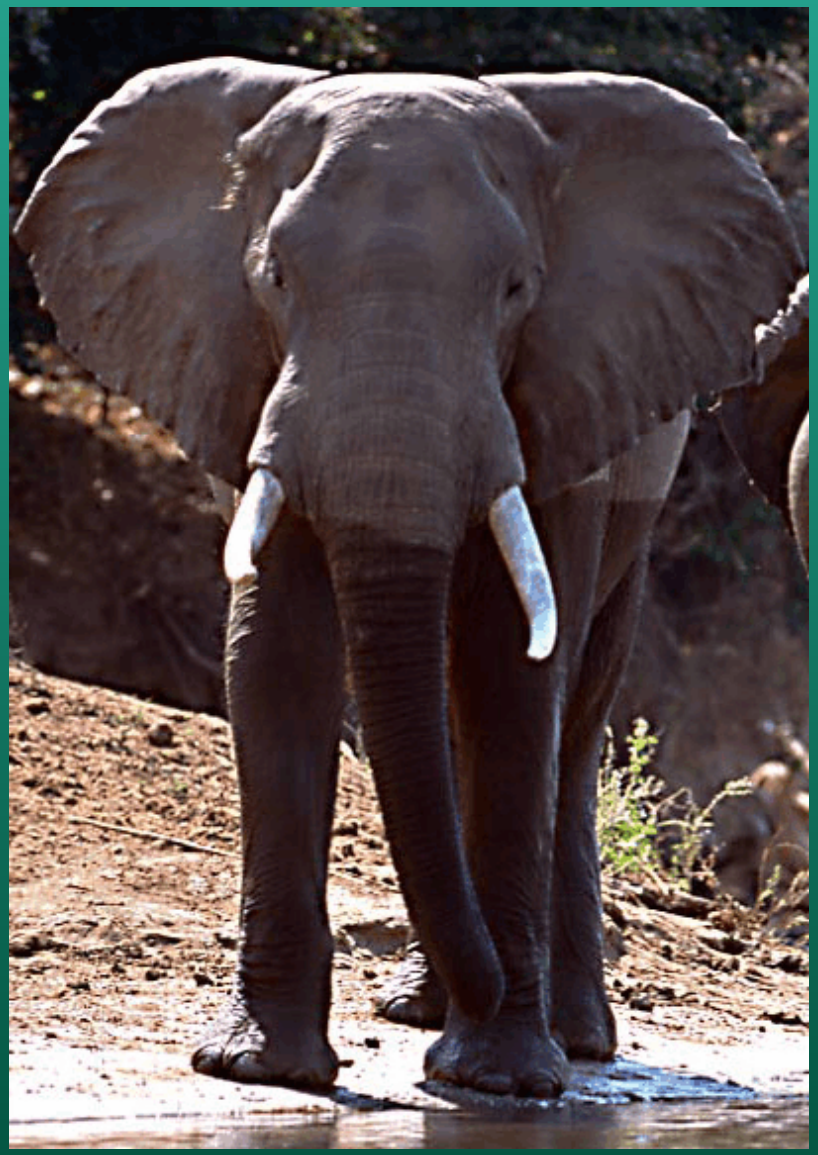


RFC Archive Database/Files Version 1

Juliann Meyer
Sr. Hydrologist - Data Systems
Missouri Basin RFC

Hydrologic DBA Workshop
March 18-21, 2003

Background Information

RFC Archive Database/Files System Project

- Phase 1 Team - Design
  - **Requirements Document June 2001**
  - **Design Document November 2001**
- Phase 2 Team - Implementation
  - **Software, dbschema, test plan delivered for testing October 2002**
  - **Hardware & Software expected to be delivered to the field Spring 2003**
- Phase 3 Team - Operations/Maintenance
  - **RDM is in the process of forming this team**

The People Involved

Phase 1 Team - Design

Victor Hom	NERFC, Team Leader
Arleen Lunsford	APRFC
Steve Shumate	CBRFC
James Paul	ABRFC
Juliann Meyer	MBRFC
Randy Rieman	OCWWS/HSD
Daniel Urban	OHD/HL
Monica Toth	OHD/HL
Kevin Hlywiak	MARFC
Jon Roe	OCWWS/HSD
Donna Page	OHD, RDM

The People Involved

Phase 2 Team - Implementation

Monica Toth	OHD/HL, Team Leader
Randy Rieman	OCWWS/HSD
Brenda Alcorn	CBRFC
Steve Shumate	CBRFC
Victor Hom	NERFC
Juliann Meyer	MBRFC
James Paul	ABRFC
Patrick Sneeringer	WGRFC
Eric Jones	LMRFC
Judi Bradberry	SERFC
Art Henkel	CNRFC
Arlene Lunsford	APRFC
Jon Roe	OHD/HL
Donna Page	OHD, RDM

Purpose

- verification
- studies to improve current and future products
- calibration activities
- channel routing development
- unitgraph development
- case studies
- operational forecast assistance
- applied research
- customer inquiry support

RFC Archive Database/FilesSystem

Version 1 Implementation

Two Main Components:

- IBM Informix RDBMS
- File Files

Hardware

- Dedicated system, Rack mounted
- Intel Xeon 2.4GHz/400MHz,
- 2 - 512MB PC2100 CL2.5 ECC DDR SDRAM RDIMM
- Ultra 320, ServeRAID-5i SCSI Controller (single channel)
- Six 73.4GB 10K rpm Ultra160 SCSI HS
- 10/100/1000 Port Ethernet Server Adapter
- Tape drive - 40/80GB DLTVS HH Int. SCSI Drive (Half-High) and Ultra 160 PCI Adapter (required for Tape device when using ServeRAID5i
- DVD Drive/Recorder - DVR-A04 Pioneer DVR (4.7gb)

Cots Software

- Operating System
  Red Hat Linux Ver. 7.2
  with updated versions of the dump & restore cmds

- Datebase Engine
  IBM Informix IDS Ver. 9.3.UC1
  includes esql/C, isql and dbaccess

Misc information

- Raid-5 allows for a single drive to fail at any given time without any data loss. In amultiple disk failure situation data will be lost; thus the importance of still having a backup strategy.
- NFS mount /awips/hydroapps/lx/public/bin off of ds for access to get_apps_defaults script and other scripts.

Misc Information

- .Apps_defaults and .Apps_defaults_site will exist on the rax
- Cooked files for the database
- Datafeed from SBN will require localization of the acq_patterns.txt file

Progamming Languages

- C
- Fortran90
- Tcl/tk
- Perl
- X11R6/Motif

Non-COTS Applications

- Flat File Archive Viewer
- shef_decode_raw
- shef_decode_pro
- dbinit suite
- variety of shef encoders
- vfytrans suite
- various apps for OFS Data
- arcmenu
- Data Viewer/Editor
- Isql Forms
- 4 data export apps
- Rating Curve Viewer
- snow density apps
- Backup & Restore scripts
- Misc file and database maintenance scripts

Non COTS Applications

Under Development

- Slope Profile
- New and improved version of Verify

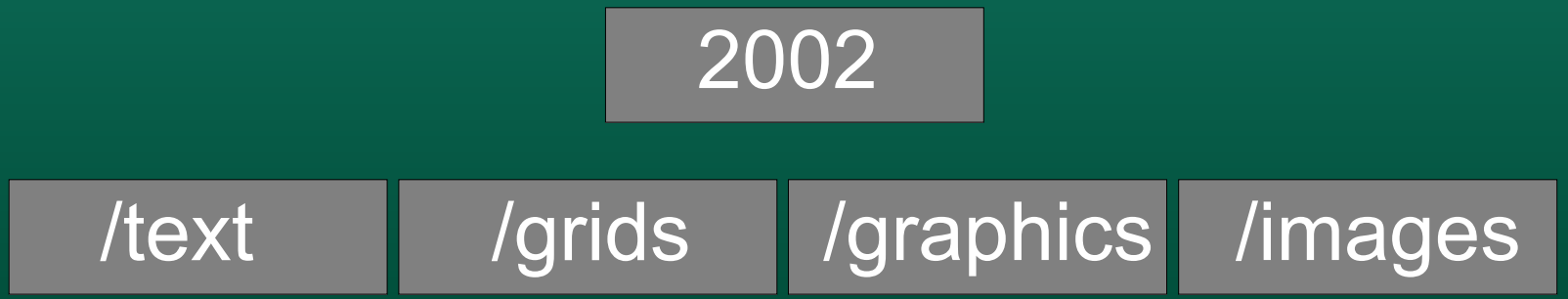
Questions?

Flat File Archive System

- Flat File Structure
- Flat File Archive Manager (FAM)
- Additional Tools for DS's:
  - Flat File Delivery Samples for the DS's
  - Flat File Operational Manager

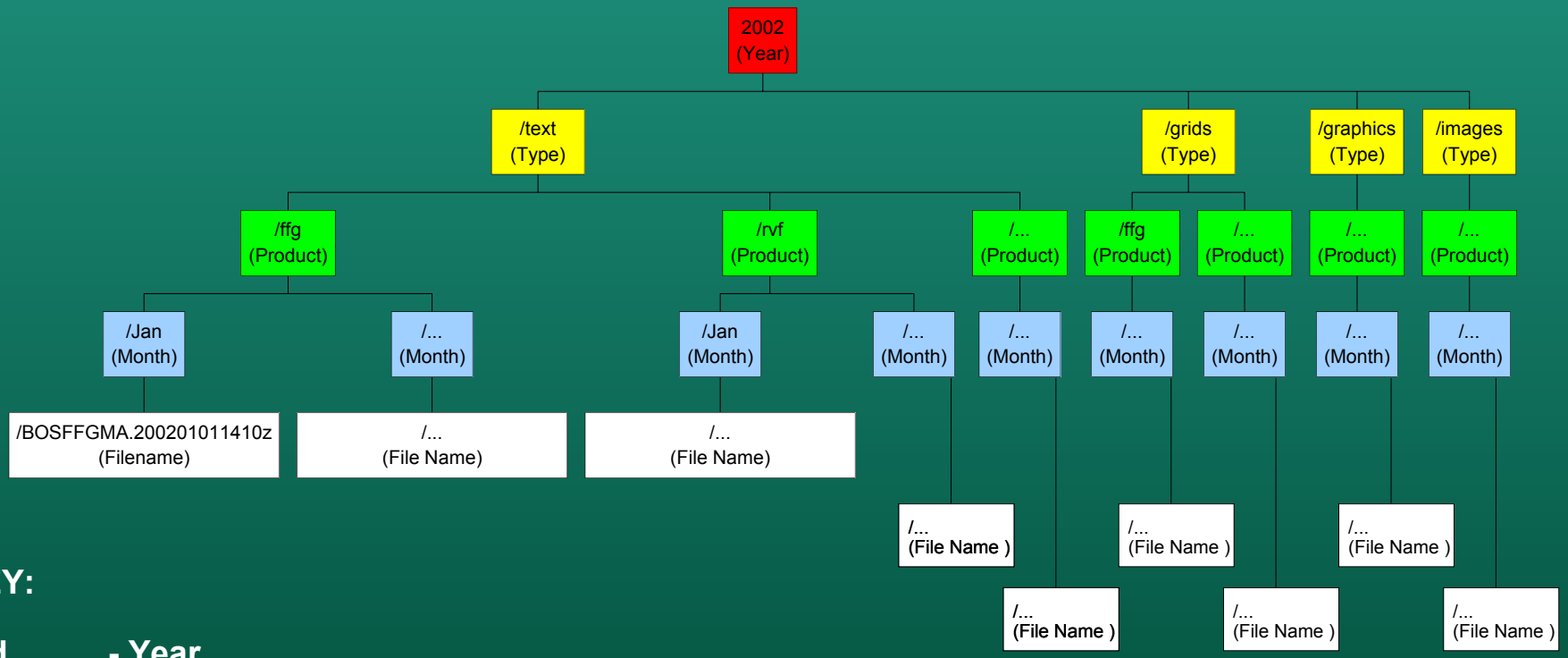
Main Data Structure

- **Year**
- **Type of Flat File**
  - (text, grids, graphics, images)
- **Product Type**
- **Month**
- **Filename**



Sample Tree Sturcture

- e.g. ./2002/text/ffg/Jan/BOSFFGMA.20020101410z where 20020101410z is the *product time* YYYYMMDDHHMMz



KEY:

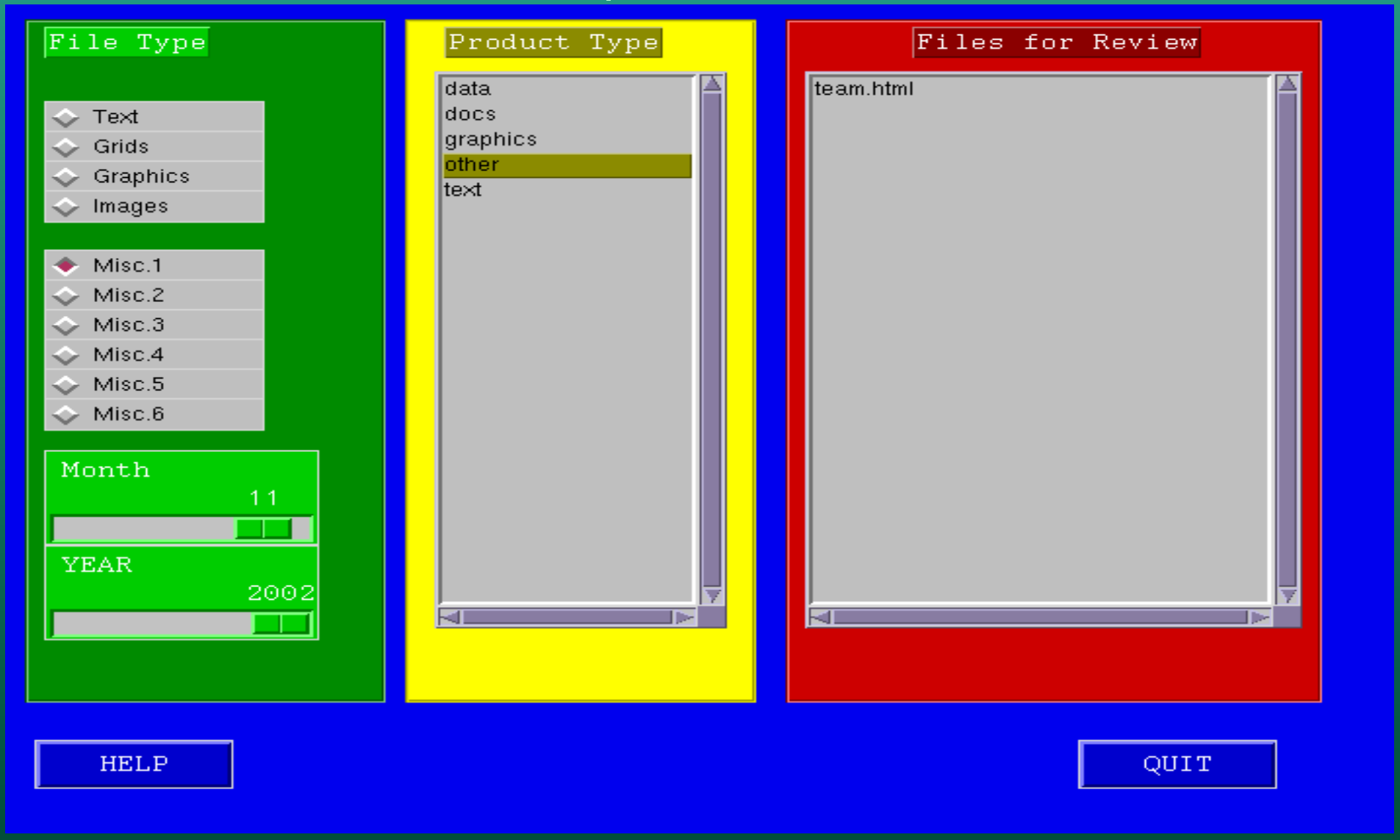
red - Year
yellow - Type of Flat File
green - Product Type
blue - Month
white - File(s)

Flat File Viewer Features

- Graphical User Interface - Point-n–Click.
- Open following graphics files: gif, jpeg, png.
- Reads htm, html, and pdf files.
- Puts text files in an editor.
- Additional directories set aside for future use.

Flat File Viewer

FAM - Graphical TCL Browser



Exporting Flat Files to the RAX

Methods

- Manual
  - Use line commands such as *rcp* and *ftp*
- Automated
  - Cron
  - AWIPS triggers
- Assisted Mode
  - Fam Operational Manager

Sample Script #1

Populating text flat file structure via textdb

- runs on cron once per day.
- creates a file list from database: fxatext.
- retrieves text products from the pre-determined list using textdb.
- stores files under the directory structure as prescribed in the Archive DB's textproductinfo table.

Sample Script #2

Populating text flat file structure via rcp

- Runs on cron once per day.
- Reads a list of directories to be archived.
- Remote copies (rcp) directory of files from source directory to destination directory.
- Stores files under the directory structure as prescribed in a list stored in Archive DB.

Sample Script #3

Bumping grids, graphics, or images to RAX via rcp

- Runs on cron once per day.
- Reads a list of directories to be archived.
- Remote copies (rcp) directory of files from source directory to destination directory.
- Stores files under the directory structure as prescribed in a list stored in Archive DB.

Sample Script #4

FXA text triggers to RAX

- Runs when a predefined file is received on AWIPS.
- Files and file types are predefined by the user as the parameters of the fxa trigger sxript.
- Remote copies (rcp) directory of files from source directory to destination directory.
- Stores files under the directory structure as prescribed in a list stored in Archive DB.

Sample Procedure #5

FAM Operational Manager
(note: has not been tested on AWIPS)

- User choose the files which they would like to archive.
- Files are transferred to RAX each night via cron.
- Remote copies (rcp) list of files from DS to destination directory on RAX.
- Stores files under the directory structure as prescribe in a list stored in Archive DB.

Questions?

Archive Database

- no logging mode
- makes use of multiple dbspaces
- cooked files for the dbspaces
- version number is part of database name
  ex. adb_ob1nhor

Reminder: The archive database is NOT intended to replace the IHFS database.

RFC Archive Database

Tables by Category

- Meta-Data (13)
- Reference Data (20)
- Quality Control (3)
- SHEF Data Value (15)
- NWSRFS (52)
- River Verification (4)
- Statistical Water Supply (5)

Tables by Category

Meta-Data

- location
- ingestfilter
- riverstat
- rivercrit
- reservoir
- rating
- ratingshift
- slopeprofile
- slopelookup
- crest
- avg
- qadjust
- flashflood

Tables by Category

Reference

aliasid
country
state
counties
huc2
huc4
huc6
huc8
wfo_hsa
rfc

shefdur
shefex
shefpetrans
shefpe
shefpe1
shefprob
shefqc
shefts
agency
prod

These tables come predefined except for aliasid, agency & prod

Tables by Category

Quality Control

datalimits

locdatalimits

sensok

Tables by Category

SHEF Data Value

pedrsep

pecrsep

pemrsep

peoosep

pedpsep

pehpsep

peqpsep

pempsep

pedcsep

pedfsep

pehfsep

peqfsep

pairedvalues

commentvalue

unkstnvalue

SHEF Data Value Tables

Structure

- single value per row
- pseudo array, multiple values per row
- Data sorted by SHEF Type and SHEF duration codes
- In addition, either of the above formats may be fragmented by SHEF PE1 code

SHEF Data Value Tables

Structure cont.

7- character SHEF code “PEDTSEP”

IHFS DB

pe	char 2
dur	smallint
ts	char 2
extremum	char 1
probability	smallfloat

Archive DB

pe1	char 1
pe2	char 1
dur	char 1
idur	smallint
t	char 1
s	char 1
e	char 1
p	char 1

SHEF Data Value Tables

Structure cont.

fragment by expression

pe1 = 'H' in dbs1,
pe1 = 'P' in dbs2,
pe1 = 'Q' in dbs3,
pe1 = 'S' in dbs4,
pe1 = 'T' in dbs5,
pe1 not in ('Q','S','P','T','H') in dbs6

single value per row table with fragmentation:

pedrsep peoosep pedfsep unkstnvalue

pseudo array table with fragmentation:

pecrsep

Tables By Category

NWSRFS

ofsstntrans
ofsdatatrans
area
areasens
cgroup
fgroup
fgroupseg
seg
segoper
opersnow17
opersacsma
opertype
operunithg

statessacsma
statessnow17
drain
pos
modctrl
modaescchng
modchgblend
modignorets
modmatchng
modmfc
modrainsnow
modromult
modrrichng

modrrimult
modsacbasef
modsacco
modsetmsng
modsetqmean
modtschng
moduadj
moduhgadj
moduhgchng
modweadd
modwechng
modzerodiff
modtsadd
modtsmult
modtsrepl
modswitchts

modxinco
modssarreg
modbublshft
modqcshift
modqpshift
modrochng
modaeicqn
modaiadj
modapicbasf
modapicco

modctrl table comes already defined

Tables By Category

River Verification

vlocation

vrivergaugeloc

vaddadjust

vfypairs

Tables by Category

Statistical Water Supply

wsequation

wsfcst

wshistorical

wsperstats

swsmail

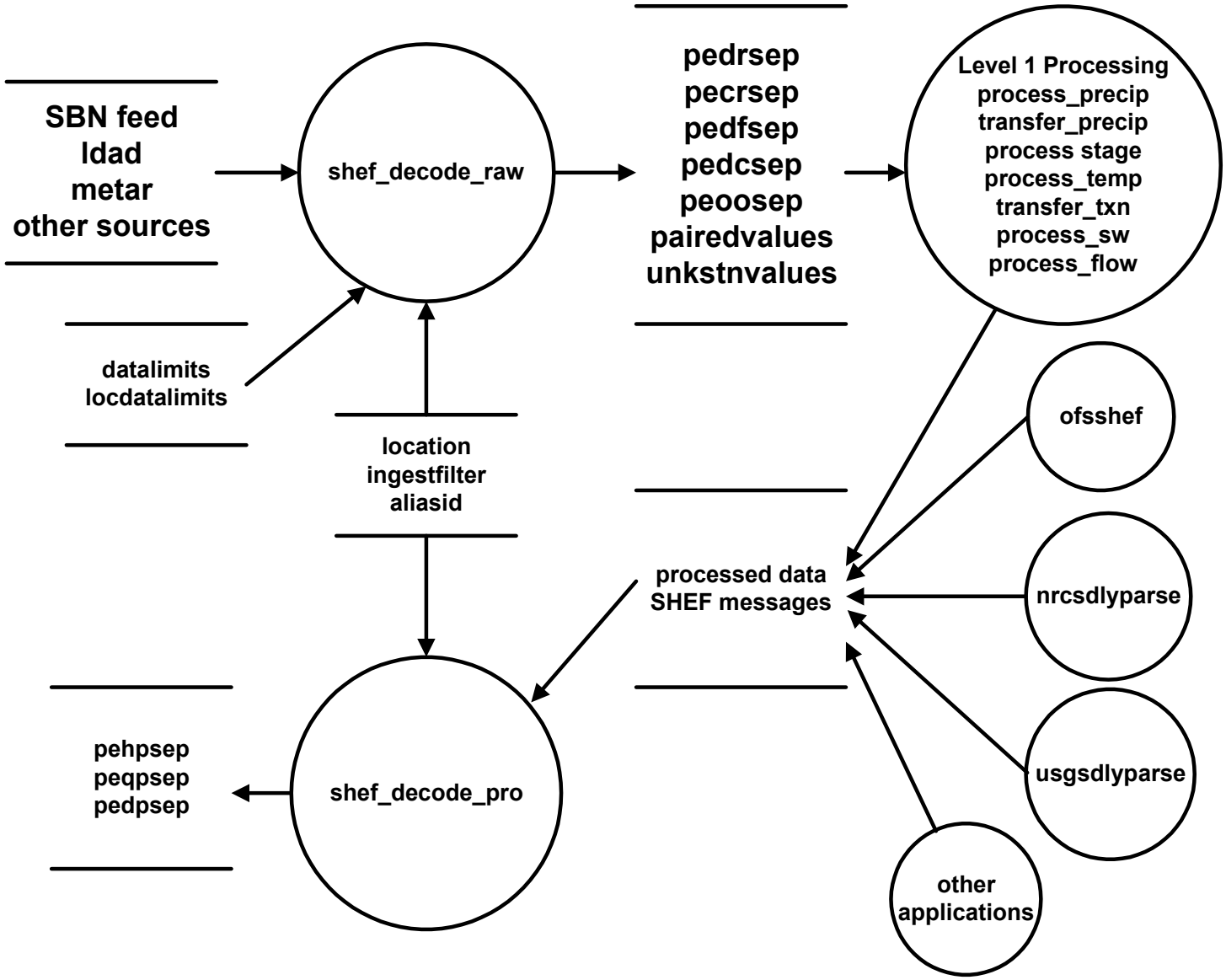
Questions?

Initialization of the Database

adbinit suite

- **Reads information from the IHFS db's location table and if available, from the histdata db's ncdc_td3200_sta table to create a load file for the archive db's location table.**
- **Reads information from the IHFS db's ingestfilter table to create a load file for the archive db's ingestfilter table.**
- **Informix dbload command is used to load the data into the archive db. Review of the logfile generated by dbload will be necessary as foreign key constraints have been defined.**
- **Note: This application is intended for use when spinning up database for the first time.**

Data Flow - SHEF Ingest



Shef Decoders

shef_decode_raw

- Processes SHEF files from any source
- Primary source is the SBN... pass it the same files as the IFHS shefdecoder receives
- Posts to the following 7 tables: pedrsep, pecrsep, pedfsep, pedcsep, peoosep, pairedvalues, unkstnvalue
- Background process... runs 24x7

SHEF Decoders

shef_decode_pro

- **Processes SHEF files from any source**
- **Primary source are the level 1 processing applications and ofsshef program**
- **Posts to the following 3 tables: pehpsep. peqpsep, pedpsep**
- **Background process... runs 24x7**

Note, neither shefdecoder currently posts to the following tables: commentvalue, pemrsep, pempsep, pehfsep, peqfsep

Shef Decoders

Differences with IHFS Shef Decoder

- **Uses a combination of apps_defaults tokens, configuration file and command line arguments for defining how it will run**
- **Currently there are 40 parsing warnings/errors that it detects**
- **Logging posting errors is optional. If this option is used posting errors are accumulated in a separate file. I.e. these errors are not included in the message error file**
- **Daily logfile of activity is an accumulated summary**

SHEF Encoders

- Outside Agency Data
  - NRCS snotel data
  - USGS daily streamflow
- Convert DATACARD format to SHEF
- Level 1 Processing Encoders
  - process_precip
  - transfer_precip
  - process_stage
  - process_temp
  - transfer_txn
  - process_sw
  - process_flow

Level 1 Processing

These applications:

- reads data from “raw” data value tables (pecrsep, pedrsep)
- performs some basic QC
- transforms the data
- SHEF encodes the data and passes the data file to the shef_decode_pro apps

Level 1 Processing

- process_precip
  - **reads PCIR*ZZ data and transforms it to PPH, PPQ and PPD data types**
  - **Quality Control**
    - **looks at entire time series, does some smoothing to eliminate up/down fluctuations and attempts to recognize when a gage has been reset**
    - **gross maximum checks**
      - **PPH max = 5"**
      - **PPQ max = 10"**
      - **PPD max = 20"**
    - **checks the sensok table for pertinent entries**

Level 1 Processing

- transfer_precip
  - **reads PPHR*ZZ, PPQR*ZZ & PPDR*ZZ data**
  - **Quality Control**
    - **checks the quality_code value**
    - **gross maximum checks**
      - **PPH max = 5"**
      - **PPQ max = 10"**
      - **PPD max = 20"**
    - **checks the sensok table for pertinent entries**

Level 1 Processing

- process_temp
  - **reads TAIR*ZZ data and creates hourly TAI and TX and TN data**
  - **Quality Control**
    - **looks at entire time series and attempts to eliminate unreasonable jumps between readings**
    - **gross maximum and minimum checks**
      - **TA max = 130 F**
      - **TA min = -50 F**
    - **checks the sensok table for pertinent entries**

Level 1 Processing

- transfer_txn
  - **reads TAIR*XZ & TAIR*NZ data**
  - **Quality Control**
    - **checks the quality_code value**
    - **gross maximum and minimum checks**
      - **TA max = 130 F**
      - **TA min = -50 F**
    - **checks the sensok table for pertinent entries**

Note: TX and TN computed by this process will NOT override TX and TN values from the transfer_txn process; does this by using shef qualifier code of V.

Level 1 Processing

- process_stage
  - **reads HGIR*ZZ, HPIR*ZZ & Q*IR*ZZ data and creates hourly instantaneous stage, storage and flow values (HGI, LSI, Q*I)**
  - **Quality Control**
    - **uses information in the rivercrit table for QC checks**
    - **checks the sensok table for pertinent entries**

Level 1 Processing

- process_flow
  - **reads Q*DR*ZZ data**
  - **Quality Control**
    - **checks the quality_code value**
    - **screens negative values**
    - **checks the sensok table for pertinent entries**

Level 1 Processing

- process_sw
  - reads SWIR*ZZ data and creates daily 12z instantaneous values
  - Quality Control
    - looks at entire time series and attempts to eliminate unreasonable jumps between readings
    - gross maximum and minimum checks
      - SW max = 500"
      - SW min = 0"
    - checks the sensok table for pertinent entries

New SHEF codes

multiple processing levels

For every SHEF source code there are 9 processing levels. The SHEF Type Code is replaced with a number.

Example:

```
1Z      process level 1, Nonspecific observed reading
2Z      process level 2, Nonspecific observed reading
3Z      process level 3, Nonspecific observed reading
4Z      process level 4, Nonspecific observed reading
5Z      process level 5, Nonspecific observed reading
6Z      process level 6, Nonspecific observed reading
7Z      process level 7, Nonspecific observed reading
8Z      process level 8, Nonspecific observed reading
9Z      process level 9, Nonspecific observed reading
```

Questions?

OFS Data - SHEF Encode-able

ofsshef

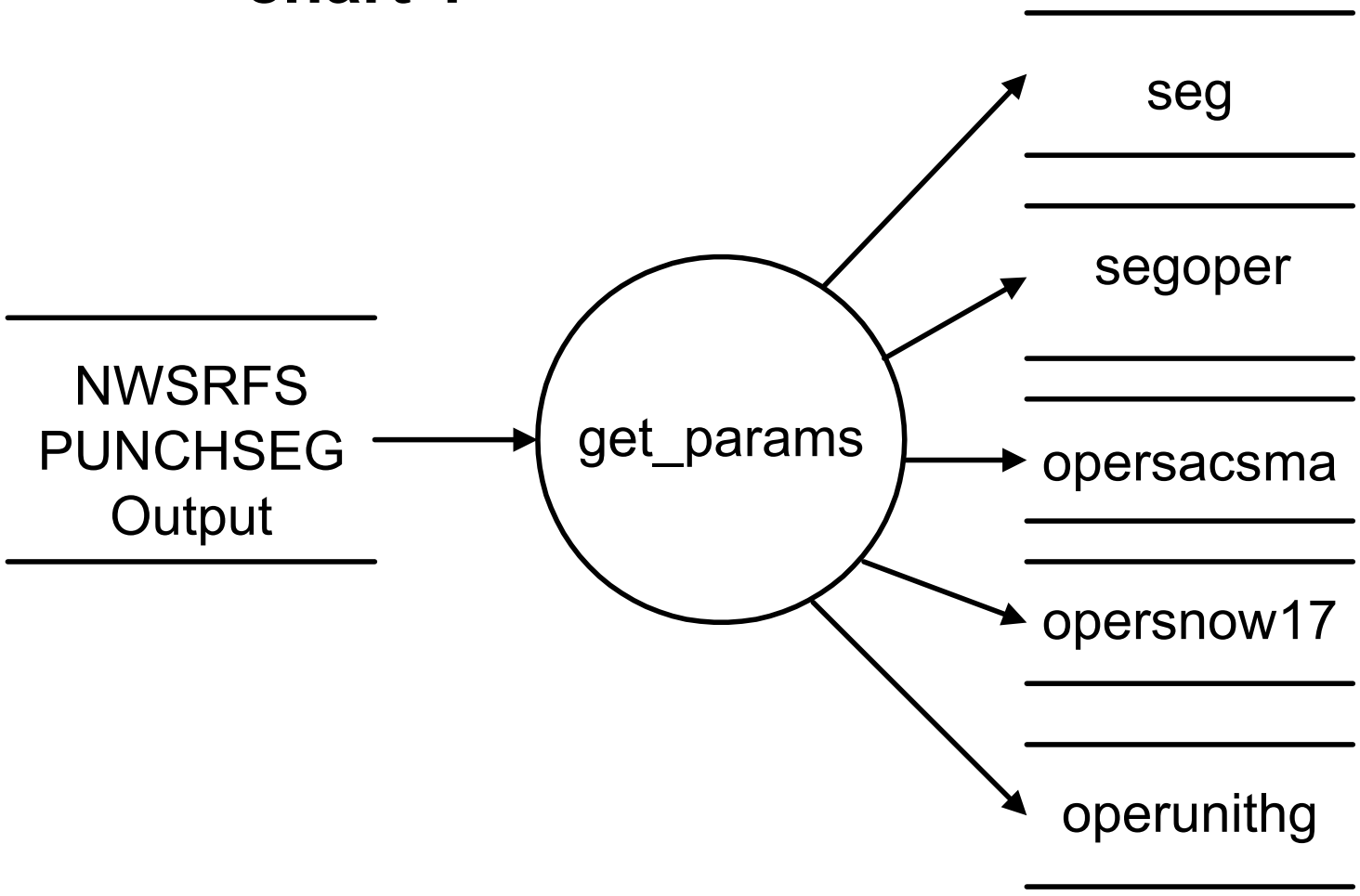
- Reads the NWSRFS PDB and PPPDB for selected data and SHEF encodes data where valid SHEF codes exists
- Does not currently SHEF encode SNOW-17 data
- User defines data of interest in an input file “ofsshef_input_xxx”
- Both unix & linux versions are available on AWIPS LAD

OFS Data - NonSHEF

- get_params
- get_states
- group_parse
- loadmods
- fetchmods

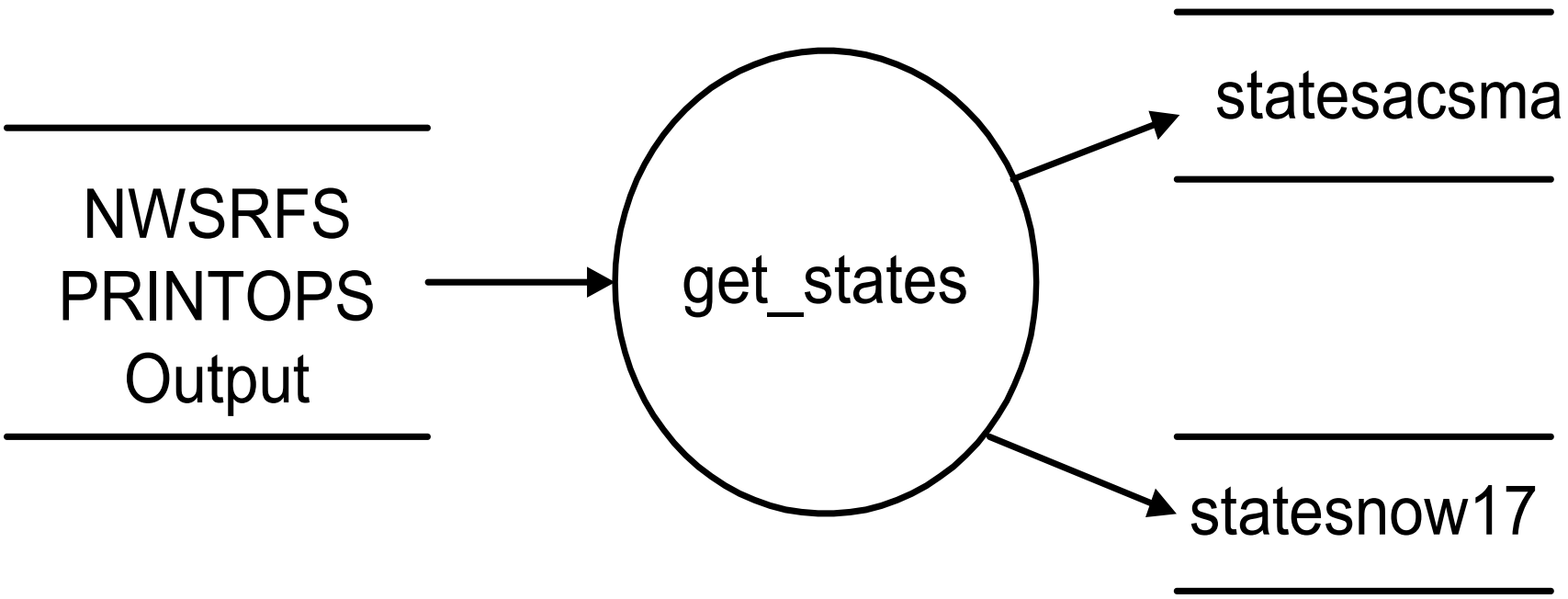
OFS Data

adb NWSRFS tables
chart 1



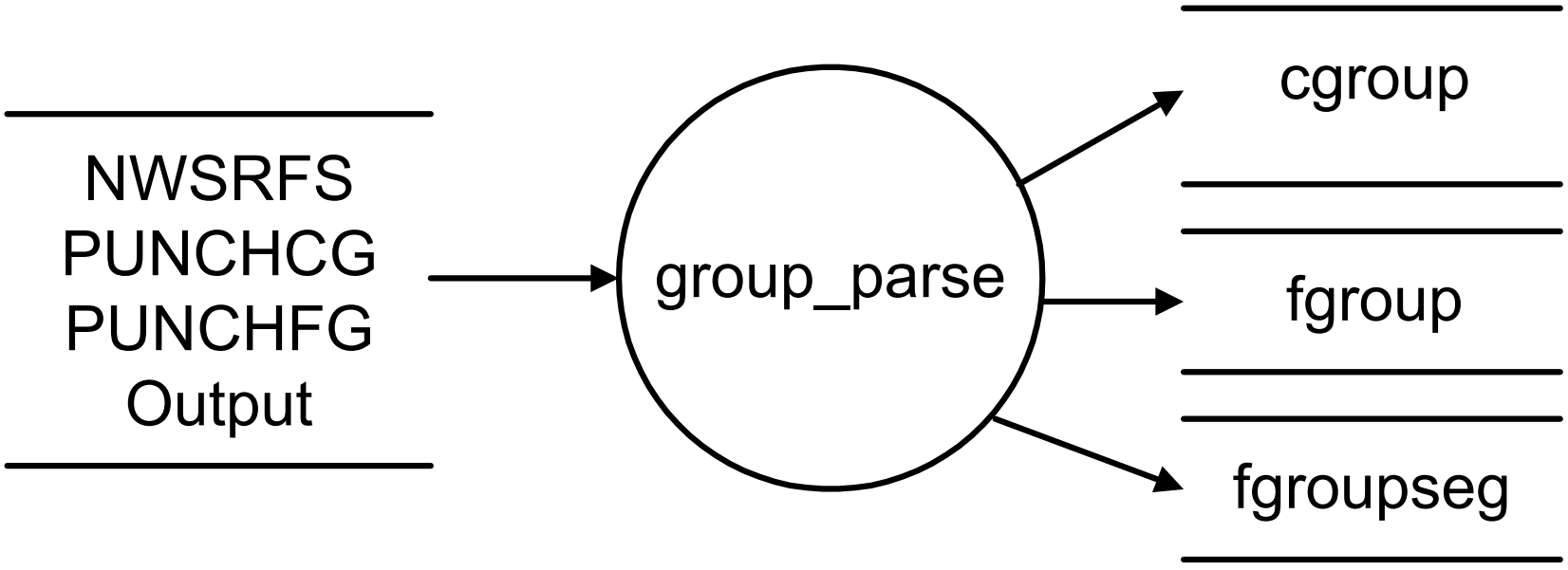
OFS Data

adb NWSRFS tables chart 2



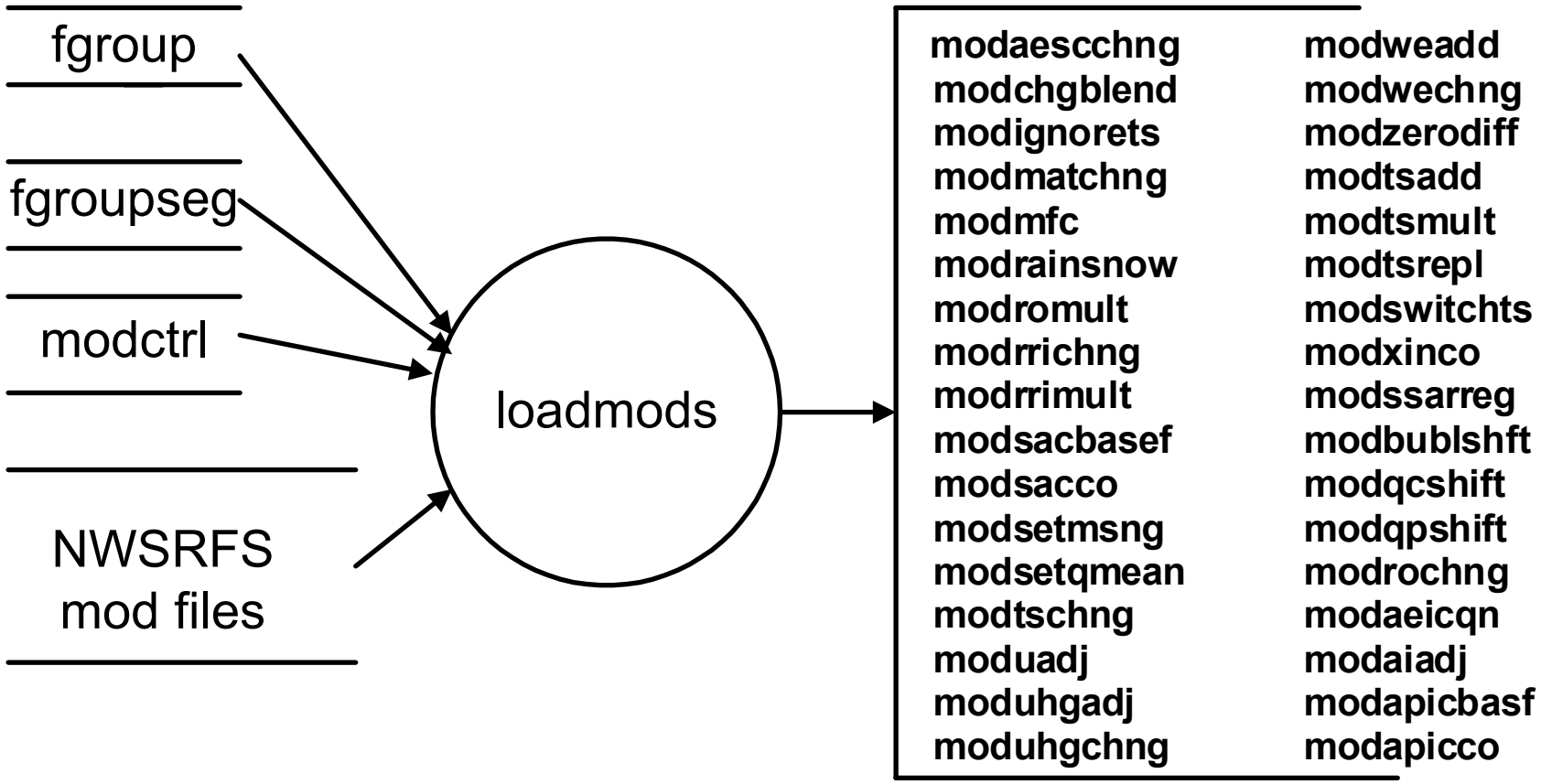
OFS Data

adb NWSRFS tables
chart 3



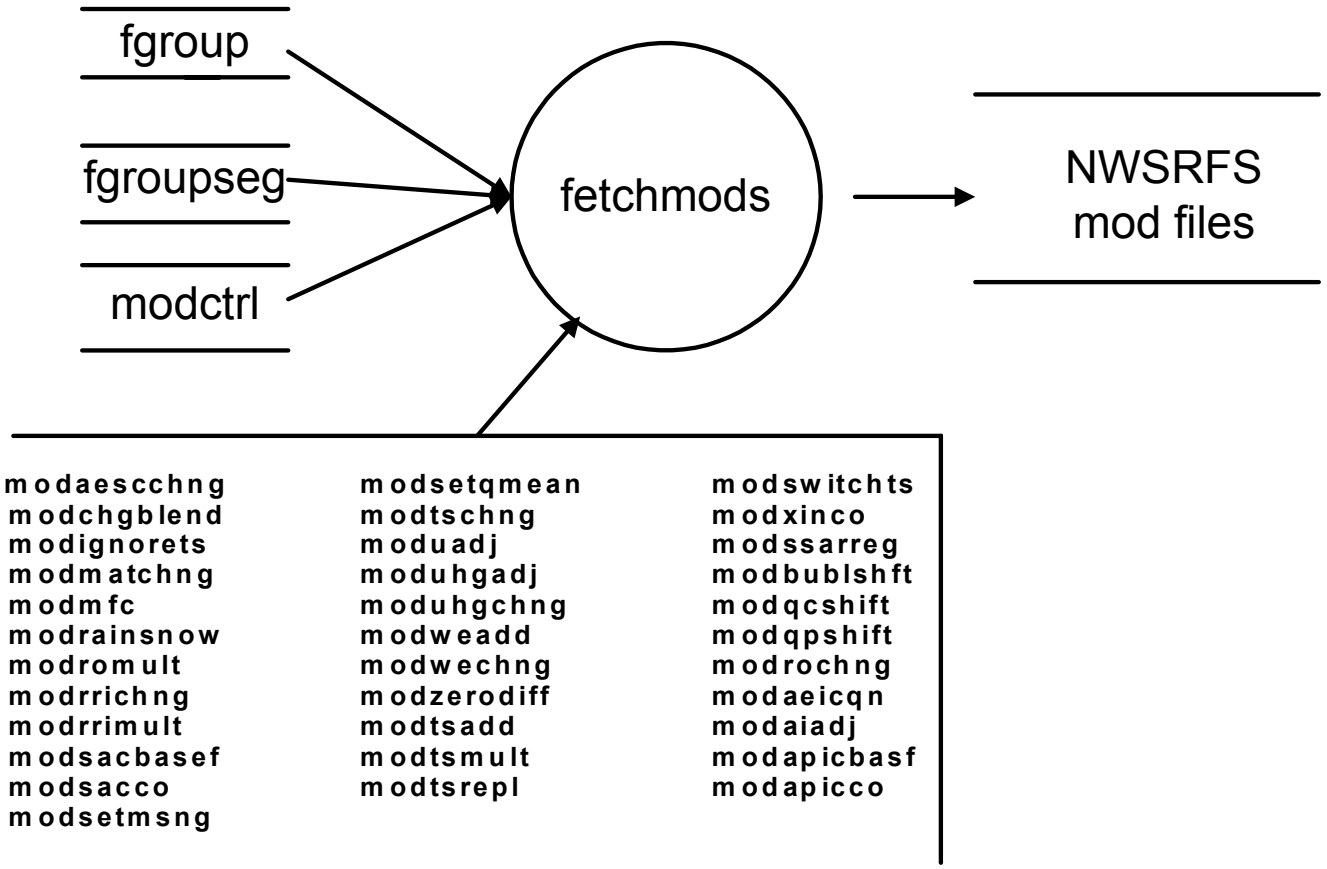
OFS Data

adb NWSRFS tables
chart 4



OFS Data

adb NWSRFS tables chart 5

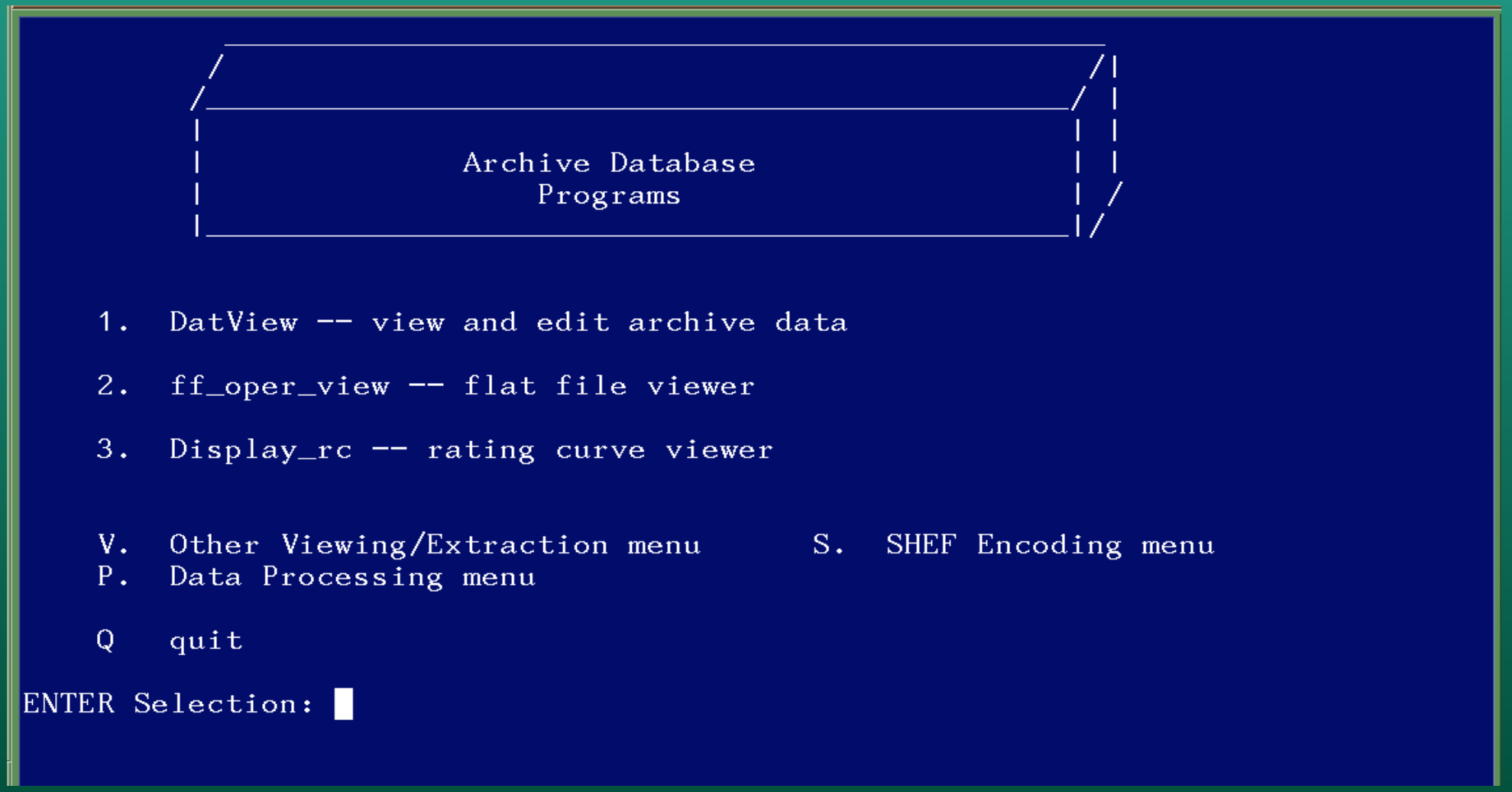


Questions?

Database Applications

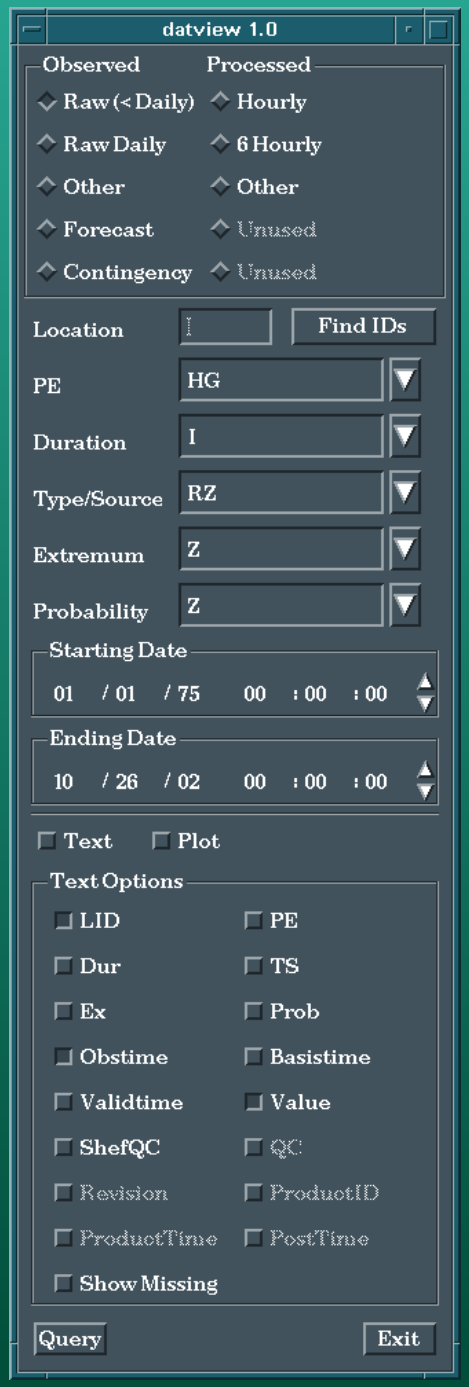
- Access most applications via arcmenu
  - DatView
  - Flat File Viewer
  - Rating Curve Viewer
  - Level 1 processing applications
  - ISQL forms
  - Data Extraction
  - SHEF Encoders
- Applications also can be run separately

arcmenu


Archive Database
Programs
1. DatView -- view and edit archive data
2. ff_oper_view -- flat file viewer
3. Display_rc -- rating curve viewer
V. Other Viewing/Extraction menu
S. SHEF Encoding menu
P. Data Processing menu
Q quit
ENTER Selection:

DatView

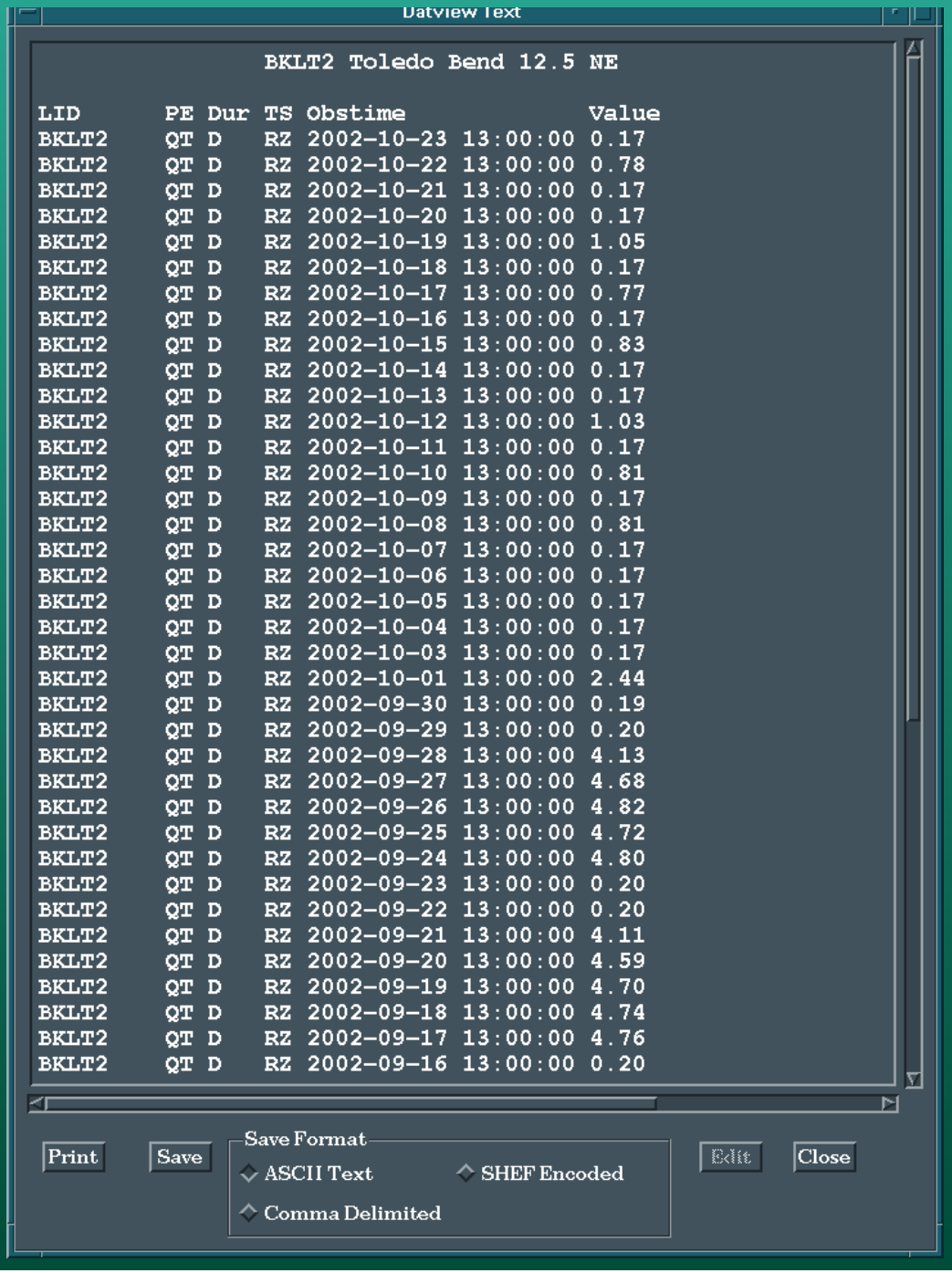
- Data viewer capable of displaying data in both text and graphical formats
  - consists of 3 main windows
    - Main user interface
    - Data plotter
    - Text-based data viewer
- Data editing via SHEF message
- Print option
- Data export options



DatView

Main User Interface

1. Choose data interval to view
2. Choose location
3. Select desired SHEF pedtsep codes
4. Select range of dates to view
5. Text and/or plot ?
6. If text, select which fields to display
7. Click query to display data



DatView

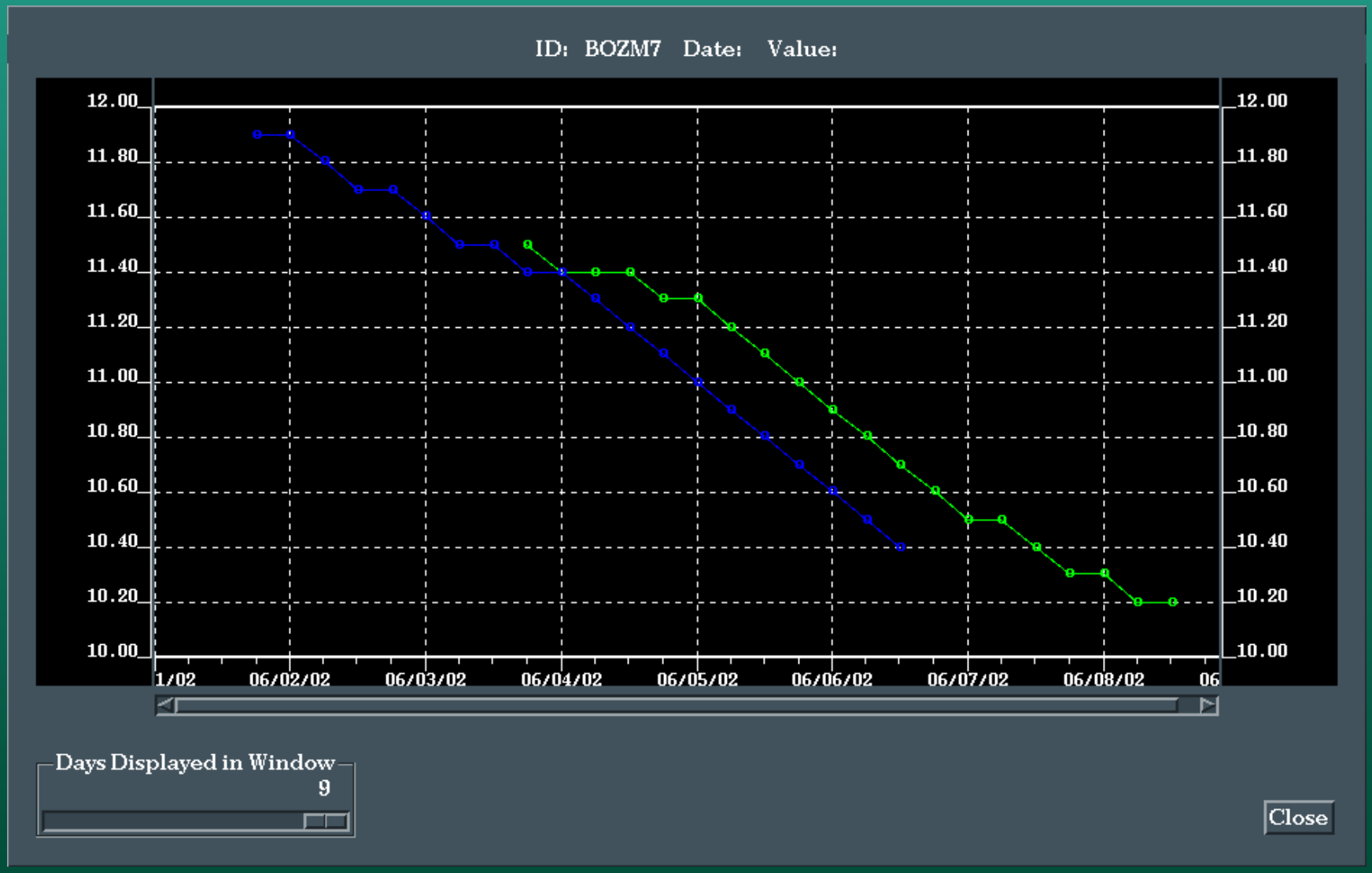
Text-based Data Viewer

Three options available:

1. **Print**
2. **Save to file**
   - ASCII Text
   - SHEF encoded
   - Comma Delimited
3. **Edit**

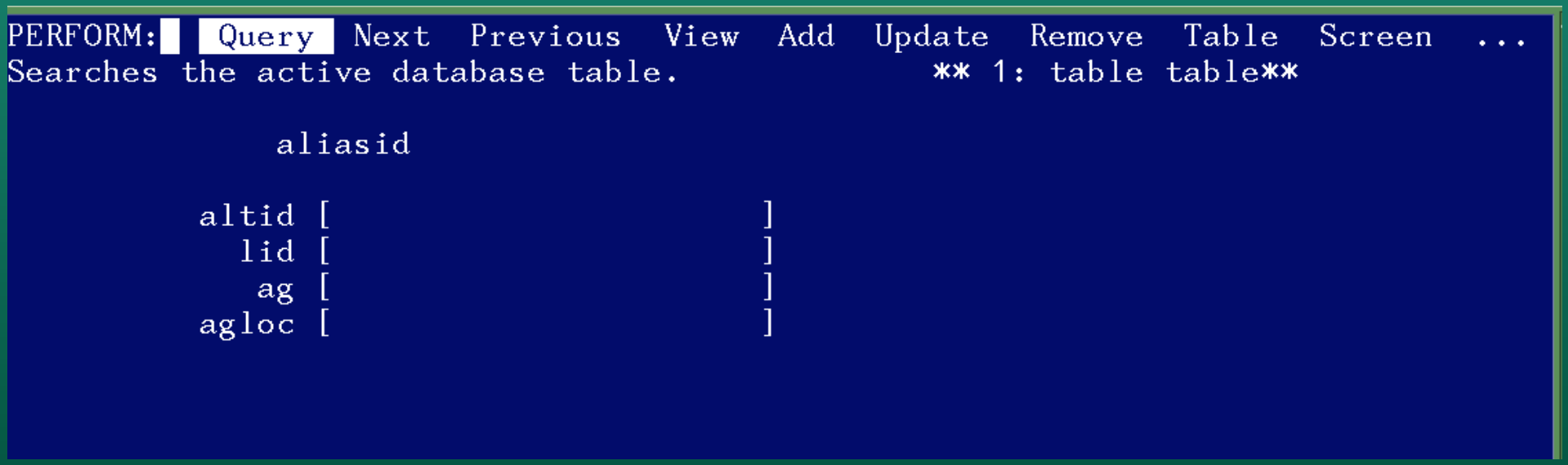
DatView

Data Plotter



ISQL Forms

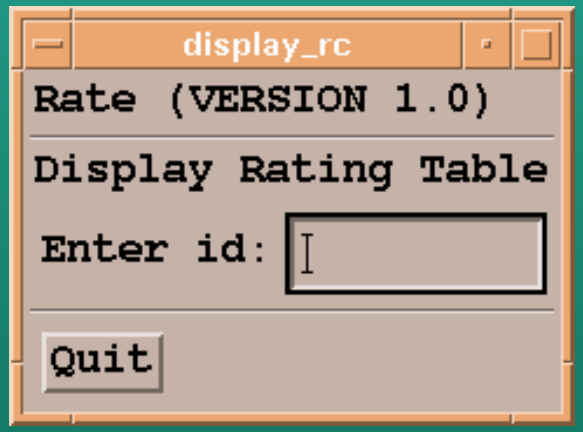
- Forms are available for all tables
- Currently it's the only way to add/modify/delete information for most of the tables



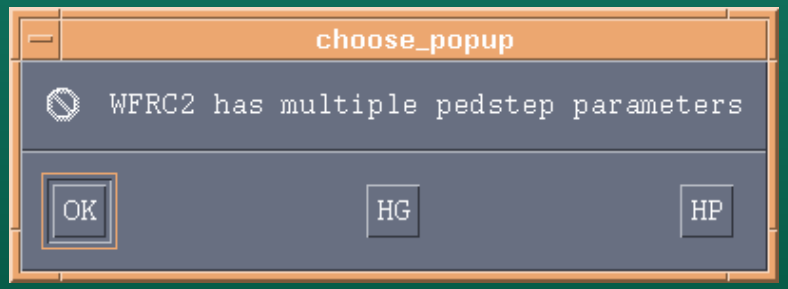
Rating Curve Viewer

- User selects location and application automatically displays the latest rating curve
- Apps allows the user to then page thru previous versions
- Apps also allows the user to enter a stage (or flow) and the apps will return corresponding flow (or stage) based on the displayed rating curve

Rating Curve Viewer

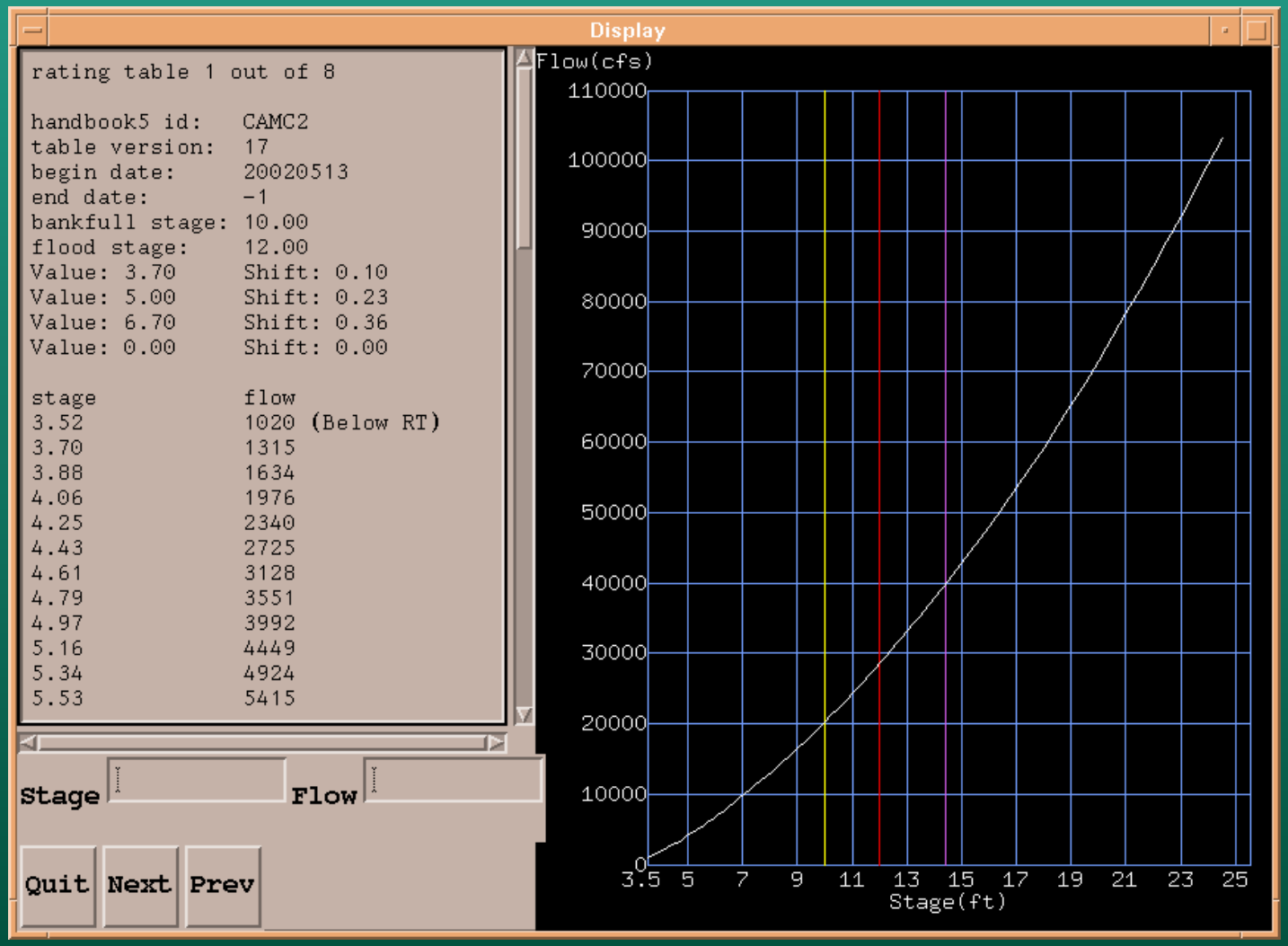


1. Enter LID



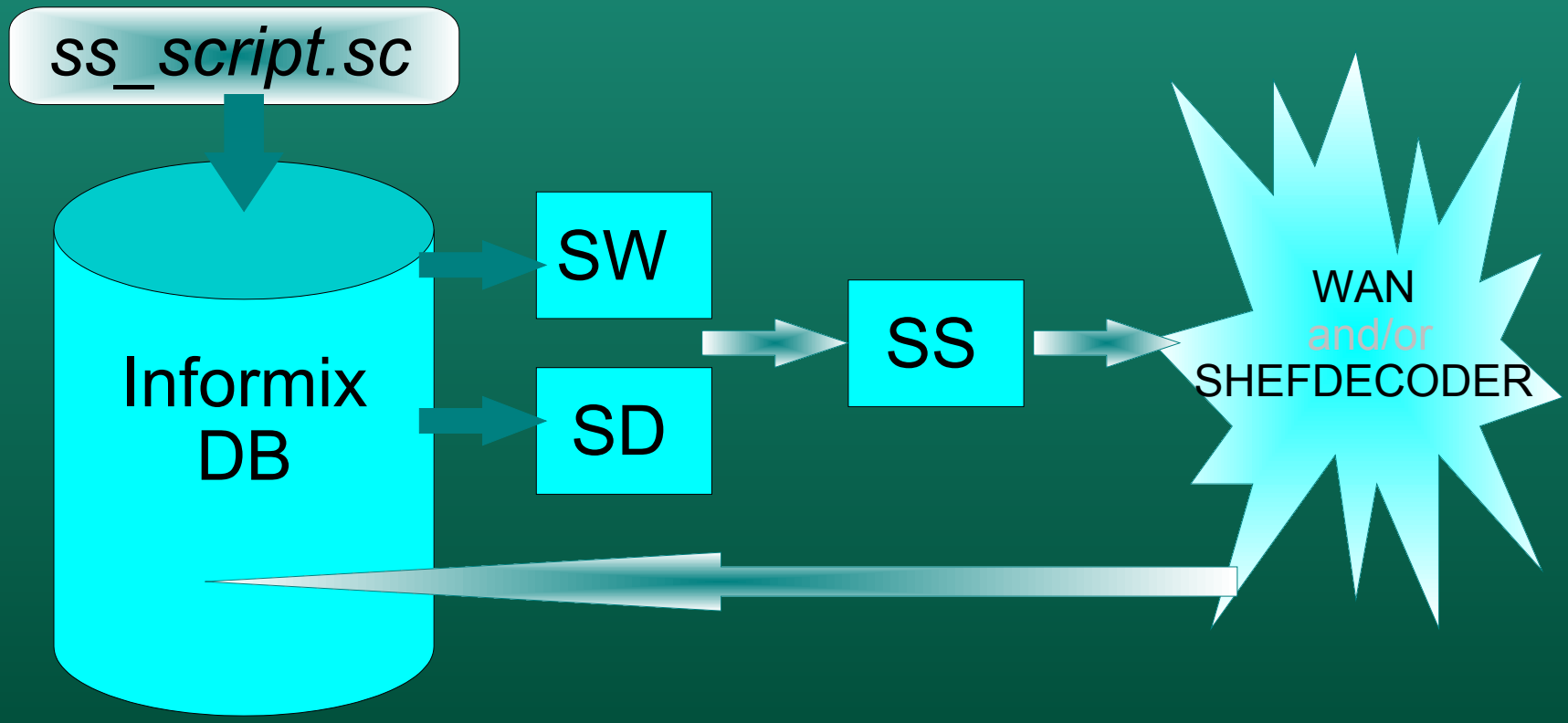
2. If both HG and HP exist,choose which one to display
   (only appears if both exists)

Rating Curve Viewer



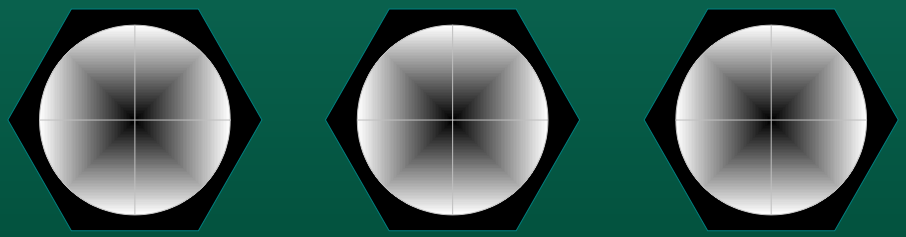
Snow Density Computation

- **Definition:** Snow Density is the ratio of Snow Liquid (Snow Water Equivalent) to Snow Depth
- **Purpose:** Retrieve 7 days worth of measured snow depth and water equivalent from Informix database and uses them to calculate snow density.



Snow Density - Nuts and Bolts

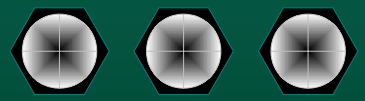
- **Executables:**
  - **written for DS, also available for RAX**
  - **Files are packaged under ss_calc.tar on ds1-nhor**
  - ***ss_script.sc* is the main script that**
    - **calls the esql-C program *ss_calc.ec***
    - **creates a text *ss_out* that can be forwarded for shef_processing and/or forwarded to AWIPS WAN via *WanSend***



Snow Density - Nuts and Bolts

- **Customization ss_script.sc for the DS:**
  - Edit parameter SQLDIR to reflect directory where executables were placed
  - Change the WMO and Message header
  - Uncomment and edit line which copies file to */data/fxa/ispan/hydro*, if you would like to send product for shef processing only
  - Add the line *$SQLDIR/WanSend <<Message Name>> $SQLDIR/ss_out*
  - Create a directory name *log* under *$SQLDIR*
  - Can be added to cron

If you need assistance, contact
victor.hom@noaa.gov



Exporting Data Options

- DATACARD (stand-alone, can access via arcmenu)
- SHEF (DatViewoption)
- Comma separated (DatViewoption)
- ASCII Text (DatViewoption)

Questions?

Backup and Restore Scripts

Linux File System

- dump_script
- restore_script

These scripts based on version of dump and restore commands dump-04.b27.3 or later.

Scripts must be run by user root.

Backup and Restore Scripts

Informix

- bkup_lev0
- recvr_lev0
- bkup_onunld
- recvr_onld

Scripts should be run by user root or informix.

Bkup_lev0 has been set-up as a cron job run by user Informix once a week.

Database and File Maintenance Utilities

- update statistics script
  - **based on the strategy in the Informix Performance Guide**
  - **run by oper's cron**
    - **update statistics low runs 6 times/day**
    - **update statistics medium/high run once per day**
- housecleaning script
  - **purges file in 4 directories**
  - **run by oper's cron 4 times/day**

Transfering Verification Data

- Meta-Data
  - **vlocation &vrivergageloc tables**
    - **simply use sql commands to unload the data from the verify db and load it into the archive db**
  - **vaddadjust table**
    - **same approach as above but some minor editing of the file is required before loading into the archive db**
- Observed and Forecast Data
  - **Applications have been provided that will extract the data from the verify database and SHEF encode it.**

Resources

- www.nws.noaa.gov/oh/rfcdev/archive_datadoc/index.html
  - **on-line documentation**
  - **Charts (under development)**
  - **Data Dictionary (under development)**

- www.erh.noaa.gov/er/nerfc/archive/archivedb
  - **Contains general information on all 3 phases of the RFC Archive DB Project**
  - **Detailed information on Phase 1 Team; includes reports and meetings**

Some of theThings That Need To Be Looked At Further

Phase 3 Team Tasks

- Complete the documentation
- Will help define the update/maintenance process
- Address the incompatibility between the archive shefdecoders and IHFS shefdecoder
- Review rivercrit table, at 1st glance appears most of the data may exist in other tables; possibly replace with a view
- Layout of the tables in dbspaces and the number of dbspaces
- First extent, next size for the various tables

What's Next?

The RDM will be forming the Phase 3 Team shortly.

RFCs need to start working with the RFC Archive Database/FIles System... give it a good shakedown... let the RFC Support Group know about any problems.

Support

- **First line of support is the *RFC Support Group*.**
- **Requirements will still go to the RFC Support Group.**
- **Operations/Maintenance Team will handle bug fixes and upgrades.** (procedures to be developed)

In Review

Getting Started

- Localization of the acq_patterns.txt file should have been completed by the HW/SW install and setup.
- Load reference tables, make any corrections and additions as provided.
- Run adbinit suite and resolve any problems logged in the error files.
- Turn on oper's cron.
- Turn on both shefdecoders.
- Make any necessary additions to the apps_defaults_site file as some of the applications provided require localization; i.e. DatView.

The End