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# McIDAS-XCD Replacement



# Rewrite Team

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# McIDAS XCD

## McIDAS **X** **C**onventional Data **D**ecoder

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

The following 2 NOAAPORT channels supply data to be decoded by McIDAS-XCD:

- **NCEP/NWSTG Channel (NWS Telecommunications Gateway)**
  - model output from the National Centers for Environmental Prediction (NCEP)
  - observations, forecasts, watches and warnings from NWS Forecast Offices
  - WSR-88D radar products
  - most observational data over North America
- **NCEP/NWSTG2 Channel**
  - supplements the NWSTG channel

# 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

# Goals

- Replace 4 parts of XCD filing and decoding:
  - GRIB (prototype done)
  - NEXRAD (prototype done)
  - Text (prototype nearing completion)
  - MD serving (prototype nearing completion)
- 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
- Match or exceed current filing and serving performance on existing hardware



# GRIB Data

- LDM files GRIB messages 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 database per model per day
- See 2012 McIDAS-XCD presentation for details

# NEXRAD Data

- LDM files NEXRAD files into a directory structure similar to existing XCD Decoder
- Data served by NEXRAD server
- See 2012 McIDAS-XCD presentation for details

# Text Data

- 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 with no stripping out of start of text, carriage return, line feed, end of text characters
  - 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
    - Start of text character 0x01 and end of text character 0x03 are included, and also 80-character padded. Carriage returns/line feeds stripped out
- Script extracts metadata to put into SQLite DB
- Text server accesses SQLite DB to find data and return information to client

# Point Data

- No MD files created, but structure created on the fly by the server
- PTLIST, PTDISP and PTCOPY get metadata from the SQLite database, then extract data from the \*.XCD file created by the text filer
- Daily Station Database table included in same SQLite database file as the Daily Text Metadata table
- Station Database is retained for archived data

# BUFR Data (Binary Universal FoRmat)

- Filed directly using LDM
- No operational McIDAS-X server exists, only a prototype server
- Individual files can be loaded into McIDAS-V if they follow the standard BUFR tables

# 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 `http://dcdbss.ssec.wisc.edu/pqact/`. The interface includes a navigation menu with tabs for WMO, NEXRAD3, HRS|HDS|NGRID, and Summarize. The Base path is set to `/data/xcd/`. A list of data categories is shown with checkboxes, and a list of file patterns is displayed below.

Navigation tabs: WMO, NEXRAD3, HRS|HDS|NGRID, Summarize

Base path: `/data/xcd/`

- 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

File patterns:

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

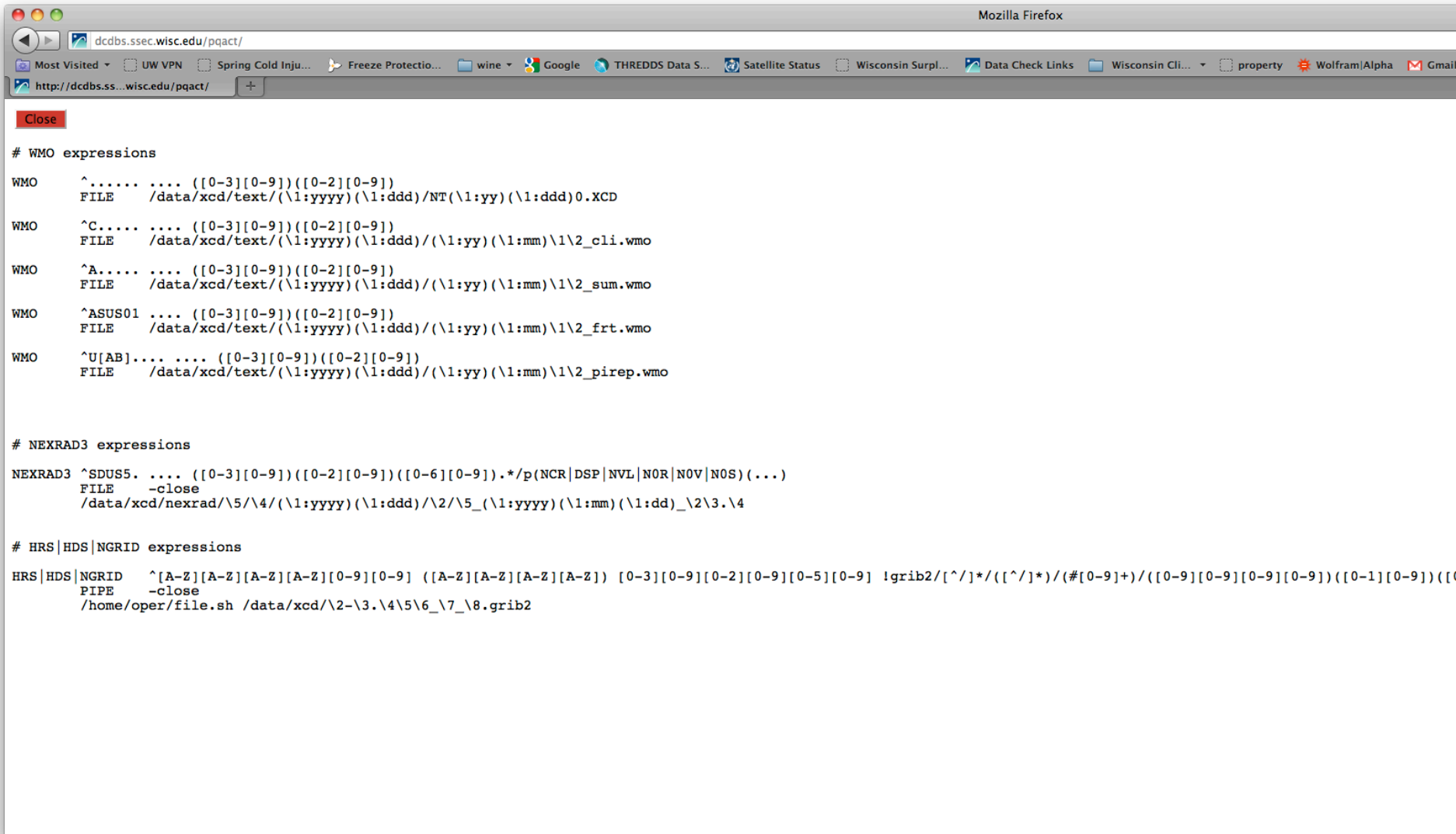
WMO ^C..... .... {[0-3][0-9]}{[0-2][0-9]}
FILE /data/xcd/text/{\1:yyyy}{\1:ddd}/{\1:yy}{\1:mm}\1\2_cli.wmo

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



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])
PIPE -close
/home/oper/file.sh /data/xcd/\2-\3.\4\5\6_\7_\8.grib2
```



# Local Data

- A couple -XCD sites have local feeds of data
- We have contacted those sites for test data
  - So far, they believe there are not any -XCD dependencies
- If there is local data that do depend on -XCD, we will add that into the existing framework

# 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@castor:~ — ssh — 83x13
Fri Sep 6 20:23:00 UTC 2013

          files to process    files being processed
Grid products: 4(816K)        0(0)
Text products: 2(8.0K)        0(0)

XCD daemon statuses
Grid      Active
Text     Active

Last grid file:  NAM_84-#215.20130906_18_048.grib1      (2013-09-06 20:22:57 UTC)
Last text file:  SXXX03-KWAL.062022.txt                (2013-09-06 20:22:58 UTC)
Last NEXRAD product from LDM: SJU_20130906_2020.DSP   (2013-09-06 20:21:27 UTC)
```

# Performance (TEXT)

## ■ TEXT lists

### ■ WXTLIST (no parameters)

- Current -XCD: fastest=.50 s slowest=1.75 s
- New -XCD: fastest=.014 s slowest=.078 s

### ■ WXTLIST WMO=SA

- Current -XCD : fastest=.015 s slowest=2.379 s
- New -XCD : fastest= .880 s slowest= .900 s

# Performance (SFCRPT)

## ■ SFCRPT

- SFCRPT KGRB 9 (Current –XCD)
  - Fastest : ~.014s
  - Slowest : ~.983 s
- SFCRPT KGRB 9 DAT=RTPTLITE/SFCHOURLY(New –XCD)
  - Fastest : ~.015s
  - Slowest : ~.036 s

# Performance (PTLIST)

## ■ PTLIST

- PTLIST RTPTSRC/SFCHOURLY SEL='DAY 2013246; TIME 12; ID KMSN'
  - Current -XCD: fastest=.021 s slowest=.037 s
  - New -XCD: fastest=.024 s slowest=.148 s
- Remove ID: PTLIST RTPTLITE/SFCHOURLY SEL='DAY 2013246; TIME 12 '
  - New -XCD slows to : ~1.23 s
- Remove ID and Time: PTLIST RTPTLITE/SFCHOURLY SEL='DAY 2013246'
  - New -XCD slows to : ~6.48 s

# Performance (GRID)

- GRID lists
  - RTGRIB2/GFS-USLC2 DAY=2013246 TIME=6:00 PAR=U NUM=10
    - Current -XCD : ~.031 s
    - New -XCD : ~.040 s
- GRID display
  - RTGRIB2/GFS-USLC2 DAY=2013246 TIME=6:00 PAR=U F HOUR=12 LEV=500
    - Current -XCD: ~.122 s
    - New -XCD : ~.125 s
- GRID copy
  - RTGRIDS/NAM-USLC2 G/G.5700 DAY=2013246 TIME=0:00 PAR=T F HOUR=9 LEV=500
    - Current -XCD: ~.074 s
    - New -XCD: ~.078 s

# Current Issues

- Dependency on existing compiled –XCD code for GRIB metadata decoding has not been eliminated
- Testing of the system with many multiple users has not been attempted thus far
- SQLite database queries and organization need to be optimized
- PTCOPY reveals MD file limitations (e.g. SFCHOURLY – 1 normal, 2 specials) when NOAAPORT datastream has more data available, including duplicates



# Current Issues (continued)

- Existing text datasets do not always follow format rules, leading to some data not being decoded
- Better handling of data searches across multiple days

# Schedule

- Prototype working – bugs and performance being addressed
- Code sharing of individual pieces
  - Bash scripts
  - Server/decoding software
  - SQLite table construction and queries
- System Testing
- Monitoring
- Packaging
- Beta release in 2014

**End**

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