XOTcl for OpenACS

An Introduction to XOTcl and the basic infrastructure of xotcl-core

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XOTcl - Short Introduction

XOTcl (www.xotcl.org) is one of several OO extensions for Tcl.

Important properties

- efficient (implemented in C)
- Similar to CLOS object system
- Relations between objects and classes (and between classes) are dynamically changeable relations
- All data is stored in object
- Class are Objects
- Classes of a Class are Meta-Classes

XOTcl Classes

Stack: the classical example for classes

```
#
# Create a stack class
#
Class Stack

Stack instproc init {} {
  # Constructor
  my instvar things
  set things ""
}

Stack instproc push {thing} {
  my instvar things
  set things [concat [list $thing] $things]
  return $thing
}

Stack instproc pop {} {
  my instvar things
  set top [lindex $things 0]
  set things [lrange $things 1 end]
  return $top
}
```

Using Stack in a script

Using the class "Stack" in a script

```
% package req XOTcl
% namespace import xotcl::*
% source stack.xotcl

# Create Object s1 of class Stack
% Stack s1
::s1
% s1 push a
a
% s1 push b
b
% s1 push c
c
% s1 pop
c
% s1 pop
b
# Delete object s1
s1 destroy
```

Mixin Classes

XOTcl supports in addition to classical class hierarchies Mixin classes to implement orthogonal aspects

- Per-Object Mixins: to modify the behavior of a single object
- Per-Class Mixins: to modify the behavior of all instances of a class

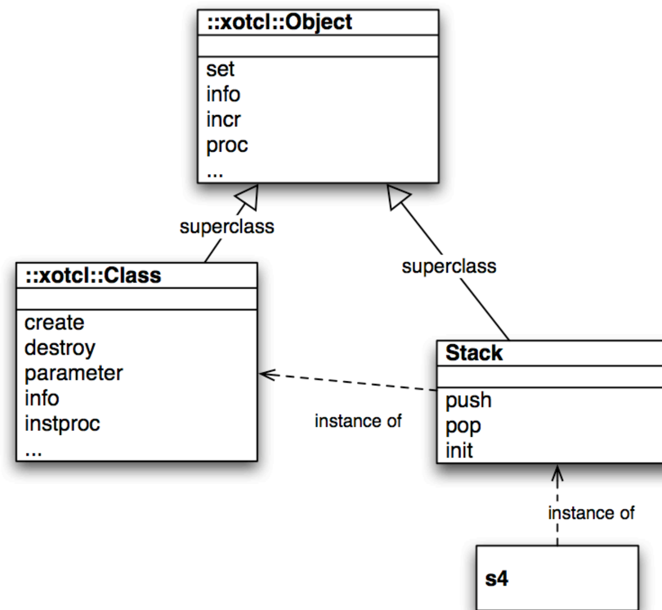
Typical examples: loggers, persistence, renderers, ...

Mixin Class Safety

Previous Stack example does not check for underruns. Implement "Saftety" as separate class, which can be used as a mixin.

```
#
# Create a safety class
#
Class Safety
Safety instproc init {} {
  my set count 0
  next
}
Safety instproc push {thing} {
  my incr count
  next
}

Safety instproc pop {} {
  if {[my set count] == 0} then { error "Stack empty!" }
  my incr count -1
  next
}
```

XOTcl Base and Application Classes



Classes and Meta-Classes

A meta-class can be used to define different kind of classes (e.g. persistent classes)

```
# Create a generic object
Object o1

# Create a different kind of object: create a new class
Class Person
Person p1

# Create a different kind of class: create a new meta-class
Class PersistentClass -superclass Class

# Create a persistent class
PersistentClass Page

# Create an instance of that class
Page p2
```

Mixin Class Safety

Important:

- "Saftety" overloads certain methods of "Stack"
- Method chaining via "next"
- Ability to perform arbitary code for the overloaded methods before and after the shadowed method call

Same mechanism for the

- intrinsic class hierarchy
- mixins
- filters (not covered here)

Use Safety as per-object mixin

We can use Safety as a per-object mixin

```
% Stack s2 -mixin Safety
::s2
% s2 push a
a
% s2 pop
a
% s2 pop
Stack empty!
```

The mixin can be added/removed to existing objects at any time

Use Safety as per-class mixin

The same class Safety can be used as per-class mixin.

```
#
# Create a safe stack class by using Stack and mixin
# Safety
#
Class SafeStack -superclass Stack -instmixin Safety

SafeStack s3
```

All instances of SafeStack are now safe.

Per-Class mixins are transitive.

Mixins are an instrument of composition

Stack for integers

Methods can be defined per-class (instproc) or per-object (proc).

Define a single stack for integers:

```
#
# Create a stack with a object-specific method
# to check the type of entries
#
# s4 is a stack of integer

Stack s4
s4 proc push {value} {
  if {![string is integer $value]} {
    error "value $value is not an integer"
  }   next
}
```

Meta-class, Class Object

Create a simple object: create an instance of ::xotcl::Object as superclass

```
Object o1
# ... is a short form for ...
Object create o1
```

Create a class: create an instance of ::xotcl::Class

```
Class Person
# ... is a short form for ...
Class create Person
# ... or ...
Class create Person -superclass Object
```

Person can now be used to define specialized objects (Persons)

Methods for classes

Since classes are Objects, one can define class-specific methods (similar to static methods in C++/Java) with the same method as object-specific methods (via "proc")

```
Class Stack
# ...
Stack proc available_stacks {} {
   return [llength [my info instances]]
}

Stack s1
Stack s2

puts [Stack available_stacks]
```

XOTcl Object System

- All classes have a common root class (::xotcl::Object)
- The behavior (methods) of the common root class is inherited to all other classes
- Methods can be added at any time using the methods "proc" and "instproc"
- XOTcl classes are as well Objects, instances of a meta-class ::xotcl::Class
- As a class provides methods to objects, a meta-class provides methods to classes

Slots and Attribute Management

Slots are meta-objects that manage property-changes of objects. A property is either an attribute or a role in an relation. In a nutshell, a slot has among other attributes:

- a *name* (which it used to access it),
- a *domain* (object or class on which it can be used) , and
- can be *multivalued* or not.

We distinguish between *system slots* (predefined slots like `class`, `superclass`, `mixin`, `instmixin`, `filter`, `instfilter`) and *attribute slots* (e.g. attributes of classes).

Attribute Slots

Attribute slots are used to manage the setting and querying of instance variables. We define now a person with three attributes `name`, `salary` and `projects`.

```
Class Person -slots {
    Attribute name
    Attribute salary -default 0
    Attribute projects -default {} -multivalued true
  }
```

Attributes might have a default value or they might be multivalued. When an instance of class Person is created, the slot names can be used for specifying values for the slots.

```
Person p1 -name "Joe"
```

Object p1 has three instance variables, namely `name`, `salary` and `projects`.

Multivalued slots

Since slot `projects` is multivalued, we can add a value to the list of values the `add` subcommand.

```
Project project1 \
   -name XOTcl  \
   -description "A highly flexible OO scripting language"

p1 projects add ::project1
p1 projects add some-other-value
```

The value of the instance variable `project` of Person `p1` is now the list `{some-other-value ::project1}`.

More Advanced Slot Options

Slots in XOTcl are extensible:

- Slots manage properties like "class", "superclass", "mixin" ....
- Slots provide methods for setter and getter of values
- Slots carry meta-data about attributes
- Slots are classes, one can therefore define different kind of slots (e.g. slots with corresponding attributes in the database)

More details in the XOTcl Tutorial

Summary

Objects

- Carry data

Classes

- Manage objects (lifecycle management)
- Provide methods for objects

Slots

- Provide meta-data for properties (mostly attributes)
- Provide methods for accessing attributes

Questions?

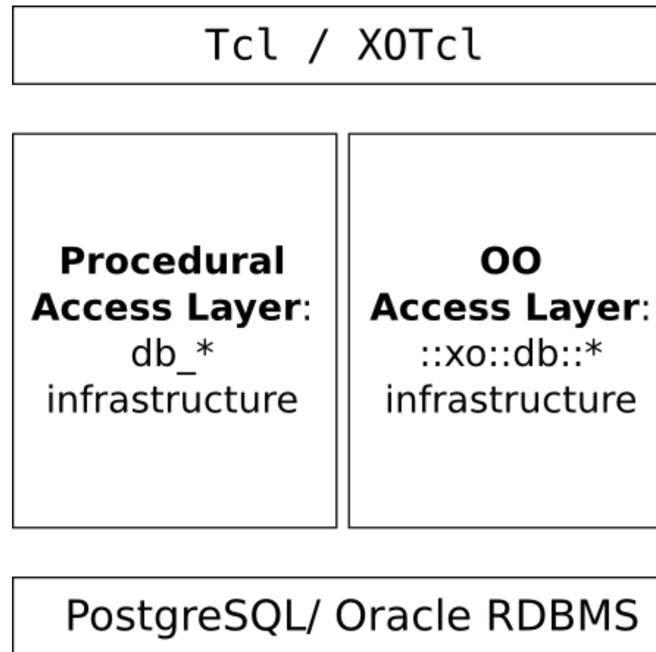
XOTcl and the OpenACS Type System

OpenACS has its own Type Sytem

- acs-objects
- acs-object-types
- acs-attributes

Linkage between XOTcl Object System to the OpenACS Type System provided through xotcl-core

Database Access Layers

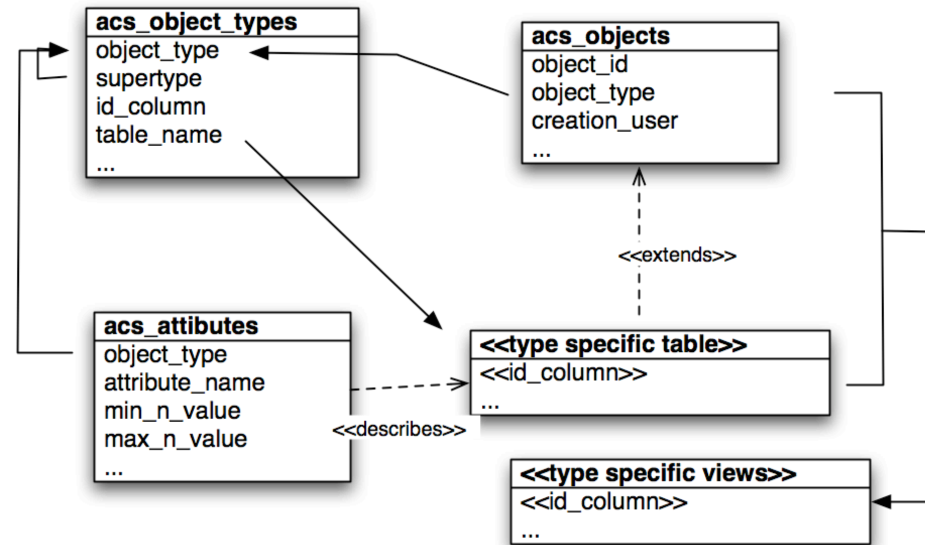


xotcl-core Object/Relational Access Layer

Facilities:

- Object proxies for Oracle/ PostgreSQL stored procedures and modules (not covered here)
- XOTcl representation of OpenACS Object System ("Split object pattern")
- Use existintg acs-object-types as XOTcl classes
- Create oacs-object-types/acs-objects by creating XOTcl classes / objects
- Additional support for the OpenACS Content Repository

Simplified OpenACS Meta Model

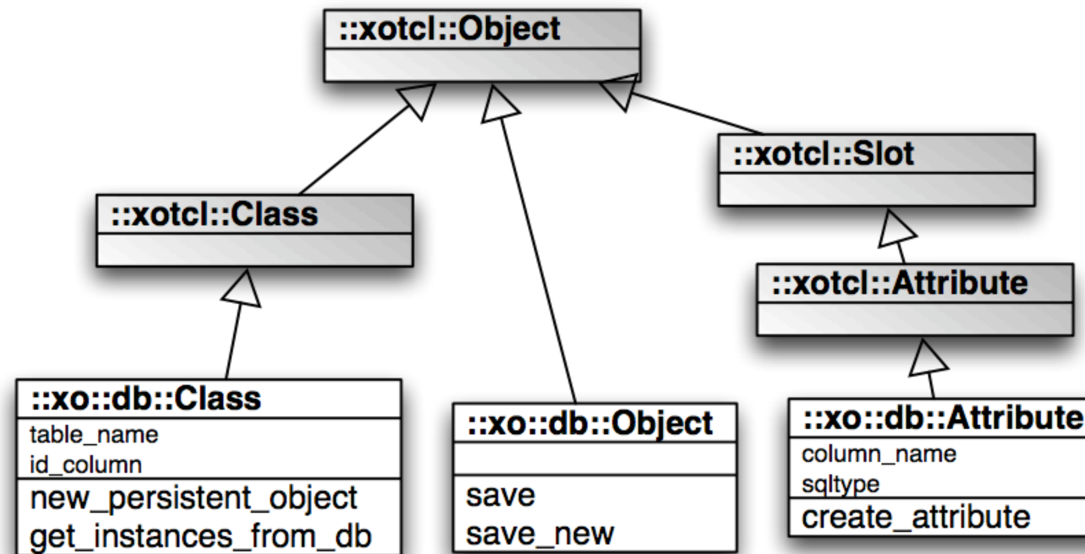


Similarities between OpenACS Meta Model and XOTcl Concepts

- **acs_object_types:** defines specialization - similar to XOTcl classes
- **acs_objects:** defines common attributes - similar to ::xotcl::Object
- **acs_attributes:** defines properties of attributes - similar to attribute slots

DB-Layer is much less flexible then XOTcl:
less support for dynamic operations (adding attributes), no support for re-classing, mixins, ...

XOTcl Classes for the Persistent Object Layer

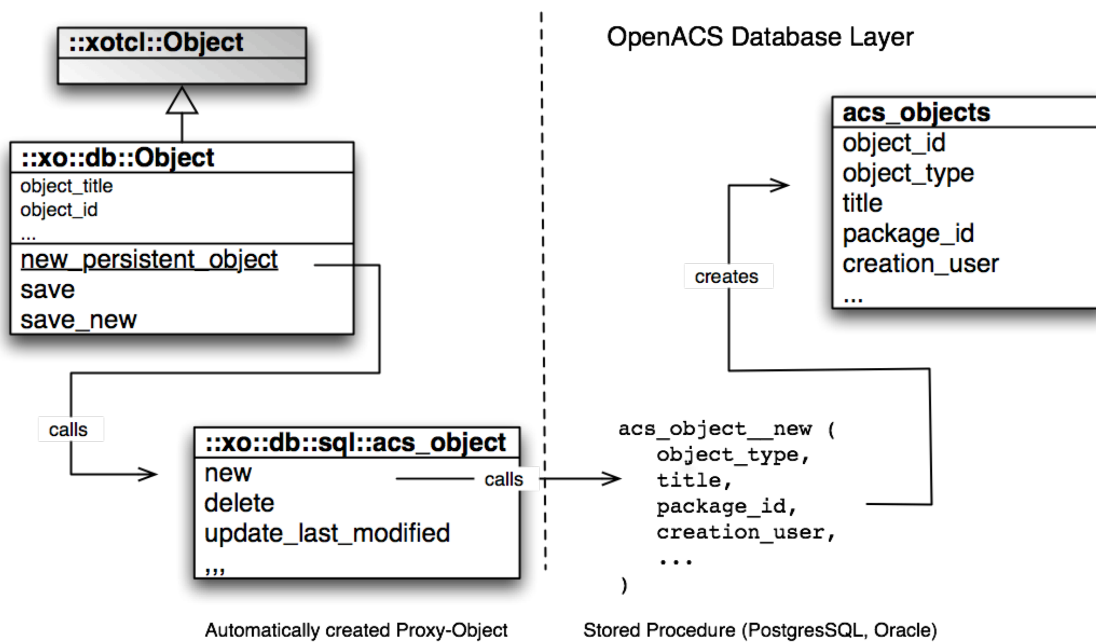


Creating ACS Objects

Approach:

- Create an instance of ::xo::db::Object
- Using a specialized method (new_persistent_object), to distinguish between creating only XOTcl object and as well acs-objects in the database
- acs-objects are created in general via stored procedures in SQL
- xotcl-core auto-generates for all stored-procedures proxy-objects from the db-system catalog

Creation of an ACS Object



Interface for acs_object__new

```
::xo::db::sql::acs_object new [ -dbn dbn ] ...
```

Defined in packages/xotcl-core/tcl/05-db-procs.tcl

Switches:

- **-dbn** (optional)
- **-object_id** (optional)
- **-object_type** (defaults to `"acs_object"`) (optional)
- **-creation_date** (defaults to `"now()"`) (optional)
- **-creation_user** (optional)
- **-creation_ip** (optional)
- **-context_id** (optional)
- **-security_inherit_p** (defaults to `"t"`) (optional)
- **-title** (optional)
- **-package_id** (optional)

Create an ACS Object from XOTcl

```
############################################################
#
# 1) Create new ACS Objects, destroy it in memory,
#    load it from the database, delete it in the database.
#
.. Create a plain new ACS object just for demo purposes.
.. The ACS object is created with a new object id.

>> set o [::xo::db::Object new_persistent_object]
=  ::7845

.. Show the contents of object ::7845 by serializing it:

>> ::7845 serialize
=  ::xo::db::Object create ::7845 -noinit  \
   -set object_title {Object 7845}  \
   -set object_id 7845
```

Check Existence of an XOTcl Object, Destroy it

```
# In the next steps, we (a) get the object_id of the newly
# created ACS object, (b) destroy the XOTcl object (the ACS
# object is still in the database, (c) we recreate the
# XOTcl object from the database, and (d) delete it in the
# database.

.. Step (a)
>> set o_id [::7845 object_id]
=  7845

#
# Delete object from memory: <object> destroy
# Check, if an XOTcl object exists: ::xotcl::Object isobject <obj>
#
>> ::xotcl::Object isobject ::7845
=  1

.. Step (b)
>> ::7845 destroy

>> ::xotcl::Object isobject ::7845
=  0
```

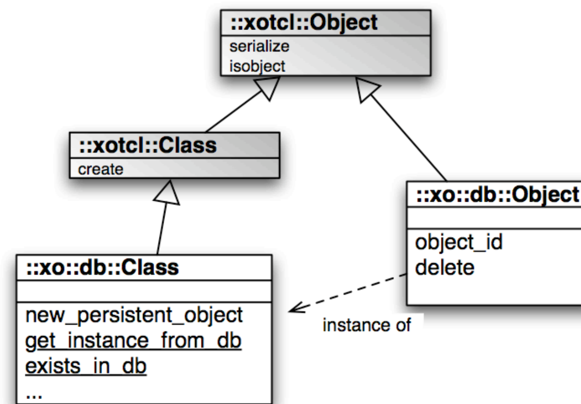
Load Object from Database

```
#
# Load an object from the database:
#     ::xo::db::Class get_instance_from_db -id <id>
#
.. Step (c)
>> set o [::xo::db::Class get_instance_from_db -id 7845]
=  ::7845

>> ::xotcl::Object isobject ::7845
=  1

.. Now, we have recreated the same object as before:

>> ::7845 serialize
=  ::xo::db::Object create ::7845 -noinit \
   -set object_title {Object 7845} \
   -set object_id 7845
```

Delete ACS Object via OO Interface

```
#
# Check, if an ACS object exists in the database:
#     ::xo::db::Class exists_in_db -id <id>
#
# Delete object from memory and database:
#     <object> delete
#
>> ::xo::db::Class exists_in_db -id 7845
=  1

.. Step (d)
>> ::7845 delete

# Now, we have deleted the ACS Object and the XOTcl object:

>> ::xo::db::Class exists_in_db -id 7845
=  0

>> ::xotcl::Object isobject ::7845
=  0
```

Methods used so far



Note, that methods from the meta-class (create, new_persistent_object) are used on instances of the meta-class

Creating ACS Object Types

Approach:

- Create a new XOTcl class via meta-class ::xo::db::Class
- Define new top-level object types as subclass of ::xo::db::Object
- If not provided, xotcl-core generates from the class name and namespace the table-name and id_column
- xotcl-core creates all tables and necessary entries in acs-object-types, acs-attributes etc. from the XOTcl class definition

Create a new ACS Object Type

```
##############################################################
#
# 2) Create new ACS Object Types, ACS Attributes and
#    SQL Tables from XOTcl Classes with slot definitions.
#
.. Create a new ACS Object type and an XOTcl class named ::demo::Person.

.. Does the ACS Object type ::demo::Person exist in the database?
>> ::xo::db::Class object_type_exists_in_db -object_type ::demo::Person
=  0

# We create a new XOTcl Class '::demo::Person'.
# By defining this class, the database layer takes care
# of creating the ACS Object Type and the necessary table via SQL.

.. The persistent attributes (stored in the database) are defined
.. as slots of type ::xo::db::Attribute.

>>
::xo::db::Class create ::demo::Person \
   -superclass ::xo::db::Object \
   -slots {
      ::xo::db::Attribute create name -column_name pname
      ::xo::db::Attribute create age -default 0 -datatype integer
      ::xo::db::Attribute create projects -default {} -multivalued true
    }

=  ::demo::Person
```

The Created Artefacts

```
# If the ACS Object Type and the ACS Attributes would be
# already defined in the database, the class definition above
# would be a no-op operation.

# Now, the ACS Object Type exists in the database

>> ::xo::db::Class object_type_exists_in_db -object_type ::demo::Person
=  1

# The XOTcl class definition created automatically the
# following table for storing instances:

CREATE TABLE demo_person (
    age  integer DEFAULT '0' ,
    pname  text ,
    projects  text DEFAULT '' ,
    person_id  integer REFERENCES acs_objects(object_id) ON DELETE CASCADE
    CONSTRAINT demo_person_person_id_pk PRIMARY KEY
)

.. SQL attribute slot names:
>> ::demo::Person array names db_slot
=  name age projects person_id
```

Created Methods

```
# The XOTcl class definition created as well a 'save' and
# an 'insert' method (latter omitted here):

.. Created 'save' method:

::demo::Person instproc save {}  {
   db_transaction {
   next
   my instvar object_id name age projects
   db_dml dbqd..update_demo_person {
     UPDATE demo_person
     SET pname = :name,age = :age,projects = :projects
     WHERE person_id = :object_id
    }
  }
}
```

Create Instance of New Object Type

```
#
# Create a new instance of ::demo::Person with name 'Gustaf'
#
# The method 'new_persistent_object' of a database class (instance of ::xo::db::Cl
# creates an ACS Object with a fresh id in the database and
# creates as well an XOTcl object in memory

>> set p [::demo::Person new_persistent_object -name Gustaf -age 105]
=  ::7846

.. check, if object ::7846 exists in memory
>> ::xotcl::Object isobject ::7846
=  1

.. check, if object ::7846 exists in the database
>> ::xo::db::Class exists_in_db -id 7846
=  1

.. Show the contents of object ::7846 (using serialize)

>> ::7846 serialize
=  ::demo::Person create ::7846 -noinit \
   -set object_title {Person 7846} \
   -set name Gustaf \
   -set age 105 \
   -set projects {} \
   -set person_id 7846 \
   -set object_id 7846
```

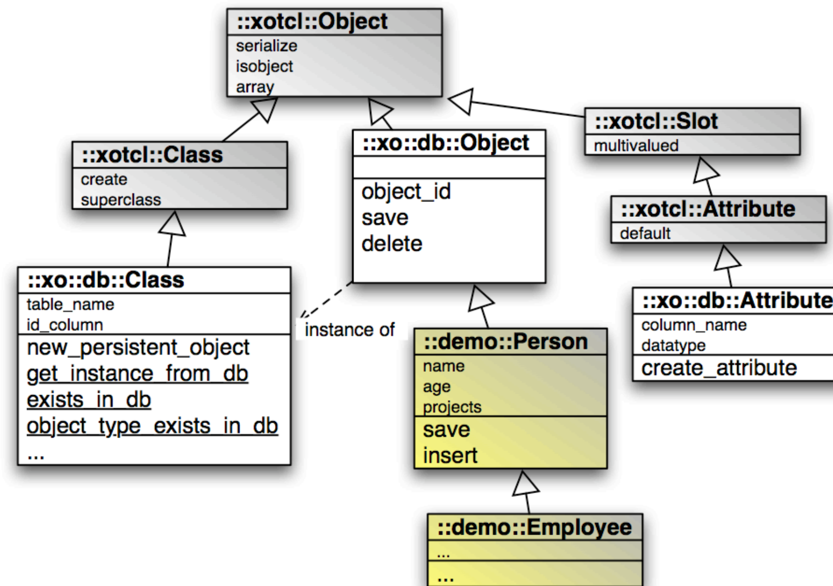
Modify Object, Save and Fetch

```
# modify some attributes of the XOTcl object
>> ::7846 incr age
=  106

# save the modified object data in the database
>> ::7846 save

# deleting xotcl object ::7846 in memory
>> $p destroy

# check, if object ::7846 exists in the database
>> ::xo::db::Class exists_in_db -id 7846
=  1

# fetch person again from database:
>> set p [::xo::db::Class get_instance_from_db -id 7846]
=  ::7846

# serialized content
::demo::Person create ::7846 -noinit \
   -set object_title {Person 7846} \
   -set name Gustaf \
   -set age 106 \
   -set projects {} \
   -set object_id 7846 \
   -set person_id 7846
```

Creating a Subclass

```
# Now, we create a subclass of ::demo::Person called ::demo::Employee
# which has a few more attributes. Again, we define an XOTcl class
# ::demo::Employee which creates the ACS Object Type, the ACS
# attributes and the table, if necessary.

>> ::xo::db::Class create ::demo::Employee \
   -superclass ::demo::Person \
   -table_name demo_employee \
   -id_column employee_id \
   -slots {
      ::xo::db::Attribute create salary -datatype integer
      ::xo::db::Attribute create dept_nr -datatype integer -default "0"
    }
=  ::demo::Employee

# The XOTcl class definition created automatically the
# following table for storing instances:

CREATE TABLE demo_employee (
    dept_nr  integer DEFAULT '0' ,
    salary  integer ,
    employee_id  integer REFERENCES demo_person(person_id) ON DELETE CASCADE
    CONSTRAINT demo_employee_employee_id_pk PRIMARY KEY
)
```

Methods used so far



XOTcl Classes from OpenACS Meta-data

```
############################################################
# 3) Create XOTcl classes from existing ACS Object Types
#    and ACS Attributes based on the definitions in the
#    database

>> set c [::xo::db::Class get_class_from_db -object_type party]
=  ::xo::db::party

.. XOTcl class ::xo::db::party created (superclass ::xo::db::Object)
.. SQL attributes:
>> ::xo::db::party array names db_slot
=  email party_id url

>> set c [::xo::db::Class get_class_from_db -object_type person]
=  ::xo::db::person

.. XOTcl class ::xo::db::person created (superclass ::xo::db::party)
.. SQL attributes:
>> ::xo::db::person array names db_slot
=  last_name first_names person_id
```

Query Interface

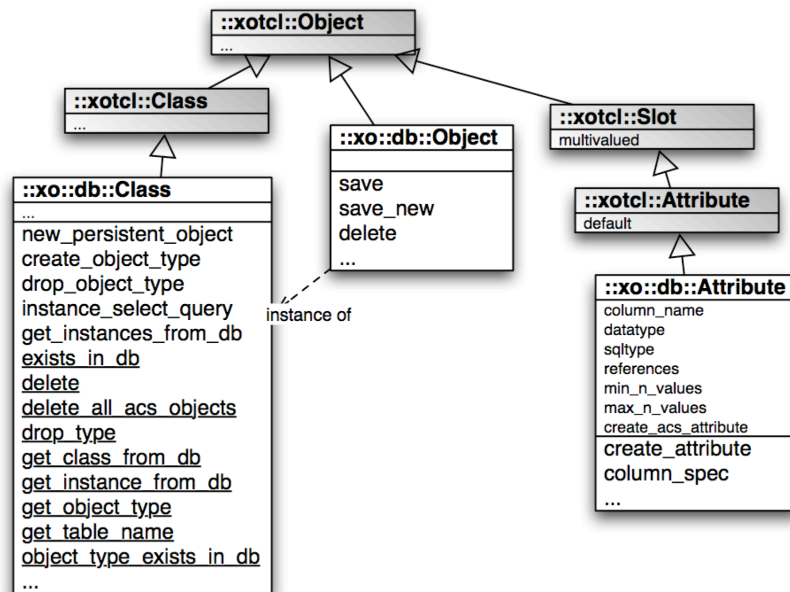
`<instance of ::xo::db::Class> get_instances_from_db ...`

Returns a set (ordered composite) of the answer tuples of an 'instance_select_query' with the same attributes. Note, that the returned objects might by partially instantiated.

Switches:
- **-select_attributes** (optional)
- **-from_clause** (optional)
- **-where_clause** (optional)
- **-orderby** (optional)
- **-page_size** (defaults to `"20"`) (optional)
- **-page_number** (optional)

Returns:
ordered composite

Summary of the xo::db Interface

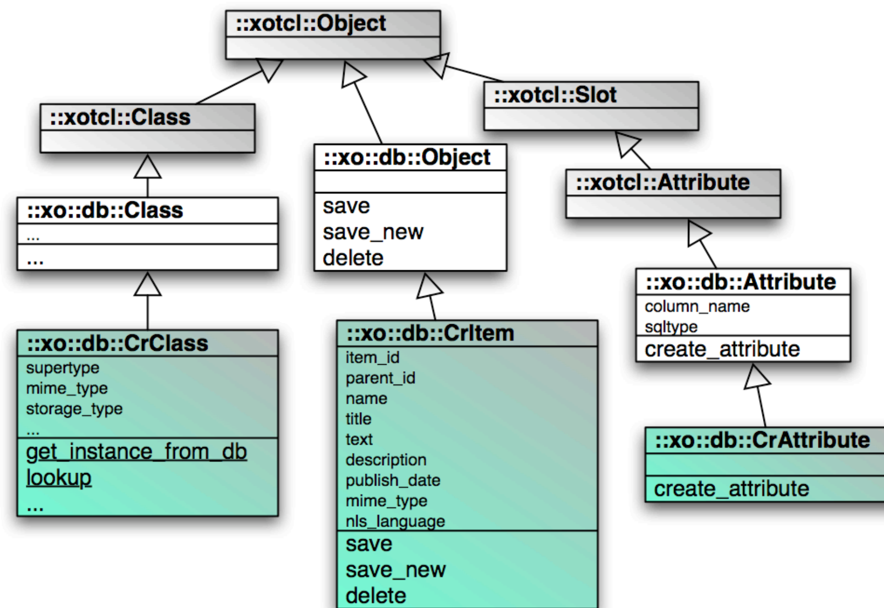


Interface to content repository

OpenACS Content Repository (CR):

- Distinction between content-item and content-revision
- Updates are revisioned
- Most attributes are stored in the revisions
- Content-items and content-revisions are acs-objects
- Content-items are named entries, unique per parent_id (e.g. folder)
- Extend attributes via subtyping/subclassing
- Single XOTcl layer, accepting either item_ids or revision_ids

Overview of the XOTcl CR Interface



Creating Application specific Subclasses of the CR

```
#################################################################
# Create new application classes by sub-typing the
# Content Repository, adding additional attributes
#
# We create a subclass of ::xo::db::CrItem called ::demo::Page
# which has a few more attributes. Actually, this class is very
# similar to ::xowiki::Page. Again, we define an XOTcl class
# ::demo::Page which creates the ACS Object Type, the ACS
# attributes and the table, if necessary.

>> ::xo::db::CrClass create Page \
   -superclass ::xo::db::CrItem \
   -pretty_name "demo Page" \
   -mime_type text/html \
   -slots {
      ::xo::db::CrAttribute create creator \
        -column_name creator_string
    }

=  ::demo::Page
```

Create Instance, Save, Delete, Fetch

```
# create a page object in memory
>> set i [::demo::Page new   \
   -name "page0"   \
   -title "Joke of the Month"
   -creator "GN"  -text "Three cannibals meet in a NYC subway station..."  ]
=  ::xotcl::__#j

# save as a new item under default parent_id (-100), allocates fresh item_id
>> $i save_new
=  7855

>> set item_id [$i item_id]
=  7855

# destroy object in memory
>> $i destroy

# fetch item per item_id from the database
>> ::demo::Page get_instance_from_db -item_id 7855
=  ::7855
```

Fetch Item by Name

```
# Lookup page from CR by name
>> ::xo::db::Class lookup -name page0
=  7855

# fetch item per item_id from the database
>> ::demo::Page get_instance_from_db -item_id 7855
=  ::7855

# modify the object
>> ::7855 set title "Kilroy was here"

# safe the object with a new revision
>> ::7855 save
```

Questions?

Creating Applications with XOTcl Core

Overview (1)

- Developing for OpenACS means creating OpenACS packages, being discrete modules in the OpenACS architecture.
- This tutorial is build around a little story: We want to create a note-keeping application call XOTcl Demo Note.
- There is a ready-made demo package available, for those who want to kick-start their own development (see below for reference).
- Use advanced OpenACS features (Object System, Content Repository) right from the beginning, facilitated by the XOTcl Core infrastructure.
- We aimed at sticking close to the message conveyed by the classic OpenACS development tutorial and show the XOTcl way of realising it ...

Overview (2)

Viewing / managing notes

Add new notes

Edit existing notes

Prerequisites

To get started with our demo package, you will need the following:

- A running OpenACS installation that provides the XOTcl Core (package: xotcl-core). You find step-by-step instructions for installing XOTcl Core at the OpenACS wiki.
- The examples files, or rather, the distribution of the underyling demo package, i.e. xotcl-demo-note. We host a copy at ...
- An authoring environment to create and modify the script files involved.

Assumptions

For the scope of this tutorial, we follow a couple of assumptions. Be aware of these, provided that you apply lessons taken from here in a different context ...

- URI of your OpenACS installation: **http://localhost:8000**
- Package key of the demo package to be created: **xotcl-demo-note**
- Whenever we refer to the "packages" directory of your OpenACS installation, we mean: <path_to_your_OACS>/packages/

Introduction in three Units

Guide to the first xotcl-core application in three Units:

- Unit 1 / Package management:
    - Creating and initialising a new OpenACS package, using the ACS Package Manager (APM)
    - Understanding the file system and logical structure of OpenACS packages

      XOTcl Core support for handling and using OpenACS application packages
- Unit 2 / Data Model
- Unit 3 / Web User Interface:
    - Using request and other context information
    - Creating simple user dialogs
    - Application's user interface (tables, lists, ...) through xotcl-core widgets

Unit 1 / OpenACS Packages

- APM (ACS Package Manager) packages have various representations:
  - File-system artifact
  - Data base artifact (in the sense of ACS objects)
  - XOTcl (in-memory) objects
- Kinds of APM packages:
  - "Application"
  - "Singleton"

Unit 1 / Creating OpenACS Application Packages

http://localhost:8000/acs-admin/apm > Create New Package

Add a New Package

Main Site : Site-Wide Administration : Package Manager : Add a New Package

Select a package key for your package. This is a unique, short, and lower-case identifier for your pa
for the address book package or photo-albu ... ackage will b

Important: A package key

Package Key: xotcl-demo-note

Select a short, human-readable name for your package, e.g., "Address Book" or "Photo Album."

Package Name: XOTcl Core Demo Package

Please indicate the plural form of the package name, e.g. the plural form of 'Bboard' is 'Bboards.'

Package Plural: XOTcl Core Demo Packages

Indicate whether this package is an application or a service. Applications are software intended for
OpenACS to provide ... Workflow.

Important: The package type

Package Type: Application

OpenACS Core? Is your package part of the OpenACS Core that forms the set of packages initially installed? If y
you'd leave this box unchecked.

Singleton? Is your package a singleton package? Singleton packages can have at most one instance; attemp
instance. Singleton packages are app ... have multiple instances, su

Optionally: Auto-mount feature

Auto-mount URI xotcl-demo-note

The URI (name) under the main site ... be mounted upon install

Pick a canonical URL for your package. This should be a URL where the package can be downloa

Package URL: http://openacs.org/repository/apm/packages/xotcl-demo-note

Select an initial version number for the package. By convention, this is 0.1d if you are just starting
4.0 code. The version ... **major number.minor number** with an option

Mandatory: Provide an initial version tag

Initial Version: 0.1d

Pick a canonical URL ... For now, the default will always be co

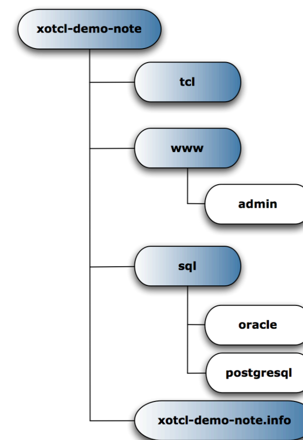
Version URL: http://openacs.org/repository/download/apm/xotcl-demo-note-0.1d.apm

Type a brief, one-sentence-or-less summary of the functionality of your package. In general, this sh
summary should begin with a capital letter and end with a period.

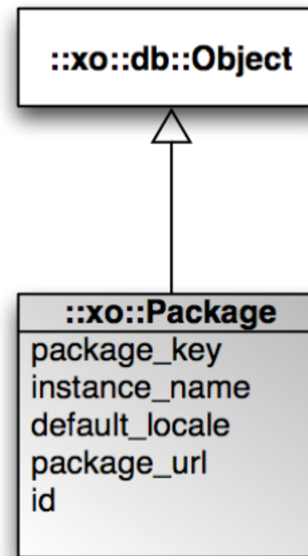
Summary:

Unit 1 / File Structure for APM Packages

- Once the package manifesto is updated, the package will be created in the file system
- In our example, the following structure is created:



Unit 1 / Packages as XOTcl Objects



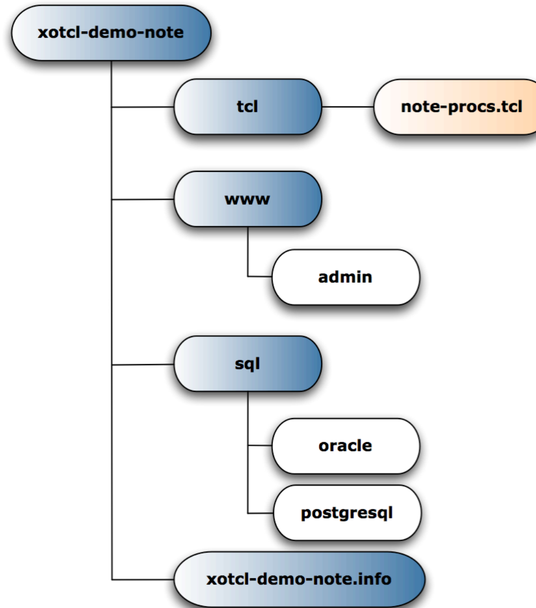
Unit 1 / Packages as XOTcl Objects

- Library script: xotcl-core/tcl/06-package-procs.tcl
  - Package manager: ::xo::PackageMgr
  - Base package: ::xo::Package
- ::xo::Package realises various features, beyond a mere object representation of APM packages
  - It may act as message redirector
  - It acts as **context resolver** (site node > package_id)
  - It amends and integrates legacy OpenACS facilities, e.g. ad page contract
  - Provides access to per-instance parameters (APM parameters)
  - In more advanced scenarios, it is point of reference for providing per-instance folders ...

Unit 1 / Manage Package Instances

- In our demo package, we want to define a new kind of package manager: **::demo::Package**
    - **Step 1**: Define a new class of package by defining an XOTcl class
    - **Step 2**: Assign initialisation behaviour to instances of this new package type
- Create a script file called "note-procs.tcl" in xotcl-demo-note/tcl/ and place the following code snippets there.

Unit 1 / Library File note-procs.tcl



Unit 2 / Define a new Package Type

```
# Define classes in the Tcl namespace ::demo in file note-procs.tcl

namespace eval ::demo {
   # Define a sub-class of ::xo::Package
   # and provide some meta-data (package-key, pretty_name ...}

   ::xo::PackageMgr create Package \
       -superclass ::xo::Package \
       -package_key "xotcl-demo-note" \
       -pretty_name "XOTcl Demo Note Package" \
       -parameter {{folder_id 0}}
   ...
}
```

Unit 1 / Package manager

Step 2: Define additional, type-specific initialisation behaviour (constructor)

- Type-specific behaviour: We want to store all notes (instances of ::demo::Note) for each package instance in an own OpenACS Content Repository folder.
- Conceptually, each package instance (bound to a site node) is associated to a single folder as item container.

Unit 1 / Package Constructor

```
# We are still in the Tcl namespace ::demo in file note-procs.tcl

  ...

  # The folder_id is an parameter of the Package.
  # Each time we initialize our package, we want to have the
  # folder id ready. So we extend the basic ::xo::Package class,
  # provide an additional parameter folder_id and create the folder on
  # the fly when necessary.

  Package instproc init {} {
    next
    my folder_id [::demo::Note require_folder \
       -name demo-note -package_id [my id]]
  }
  ...
```

Unit 1 / Best Practice

Best practices

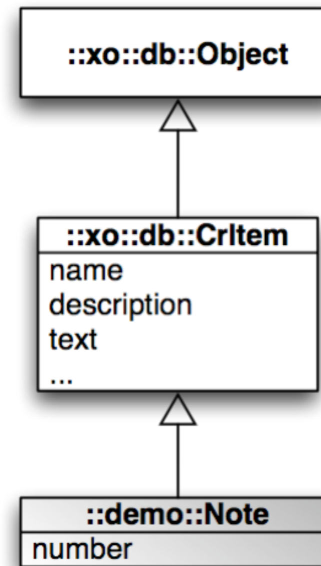
- Always provide a application-specific package manager, it facilitates both content management and request processing (in www/* scripts)
- Declare your package manager in a library (*-procs.tcl) script, e.g. tcl/note-procs.tcl
- It is good practice to declare application-specific code in a proper TCL namespace; in our example everything goes into: namespace eval ::demo { ... }

End of Unit 1

Unit 2 / Devise your Application's Data Model

- Remember the section on XOTcl Core's Interface to the content repository presented earlier.
- Notes will be realized as special kind of Content Items in the Content Repository
  - On the one hand, this allows to seamlessly integrate framework features such as comments, notifications, category management, full-text searches etc. with our notes application.
  - On the other hand, we gain all benefits from the Content Repository (access, revision management, structuring, ...)
- By using the OO Content Repository interface it is sufficient to define a new type of content item. The SQL data model is created automatically
- Let's consider our application data model conceptually

Unit 2 / Conceptual Content Model



Unit 2 / Define a Package-specific Content Type

```
# We are still in the Tcl namespace ::demo in file note-procs.tcl
  ...
  # The class ::demo::Note has an additional attribute "number" in
  # addition to the common attributes of CrItems. Since Note is a
  # subclass of content repository items, the additional attributes
  # are versioned, this means that when an entry is modified and
  # saved, the old revisions with the old values are still continue to
  # exist.

  ::xo::db::CrClass create Note -superclass ::xo::db::CrItem \
      -pretty_name "Demo Note"  -pretty_plural "Demo Notes" \
      -slots {
         ::xo::db::CrAttribute create number \
           -datatype integer -default 0
      }
}
# end of file note-procs.tcl
ns_log Notice "note-procs.tcl loaded"
```

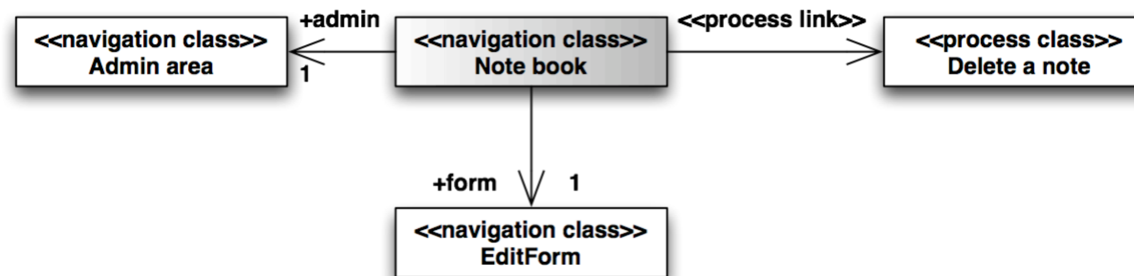
Unit 2 / Checking the Data Model

- After note-procs.tcl is created, it can be loaded into a running OpenACS instance via APM (/acs-admin/apm), choose "Reload files changed" for the note package.
- This will cause the XOTcl Core to set-up the data model
- Primarily the following things are created in the database:
  - A new entry in relation "acs_object_types" called "::demo::Note"
  - A new attribute table "demo_note" that stores type-specific attribute values, e.g. number.
- As there is no need for creation SQL scripts, there is also no need for SQL deletion ones. You may use ::demo::Note->drop_object_type manually or in a package removal hook (after-uninstall etc.)

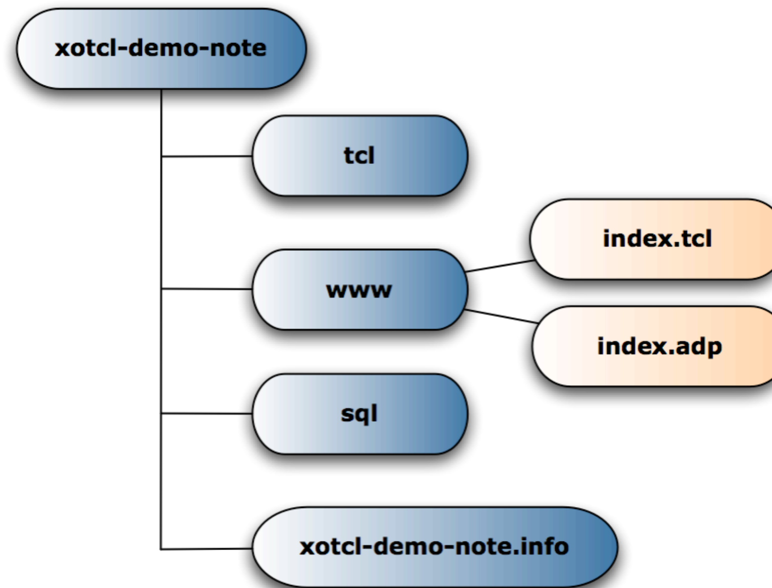
End of Unit 2

Unit 3 / The Navigational Model

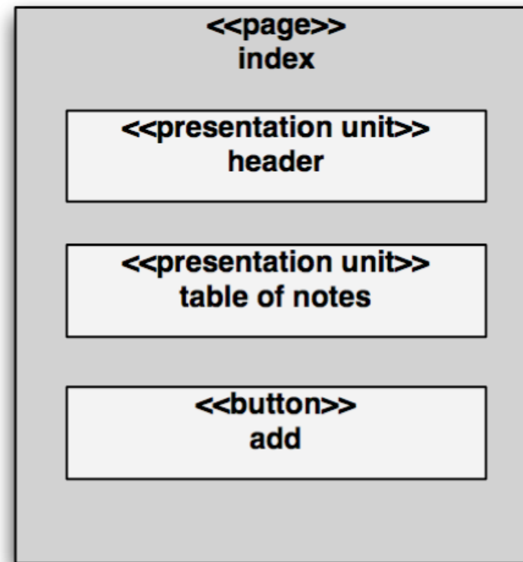
A navigation model as proposed by UML for Web Engineering



Unit 3 / The Index Page as Note Book



Unit 3 / The Presentation Model: Index Page



Unit 3 / Package manager (1)

www/index.tcl: Using your package manager as context resolver

- Call to a creator method: ::xo::PackageMgr->initialize()
- Providing a documentation string
- Specify expected parameter set

```
# file xotcl-demo-note/www/index.tcl

::demo::Package initialize -ad_doc {

  This is the main page for the package.
  It displays all of the Demo Notes and
  provides links to create, edit and delete Notes.

  @author Gustaf Neumann
  @cvs-id $Id$
} -parameter {
  {-orderby:optional "last_modified,desc"}
}
...
```

Unit 3 / Package Manager (2)

::xo::Package provides a simple page-contract interface, similar to ad_page_contract

- Page contracts (see ad page contract) negotiate both a required and provided feature set between the template (*.adp) and the script (*.tcl) or the request and the script, respectively.
- The required features include expected request parameters, optional validation, default values etc.
- The provided feature include properties, i.e. variable that will be accessible within the scope of the affiliated template.

Unit 3 / Package manager (3)

- Parameter-wise constraints are realised through XOTcl's non-positional arguments
- Examples:
  - -aParameter:optional aDefaultValue
  - -aParameter:required
  - -aParameter:integer
  - -aParameter ""
  - -aParameter:boolean,required false

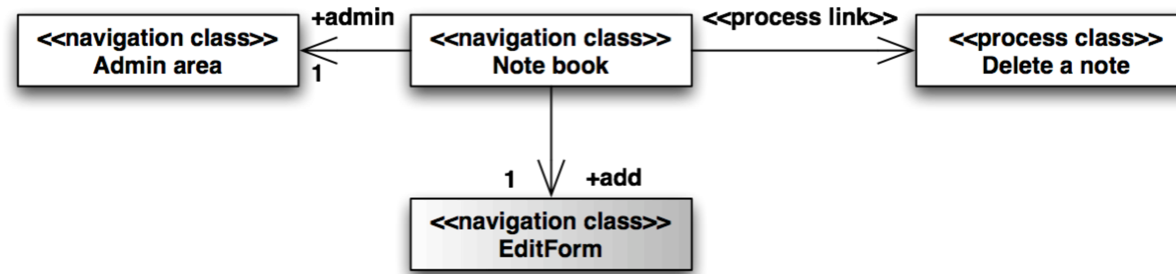
Unit 3 / Use xotcl-core Table Widget

```
# still in file xotcl-demo-note/www/index.tcl
#
# We define a table with an action to add new items
#
TableWidget index -volatile  -actions [subst {
      Action new -label Add \
          -url [$package_id package_url]edit \
          -tooltip  "Add a new [::demo::Note pretty_name]"
    }]  -columns {
      ImageField_EditIcon edit -label "" -html {style "padding-right: 2px;"}
      AnchorField name -label "Name" -orderby name
      Field size -label "Size" -orderby size -html {align right}
      Field last_modified -label "Last Modified" -orderby last_modified
      Field mod_user -label "By User" -orderby mod_user
      ImageField_DeleteIcon delete -label "" \
         ;#-html {onClick "return(confirm('Confirm delete?'));"
      }
    }
...
```

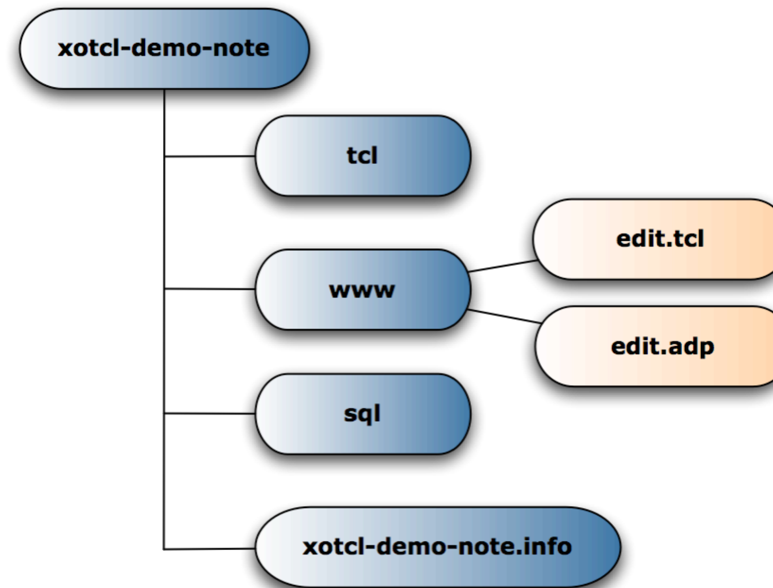
Unit 3 / Populating the Table Widget

```
# still in file xotcl-demo-note/www/index.tcl
#
# We populate the table widget with notes stored in the db
# We use the ::xo::db::Class->instance_select_query interface
#

db_foreach instance_select  [::demo::Note instance_select_query  \
   -folder_id [$package_id folder_id]  \
   -select_attributes [list content_length creation_user \
      "to_char(last_modified,'YYYY-MM-DD HH24:MI:SS') as last_modified"]] {
      index add \
       -name $name  -name.href [export_vars -base edit {item_id}]  \
       -last_modified $last_modified  \
       -size [expr {$content_length ne "" ? $content_length : 0}]  \
       -edit.href [export_vars -base edit {item_id}]  \
       -mod_user [::xo::get_user_name $creation_user]  \
       -delete.href [export_vars -base delete {item_id}]
    }

set html [index asHTML]
```

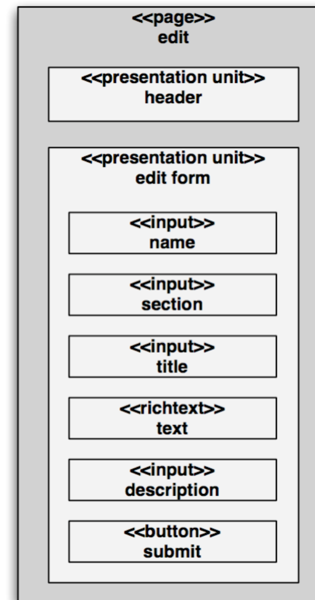
Unit 3 / User Dialog to Add and Edit Notes



Unit 3 / The Edit&Update User Interface



Unit 3 / Presentation model for the Edit Page



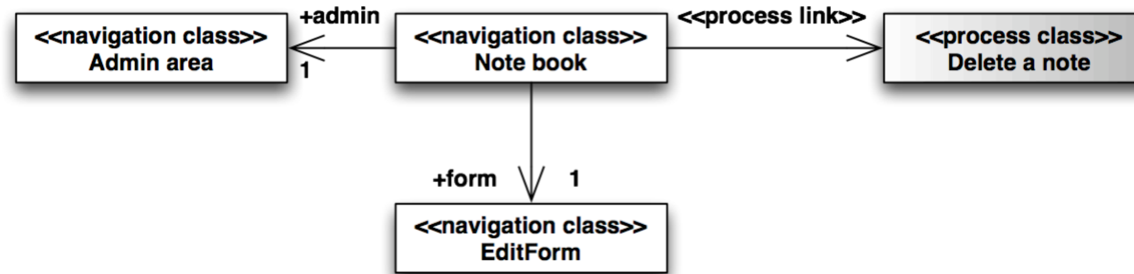
Unit 3 / Using the Form Builder ::Generic::Form (1)

```
# file xotcl-demo-note/www/admin/edit.tcl
::demo::Package initialize -parameter { {-item_id:integer} }

# This script is called in multiple situations: it is called, when
# an item should be newly created (with default fields), when the
# values for the new item are provided by the user, or when
# an existing item should be displayed or saved. Depending on the
# situation, we might have the item_id of the note. If it exists,
# we can fetch it from the database to use the values from there.

if {[info exists item_id] && [::xo::db::Class exists_in_db -id $item_id]} {
  set item [::demo::Note get_instance_from_db -item_id $item_id]
} else {
  set item [::demo::Note new -package_id $package_id]
  $item set parent_id [$package_id folder_id]
}
 ...
```

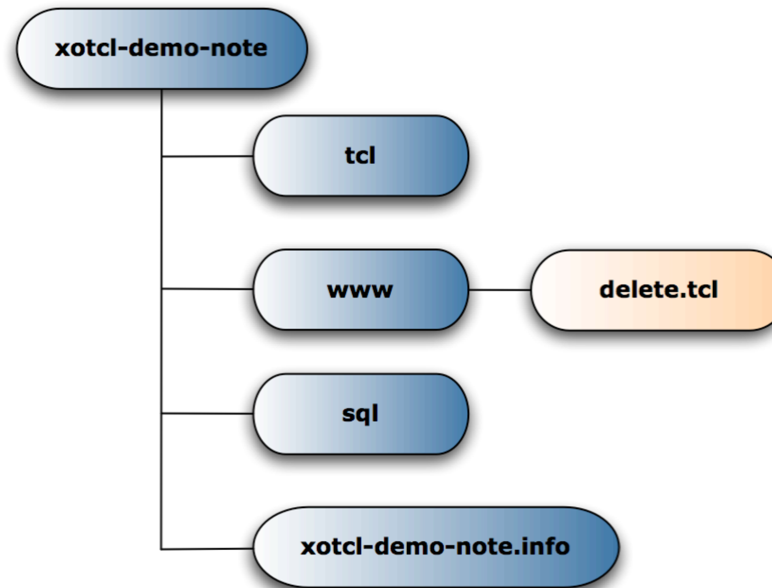
Unit 3 / Using the Form Builder ::Generic::Form (2)

```
# still in file xotcl-demo-note/www/admin/edit.tcl

#
# Provide a form + field specification
#

::Generic::Form create form1 -volatile  -data $item  -fields {
      {item_id:key}
      {name:text {label Name}}
      {number:text {label Number}}
      {text:richtext(richtext),nospell,optional {label Content} {options {editor x
      {description:text(textarea),nospell,optional {label Description}
        {html {cols 60 rows 2}}
      }
    }

form1 generate
# provide values for edit.adp
form1 instvar context formTemplate
set title "My first Form"
```

Unit 3 / Deletion of Notes



Unit 3 / Script for Note Deletion



Unit 3 / Deletion of Notes

```
# file xotcl-demo-note/www/admin/delete.tcl

::demo::Package initialize -ad_doc {
  Delete a note
} -parameter {
  {-item_id:integer}
}

#
# We need to verify the current user's privileges
#
permission::require_write_permission -object_id $item_id

#
# Proceed with deletion
#
::xo::db::CrItem delete -item_id $item_id
```

Unit 3 / What did we achieve?

Questions?

References

- www.xotcl.org
- Handbook
- Tutorial
- Publications Section
- UML for Web Engineering
- git://alice.wu-wien.ac.at/xotcl-demo-note