

Jerrold Robaidek

May 7, 2012

McIDAS-XCD Replacement



Rewrite Team

- Kevin Baggett, Kevin Hallock, Dave Parker, Roseann Spangler, Becky Schaffer, Jerrold Robaidek

McIDAS XCD

McIDAS X C D Conventional Data Decoder

McIDAS-XCD files, decodes and indexes the NOAAPORT data stream into formats that can be served by McIDAS-X ADDE servers.

Output formats include McIDAS MD files, Text files, GRID files, grib1 and grib2 files, NEXRAD files, and BUFR files.

NOAAPORT Data

- The NOAAPORT broadcast system provides a one-way broadcast communication of NOAA environmental data and information in near-real time to NOAA and external users. This broadcast service is implemented by a commercial provider of satellite communications utilizing C-band.

NOAAPORT Channels

■ GOES Channel

- GOES-East visible, infrared, and water vapor for the Eastern Conterminous United States (CONUS), Puerto Rico, supernational composites, and Northern Hemisphere (NH) composites
- GOES-West. visible, infrared, water vapor for CONUS, Alaska, and Hawaii; supernational composites, and NH composites

■ *NCEP/NWSTG Channel (NWS Telecommunications Gateway)

- model output from the National Centers for Environmental Prediction (NCEP)
- observations, forecasts, watches and warnings produced by NWS Forecast Offices
- WSR-88D radar products
- most observational data over North America

■ *NCEP/NWSTG2 Channel

- supplements the NWSTG channel

■ Non-GOES Imagery/DCP Data Channel

- GOES DCP data
- GMS/GOES-West/GOES-East/METEOSAT-7/METOSAT-9 composites for visible, IR, and water vapor products (every 3 hours)
- OCONUS grids

NOAAPORT Data flow into SSEC

Users generally get NOAAPORT data in two Ways:

1. Directly from DOMSAT (101°W)
2. Over the Internet via LDM

Why replace XCD?

- Installation is difficult
- Upgrades are difficult
- System is overly complex, large learning curve for operators, and very large learning curve for new programmer
- System was written for a mainframe then ported to UNIX
- A powerful system is needed to run XCD, otherwise data can be lost
- A data format change can mean bad data, and a fix can be difficult to implement, and is only effective for future data

Survey Highlights

- Survey was sent out during the last Quarter of 2010
- 26 responses (*not all current users of XCD*)
- Feed types decoded:
 - 33% used for CONDUIT feed
 - 100% used for NOAAPORT
 - Local data?
- All used XCD with LDM
- Built in monitoring not used?

Goals

- Replace 4 parts of XCD filing and decoding:
 - GRIB (prototype done)
 - NEXRAD (prototype done)
 - Text (in process)
 - MD serving (in process)
- Utilize LDM direct filing
- Create simple interface to pqact.conf and ldmd.conf to select and edit data to be filed
- Reduce or eliminate compiled code
- Remove legacy mainframe complexity
- Utilize simple open-source database, SQLite
- No more GRIDXXXX files created by XCD
- Match or exceed current filing and serving performance on existing hardware


GRIB details

- LDM files GRIB files to a temporary directory
- A GRIB daemon watches for directories, and moves it to a temporary directory name
- Another daemon watches for temporary directories and extracts information and files metadata in to an SQLite DB; One SQLite DB per model per day

GRIB processing

GRIB messages arrive on LDM

```
!grib/ncep/NAM_84/#215/201204251800/Foo3/VGRD/90-60 mb above gnd/  
!grib/ncep/NAM_84/#212/201204251800/Foo9/RH/925 mb/  
!grib2/ncep/NAM_84/#218/201204251800/Foo9/UREL/525 hPa PRES  
!grib2/ncep/NAM_84/#218/201204251800/Foo9/AVOR/250 hPa PRES  
!grib2/ncep/NAM_84/#218/201204251800/Foo9/RELH/500 hPa PRES
```



LDM directly files GRIB message to disk

```
...  
FILE -close /data/xcd/incoming_grib.tmp/\2-\3.\4\5\6_\7_\8.grib1  
...  
FILE -close /data/xcd/incoming_grib.tmp/\2-\3.\4\5\6_\7_\8.grib2
```

Daemon xcdgribdir.sh moves temporary directory to processing directory

Daemon xcdgribprocess.sh runs rt_gribdblite.k on all gribfiles in the temporary directory, extracts metadata to put into the SQL Lite database and moves the data to the final directory.

```
/data/xcd/incoming_grib.tmp/  
NAM_84-#215.20120425_18_003.grib1  
NAM_84-#212.20120425_18_009.grib1  
NAM_84-#218.20120425_18_009.grib2
```

```
/data/xcd/incoming_grib.process/2012117_220304  
NAM_84-#215.20120425_18_003.grib1  
NAM_84-#212.20120425_18_009.grib1  
NAM_84-#218.20120425_18_009.grib2
```

```
/data/xcd/database/2012117/2012117_grib2NAM_84.sqlite  
/data/xcd/database/2012117/2012117_grib1NAM_84.sqlite
```

```
/data/xcd/grib/  
NAM_84-#215.20120425_18_003.grib1  
NAM_84-#212.20120425_18_009.grib1  
NAM_84-#218.20120425_18_009.grib2
```

GRIB processing

GRIB messages arrive on LDM

```
!grib/ncep/NAM_84/#215/201204251800/Foo3/VGRD/90-60 mb above gnd/  
!grib/ncep/NAM_84/#212/201204251800/Foo9/RH/925 mb/  
!grib2/ncep/NAM_84/#218/201204251800/Foo9/UREL/525 hPa PRES  
!grib2/ncep/NAM_84/#218/201204251800/Foo9/AVOR/250 hPa PRES  
!grib2/ncep/NAM_84/#218/201204251800/Foo9/RELH/500 hPa PRES
```

LDM directly files GRIB message to disk

```
...  
FILE -close /data/xcd/incoming_grib.tmp/\2-\3.\4\5\6_\7_\8.grib1  
...  
FILE -close /data/xcd/incoming_grib.tmp/\2-\3.\4\5\6_\7_\8.grib2
```

/data/xcd/incoming_grib.tmp/
NAM_84-#215.20120425_18_003.grib1
NAM_84-#212.20120425_18_009.grib1
NAM_84-#218.20120425_18_009.grib2

Daemon xcdgribdir.sh moves temporary directory to processing directory

/data/xcd/incoming_grib.process/2012117_220304
NAM_84-#215.20120425_18_003.grib1
NAM_84-#212.20120425_18_009.grib1
NAM_84-#218.20120425_18_009.grib2

Daemon xcdgribprocess.sh runs rt_gribdblite.k on all gribfiles in the temporary directory, extracts metadata to put into the SQL Lite database and moves the data to the final directory.

/data/xcd/database/2012117/2012117_grib2NAM_84.sqlite
/data/xcd/database/2012117/2012117_grib1NAM_84.sqlite

/data/xcd/grib/
NAM_84-#215.20120425_18_003.grib1
NAM_84-#212.20120425_18_009.grib1
NAM_84-#218.20120425_18_009.grib2

NEXRAD Details

- LDM files NEXRAD files into a directory structure similar to existing XCD Decoder
- Data served by NEXRAD server

NEXRAD to Disk

NEXRAD via LDM

```
.....  
NEXRAD3 15995913 SDUS86 KOTX 261535 /pNoCOTX !nids/  
NEXRAD3 15995914 SDUS86 KOTX 261535 /pNoHOTX !nids/  
NEXRAD3 15995915 SDUS55 KTWC 261528 /pDPAEMX  
NEXRAD3 15995916 SDUS24 KMAF 261529 /pN2SMAF  
NEXRAD3 15995917 SDUS74 KTSA 261534 /pTV2TUL !nids/  
.....
```

```
(pqact.cfg)  
NEXRAD3 ^SDUS.. .... ([0-3][0-9])([0-2][0-9])([0-6][0-9]).*/p(...)(...)  
FILE -close /data/xcd/nexrad/\5/\4/\5_(\1:yyyy)(\1:mm)\1_\2\3.\4
```

```
/data/xcd/nexrad/OTX/N0C/OTX_20120426_1535.N0C  
/data/xcd/nexrad/OTX/N0H/OTX_20120426_1535.N0H  
/data/xcd/nexrad/EMX/DPA/EMX_20120426_1528.DPA  
/data/xcd/nexrad/MAF/N2S/MAF_20120426_1529.N2S  
/data/xcd/nexrad/TUL/TV2/TUL_20120426_1534.TV2
```

Text

- LDM files data directly to disk
- A script running as a daemon watches for new data and files data into a daily *.XCD file as data comes in
 - New -XCD:
 - A concatenation of the text from the LDM stream
 - No stripping out of start of text, carriage returns, line feeds, end of text
 - Current -XCD:
 - Starts with the date of the file (in binary) and a total 80-byte header
 - Padding (spaces) in the file - to make 80 character lines - carriage returns and line feeds have been stripped out
 - Start of text character 0x01 and end of text character 0x03 are included, and also are 80-character padded
- Script extracts metadata to put into SQLite DB
- Text server accesses SQLite DB to find data and return information to server

Text processing

text messages

```
IDS|DDPLUS 16144267 FLUS42 KFFC 261659 /pHWOFFC
IDS|DDPLUS 16144301 SIAA01 KARS 261600 RRB
IDS|DDPLUS 16144298 SRBZ40 KWAL 261659
IDS|DDPLUS 16144426 SRUS55 KTWC 261659 /pRR2TWC
```

LDM directly files text message to disk

```
...
PPS|DDS|IDS (^.....) ([A-Z] [A-Z] [A-Z] [A-Z]) (.....) ( |) (... |) (
/|) (p..... |)
FILE -close /data/xcd/incoming_text/\1-\2.\3\7.txt
```

/data/xcd/incoming_text/

```
FLUS42-KFFC.261659pHWOFFC.txt
SIAA01-KARS.261600.txt
SRBZ40-KWAL.261659.txt
SRUS55-KTWC.261659pRR2TWC.txt
```

Daemon xcdtextdir.sh moves temporary directory to processing directory

```
/data/xcd/incoming_text.process/2012117_180304
FLUS42-KFFC.261659pHWOFFC.txt
SIAA01-KARS.261600.txt
SRBZ40-KWAL.261659.txt
SRUS55-KTWC.261659pRR2TWC.txt
```

Daemon xcdtextprocess.sh runs on all files in the temporary directory, extracts meta data to put in the SQL Lite database and moves the data to the final directory.

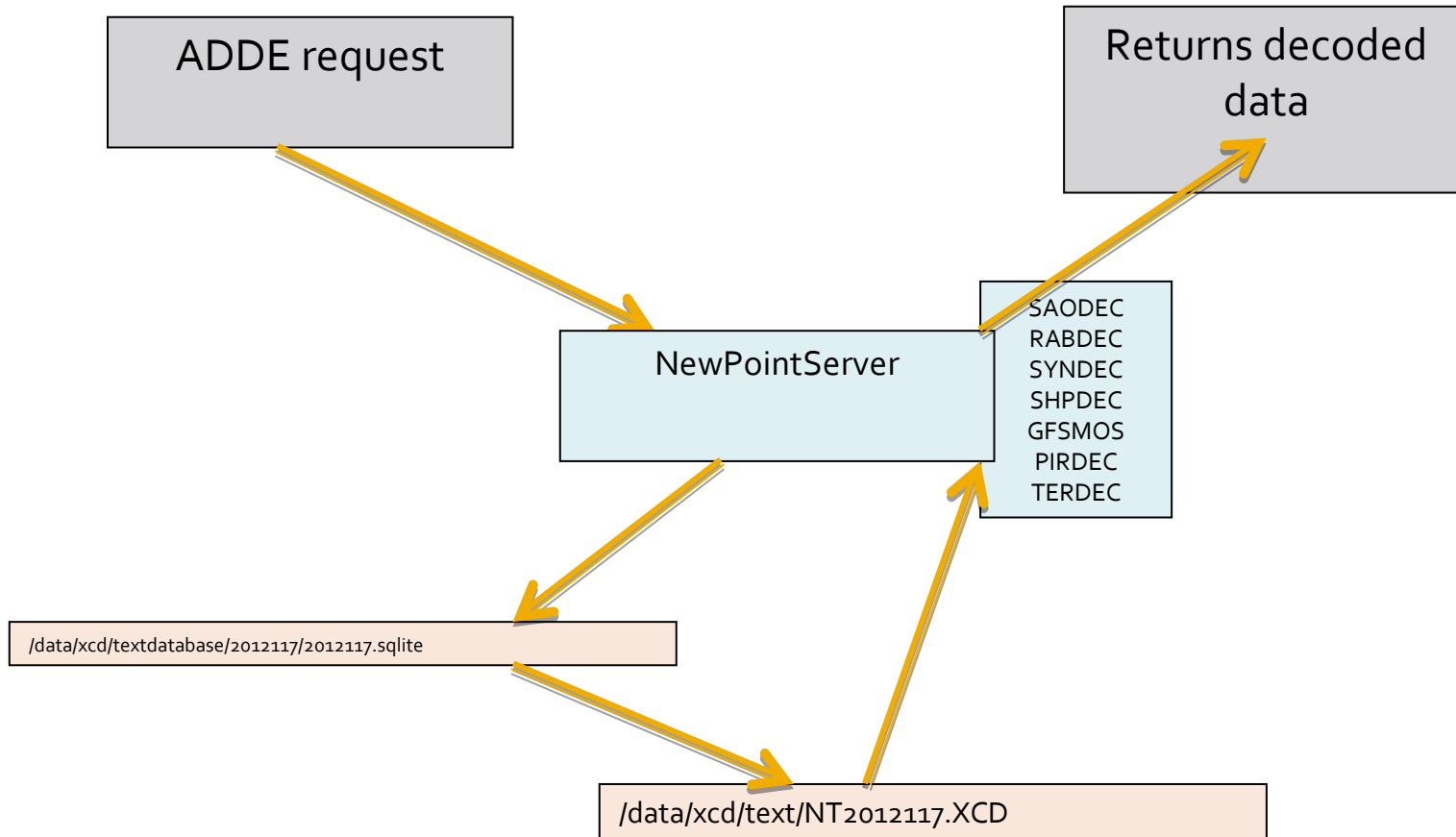
/data/xcd/textdatabase/2012117/2012117.sqlite

/data/xcd/text/NT2012117.XCD

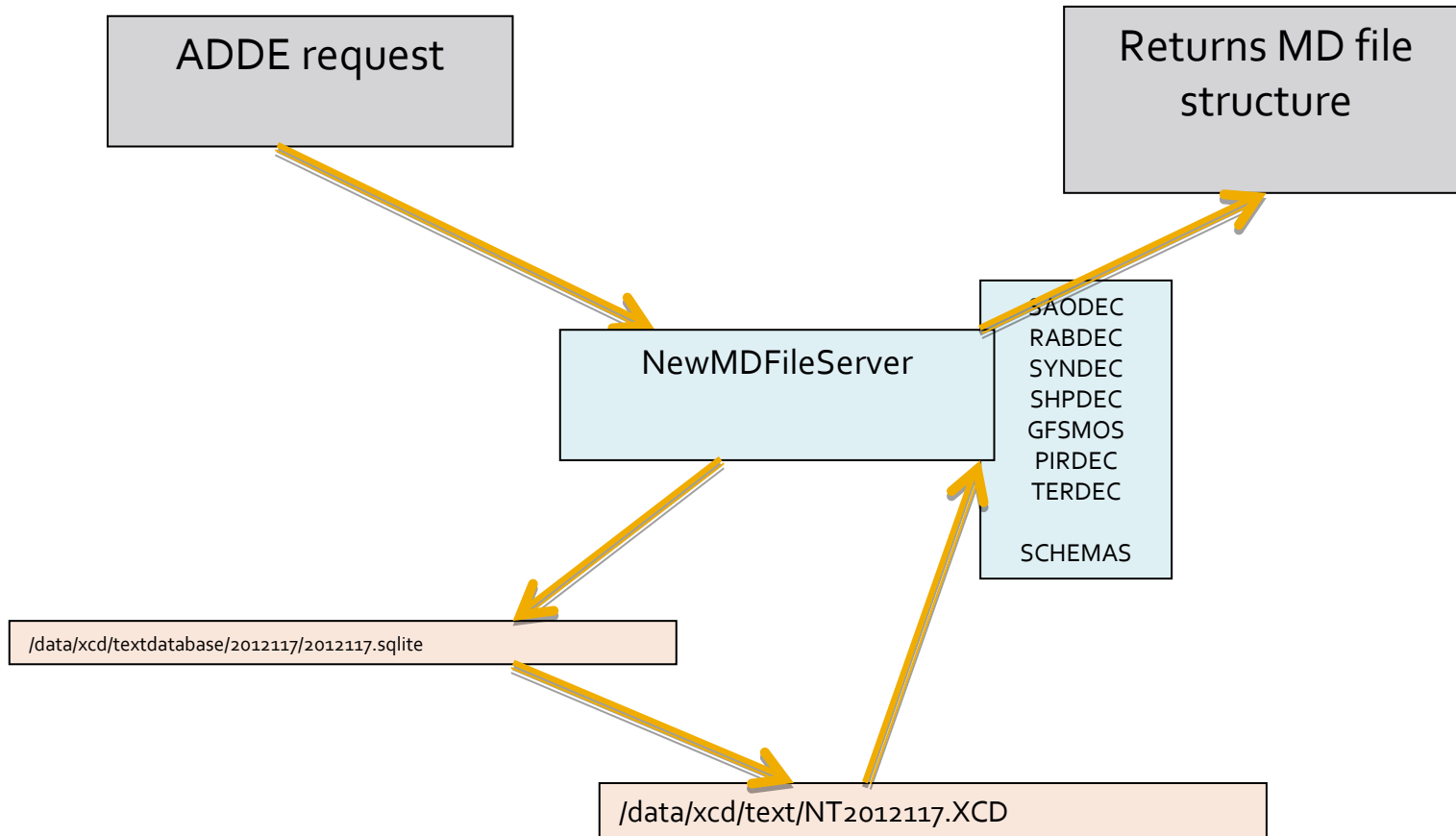
MD

- Uses the *.XCD file created by the text filer
- No MD files created (current plan)
- PTLIST and PTDISP serves from *.XCD file
- PTCOPY serves from *.XCD file
- Daily Station Database
- Station Database is retained for archived data

MD data ADDE serving (PTLIST & PTDISP)



MD data ADDE serving (PTCOPYY)



BUFR

(Binary Universal FoRmat)

- Filed directly using LDM
- No operational server exists, only a prototype server

LDM pqact.cfg configuration assistant

- Allows user to select Models, stations, parameters, etc
- Web interface
- Cut and paste to pqact.cfg

pqact assistant

The screenshot shows the Mozilla Firefox browser window displaying the pqact assistant interface. The address bar shows the URL `dcdb.ssec.wisc.edu/pqact/`. The page has a navigation bar with tabs for **WMO**, **NEXRAD3**, **HRS|HDS|GRID**, and **Summarize**. A text input field labeled "Base path:" contains the value `/data/xcd/`. Below the navigation bar is a list of checkboxes for various data categories, with several checked. At the bottom, there is a list of file paths generated by the application, each preceded by a WMO code and a pattern of dots representing a file name.

WMO Text data, observations, data
 Administrative messages
 Climate data
 Forecast data
 Severe weather reports
 Summary reports
 CMAN reports
 Earthquake reports
 Fronts
 Miscellaneous surface reports
 MOS data
 Pilot reports
 River reports
 Surface METAR obs
 Satellite /data/newxcd/text
 Synoptic reports (SYNOP,SHIP)
 Terminal forecasts
 Upper air
 Watch boxes
 Miscellaneous
 Lightning
 Rebook graphics
 Tropical advisories

```
WMO ^..... .... {[0-3][0-9]}{[0-2][0-9]}
FILE /data/xcd/text/{\1:yyyy}{\1:ddd}/NT{\1:yy}{\1:ddd}0.XCD

WMO ^C..... .... {[0-3][0-9]}{[0-2][0-9]}
FILE /data/xcd/text/{\1:yyyy}{\1:ddd}/{\1:yy}{\1:mm}\1\2_cli.wmo

WMO ^A..... .... {[0-3][0-9]}{[0-2][0-9]}
FILE /data/xcd/text/{\1:yyyy}{\1:ddd}/{\1:yy}{\1:mm}\1\2_sum.wmo

WMO ^ASUS01 .... {[0-3][0-9]}{[0-2][0-9]}
FILE /data/xcd/text/{\1:yyyy}{\1:ddd}/{\1:yy}{\1:mm}\1\2_frt.wmo

WMO ^U[AB].... .... {[0-3][0-9]}{[0-2][0-9]}
FILE /data/xcd/text/{\1:yyyy}{\1:ddd}/{\1:yy}{\1:mm}\1\2_pirep.wmo
```

pqact assistant

The screenshot shows a web browser window titled "Mozilla Firefox" with the address bar displaying "dcdbs.ssec.wisc.edu/pqact/". The page content includes a navigation menu with "WMO", "NEXRAD3", "HRS|HDS|NGRID", and "Summarize" buttons. A "Base path:" field contains "/data/xcd/". Below this are "Add a station:" and "Remove a station:" buttons. A list of data products is shown with checkboxes: "None", "All", "NCR - Composite Reflectivity (16 Levels)", "DHR - Digital Hybrid Scan Reflectivity", "DPA - Digital Precipitation Array", "DSP - Digital Storm Total Precipitation", "NTP - Storm Total Precipitation", "NVL - Vertical Integrated Liquid", "NOR - Base Reflectivity (lowest elevation angle)", "NOV - Base Velocity (lowest elevation angle)", "NOS - Storm Relative Velocity (lowest elevation angle)", "TR0 - TDWR Base Reflectivity", "TV0 - TDWR Base Velocity", and "TZL - TDWR Long Range Base Reflectivity (0.6 elev angle)". At the bottom, a code block shows the command:

```
NEXRAD3 ^SDUS5. .... {[0-3][0-9]}{[0-2][0-9]}{[0-6][0-9]}.*/p(NCR|DSP|NVL|NOR|NOV|NOS)(...)  
FILE -close  
/data/xcd/nexrad/5/4/(\1:yyyy)(\1:ddd)/2/5_(\1:yyyy)(\1:mm)(\1:dd)_2\3.\4
```

pqact assistant

Mozilla Firefox

dcdb.ssec.wisc.edu/pqact/

Most Visited UW VPN Spring Cold Inju... Freeze Protectio... wine Google THREDDS Data S... Satellite Status Wisconsin Surpl... Data Check Links Wisconsin Cli... property Wolfram|Alpha

http://dcdb.ssec.wisc.edu/pqact/

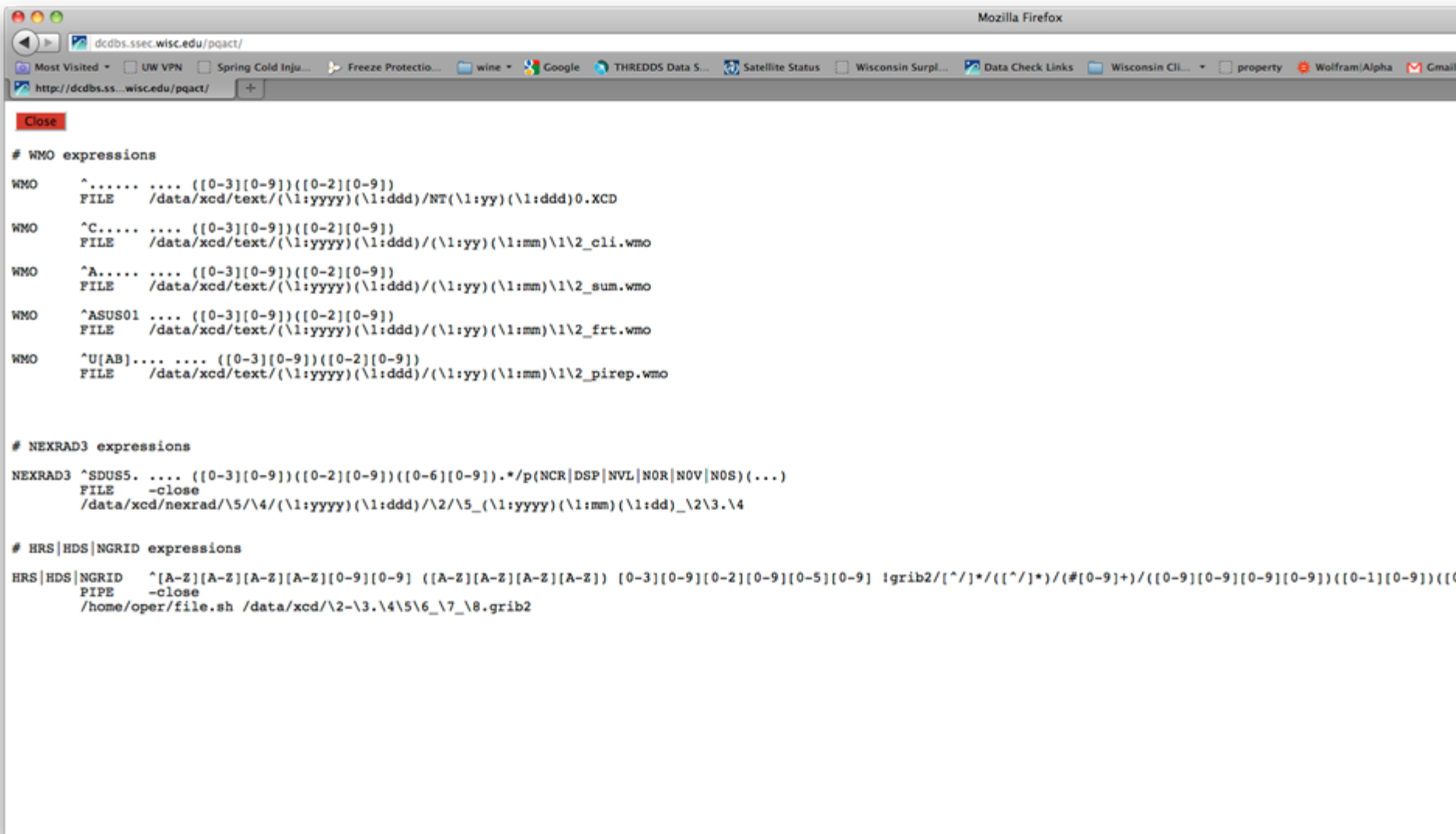
WMO NEXRAD3 HRS|HDS|NGRID Summarize Base path: /data/xcd/

- None
- All
- CPC
- DGEX_115
- FORECASTER
- GFS
- GLWM
- GMGWM
- ICE_120
- LAMP
- NAM_84
- NCEP_QPF
- NDFD
- NMM_89
- NWS
- RTMA
- RUC2
- SREF_113
- SSIGFS
- SST
- SURGE

Add a product: Remove a product:

```
HRS|HDS|NGRID ^[A-Z][A-Z][A-Z][A-Z][0-9][0-9] ([A-Z][A-Z][A-Z][A-Z]) [0-3][0-9][0-2][0-9][0-5][0-9] !grib2/[^\/*]*/([^\/*]*/)(#[0-9]+)/([0-9][0-9][0-9][0-9])([0-1][0-9])
PIPE -close
/home/oper/file.sh /data/xcd/\2-\3.\4\5\6_\7_\8.grib2
```


pqact assistant



```
Close

# WMO expressions
WMO ^..... .... {[0-3][0-9]}{[0-2][0-9]}
FILE /data/xcd/text/{\1:yyyy}{\1:ddd}/NT{\1:yy}{\1:ddd}0.XCD

WMO ^C..... .... {[0-3][0-9]}{[0-2][0-9]}
FILE /data/xcd/text/{\1:yyyy}{\1:ddd}/{\1:yy}{\1:mm}{\1\2_cli.wmo

WMO ^A..... .... {[0-3][0-9]}{[0-2][0-9]}
FILE /data/xcd/text/{\1:yyyy}{\1:ddd}/{\1:yy}{\1:mm}{\1\2_sum.wmo

WMO ^ASUS01 .... {[0-3][0-9]}{[0-2][0-9]}
FILE /data/xcd/text/{\1:yyyy}{\1:ddd}/{\1:yy}{\1:mm}{\1\2_frt.wmo

WMO ^U[AB].... .... {[0-3][0-9]}{[0-2][0-9]}
FILE /data/xcd/text/{\1:yyyy}{\1:ddd}/{\1:yy}{\1:mm}{\1\2_pirep.wmo

# NEXRAD3 expressions
NEXRAD3 ^SDUS5. .... {[0-3][0-9]}{[0-2][0-9]}{[0-6][0-9]}.*/p(NCR|DSP|NVL|NOR|NOV|NOS){...}
FILE -close
/data/xcd/nexrad/\5\4/{\1:yyyy}{\1:ddd}/\2\5_{\1:yyyy}{\1:mm}{\1:dd}_\2\3.\4

# HRS|HDS|NGRID expressions
HRS|HDS|NGRID ^[A-Z][A-Z][A-Z][A-Z][0-9][0-9] {[A-Z][A-Z][A-Z][A-Z]} [0-3][0-9][0-2][0-9][0-5][0-9] !grib2/[^/]*/{[^/]*}/(#[0-9]+)/([0-9][0-9][0-9][0-9]){[0-1][0-9]}{([0-9][0-9][0-9][0-9])}
PIPE -close
/home/oper/file.sh /data/xcd/\2-\3.\4\5\6_\7_\8.grib2
```

Local feeds

- Several sites have local feeds
- We will be contacting those sites in the future for test data

Reprocessing Data

- Script with a filename argument
- Script automatically determines data type (e.g. text, GRIB)
- Files data appropriately and updates SQLite DB

Monitoring

```
oper@wilma:~ — ssh — 83x13
Thu May 3 18:43:50 UTC 2012

          files to process   files being processed
Grid products: 0(0)         0(0)
Text products: 2(16K)      66(528K)

XCD daemon statuses
Grid      Active
Text     Active

Last grid file:  RTMA-#197.20120503_18_000.grib2      (2012-05-03 18:43:24 UTC)
Last text file:  SRIL30-KWAL.031843.txt              (2012-05-03 18:43:50 UTC)
Last NEXRAD product from LDM:  MAX_20120503_1814.NVL (2012-05-03 18:19:27 UTC)
```

Performance (TEXT)

■ TEXT lists (no parameters)

- WXTLIST
 - Current XCD: fastest=.158 s slowest=1.584 s
 - New XCD: fastest=1.544 s slowest=2.453 s

■ TEXT lists

- WXTLIST WMO=SA
 - Current XCD : fastest=.024 s slowest=.556 s
 - New XCD : fastest=.026 s slowest=.612 s

Performance (SFCRPT)

■ SFCRPT

- SFCRPT KGRB 9
 - Current XCD: $\sim .0405$
 - New XCD: $\sim .6405$

Performance (GRID)

■ GRID lists

- RTGRIB2/GFS-USLC2 DAY=2012124 TIME=6:00 PAR=U NUM=10
 - Current XCD: .064 s
 - New XCD: .052 s

■ GRID display

- RTGRIB2/GFS-USLC2 DAY=2012124 TIME=6:00 PAR=U F HOUR=12 LEV=500
 - Current XCD: .868 s
 - New XCD: .414 s

■ GRID copy

- RTGRIDS/NAM-USLC2 G/G.5700 DAY=2012124 TIME=0:00 PAR=T F HOUR=9 LEV=500
 - Current XCD: .451 s
 - New XCD: .205 s

Schedule

- Prototype this summer
- Released 2013

End
