

Automatic Quality Control in the New production environment using ArcGIS

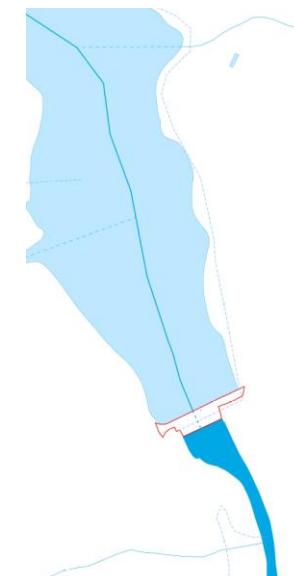
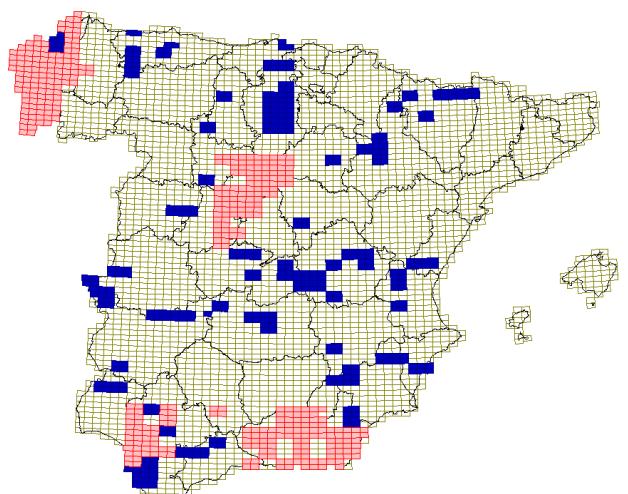
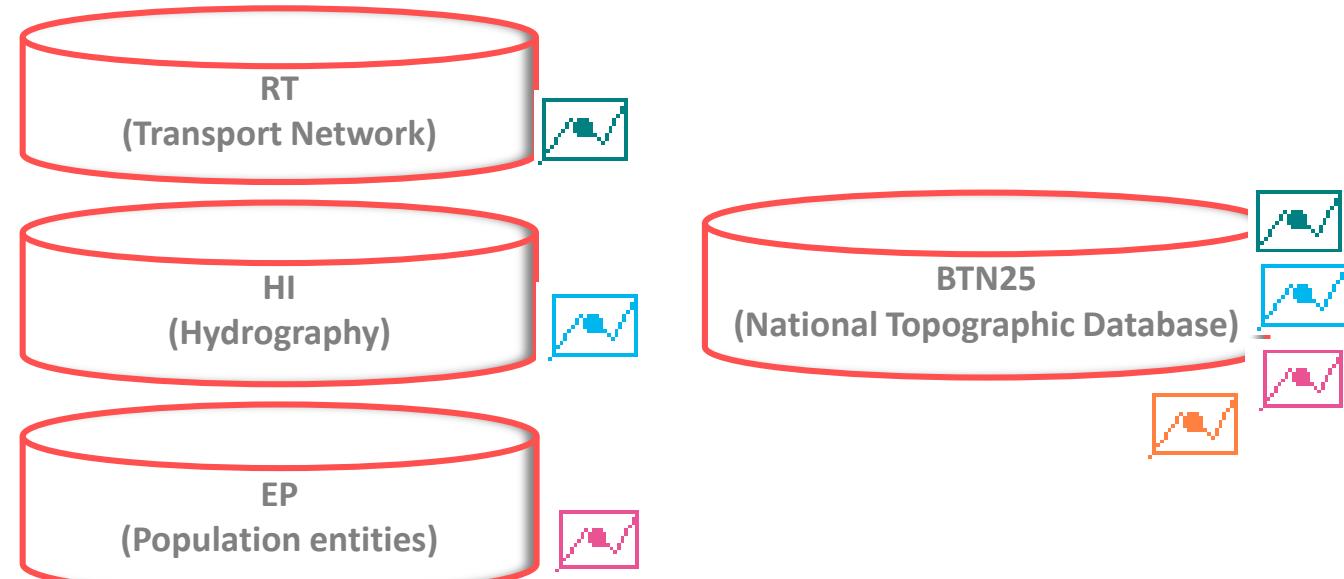
Gonzalo Moreno Vergara

- **Changing the update process**
- **BDIG program**
 - **Changes detection**
 - **Work orders management**
 - **BDIG environment (with ArcGIS)**
 - **BDIG environment. Databases**
- **Main workflow**
- **Consistency rules. Possibilities to automate**
- **Consistency rules. Solution applied**
- **Error management**

Changing the update process

Current production

- Different environments
- Geometries duplicated
- Updates by themes
- Updates by blocks



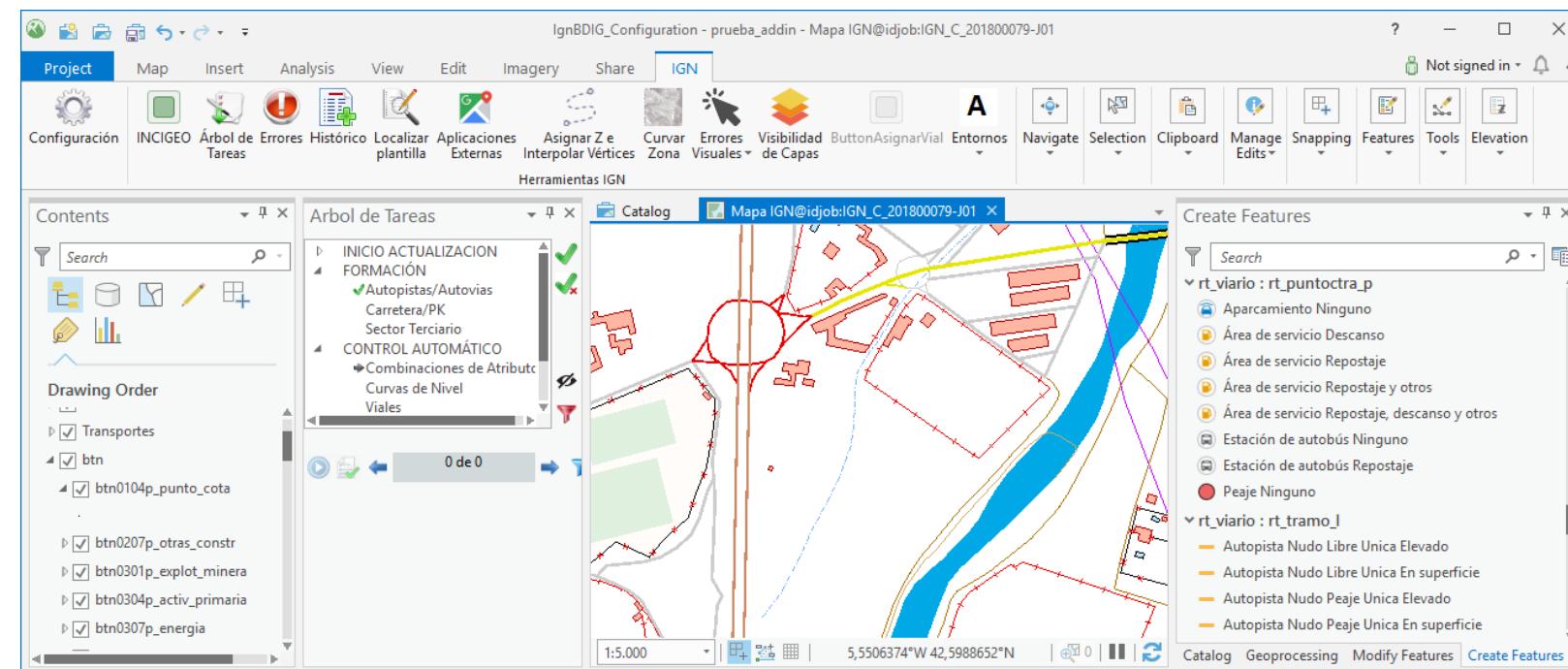
Current production

- Different environments
- Geometries duplicated
- Updates by themes
- Updates by blocks



Future Production

- One production environment



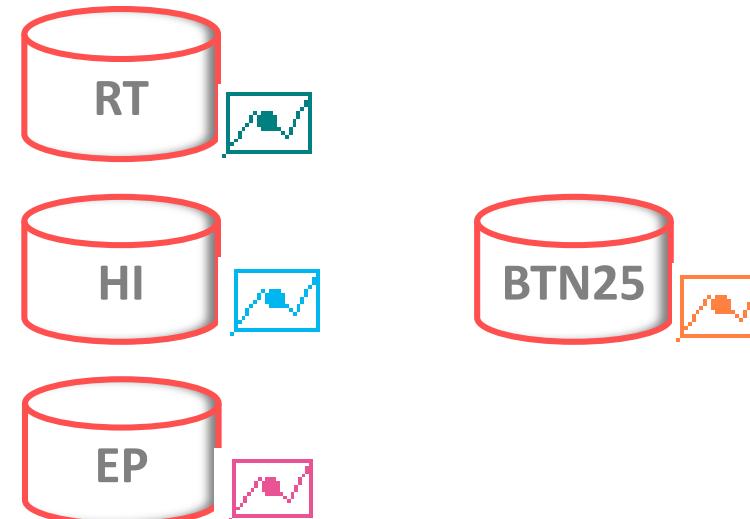
Current production

- Different environments
- Geometries duplicated
- Updates by themes
- Updates by blocks



Future Production

- One production environment
- **One geometry**



Changing the update process

Current production

- Different environments
- Geometries duplicated
- Updates by themes
- Updates by blocks



Future Production

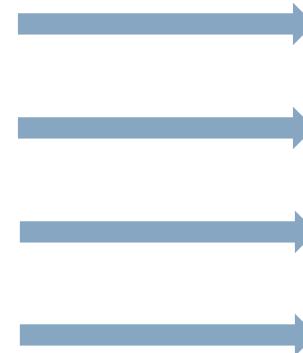
- One production environment
- One geometry
- **Update by changes**



Changing the update process

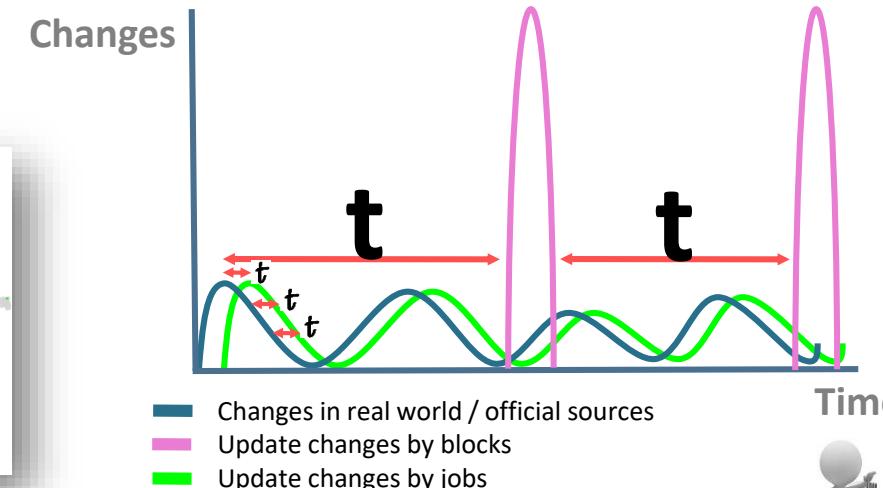
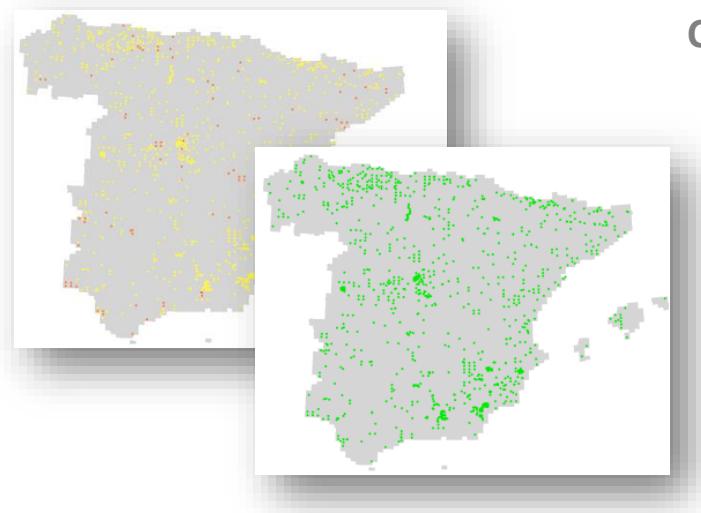
Current production

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- Updates by themes
- Updates by blocks



Future Production

- One production environment
- One geometry
- Update by changes
- **Update by jobs**



Changes detection
Work orders management

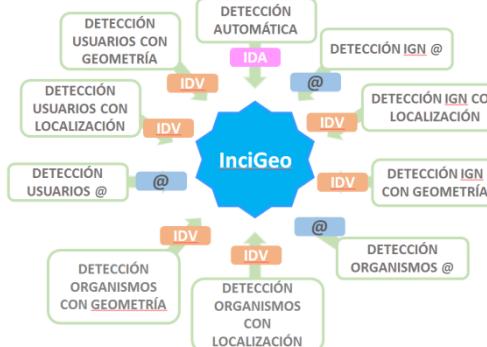


Aim: continuous updating of Geospatial Information Databases (BDIG)

4 principles

- Jointly
- Without geometry duplication
- By changes
- By jobs

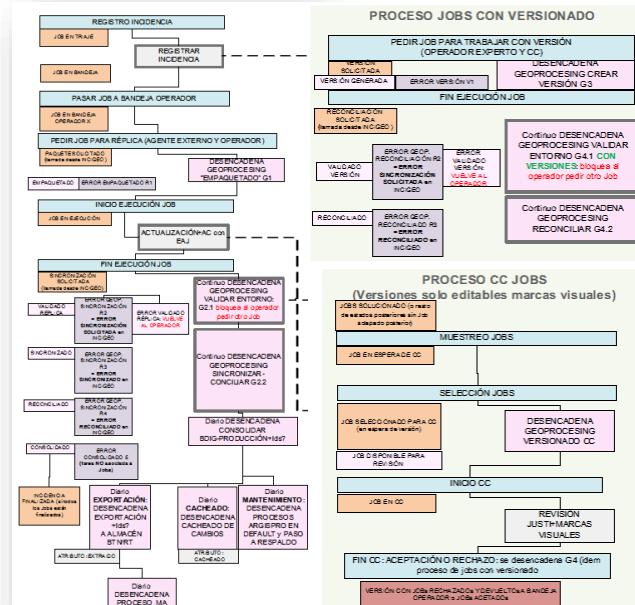
Changes detection



CNIG demand



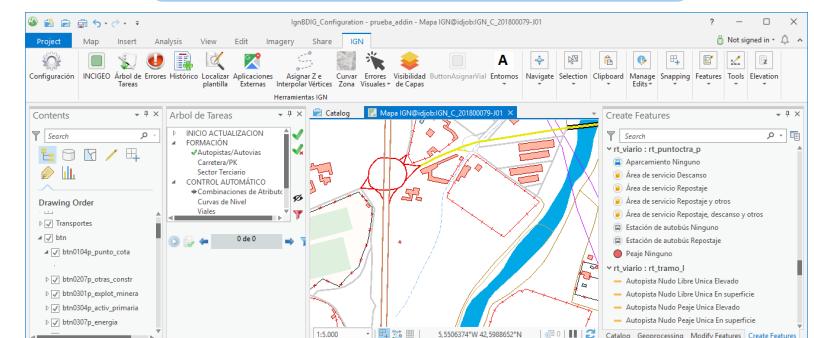
InciGeo



Projects

- Changes detection
- InciGeo
- BDIG environment

BDIG environment



Publish

Changes detection



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AUTOMATIC DETECTION

OFFICIAL SOURCES
DIRECT UPDATE

OTHER SOURCES

CHANGES / ERRORS
WITH GEOMETRY

CHANGES / ERRORS
WITHOUT LOCATION

WITH GEOMETRY



Cadastre



Official sources:
e.g. street addresses



OpenStreetMap



Neural networks

Bots

VISUAL DETECTION

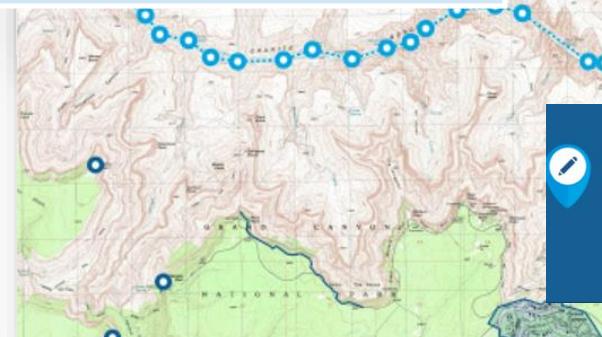
CHANGES / ERRORS
WITH GEOMETRY

WITHOUT GEOMETRY

Cartografía e imágenes



Error marks on map
viewers and Apps



Comparador de mapas

Cervantes y el Madrid del siglo XVII

Fototeca Digital

GeoEditor
for MapTiler





Aim: efficient management of potential changes

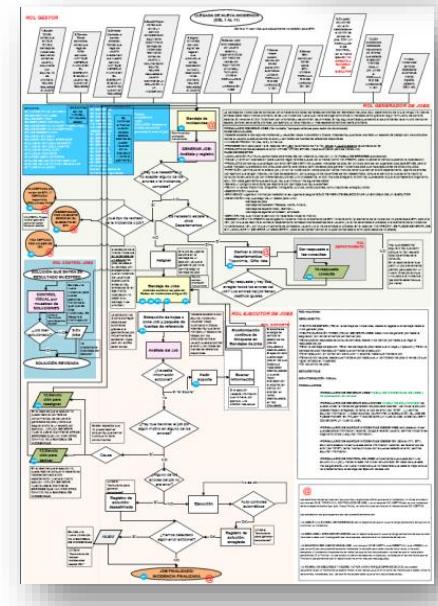
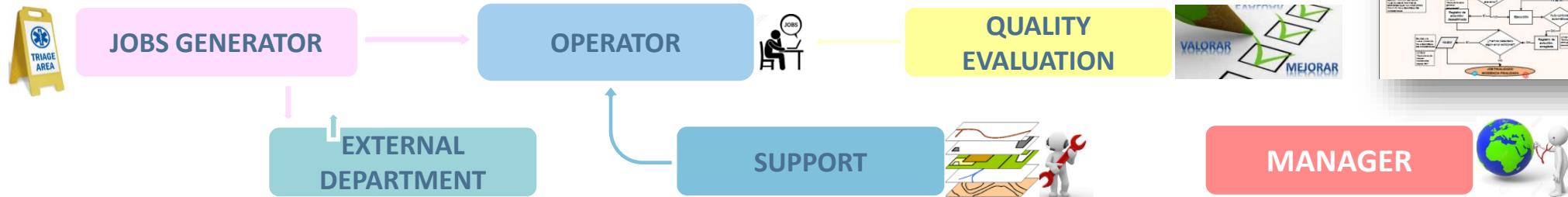
■ Diversity of entries



■ Triage



■ Automatic flow between different roles



■ Monitored

STATES

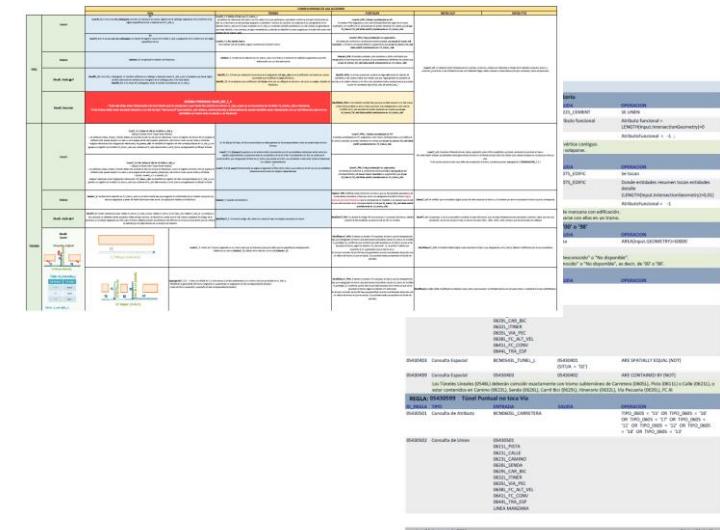
TASK TIMES

WARNINGS

INCIDENCE USER TRACKING (@)

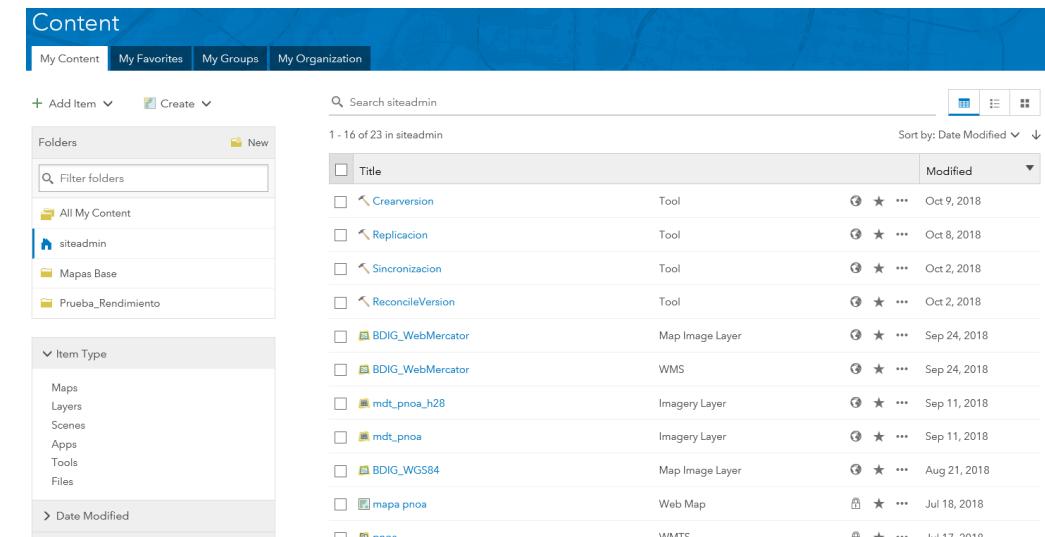
■ Update GI

- By Jobs
- Jointly
- Ensure specifications

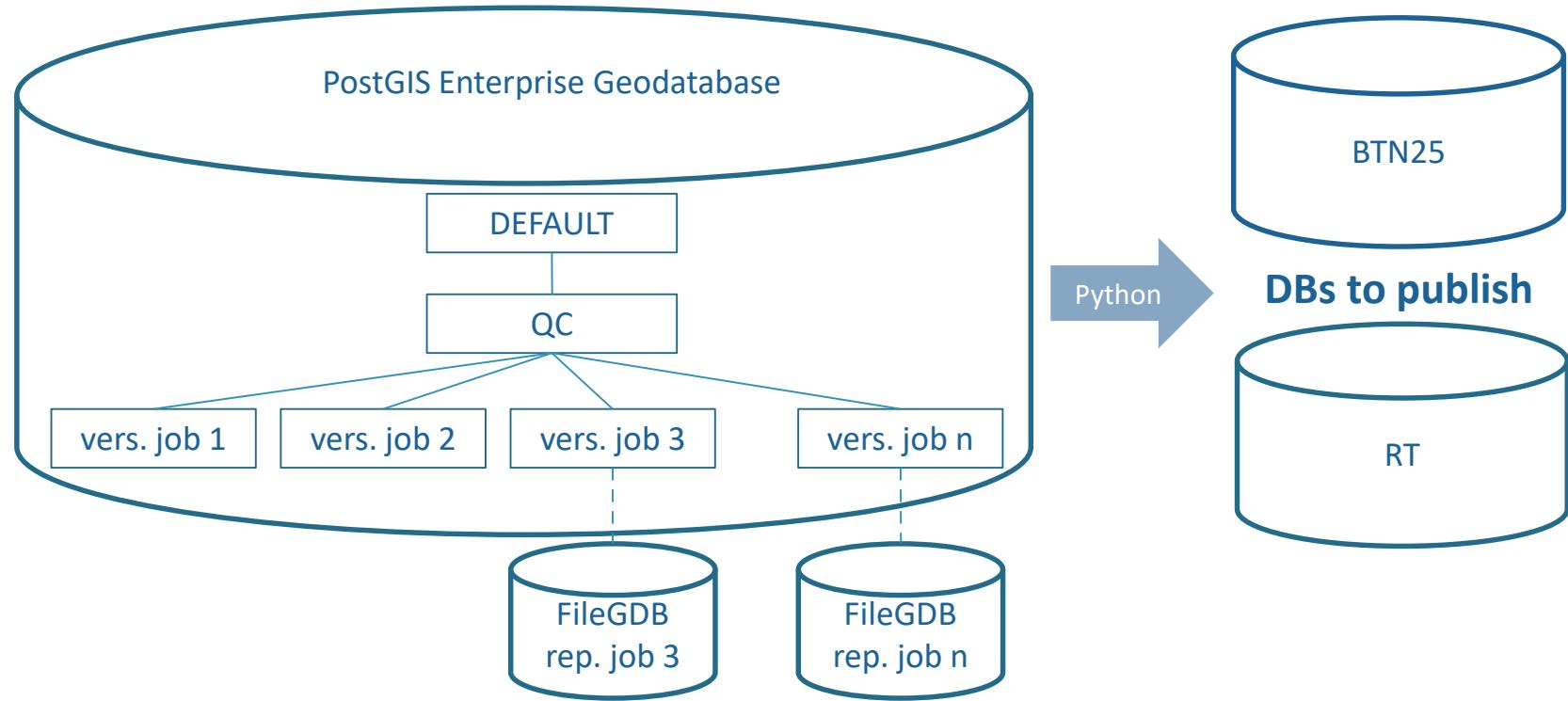


■ On ArcGIS Pro

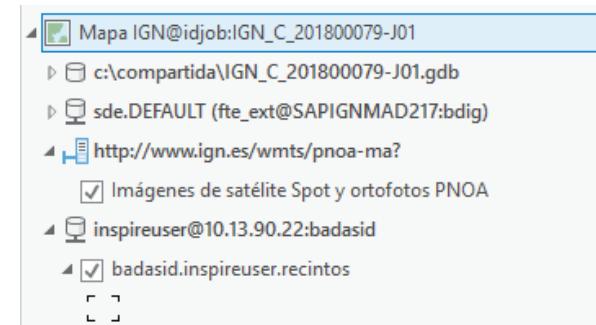
- Customized (Add-In)
- Services
 - Reference data
 - Geoprocessing
- Ensure consistency



- Edition geodatabase
 - Schemas
 - BTN25 (partially)
 - RT
 - Versions and replicas



- Reference data
 - Services
 - Existing
 - Created on purpose



Main workflow



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■ Change in real world



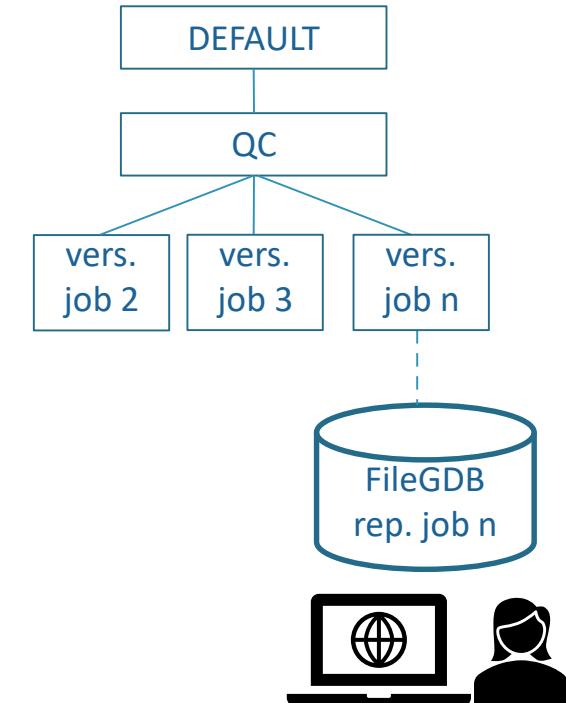
Main workflow

- Change in real world
- Create area for a job



Main workflow

- Change in real world
- Create area for a job
- Assign job to operator
- Generate a replica



Operator (at a
company with a
contract)

Main workflow

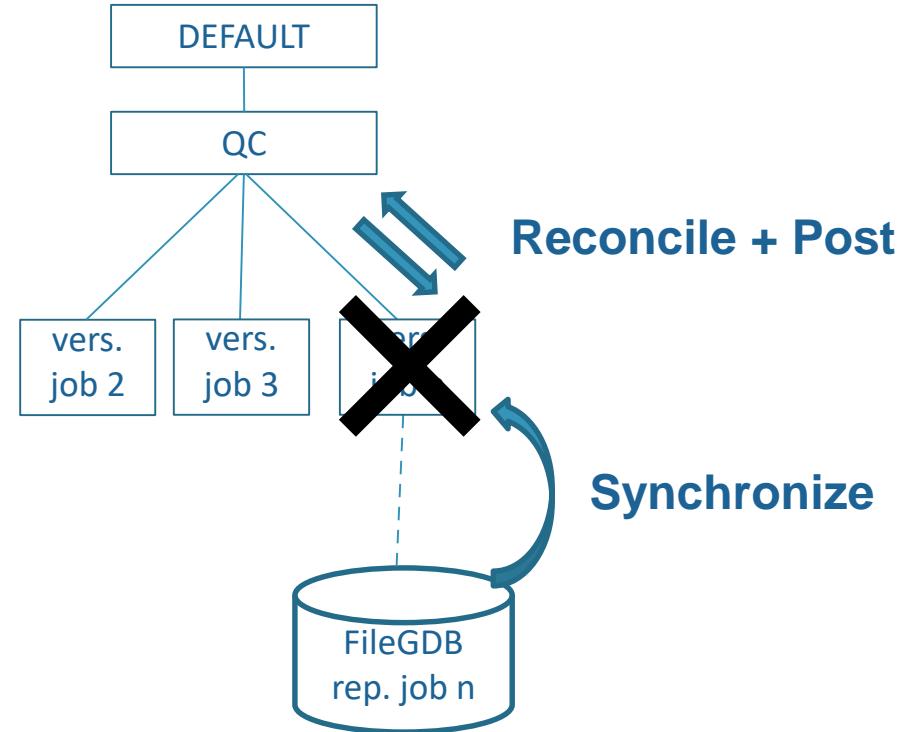
- Change in real world
- Create area for a job
- Assign job to operator
- Generate a replica
- Operator
 - Update
 - Run consistency rules
 - Fix errors



Operator (at a
company with a
contract)

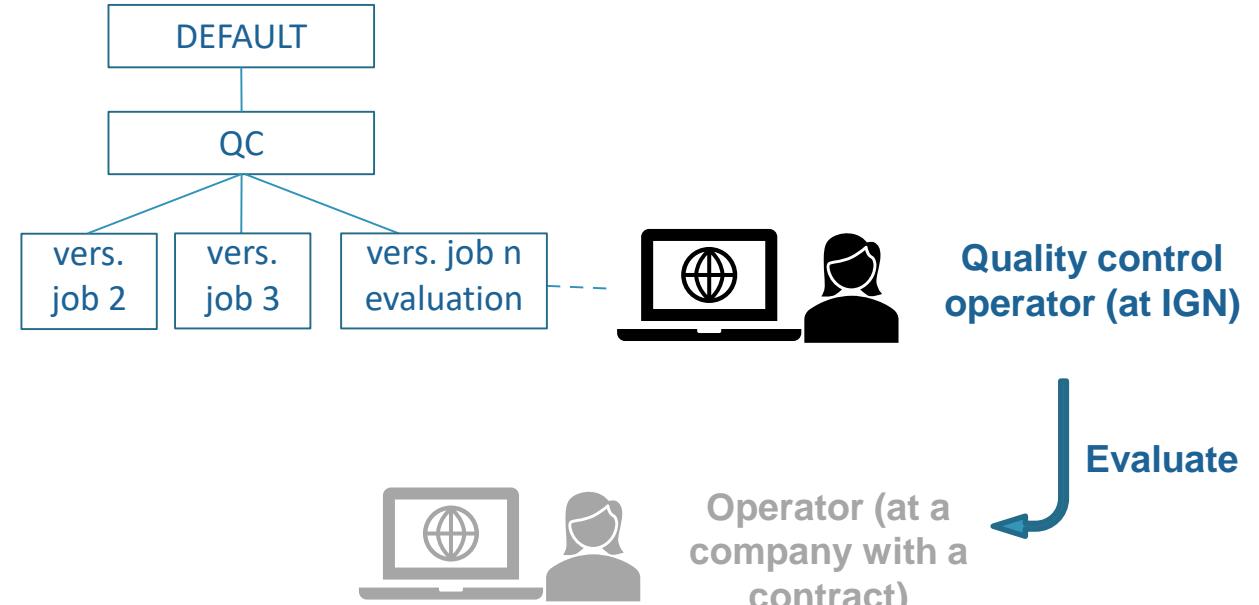
Main workflow

- Change in real world
- Create area for a job
- Assign job to operator
- Generate a replica
- Operator
 - Update
 - Run consistency rules
 - Fix errors
- Finishing the job
 - Verify no errors remain
 - Synchronize
 - Reconcile + Post
 - Delete version



Main workflow

- Change in real world
- Create area for a job
- Assign job to operator
- Generate a replica
- Operator
 - Update
 - Run consistency rules
 - Fix errors
- Finishing the job
 - Verify no errors remain
 - Synchronize
 - Reconcile + Post
 - Delete version



- For some finished Jobs
 - Pick up for quality evaluation
 - Generate a version and assign to a quality control operator
 - Aim: evaluate the operator

Define functions and procedure on PostGIS DB

- ☺ Independence from ArcGIS
- ☹ Data must be on PostGIS DB

Using ArcGIS Data Reviewer

- ☺ Basic functions and error management provided
- ☺ Work on Enterprise and File Geodatabase
- ☹ Hard to define for big dataset (graphic interface to define the application of rules one by one)
- ☹ ArcGIS dependency and extra licence

Define functions and procedure with ArcPy and configuration tables

- ☺ Flexibility
- ☺ Work on Enterprise and File Geodatabase
- ☹ Extra work to define
- ☹ ArcGIS dependency

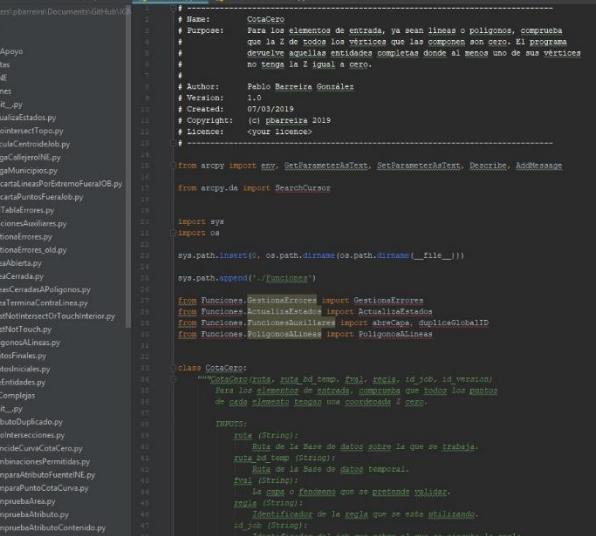
ArcPy + configuration tables

- Define basic rules (or as basic as possible)
 - For now, 36 rules (developing)

Name	Definition	Feature validated	Feature to compare (if any)	Other parameters
OBJE	nombre	definicion	fenomeno_validado	fenomeno_comparado
2	LineaFuerzaPoligono	Las entidades lineales no deben cruzar las entid...	True	True
3	AutoIntersecciones	Las entidades no pueden cortarse a si mismas.	True	False
4	CoordZConstante	Las entidades han de tener una coordenada Z c...	True	False
5	LineaTocaLineaMismaFC	Las entidades lineales no pueden tocar otras en...	True	True
6	CompruebaAtributo	Los atributos de las entidades deben cumplir la...	True	False
7	PuntoDentroPolilineaCer...	Dentro de una polilínea cerrada ha de haber un...	True	False
8	ComparaPuntoCotaCurva	La cota de los puntos acotados debe estar relac...	True	True
10	PuntoTocaLinea	Los elementos puntuales no pueden tocar los e...	True	False
11	MultiLineaCortaMultiPol...	Los elementos lineales no pueden cortar comp...	True	True
12	CombinacionesPermitidas	Las combinaciones de atributos tienen que cor...	True	False
13	AtributoDuplicado	El atributo tiene que tener un valor único para...	True	False

ArcPy + configuration tables

- Define basic rules (or as basic as possible)
 - For now, 36 rules (developing)
- Each rule → .py



The screenshot shows the PyCharm IDE interface with the 'CotaCero' project open. The code editor displays 'FuncionesAuxiliares.py' with the following content:

```
# Name: CotaCero
# Purpose: Para los elementos de entrada, ya sean líneas o polígonos, comprueba
# que la Z de todos los vértices que las componen son cero. El programa
# devolverá aquellas entidades completas donde al menos uno de sus vértices
# no tenga la Z igual a cero.

# Author: Pablo Barreiro González
# Version: 1.0
# Created: 07/2019
# Copyright: (c) phbarreiro 2019
# License: <your license>
# http://www.gnu.org/licenses/gpl-3.0.html

from arcpy import env, SetParameterAsText, SetParameterAsText, Describe, AddMessage
from arcpy.da import SearchCursor

import sys
import os

sys.path.insert(0, os.path.dirname(os.path.dirname(__file__)))
sys.path.append('..\Funciones')

from Funciones.GestionErrores import GestionErrores
from Funciones.KnowHowExcepciones import ActualizaEstados
from Funciones.FuncionesAuxiliares import altaCaso, DuplicaGlobalID
from Funciones.FuncionesAlineas import PoligonoAlineas

class CotaCero:
    nombreRegla = rutaEdTemp + 'CotaCero.shrx'
    rutaEdTemp = rutaEdTemp + 'CotaCero.shrx'
    idJob = idJob
    idVersion = idVersion

    def __init__(self, rutaEdTemp):
        """Para los elementos de entrada, comprueba que todos los puntos
        de cada elemento tengan una coordenada Z cero.

        INPUTS:
        rutaEdTemp (String):
            Ruta de la Base de datos sobre la que se trabaja.
        rutaEdTemp (String):
            Ruta de la Base de datos temporal.
        idJob (String):
            Identificador del job que ejecuta el que se ejecuta la regla.
        idVersion (String):
            Identificador de la versión sobre la que se trabaja (en su caso).
```

Python [C:\Users\pbanero\Documents\GitHub\IGN_EDIG_AdIn\IgnEDIG_AdIn\Python] - ...\\ReglasComplejas\\CotaCero.py [Python] - PyCharm

File Edit View Navigator Code Refactor Run Tools VCS Window Help

ESPlinesAcabaEnElemento

Project: Python [C:\Users\pbanero\Documents\GitHub\IGN_EDIG_AdIn\IgnEDIG_AdIn\Python]

File: CotaCero.py

Code: FuncionesAuxiliares.py

```
def calcular_recta(ruta, ruta_hd, temp, eval, regla, id_job, id_version):
    self.ruta = ruta
    self.ruta_hd = ruta_hd
    self.temp = temp
    self.eval = eval
    self.regla = regla
    self.id_job = id_job
    self.id_version = id_version
    self.id_caso = 0
    self.descripcion = ''
    self.descripcion_caso = ''
    self.descripcion_regla = 'Cordenada 1 (x0)'
    self.descripcion_regla2 = 'la coordenada 2 de las entidades no es paralela a lo largo de toda su geometria'
    self.salida = []

def sistema(sintax):
    """Funcion que ejecuta la validacion de la regla. No requiere parametros de entrada y no devuelve nada.
    Necesario llamar a la funcion resultado para obtener el resultado de la misma."""
    # Comprobamos el archivo recibido como parametro validado
    (self.eval, nombre_eval, hay_geometria) = cargar_archivo(self.eval)

    # Comprobamos el tipo de entidad que entra en la funcion (polígono, linea,...) y en función del tipo generado
    descriptor_entidad(self.eval)

    # LIMPIAMOS
    if desc_shapeType == ('Polyline'):
        print('es linea')
        cursor = SearchCursor(self.eval, ('SHAPE$', 'globalID'))
        for row in cursor:
            # POLIGONOS (necesario duplicar el globalID y convertir poligono a linea)
            if desc_shapeType == ('Polygon'):
                print('es poligono')
                sal000 = "in_memory\\sal000"
                sal000 = "in_memory\\sal000"
                duplicarGlobalID(self.eval, sal000, sal1000)

                sal1001 = "in_memory\\sal1001"
                # sal1001 = "C:\\Users\\Borras\\Desktop\\pol_a_linea"
                polg = PoligonosLineas(sal000, sal1001)
                polg.execute()

                cursor = SearchCursor(sal000, ('SHAPE$', 'copy_globalID'))
```

Python [C:\Users\lpbarrena\Documents\GitHub\IGN_BD\IgnBDIG_AdIn\IgnEDIG_AdIn\Python] - ...\\ReglasComplejas\CotaCero.py | PyCharm

File Edit View Navigate Code Refactor Run Tools VCS Window Help

ESLineaAcabaEnElemento

Project - Python - V8 - ReglasComplejas - CotaCero.py

Code CotaCero.py

FuncionesAuxiliares.py

```
for i in errores:
    print(i)
    AddressError("error: (%i)" % i, format(c))

# PARÁMETROS ERRORES A GESTIONERERRORES
if len(errores) > 0:
    gestion = GestiónErrores(errores, self.ruta, self.regla, self.nombre_regla, self.descripcion_regla,
                           self.id_job, self.id_version, nombre_fval)
    gestion.ejecuta()
    self.salida = "|||||".format(len(errores), gestion.erroritos)
else:
    estados = ActualizarEstados(self.ruta, nombre_fval, self.regla, self.id_job, self.id_version, [LINEA])
    estados.ejecuta()
    self.salida = "0|0"

# XML
    delete("in_memory")
    self.XML()
    para
    self.ejecucion = True

# -----
# ----- COTAS CERO -----
# -----
enviandoOutput = True
# ----

ruta = GetParameterByName(0)
ruta_id_ruta = GetParameterByName(1)
eval = GetParameterByName(2)
regla = GetParameterByName(3)
id_job = GetParameterByName(4)
id_version = GetParameterByName(5)
AddressError("Parametros: ruta = (%s), eval = (%s), regla = (%s), id_job = (%s), id_version = (%s)." % (ruta, eval, regla, id_job, id_version))

# -----
# -----
comprueba = CotaCero(ruta, ruta_id_ruta, eval, regla, id_job, id_version)
comprueba.ejecuta()
AddressError(comprueba.salida)

# -----
# -----
SetParameterByName(6, comprueba.salida)

print('|| - Fin'.format(time.strftime('%H:%M:%S')))
```

ArcPy + configuration tables

- Define basic rules (or as basic as possible)

- For now, 36 rules (developing)

- Each rule → .py

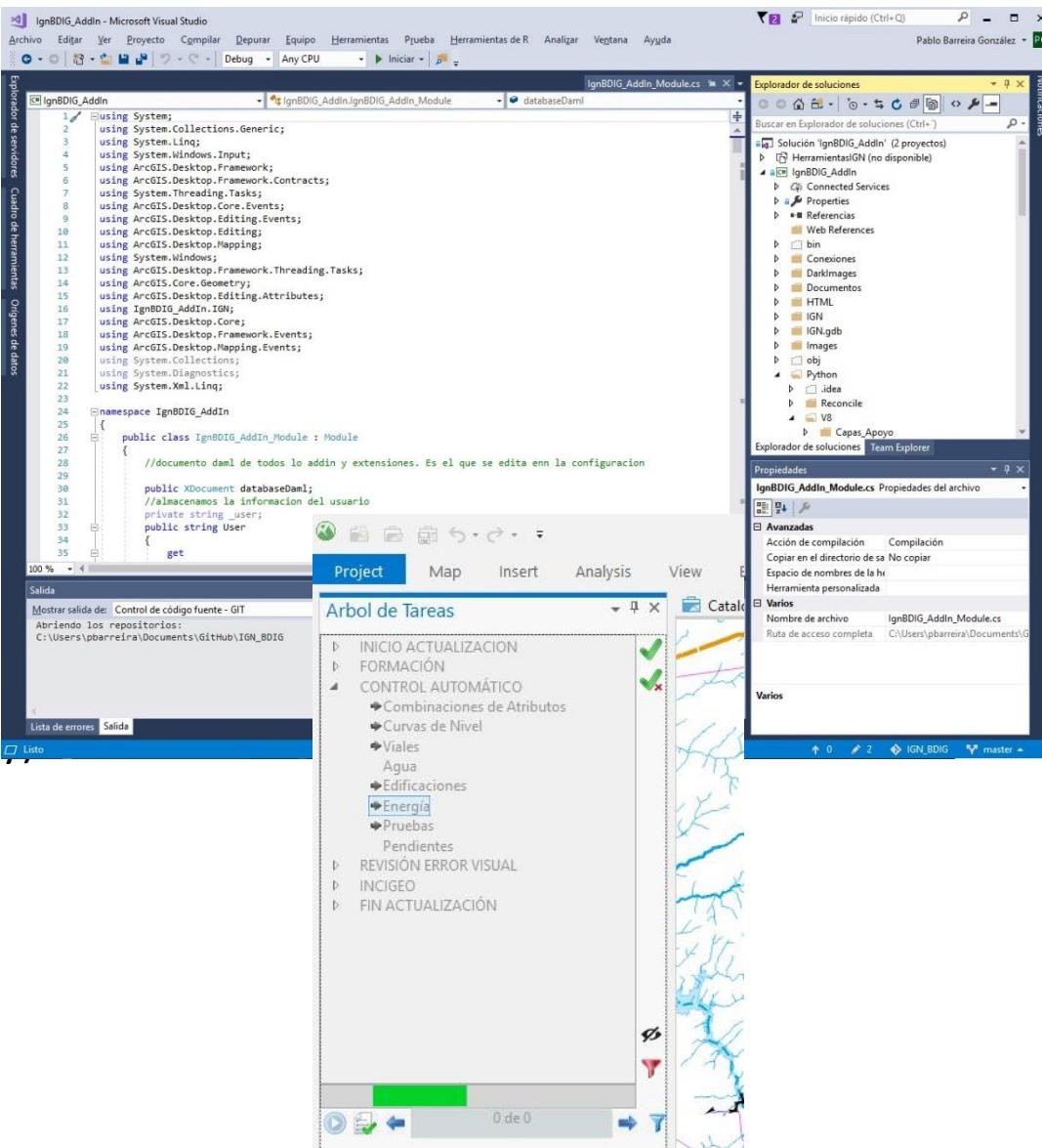
- Configuration tables

- Rules
- Rules X Features
- Errors
 - 4 tables (1 per geometry type and 1 without geometry)
 - Status field

OBJE	fenomeno_validado	Feature validated	Rule	Feature to compare (if any)	Other parametres
67	rt_tramoffcc_l	CombinacionesPermitidas	regla	<Null>	<Null>
68	btn0401l_curso_natural	CompruebaAtributoDentroYFuera	CONSULTA_AGUAS_SUPERFICIALES_BDIG	<Null>	"trar
69	btn0401l_curso_natural	MultiLineaCortaMultiPoligono	CONSULTA_AGUAS_SUPERFICIALES_BDIG	codigo	<Nu
70	btn0401s_curso_natural	MultiPoligonoNoContieneLinea	FILTRO_CURSOS_NAT_CONEXION	nombre;codigo;jerar...	<Nu
71	FILTRO_RIOS_NO_CUBIERTOS	LineaCruzaLineaSinElevacion	rt_tramo_l	<Null>	situac
72	FILTRO_RIOS_NO_CUBIERTOS	LineaCruzaLineaSinElevacion	rt_tramoffcc_l	<Null>	situac
73	CONSULTA_RIOS_LINEAL_BDIG	SuperficieAguaSinLinealInterior	CONSULTA_AGUAS_SUPERFICIALES_BDIG	<Null>	<Nu
74	btn0401l curso natural	ExcesoRamificaciones	<Null>	codiao	Non

ArcPy + configuration tables

- Define basic rules (or as basic as possible)
 - For now, 36 rules (developing)
- Each rule → .py
- Configuration tables
 - Rules
 - Rules X Features
 - Errors
 - 4 tables (1 per geometry type and 1 without geometry)
 - Status field
- Execution Flow
 - Launched from Addin



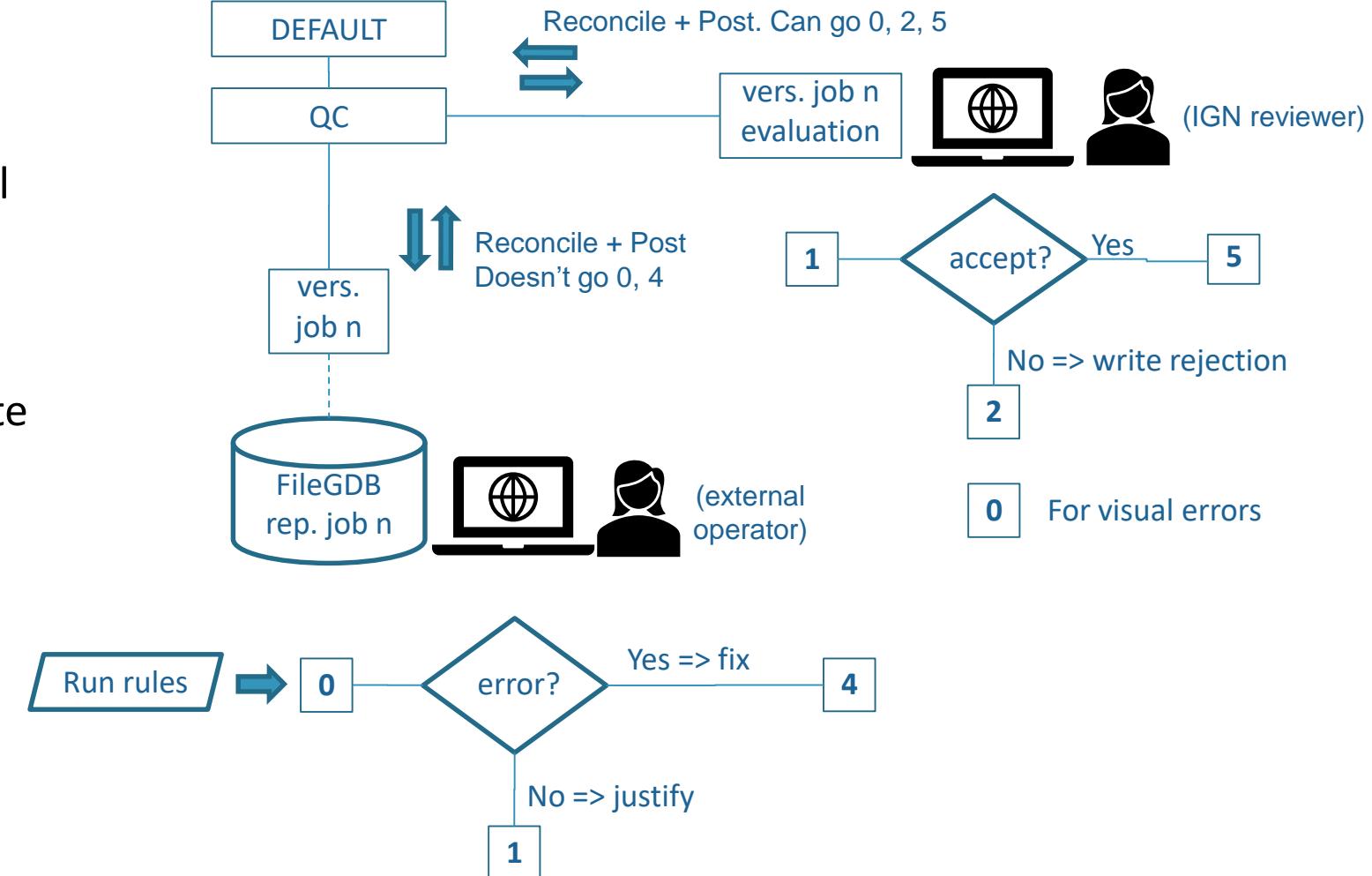
ArcPy + configuration tables

- Define basic rules (or as basic as possible)
 - For now, 36 rules (developing)
- Each rule → .py
- Configuration tables
 - Rules
 - Rules X Features
 - Errors
 - 4 tables (1 per geometry type and 1 without geometry)
 - Status field
- Execution Flow
 - Launched from Addin
- Other .py functions (manage errors, etc.)



- Status field in error tables.
Six possible values

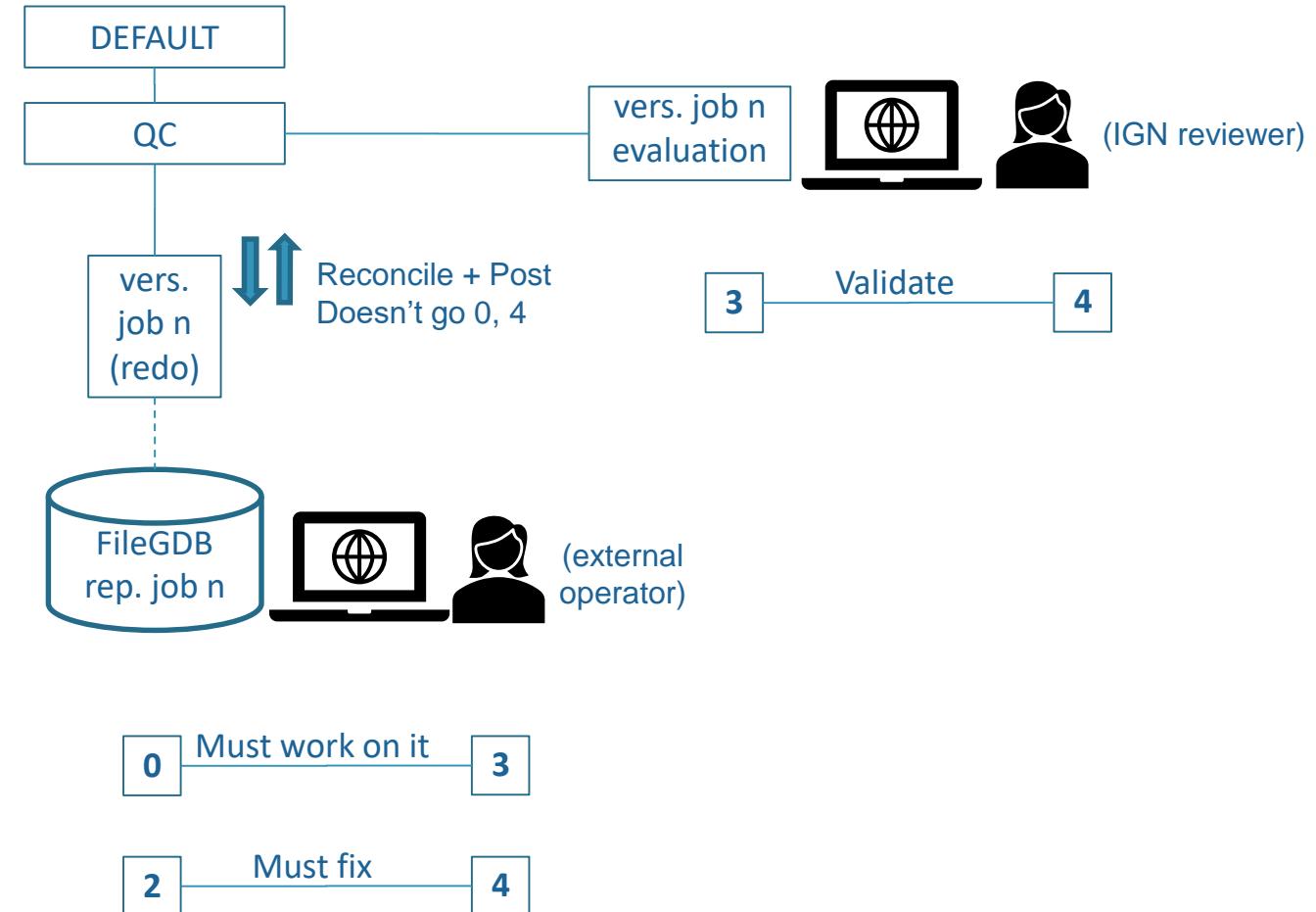
- 0: error detected
- 1: error justified (by external operator)
- 2: justification rejected (by IGN reviewer)
- 3: IGN reviewer must validate
- 4: error fixed
- 5: false error

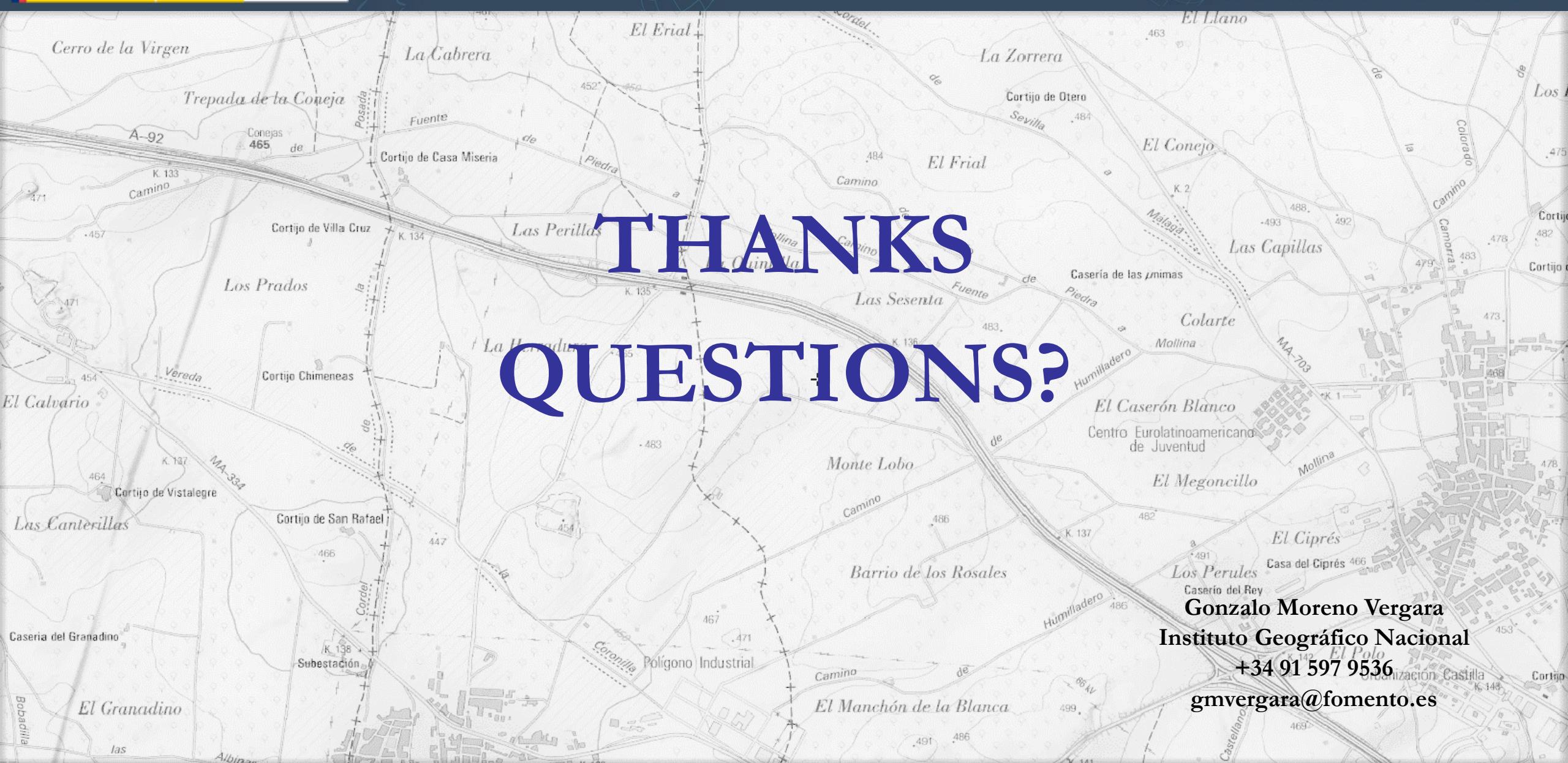




- Status field in error tables.
Six possible values

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