XBlocks that match certain conditions

### 1.12 1.0 - Python 3

- Introduce Python 3 compatibility to the xblock code base. This does not enable Python 2 codebases (like edx-platform) to load xblocks written in Python 3, but it lays the groundwork for future migrations.

### 1.13 0.5 - ???

No notes provided.



## 1.14 0.4

- Separate Fragment class out into new web-fragments package
- Make Scope enums (UserScope.\* and BlockScope.\*) into Sentinels, rather than just ints, so that they can have more meaningful string representations.
- Rename *export\_xml* to *add\_xml\_to\_node*, to more accurately capture the semantics.
- Allowed *Runtime* implementations to customize loading from **block\_types** to *XBlock* classes.

## 1.15 0.3 - 2014-01-09

- Added services available through *Runtime.service*, once XBlocks have announced their desires with *@XBlock.needs* and *@XBlock.wants*.
- The “i18n” service provides a *gettext.Translations* object for retrieving localized strings.
- Make *context* an optional parameter for all views.
- Add shortcut method to make rendering an XBlock’s view with its own runtime easier.
- Change the user field of scopes to be three valued, rather than two. *False* becomes *UserScope.NONE*, *True* becomes *UserScope.ONE*, and *UserScope.ALL* is new, and represents data that is computed based on input from many users.
- Rename *ModelData* to *FieldData*.
- Rename *ModelType* to *Field*.
- Split *xblock.core* into a number of smaller modules:
  - *xblock.core*: Defines XBlock.
  - *xblock.fields*: Defines *ModelType* and subclasses, *ModelData*, and metaclasses for classes with fields.
  - *xblock.namespaces*: Code for XBlock Namespaces only.
  - *xblock.exceptions*: exceptions used by all parts of the XBlock project.
- Changed the interface for *Runtime* and *ModelData* so that they function as single objects that manage large numbers of *XBlocks*. Any method that operates on a block now takes that block as the first argument. Blocks, in turn, are responsible for storing the key values used by their field scopes.
- Changed the interface for *model\_data* objects passed to *XBlocks* from dict-like to the being cache-like (as was already used by *KeyValueStore*). This removes the need to support methods like iteration and length, which makes it easier to write new *ModelDatas*. Also added an actual *ModelData* base class to serve as the expected interface.



## INTRODUCTION TO XBLOCKS

As a developer, you build XBlocks that course teams use to create independent course components that work seamlessly with other components in an online course.

For example, you can build XBlocks to represent individual problems or pieces of text or HTML content. Furthermore, like Legos, XBlocks are composable; you can build XBlocks to represent larger structures such as lessons, sections, and entire courses.

A primary advantage to XBlocks is that they are sharable. The code you write can be deployed in any instance of the edX Platform or other XBlock runtime application, then used by any course team using that system.

By combining XBlocks from a wide variety of sources, from text and video, to multiple choice and numerical questions, to sophisticated collaborative and interactive learning laboratories, course teams can create rich and engaging courseware.

### 2.1 XBlock Independence and Interoperability

You must design your XBlock to meet two goals.

- The XBlock must be independent of other XBlocks. Course teams must be able to use the XBlock without depending on other XBlocks.
- The XBlock must work together with other XBlocks. Course teams must be able to combine different XBlocks in flexible ways.

### 2.2 XBlocks Compared to Web Applications

XBlocks are like miniature web applications: they maintain state in a storage layer, render themselves through views, and process user actions through handlers.

XBlocks differ from web applications in that they render only a small piece of a complete web page.

Like HTML `<div>` tags, XBlocks can represent components as small as a paragraph of text, a video, or a multiple choice input field, or as large as a section, a chapter, or an entire course.



## XBLOCK API

**class** `xblock.core.XBlock` (*runtime*, *field\_data=None*, *scope\_ids=<object object>*, \*args, \*\*kwargs)  
Base class for XBlocks.

Derive from this class to create a new kind of XBlock. There are no required methods, but you will probably need at least one view.

Don't provide the `__init__` method when deriving from this class.

Construct a new XBlock.

This class should only be instantiated by runtimes.

### Parameters

- **runtime** (*Runtime*) – Use it to access the environment. It is available in XBlock code as `self.runtime`.
- **field\_data** (*FieldData*) – Interface used by the XBlock fields to access their data from wherever it is persisted. Deprecated.
- **scope\_ids** (*ScopeIds*) – Identifiers needed to resolve scopes.

**add\_children\_to\_node** (*node*)  
Add children to `etree.Element node`.

**add\_xml\_to\_node** (*node*)  
For exporting, set data on `etree.Element node`.

**clear\_child\_cache** ()  
Reset the cache of children stored on this XBlock.

**force\_save\_fields** (*field\_names*)  
Save all fields that are specified in *field\_names*, even if they are not dirty.

**get\_child** (*usage\_id*)  
Return the child identified by *usage\_id*.

**get\_children** (*usage\_id\_filter=None*)  
Return instantiated XBlocks for each of this blocks children.

**get\_parent** ()  
Return the parent block of this block, or None if there isn't one.

**classmethod get\_public\_dir** ()  
Gets the public directory for this XBlock.

**classmethod get\_resources\_dir** ()  
Gets the resource directory for this XBlock.

**handle** (*handler\_name, request, suffix=""*)  
Handle *request* with this block's runtime.

**classmethod handler** (*func*)  
A decorator to indicate a function is usable as a handler.  
The wrapped function must return a *webob.Response* object.

**property has\_cached\_parent**  
Return whether this block has a cached parent block.

**has\_support** (*view, functionality*)  
Returns whether the given view has support for the given functionality.

An XBlock view declares support for a functionality with the `@XBlock.supports` decorator. The decorator stores information on the view.

Note: We implement this as an instance method to allow xBlocks to override it, if necessary.

#### Parameters

- **view** (*object*) – The view of the xBlock.
- **functionality** (*str*) – A functionality of the view. For example: "multi\_device".

**Returns** True or False

**index\_dictionary** ()  
return key/value fields to feed an index within in a Python dict object values may be numeric / string or dict

**classmethod json\_handler** (*func*)  
Wrap a handler to consume and produce JSON.

Rather than a Request object, the method will now be passed the JSON-decoded body of the request. The request should be a POST request in order to use this method. Any data returned by the function will be JSON-encoded and returned as the response.

The wrapped function can raise `JsonHandlerError` to return an error response with a non-200 status code.

This decorator will return a 405 HTTP status code if the method is not POST. This decorator will return a 400 status code if the body contains invalid JSON.

**classmethod load\_class** (*identifier, default=None, select=None*)  
Load a single class specified by identifier.

If *identifier* specifies more than a single class, and *select* is not None, then call *select* on the list of *entry\_points*. Otherwise, choose the first one and log a warning.

If *default* is provided, return it if no *entry\_point* matching *identifier* is found. Otherwise, will raise a `PluginMissingError`

If *select* is provided, it should be a callable of the form:

```
def select(identifier, all_entry_points):  
    # ...  
    return an_entry_point
```

The *all\_entry\_points* argument will be a list of all *entry\_points* matching *identifier* that were found, and *select* should return one of those *entry\_points* to be loaded. *select* should raise `PluginMissingError` if no plugin is found, or `AmbiguousPluginError` if too many plugins are found

**classmethod load\_classes** (*fail\_silently=True*)  
Load all the classes for a plugin.

Produces a sequence containing the identifiers and their corresponding classes for all of the available instances of this plugin.

`fail_silently` causes the code to simply log warnings if a plugin cannot import. The goal is to be able to use part of libraries from an XBlock (and thus have it installed), even if the overall XBlock cannot be used (e.g. depends on Django in a non-Django application). There is disagreement about whether this is a good idea, or whether we should see failures early (e.g. on startup or first page load), and in what contexts. Hence, the flag.

**classmethod `load_tagged_classes`** (*tag*, *fail\_silently=True*)

Produce a sequence of all XBlock classes tagged with *tag*.

`fail_silently` causes the code to simply log warnings if a plugin cannot import. The goal is to be able to use part of libraries from an XBlock (and thus have it installed), even if the overall XBlock cannot be used (e.g. depends on Django in a non-Django application). There is disagreement about whether this is a good idea, or whether we should see failures early (e.g. on startup or first page load), and in what contexts. Hence, the flag.

**classmethod `needs`** (*\*service\_names*)

A class decorator to indicate that an XBlock class needs particular services.

**classmethod `open_local_resource`** (*uri*)

Open a local resource.

The container calls this method when it receives a request for a resource on a URL which was generated by `Runtime.local_resource_url()`. It will pass the URI from the original call to `local_resource_url()` back to this method. The XBlock must parse this URI and return an open file-like object for the resource.

For security reasons, the default implementation will return only a very restricted set of file types, which must be located in a folder that defaults to “public”. The location used for public resources can be changed on a per-XBlock basis. XBlock authors who want to override this behavior will need to take care to ensure that the method only serves legitimate public resources. At the least, the URI should be matched against a whitelist regex to ensure that you do not serve an unauthorized resource.

**classmethod `parse_xml`** (*node*, *runtime*, *keys*, *id\_generator*)

Use *node* to construct a new block.

#### Parameters

- **node** (*Element*) – The xml node to parse into an xblock.
- **runtime** (*Runtime*) – The runtime to use while parsing.
- **keys** (*ScopeIds*) – The keys identifying where this block will store its data.
- **id\_generator** (*IdGenerator*) – An object that will allow the runtime to generate correct definition and usage ids for children of this block.

**classmethod `register_temp_plugin`** (*class\_*, *identifier=None*, *dist='xblock'*)

Decorate a function to run with a temporary plugin available.

Use it like this in tests:

```
@register_temp_plugin(MyXBlockClass):
def test_the_thing():
    # Here I can load MyXBlockClass by name.
```

**render** (*view*, *context=None*)

Render *view* with this block’s runtime and the supplied *context*

**save** ()

Save all dirty fields attached to this XBlock.

**classmethod service\_declaration** (*service\_name*)

Find and return a service declaration.

XBlocks declare their service requirements with `@XBlock.needs` and `@XBlock.wants` decorators. These store information on the class. This function finds those declarations for a block.

**Parameters** **service\_name** (*str*) – the name of the service requested.

**Returns** One of “need”, “want”, or None.

**classmethod supports** (*\*functionalities*)

A view decorator to indicate that an xBlock view has support for the given functionalities.

**Parameters** **functionalities** – String identifiers for the functionalities of the view. For example: “multi\_device”.

**static tag** (*tags*)

Returns a function that adds the words in *tags* as class tags to this class.

**ugettext** (*text*)

Translates message/text and returns it in a unicode string. Using runtime to get i18n service.

**validate** ()

Ask this xblock to validate itself. Subclasses are expected to override this method, as there is currently only a no-op implementation. Any overriding method should call super to collect validation results from its superclasses, and then add any additional results as necessary.

**classmethod wants** (*\*service\_names*)

A class decorator to indicate that an XBlock class wants particular services.

**xml\_element\_name** ()

What XML element name should be used for this block?

**xml\_text\_content** ()

What is the text content for this block’s XML node?



## FIELDS API

Fields declare storage for XBlock data. They use abstract notions of **scopes** to associate each field with particular sets of blocks and users. The hosting runtime application decides what actual storage mechanism to use for each scope.

**class** `xblock.fields.BlockScope`

Enumeration of block scopes.

The block scope specifies how a field relates to blocks. A *BlockScope* and a *UserScope* are combined to make a *Scope* for a field.

USAGE: The data is related to a particular use of a block in a course.

**DEFINITION: The data is related to the definition of the block. Although** unusual, one block definition can be used in more than one place in a course.

TYPE: The data is related to all instances of this type of XBlock.

**ALL: The data is common to all blocks. This can be useful for storing** information that is purely about the student.

**classmethod** `scopes ()`

Return a list of valid/understood class scopes.

**class** `xblock.fields.Boolean` (*help=None*, *default=fields.UNSET*,  
*scope=ScopeBase(user=UserScope.NONE*,  
*block=BlockScope.DEFINITION*, *name='content'*), *dis-*  
*play\_name=None*, *\*\*kwargs*)

A field class for representing a boolean.

The value, as loaded or enforced, can be either a Python bool, a string, or any value that will then be converted to a bool in the `from_json` method.

Examples:

```
True -> True
'true' -> True
'TRUE' -> True
'any other string' -> False
[] -> False
['123'] -> True
None -> False
```

**enforce\_type** (*value*)

Return value as a native full featured python type (the inverse of `to_json`)

Called during field reads to convert the stored value into a full featured python object

**from\_json** (*value*)

Return value as a native full featured python type (the inverse of `to_json`)

Called during field reads to convert the stored value into a full featured python object

```
class xblock.fields.Dict (help=None, default=fields.UNSET, scope=ScopeBase(user=UserScope.NONE,  
block=BlockScope.DEFINITION, name='content'), display_name=None, values=None, enforce_type=False, xml_node=False,  
force_export=False, **kwargs)
```

A field class for representing a Python dict.

The value, as loaded or enforced, must be either be None or a dict.

**enforce\_type** (*value*)

Return value as a native full featured python type (the inverse of to\_json)

Called during field reads to convert the stored value into a full featured python object

**from\_json** (*value*)

Return value as a native full featured python type (the inverse of to\_json)

Called during field reads to convert the stored value into a full featured python object

**to\_string** (*value*)

In python3, json.dumps() cannot sort keys of different types, so preconvert None to 'null'.

```
class xblock.fields.Field (help=None, default=fields.UNSET, scope=ScopeBase(user=UserScope.NONE,  
block=BlockScope.DEFINITION, name='content'), display_name=None, values=None, enforce_type=False, xml_node=False,  
force_export=False, **kwargs)
```

A field class that can be used as a class attribute to define what data the class will want to refer to.

When the class is instantiated, it will be available as an instance attribute of the same name, by proxying through to the field-data service on the containing object.

#### Parameters

- **help** (*str*) – documentation for the field, suitable for presenting to a user (defaults to None).
- **default** – field’s default value. Can be a static value or the special xblock.fields.UNIQUE\_ID reference. When set to xblock.fields.UNIQUE\_ID, the field defaults to a unique string that is deterministically calculated for the field in the given scope (defaults to None).
- **scope** – this field’s scope (defaults to Scope.content).
- **display\_name** – the display name for the field, suitable for presenting to a user (defaults to name of the field).
- **values** – a specification of the valid values for this field. This can be specified as either a static specification, or a function that returns the specification. For example specification formats, see the values property definition.
- **enforce\_type** – whether the type of the field value should be enforced on set, using self.enforce\_type, raising an exception if it’s not possible to convert it. This provides a guarantee on the stored value type.
- **xml\_node** – if set, the field will be serialized as a separate node instead of an xml attribute (default: False).
- **force\_export** – if set, the field value will be exported to XML even if normal export conditions are not met (i.e. the field has no explicit value set)
- **kwargs** – optional runtime-specific options/metadata. Will be stored as runtime\_options.

**property default**

Returns the static value that this defaults to.

**delete\_from** (*xblock*)

Delete the value for this field from the supplied xblock

**property display\_name**

Returns the display name for this class, suitable for use in a GUI.

If no display name has been set, returns the name of the class.

**enforce\_type** (*value*)

Coerce the type of the value, if necessary

Called on field sets to ensure that the stored type is consistent if the field was initialized with `enforce_type=True`

This must not have side effects, since it will be executed to trigger a `DeprecationWarning` even if `enforce_type` is disabled

**from\_json** (*value*)

Return value as a native full featured python type (the inverse of `to_json`)

Called during field reads to convert the stored value into a full featured python object

**from\_string** (*serialized*)

Returns a native value from a YAML serialized string representation. Since YAML is a superset of JSON, this is the inverse of `to_string`.)

**is\_set\_on** (*xblock*)

Return whether this field has a non-default value on the supplied xblock

**property name**

Returns the name of this field.

**read\_from** (*xblock*)

Retrieve the value for this field from the specified xblock

**read\_json** (*xblock*)

Retrieve the serialized value for this field from the specified xblock

**to\_json** (*value*)

Return value in the form of nested lists and dictionaries (suitable for passing to `json.dumps`).

This is called during field writes to convert the native python type to the value stored in the database

**to\_string** (*value*)

Return a JSON serialized string representation of the value.

**property values**

Returns the valid values for this class. This is useful for representing possible values in a UI.

Example formats:

- A finite set of elements:

```
[1, 2, 3]
```

- A finite set of elements where the display names differ from the values:

```
[
  {"display_name": "Always", "value": "always"},
  {"display_name": "Past Due", "value": "past_due"},
]
```

- A range for floating point numbers with specific increments:

```
{"min": 0 , "max": 10, "step": .1}
```

If this field class does not define a set of valid values, this property will return None.

**write\_to** (*xblock, value*)

Set the value for this field to value on the supplied xblock

```
class xblock.fields.Float (help=None, default=fields.UNSET, scope=ScopeBase(user=UserScope.NONE,  
block=BlockScope.DEFINITION, name='content'), display_name=None, values=None, enforce_type=False, xml_node=False,  
force_export=False, **kwargs)
```

A field that contains a float.

The value, as loaded or enforced, can be None, '' (which will be treated as None), a Python float, or a value that will parse as an float, ie., something for which float(value) does not throw an error.

**enforce\_type** (*value*)

Return value as a native full featured python type (the inverse of to\_json)

Called during field reads to convert the stored value into a full featured python object

**from\_json** (*value*)

Return value as a native full featured python type (the inverse of to\_json)

Called during field reads to convert the stored value into a full featured python object

```
class xblock.fields.Integer (help=None, default=fields.UNSET,  
scope=ScopeBase(user=UserScope.NONE,  
block=BlockScope.DEFINITION, name='content'), display_name=None, values=None, enforce_type=False,  
xml_node=False, force_export=False, **kwargs)
```

A field that contains an integer.

The value, as loaded or enforced, can be None, '' (which will be treated as None), a Python integer, or a value that will parse as an integer, ie., something for which int(value) does not throw an error.

Note that a floating point value will convert to an integer, but a string containing a floating point number ('3.48') will throw an error.

**enforce\_type** (*value*)

Return value as a native full featured python type (the inverse of to\_json)

Called during field reads to convert the stored value into a full featured python object

**from\_json** (*value*)

Return value as a native full featured python type (the inverse of to\_json)

Called during field reads to convert the stored value into a full featured python object

```
class xblock.fields.List (help=None, default=fields.UNSET, scope=ScopeBase(user=UserScope.NONE,  
block=BlockScope.DEFINITION, name='content'), display_name=None, values=None, enforce_type=False, xml_node=False,  
force_export=False, **kwargs)
```

A field class for representing a list.

The value, as loaded or enforced, can either be None or a list.

**enforce\_type** (*value*)

Return value as a native full featured python type (the inverse of to\_json)

Called during field reads to convert the stored value into a full featured python object

**from\_json** (*value*)

Return value as a native full featured python type (the inverse of to\_json)

Called during field reads to convert the stored value into a full featured python object

**class** xblock.fields.Scope (*user, block, name=None*)

Defines six types of scopes to be used: *content*, *settings*, *user\_state*, *preferences*, *user\_info*, and *user\_state\_summary*.

The *content* scope is used to save data for all users, for one particular block, across all runs of a course. An example might be an XBlock that wishes to tabulate user “upvotes”, or HTML content to display literally on the page (this example being the reason this scope is named *content*).

The *settings* scope is used to save data for all users, for one particular block, for one specific run of a course. This is like the *content* scope, but scoped to one run of a course. An example might be a due date for a problem.

The *user\_state* scope is used to save data for one user, for one block, for one run of a course. An example might be how many points a user scored on one specific problem.

The *preferences* scope is used to save data for one user, for all instances of one specific TYPE of block, across the entire platform. An example might be that a user can set their preferred default speed for the video player. This default would apply to all instances of the video player, across the whole platform, but only for that student.

The *user\_info* scope is used to save data for one user, across the entire platform. An example might be a user’s time zone or language preference.

The *user\_state\_summary* scope is used to save data aggregated across many users of a single block. For example, a block might store a histogram of the points scored by all users attempting a problem.

Create a new Scope, with an optional name.

**classmethod** named\_scopes ()

Return all named Scopes.

**classmethod** scopes ()

Return all possible Scopes.

**class** xblock.fields.ScopeIds (*user\_id, block\_type, def\_id, usage\_id*)

A simple wrapper to collect all of the ids needed to correctly identify an XBlock (or other classes deriving from ScopedStorageMixin) to a FieldData. These identifiers match up with BlockScope and UserScope attributes, so that, for instance, the *def\_id* identifies scopes that use BlockScope.DEFINITION.

Create new instance of ScopeIds(*user\_id, block\_type, def\_id, usage\_id*)

**class** xblock.fields.Set (*\*args, \*\*kwargs*)

A field class for representing a set.

The stored value can either be None or a set.

Set class constructor.

Redefined in order to convert default values to sets.

**enforce\_type** (*value*)

Return value as a native full featured python type (the inverse of to\_json)

Called during field reads to convert the stored value into a full featured python object

**from\_json** (*value*)

Return value as a native full featured python type (the inverse of to\_json)

Called during field reads to convert the stored value into a full featured python object

```
class xblock.fields.String (help=None, default=fields.UNSET, scope=ScopeBase(user=UserScope.NONE,
                                block=BlockScope.DEFINITION, name='content'), display_name=None,
                                values=None, enforce_type=False,
                                xml_node=False, force_export=False, **kwargs)
```

A field class for representing a string.

The value, as loaded or enforced, can either be None or a basestring instance.

**enforce\_type** (*value*)

Return value as a native full featured python type (the inverse of to\_json)

Called during field reads to convert the stored value into a full featured python object

**from\_json** (*value*)

Return value as a native full featured python type (the inverse of to\_json)

Called during field reads to convert the stored value into a full featured python object

**from\_string** (*value*)

String gets serialized and deserialized without quote marks.

**property none\_to\_xml**

Returns True to use a XML node for the field and represent None as an attribute.

**to\_string** (*value*)

String gets serialized and deserialized without quote marks.

```
class xblock.fields.UserScope
```

Enumeration of user scopes.

The user scope specifies how a field relates to users. A *BlockScope* and a *UserScope* are combined to make a *Scope* for a field.

**NONE: Identifies data agnostic to the user of the XBlock.** The data is related to no particular user. All users see the same data. For instance, the definition of a problem.

**ONE: Identifies data particular to a single user of the XBlock.** For instance, a student's answer to a problem.

**ALL: Identifies data aggregated while the block is used by many users.** The data is related to all the users. For instance, a count of how many students have answered a question, or a histogram of the answers submitted by all students.

**classmethod scopes** ()

Return a list of valid/understood class scopes. Why do we need this? I believe it is not used anywhere.

```
class xblock.fields.XBlockMixin (*args, **kwargs)
```

A wrapper around xblock.core.XBlockMixin that provides backwards compatibility for the old location.

Deprecated.

Arguments: field\_data (FieldData): Interface used by the XBlock

fields to access their data from wherever it is persisted.

**scope\_ids** (*ScopeIds*): Identifiers needed to resolve scopes.

```
class xblock.fields.XMLString (help=None, default=fields.UNSET,
                                scope=ScopeBase(user=UserScope.NONE,
                                block=BlockScope.DEFINITION, name='content'), display_name=None,
                                values=None, enforce_type=False,
                                xml_node=False, force_export=False, **kwargs)
```

A field class for representing an XML string.

The value, as loaded or enforced, can either be None or a basestring instance. If it is a basestring instance, it must be valid XML. If it is not valid XML, an lxml.etree.XMLSyntaxError will be raised.

**enforce\_type** (*value*)

Coerce the type of the value, if necessary

Called on field sets to ensure that the stored type is consistent if the field was initialized with enforce\_type=True

This must not have side effects, since it will be executed to trigger a DeprecationWarning even if enforce\_type is disabled

**to\_json** (*value*)

Serialize the data, ensuring that it is valid XML (or None).

Raises an lxml.etree.XMLSyntaxError if it is a basestring but not valid XML.

```
class xblock.reference.plugins.Filesystem (help=None, default=fields.UNSET,
                                           scope=ScopeBase(user=UserScope.NONE,
                                           block=BlockScope.DEFINITION,
                                           name='content'), display_name=None,
                                           values=None, enforce_type=False,
                                           xml_node=False, force_export=False,
                                           **kwargs)
```

An enhanced pyfilesystem.

This returns a file system provided by the runtime. The file system has two additional methods over a normal pyfilesystem:

- *get\_url* allows it to return a URL for a file
- *expire* allows it to create files which may be garbage collected after a preset period. *edx-platform* and *xblock-sdk* do not currently garbage collect them, however.

More information can be found at: <http://docs.pyfilesystem.org/en/latest/> and <https://github.com/pmitros/django-pyfs>

The major use cases for this are storage of large binary objects, pregenerating per-student data (e.g. *pylab* plots), and storing data which should be downloadable (for example, serving `<img src=...>` will typically be faster through this than serving that up through XBlocks views.





## RUNTIME API

Machinery to make the common case easy when building new runtimes

`xblock.runtime.DbModel`

alias of `xblock.runtime.KvsFieldData`

**class** `xblock.runtime.DictKeyValueStore` (*storage=None*)

A *KeyValueStore* that stores everything into a Python dictionary.

**delete** (*key*)

Deletes *key* from storage.

**get** (*key*)

Reads the value of the given *key* from storage.

**has** (*key*)

Returns whether or not *key* is present in storage.

**set** (*key, value*)

Sets *key* equal to *value* in storage.

**set\_many** (*other\_dict*)

For each (*key, value*) in *update\_dict*, set *key* to *value* in storage.

The default implementation brute force updates field by field through set which may be inefficient for any runtimes doing persistence operations on each set. Such implementations will want to override this method.

**Update\_dict** field\_name, field\_value pairs for all cached changes

**class** `xblock.runtime.IdGenerator`

An abstract object that creates usage and definition ids

**abstract create\_aside** (*definition\_id, usage\_id, aside\_type*)

Make a new aside definition and usage ids, indicating an `XBlockAside` of type *aside\_type* commenting on an `XBlock` usage *usage\_id*

**Returns** (*aside\_definition\_id, aside\_usage\_id*)

**abstract create\_definition** (*block\_type, slug=None*)

Make a definition, storing its block type.

If *slug* is provided, it is a suggestion that the definition id incorporate the slug somehow.

Returns the newly-created definition id.

**abstract create\_usage** (*def\_id*)

Make a usage, storing its definition id.

Returns the newly-created usage id.

### **class** `xblock.runtime.IdReader`

An abstract object that stores usages and definitions.

#### **abstract** `get_aside_type_from_definition` (*aside\_id*)

Retrieve the XBlockAside *aside\_type* associated with this aside definition id.

**Parameters** *aside\_id* – The definition id of the XBlockAside.

**Returns** The *aside\_type* of the aside.

#### **abstract** `get_aside_type_from_usage` (*usage\_id*)

Retrieve the XBlockAside *aside\_type* associated with this aside usage id.

**Parameters** *usage\_id* – The usage id of the XBlockAside.

**Returns** The *aside\_type* of the aside.

#### **abstract** `get_block_type` (*def\_id*)

Retrieve the *block\_type* of a particular definition

**Parameters** *def\_id* – The id of the definition to query

**Returns** The *block\_type* of the definition

#### **abstract** `get_definition_id` (*usage\_id*)

Retrieve the definition that a usage is derived from.

**Parameters** *usage\_id* – The id of the usage to query

**Returns** The *definition\_id* the usage is derived from

#### **abstract** `get_definition_id_from_aside` (*aside\_id*)

Retrieve the XBlock *definition\_id* associated with this aside definition id.

**Parameters** *aside\_id* – The definition id of the XBlockAside.

**Returns** The *definition\_id* of the xblock the aside is commenting on.

#### **abstract** `get_usage_id_from_aside` (*aside\_id*)

Retrieve the XBlock *usage\_id* associated with this aside usage id.

**Parameters** *aside\_id* – The usage id of the XBlockAside.

**Returns** The *usage\_id* of the usage the aside is commenting on.

### **class** `xblock.runtime.KeyValueStore`

The abstract interface for Key Value Stores.

#### **class** `Key` (*scope*, *user\_id*, *block\_scope\_id*, *field\_name*, *block\_family*='xblock.v1')

Keys are structured to retain information about the scope of the data. Stores can use this information however they like to store and retrieve data.

Create new instance of Key(*scope*, *user\_id*, *block\_scope\_id*, *field\_name*, *block\_family*)

#### **default** (*key*)

Returns the context relevant default of the given *key* or raise `KeyError` which will result in the field's global default.

#### **abstract** `delete` (*key*)

Deletes *key* from storage.

#### **abstract** `get` (*key*)

Reads the value of the given *key* from storage.

#### **abstract** `has` (*key*)

Returns whether or not *key* is present in storage.

**abstract set** (*key, value*)  
Sets *key* equal to *value* in storage.

**set\_many** (*update\_dict*)  
For each (*key, value*) in *update\_dict*, set *key* to *value* in storage.

The default implementation brute force updates field by field through set which may be inefficient for any runtimes doing persistence operations on each set. Such implementations will want to override this method.

**Update\_dict** *field\_name, field\_value* pairs for all cached changes

**class** `xblock.runtime.KvsFieldData` (*kvs, \*\*kwargs*)

An interface mapping value access that uses field names to one that uses the correct scoped keys for the underlying KeyValueStore

**default** (*block, name*)  
Ask the kvs for the default (default implementation which other classes may override).

#### Parameters

- **block** (*XBlock*) – block containing field to default
- **name** – name of the field to default

**delete** (*block, name*)  
Reset the value of the field named *name* to the default

**get** (*block, name*)  
Retrieve the value for the field named *name*.

If a value is provided for *default*, then it will be returned if no value is set

**has** (*block, name*)  
Return whether or not the field named *name* has a non-default value

**set** (*block, name, value*)  
Set the value of the field named *name*

**set\_many** (*block, update\_dict*)  
Update the underlying model with the correct values.

**class** `xblock.runtime.MemoryIdManager`

A simple dict-based implementation of IdReader and IdGenerator.

**ASIDE\_DEFINITION\_ID**  
alias of `xblock.runtime.MemoryAsideDefinitionId`

**ASIDE\_USAGE\_ID**  
alias of `xblock.runtime.MemoryAsideUsageId`

**clear** ()  
Remove all entries.

**create\_aside** (*definition\_id, usage\_id, aside\_type*)  
Create the aside.

**create\_definition** (*block\_type, slug=None*)  
Make a definition, storing its block type.

**create\_usage** (*def\_id*)  
Make a usage, storing its definition id.

**get\_aside\_type\_from\_definition** (*aside\_id*)  
Get an aside's type from its definition id.

**get\_aside\_type\_from\_usage** (*aside\_id*)

Get an aside's type from its usage id.

**get\_block\_type** (*def\_id*)

Get a block\_type by its definition id.

**get\_definition\_id** (*usage\_id*)

Get a definition\_id by its usage id.

**get\_definition\_id\_from\_aside** (*aside\_id*)

Extract the original xblock's definition\_id from an aside's definition\_id.

**get\_usage\_id\_from\_aside** (*aside\_id*)

Extract the usage\_id from the aside's usage\_id.

**class** xblock.runtime.**Mixologist** (*mixins*)

Provides a facility to dynamically generate classes with additional mixins.

**Parameters** **mixins** (*iterable of class*) – Classes to mixin or names of classes to mixin.

**mix** (*cls*)

Returns a subclass of *cls* mixed with *self.mixins*.

**Parameters** **cls** (*class*) – The base class to mix into

**class** xblock.runtime.**NullI18nService**

A simple implementation of the runtime “i18n” service.

**strftime** (*dtime, format*)

Locale-aware strftime, with format short-cuts.

**property** **ugettext**

Dispatch to the appropriate gettext method to handle text objects.

Note that under python 3, this uses *gettext()*, while under python 2, it uses *ugettext()*. This should not be used with bytestrings.

**property** **ungettext**

Dispatch to the appropriate ngettext method to handle text objects.

Note that under python 3, this uses *ngettext()*, while under python 2, it uses *ungettext()*. This should not be used with bytestrings.

**class** xblock.runtime.**ObjectAggregator** (*\*objects*)

Provides a single object interface that combines many smaller objects.

Attribute access on the aggregate object acts on the first sub-object that has that attribute.

**class** xblock.runtime.**RegexLexer** (*\*toks*)

Split text into lexical tokens based on regexes.

**lex** (*text*)

Iterator that tokenizes *text* and yields up tokens as they are found

**class** xblock.runtime.**Runtime** (*id\_reader, field\_data=None, mixins=(), services=None, default\_class=None, select=None, id\_generator=None*)

Access to the runtime environment for XBlocks.

**Parameters**

- **id\_reader** (*IdReader*) – An object that allows the *Runtime* to map between *usage\_ids*, *definition\_ids*, and *block\_types*.
- **id\_generator** (*IdGenerator*) – The *IdGenerator* to use for creating ids when importing XML or loading XBlockAsides.

- **field\_data** (*FieldData*) – The *FieldData* to use by default when constructing an *XBlock* from this *Runtime*.
- **mixins** (*tuple*) – Classes that should be mixed in with every *XBlock* created by this *Runtime*.
- **services** (*dict*) – Services to make available through the *service()* method. There’s no point passing anything here if you are overriding *service()* in your sub-class.
- **default\_class** (*class*) – The default class to use if a class can’t be found for a particular *block\_type* when loading an *XBlock*.
- **select** – A function to select from one or more *XBlock* subtypes found when calling *XBlock.load\_class()* to resolve a *block\_type*. This is the same *select* as used by *Plugin.load\_class()*.

**add\_block\_as\_child\_node** (*block, node*)

Export *block* as a child node of *node*.

**add\_node\_as\_child** (*block, node, id\_generator=None*)

Called by *XBlock.parse\_xml* to treat a child node as a child block.

**applicable\_aside\_types** (*block*)

Return the set of applicable aside types for this runtime and block. This method allows the runtime to filter the set of asides it wants to support or to provide even block-level or *block\_type* level filtering. We may extend this in the future to also take the user or user roles.

**construct\_xblock** (*block\_type, scope\_ids, field\_data=None, \*args, \*\*kwargs*)

Construct a new xblock of the type identified by *block\_type*, passing *\*args* and *\*\*kwargs* into *\_\_init\_\_*.

**construct\_xblock\_from\_class** (*cls, scope\_ids, field\_data=None, \*args, \*\*kwargs*)

Construct a new xblock of type *cls*, mixing in the mixins defined for this application.

**create\_aside** (*block\_type, keys*)

The aside version of *construct\_xblock*: take a type and key. Return an instance

**export\_to\_xml** (*block, xmlfile*)

Export the block to XML, writing the XML to *xmlfile*.

**property field\_data**

Access the *FieldData* passed in the constructor.

Deprecated in favor of a ‘field-data’ service.

**get\_aside** (*aside\_usage\_id*)

Create an *XBlockAside* in this runtime.

The *aside\_usage\_id* is used to find the *Aside* class and data.

**get\_aside\_of\_type** (*block, aside\_type*)

Return the aside of the given *aside\_type* which might be decorating this *block*.

#### Parameters

- **block** (*XBlock*) – The block to retrieve asides for.
- **aside\_type** (*str*) – the type of the aside

**get\_asides** (*block*)

Return instances for all of the asides that will decorate this *block*.

**Parameters** **block** (*XBlock*) – The block to render retrieve asides for.

**Returns** List of *XBlockAside* instances

**get\_block** (*usage\_id*, *for\_parent=None*)

Create an XBlock instance in this runtime.

The *usage\_id* is used to find the XBlock class and data.

**handle** (*block*, *handler\_name*, *request*, *suffix=""*)

Handles any calls to the specified *handler\_name*.

Provides a fallback handler if the specified handler isn't found.

**Parameters**

- **handler\_name** – The name of the handler to call
- **request** (*webob.Request*) – The request to handle
- **suffix** – The remainder of the url, after the handler url prefix, if available

**abstract handler\_url** (*block*, *handler\_name*, *suffix=""*, *query=""*, *thirdparty=False*)

Get the actual URL to invoke a handler.

*handler\_name* is the name of your handler function. Any additional portion of the url will be passed as the *suffix* argument to the handler.

The return value is a complete absolute URL that will route through the runtime to your handler.

**Parameters**

- **block** – The block to generate the url for
- **handler\_name** – The handler on that block that the url should resolve to
- **suffix** – Any path suffix that should be added to the handler url
- **query** – Any query string that should be added to the handler url (which should not include an initial ? or &)
- **thirdparty** – If true, create a URL that can be used without the user being logged in. This is useful for URLs to be used by third-party services.

**layout\_asides** (*block*, *context*, *frag*, *view\_name*, *aside\_frag\_fns*)

Execute and layout the *aside\_fragments* wrt the block's *frag*. Runtimes should feel free to override this method to control execution, place, and style the *asides* appropriately for their application

This default method appends the *aside\_fragments* after *frag*. If you override this, you must call *wrap\_aside* around each *aside* as per this function.

**Parameters**

- **block** (*XBlock*) – the block being rendered
- **frag** (*html*) – The result from rendering the block
- **list** (*aside\_frag\_fns*) – The *asides* and closures for rendering to call

**load\_aside\_type** (*aside\_type*)

Returns a subclass of *XBlockAside* that corresponds to the specified *aside\_type*.

**load\_block\_type** (*block\_type*)

Returns a subclass of *XBlock* that corresponds to the specified *block\_type*.

**abstract local\_resource\_url** (*block*, *uri*)

Get the URL to load a static resource from an XBlock.

*block* is the XBlock that owns the resource.

**uri** is a relative URI to the resource. The XBlock class's `get_local_resource(uri)` method should be able to open the resource identified by this uri.

Typically, this function uses `open_local_resource` defined on the XBlock class, which by default will only allow resources from the “public/” directory of the kit. Resources must be placed in “public/” to be successfully served with this URL.

The return value is a complete absolute URL which will locate the resource on your runtime.

**parse\_xml\_file** (*fileobj*, *id\_generator=None*)

Parse an open XML file, returning a usage id.

**parse\_xml\_string** (*xml*, *id\_generator=None*)

Parse a string of XML, returning a usage id.

**abstract publish** (*block*, *event\_type*, *event\_data*)

Publish an event.

For example, to participate in the course grade, an XBlock should set `has_score` to `True`, and should publish a grade event whenever the grade changes.

In this case the *event\_type* would be `grade`, and the *event\_data* would be a dictionary of the following form:

```
{
  'value': <number>,
  'max_value': <number>,
}
```

The grade event represents a grade of `value/max_value` for the current user.

*block* is the XBlock from which the event originates.

**query** (*block*)

Query for data in the tree, starting from *block*.

Returns a Query object with methods for navigating the tree and retrieving information.

**querypath** (*block*, *path*)

An XPath-like interface to *query*.

**render** (*block*, *view\_name*, *context=None*)

Render a block by invoking its view.

Finds the view named *view\_name* on *block*. The default view will be used if a specific view hasn't be registered. If there is no default view, an exception will be raised.

The view is invoked, passing it *context*. The value returned by the view is returned, with possible modifications by the runtime to integrate it into a larger whole.

**render\_asides** (*block*, *view\_name*, *frag*, *context*)

Collect all of the asides' add ons and format them into the frag. The frag already has the given block's rendering.

**render\_child** (*child*, *view\_name=None*, *context=None*)

A shortcut to render a child block.

Use this method to render your children from your own view function.

If *view\_name* is not provided, it will default to the view name you're being rendered with.

Returns the same value as `render()`.

**render\_children** (*block*, *view\_name=None*, *context=None*)

Render a block's children, returning a list of results.

Each child of *block* will be rendered, just as *render\_child()* does.

Returns a list of values, each as provided by *render()*.

**abstract resource\_url** (*resource*)

Get the URL for a static resource file.

*resource* is the application local path to the resource.

The return value is a complete absolute URL that will locate the resource on your runtime.

**save\_block** (*block*)

Finalize/commit changes for the field data from the specified block. Called at the end of an XBlock's *save()* method. Runtimes may ignore this as generally the field data implementation is responsible for persisting changes.

(The main use case here is a runtime and field data implementation that want to store field data in XML format - the only way to correctly serialize a block to XML is to ask the block to serialize itself all at once, so such implementations cannot persist changes on a field-by-field basis.)

**Parameters** *block* (*XBlock*) – the block being saved

**service** (*block*, *service\_name*)

Return a service, or None.

Services are objects implementing arbitrary other interfaces. They are requested by agreed-upon names, see [XXX TODO] for a list of possible services. The object returned depends on the service requested.

XBlocks must announce their intention to request services with the *XBlock.needs* or *XBlock.wants* decorators. Use *needs* if you assume that the service is available, or *wants* if your code is flexible and can accept a None from this method.

Runtimes can override this method if they have different techniques for finding and delivering services.

**Parameters**

- **block** (*XBlock*) – this block's class will be examined for service decorators.
- **service\_name** (*str*) – the name of the service requested.

**Returns** An object implementing the requested service, or None.

**wrap\_aside** (*block*, *aside*, *view*, *frag*, *context*)

Creates a div which identifies the aside, points to the original block, and writes out the *json\_init\_args* into a script tag.

The default implementation creates a frag to wraps frag w/ a div identifying the xblock. If you have javascript, you'll need to override this impl

**wrap\_xblock** (*block*, *view*, *frag*, *context*)

Creates a div which identifies the xblock and writes out the *json\_init\_args* into a script tag.

If there's a *wrap\_child* method, it calls that with a deprecation warning.

The default implementation creates a frag to wraps frag w/ a div identifying the xblock. If you have javascript, you'll need to override this impl



## FRAGMENT API

Makes the `Fragment` class available through the old namespace location.

**class** `xblock.fragment.Fragment` (*\*args, \*\*kwargs*)

A wrapper around `web_fragments.fragment.Fragment` that provides backwards compatibility for the old location.

Deprecated.

**add\_frag\_resources** (*fragment*)

Add all the resources from a single fragment to my resources.

This is used to aggregate resources from another fragment that should be considered part of the current fragment.

The content from the `Fragment` is ignored. The caller must collect together the content into this `Fragment`'s content.

**add\_frags\_resources** (*fragments*)

Add all the resources from *fragments* to my resources.

This is used to aggregate resources from a sequence of fragments that should be considered part of the current fragment.

The content from the `Fragments` is ignored. The caller must collect together the content into this `Fragment`'s content.



## EXCEPTIONS API

Module for all xblock exception classes

**exception** `xblock.exceptions.DisallowedFileError`

Raised by `open_local_resource()` if the requested file is not allowed.

**exception** `xblock.exceptions.FieldDataDeprecationWarning`

Warning for use of deprecated `_field_data` accessor

**exception** `xblock.exceptions.InvalidScopeError` (*invalid\_scope, valid\_scopes=None*)

Raised to indicate that operating on the supplied scope isn't allowed by a `KeyValueStore`

**exception** `xblock.exceptions.JsonHandlerError` (*status\_code, message*)

Raised by a function decorated with `XBlock.json_handler` to indicate that an error response should be returned.

**get\_response** (*\*\*kwargs*)

Returns a `Response` object containing this object's status code and a JSON object containing the key "error" with the value of this object's error message in the body. Keyword args are passed through to the `Response`.

**exception** `xblock.exceptions.KeyValueMultiSaveError` (*saved\_field\_names*)

Raised to indicate an error in saving multiple fields in a `KeyValueStore`

Create a new `KeyValueMultiSaveError`

*saved\_field\_names* - an iterable of field names (strings) that were successfully saved before the exception occurred

**exception** `xblock.exceptions.NoSuchDefinition`

Raised by `IdReader.get_block_type()` if the definition doesn't exist.

**exception** `xblock.exceptions.NoSuchHandlerError`

Raised to indicate that the requested handler was not found.

**exception** `xblock.exceptions.NoSuchServiceError`

Raised to indicate that a requested service was not found.

**exception** `xblock.exceptions.NoSuchUsage`

Raised by `IdReader.get_definition_id()` if the usage doesn't exist.

**exception** `xblock.exceptions.NoSuchViewError` (*block, view\_name*)

Raised to indicate that the view requested was not found.

Create a new `NoSuchViewError`

### Parameters

- **block** – The `XBlock` without a view
- **view\_name** – The name of the view that couldn't be found

**exception** `xblock.exceptions.XBlockNotFoundError` (*usage\_id*)

Raised to indicate that an XBlock could not be found with the requested *usage\_id*

**exception** `xblock.exceptions.XBlockSaveError` (*saved\_fields*, *dirty\_fields*, *message=None*)

Raised to indicate an error in saving an XBlock

Create a new XBlockSaveError

*saved\_fields* - a set of fields that were successfully saved before the error occurred *dirty\_fields* - a set of fields that were left dirty after the save

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