

# Software + Services for Data Storage, Management, Discovery, and Re-Use



CODATA 22 Conference  
Stellenbosch, South Africa  
25 October 2010

**Alex D. Wade**

Director – Scholarly Communication  
Microsoft External Research

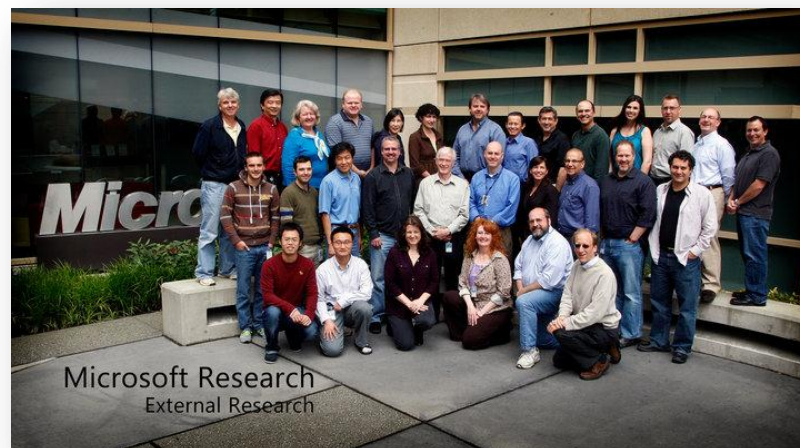
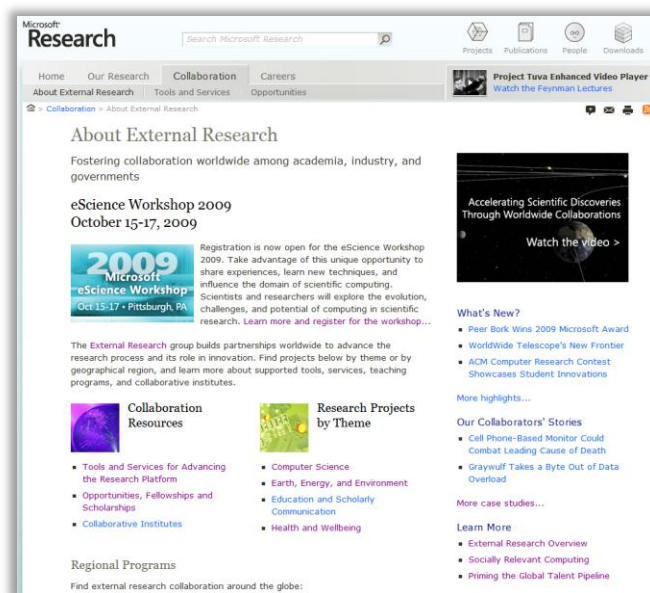
# Microsoft® Research



-  **Microsoft Research Labs**
-  **External Research Groups**
-  **Technology Learning Labs**
-  **Collaborative Institutes and Centers**

# Microsoft External Research

- Division within Microsoft Research **focused on partnerships** between academia, industry and government to advance research in fields that rely heavily upon advanced computing
- Supporting **groundbreaking research** to help advance human potential and the wellbeing of our planet
- Developing **advanced technologies** and services to support every stage of the research process
- Microsoft External Research is **committed to interoperability** and to providing open access, open tools, and open technology





# Mission

**Tailor Microsoft software to meet the specific needs of the academic research community**

**Our approach:**

*Conduct applied projects to enhance academic productivity by evolving Microsoft's scholarly communication offerings*



*The*  
**F O U R T H**  
**P A R A D I G M**

DATA-INTENSIVE SCIENTIFIC DISCOVERY

EDITED BY TONY HEY, STEWART TANSLEY, AND KRISTIN TOLLE

# Free PDF Download Or, Amazon Kindle version & paperback print-on-demand

“The impact of Jim Gray’s thinking is continuing to get people to think in a new way about how data and software are redefining what it means to do science.”

— **Bill Gates**, Chairman, Microsoft Corporation

“One of the greatest challenges for 21st-century science is how we respond to this new era of data-intensive science. This is recognized as a new paradigm beyond experimental and theoretical research and computer simulations of natural phenomena—one that requires new tools, techniques, and ways of working.”

— **Douglas Kell**, University of Manchester

“The contributing authors in this volume have done an extraordinary job of helping to refine an understanding of this new paradigm from a variety of disciplinary perspectives.”

— **Gordon Bell**, Microsoft Research

The screenshot shows the Microsoft Research website page for "The Fourth Paradigm: Data-Intensive Scientific Discovery". The page features a navigation bar with links for Home, Our Research, Collaboration, and Careers. A search bar is located at the top right. The main content area includes a title, a brief introduction, and a section titled "The Fourth Paradigm Now Available in Paperback and On Demand". This section provides information about the availability of the book in PDF, paperback, and Kindle formats, along with links to purchase the paperback and Kindle versions from Amazon.com. There are also sections for "In the News" and "Related Resources".

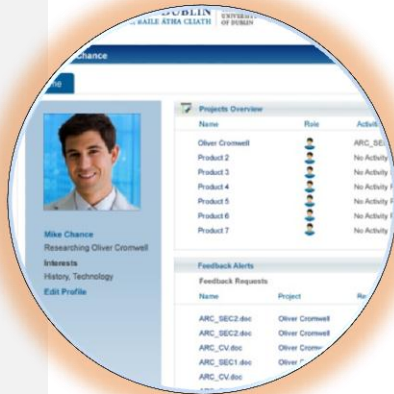


<http://research.microsoft.com/fourthparadigm/>

# Goals

- Simple
- Modular
- Familiar – integrate with existing tools and workflows
  
- Interoperable
- Free
- Open Source

VRE



# VIRTUAL RESEARCH ENVIRONMENT

A VRE Toolkit for SharePoint



# Virtual Research Environment (VRE) Toolkit

Collaborative environment  
for research groups

The screenshot shows a web interface for the VRE Toolkit. At the top, it features the logos for Trinity College Dublin and The University of Dublin, along with the text 'Research Information Centre'. A navigation bar includes links for 'Help', 'Contact Us', and 'Feedback', a search box, and a 'Log Out' button. The main content area is titled 'Overview' for user 'Oliver Cromwell'. It includes a profile picture, a list of project activities (ARC\_SEC2.doc, ARC\_SEC1.doc, ARC\_CV.doc), a table of document management actions, and sections for 'Discussions', 'RSS Feeds', and 'Documents'. A sidebar on the left contains navigation links: 'Home', 'Annotation', 'Study Planning', 'Funding', 'Experimentation', and 'Dissemination'. A footer at the bottom indicates the system is powered by Microsoft Office Sharepoint 2007.

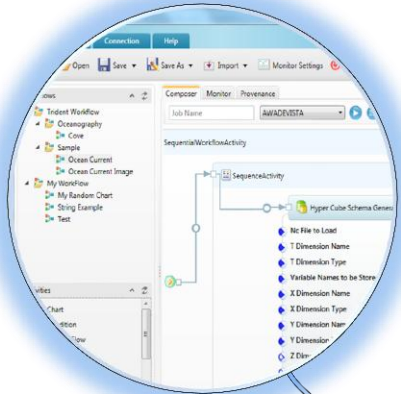
Descriptions	Date & Time	Action	Performed By
ARC_SEC2.doc	12/04/2010 15:34:28	Update	Jan Holloway
ARC_SEC2.doc	12/04/2010 15:34:28	Add	Jan Holloway
ARC_CV.doc	12/04/2010 15:34:28	Update	Jan Holloway
ARC_SEC1.doc	12/04/2010 15:34:28	Update	Jan Holloway
ARC_CV.doc	12/04/2010 15:34:28	Add	

Personal site for each  
researcher and project  
site for each project

Document management,  
federated search, social  
networking, real-time  
communication, blogs, wikis



# Scientific Workflows



VRE



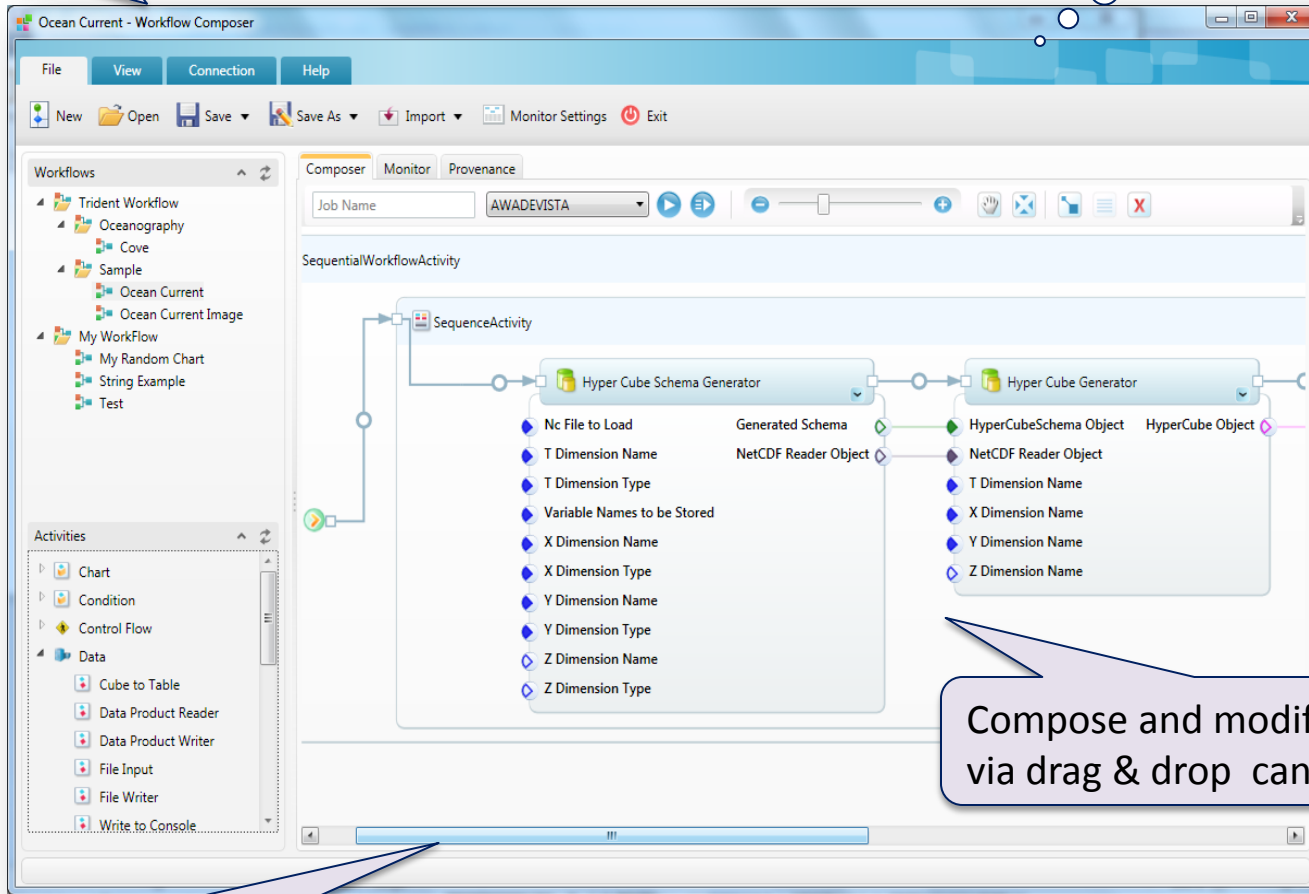
# DATASET MANAGEMENT

Project Trident Integration Kit

# Project Trident – a Scientific Workflow Workbench

Author, Execute and Monitor Workflows

Share workflows via  
**my experiment**



Compose and modify workflows  
via drag & drop canvas

View data products, performance  
metrics, and provenance data

Version 1.3 (Open Source under Apache 2.0 License):  
<http://tridentworkflow.codeplex.com/>



VRE Toolkit for SharePoint

# SCIENTIFIC WORKFLOW INTEGRATION



# Microsoft® Research Information Centre Framework Biology Workflow Template

Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

Workflow Manager > Job Status > Workflow Output

Execute Terminate  
Workflow

Execution status: - NWA - 6/21/2010 5:16:18 PM - Running

Workflows

- Trident Workflow
  - Oceanography
    - Cove
  - Sample
    - Ocean Current
    - Ocean Current Image
- All users' Workflows
  - localadmin (WORKFLOW-VRE)\admini
  - Kartik (fareast\v-kashah)
    - My WorkFlow
      - NWA

Details Execution

Workflow Input Parameters

Input Parameters	Value
SingleSequenceParserActivity.InputFile	C:\DemoData\SwineFluOutbreak_NewYork_DNA.FASTA
SingleSequenceParserActivity.InputFile	C:\DemoData\SwineFluOutbreak_HongKong_DNA.FASTA

Notes

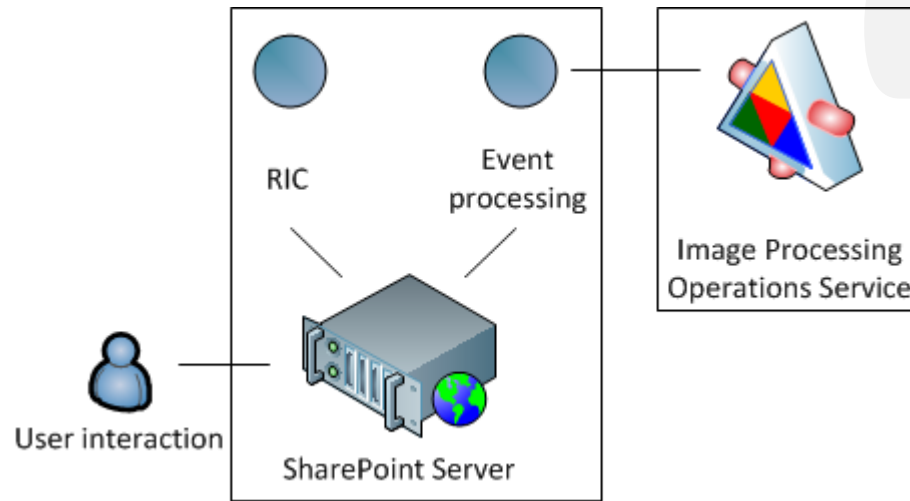


# Scientific Workflow Integration Kit for SharePoint

From SharePoint, researchers can...

- **View/execute/monitor** scientific workflows within the context of project collaboration site
- **Receive alerts** (email, SMS) when workflows complete
- **Browse workflow execution history** and provenance information
- **Review/store/manage data files** that are written back into SharePoint by Project Trident

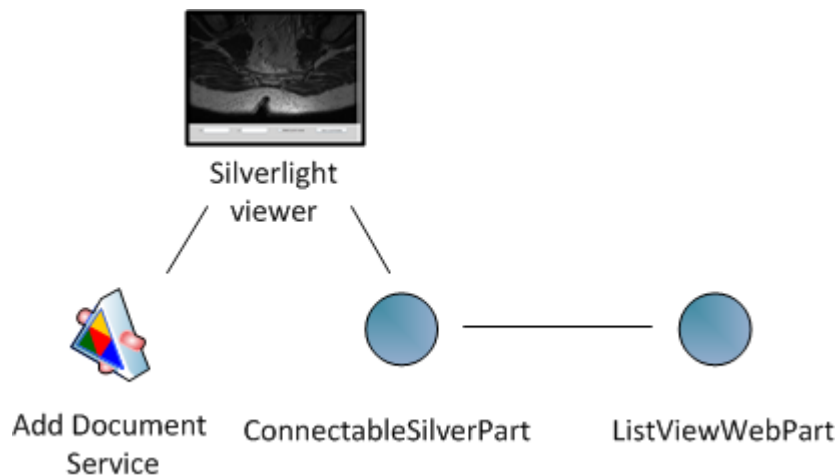
# Data Management Toolkits



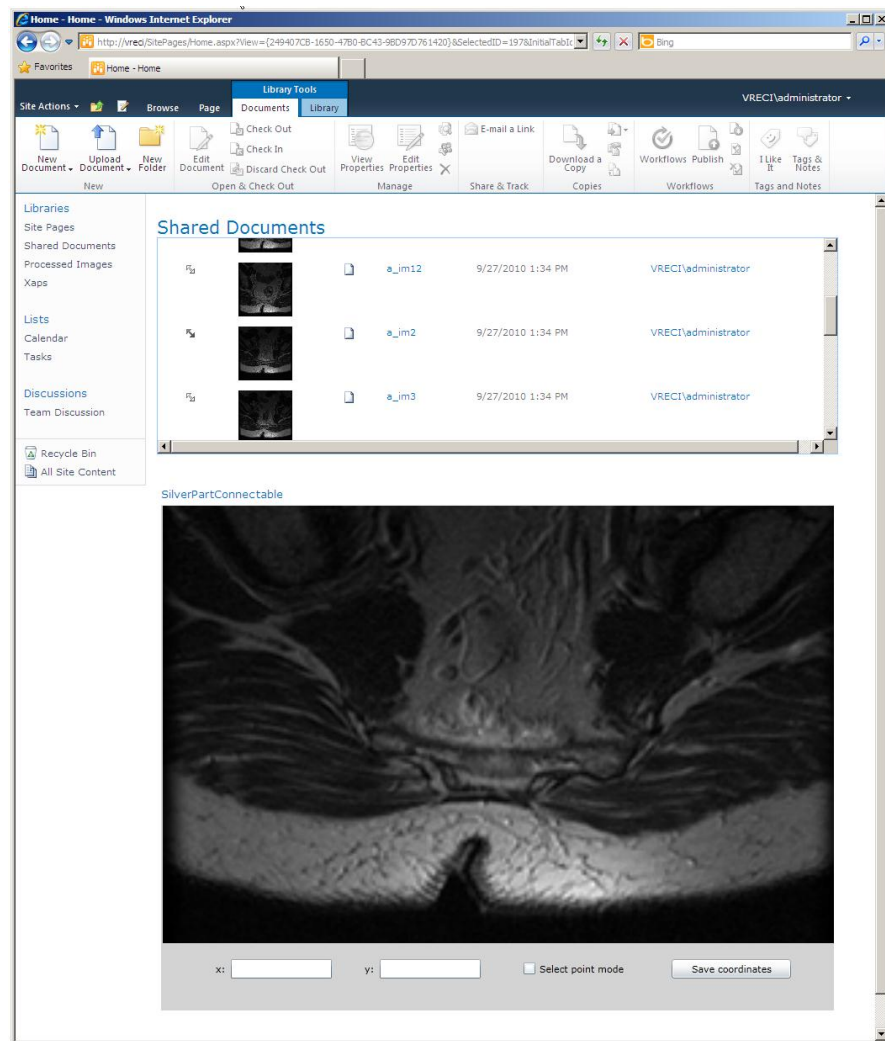
- Triggered when data files are added to system
- Generates related temporary files and cleans up automatically as you go

-  BMP
-  DeepZoom
-  Thumbnail

# DICOM Image Processing

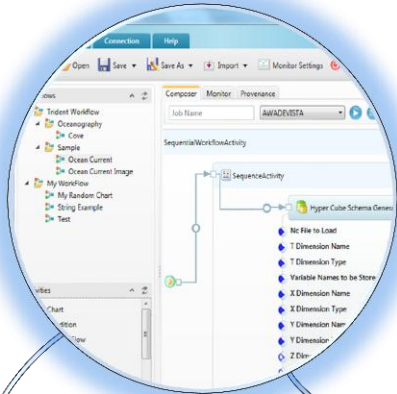


- DICOM Image Processing
- DICOM metadata extraction
- Metadata surfaced as queryable/sortable/filterable columns
- Annotations added back into store





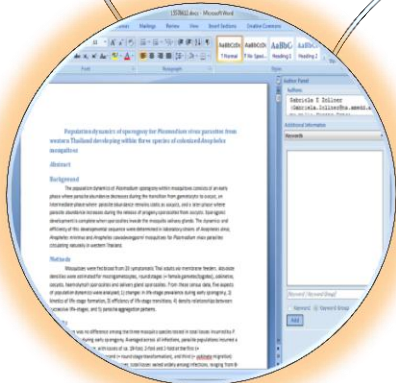
# Scientific Workflows



## VREs



## Word



# AUTHORING

Include Data and Data artifacts in compound documents

# GenePattern: Reproducible Research Add-in



Services: Control and execute scientific workflows

Resulting data (and provenance) stored within Word document

Workflow artifacts such as charts and images can be embedded directly into document

# Chemistry Add-in for Word

Author/edit 1D and 2D chemistry.  
Change chemical layout styles.



- Peter Murray-Rust
- Joe Townsend
- Jim Downing

1.1 Specific experimental procedures

1.2 Experimental procedures for chapter 3: decarestrictine D

1.2.1 Preparation of (2E) - 3 - (3 - methyloxiran - 2 - yl)prop - 2 - en - 1 - ol  
(173)

Diisobutylaluminium hydride (17.70 ml of a 1 M solution in THF, 17.70 mmol) was slowly added to the epoxide ester **172** (1.20 g, 7.68 mmol) in THF (10 ml) at -78°C. After stirring at this temperature for 1h, methanol (10

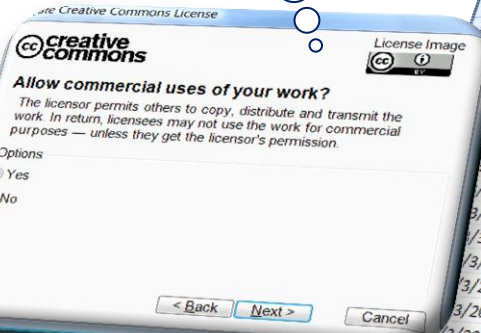
**Intelligence:** Verifies validity of authored chemistry

# Creative Commons Add-in for Office



**Intent:** Insert Creative Commons licenses from within Office documents

**Services:** Integrates with Creative Commons Web API to create new licenses



**Relationships:** license information stored as RDF XML within the document OOXML

	DATE	LAT	LON	DEPTH	MAG	TYPE	CATALOG	EVENT_CC	MAG_CODE	REGION	REGION_TEX
2	3/3/2010 22:54	3.78	127.11	63.5	4.7	M	FINGER	NEIC	NEIC	263	23 TALAUD ISLA
3	3/3/2010 22:17	3.61	127.18	60	4.6	M	FINGER	NEIC	NEIC	263	23 TALAUD ISLA
4	3/3/2010 21:37	3.68	127.25	35.3	4.8	M	FINGER	NEIC	NEIC	263	23 TALAUD ISLA
5	3/3/2010 21:24	-38.46	-73.7	35	5.1	M	FINGER	NEIC	NEIC	135	8 NEAR COAST
6	3/3/2010 19:58	-33.46	-71.82	28.7	5.3	M	FINGER	NEIC	NEIC	135	8 NEAR COAST
7	3/3/2010 19:58	-33.4783	-71.8882	20.4	5.6	MB	NEICALRT	NEIC	NEIC	135	8 NEAR COAST
8	3/3/2010 17:44	-36.4975	-73.1839	35	5.9	MW	NEICALRT	NEIC	NEIC	135	8 NEAR COAST
	3/3/2010 17:44	-36.5	-73.18	35	5.9	M	FINGER	NEIC	NEIC	135	8 NEAR COAST
	3/3/2010 15:25	-34.58	-72.25	19	6	M	FINGER	NEIC	NEIC	135	8 NEAR COAST
	3/3/2010 15:25	-34.65	-72.43	35	4.9	M	FINGER	NEIC	NEIC	135	8 NEAR COAST
	3/3/2010 14:21	-37.07	-72.83	33.5	4.9	M	FINGER	NEIC	NEIC	135	8 NEAR COAST
	3/3/2010 12:50	-34.8	-72.25	35	4.8	M	FINGER	NEIC	NEIC	136	8 NEAR COAST
	3/3/2010 11:13	3.16	127.08	64.5	4.9	M	FINGER	NEIC	NEIC	135	8 CENTRAL CH
	3/3/2010 8:49	-17.18	-177.57	355.6	5	M	FINGER	NEIC	NEIC	135	8 NEAR COAST
	3/3/2010 7:51	6.82	-73.06	157.3	4.6	M	FINGER	NEIC	NEIC	263	23 TALAUD ISLA
	3/3/2010 7:09	-35.97	-72.61	35.1	4.7	M	FINGER	NEIC	NEIC	181	13 FIJI ISLANDS
	3/3/2010 6:16	-33.62	-71.96	35.1	4.9	M	FINGER	NEIC	NEIC	99	7 NORTHERN C
	3/3/2010 5:49	-32.6	-71.71	35	5.1	M	FINGER	NEIC	NEIC	135	8 NEAR COAST
	3/3/2010 4:35	-37.53	-73.77	30.2	4.7	M	FINGER	NEIC	NEIC	135	8 NEAR COAST
					5.1	M	FINGER	NEIC	NEIC	135	8 NEAR COAST

Open source under Ms-PL license:  
<http://ccaddin2007.codeplex.com>

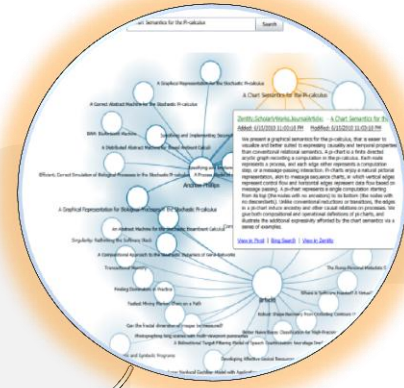
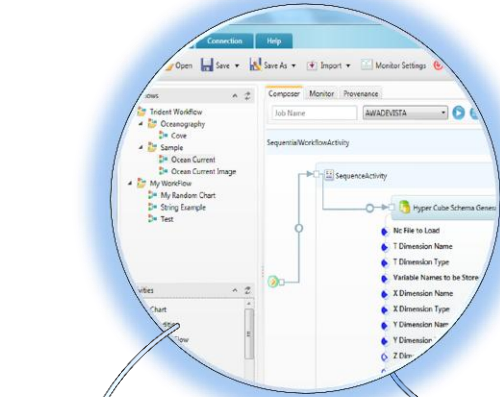
# Scientific Workflows

# Repositories

# VREs

# Word

# DATA DEPOSIT SWORD client for SharePoint

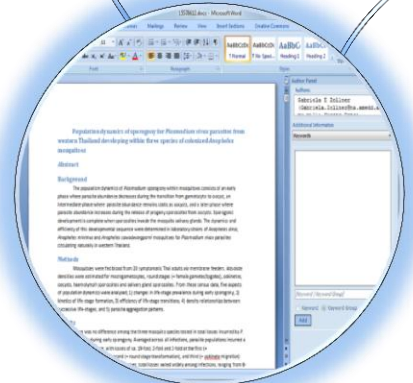


Projects Overview

Name	Role	Activity
Oliver Cromwell		ARC_SEC
Product 2		No Activity
Product 3		No Activity
Product 4		No Activity
Product 5		No Activity
Product 6		No Activity
Product 7		No Activity

Feedback Alerts

Name	Project	Role
ARC_SEC2.doc	Oliver Cromwell	
ARC_SEC2.doc	Oliver Cromwell	
ARC_CV.doc	Oliver Crom	
ARC_SEC1.doc	Oliver	
ARC_CV.doc		



# Repository Integration kit (SWORD Client)

TRINITY COLLEGE DUBLIN  
COLAISTE NA TRIONÓIDÉ, BAILE ÁTHA CLIATH

THE UNIVERSITY OF DUBLIN

Research Information Centre

Welcome Mike Chance

Home

**Projects Overview**

Name	Role	Activities
Oliver Cromwell		ARC_SEC2.doc added by Jan
Product 2		No Activity Performed
Product 3		No Activity Performed
Product 4		No Activity Performed
Product 5		No Activity Performed
Product 6		No Activity Performed
Product 7		No Activity Performed

**Feedback Alerts**

Name	Project	Requested By	Received On	Feedback
ARC_SEC2.doc	Oliver Cromwell	Jan Holloway	12/04/2010 15:34:28	Provide Feedback
ARC_SEC2.doc	Oliver Cromwell	Jan Holloway	12/04/2010 15:34:28	Provide Feedback
ARC_CV.doc	Oliver Cromwell	Jan Holloway	12/04/2010 15:34:28	Provide Feedback
ARC_SEC1.doc	Oliver Cromwell	Jan Holloway	12/04/2010 15:34:28	Provide Feedback
ARC_CV.doc	Oliver Cromwell	Jan Holloway	12/04/2010 15:34:28	Provide Feedback
ARC_SEC2.doc	Oliver Cromwell	Jan Holloway	12/04/2010 15:34:28	Provide Feedback
ARC_CV.doc	Oliver Cromwell	Jan Holloway	12/04/2010 15:34:28	Provide Feedback
ARC_SEC1.doc	Oliver Cromwell	Jan Holloway	12/04/2010 15:34:28	Provide Feedback

Powered by Microsoft Office @ Sharepoint @ Server 2007 ©



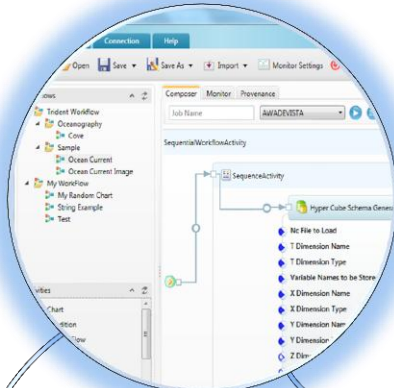
# SWORD client for SharePoint



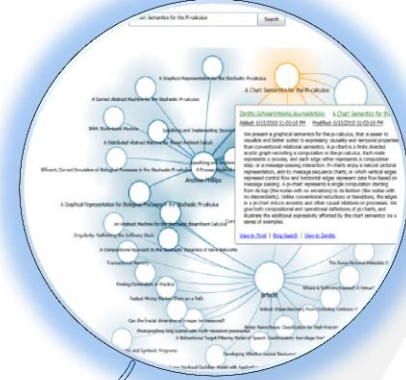
From SharePoint, researchers can...

- **Select any file in SharePoint:**
  - Document
  - Presentation
  - Image
  - Data files
- **and publish it to any repository** (via SWORD)
- SWORD endpoints are managed as a custom list, so new locations are easily added

# Scientific Workflows



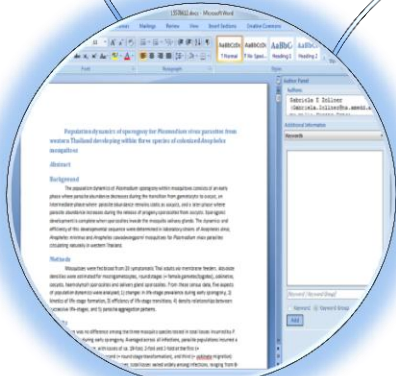
# Repositories



# VREs



# Word



# Excel

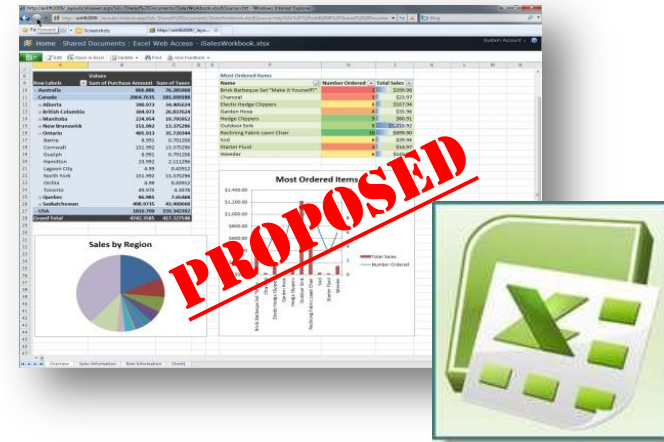
A screenshot of an Excel spreadsheet showing a 'SeismiQuery: Event Query' table. The table has columns for DATE, LAT, LON, DEPTH, and MA. The data represents seismic events with their respective coordinates and magnitudes.

DATE	LAT	LON	DEPTH	MA
3/3/2010 22:54	3.78	127.11	63.5	
3/3/2010 22:17	3.61	127.18	60	
3/3/2010 21:37	3.68	127.25	35.3	
3/3/2010 21:24	-38.46	-73.7		
3/3/2010 19:58	-33.46	-71.82		
3/3/2010 19:58	-33.4783	-71.8882		
3/3/2010 17:44	-36.4975	-73.18		

# DATA CURATION through Excel 2010



# Data Curation Add-in for Microsoft Excel



- **Microsoft Research, in partnership with [California Digital Library's Curation Center](#)**
  - Collaboration with **Tricia Cruse & John Kunze**
  - Part of the [DataONE](#) (an NSF DataNet Project)
- **Proposed functionality *under consideration*:**
  - **Versioning** - revision history and original raw data can be protected and recovered
  - **Time stamps** - easily determine when the data were created and last updated
  - **"Workbook builder"** - select from globally shared standardized layouts for capturing data
  - **Export metadata in a standard formats** (e.g., a DataCite citation or an EML document that describes the dataset(s) in a workbook) so that researchers can readily share their data,
  - **Globally shared vocabulary of terms for data descriptions** (e.g., column names), and as needed to add new terms to the globally shared vocabulary, to enable wide collaboration between researchers
  - **Import term descriptions from the shared vocabulary** and annotate them to refine local definitions
  - **Deposit data and metadata into a data archive** to preserve and publish research data



# Scientific Workflows

# Repositories

# VREs

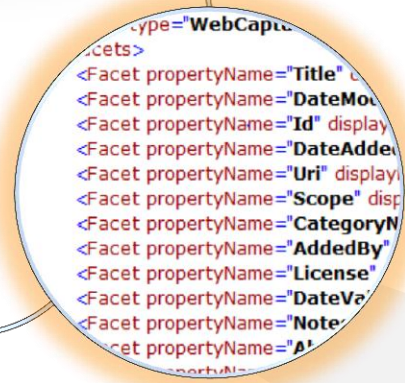
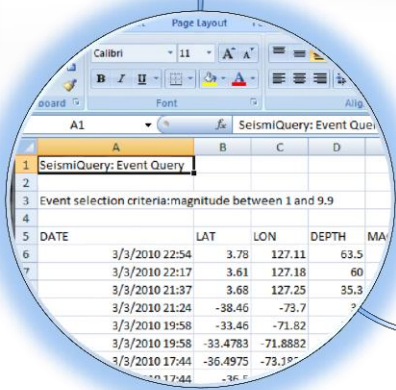
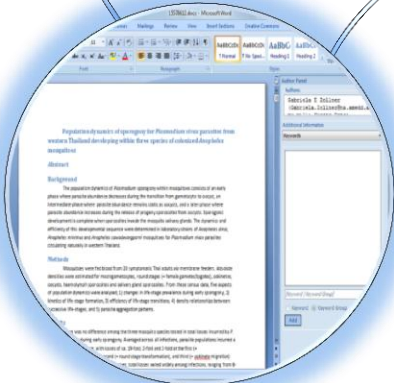
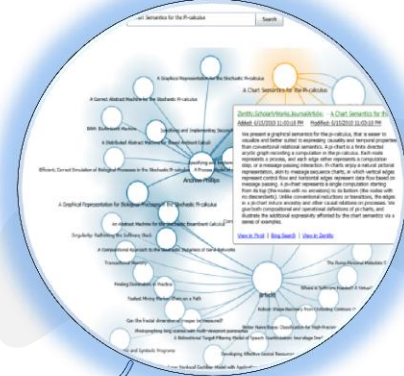
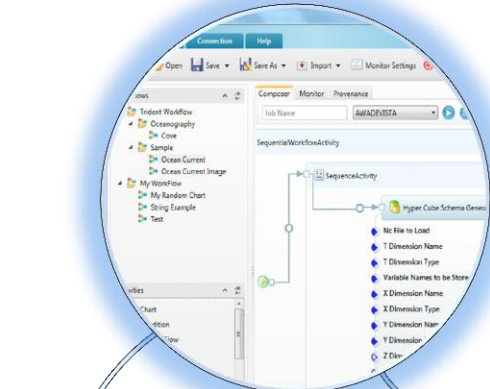
# SHARING & REUSE

# Word

# Excel

# OData

# OData Protocol





# Open Data Protocol

## A RESTful Interface for Data

### Just HTTP

- Items as resources, HTTP methods (GET, PUT, ...) to act
- Leverage proxies, authentication, ETags, ...

### Uniform URL convention

- Every piece of information is addressable
- Predictable and flexible URL syntax

### Multiple representations

- Use regular HTTP content-type negotiation
- JSON and Atom (full AtomPub support)



# Open Data Protocol

## OData Producers

- SharePoint 2010
- IBM Websphere
- Windows Azure Table Storage & SQL Azure
- Zentity 2.0
- Services:
  - Facebook Insights
  - Netflix
  - Open Government Data Initiative
  - Open Science Data Initiative
  - DBPedia

## OData Consumers

- Web Browsers
- Excel 2010
- LinQPad
- Client libraries for
  - Javascript
  - PHP
  - Java
  - Windows 7 Phone
  - iPhone (Objective C)
  - .NET

# OGDI SDK - (<http://ogdi.codeplex.com/>)

The screenshot shows a web browser window titled "Open Government Data Initiative - Windows Internet Explorer". The address bar contains the URL <http://ogdisdk.cloudapp.net/DataBrowser.aspx?Contain>. The page header features the "OPEN GOVERNMENT data initiative" logo and a "BETA" badge. Navigation links for "Home", "Data", and "Developers" are present.

## Data Browser

Interact with the data you selected. Enter filter expression into a text box (text edit area) below and click Run. If you leave the Filter Expression box blank, your query will return all of the data in the selected data set.

Entity Set: **CrimelIncidents**  
Base Query: <http://ogdi.cloudapp.net/v1/dc/CrimelIncidents/>  
Filter Expression:

View options:

### Sample Code

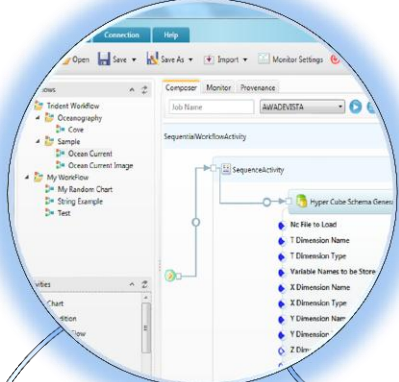
#### Results

Full Query URL: <http://ogdi.cloudapp.net/v1/dc/CrimelIncidents/?&format=kml>  
(Click to view results as XML/KML)

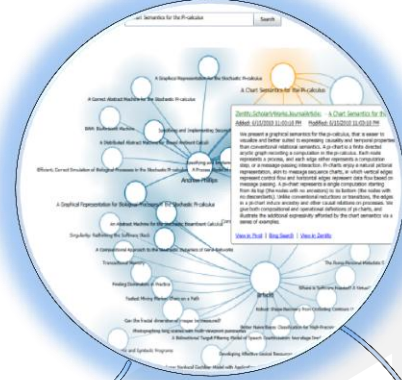
The map view displays a geographic area, likely in the Washington, D.C. region, with various locations labeled such as Bethesda, College Park, and Silver Spring. A blue location pin is placed on the map, indicating a specific data point.

Footer: <http://ogdisdk.cloudapp.net/DataBrowser.aspx> | Internet | Protected Mode: On | 75%

# Project Trident



# Zenty

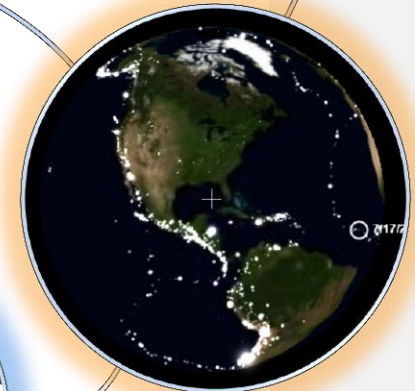


# Research Information Centre

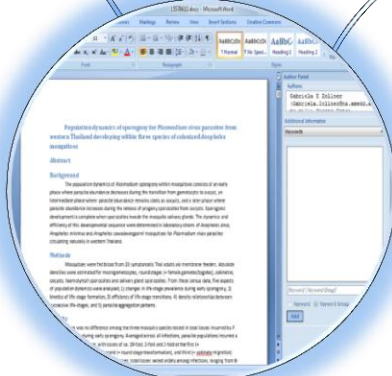


# VISUALIZING DATA

# WWT | Earth



# Word 2010



# Excel 2010

SeismiQuery: Event Query

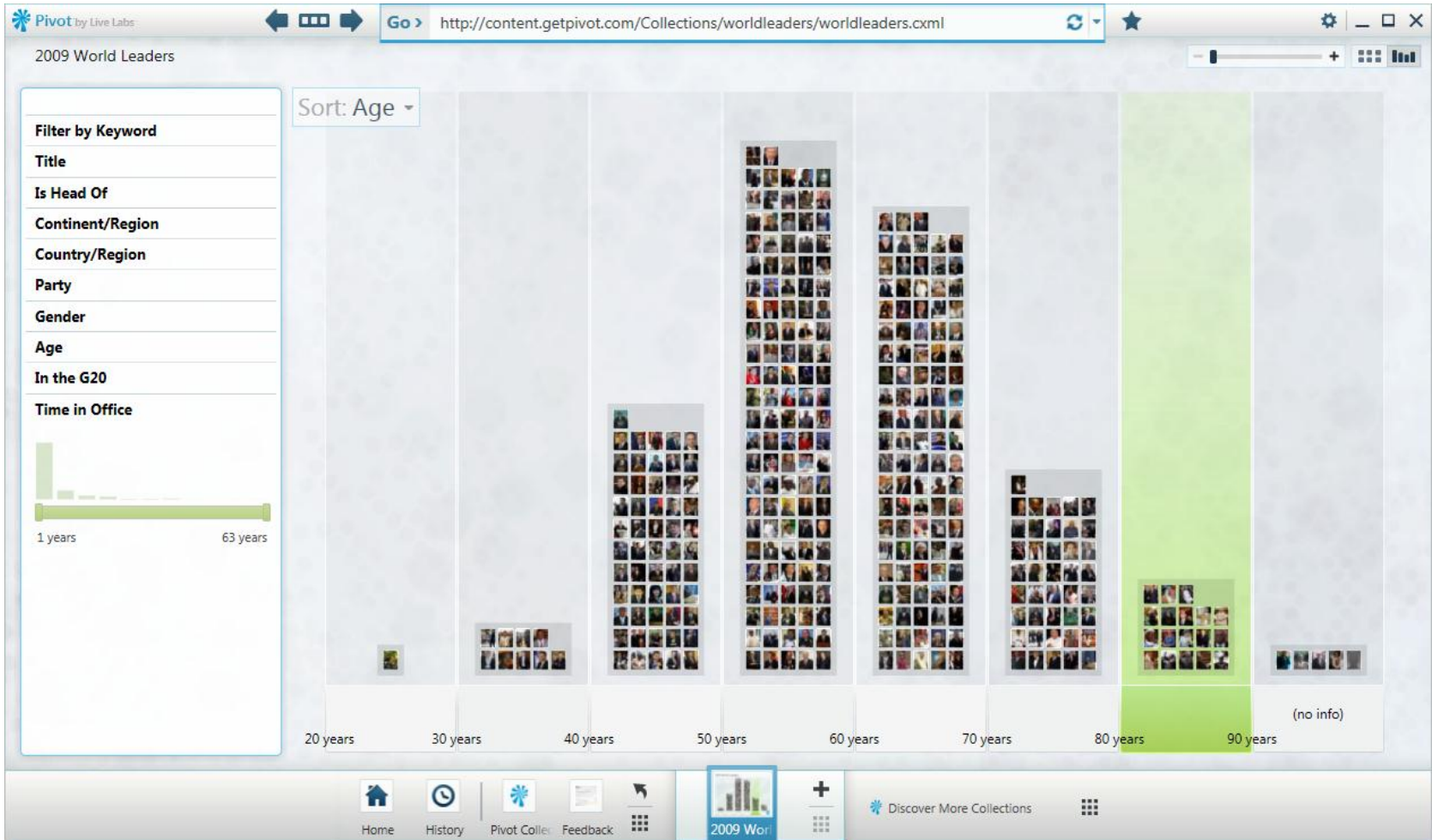
DATE	LAT	LON	DEPTH	MA
3/3/2010 22:54	3.78	127.11	63.5	
3/3/2010 22:17	3.61	127.18	60	
3/3/2010 21:37	3.68	127.25	35.3	
3/3/2010 21:24	-38.46	-73.7		
3/3/2010 19:58	-33.46	-71.82		
3/3/2010 19:58	-33.4783	-71.8882		
3/3/2010 17:44	-36.4975	-73.18		

# OData

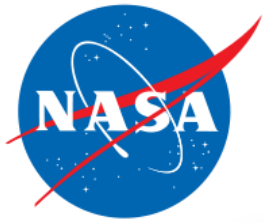
```

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<Facet propertyName="DateModified" display="Text" />
<Facet propertyName="Id" display="Text" />
<Facet propertyName="DateAdded" display="Text" />
<Facet propertyName="Uri" display="Text" />
<Facet propertyName="Scope" display="Text" />
<Facet propertyName="CategoryName" display="Text" />
<Facet propertyName="AddedBy" display="Text" />
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<Facet propertyName="DateValue" display="Text" />
<Facet propertyName="Note" display="Text" />
<Facet propertyName="A" display="Text" />

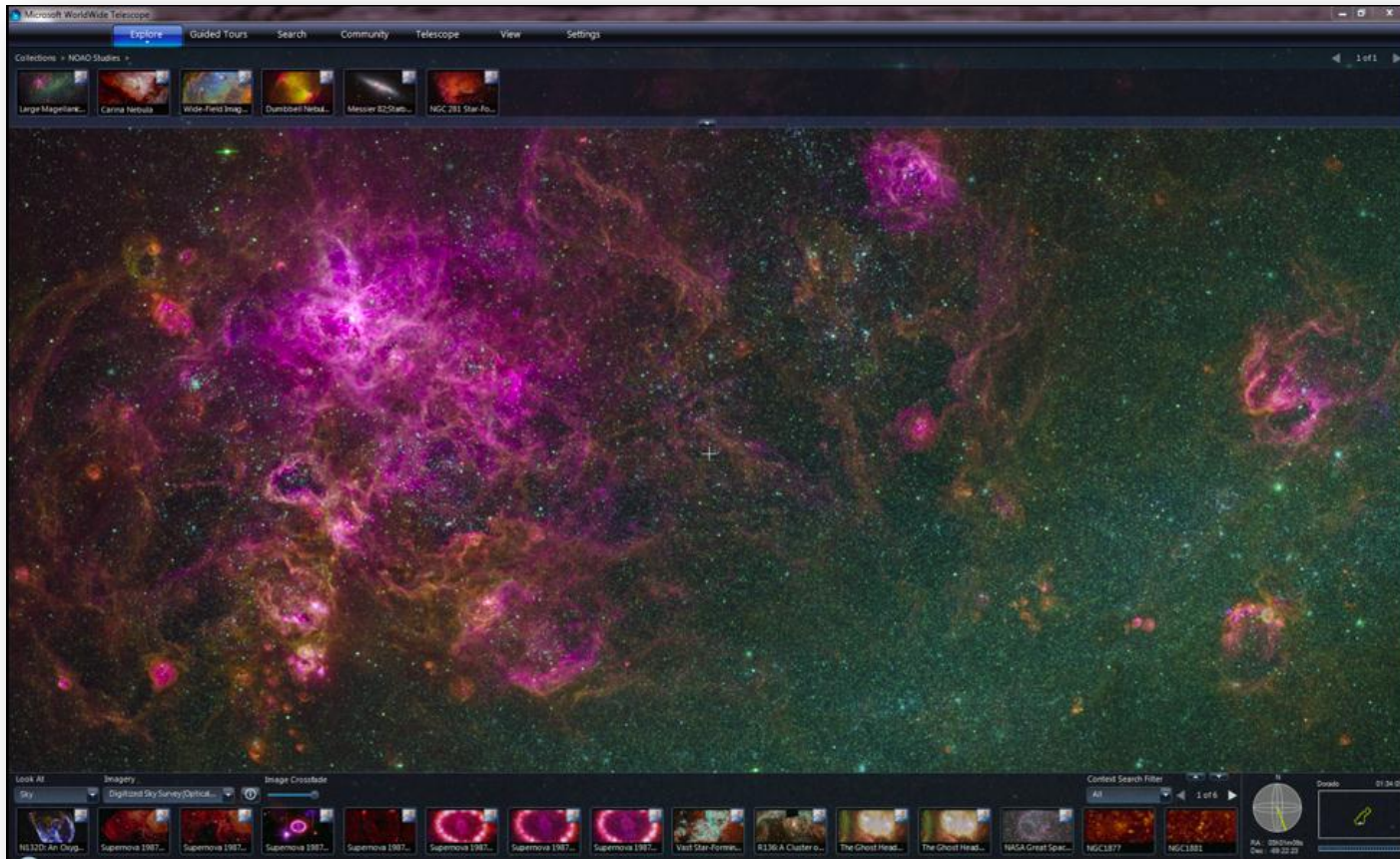
```





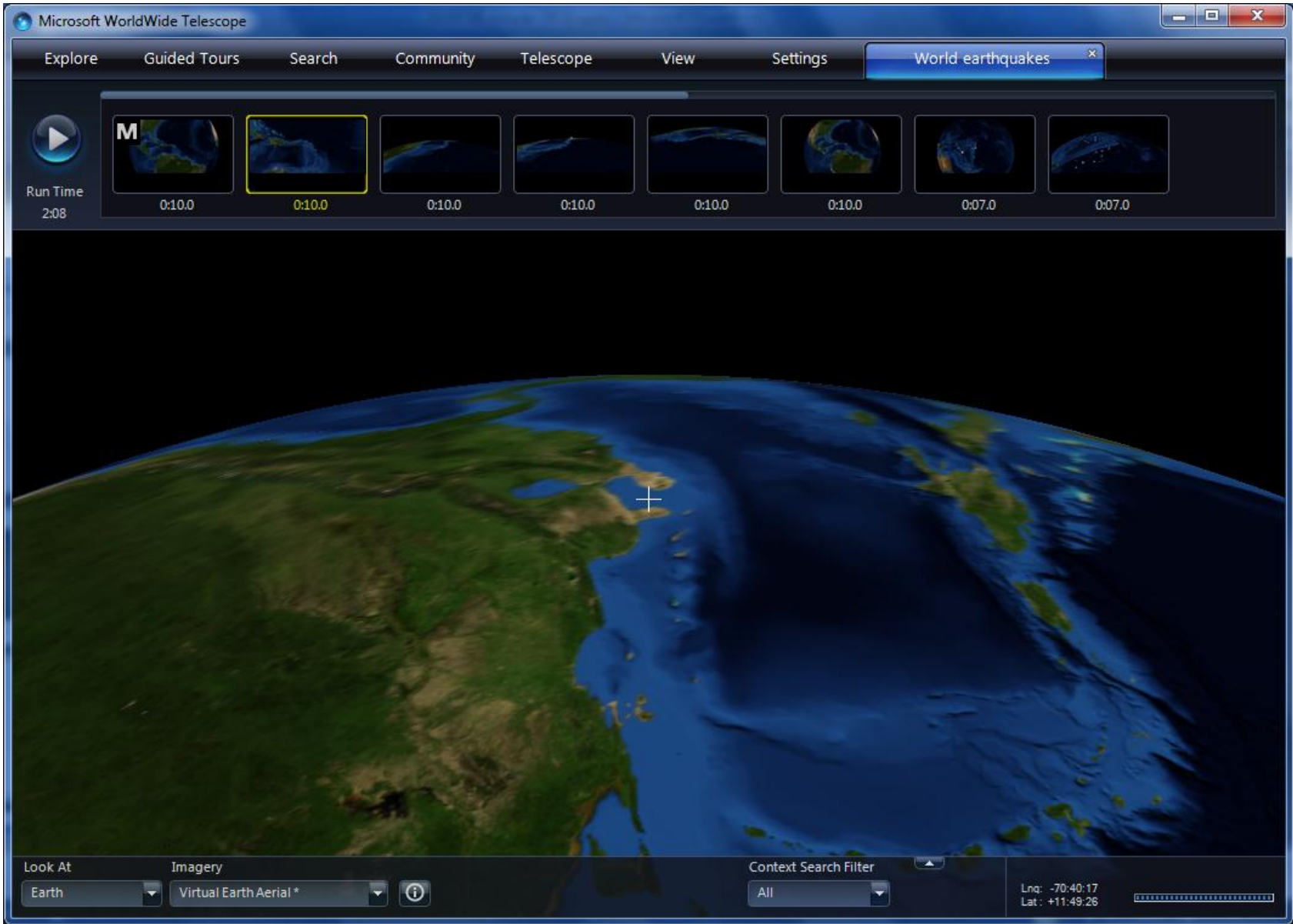


# Worldwide Telescope



Harvard Smithsonian Center  
for Astrophysics

<http://www.worldwidetelescope.org/>



Recent Quakes (version 1).xlsb [Autosaved] - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Creative Commons

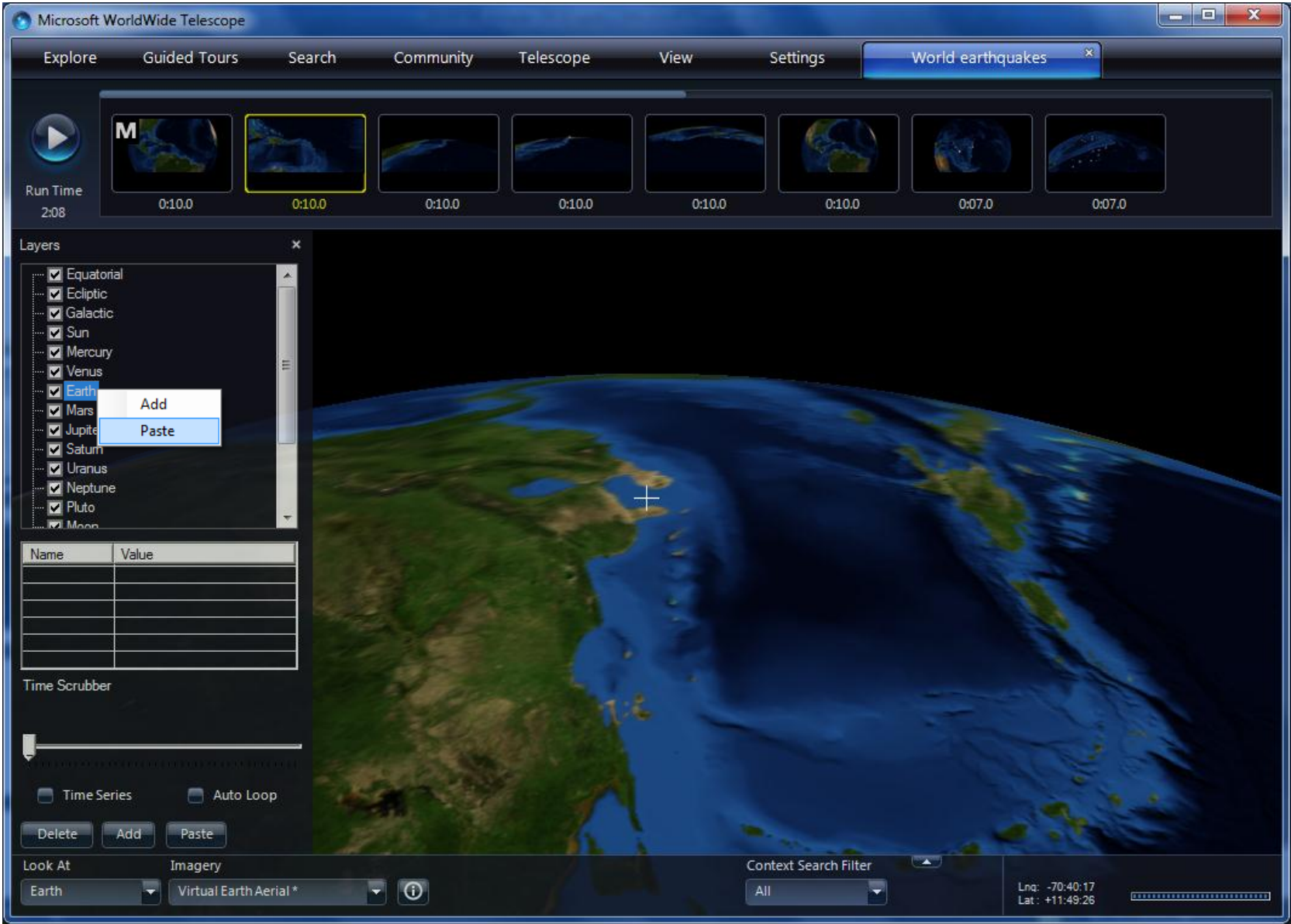
Clipboard Font Alignment Number Styles Cells Editing

data Date

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	SeismiQuery: Event Query														
2															
3	Event selection criteria:magnitude between 1 and 9.9														
4															
5	Date	LAT	LON	DEPTH	MAG	TYPE	CATALOG	EVENT_CC	MAG_COM	CODE	REGION	REGION_TEXT			
6	3/3/2010 22:54	3.78	127.11	63.5	4.7	M	FINGER	NEIC	NEIC	263	23	TALAUD IS INDONESIA			
7	3/3/2010 22:17	3.61	127.18	60	4.6	M	FINGER	NEIC	NEIC	263	23	TALAUD IS INDONESIA			
8	3/3/2010 21:37	3.68	127.25	35.3	4.8	M	FINGER	NEIC	NEIC	263	23	TALAUD IS INDONESIA			
9	3/3/2010 21:24	-38.46	-73.7	35	5.1	M	FINGER	NEIC	NEIC	135	8	NEAR COAST OF CENTRAL CHILE			
10	3/3/2010 19:58	-33.46	-71.82	28.7	5.3	M	FINGER	NEIC	NEIC	135	8	NEAR COAST OF CENTRAL CHILE			
11	3/3/2010 19:58	-33.4783	-71.8882	20.4	5.6	MB	NEICALRT	NEIC	NEIC	135	8	NEAR COAST OF CENTRAL CHILE			
12	3/3/2010 17:44	-36.4975	-73.1839	35	5.9	MW	NEICALRT	NEIC	NEIC	135	8	NEAR COAST OF CENTRAL CHILE			
13	3/3/2010 17:44	-36.5	-73.18	35	5.9	M	FINGER	NEIC	NEIC	135	8	NEAR COAST OF CENTRAL CHILE			
14	3/3/2010 17:44	-36.45	-73.07	19	6	M	FINGER	NEIC	NEIC	135	8	NEAR COAST OF CENTRAL CHILE			
15	3/3/2010 15:25	-34.58	-72.25	35	4.9	M	FINGER	NEIC	NEIC	135	8	NEAR COAST OF CENTRAL CHILE			
16	3/3/2010 15:25	-34.65	-72.43	33.5	4.9	M	FINGER	NEIC	NEIC	135	8	NEAR COAST OF CENTRAL CHILE			
17	3/3/2010 14:21	-37.07	-72.83	35	4.8	M	FINGER	NEIC	NEIC	136	8	CENTRAL CHILE			
18	3/3/2010 12:50	-34.8	-72.25	35	4.9	M	FINGER	NEIC	NEIC	135	8	NEAR COAST OF CENTRAL CHILE			
19	3/3/2010 11:13	3.16	127.08	64.5	5	M	FINGER	NEIC	NEIC	263	23	TALAUD IS INDONESIA			
20	3/3/2010 8:49	-17.18	-177.57	355.6	4.6	M	FINGER	NEIC	NEIC	181	13	FIJI ISLANDS REGION			
21	3/3/2010 7:51	6.82	-73.06	157.3	4.7	M	FINGER	NEIC	NEIC	99	7	NORTHERN COLOMBIA			
22	3/3/2010 7:09	-35.97	-72.61	35.1	4.9	M	FINGER	NEIC	NEIC	135	8	NEAR COAST OF CENTRAL CHILE			
23	3/3/2010 6:16	-33.62	-71.96	35	5.1	M	FINGER	NEIC	NEIC	135	8	NEAR COAST OF CENTRAL CHILE			
24	3/3/2010 5:49	-32.6	-71.71	35	4.7	M	FINGER	NEIC	NEIC	135	8	NEAR COAST OF CENTRAL CHILE			
25	3/3/2010 4:35	-37.53	-73.77	30.2	5.1	M	FINGER	NEIC	NEIC	135	8	NEAR COAST OF CENTRAL CHILE			
26	3/3/2010 4:35	35.55	-97.28	5	2.5	M	FINGER	NEIC	NEIC	499	34	OKLAHOMA			

Sheet1 Sheet2 Sheet3

Ready Recovered Average: 5754.336423 Count: 377828 Sum: 1383509352 100%



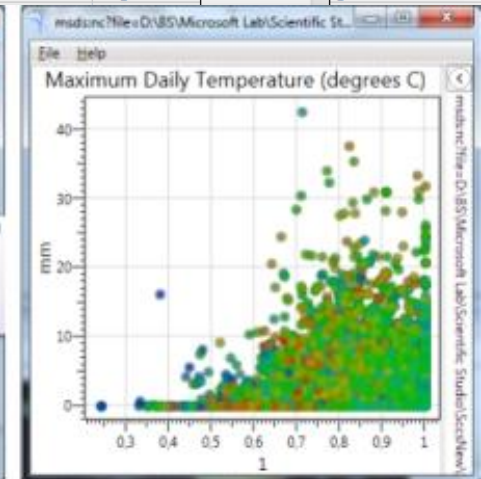
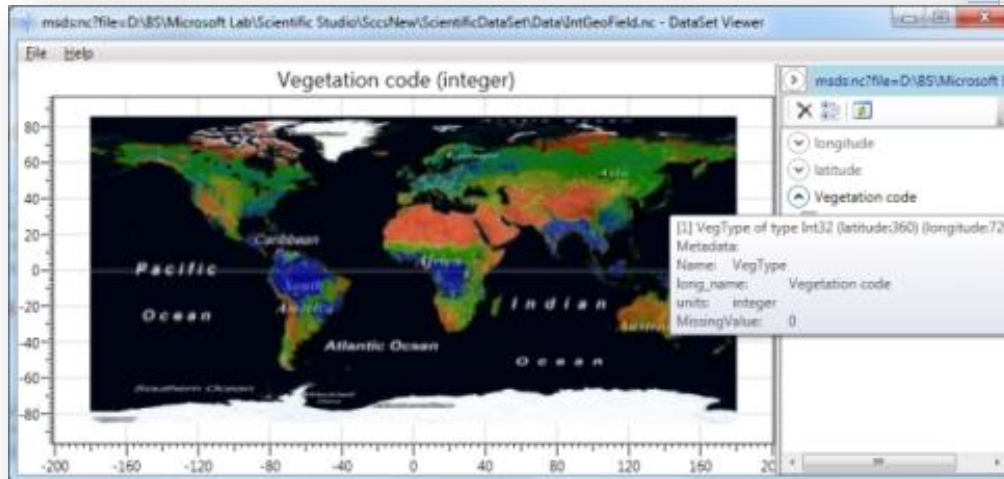




# SDS: Scientific DataSet Library and Tools

- Create self-descriptive data packages
- Supports common data formats (CSV, NetCDF, HDF5)
- Scale from simple text files to multi-terabyte Windows Azure archives
- Concurrent access in multicore and distributed settings
- Consistency checks and transactional updates

	A	B	C	D	E
1	msds.csv?file=C:\wet.csv				
2	Global metadata		<a href="#">Add new variable</a>		
3		Key	Type	Value	
4		Name	String	c:/devel/cru/cru_wet_clim_1961-1990.nc	
5		Conventions	String	CF-1.0	
6		history	String	from cru_ts_2_10.1901-2002.wet: Tyndal	
7		processing_de	String	converted to float, multiplied by 0.01	
8		comment	String	Results on 2010-10-20	
9			Auto		
10	Variables				
11	ID	Name	Type	Dimensions	Size
12	17	time_bounds	Single	time,bounds	12x2
13		Name	String	time_bounds	
14		DisplayName	String	time_bounds	
15		MissingValue	Auto		
16		csv_column	Int32		8645
17		name	String	bounds	
18		units	String	days since 1990-01-01 00:00:00	
19		comment	Auto		
20			Int32		
21			Int32		
21	16 longitude		Int64	ngitude	720



*Thank you!*

**Alex D. Wade**

*Director—Scholarly Communication*

*Microsoft External Research*

[awade@microsoft.com](mailto:awade@microsoft.com)

<http://research.microsoft.com/people/awade>

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