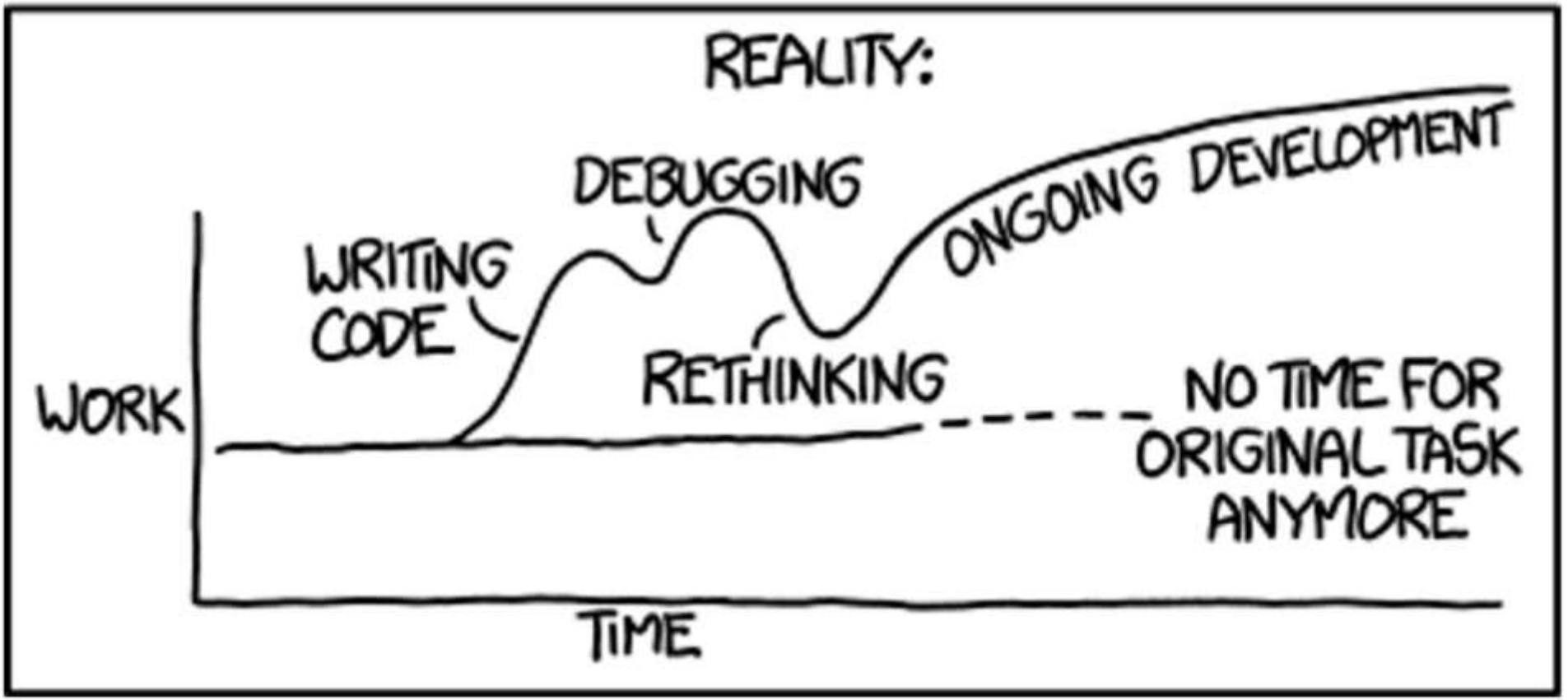
"I SPEND A LOT OF TIME ON THIS TASK.
I SHOULD WRITE A PROGRAM AUTOMATING IT!"



theory or reality?

Automating Regional Data Integration for Emergency Services with Python

Heather Widlund, GIS Coordinator
San Miguel County, Colorado

GIS Data Integration for Emergency Services

West Region Data Integration Group

West Region Data Integration Group

Schemas*

- Roads
- Driveway & Structure Addresses
- Landmarks & Addressed Places

*data schema = set of field properties (name, length, type, etc.)

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Colorado West Region Address Point Schema
Revised 07/15/14

FIELD NAME	NULLABLE	FIELD SOURCE STANDARD	MAX CHAR	TYPE	ALIAS	DESCRIPTION
SOD	NO	i3	6	Text	Source of Data	Agency who last updated the data, usually the 911 authority
SID	NO	i3/NENA	20	Text	Unique site ID	e.g. SANMCO_XXXXX
EDT	YES	NENA	N/A	Date	Effective Date	Date address is effective
SAN	YES	NENA/PIDF-LO	(10)	Long Integer	Site Address Number	Numeric identifier of a location along a road
SNS	YES	PIDF-LO	5	Text	Site Address Number suffix	A, 1/2, etc.
PRD	YES	roads data dict./NENA	2	Text	Street Prefix Direction	(n,e,s,w nw,ne,sw,se)
RD	NO	roads DD/NENA	60	Text	Street Name	spelled out street name
STS	YES	roads DD/NENA	4	Text	Street type suffix	from postal standards (e.g. ST, AVE, RD, WAY)
POD	YES	roads DD/NENA	2	Text	Street Post Directional	(n,e,s,w nw,ne,sw,se)
FSA	NO	group	100	Text	Full Street Address	Full street address with all elements incl. unit
ESN	NO	NENA	(3)	Short Integer	Emergency Service Number	Number identifying the combination of Law, Fire, EMS services for the location.
MCN	NO	NENA	35	Text	MSAG Community Name	Community name used on the address's related MSAG Range and associated ALI data. For geocoding of ALI data. May not match Postal Community Name.
PCN	NO	i3	35	Text	Postal Community Name	Community name used for USPS delivery or ZIP.
BLD	YES	i3	35	Text	Building Name	Common name of building/location
UNIT	YES	i3	5	Text	Unit ID	Unit identifier, apart from Address Number Suffix
UTY	YES	i3	35	Text	Unit type	Unit, Apt, Trlr, Suite
LOC	YES	i3	35	Text	Location Information	Additional location info/comments
PLC	YES	PIDF-LO	35	Text	Place Type	(office, school, store, church, residential, mixed)
LAT	YES	group	(15)	double	Latitude, GCS Decimal Degrees	Double numbers allow up to 15 places. Minimum
LON	YES	group	(15)	double	Longitude, GCS Decimal Degrees	six place past the decimal.
ASN	YES		60	AN	Alias Street Name	Concatenated Alias Street Name for labeling and alternate street name address matching
ASN2	YES		60	AN	Alias Street Name 2	Second Concatenated Alias Street Name for labeling and alternate street name address matching

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Integrated data at work

- Reverse emergency alert address validation
- 9-1-1 dispatch mapping
- 9-1-1 call address validation
- 9-1-1 address database maintenance

CodeRED
Keeping citizens informed.

9-1-1 NET


The end...?
Nope

What is the problem?

Data updates are arduous.

Source Schema	Target Schema
LABEL_NAME	FSN
LANES	
STDIR	PRD
STEXT	STS
STNAME	RD
STREETUSE	
CO_UNIQUE	
ALIAS_1	ASN
STDIRSUF	POD
SOD	SOD
SID	SID

Map non-matching fields…

Drop fields…

Extract data…

Populate fields…

Reproject…

Zip & ship…

Man Died

DEC 17, 2014

- Colorado Wildfire: Mapping Glitch Blamed For Failure To Alert Some Residents To Wildfire (Associated Press - best overall article)

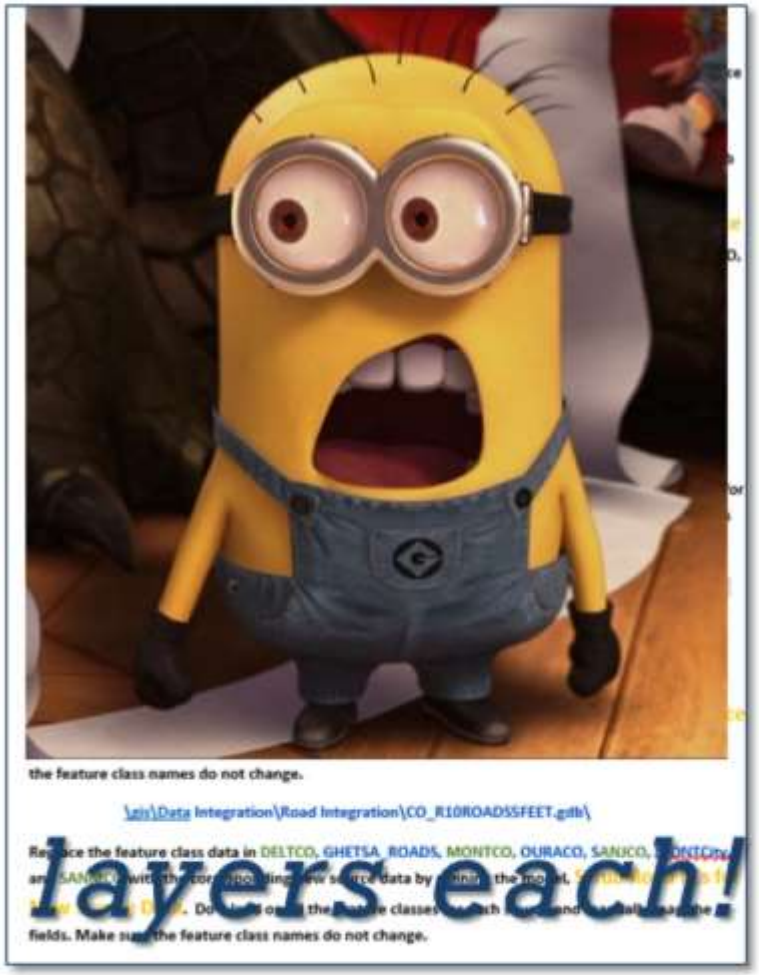
more than 100,000 geo-coding errors in the ENS database that was in use at the time

Data integration – old method

Manually check spatial reference of each layer

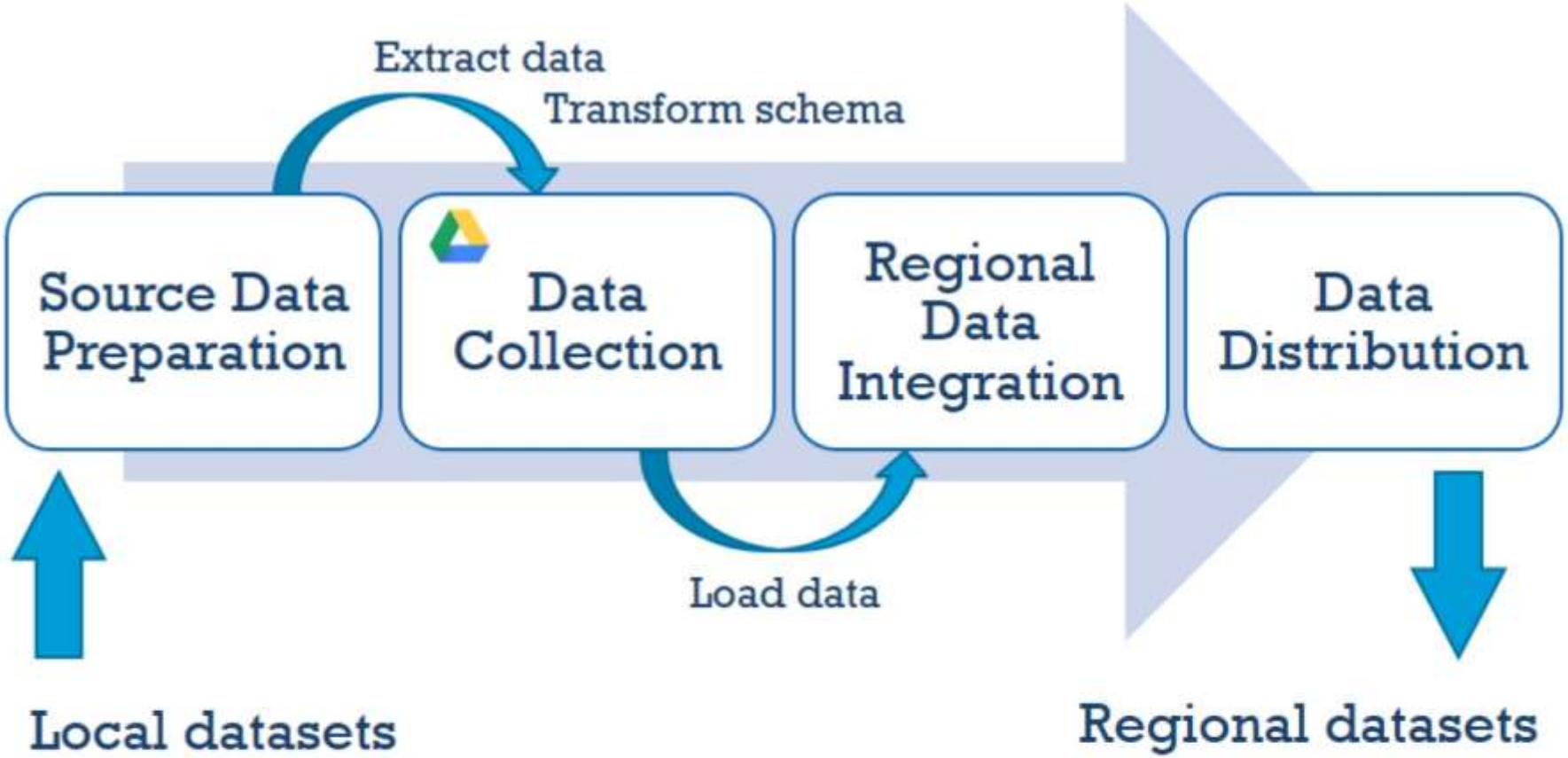
Four separate models to delete old data

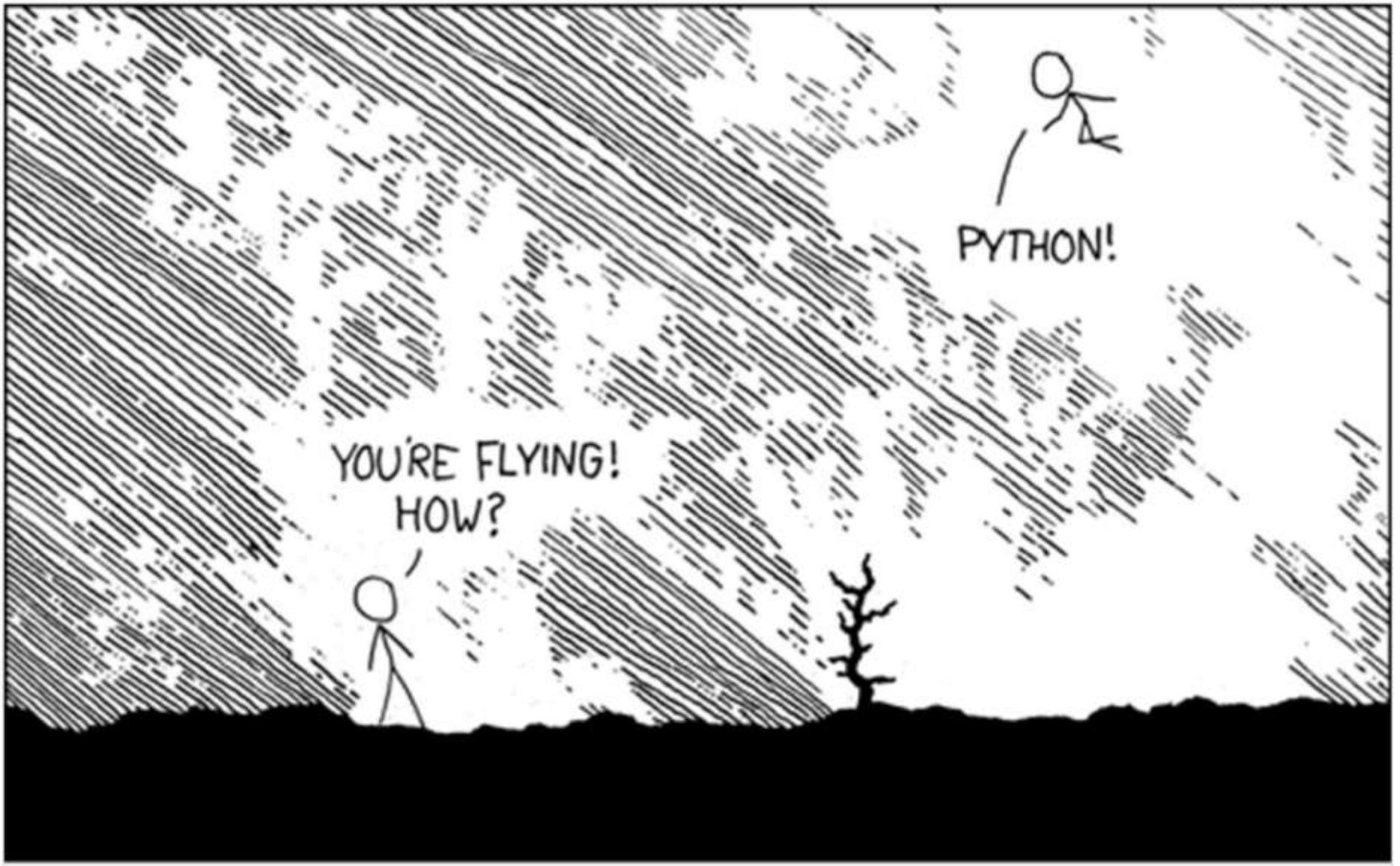
"Do a load on all the feature classes for each source and **manually map the fields**"



6 agencies x 4 layers each!

Data integration – new method





xkcd.com/353

Two stages of automation

Source data preparation

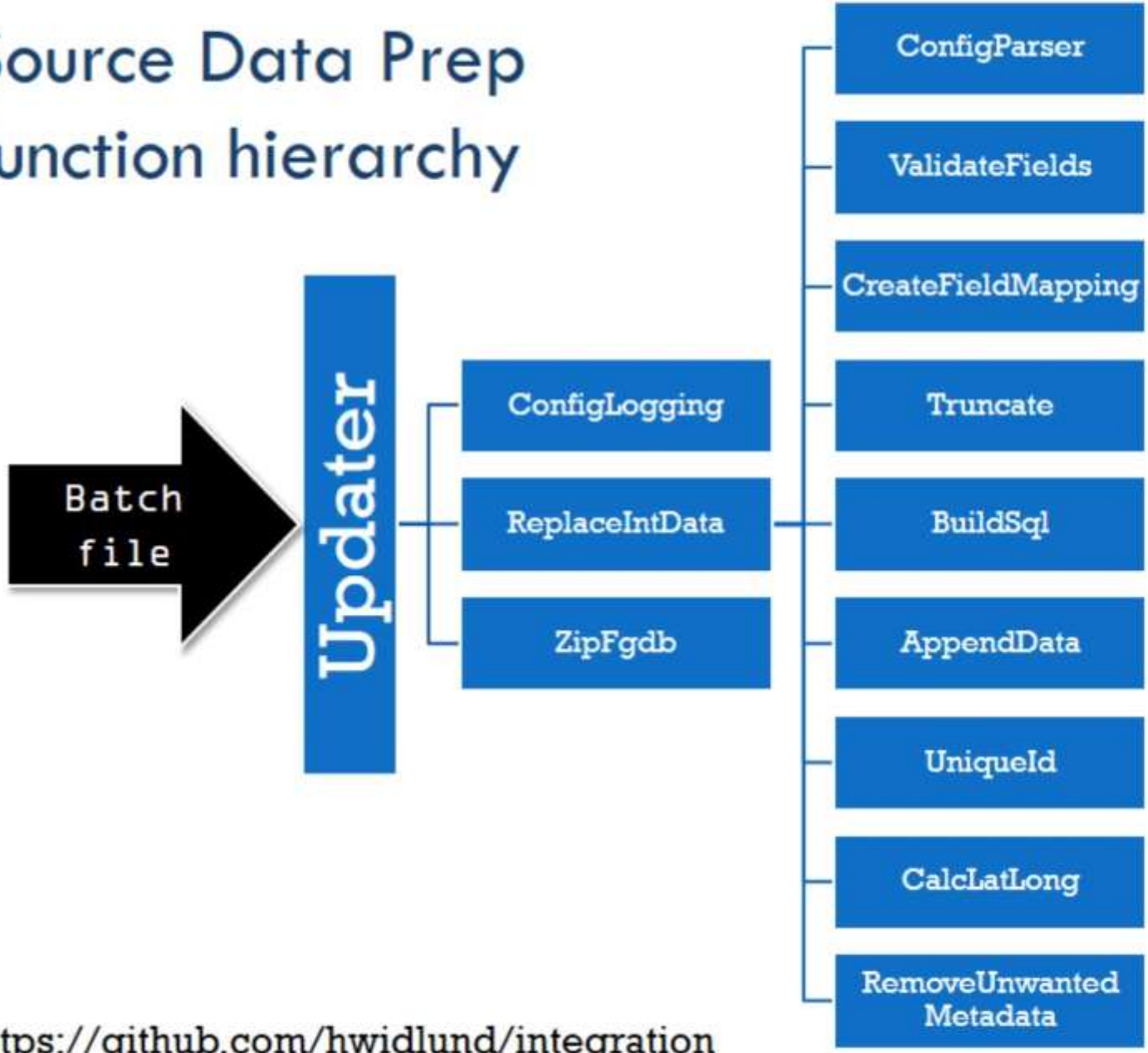
- Configure parameters
- Run update script
- Output: Zipped file geodatabase (one agency)

Regional data integration

- Run script tool
- Output: Integrated file geodatabase (all agencies)

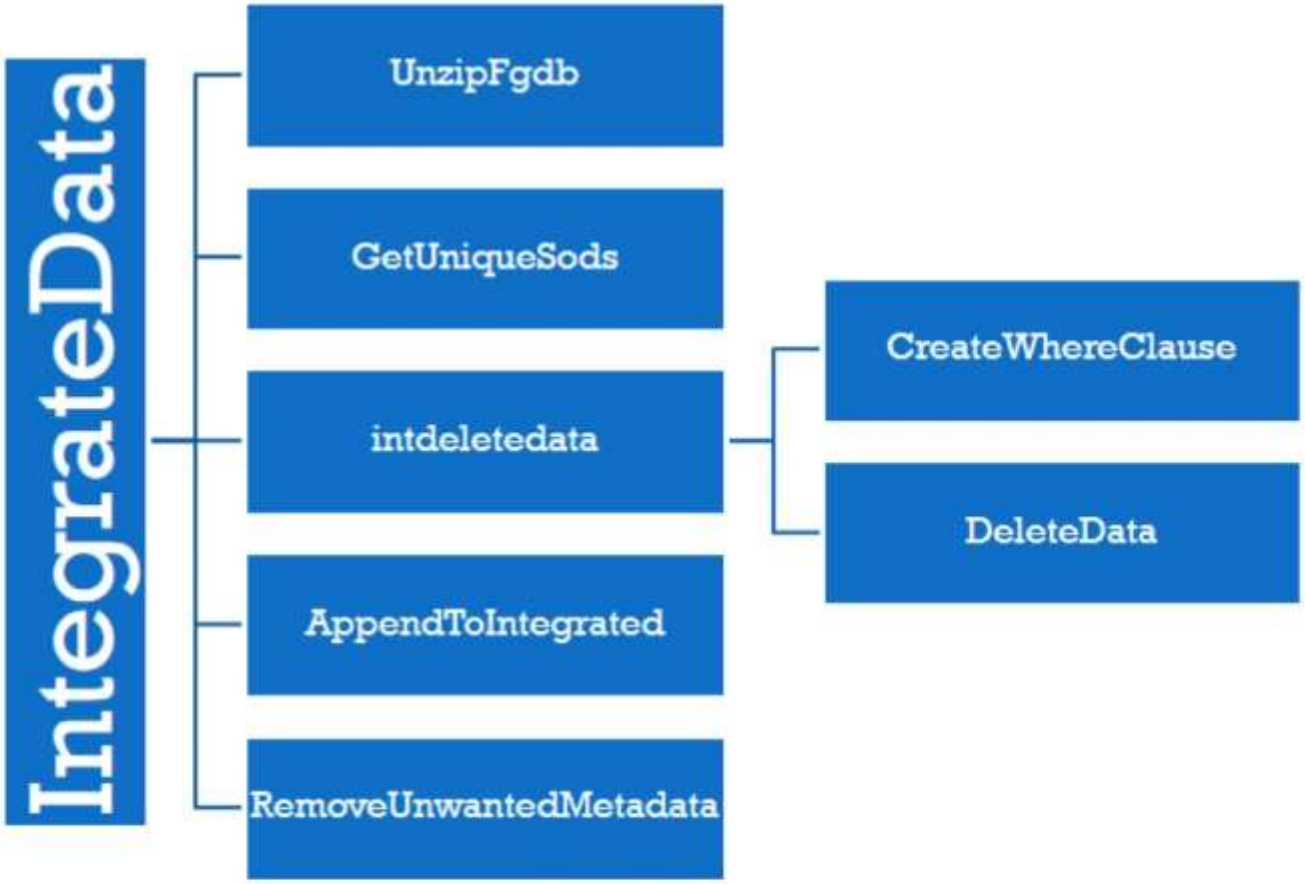
Demo

Source Data Prep function hierarchy



https://github.com/hwidlund/integration

Data Integration function hierarchy



https://github.com/hwidlund/integration

Key requirements

- Config script with schema/script tool
- "Blueprint" datasets: source & integrated
- Source agency identifier/code (SANMCO)

Code Highlights

Iteration

Source data prep

- *.ini files in directory
- Feature classes in a geodatabase

Data integration

- Zip files in directory
- Agency geodatabases

All

- Items in lists
  (fields in feature classes, feature classes in gdb)
- Keys/values in dictionaries (field properties)

Field map dictionary

```
fldMapDict =
dict(config.items('FIELD_MAPPER'))
```

```
[FIELD_MAPPER]
sod = SOD
sid = SID
fsn = LABEL_NAME
prd = STDIR
rd = STNAME
```

```
{'fsn': 'LABEL_NAME',
 'prd': 'STDIR',
 'rd': 'STNAME',
 'sid': 'SID',
 'sod': 'SOD'}
```

- Validate field lengths & types
- Create field mapping object

Validate field properties – 3 dictionaries

1. Field map dictionary (target: source)

```
{'rd': 'STNAME'}
```

2. Source field dictionary

```
{'STNAME': ['String', 50]}
```

3. Target field dictionary

```
{'RD': ['String', 60]}
```

Make 2 field dicts.

Iterate dict. 1

Get field properties from dict. 2&3

Compare string field length

Compare field types

```
# Make dictionaries of field characteristics for source & target fields
# {'SOD':['String',6], 'SID':['String',20], 'NAME':['String',60]...}
srcFields = arcpy.ListFields(srcFC)
srcDict = {}
for srcField in srcFields:
        if not srcField.required:
            srcDict[srcField.name] = [srcField.type, srcField.length]
targetFields = arcpy.ListFields(targetFc)
targetDict = {}
for targetField in targetFields:
        if not targetField.required:
            targetDict[targetField.name] = [targetField.type, targetField.length]
# compare to field map dictionary from config file
for targetFld, srcFld in fldMapDict.items():
       if not srcFld == '':
            targetFldUpper = targetFld.upper()
            if targetFldUpper in targetDict and srcFld in srcDict:
                targetFldType = targetDict[targetFldUpper][0]  ## type
                targetFldLen = targetDict[targetFldUpper][1]   ## length
                srcFldType = srcDict[srcFld][0]          ## type
                srcFldLen = srcDict[srcFld][1]           ## length
                if (targetFldType == 'String' and
                    srcFldType == 'String' and
                    targetFldLen < srcFldLen):  ## a fatal error; won't append
                    error += "String field length mismatch (fatal error):"\
                        "target {0} length: {1} src {2} length: {3} \n"\
                        .format(targetFldUpper,str(targetFldLen),\
                        srcFld,str(srcFldLen))
                if not targetFldType == srcFldType:       ## not a fatal error
                    message += "Field type mismatch (not a fatal error):"\
                        " {0} ({1}) & {2} ({3})\n".format\
                        (targetFldUpper,targetFldType,srcFld,srcFldType)
```

Source data prep: append

- Projects to target coordinate system
- Respects datum transformation if set
- Respects data selection in input feature layer
- Maps mismatched fields using field mappings object
- Drops unmapped fields

```
arcpy.Append_management(flInput, outputFC, 'NO_TEST', fieldMappings)
```

Project Status

Progress

- Spring/summer

- August
- Agencies ran prep scripts (1 to 10 minutes)
- Collected new data zips
- Ran full integration (@18 minutes)

- Aug./Sept.
- Deployed to 1 dispatch center
- CodeRED (reverse alert) address validation

- September 28th

Goals

Semi-monthly dispatch updates

Quarterly CodeRED validation

theory or reality?

1. Saves time
2. Redu or
3. Inc requency

= Improved protection of life safety & property

Thanks

West Region Data Integration Group

Matt Goetsch, City of Montrose/METSA

James Detwiler, Pennsylvania State University MGIS program

Contact

Heather Widlund

heatherw@sanmiguelcountyco.gov

https://github.com/hwidlund/integration
(code & documentation)

www.gishackerhiker.com
(snippets & discussion)