PHP 5 and the new OO features for enterprise solutions, Part 2

Marcus Börger

After creating a basic PHP5 Extensions

- ☑ How to create your own classes
- ☑ How to create interfaces
- ☑ How to create methods
- ☑ What can be overloaded

PHP5 Extensions

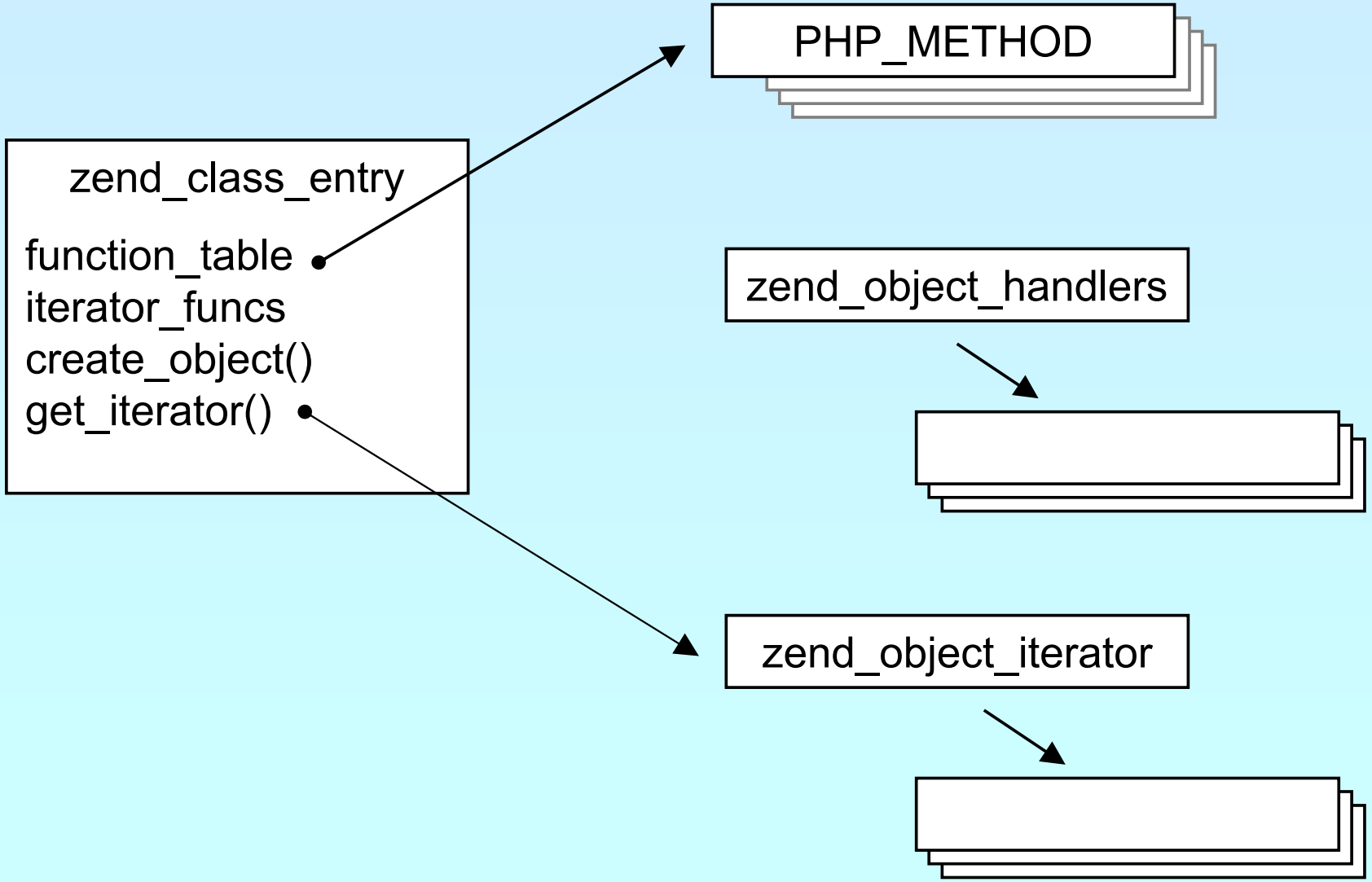
- ☑ PHP5 extensions are the same as in PHP4
- ☑ ext_skel generates the basic skeleton

```
marcus@zaphod src/php5/ext $ ./ext_skel --extname=util
Creating directory util
Creating basic files: config.m4 .cvsignore util.c php_util.h CREDITS
EXPERIMENTAL tests/001.phpt util.php [done].

To use your new extension, you will have to execute the following steps:

1.  $ cd ..
2.  $ vi ext/util/config.m4
3.  $ ./buildconf
4.  $ ./configure --[with|enable]-util
5.  $ make
6.  $ ./php -f ext/util/util.php
7.  $ vi ext/util/util.c
8.  $ make

Repeat steps 3-6 until you are satisfied with ext/util/config.m4 and
step 6 confirms that your module is compiled into PHP. Then, start
writing code and repeat the last two steps as often as necessary.
```

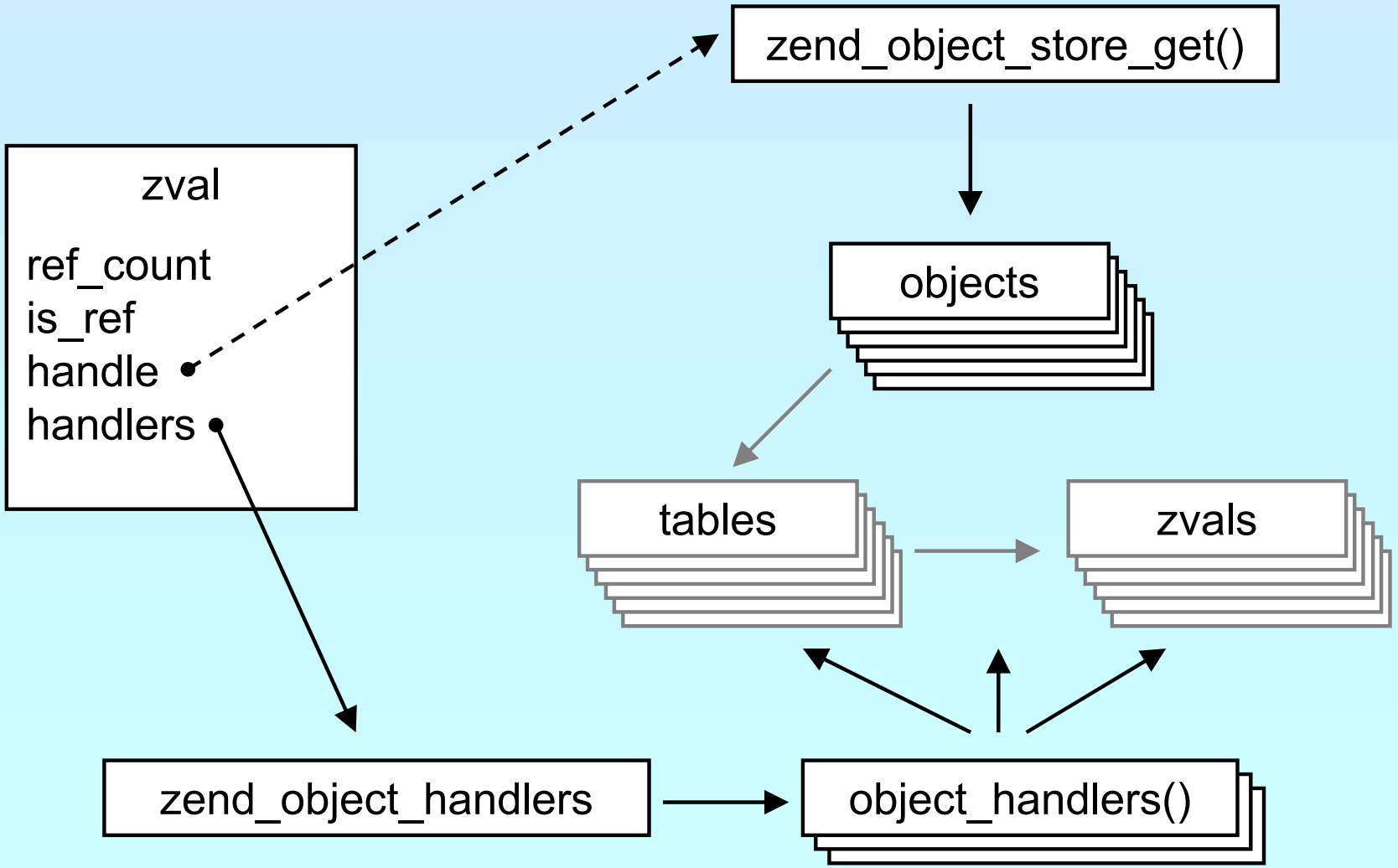
What is needed?

- ☑ Providing methods
- ☑ Providing a zend_class_entry pointer
- ☑ Providing object handlers
- ☑ Registering the class

General class layout



General class layout



Registering

```
/* {{{ PHP_MINIT_FUNCTION(util) */
PHP_MINIT_FUNCTION(util)
{
     zend_class_entry ce;

     INIT_CLASS_ENTRY(ce, "dirs", util_dir_class_functions);
     util_ce_dir = zend_register_internal_class(&ce TSRMLS_CC);
     util_ce_dir->create_object = util_dir_object_new;
     zend_class_implements(util_ce_dir TSRMLS_CC, 1, zend_ce_iterator);
     memcpy(&util_dir_handlers, zend_get_std_object_handlers(),
          sizeof(zend_object_handlers));
     util_dir_handlers.clone_obj = util_dir_object_clone;

     util_ce_dir->ce_flags |= ZEND_ACC_FINAL_CLASS;
     util_ce_dir->get_iterator = util_dir_get_iterator;

     return SUCCESS;
}
/* }}} */
```

Declaring methods

```
/* forward declaration for all methods use (class-name, method-name) */
PHP_METHOD(dir, __construct);
PHP_METHOD(dir, rewind);
PHP_METHOD(dir, hasMore);
PHP_METHOD(dir, key);
PHP_METHOD(dir, current);
PHP_METHOD(dir, next);
PHP_METHOD(dir, getPath);

/* declare method parameters,  */
/* supply a name and default to call by parameter */
static ZEND_BEGIN_ARG_INFO(arginfo_dir___construct, 0)
     ZEND_ARG_INFO(0, path)  /* parameter name */
ZEND_END_ARG_INFO();

/* each method can have its own parameters and visibility */
static zend_function_entry util_dir_class_functions[] = {
     PHP_ME(dir, __construct, arginfo_dir___construct, ZEND_ACC_PUBLIC)
     PHP_ME(dir, rewind,      NULL, ZEND_ACC_PUBLIC)
     PHP_ME(dir, hasMore,     NULL, ZEND_ACC_PUBLIC)
     PHP_ME(dir, key,         NULL, ZEND_ACC_PUBLIC)
     PHP_ME(dir, current,     NULL, ZEND_ACC_PUBLIC)
     PHP_ME(dir, next,        NULL, ZEND_ACC_PUBLIC)
     PHP_ME(dir, getPath,     NULL, ZEND_ACC_PUBLIC)
     {NULL, NULL, NULL}
};
```

class/object structs

```
/* declare the class handlers */
static zend_object_handlers util_dir_handlers;


/* decalre the class entry */
static zend_class_entry *util_ce_dir;


/* the overloaded class structure */

/* overloading the structure results in the need of having
   dedicated creatin/cloning/destruction functions */
typedef struct _util_dir_object {
        zend_object       std;
        php_stream        *dirp;
        php_stream_dirent entry;
        char              *path;
        int               index;
} util_dir_object;
```

Object creation

```
/* {{{ util_dir_object_new */
/* See util_dir_object_new_ex */
/* creates the object by
   - allocating memory
   - initializing the object members
   - storing the object
   - setting it's handlers
 */
static zend_object_value
util_dir_object_new(zend_class_entry *class_type TSRMLS_DC)
{
     util_dir_object *tmp;
     return util_dir_object_new_ex(class_type, &tmp TSRMLS_CC);
}
/* }}} */
```

Object creation/cloning

```
/* {{{ util_dir_object_new */
static zend_object_value
util_dir_object_new_ex(zend_class_entry *class_type,
          util_dir_object **obj TSRMLS_DC)
{
     zend_object_value retval;
     util_dir_object *intern;
     zval *tmp;

     intern = emalloc(sizeof(util_dir_object));
     memset(intern, 0, sizeof(util_dir_object));
     intern->std.ce = class_type;
     *obj = intern;

     ALLOC_HASHTABLE(intern->std.properties);
     zend_hash_init(intern->std.properties, 0, NULL, ZVAL_PTR_DTOR, 0);
     zend_hash_copy(intern->std.properties,
               &class_type->default_properties,
               (copy_ctor_func_t) zval_add_ref,
               (void *) &tmp, sizeof(zval *));

     retval.handle = zend_objects_store_put(intern,
                         util_dir_object_dtor, NULL TSRMLS_CC);
     retval.handlers = &util_dir_handlers;
     return retval;
}
/* }}} */
```

Object cloning

```
/* {{{ util_dir_object_clone */
static zend_object_value
util_dir_object_clone(zval *zobject TSRMLS_DC)
{
     zend_object_value new_obj_val;
     zend_object *old_object;
     zend_object *new_object;
     zend_object_handle handle = Z_OBJ_HANDLE_P(zobject);
     util_dir_object *intern;

     old_object = zend_objects_get_address(zobject TSRMLS_CC);
     new_obj_val = util_dir_object_new_ex(old_object->ce, &intern
                          TSRMLS_CC);
     new_object = &intern->std;

     util_dir_open(intern, ((util_dir_object*)old_object)->path
                          TSRMLS_CC);

     zend_objects_clone_members(new_object, new_obj_val, old_object,
                          handle TSRMLS_CC);

     return new_obj_val;
}
/* }}} */
```

Object destruction

```
/* {{{ util_dir_object_dtor */
/* close all resources and the memory allocated for the object */
static void
util_dir_object_dtor(void *object, zend_object_handle handle TSRMLS_DC)
{
     util_dir_object *intern = (util_dir_object *)object;

     zend_hash_destroy(intern->std.properties);
     FREE_HASHTABLE(intern->std.properties);

     if (intern->path) {
          efree(intern->path);
     }
     if (intern->dirp) {
          php_stream_close(intern->dirp);
     }
     efree(object);
}
/* }}} */
```

Retrieving the class entry

- ☑ A final class may have a dedicated function

```
/* {{{ util_dir_get_ce */
static zend_class_entry *util_dir_get_ce(zval *object TSRMLS_DC)
{
        return util_ce_dir;
}
/* }}} */
```

A simple method

```
/* {{{ proto string dir::key()
   Return current dir entry */
PHP_METHOD(dir, key)
{
     zval *object = getThis();
     util_dir_object *intern = (util_dir_object*)
          zend_object_store_get_object(object TSRMLS_CC);

     if (intern->dirp) {
          RETURN_LONG(intern->index);
     } else {
          RETURN_FALSE;
     }
}
/* }}} */
```

The constructor

```
/* {{{ proto void dir::__construct(string path)
 Cronstructs a new dir iterator from a path. */
PHP_METHOD(dir, __construct)
{
     zval *object = getThis();
     util_dir_object *intern;
     char *path;
     long len;

     php_set_error_handling(EH_THROW, zend_exception_get_default()
          TSRMLS_CC);

     if (zend_parse_parameters(ZEND_NUM_ARGS() TSRMLS_CC, "s", &path,
               &len) == FAILURE) {
          return;
     }

     intern = (util_dir_object*)zend_object_store_get_object(object
               TSRMLS_CC);
     util_dir_open(intern, path TSRMLS_CC);

     php_set_error_handling(EH_NORMAL, NULL TSRMLS_CC);
}
/* }}} */
```

Iterators

```
/* define an overloaded iterator structure */
typedef struct {
     zend_object_iterator  intern;
     zval                  *current;
} util_dir_it;

static void util_dir_it_dtor(zend_object_iterator *iter TSRMLS_DC);
static int util_dir_it_has_more(zend_object_iterator *iter TSRMLS_DC);
static void util_dir_it_current_data(zend_object_iterator *iter,
          zval ***data TSRMLS_DC);
static int util_dir_it_current_key(zend_object_iterator *iter,
          char **str_key, uint *str_key_len, ulong *int_key TSRMLS_DC);
static void util_dir_it_move_forward(zend_object_iterator *iter
          TSRMLS_DC);
static void util_dir_it_rewind(zend_object_iterator *iter TSRMLS_DC);

/* iterator handler table */
zend_object_iterator_funcs util_dir_it_funcs = {
     util_dir_it_dtor,
     util_dir_it_has_more,
     util_dir_it_current_data,
     util_dir_it_current_key,
     util_dir_it_move_forward,
     util_dir_it_rewind
};
/* }}} */
```

Creating the iterator

```
/* {{{ util_dir_get_iterator */
zend_object_iterator *util_dir_get_iterator(zend_class_entry *ce, zval
*object TSRMLS_DC)
{
     util_dir_it *iterator = emalloc(sizeof(util_dir_it));

     object->refcount++;
     iterator->intern.data = (void*)object;
     iterator->intern.funcs = &util_dir_it_funcs;
     iterator->current = NULL;

     return (zend_object_iterator*)iterator;
}
/* }}} */
```

Destructing the iterator

```
/* {{{ util_dir_it_dtor */
static void util_dir_it_dtor(zend_object_iterator *iter TSRMLS_DC)
{
     util_dir_it *iterator = (util_dir_it *)iter;
     zval        *intern = (zval*)iterator->intern.data;

     if (iterator->current) {
          zval_ptr_dtor(&iterator->current);
     }
     zval_ptr_dtor(&intern);

     efree(iterator);
}
/* }}} */
```

Getting the data

- ☑ Data is read on next() calls
- ☑ A zval* is stored inside the iterator

```
/* {{{ util_dir_it_current */
static void
util_dir_it_current(util_dir_it *iterator, util_dir_object *object
          TSRMLS_DC)
{
      MAKE_STD_ZVAL(iterator->current);
      if (object->dirp) {
          ZVAL_STRING(iterator->current, object->entry.d_name, 1);
      } else {
          ZVAL_FALSE(iterator->current);
      }
}
/* }}} */
```

Iterator hasMore()

☑ Check whether more data is available

```
/* {{{ util_dir_it_has_more */
static int
util_dir_it_has_more(zend_object_iterator *iter TSRMLS_DC)
{
     util_dir_it     *iterator = (util_dir_it *)iter;
     util_dir_object *object = (util_dir_object*)
                          zend_object_store_get_object(
                               (zval*)iterator->intern.data TSRMLS_CC);

     return object->entry.d_name[0] != '\0' ? SUCCESS : FAILURE;
}
/* }}} */
```

Iterator current()

```
/* {{{ util_dir_it_current_data */
static void util_dir_it_current_data(zend_object_iterator *iter, zval
***data TSRMLS_DC)
{
     util_dir_it *iterator = (util_dir_it *)iter;

     *data = &iterator->current;
}
/* }}} */


/* {{{ util_dir_it_current_key */
static int util_dir_it_current_key(zend_object_iterator *iter, char
**str_key, uint *str_key_len, ulong *int_key TSRMLS_DC)
{
     util_dir_it *iterator = (util_dir_it *)iter;
     zval              *intern = (zval*)iterator->intern.data;
     util_dir_object   *object =
(util_dir_object*)zend_object_store_get_object(intern TSRMLS_CC);

     *int_key = object->index;
     return HASH_KEY_IS_LONG;
}
/* }}} */
```

Iterator next()

```
/* {{{ util_dir_it_move_forward */
static void
util_dir_it_move_forward(zend_object_iterator *iter TSRMLS_DC)
{
     util_dir_it       *iterator = (util_dir_it *)iter;
     zval              *intern = (zval*)iterator->intern.data;
     util_dir_object   *object = (util_dir_object*)
                      zend_object_store_get_object(intern TSRMLS_CC);

     if (iterator->current) {
          zval_ptr_dtor(&iterator->current);
     }
     object->index++;
     if (!object->dirp
     || !php_stream_readdir(object->dirp, &object->entry))
     {
          object->entry.d_name[0] = '\0';
     }
     util_dir_it_current(iterator, object TSRMLS_CC);
}
/* }}} */
```

Iterator rewind()

```
/* {{{ util_dir_it_rewind */
static void
util_dir_it_rewind(zend_object_iterator *iter TSRMLS_DC)
{
     util_dir_it     *iterator = (util_dir_it *)iter;
     zval            *intern = (zval*)iterator->intern.data;
     util_dir_object *object = (util_dir_object*)
                          zend_object_store_get_object(intern TSRMLS_CC);

     object->index = 0;
     if (object->dirp) {
          php_stream_rewinddir(object->dirp);
     }
     if (!object->dirp
     || !php_stream_readdir(object->dirp, &object->entry))
     {
          object->entry.d_name[0] = '\0';
     }
     if (iterator->current) {
          zval_ptr_dtor(&iterator->current);
     }
     util_dir_it_current(iterator, object TSRMLS_CC);
}
/* }}} */
```

What else ?

- ☑ Objects can overload several handlers
  - ☑ Object casting
  - ☑ Array access
  - ☑ Property access

zend_object_handlers

```
typedef struct _zend_object_handlers {
        /* general object functions */
        zend_object_add_ref_t               add_ref;
        zend_object_del_ref_t               del_ref;
        zend_object_delete_obj_t            delete_obj;
        zend_object_clone_obj_t             clone_obj;
        /* individual object functions */
        zend_object_read_property_t         read_property;
        zend_object_write_property_t        write_property;
        zend_object_read_dimension_t        read_dimension;
        zend_object_write_dimension_t       write_dimension;
        zend_object_get_property_ptr_ptr_t  get_property_ptr_ptr;
        zend_object_get_t                   get;
        zend_object_set_t                   set;
        zend_object_has_property_t          has_property;
        zend_object_unset_property_t        unset_property;
        zend_object_unset_dimension_t       unset_dimension;
        zend_object_get_properties_t        get_properties;
        zend_object_get_method_t            get_method;
        zend_object_call_method_t           call_method;
        zend_object_get_constructor_t       get_constructor;
        zend_object_get_class_entry_t       get_class_entry;
        zend_object_get_class_name_t        get_class_name;
        zend_object_compare_t               compare_objects;
        zend_object_cast_t                  cast_object;
} zend_object_handlers;
```

Object casting

```
/* {{{ */
static int
zend_cast_exception(zval *readobj, zval *writeobj, int type, int
should_free TSRMLS_DC)
{
     if (type == IS_STRING) {
          zval fname, *retval;

          ZVAL_STRING(&fname, "__tostring", 0);
          if (call_user_function_ex(NULL, &readobj, &fname,
                    &retval, 0, NULL, 0, NULL TSRMLS_CC) == SUCCESS)
          {
               ZVAL_STRING(writeobj, Z_STRVAL_P(retval), 1);
               zval_ptr_dtor(&retval);
               return SUCCESS;
          }
     }
     return FAILURE;
}
/* }}} */
```

Array overloading

```
static zval *
sxe_dimension_read(zval *object, zval *offset TSRMLS_DC)
{
     convert_to_string_ex(&offset);
     /* MAKE_STD_ZVAL() */
     return sxe_prop_dim_read(object, offset, 0, 1, 0 TSRMLS_CC);
}


static void
sxe_dimension_write(zval *object, zval *offset, zval *value TSRMLS_DC)
{
    convert_to_string_ex(&offset);
    sxe_prop_dim_write(object, offset, value, 0, 1 TSRMLS_CC);
}


static void
sxe_dimension_delete(zval *object, zval *offset TSRMLS_DC)
{
     convert_to_string_ex(&offset);
     sxe_prop_dim_delete(object, offset, 1, 1 TSRMLS_CC);
}
```

Element overloading

```
static zval *
sxe_element_read(zval *object, zval *offset TSRMLS_DC)
{
     /* MAKE_STD_ZVAL() */
     return sxe_prop_dim_read(object, offset, 0, 1, 0 TSRMLS_CC);
}

static void
sxe_element_write(zval *object, zval *offset, zval *value TSRMLS_DC)
{
     sxe_prop_dim_write(object, offset, value, 0, 1 TSRMLS_CC);
}

static void
sxe_element_delete(zval *object, zval *offset TSRMLS_DC)
{
     sxe_prop_dim_delete(object, offset, 1, 1 TSRMLS_CC);
}

static int
sxe_property_exists(zval *object, zval *member, int check_empty
     TSRMLS_DC)
{
    return 0; /* or 1 */
}
```

References

- ☑ Source to ext/util
  http://somabo.de/php/ext/util
- ☑ Documentation and Sources to PHP5
  http://php.net
- ☑ Describing Zend Engine
  Harald Radi
  Extending PHP
  PHP5's object model
  international php magazine, issue 4.03