Open Source & XBRL: the Arelle® Project

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The Problem

Currently, there are a number of proprietary XBRL processors on the market each with varying degrees of conformity to the XBRL 2.1 specification and differing levels of implementation, integration, and support for XBRL extension modules, Filer Manual tests, and test suites. A quick look at http://edgardashboard.xbrlcloud.com/edgar-index.html on XBRLCloud, will give insight into usage and results with the wide variety of tools available for creating XBRL filings. Each has a slightly different approach to document creation, varying levels of validation leading to a wide range of errors and warnings, and different transparency in its implementation and degree of conformance. However, this should not be seen a US centric problem, as the same issues arise in each jurisdiction where XBRL has been adopted. XBRL software developers struggle through the XBRL 2.1 specification, the companion dimensions specification, the Edgar and Global Filer Manuals, and make valiant attempts at implementing conformant processors. It is hard to know which may be more successful than others, because the users don't usually have integrated access to the test suites to check conformance, or the the various extension modules such as versioning, rendering and formula. This situation sparks frequent XBRL online and blog discussion of variation in levels of conformity in XBRL instances and tools that consume and validate them.

We believe there is a need to supply software developers with a cohesive, easy-to-use programming model for building XBRL-compliant applications and curb the proliferation of non-conformant XBRL processors. Developers new to XBRL are forced to learn and interpret the entire XBRL 2.1 specification just to build a simple application. Advanced XBRL developers are forced to write tedious plumbing code; and tools authors are limited in what they can do to simplify the experience due to the underlying complexity.

XII itself is dependent on member vendors to implement and test changes to the specification or new modules, constraining XII to vendor member's resource availability and interest levels in specific aspects of the new modules – which are not always in line with the market needs and requirements to drive adoption of XBRL.

Our Approach

In order to advance the adoption and resolve the interoperability and conformance issues, we have launched an open source software effort to facilitate the ongoing development of XBRL-related technology resources that will be freely available to the public obtain, use, redistribute, and modify.

The XML standard, the underpinning technology of XBRL, is an open source project, with a strong, stable open source community supporting it's care and maintenance. "Open source" is defined as: freely available technology licensed under terms compatible with Version 1.9 (or later) of the Open Source Definition, as established by the Open Source Initiative (see http://www.opensource.org/).

Using Python, an open source dynamic language known for high productivity, we have developed a highly portable software library for parsing and validating XBRL documents, and released it under the Apache 2 license. This will remove significant barriers to entry into the XBRL market; enable the development of reliable, stable and conformant financial software applications that would promote the adoption of XBRL technology across the globe.

The Arelle Project

Arelle is a project to provide an easy to use open source facility for XBRL. The intent began to meet needs that are not commercially viable, such as to support under-development extension modules and test suite facilities, in a compact framework, and to support academic training and projects.

Support for XBRL versioning was an initial goal, to provide both a validation tool for versioning reports and a production tool to generate the basics of a versioning report that can be inferred by diffing two DTSes.

As the project evolved, Edgar and Global Filer Manual validation, Base Specification, Dimensions, Generic linkbase, Formula, and Eurofiling rendering linkbase, were added. Additional features were added to allow formula experimentation with existing real filings, by an RSS Watch facility.

Arelle fully integrates test cases with the object models for XBRL instances and DTSes. This allows continual verification of tool performance as it is extended and adapted by its users.

Users can explore the functionality and features from either an interactive GUI or command line interface, and can develop their own controller interfaces as needed.

Arelle is supported on the website http://arelle.org

Background

Arelle’s origin was a need to provide tooling focusing on early support for technical development of standards extension modules. These stages require a way to error check and validate prototype test suites facilities before commercial tools become available.

For this reason test case operation has been fully integrated to the object model and tool interfaces.

Although there has been a long and steady interest in open source facilities, the importance of this need was highlighted by the XBRL Standards Board survey project, which found two relevant and consistent feedback points, (1) the request for open source facilities, and (2) the request for an independent API.

An advantage of open source is that fresh bright minds will, from time to time, come to look at the architecture and structure and see things that those, who are too deep in the forest to see the trees, may have overlooked. It is expected that the architecture will evolve over time and lead to continual product evolution and improvement.

Arelle was designed to be a minimalist facility, as a counter-response to experience with other APIs that are large, hard to learn, and not directly supportive of the XBRL extension modules. In this case, the API is compact and implemented with a bare minimum of coding. Arelle is platform independent, implemented in Python, completely from scratch.

To prove the viability of the initial API, it was suggested to assure that SEC Edgar Validation and the Versioning module were implementable, particularly as these have test suites. It was considered lesser priority to replicate functions widely available in other products, such as XML validation (this will be provided later on).

About the name: the sound of pronouncing XBRL makes a pseudonym, Ecksbee Arelle. Arelle is found on baby name websites as a valid girl's name.

The implementation is in Python 3.1, and is intended for Windows (any recent), Mac OS-X 10.3 to 10.6, or any Unix or Linux. Memory required is about twice of comparable commercial products, e.g., a US-GAAP filing might need 30-60MB (x32 ok), comparing two 2011 us-gaaps for versioning report generation might take 4.5G (x64 needed). Loading speed about half of commercial products.

Architecture

An MVC (model-view-controller) architecture has been selected.

Model represents the objects of XBRL: instances, inline-instances, DTS schemas and linkbases, individual test cases, test suites, formula, and versioning reports. The model has a modelManager, which manages the set of models loaded at a time.

The controller represents interaction with external users and external programmatic control, such as by GUI, web, and command line.

A view represents pre-defined API interactions with the model, to present object views for GUI, web, and textual use (e.g., CGI files).

A number of utility functions are included to make the code easier to read and more compact. These include XML utilities, URI utilities, and a customized Python web cache.

Validation operations are factored out to separate classes, as they are quite large to include with the objects that they validate for. Validation operations have been integrated to prevent redundant passes through object models**.**

Model

The intent of the model is to provide independence of the eventual serialization of XBRL, which for now is XML. The XSB Strategic Initiatives project has a task to develop an SQL model, which may for a basis for an alternate serialization to be consumed by Arelle.

From the top down, there is the necessity to process multiple instances (DTSes) of XBRL concurrently. A ModelManager coordinates them for the Controller, and is the interface to utility functions (such as the Python web cache), and application specific formalisms (such as the SEC restrictions on referencable base taxonomies).

Each loaded instance, DTS, testcase, testsuite, or versioning report is represented by an instance of a ModelXbrl object. The ModelXbrl object has a collection of ModelDocument objects, each representing an XML document (for now, alternate serialization whenever that time comes). One of the modelDocuments of the ModelXbrl is the entry point (of discovery or of the test suite).

Each modelDocument represents a set of modelObjects, which are specialized as follows according to the type of document. There is also one specialization of modelDocument, which is a modelVersReport, as the versioning report has different objects and methods than from any other XBRL modelDocument.

There is also an inherently different model, modelRelationshipSet, which represents an individual base or dimensional-relationship set, or a collection of them (such as labels independent of extended link role).

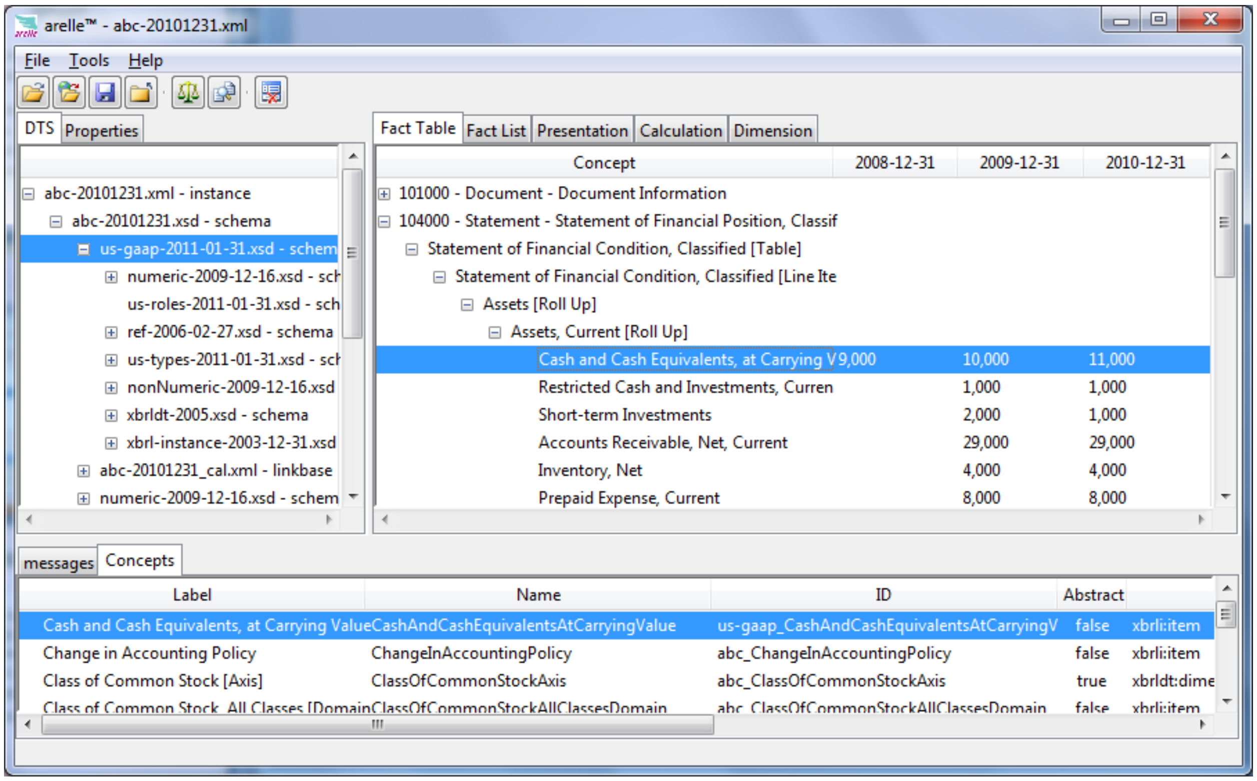
The model objects are, from general to more specific, models representing a superclass XBRL object, and models representing XBRL role/arcrole types, schema objects, concepts, attributes, and types; for Xlink, links, resources, and locators. Specialized resources represent formula linkbase objects, rendering linkbase objects, and versioning objects. Model relationships represent arcs and are suitable both for effective arc base and relationship sets, and for determining of ineffective arcs (for Filer submission validation). Instance objects include facts (instance and inline XBRL), contexts, dimensions and units. Testcase objects represent fully integrated testcase variation objects.

Validation operations are separated from the objects that are validated, because the operations are complex, interwoven, and factored quite differently than the objects being validated. There are these validation modules at present: validation infrastructure, test suite and submission control, versioning report validation, XBRL base spec, dimensions, and formula linkbase validation, Edgar and Global Filer Manual validation.

View

View facilities are segregated by the means of rendering, to modules dealing (at present) with CSV result files (static views), GUI window panes (dynamic and interlinked views), and later Web Views (dynamic interlinked and deferred-delivery views). Web based views will be added after extension modules are completed.

The typical instance and DTS views are synchronized for fact, relationship, concept, and other views of the DTS. Selection events of any one view synchronize others that present the same object:

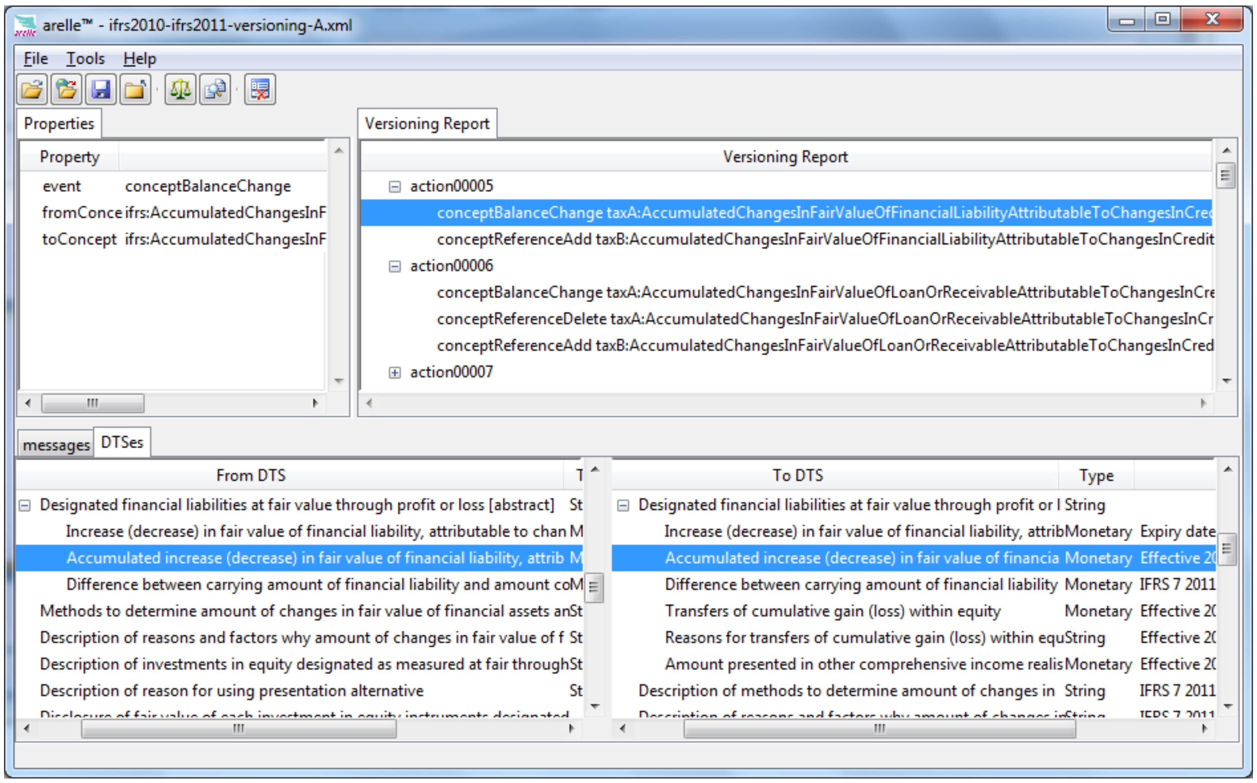


```
abc-20101231.xml - instance
  abc-20101231.xsd - schema
    us-gaap-2011-01-31.xsd - schem
      numeric-2009-12-16.xsd - sch
      us-roles-2011-01-31.xsd - sch
      ref-2006-02-27.xsd - schema
      us-types-2011-01-31.xsd - sch
      nonNumeric-2009-12-16.xsd
      xbrldt-2005.xsd - schema
      xbrl-instance-2003-12-31.xsd
    abc-20101231_cal.xml - linkbase
    numeric-2009-12-16.xsd - schem
```

Concept	2008-12-31	2009-12-31	2010-12-31
101000 - Document - Document Information			
104000 - Statement - Statement of Financial Position, Classif			
Statement of Financial Condition, Classified [Table]			
Statement of Financial Condition, Classified [Line Ite			
Assets [Roll Up]			
Assets, Current [Roll Up]			
Cash and Cash Equivalents, at Carrying V	9,000	10,000	11,000
Restricted Cash and Investments, Curren		1,000	1,000
Short-term Investments		2,000	1,000
Accounts Receivable, Net, Current		29,000	29,000
Inventory, Net		4,000	4,000
Prepaid Expense, Current		8,000	8,000

Label	Name	ID	Abstract	
Cash and Cash Equivalents, at Carrying Value	CashAndCashEquivalentsAtCarryingValue	us-gaap_CashAndCashEquivalentsAtCarryingV	false	xbrli:item
Change in Accounting Policy	ChangeInAccountingPolicy	abc_ChangeInAccountingPolicy	false	xbrli:item
Class of Common Stock [Axis]	ClassOfCommonStockAxis	abc_ClassOfCommonStockAxis	true	xbrldt:dime
Class of Common Stock, All Classes [Domain	ClassOfCommonStockAllClassesDomain	abc_ClassOfCommonStockAllClassesDomain	false	xbrli:item

Versioning reports are entering use with the 2011 IFRS release. Here is a view of the 2010 and 2011 IFRS taxonomies with the actions of the versioning report interlinked to IFRS-style ("ITI") displays of the from and to DTSes. Full validation of the versioning report is available, and was helpful in preparing the IFRS 2010/2011 report.


arelle™ - ifrs2010-ifrs2011-versioning-A.xml

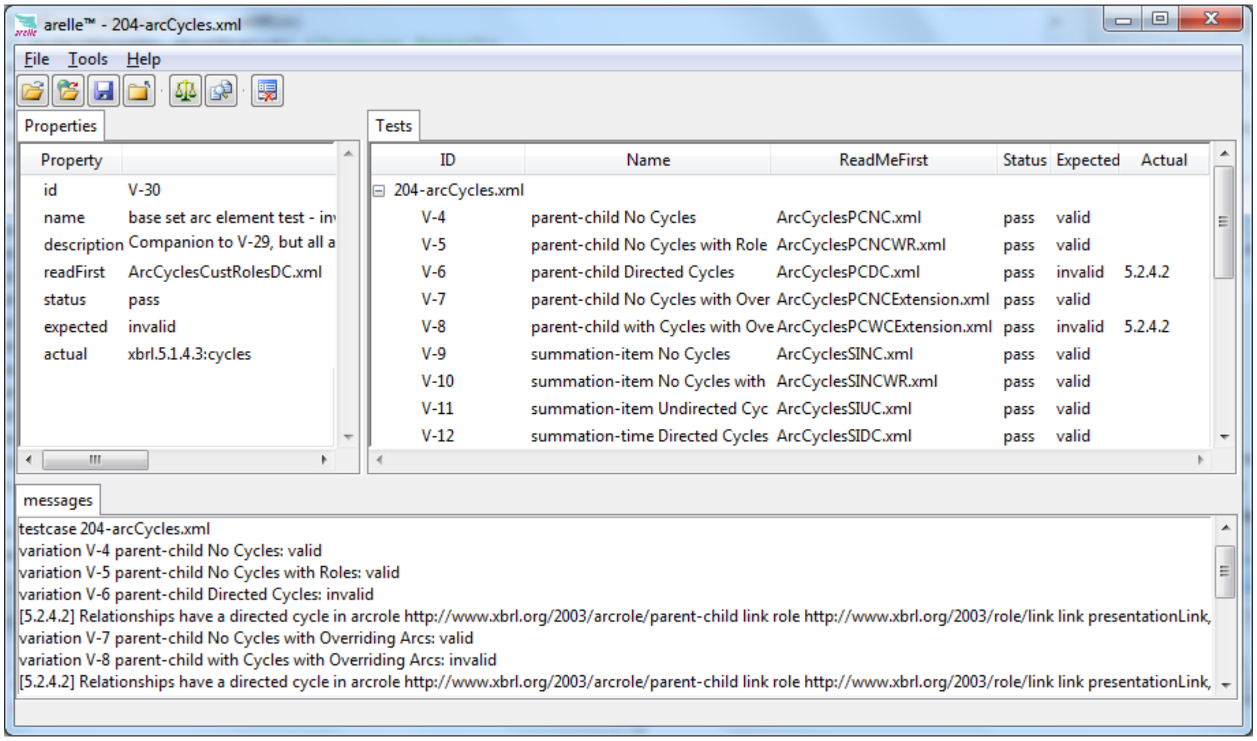
Property	
event	conceptBalanceChange
fromConce	ifrs:AccumulatedChangesInF
toConcept	ifrs:AccumulatedChangesInF

```
Versioning Report
⊟ action00005
    conceptBalanceChange taxA:AccumulatedChangesInFairValueOfFinancialLiabilityAttributableToChangesInCre
    conceptReferenceAdd taxB:AccumulatedChangesInFairValueOfFinancialLiabilityAttributableToChangesInCredit
⊟ action00006
    conceptBalanceChange taxA:AccumulatedChangesInFairValueOfLoanOrReceivableAttributableToChangesInCre
    conceptReferenceDelete taxA:AccumulatedChangesInFairValueOfLoanOrReceivableAttributableToChangesInCr
    conceptReferenceAdd taxB:AccumulatedChangesInFairValueOfLoanOrReceivableAttributableToChangesInCred
⊞ action00007
```

From DTS	T
⊟ Designated financial liabilities at fair value through profit or loss [abstract]	St
Increase (decrease) in fair value of financial liability, attributable to chan	M
Accumulated increase (decrease) in fair value of financial liability, attrib	M
Difference between carrying amount of financial liability and amount co	M
Methods to determine amount of changes in fair value of financial assets an	St
Description of reasons and factors why amount of changes in fair value of f	St
Description of investments in equity designated as measured at fair through	St
Description of reason for using presentation alternative	St

To DTS	Type	
⊟ Designated financial liabilities at fair value through profit or l	String	
Increase (decrease) in fair value of financial liability, attrib	Monetary	Expiry date
Accumulated increase (decrease) in fair value of financia	Monetary	Effective 20
Difference between carrying amount of financial liability	Monetary	IFRS 7 2011
Transfers of cumulative gain (loss) within equity	Monetary	Effective 20
Reasons for transfers of cumulative gain (loss) within equ	String	Effective 20
Amount presented in other comprehensive income realis	Monetary	Effective 20
Description of methods to determine amount of changes in	String	IFRS 7 2011

Synchronized viewing is provided for test suite operation. The intent is to encourage uniform access to test suites by all users. As a test is interactively executed the pass/fail status and log of errors can be viewed interactively. (There are scripts to run tests in batch mode too.)


arelle™ - 204-arcCycles.xml

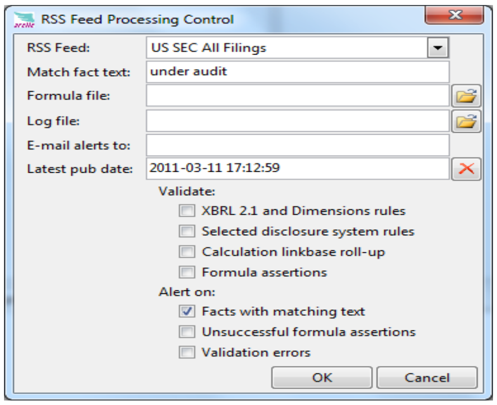
Property	
id	V-30
name	base set arc element test - in
description	Companion to V-29, but all a
readFirst	ArcCyclesCustRolesDC.xml
status	pass
expected	invalid
actual	xbrl.5.1.4.3:cycles

ID	Name	ReadMeFirst	Status	Expected	Actual
⊟ 204-arcCycles.xml					
V-4	parent-child No Cycles	ArcCyclesPCNC.xml	pass	valid	
V-5	parent-child No Cycles with Role	ArcCyclesPCNCWR.xml	pass	valid	
V-6	parent-child Directed Cycles	ArcCyclesPCDC.xml	pass	invalid	5.2.4.2
V-7	parent-child No Cycles with Over	ArcCyclesPCNCExtension.xml	pass	valid	
V-8	parent-child with Cycles with Ove	ArcCyclesPCWCExtension.xml	pass	invalid	5.2.4.2
V-9	summation-item No Cycles	ArcCyclesSINC.xml	pass	valid	
V-10	summation-item No Cycles with	ArcCyclesSINCWR.xml	pass	valid	
V-11	summation-item Undirected Cyc	ArcCyclesSIUC.xml	pass	valid	
V-12	summation-time Directed Cycles	ArcCyclesSIDC.xml	pass	valid	

```
testcase 204-arcCycles.xml
variation V-4 parent-child No Cycles: valid
variation V-5 parent-child No Cycles with Roles: valid
variation V-6 parent-child Directed Cycles: invalid
[5.2.4.2] Relationships have a directed cycle in arcrole http://www.xbrl.org/2003/arcrole/parent-child link role http://www.xbrl.org/2003/role/link link presentationLink,
variation V-7 parent-child No Cycles with Overriding Arcs: valid
variation V-8 parent-child with Cycles with Overriding Arcs: invalid
[5.2.4.2] Relationships have a directed cycle in arcrole http://www.xbrl.org/2003/arcrole/parent-child link role http://www.xbrl.org/2003/role/link link presentationLink,
```

Several view features extend the test suite concept to training and exploration of XBRL formula. An RSS Watch facility allows the user to specify a regular expression or formula (as a set of assertions) to run against the SEC live RSS feeds. This can be started, resumed, or left to run in background.

There are configuration options, including which feed, where to e-mail alerts to, and whether to perform XBRL and Disclosure System validations

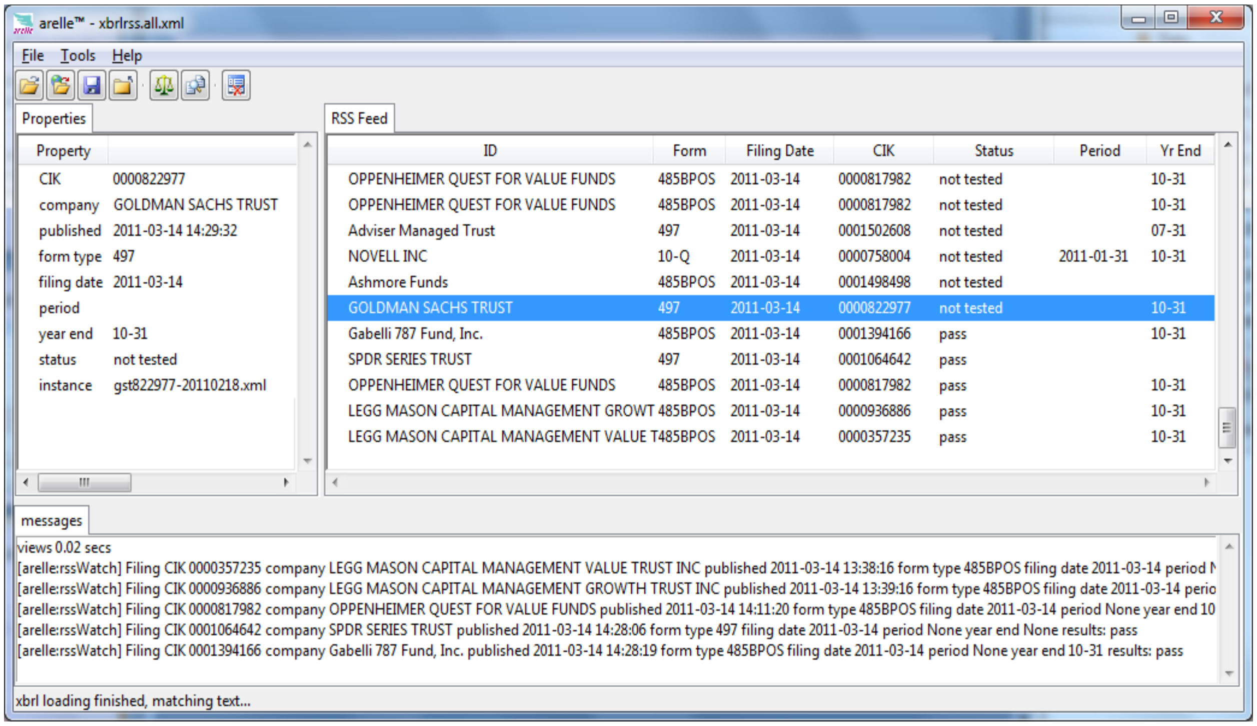


RSS Feed:	US SEC All Filings
Match fact text:	under audit
Formula file:	
Log file:	
E-mail alerts to:	
Latest pub date:	2011-03-11 17:12:59

Validate:
- [ ] XBRL 2.1 and Dimensions rules
- [ ] Selected disclosure system rules
- [ ] Calculation linkbase roll-up
- [ ] Formula assertions

Alert on:
- [✓] Facts with matching text
- [ ] Unsuccessful formula assertions
- [ ] Validation errors

As this process runs, a view similar to the integrated test suite operation is shown, where one can see the lastest published reports and the status of the testing:



Property	
CIK	0000822977
company	GOLDMAN SACHS TRUST
published	2011-03-14 14:29:32
form type	497
filing date	2011-03-14
period	
year end	10-31
status	not tested
instance	gst822977-20110218.xml

ID	Form	Filing Date	CIK	Status	Period	Yr End
OPPENHEIMER QUEST FOR VALUE FUNDS	485BPOS	2011-03-14	0000817982	not tested		10-31
OPPENHEIMER QUEST FOR VALUE FUNDS	485BPOS	2011-03-14	0000817982	not tested		10-31
Adviser Managed Trust	497	2011-03-14	0001502608	not tested		07-31
NOVELL INC	10-Q	2011-03-14	0000758004	not tested	2011-01-31	10-31
Ashmore Funds	485BPOS	2011-03-14	0001498498	not tested		
GOLDMAN SACHS TRUST	497	2011-03-14	0000822977	not tested		10-31
Gabelli 787 Fund, Inc.	485BPOS	2011-03-14	0001394166	pass		10-31
SPDR SERIES TRUST	497	2011-03-14	0001064642	pass		
OPPENHEIMER QUEST FOR VALUE FUNDS	485BPOS	2011-03-14	0000817982	pass		10-31
LEGG MASON CAPITAL MANAGEMENT GROWT	485BPOS	2011-03-14	0000936886	pass		10-31
LEGG MASON CAPITAL MANAGEMENT VALUE T	485BPOS	2011-03-14	0000357235	pass		10-31

```
views 0.02 secs
[arelle:rssWatch] Filing CIK 0000357235 company LEGG MASON CAPITAL MANAGEMENT VALUE TRUST INC published 2011-03-14 13:38:16 form type 485BPOS filing date 2011-03-14 period
[arelle:rssWatch] Filing CIK 0000936886 company LEGG MASON CAPITAL MANAGEMENT GROWTH TRUST INC published 2011-03-14 13:39:16 form type 485BPOS filing date 2011-03-14 perio
[arelle:rssWatch] Filing CIK 0000817982 company OPPENHEIMER QUEST FOR VALUE FUNDS published 2011-03-14 14:11:20 form type 485BPOS filing date 2011-03-14 period None year end 10
[arelle:rssWatch] Filing CIK 0001064642 company SPDR SERIES TRUST published 2011-03-14 14:28:06 form type 497 filing date 2011-03-14 period None year end None results: pass
[arelle:rssWatch] Filing CIK 0001394166 company Gabelli 787 Fund, Inc. published 2011-03-14 14:28:19 form type 485BPOS filing date 2011-03-14 period None year end 10-31 results: pass
```

xbrl loading finished, matching text...

Controller

In a standard definition, the controller receives input and initiates a response by making calls on model objects. A controller accepts input from the user and instructs the model and viewers to perform actions based on that input.

Arelle has these controllers: a superclass for shared common functionality, a command line based controller, suitable for batch file integration, and a GUI controller for mouse-and-menu operation. The GUI uses only graphic libraries distributed with the standard Python distribution (tkinter), so that it is fully compatible and consistent on all of the Python platforms. The batch controller is primarily used for scripted test operation and to perform formula and other tests on large collections of submissions.

Features for Academia

A goal of this project is a platform for XBRL training. This is supported by two key features distinguishing from other products, a compact code base, and a unified object model.

The size of XBRL platforms in their source code form is critical in the ability to support student exploration of features. When size exceeds what can be explored rapidly, the effort to dive into a product becomes out of the scope of student project periods. Arelle owes its compactness to the Python features such as set operations and compact expressiveness, and its code appears to be smaller by the usual ratio claimed for Python (six-fold reduction of code size is often claimed for Python).

The internal architecture supports academic training by being based on a single set of integrated models, with extension features such as formula, versioning, and rendering, fully integrated.

Development Environment

There are several Python-based development environments, but most XBRL practitioners have spent their lives with Java. Eclipse can be configured for Python, and is compatible with Arelle.

The project is hosted at http://arelle.org, including source code, documentation, and a user forum.

About the authors:

Herm Fischer has contributed to the XBRL base specification, and its dimensions, formula, versioning, and rendering modules. He currently chairs the Formula Working Group and is vice chair of the Base Specification and Maintenance Working Group. He contributed to the 2007 XBRL US GAAP Project. Formerly with UBmatrix, Inc, he developed Taxonomy Designer, formula editors and processors, and XBRL processors. He participated in development of SEC validation and its test suite.

Diane Mueller is the founder/president of XBRLSpy Research Inc. She is an Open Source/Open Standards Evangelist, and a XBRL Implementation Strategist. Currently serves as the XBRL Canada representative to the XBRL International Steering Committee and Best Practices Board, and chairs the Technical Working Group on Rendering responsible for the Inline XBRL Specification. She is a frequent commentator and lecturer on Financial Compliance, XML Standards and Semantic Web technologies.