A modern open webservice-based GIS infrastructure

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the University of Virginia Library
Digital Scholarship and
Research Services R & D

Why a specialized geospatial data repository?

GIS data is weird.

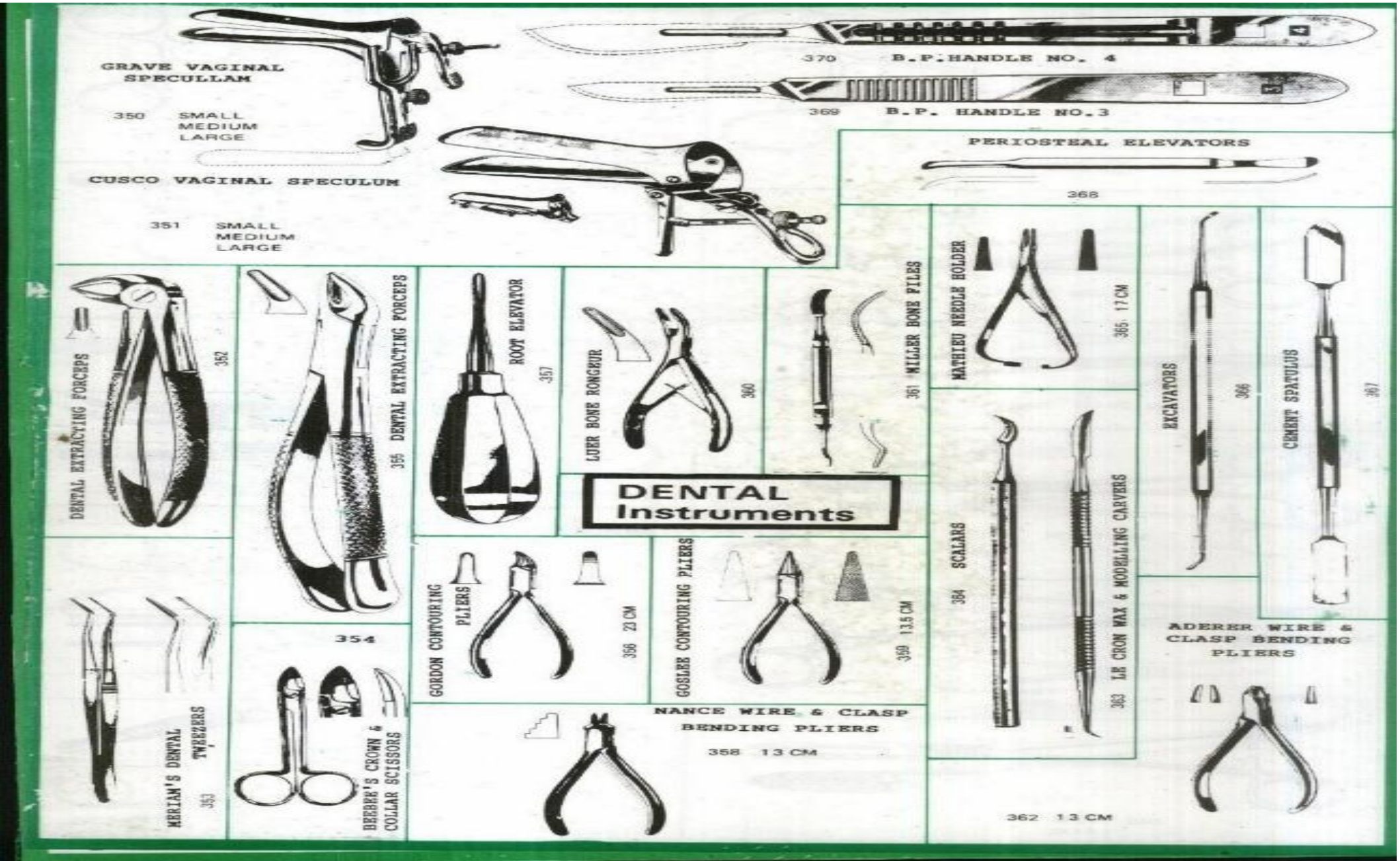
It's huge.

It's shaped all funny-like.

It lives in odd formats.

- ESRI grid
- IMG
- DXF
- National Transfer Format
- GeoMedia
- Vector Product Format
- Personal Geodatabase
- File Geodatabase
- MapInfo TAB format
- Shapefiles
- TIGER
- MrSID
- ECW
- ADRG
- CIB
- many, many, many more…

It requires special tools for use.



It deserves specialized description.

- It's yet another kind of object for which MARC is not appropriate.
- Good (international) standards exist for cataloging geospatial data, but your ILS doesn't know that.

Standards

Sources of standards

- Open Geospatial Consortium
- ISO TC 211
- Eruptions of GIS into other technical communities (e.g. GeoRSS, GeoJSON)

OGC

- The “W3C” of GIS, in that it
- produces standards, not tools,
- has members from industry, academia, and government,
- and concerns itself mostly with interoperability.

ISO TC 211
Geographic information/Geomatics

- Produces sophisticated and enterprise-y standards for GIS based on UML models, and
- usually blesses OGC standards after extensive review.
- If you love entity diagrams as much as I do…

So whose standards are standard?

OGC and
ISO TC211
are friends.

Specific standards

- Simple Feature Access / SQL
- GML
- ISO 19115 / ISO 19139
- WMS
- WFS

Specific Standards: Simple Feature Access / SQL

- “a well-defined and common way for applications to store and access feature data in relational or object-relational databases”
- SQL API for constructing and manipulating geographical objects
- Standard document exists for SQL
- Many other languages and environments have community-supported versions.

Specific Standards:
Simple Feature Access / SQL

SQL Example:

SELECT **ST_Intersection**(r.the_geom,
m.the_geom) AS intersection_geom,
ST_Length(r.the_geom) AS rd_orig_length, r.*
FROM bc_roads AS r, bc_municipality AS m
WHERE **ST_Intersects**(r.the_geom, m.the_geom
AND m.name = 'PRINCE GEORGE';

Specific Standards:
Simple Feature Interface / SQL

WKT Example:

MULTIPOLYGON(((0 0,4 0,4 4,0 4,0 0),(1 1,2 1,2 2,1 2,1 1)), ((-1 -1,-1 -2,-2 -2,-2 -1,-1 -1)))

Specific Standards: Geography Markup Language

- An XML language for defining geographical objects which is
- enormously sophisticated and expressive
- and therefore verbose,
- but provides a solid baseline for interchange.

Specific Standards: Geography Markup Language

```
<abc:Building xmlns:abc="http://abc" xmlns:app="http://app" xmlns:gml="http://www.opengis.net/gml"
    gml:id="SearsTower">
    <gml:name>Sears Tower</gml:name>
    <abc:height>52</abc:height>
    <abc:position>
        <gml:Point>
            <gml:coordinates>100,200</gml:coordinates>
        </gml:Point>
    </abc:position>
    <app:extent>
        <gml:Polygon>
            <gml:exterior>
                <gml:LinearRing>
                    <gml:coordinates>100,200</gml:coordinates>
                </gml:LinearRing>
            </gml:exterior>
        </gml:Polygon>
    </app:extent>
    <gml:timeStamp>
        <gml:TimeInstant gml:id="GML_TT_8539493">
            <gml:timePosition>2005-08-11T10:43:00</gml:timePosition>
        </gml:TimeInstant>
    </gml:timeStamp>
</abc:Building>
```

Specific Standards: ISO 19115 / ISO 19139

- 19115 is the abstract model for metadata about geospatial… things.
- 19139 is the standard for serializing 19115 in XML.
- A rich, expressive, specialized language for describing anything that has place.

Specific Standards:
ISO 19115 / ISO 19139

See example…

Specific Standards: Web Map Service

- A service that accepts queries and produces imagery.
- Defined in ISO 19128.
- Used to publish both raster and vector data in rendered form.
- Can be consumed by anything that can load an URL and display an image.

Specific Standards:
Web Map Service

Example:

Query:

http://blah/geoserver/wms?**request**=GetMap&**layers**=benford:1850&**bbox**=334996.21452146204,255850.78955473876,365695.43672146206,284695.4647547388&**styles**=&**Format**=image/png&**version**=1.1.1&**width**=800&**height**=705&**srs**=EPSG:3438

Specific Standards: Web Map Service

Example:

Response:

Specific Standards:
Web Map Service

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Specific Standards: Web Map Service

Example:

Response:

```
<?xml version="1.0" encoding="UTF-8"?>
<kml>
  <Folder>
    <name>layer_0</name>
    <description>benford:1850</description>
    <GroundOverlay>
      <name>benford:1850</name>
      <drawOrder>0</drawOrder>
      <Icon>

<href>http://localhost:8080/geoserver/wms?height=705&amp;bbox=334996.21452146204%2C255850.78955473876%2C365695.43672146206%2C284695.4647547388&amp;width=800&amp;layers=benford%3A1850&amp;request=GetMap&amp;service=wms&amp;styles=Raster+Style&amp;srs=EPSG%3A3438&amp;format=application%2Fvnd.google-earth.kml+XML&amp;transparent=false&amp;version=1.1.1</href>
        <viewRefreshMode>never</viewRefreshMode>
        <viewBoundScale>0.75</viewBoundScale>
      </Icon>
      <LatLonBox>
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        <south>41.78541164893516</south>
        <east>-71.36190468629343</east>
        <west>-71.47463768373167</west>
      </LatLonBox>
    </GroundOverlay>
  </Folder>
</kml>
```

Specific Standards:
Web Map Service

Example:

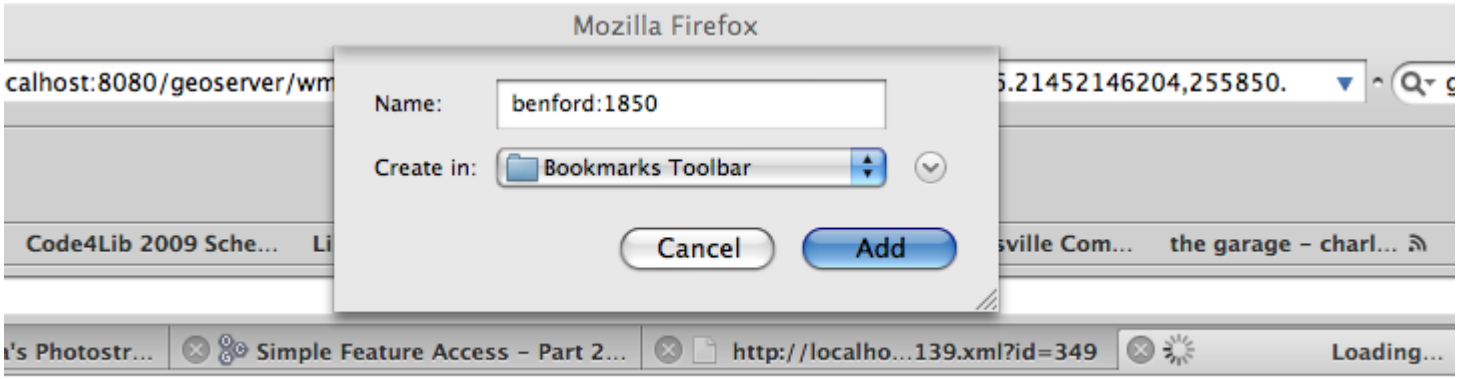
Query:

http://blah/geoserver/wms?**request**=GetMap&**layers**=benford:1850&**bbox**=334996.21452146204,255850.78955473876,365695.43672146206,284695.46475473888&**styles**=&**Format**=**rss**&**version**=1.1.1&**width**=800&**height**=705&**srs**=EPSG:3438

Specific Standards: Web Map Service

Example:

Response:



Specific Standards: Web Feature Service

- A service that accepts queries and produces feature data.
- Defined in ISO 19142.
- Used to publish vector data in non-rendered form.
- Can be consumed by clients that understand geographic information.

Specific Standards:
Web Feature Service

Example:

Query:

http://blah/geoserver/wfs?**request**=GetFeature&**typeName**=lovecraft:places

Specific Standards:
Web Feature Service

Example:

Response: See example…

Specific Standards:
Web Feature Service

Example:

Query:

http://blah/geoserver/wfs?**request**=GetFeature&**typeName**=lovecraft:places&**outputformat**=json

Specific Standards:
Web Feature Service

Example:

Response: See example…

Specific Standards:
Web Feature Service

Example:

Query:

http://blah/geoserver/wfs?**request**=GetFeature&**typeName**=lovecraft:places&**filter**=<Filter xmlns%3Alovecraft%3D'http%3A//localhost'><PropertyIsEqualTo><Function name%3D'strMatches'><PropertyName>lovecraft%3Amentionedin</PropertyName><Literal>.*CDW.*</Literal></Function><Literal>true</Literal></PropertyIsEqualTo></Filter>

Specific Standards:
Web Feature Service

Example:

Response: See example…

Specific Standards:
Web Feature Service

```
<Filter>
   <PropertyIsEqualTo>
      <Function name="strMatches">
<PropertyName>lovecraft:mentionedin</PropertyName>
         <Literal>.*CDW.*</Literal>
      </Function>
      <Literal>true</Literal>
   </PropertyIsEqualTo>
</Filter>
```

Tools

PostgreSQL / PostGIS

- A well-supported open-source RDMBS with extension code for spatial data types and functionality.

PostGIS

An extension library for PostgreSQL supplying spatial data types and functionality by leveraging

- GEOS, a C++ library implementing OGC Simple Features, and
- PROJ.4, a library implementing support for geographical projections.

Other datastores can be used under our web-tier

- Oracle
- ESRI ArcSDE
- Microsoft products
- MySQL

GeoServer

- A Spring-based server that supplies WMS / WFS and more, by leveraging a powerful Java library called GeoTools.
- Connects to data stores and raster imagery and publishes services from them.

GeoNetwork

A UN-sponsored metadata repository backed by an RDBMS and Lucene.

GeoNetwork

- GN is made of a servlet-based webapp over
- a Lucene index over
- an RDBMS that actually stores the metadata.

GeoNetwork

- Features:
- metadata editors
- user-group management with various roles
- query by various means, including by extent
- a wide variety of connectivity (Z39.50, OAI-PMH, CSW)
- easy extensibility
- strong internationalization

Screenshots

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lat (min)
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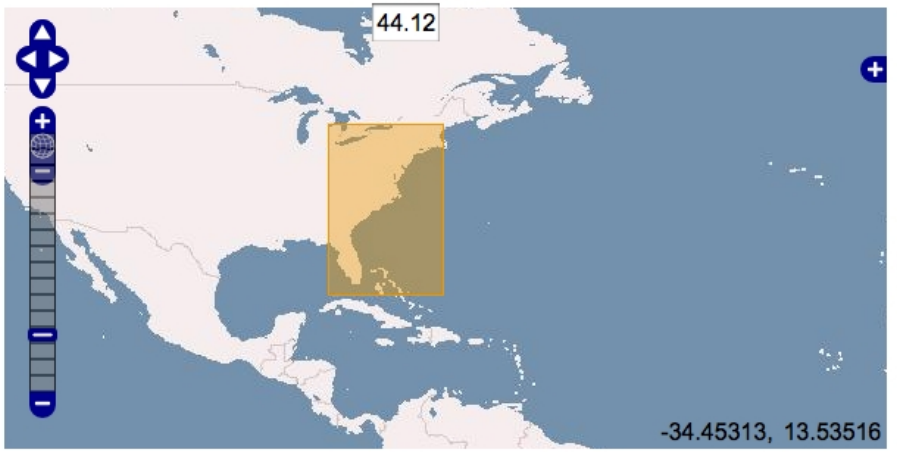
long (min)
-83.8



long (max)
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lat (max)
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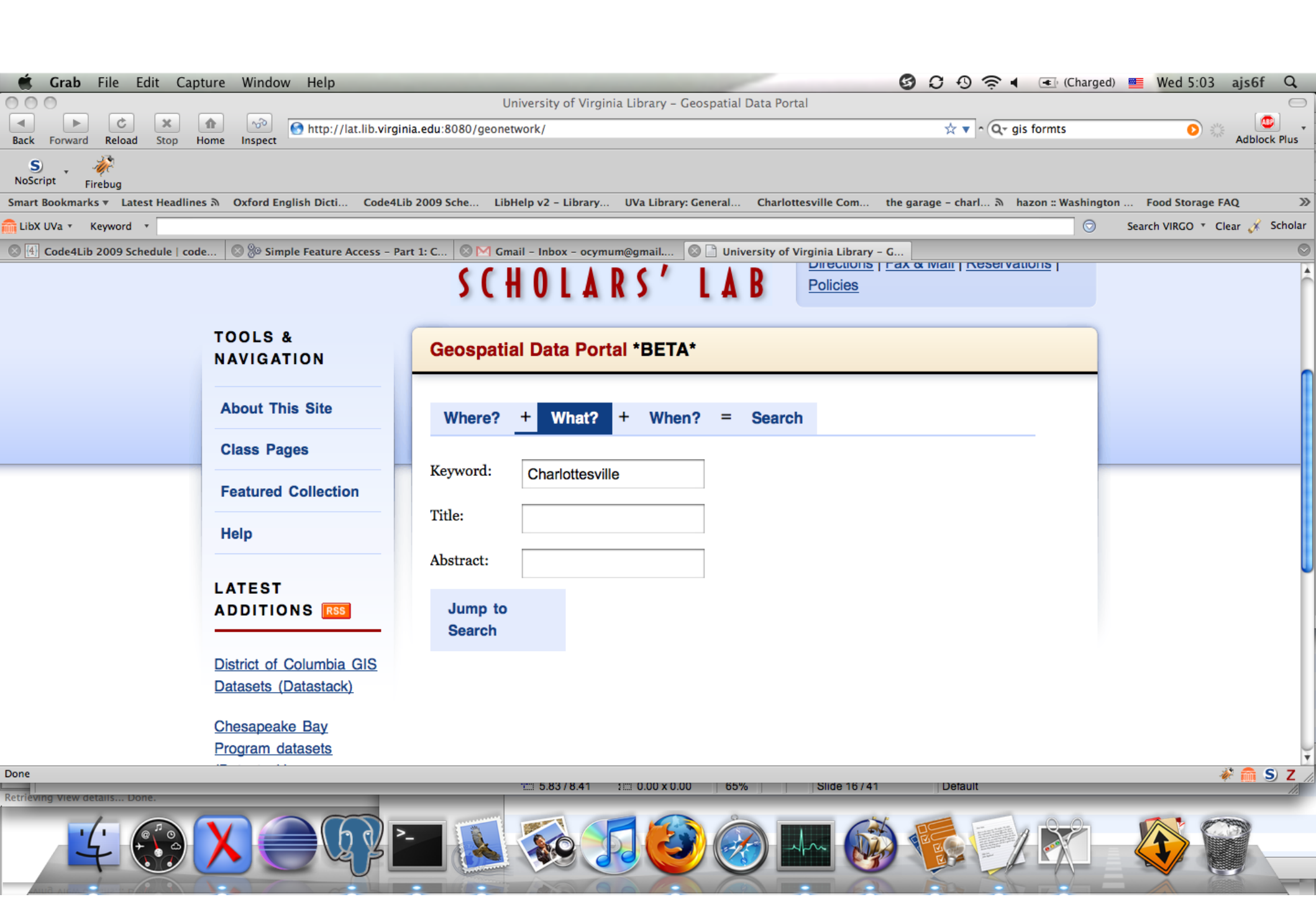
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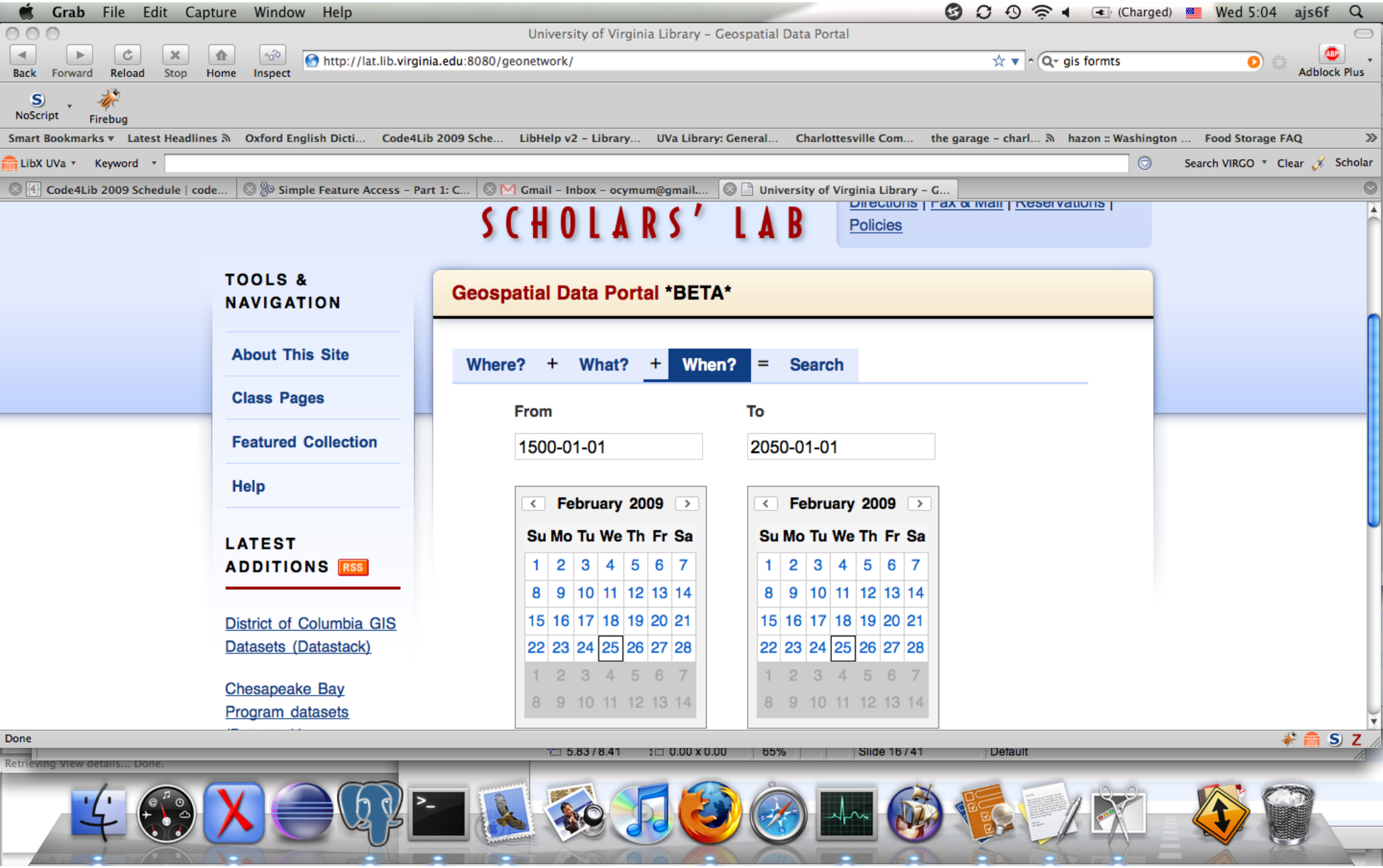
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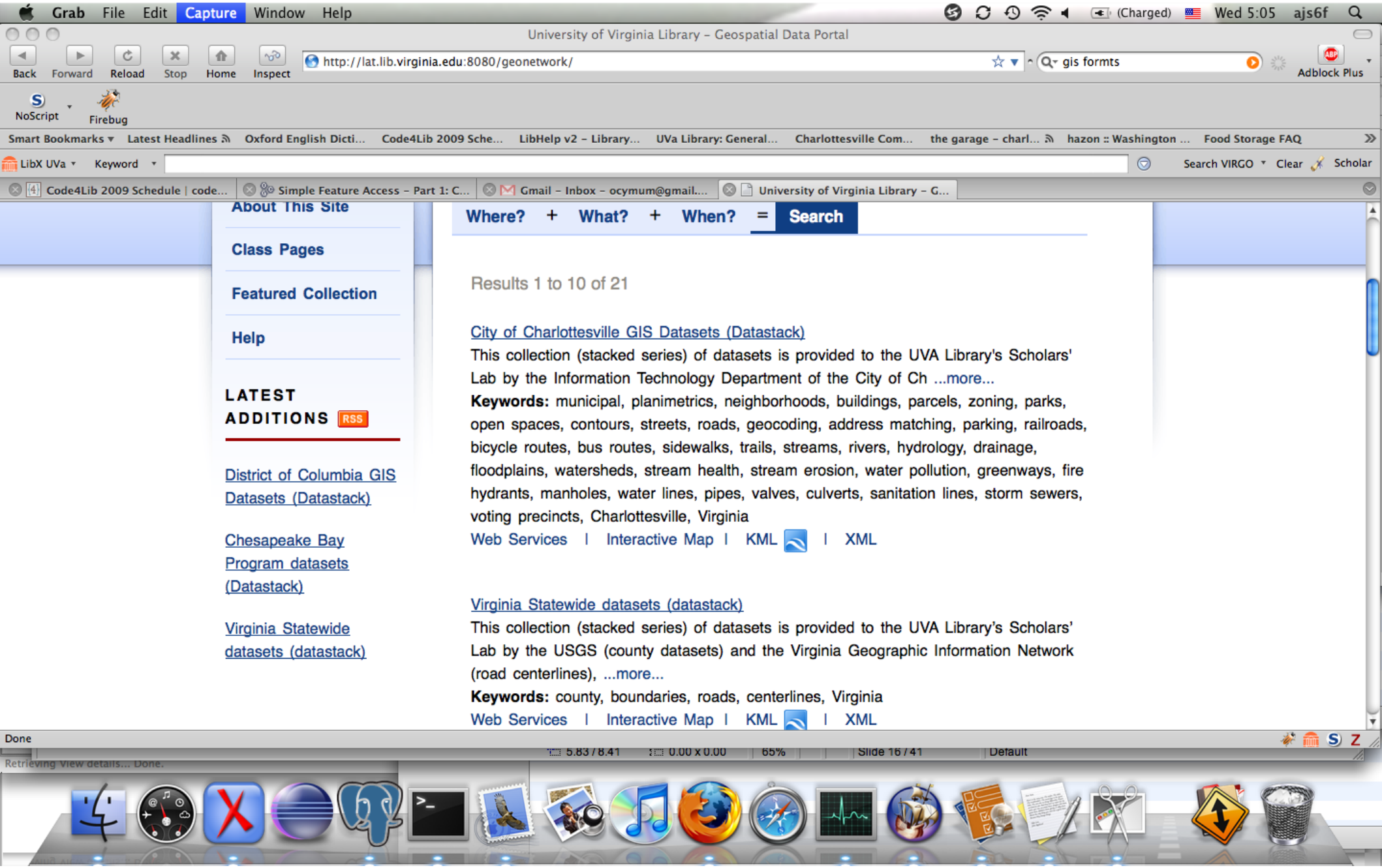
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Results 1 to 10 of 21
City of Charlottesville GIS Datasets (Datastack)
This collection (stacked series) of datasets is provided to the UVA Library's Scholars' Lab by the Information Technology Department of the City of Ch ...more...
Keywords: municipal, planimetrics, neighborhoods, buildings, parcels, zoning, parks, open spaces, contours, streets, roads, geocoding, address matching, parking, railroads, bicycle routes, bus routes, sidewalks, trails, streams, rivers, hydrology, drainage, floodplains, watersheds, stream health, stream erosion, water pollution, greenways, fire hydrants, manholes, water lines, pipes, valves, culverts, sanitation lines, storm sewers, voting precincts, Charlottesville, Virginia
Web Services | Interactive Map | KML | XML
Virginia Statewide datasets (datastack)
This collection (stacked series) of datasets is provided to the UVA Library's Scholars' Lab by the USGS (county datasets) and the Virginia Geographic Information Network (road centerlines), ...more...
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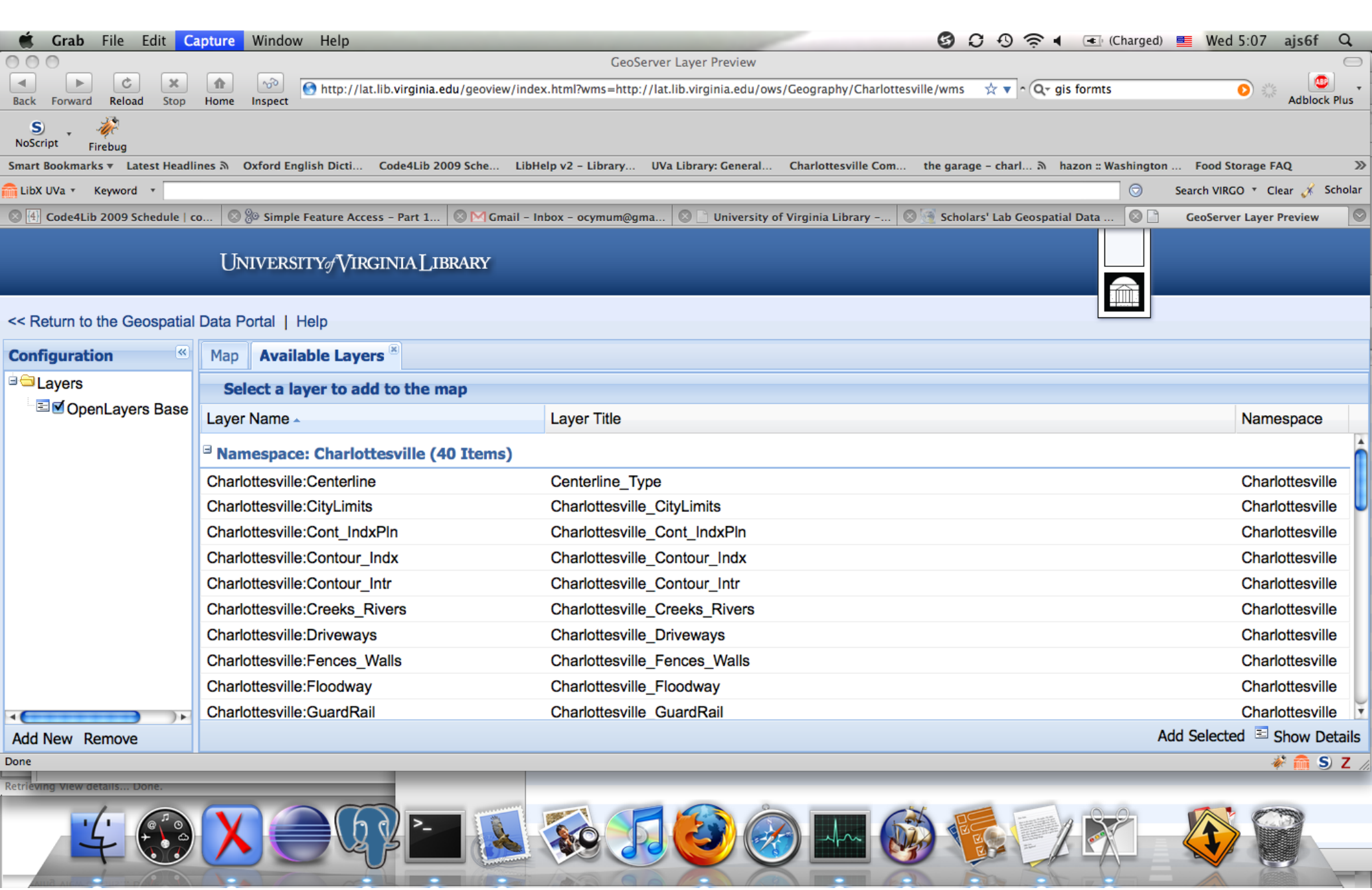
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Charlottesville:CityLimits Charlottesville_CityLimits Charlottesville
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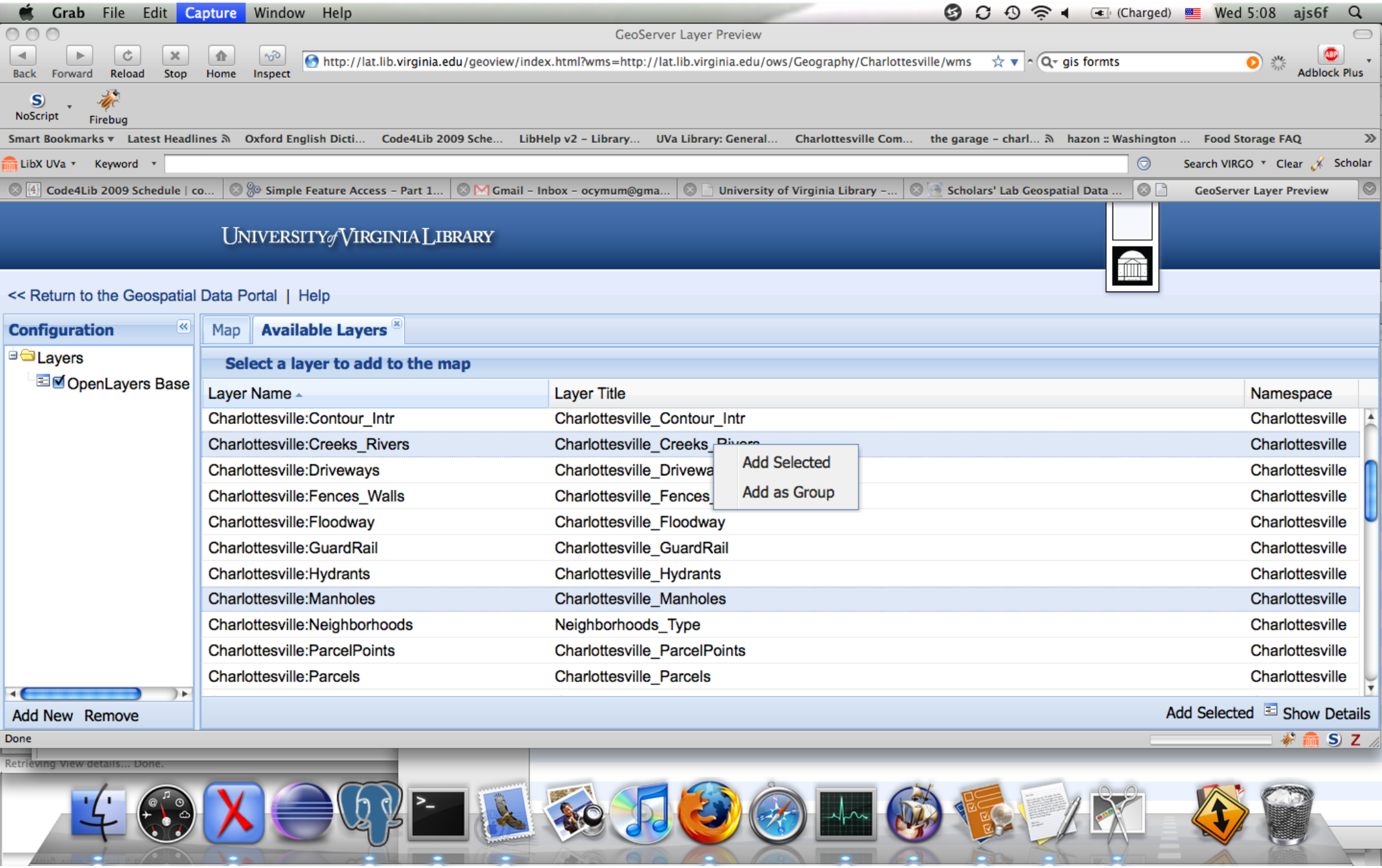
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Charlottesville:Creeks_Rivers
Charlottesville_Creeks_Rivers
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Add Selected
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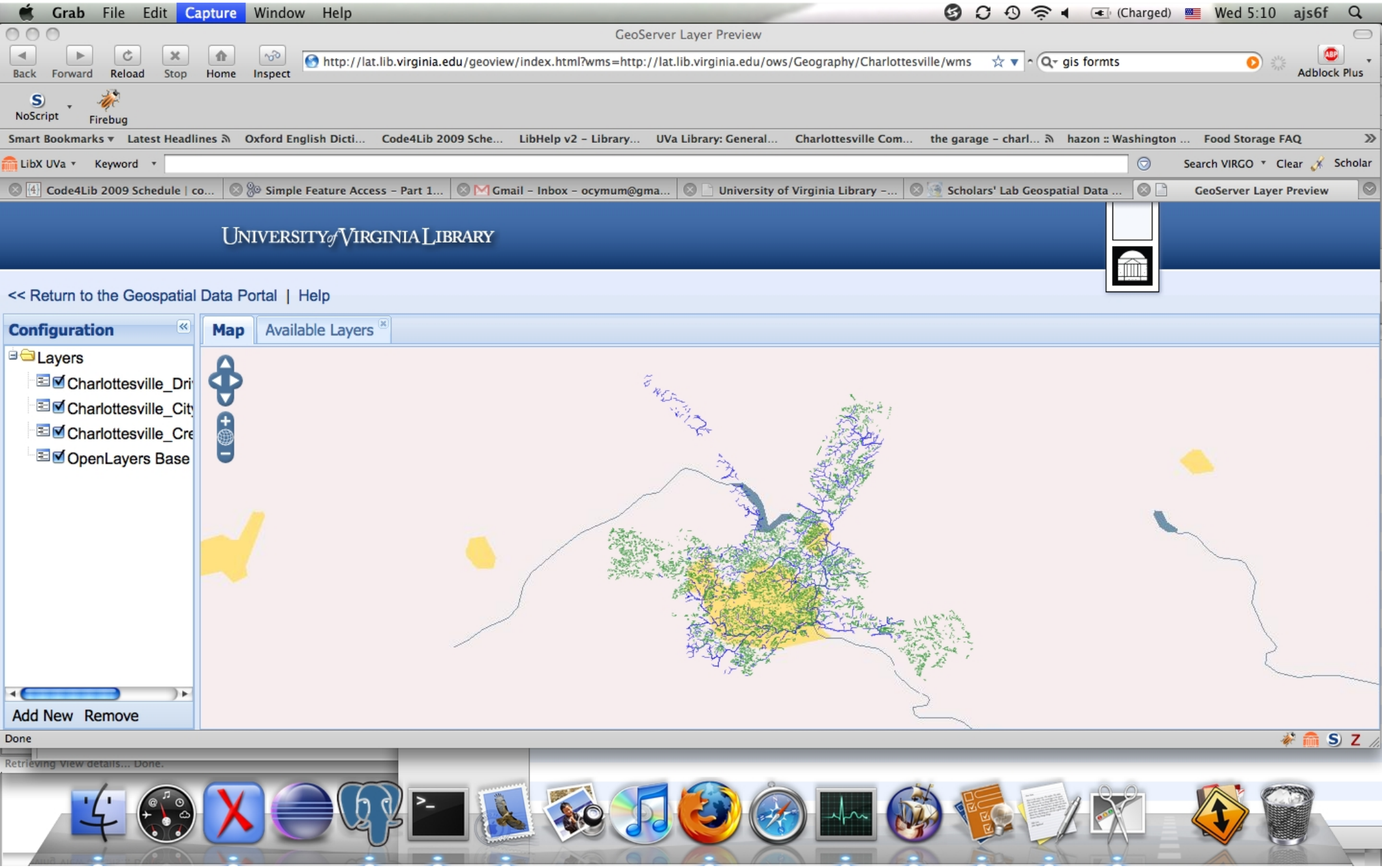
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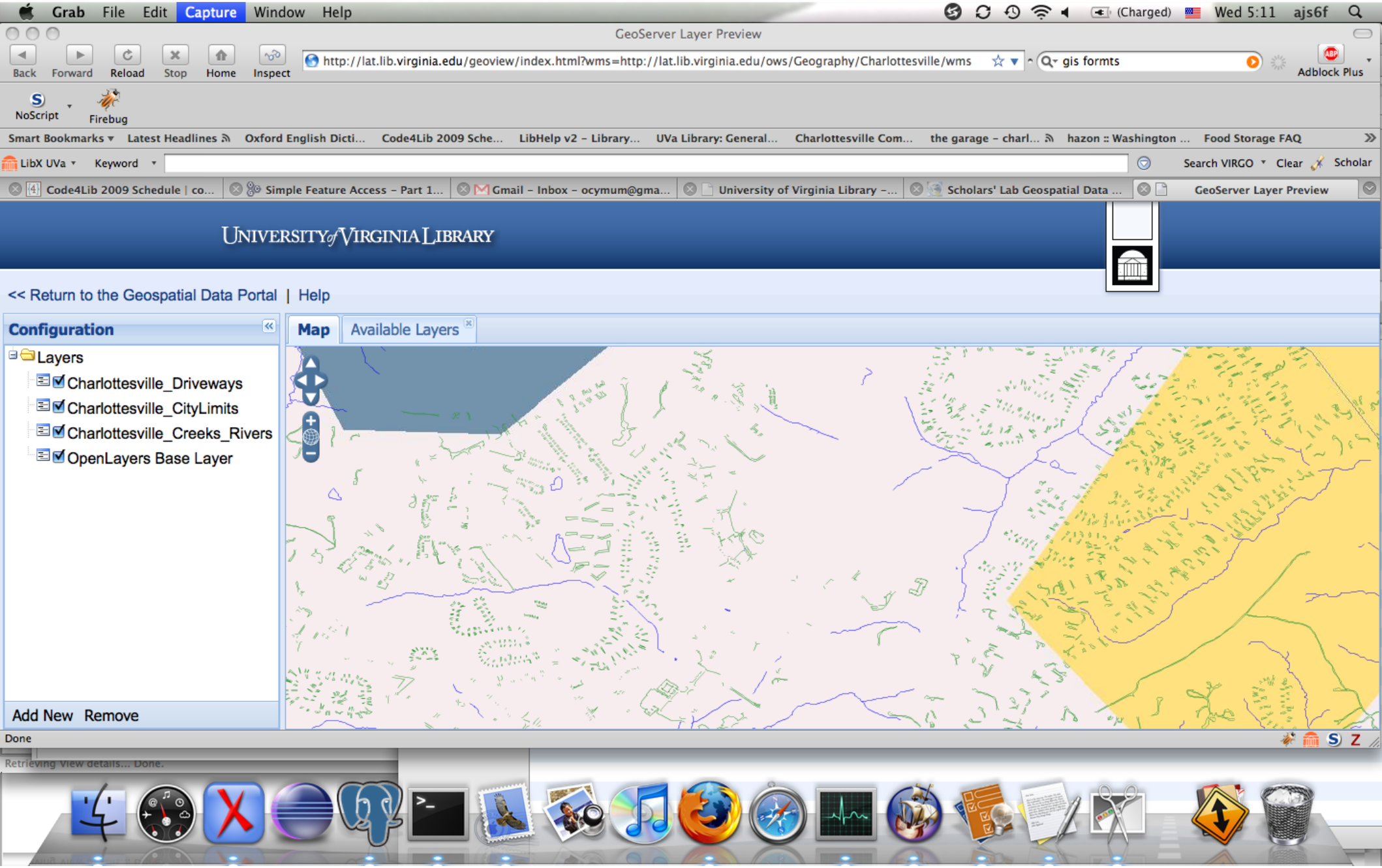
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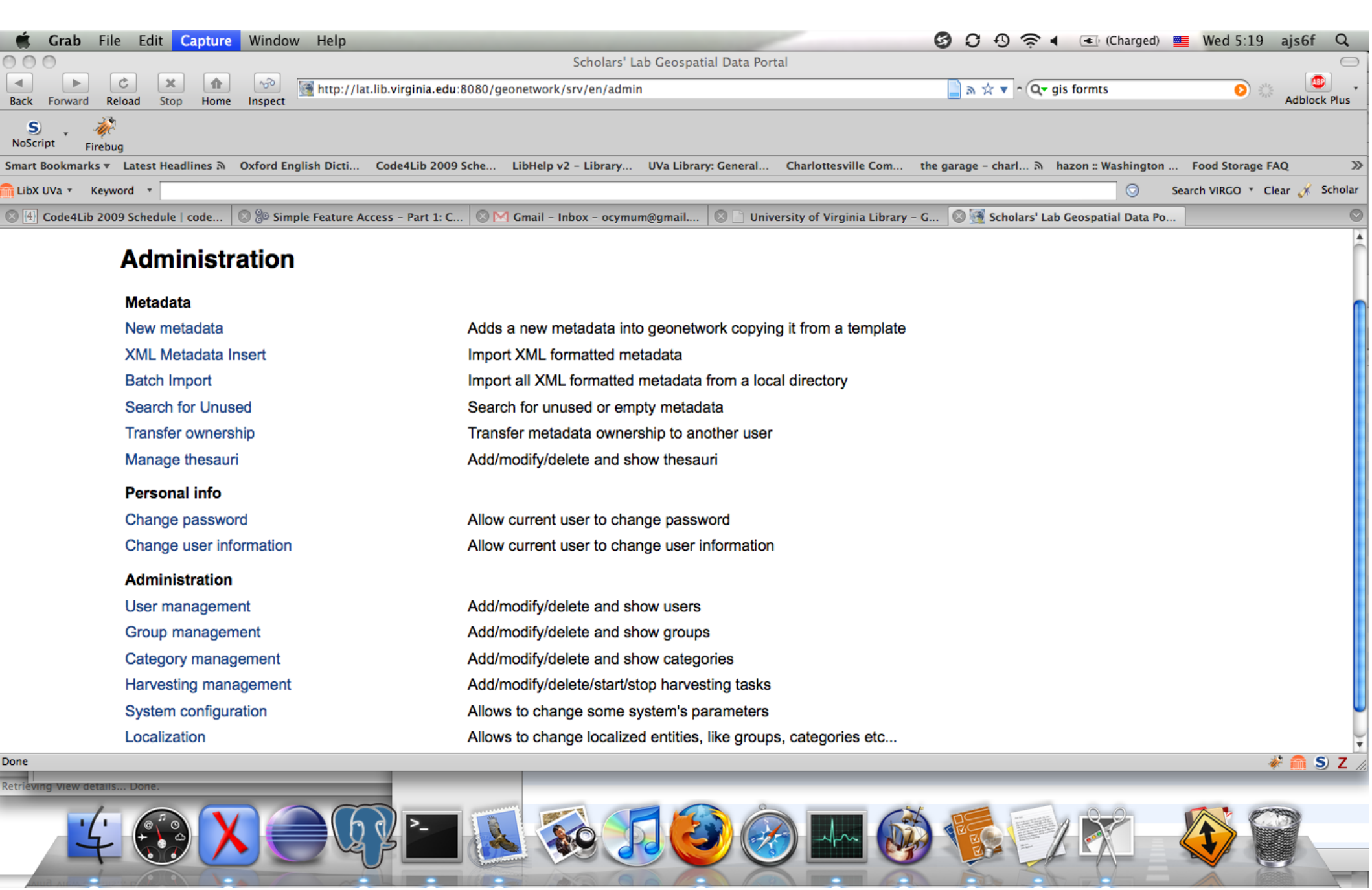
Charlottesville_Driveways
Charlottesville_CityLimits
Charlottesville_Creeks_Rivers
OpenLayers Base Layer
Add New Remove
Map
Available Layers
Done
Retrieving view details... Done.


Grab File Edit Capture Window Help
(Charged) Wed 5:19 ajs6f
Scholars' Lab Geospatial Data Portal
Back Forward Reload Stop Home Inspect
http://lat.lib.virginia.edu:8080/geonetwork/srv/en/admin
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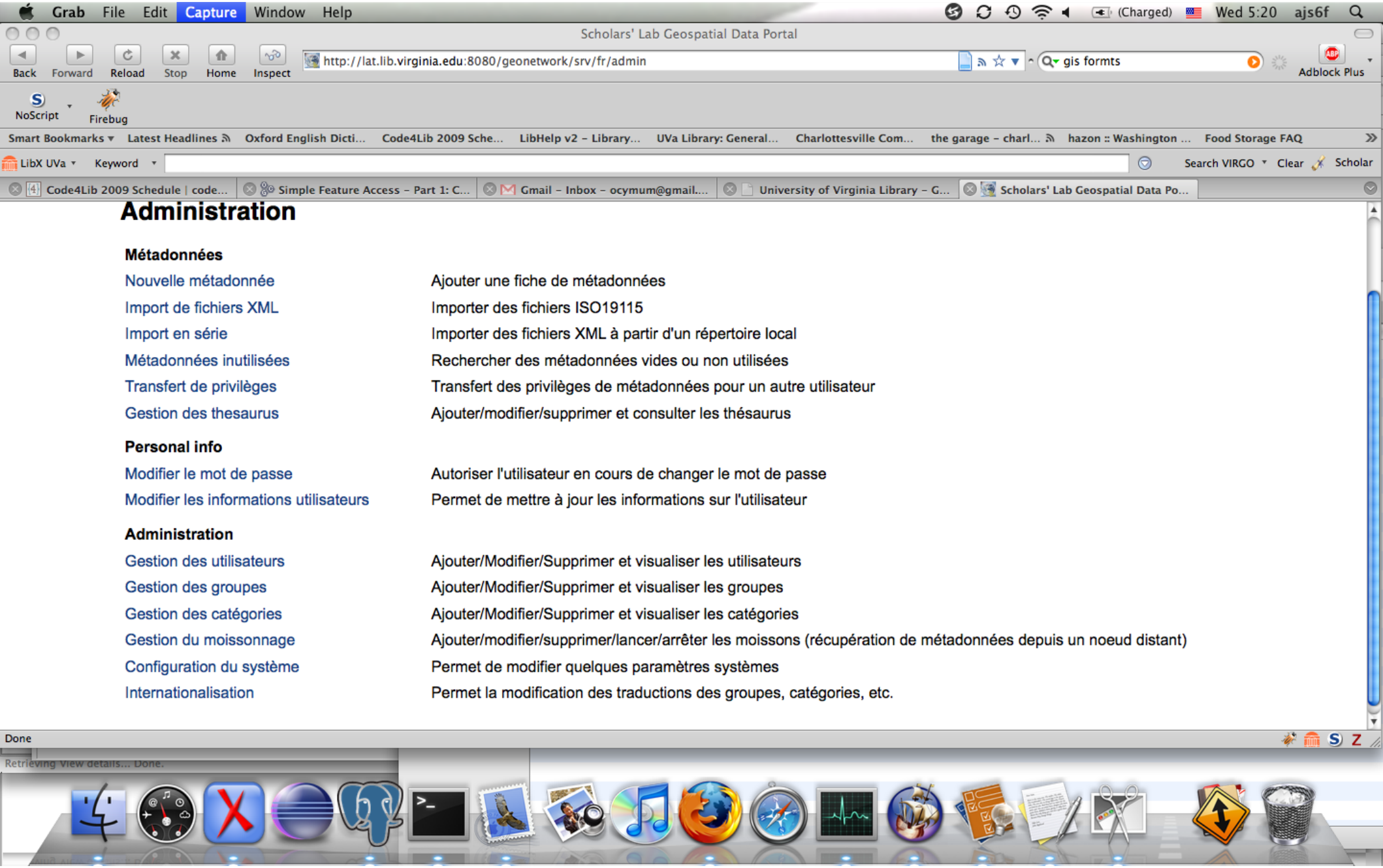
NoScript
Firebug
Smart Bookmarks Latest Headlines Oxford English Dicti... Code4Lib 2009 Sche... LibHelp v2 - Library... UVa Library: General... Charlottesville Com... the garage - charl... hazon :: Washington ... Food Storage FAQ
LibX UVa Keyword
Search VIRGO Clear Scholar
Code4Lib 2009 Schedule | code...
Simple Feature Access - Part 1: C...
Gmail - Inbox - ocymum@gmail....
University of Virginia Library - G...
Scholars' Lab Geospatial Data Po...
Administration
Metadata
New metadata
Adds a new metadata into geonetwork copying it from a template
XML Metadata Insert
Import XML formatted metadata
Batch Import
Import all XML formatted metadata from a local directory
Search for Unused
Search for unused or empty metadata
Transfer ownership
Transfer metadata ownership to another user
Manage thesauri
Add/modify/delete and show thesauri
Personal info
Change password
Allow current user to change password
Change user information
Allow current user to change user information
Administration
User management
Add/modify/delete and show users
Group management
Add/modify/delete and show groups
Category management
Add/modify/delete and show categories
Harvesting management
Add/modify/delete/start/stop harvesting tasks
System configuration
Allows to change some system's parameters
Localization
Allows to change localized entities, like groups, categories etc...
Done
Retrieving View details... Done.


Grab File Edit Capture Window Help
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Scholars' Lab Geospatial Data Portal
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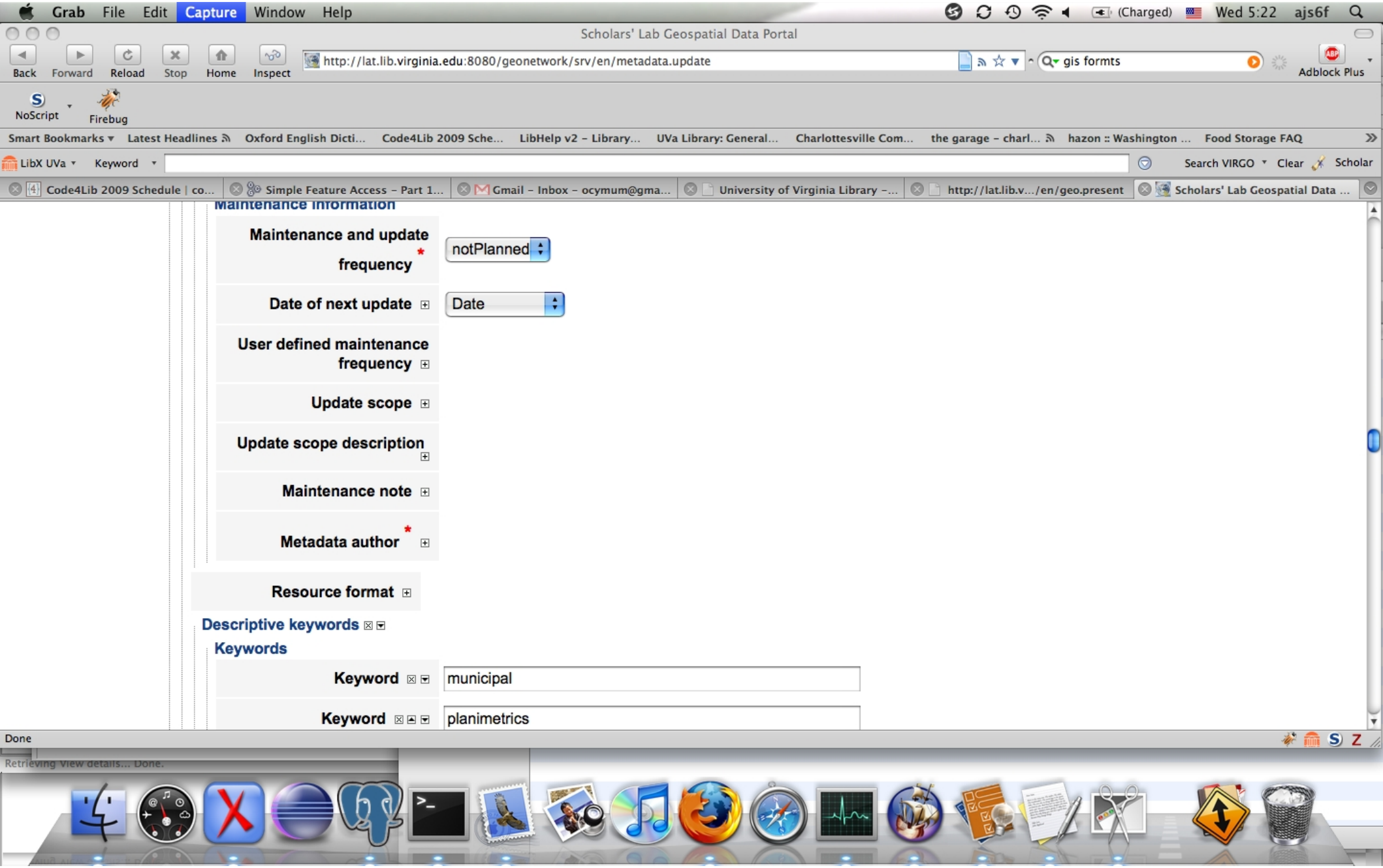
Smart Bookmarks Latest Headlines Oxford English Dicti... Code4Lib 2009 Sche... LibHelp v2 - Library... UVa Library: General... Charlottesville Com... the garage - charl... hazon :: Washington ... Food Storage FAQ
LibX UVa Keyword Search VIRGO Clear Scholar
Code4Lib 2009 Schedule | code... Simple Feature Access - Part 1: C... Gmail - Inbox - ocymum@gmail.... University of Virginia Library - G... Scholars' Lab Geospatial Data Po...
Administration
Métadonnées
Nouvelle métadonnée Ajouter une fiche de métadonnées
Import de fichiers XML Importer des fichiers ISO19115
Import en série Importer des fichiers XML à partir d'un répertoire local
Métadonnées inutilisées Rechercher des métadonnées vides ou non utilisées
Transfert de privilèges Transfert des privilèges de métadonnées pour un autre utilisateur
Gestion des thesaurus Ajouter/modifier/supprimer et consulter les thésaurus
Personal info
Modifier le mot de passe Autoriser l'utilisateur en cours de changer le mot de passe
Modifier les informations utilisateurs Permet de mettre à jour les informations sur l'utilisateur
Administration
Gestion des utilisateurs Ajouter/Modifier/Supprimer et visualiser les utilisateurs
Gestion des groupes Ajouter/Modifier/Supprimer et visualiser les groupes
Gestion des catégories Ajouter/Modifier/Supprimer et visualiser les catégories
Gestion du moissonnage Ajouter/modifier/supprimer/lancer/arrêter les moissons (récupération de métadonnées depuis un noeud distant)
Configuration du système Permet de modifier quelques paramètres systèmes
Internationalisation Permet la modification des traductions des groupes, catégories, etc.
Done
Retrieving view details... Done.


Grab File Edit Capture Window Help
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Scholars' Lab Geospatial Data Portal
Back Forward Reload Stop Home Inspect
http://lat.lib.virginia.edu:8080/geonetwork/srv/en/metadata.update
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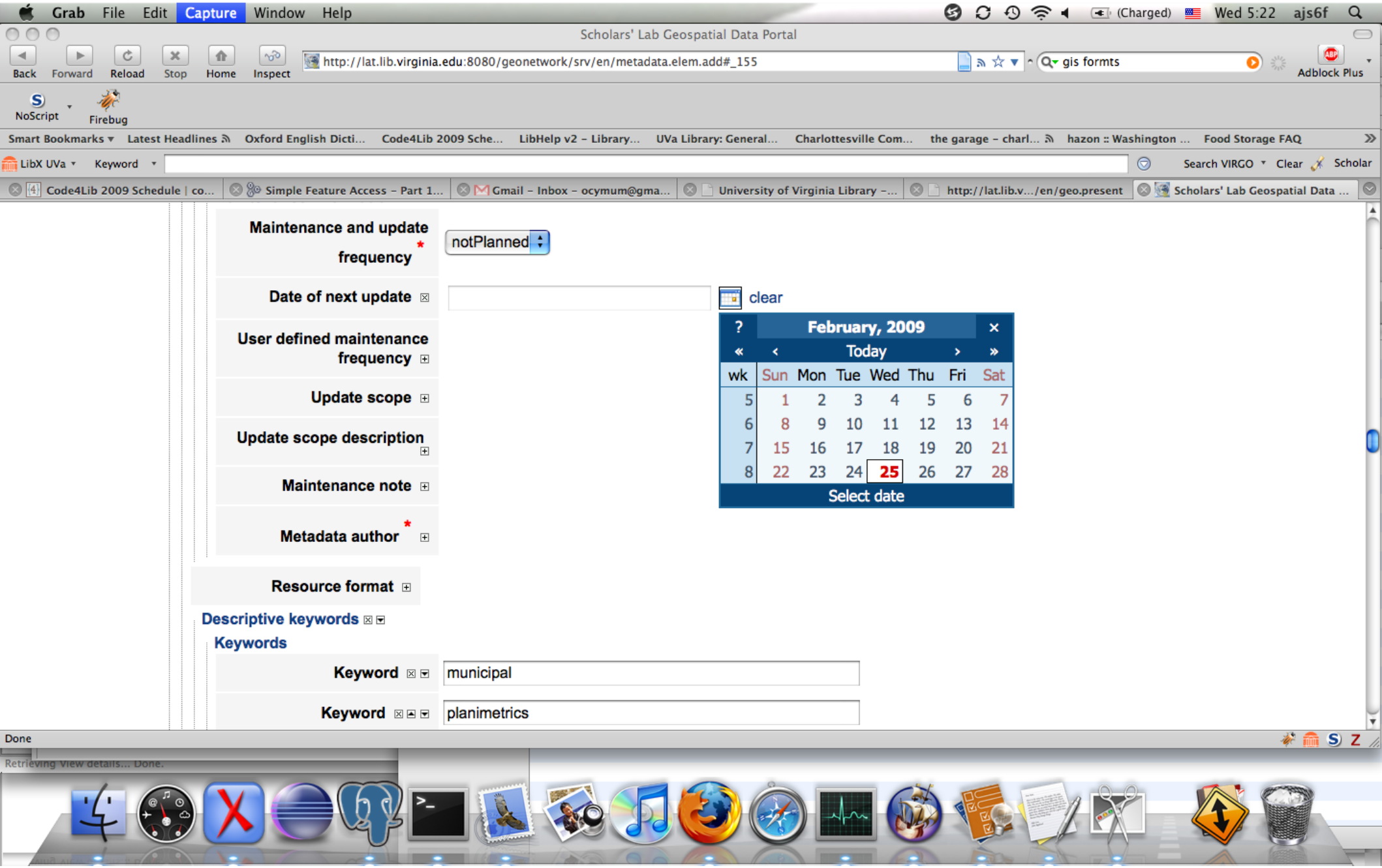
Smart Bookmarks Latest Headlines Oxford English Dicti... Code4Lib 2009 Sche... LibHelp v2 - Library... UVa Library: General... Charlottesville Com... the garage - charl... hazon :: Washington ... Food Storage FAQ
LibX UVa Keyword Search VIRGO Clear Scholar
Code4Lib 2009 Schedule | co... Simple Feature Access - Part 1... Gmail - Inbox - ocymum@gma... University of Virginia Library -... http://lat.lib.v.../en/geo.present Scholars' Lab Geospatial Data ...
Maintenance information
Maintenance and update frequency *
notPlanned
Date of next update
Date
User defined maintenance frequency
Update scope
Update scope description
Maintenance note
Metadata author *
Resource format
Descriptive keywords
Keywords
Keyword
municipal
Keyword
planimetrics
Done
Retrieving view details... Done.


Grab File Edit Capture Window Help
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Scholars' Lab Geospatial Data Portal
Back Forward Reload Stop Home Inspect
http://lat.lib.virginia.edu:8080/geonetwork/srv/en/metadata.elem.add#_155
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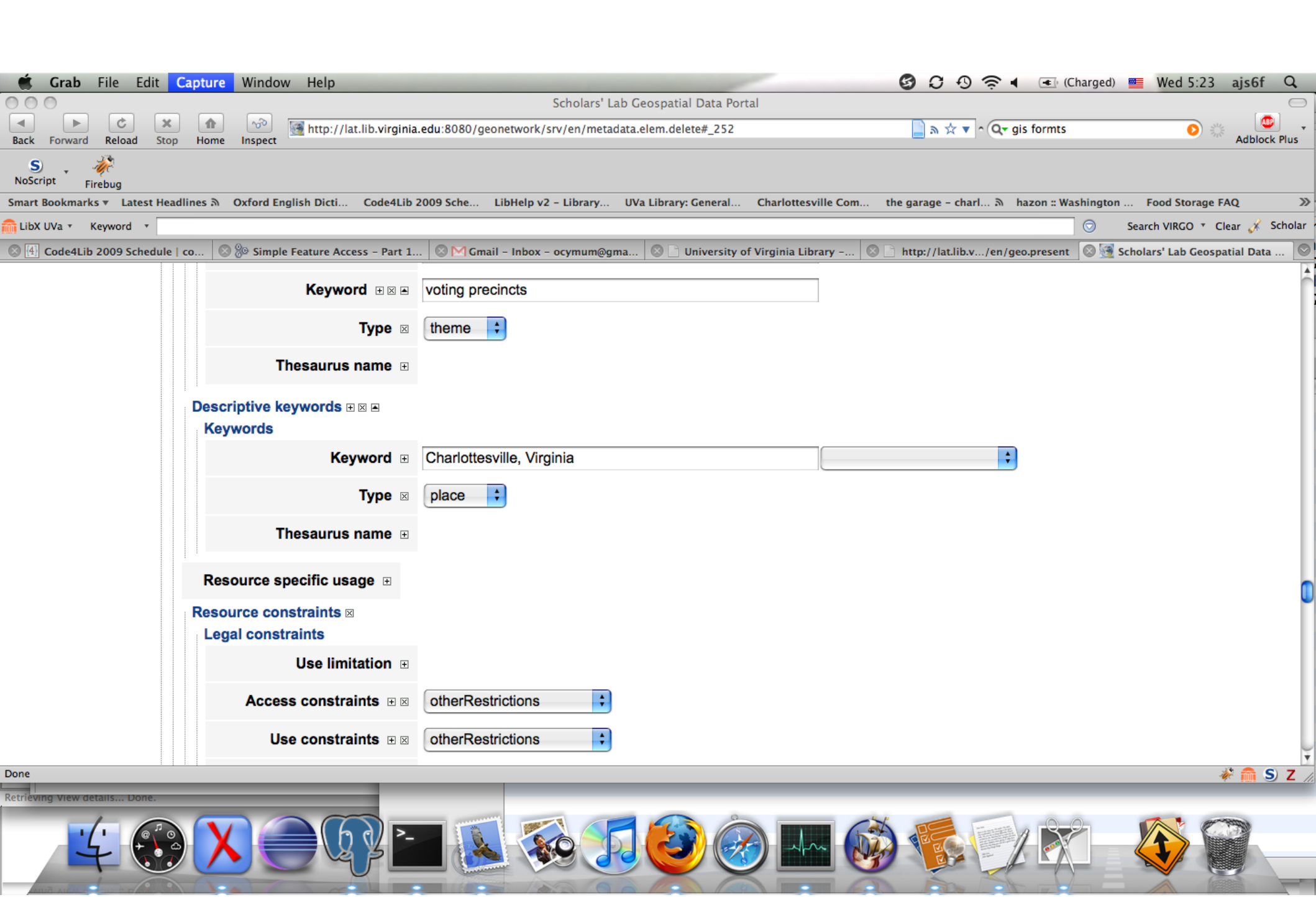
NoScript Firebug
Smart Bookmarks Latest Headlines Oxford English Dicti... Code4Lib 2009 Sche... LibHelp v2 - Library... UVa Library: General... Charlottesville Com... the garage - charl... hazon :: Washington ... Food Storage FAQ
LibX UVa Keyword Search VIRGO Clear Scholar
Code4Lib 2009 Schedule | co... Simple Feature Access - Part 1... Gmail - Inbox - ocymum@gma... University of Virginia Library -... http://lat.lib.v.../en/geo.present Scholars' Lab Geospatial Data ...
Maintenance and update frequency *
notPlanned
Date of next update
clear
User defined maintenance frequency
Update scope
Update scope description
Maintenance note
Metadata author *
February, 2009
Today
wk Sun Mon Tue Wed Thu Fri Sat
5 1 2 3 4 5 6 7
6 8 9 10 11 12 13 14
7 15 16 17 18 19 20 21
8 22 23 24 25 26 27 28
Select date
Resource format
Descriptive keywords
Keywords
Keyword
municipal
Keyword
planimetrics
Done
Retrieving view details... Done.


Grab File Edit Capture Window Help
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Scholars' Lab Geospatial Data Portal
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http://lat.lib.virginia.edu:8080/geonetwork/srv/en/metadata.elem.delete#_252
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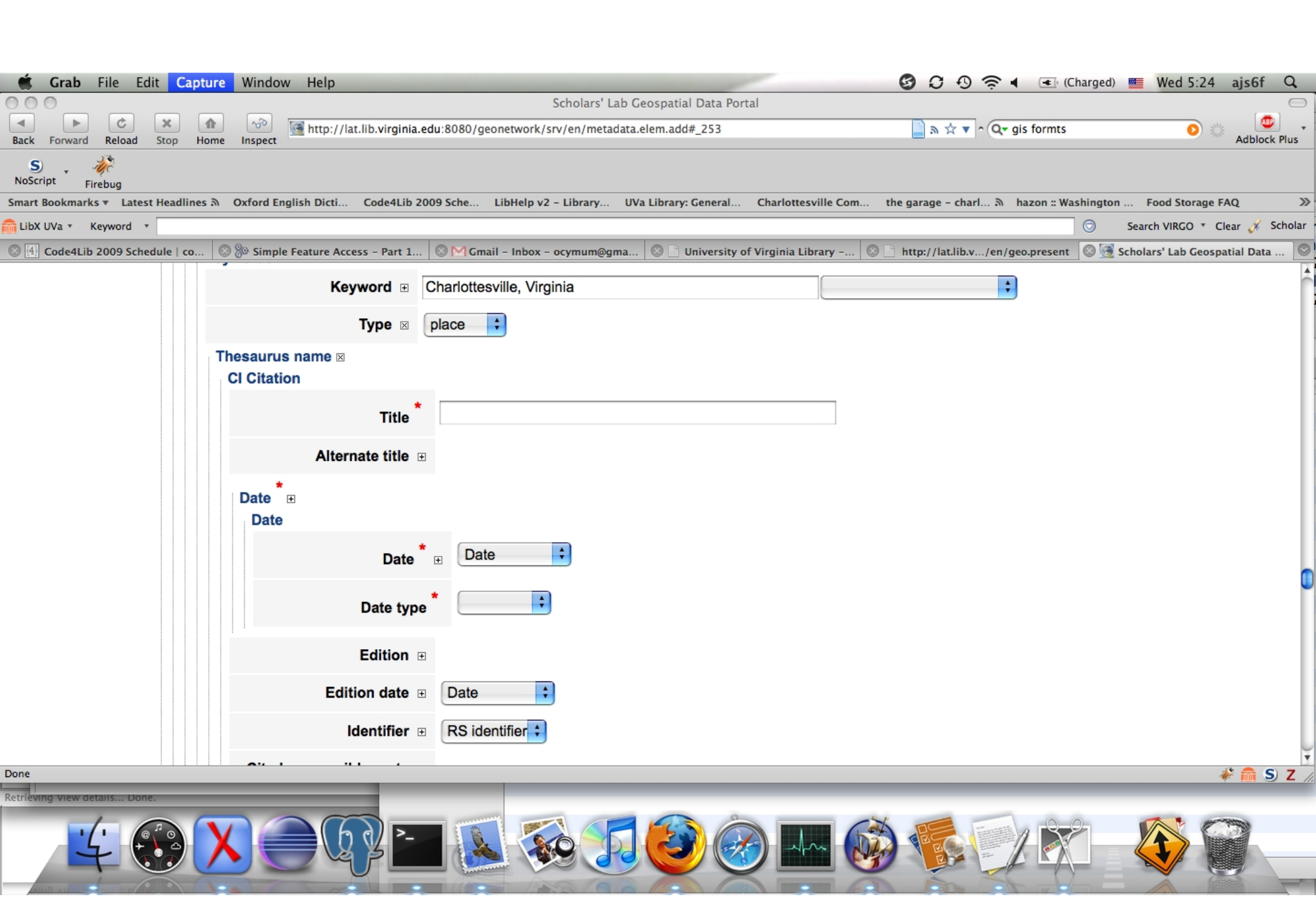
NoScript Firebug
Smart Bookmarks Latest Headlines Oxford English Dicti... Code4Lib 2009 Sche... LibHelp v2 - Library... UVa Library: General... Charlottesville Com... the garage - charl... hazon :: Washington ... Food Storage FAQ
LibX UVa Keyword Search VIRGO Clear Scholar
Code4Lib 2009 Schedule | co...
Simple Feature Access - Part 1...
Gmail - Inbox - ocymum@gma...
University of Virginia Library -...
http://lat.lib.v.../en/geo.present
Scholars' Lab Geospatial Data ...
Keyword
voting precincts
Type
theme
Thesaurus name
Descriptive keywords
Keywords
Keyword
Charlottesville, Virginia
Type
place
Thesaurus name
Resource specific usage
Resource constraints
Legal constraints
Use limitation
Access constraints
otherRestrictions
Use constraints
otherRestrictions
Done
Retrieving view details... Done.


Grab File Edit Capture Window Help
(Charged) Wed 5:24 ajs6f
Scholars' Lab Geospatial Data Portal
Back Forward Reload Stop Home Inspect
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Adblock Plus
NoScript Firebug
Smart Bookmarks Latest Headlines Oxford English Dicti... Code4Lib 2009 Sche... LibHelp v2 - Library... UVa Library: General... Charlottesville Com... the garage - charl... hazon :: Washington ... Food Storage FAQ
LibX UVa Keyword Search VIRGO Clear Scholar
Code4Lib 2009 Schedule | co... Simple Feature Access - Part 1... Gmail - Inbox - ocymum@gma... University of Virginia Library -... http://lat.lib.v.../en/geo.present Scholars' Lab Geospatial Data ...
Keyword Charlottesville, Virginia
Type place
Thesaurus name
CI Citation
Title
Alternate title
Date
Date
Date Date
Date type
Edition
Edition date Date
Identifier RS identifier
Done
Retrieving view details... Done.