Data Ingest at the IVS Data Centers

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12th IVS General Meeting
Finnish Cyberspace
March 29, 2022
Three **Primary IVS Data Centers** hold the IVS products and data files:

- **Crustal Dynamics Data Information System (CDDIS), Goddard, MD, USA**
  - Poster S2-P09 (Yates et al.) on Tue @ 12:45 UT
- **Bundesamt für Kartographie und Geodäsie (BKG), Frankfurt, Germany**
  - Poster S2-P08 (Girdiuk et al.) on Tue @ 12:45 UT
- **Observatoire de Paris (OPAR), Paris, France**

Data Centers mirror each other daily (every 4 hours) to ensure common holdings.

Primary Data Centers serve as the main method for disseminating IVS data and products.
Data Centers (DCs) are one of seven component types.
Data Center Structure

vlbi/
  |-- ivscontrol
  |   |-- ac-codes.txt
  |   |-- masteryy.txt
  |   |-- ...
  |   |-- ns-codes.txt
  |-- ivsdata
  |   |-- aux
  |     |-- yyyy
  |     |   |-- <ssssss>
  |     |     |-- <ssssss>.skd
  |     |     |-- <ssssss>.txt
  ...  
  |-- swin
  |   |-- yyyy
  |     |-- yyyyymmdd_<ssssss>_vnnn_swin.tar.bz2
  ...  
  |-- vgosdb
  |   |-- yyyy
  |     |-- yyMMMddCC.tgz
|--- ivsdocuments
|   |-- ivsdocuments
|   |-- ivsformats
|   |-- ivsproducts

ivsdocuments to be moved under ivsproducts and renamed to soln_descr
## History of “ingest” Software

<table>
<thead>
<tr>
<th>Author</th>
<th>Software</th>
<th>Data Centers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frank Gomez</td>
<td>ivsincoming2ivs (ingest v.1)</td>
<td>CDDIS, BKG, OPAR</td>
</tr>
<tr>
<td>Nathan Pollack</td>
<td>ingest v.2</td>
<td>CDDIS</td>
</tr>
<tr>
<td>Justine Woo, Taylor Yates</td>
<td><strong>ingest v.3</strong> [CDDIS]</td>
<td>CDDIS</td>
</tr>
<tr>
<td>Mario Bérubé, Anastasiia Girdiuk, Dirk Behrend</td>
<td><strong>ingest v.3</strong> [BKG, OPAR]</td>
<td>BKG, OPAR</td>
</tr>
</tbody>
</table>

➢ Some features of “ivsincoming2ivs”:
  - monolithic script (10,000+ lines of code)
  - difficult to maintain, evolved over time
  - used for 20 years at all three DCs

➢ Divergence of data handling with “ingest v.2”
Some Basics of ingest v.3

- Modular design, Python-based
- First at CDDIS (GSFC), then for BKG/OPAR
- **CDDIS**: main program part of larger suite that supports all geodetic techniques: cannot be disentangled and ported to other DCs
- **BKG/OPAR**: different main program written that implements CDDIS main program functions
- Two common pieces between both suites:
  - data description files (DDF) and
  - validation scripts (for QC)
Some Statistics of ingest v.3

- Statistics on BKG/OPAR implementation
- Lines of code (incl. comment/blank lines): \(~2500\)
- Main program:
  - Seven modules with a total of \(~900\) lines
  - Main module has \(~500\) lines
- Validation routines:
  - Some 30 routines with code of \(<50…125\) lines
  - Average length of module: \(~60\) lines
- DDFs:
  - Some 70 files
  - Several DDFs call same validation routine
def main(filename):
    """Validate a VLBI product file given in SINEX format."""
    try:
        # Initiate list of warnings
        warn_list = []

        # Read the SINEX file
        with open(filename, "r", encoding="latin-1") as reader:
            lines = reader.readlines()
        reader.close()

        # Verify SINEX format of header and trailer lines
        header = lines[0]
        trailer = lines[-1]
        if (header[:5] != "%=SNX") or (trailer[:7] != "%ENDSNX"):
            print ("FATAL: The given file is not in SINEX format!")
            return [False, "FATAL: Wrong format file."]
        exit(1)
        if header[58:59] != "R":  
            print ("FATAL: The SINEX solution is not based on VLBI data!")
            return [False, "FATAL: Not a VLBI SINEX file."]
        exit(1)

        # Verify integrity of SINEX file blocks, ensure inclusion of required blocks
        # incorporating SINEX solution methods 6a, 6b, 6c (after reading contained blocks)
        required_blocks = ["FILE/REFERENCE", "NUTATION/DATA", "PRECESSION/DATA",
                           "SOURCE/ID", "SITE/ID", "SITE/ECCENTRICITY",
                           "SOLUTION/EPOCHS", "SOLUTION/APRIORI"]
Tasks Done by “ingest”

➢ Main program: ➤ filename check
  ▪ Build proper name from applicable control files (i.e., Master files, ac-codes.txt, ns-codes.txt)
  ▪ Check proper name vs. filename, compression
  ▪ Reject file if no match or wrong compression

➢ Validation routine: ➤ QC step
  ▪ Check integrity of content (e.g., header/trailer lines and block structure in SINEX files)
  ▪ Extract metadata (e.g., start and stop times of session related files)
  ▪ Reject file if prior steps fail
Impact on Submissions

➢ Enhanced quality control (QC):
  ▪ Strict enforcement of filename conventions
  ▪ Stricter quality checks of file content, i.e., verify that standard formats are followed (SKD, VEX, SINEX, EOP format, etc.)
  ► Some files that used to pass are now rejected!

➢ Need for improved notification system:
  ▪ E.g., at CDDIS “successful upload” indicates “file received” but not successful pass of QC
  ▪ Possible options (feedback requested):
    o Email notification of success/failure or
    o Webpage listing of last ~200 submissions
Status of Rollout

➢ August 2, 2021: all three data centers switched to new ingest


➢ Cleanup of repository
  ▪ Reprocessing of existing data holding
  ▪ Removal of erroneous files
  ▪ Renaming of misnamed files
  ▪ Tentative date: April 30, 2022
<table>
<thead>
<tr>
<th>File type</th>
<th>Name convention</th>
<th>Compression</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>schedule file</td>
<td>&lt;ssssss&gt;.skd</td>
<td></td>
<td>r11002.skd</td>
</tr>
<tr>
<td>session notes</td>
<td>&lt;ssssss&gt;.txt</td>
<td></td>
<td>r11002.txt</td>
</tr>
<tr>
<td>log files</td>
<td>&lt;ssssss&gt;nn.log</td>
<td></td>
<td>r11002ht.log</td>
</tr>
<tr>
<td>full log files</td>
<td>&lt;ssssss&gt;nn_full.log</td>
<td>.bz2</td>
<td>r11002k2_full.log.bz2</td>
</tr>
<tr>
<td>SWIN files</td>
<td>yyyymmdd_&lt;ssssss&gt;_vnnn_swin.tar</td>
<td>.bz2</td>
<td>20210607_r11002_v001_swin.tar.bz2</td>
</tr>
<tr>
<td>vgosDB</td>
<td>yyMMMddCC</td>
<td>.tgz</td>
<td>21JUN07XA.tgz</td>
</tr>
<tr>
<td>CRF</td>
<td>aaaccccc.crf</td>
<td>.gz</td>
<td>opa2021a.crf.gz</td>
</tr>
<tr>
<td></td>
<td>aaaccccc.stats.crf</td>
<td>.gz</td>
<td>opa2021a.stats.crf.gz</td>
</tr>
<tr>
<td>EOPS</td>
<td>aaaccccc.eops</td>
<td>.gz</td>
<td>gsf2020a.eops.gz</td>
</tr>
<tr>
<td></td>
<td>aaaccccc.stats.eops</td>
<td>.gz</td>
<td>gsf2020a.stats.eops.gz</td>
</tr>
<tr>
<td>Daily SINEX</td>
<td>yyMMMddCC_aaaccccc.snx</td>
<td>.gz</td>
<td>21JUN07XA_bkg2020a.snx.gz</td>
</tr>
<tr>
<td>DOCS</td>
<td>aaaccccc.crf.txt</td>
<td></td>
<td>opa2021a.crf.txt</td>
</tr>
<tr>
<td></td>
<td>aaaccccc.eops.txt</td>
<td></td>
<td>gsf2020a.eops.txt</td>
</tr>
<tr>
<td></td>
<td>aaaccccc.dsnx.txt</td>
<td></td>
<td>bkg2020a.dsnx.txt</td>
</tr>
</tbody>
</table>
How to Add New Data Type

➢ Community:
  ▪ Discuss and define format description
  ▪ Determine storage needs

➢ DC group:
  ▪ Write DDF, including location in directory tree
  ▪ Write validation routine
  ▪ Extend storage capacity, if needed
  ▪ Test DDF, routine in shadow ingest system

➢ Community and DCs:
  ▪ Submit files of new data type
  ▪ Correct any kinks
As of August 2, 2021, a new ingest software is running at the IVS DCs of CDDIS, BKG, OPAR.

BKG and OPAR use the same suite; CDDIS uses its own flavor of the main ingest program.

DDFs and validation scripts are the same for all.

DCs will reprocess existing holdings (cleanup); tentatively scheduled for April 30, 2022.

Following cleanup at all three DCs, the data holdings will be synchronized.

Then mirroring should ensure identical holdings going forward.

Contact the DCs: ivs-datcen@lists.nasa.gov
Thank you.