

Ardenno Layered Metadata

The Key to Unlocking the Information in your Data



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Synopsis

The drive to improve team collaboration and organizational efficiency has been greatly slowed by the inability to easily include access to unstructured data for the user community. Companies have tried to solve the problem by spending an exorbitant amount of resources on transforming data into a standardized database. The problem is that the data transformation problem never goes away. The end user rarely is provided full data access because the targeted transformation database and the document management systems are unable to address the unique data structure demands of unstructured content. A recent Delphi Group report found that on average, users waste 3.5 hours per week executing searches that do not find positive results. The inability to include unstructured data in these searches is a data inhibitor and causes extreme end user frustration. The Delphi Group also found that 80% of user's had either trouble finding information on the company intranet or think the search function should be completely re-done. The way to solve the problem is through enabling the ability to apply consistent layers of metadata on structured and unstructured data. This ultimately leads to the holy grail for the end user, semantic searching.

Introduction

For companies with knowledge workers, information overload has become a major problem, costing untold thousands and millions of dollars in lower productivity and has hampered innovation. The growing level of data complexity is being driven by unstructured data. Numerous types of data are mostly proprietary file formats and often produce data files that require additional analysis software to comprehend the content of the file. A key challenge is making the vast amount of available data that is mostly unstructured, easily accessible for internal collaborative purposes. Most approaches to solving this problem have been to create overly complex solutions. The hard part has been to provide information access for your unstructured data without manual end user intervention. Delphi Group found that 42% of the time when doing a search is spent reviewing irrelevant documents. Their research finding is an indication that no matter the efforts and funding, the problem for the end user still exists. It will not be solved until organizations embrace and fully leverage the ability to apply layers of metadata, without end user intervention.

This white paper will review how metadata can add value to your enterprise, without required a major overall or investment to right the wrongs for your users. We will discuss how automating the process to apply consistent layers of metadata on structured and unstructured data enables semantic end user searching. We finally will discuss how the end user community can gain immediate value from this effort, without extensive IT intervention and ongoing administration.

“Metadata is key to ensuring that resources will survive and continue to be accessible into the future.”

National Information Standards Organization



Problem Statement

You have so much data that you can't find what you are looking for. Companies have tried to solve the problem by spending an exorbitant amount of resources on transforming data into a standardized database. These systems though rarely include unstructured data and is causing extreme end user frustration. With information volumes exploding inside your enterprise, you need multiple ways to organize information for improved information sharing and collaboration. The ability to better organize and categorize information should not force the creation of yet another database repository to support and manage.





Previous Options

The problem has been that previous approaches required the "end user" to apply metadata tags manually. This has been the main reason why simple tagging systems have failed to take root within the corporate environment. It's the utilization of metadata tags for semantic searching that make the Ardenno solution so exciting to the enterprise.

Today, enterprises are looking for and need solutions that add value to their day and minimize administrative workload.

How do you do the following?

To better appreciate the importance and business value of metadata, please review the following situations and review how you would accomplish each task and please estimate how long it would take you to successfully complete the task with 100% confidence?

-  It's 10am on a Monday. Your manager just called and said that his boss just called a meeting Wednesday to review work on Project 101 related to Subject Matter XYZ. You know that these meetings often are free form and zig and zag. So, you need to make sure that you bring everything. Better to be over prepared then look unprepared. What would be the process you go through to collect all the latest data files? How long would it take you to prepare for the meeting? How confident are you that you actually have 100% of the available content from your team?
-  You were given a new task today. Before you begin your work, you want to learn what previously accomplished throughout the company. How would you go about to ensure you located all the pertinent information? How long would it take you to find all the relevant information? How much time would you spend searching?
-  How would you quickly find out what discussions were been held on a specific subject matter that was reviewed and abandoned last year (without holding a meeting or calling the previous leader of the effort- who no longer is at the company)?
-  You want to check through all the existing PDF, Word and image files for content related to a subject from Study 10. How long would it take you to review all the available files to locate the relevant files and content needed to advance your efforts?

Metadata is the Key to Success

The key to improving collaboration starts with making all relevant data accessible. The ability to apply various layers of metadata tags in an automated manner makes it possible. So what is metadata?

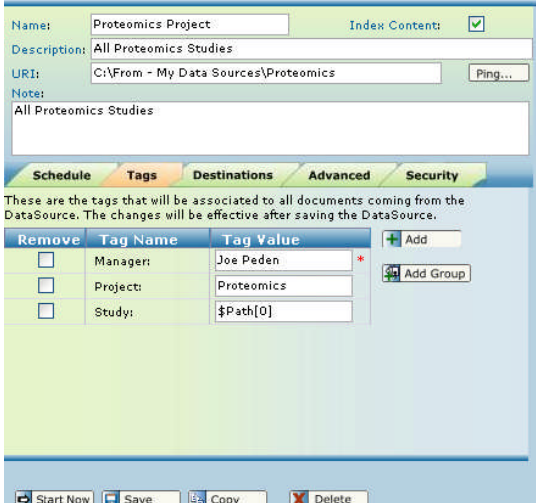
Metadata is information about information: more precisely, it's structured information about a data file – even for unstructured data files. The key is that metadata enables semantic searching and expands the ability to provide increased content relevancy.

Metadata is structured information that describes, explains, locates, or otherwise makes it easier to retrieve, use, or manage an information resource. The need for metadata is not limited to the laboratory. For example, "12345" is data, and with no additional context it has little meaning. When "12345" is given a meaningful name (metadata) or "ZIP code" value, one can understand (at least in the United States) that placing "ZIP code" within the context of a postal address that "12345" refers to the General Electric plant in Schenectady, New York.

In fact, many of us already exploit metadata on a daily basis. Consider the songs on your iPod (or your MP3 player). You do not search or organize the music by the words in the song or even the filename, but rather we use the metadata (Title, Artist and Genre).

Additionally, you may want to define a set vocabulary for the tags available for use, in effect creating an Ontology for your company. The result is a better way to organize bookmarks and a great way to improve data relevancy and enables semantic searching for structured and unstructured information.

If metadata is to be truly beneficial to your company you will need a mechanism that allows you to apply the necessary tags automatically. Figure 1 details how metadata can be automatically defined and applied for all files located to an identified datasource or instrument datasource.



The screenshot shows a software window with the following fields and options:

- Name:** Proteomics Project
- Index Content:**
- Description:** All Proteomics Studies
- URI:** C:\From - My Data Sources\Proteomics
- Note:** All Proteomics Studies
- Navigation tabs:** Schedule, Tags, Destinations, Advanced, Security
- Message:** These are the tags that will be associated to all documents coming from the DataSource. The changes will be effective after saving the DataSource.
- Table of Tags:**

Remove	Tag Name	Tag Value	
<input type="checkbox"/>	Manager:	Joe Peden *	<input type="button" value="Add"/>
<input type="checkbox"/>	Project:	Proteomics	<input type="button" value="Add Group"/>
<input type="checkbox"/>	Study:	\$\$Path[0]	
- Buttons:** Start Now, Save, Copy, Delete

Figure 1

The first two metadata tag fields (Manager and Project) and their respective populated values (Joe Peden and Proteomics) are how you can automatically apply tags and their desired values for all files from a specific datasource. No manual intervention would be required moving forward. The only system administration required would occur when you want to change values. The Study Tag in this example is populated automatically, but the value for this tag is automatically acquired from the subfolder structure of the datasource.

Wasting Knowledge Worker Time

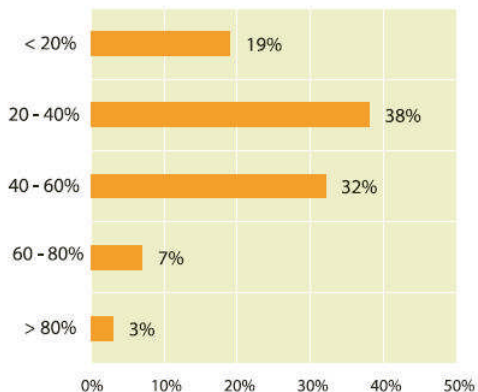
There has been a tremendous amount of quantitative research recently published reviewing enterprise search and the overall user experience. Some of the key findings from the research were:

1. Delphi Group found that on average, user waster 3.5 hours on searches that did not find a positive result.
2. IDC found that 73% of people spend at least 4 hours a week searching for information.
3. Delphi Group found that 42% of the time when doing a search is spent reviewing irrelevant documents.
4. IDC found that 62% of users were either dissatisfied or very dissatisfied with their enterprise search experience.
5. Delphi Group found that 80% of user's had either trouble finding information on the company intranet or think the search function should be completely re-done.



Source: IDC
Figure 2

Percent of Search Time Spent Reviewing Irrelevant Documents



2006 Delphi Group

Figure 3

Google-Like Behavior Wanted

“Not sure what I am trying to find, but I will know it when I see it”

Your end users

Many enterprises ask their internal IT department why they can't create an easy to use environment like Google. The only difference in their mind is that they want to focus on searching for documents and files behind their secure firewall, as opposed to looking for the best ribs in Chicago (Twin Anchors by the way).

First, let us look at how Google works. The following graphic shows how Google effectively creates “relevancy” rankings when organizing its results.

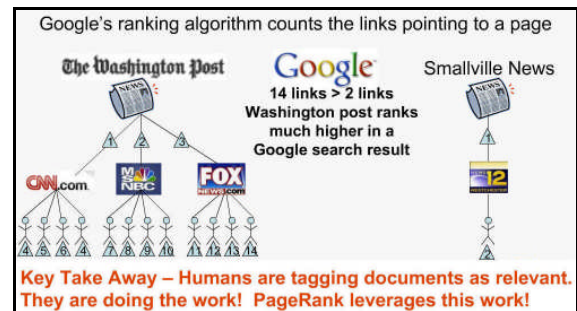


Figure 4

So, how would this work for a secure enterprise environment? This ranking approach would be effective, if all your content was in a structured HTML environment (like Google). Unfortunately, your enterprise is not made up of 100% structured HTML content that can be indexed by “crawling”. Nor, to the frustration of many, can this behavior be configured. Google and the Microsoft SharePoint 2007 approach work in “similar” manners. Neither of these products, as is the case with many generic search tools are able to apply automatically searchable information to an unstructured file, such as an image file. Thus, your unstructured image files would not be a part of your enterprise search environment results. You would require end users to manually apply metadata tags to individual files in order for them to be included in global searching. Tagging is a waste of time with

Google because it crawls and searches everything. This approach is great for structured web HTML files, but behind your firewall, you have image files with file names without meaning. You also have binary files, proprietary file formats and other unstructured data files. These files will be excluded from your enterprise search without metadata. Finally, you may also want to search for a file characteristic that is simply not stored in the file or it's title. You may want to locate specific files in a project or the study. Without metadata, this simply is impossible to achieve.

Advanced Ardenno Layered Metadata

The power of metadata begins when the corporate community can automate the population of these basic tags for users and can use the tag content for semantic searching. Figure 5 shows some of the various types of advanced Ardenno metadata.

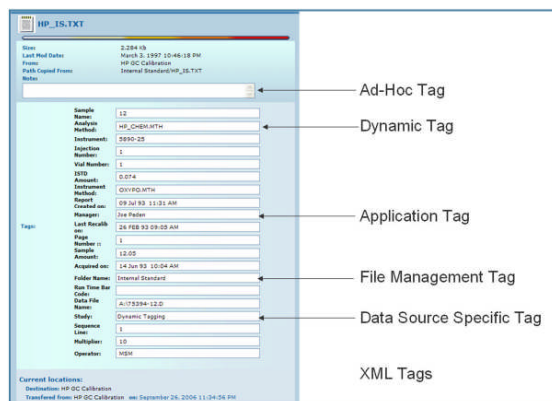


Figure 5

Ardenno's power and flexibility comes from its ability to automatically apply multiple types of advanced metadata tags to datasource files. Datasources is the term used by Ardenno to describe all sources of laboratory data and files. These are folders on the company network, as well as local folders.

Ardenno supports a multitude of metadata layers. Within each individual metadata layer, Ardenno can provide an unlimited numbers of metadata labels and potential values.

Types of advanced Ardenno metadata tags:

- Dynamic
- Application Specific
- File Structure
- Datasource Specific
- XML
- Bi-directional
- Adobe PDF Forms
- Microsoft Office 2007 Forms and Templates

Ardenno File Structure Metadata

Many organizations have designed and constructed rich and intelligent network file structures an attempt to add context to their unstructured data.

These hierarchies provide the user community with a smart way to store and find information. Ardenno's file structure metadata enables you to fully exploit this existing investment by leverage the existing file structures.

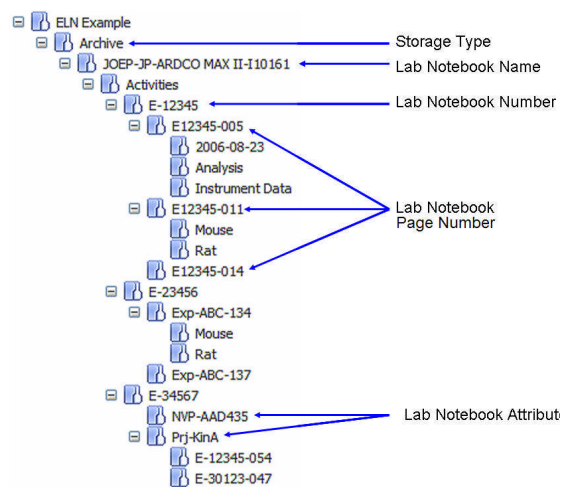


Figure 6

Figure 6 shows an example of an intelligent file structure created to allow this company to mirror an electronic notebook with their network file structure. Ardenno can fully leverage your pre-existing structure and can seamlessly apply your respective metadata layer with your unique tag values.

Ardenno Metadata from File Headers

Scientific instruments and robotics are key data generators for every R&D infrastructure. One of the biggest challenges with instrument data is that virtually every manufacturer has defined their own proprietary data formats. This has prevented virtually everyone from being able to easily and inexpensively leverage all the data into a single pliable technology environment. *It takes a large and unfortunately large ongoing level of investment to stay current with the latest instrument system drivers. Ardenno completely eliminates the need to make this wasteful investment.*

Ardenno is able to eliminate the need to purchase, build and maintain expensive instrument drivers by leveraging the metadata that each manufacturer provides in their output files. Figure 7 is an output file from an Agilent instrument. Most instrument providers have similar section headers with proprietary metadata.

Tag Names	Tag Values
Internal instrument report	
Data File Name	A:\75394-62.D
Operator	HP
Instrument	5890-25
Sample Name	12
Run Time Bar Code	
Acquired on	14 Jun 02 10:04 AM
Report Created on	09 Jul 02 11:31 AM
Last Recalib on	26 FEB 93 09:05 AM
Multiplier	1.00
Page Number	1
Vial Number	1
Injection Number	1
Sequence Line	1
Instrument Method	OXYPO.MTH
Analysis Method	HP_CHEM.MTH
Sample Amount	12.05
ISTD Amount	0.074

Ret. Time	Area	Type	Width	Ref#	Amount	%	Name
2.270	205	FB	0.045	1	0.0338		VC1
3.220	2372	BV	0.045	1	0.3000		CH2CL
3.781	85	PV	0.063	1	0.0134		CLM2
4.292	183	AV	0.051	1	0.0307		1,1-DCEC
4.343	524	PV	0.063	1	0.0882		1,1-DCEC
5.122	508	BV	0.051	1	0.0874		1,1-DCEC
5.228	812	PB	0.042	1	0.113		CLM1
6.476	2311	BV	0.074	1	0.489		CLM4
7.378	629	PV	0.072	1	0.128		CHLORAL
7.989	1896	BV	0.065	1	0.187		CONCLES
9.066	2485	BV	0.075	1	4.025		1,1,1-TRIA
12.862	8356	BV	0.067	1	0.280		1,1,1,1-TETRA
17.228	11248	PV	0.075	1-3K	6.143		HP_C13H28

Time Reference	Peak	Expected RT	Actual RT	Difference
13		17.210	17.228	0.1%

Figure 7

The file has two main sections. The top section is all about the file's metadata. It's the only area that Ardenno really focuses on. The bottom section contains the proprietary data content. Ardenno is able to seamlessly extract and identify the unique metadata available in the file's record header. You are able to parse the header content and populate the tags and their unique values.

Figure 8 shows how Ardenno is able to fully utilize the proprietary instrument file's metadata. The key is that this information is now able to enhance your ability to semantically search through all available instrument files, no matter the file format.

HP_IS.TXT

Size: 2.284 Kb
 Last Mod Date: November 16, 2006 4:37:45 AM
 From: HP 5890 Raw Data
 Path Copied From: Harry/HP_IS.TXT
 Note:

Study: User Data
 Instrument User: Harry
 Manager: Joe Peden
 Project: Not Assigned
 Data File Name: A:\75394-62.D
 Operator: Harry
 Instrument: 5890-25
 Sample Name: 62
 Acquired on: 14 Nov 06 10:04 AM
 Report Created on: 19 Nov 06 11:31 AM
 Last Recalib on: 06 Nov 06 09:05 AM
 Multiplier: 10
 Page Number: 1
 Vial Number: 1
 Injection Number: 1
 Sequence Line: 1
 Instrument Method: OXYPO.MTH
 Analysis Method: HP_CHEM.MTH
 Sample Amount: 12.05
 ISTD Amount: 0.074

Current locations:
 Destination: HP 5890 Raw Data
 Transferred from: HP 5890 Raw Data on: February 2, 2007 12:22:51 PM

Save Delete

Figure 8

Ardenno Metadata Ontologies

Another key Ardenno metadata approach is through the use of Ontologies or Taxonomies. Ontologies classify information into logical multiple tiers and categories. Ontologies supercharge semantic search and data retrieval capabilities. The ability to apply a common vocabulary provides organizational continuity and streamlines the effort to create meaningful and useful science oriented ontology for a datasource or an instrument.



Figure 9

The example above shows the standard Gene Ontology in Ardenno. Each customer is able to then make adjustments to these base Ontologies to fit their exacting needs. The key is that once the tag values are applied to a datasource, no administration effort is required by your individual users. Each field contributes to enhancing the end user semantic searching and data relevancy capabilities and experience.

Ardenno XML Metadata Tags

As can be seen with the introduction of Office 2007 more and more applications support XML as a file output format option. This offers yet another method for customers to leverage the existing file metadata. The following example shows how metadata was obtained from a Waters SDMS (Nugenesis) "captured" archive file. The tags and their values are directly from a NuGenesis file. The value to NuGenesis users is that they are now able to search and understand data relevancy across all their archived files.



Figure 10

Industry and vendor XML file standards are also starting to gain industry acceptance as a way to minimize proprietary file formats. One of the leading solutions supported by Ardenno is AnIML, an open-source development platform for a new XML standard for Analytical Chemistry Information. AnIML development is hosted on SourceForge, the world's largest Open Source software development website. The project is a collaborative effort between many groups and individuals and is sanctioned by the ASTM under subcommittee E13.15. Ardenno also supports the Dublin Core Metadata Initiative (DCMI).

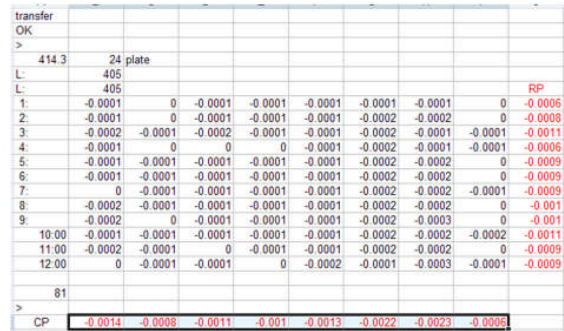
ThermoFisher Scientific has also been very active in the area of helping create XML file output standards. ThermoFisher Scientific has proposed the **Generalized Analytical Markup Language (GAML) XML-based data model (GAML.ORG)**. The following screen (figure 11) is an example of how Ardenno is able to fully leverage and support the proposed GAML XML standard.



Figure 11

Ardenno Bi-directional Metadata

The ability to post process and chart file results is also a capability available in Ardenno through the use of a files metadata. In the following example (figure 12), Ardenno creates metadata from a plate reader output file for each well content. This offers the ability to semantically search through HTS (high throughput screening) results and then to present trend results, without having to build an internal LIMS database.



transfer	OK								
>									
	414.3	24	plate						
L:	405								
L:	405								RP
1:	-0.0001	0	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	0	-0.0006
2:	-0.0001	0	-0.0001	-0.0001	-0.0001	-0.0002	-0.0002	0	-0.0008
3:	-0.0002	-0.0001	-0.0002	-0.0001	-0.0001	-0.0002	-0.0001	-0.0001	-0.0011
4:	-0.0001	0	0	0	-0.0001	-0.0002	-0.0001	-0.0001	-0.0006
5:	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0002	-0.0002	0	-0.0009
6:	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0002	-0.0002	0	-0.0009
7:	0	-0.0001	-0.0001	-0.0001	-0.0001	-0.0002	-0.0002	-0.0001	-0.0009
8:	-0.0002	-0.0001	-0.0001	-0.0001	-0.0001	-0.0002	-0.0002	0	-0.0011
9:	-0.0002	0	-0.0001	-0.0001	-0.0001	-0.0002	-0.0003	0	-0.0011
10:00	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0002	-0.0002	-0.0002	-0.0011
11:00	-0.0002	-0.0001	0	-0.0001	-0.0001	-0.0002	-0.0002	0	-0.0009
12:00	0	-0.0001	-0.0001	0	-0.0002	-0.0001	-0.0003	-0.0001	-0.0009
>									
CP									

Figure 12

This figure 13 we show an example file from the plate reader. Each cell represents a well's content values. Ardenno is then able to post process the content and process the information into metadata seamlessly.



Figure 13

Adobe Forms and Office 2007 Forms

Many companies have constructed database input forms using third party applications such as Adobe Designer, Microsoft Word or Microsoft Excel to create structured user input forms. Ardenno is able to fully leverage the inserted form content information into metadata seamlessly. The key is that all these form fields are now able to fully support Ardenno semantic searching capabilities across your enterprise.

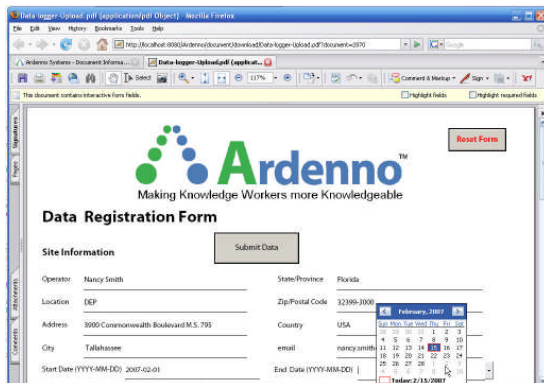


Figure 14 – Adobe Designer Forms

Figure 14 is an Adobe PDF form example. Ardenno is able to use the content and create field specific metadata that allows the content to be searchable throughout the Ardenno semantic searching repository.

The screen below shows the unique tags stored in Ardenno that came directly from the Adobe PDF form above.

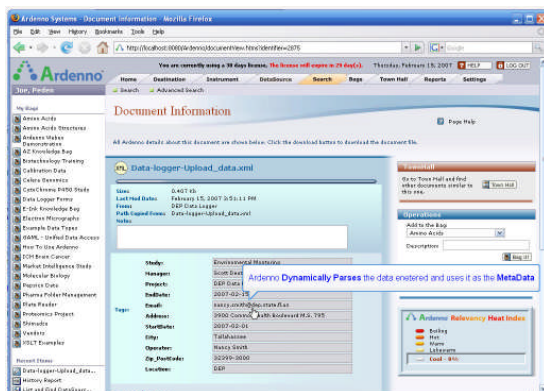


Figure 15

This same level of capability can be achieved with other forms packages, as well as with Microsoft Word and Microsoft Excel template forms capabilities.

Figure 16 is an example using Word 2007.



The screenshot shows a Microsoft Word 2007 template form titled "Data Registration Form". The form fields are as follows:

Operator	Joe Peden
E-Mail	joe.peden@ardenno.com
Location	Choose an item. joe.peden@ardenno.com scott.deutsch@ardenno.com
Address	9 St. James Drive
City	Manchester
State/Province	Cheshire
Zip/PostCode	M33 7QX
Country	United Kingdom
Start Date	1 February 2007
End Date	20 February 2007

Figure 16 – MS Word 2007 Template Form

Figure 17 is an example using Excel 2007.



The screenshot shows a Microsoft Excel 2007 template form titled "Data Registration Form". The form fields are as follows:

Operator	Joe Peden
E-Mail	Joe.Peden@Ardenno.com
Location	Joe.Peden@Ardenno.com Scott.Deutsch@Ardenno.com
Address	9 St. James Drive
City	Manchester
State/Province	Cheshire
Zip/PostCode	M33 7QX
Country	United Kingdom
Start Date	3-Mar-2007
End Date	7-Mar-2007

Figure 17 – MS Excel 2007 Template Form

Semantic Searching with Metadata

The effort to apply metadata in all these manners would be an exercise of futility, unless the company and the individual could gain value from the effort. This is the main reason why the metadata available in Microsoft Office products has never gained wide adoption, and this will unfortunately not change with the recent release of Office 2007. This is not the case with Ardenno. Ardenno provides you the ability to apply metadata to any type of file format. Yes, any type of file, even proprietary instrument files types. All the individual metadata tags are searchable.

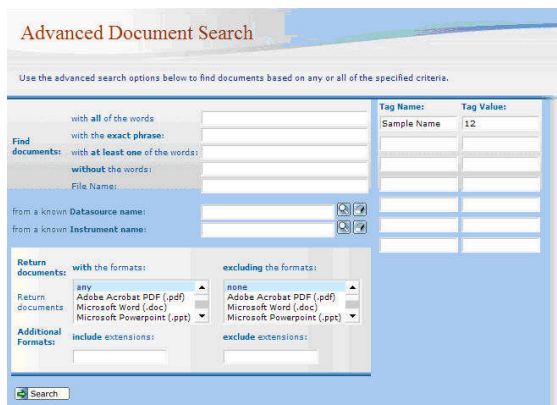


Figure 18

Figure 18 an Advanced Search example from Ardenno. If you have used any leading search offering, you will feel right at home with the rich and flexible Ardenno searching capabilities. More importantly, the ability to search for specific metadata values is fully available. So yes, the effort to apply metadata is richly rewarded for end users to gain immediate value.

The Ardenno Solution

Ardenno looked at the fundamental business pains that hinder effective team collaboration. Our approach addresses one of the root causes of collaboration inefficiency confronting virtually every organization. They have too much data and are unable to access all the available relevant information in a simplistic manner.

Since, data comes to users in a variety of formats from a variety of sources, it is vital not to add further complexity to a company's existing infrastructure. A solution must be able to address on-line journals, company reports, web searches, the company intranet, conference presentations, analytical spreadsheets, raw instrument data, custom data systems, LIMS data, Lab Notebooks... to name only a few.

Overwhelmed users struggle to locate relevant data in order to determine content to select pertinent information. To avoid data clutter, users seldom share negative studies or negative results recorded with project teams. This is a major reason for the duplication of work by research teams. Without Ardenno, there is no easy way to ensure that all this data is made available for others to leverage.

A common approach of users attempting to address these issues is to establish their own personal repositories of data and information that they have deemed as important. We call this the "MyData" Dilemma. The "MyData" personal repositories have made even personal searching very difficult. "MyData" is far from a satisfactory solution to this problem. It is antagonistic to collaboration, team work, and impedes the overall success of a project and the project team.

Implementation

The success of an implementation is measured by how quickly new applications are adopted throughout the organization. Ardenno's product training is oriented towards passing the knowledge you need to be self-sufficient rapidly. The Get Ardenno Started (G.A.S.) configuration and training session takes you from zero to 60 in one day. You learn how to configure and support Ardenno administratively. We'll teach you how to share the power of Ardenno and how to maximize the value of Ardenno semantic metadata tagging with your existing infrastructure.

The configuration takes about four hours. Below is an actual task list with estimates based upon our previous successful experiences.

Customer Configuration Effort: 3 Hours 30 Minutes

Steps	Step Duration	Special Notes
Review Training Guide and on-line materials	10 minutes	
Configure Administrative users	15 minutes	
Configure Application Properties	5 minutes	
Configure Metadata Application Tags	10 minutes	Use Workbook values
Configure Metadata Tag Ontology's	20 minutes	Use Workbook values
Configure Destinations	20 minutes	Use Workbook values
Configure DataSources	20 minutes	Use Workbook values
Configure Instruments	20 minutes	Use Workbook values
Configure Ardenno Historian	20 minutes	
Configure Group Security	20 minutes	
Configuration Review	30 minutes	

Table 1

Once configured, power end-user training takes about two hours. Below is the detailed training schedule.

User Training: Two Hours

Steps	Step Duration
Learning about Ardenno Search	40 minutes
Learning about Ardenno Knowledge Bags and Ardenno Blogs	10 minutes
Learning about Ardenno Town Hall	20 minutes
Learning about Ardenno MyData Agent	20 minutes
Learning about Ardenno Reporting	15 minutes
Ardenno Class Summary/Review	15minutes

Table 2

We do this all in one day at your office.

Summary

The key to improving collaboration starts with making all relevant data accessible. The ability to apply various layers of metadata tags in an automated manner makes it possible. Applying multiple layers of metadata addresses the problem directly and greatly enhances the user experience for data access and semantic searching and reduces IT expenses rapidly. Ardenno has solved the hard problem of providing a high level of information access for your structured and unstructured manner without user intervention.

The Ardenno automated approach to layering metadata is the only known off-the-shelf solution of its kind. Ardenno is uniquely qualified to help you better manage your structured and unstructured data. The Ardenno solution has been specifically designed to improve your teams ability to collaborate and increase team efficiency,

Ardenno helps you get the knowledge fast and collaborate better!

Ardenno Layered Metadata: The Key to Unlocking the Information in your Data

March 2007

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