Epsilon International SA

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eENVplus pilot 7:

forest fire management

FP7/ICT-PSP No. 325232"eENVplus"
eEnvironmental services for advanced applications within INSPIRE

Mr. Alkis Astyakopoulos (associated project manager)
Prof. Marc Bonazountas (project manager)

Related projects and products

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ArcFIRE.eu
Forest Fire Management System

BRISEIDE

eENVplus

ArcFUEL.eu
Forest Fuel Mapping Service

Epsilon International SA

ArcFIRE.eu
Forest Fire Management System

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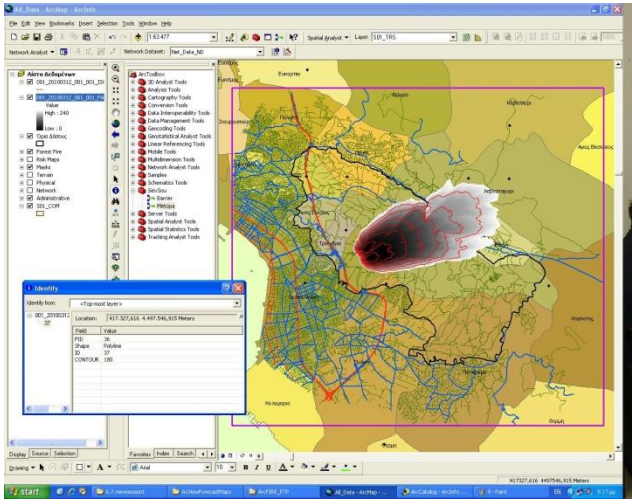
- A state-of-the-technology Integrated Wildland & Forest Fire Management Platform under constant technology evolution since 1990.
- It is offered to Civil Protection Authorities, and National- Regional- & Local Authorities.
- Its aim is to guide operations and protect our forests.
- The platform is customizable to meet any client's needs



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ArcFIRE Architecture

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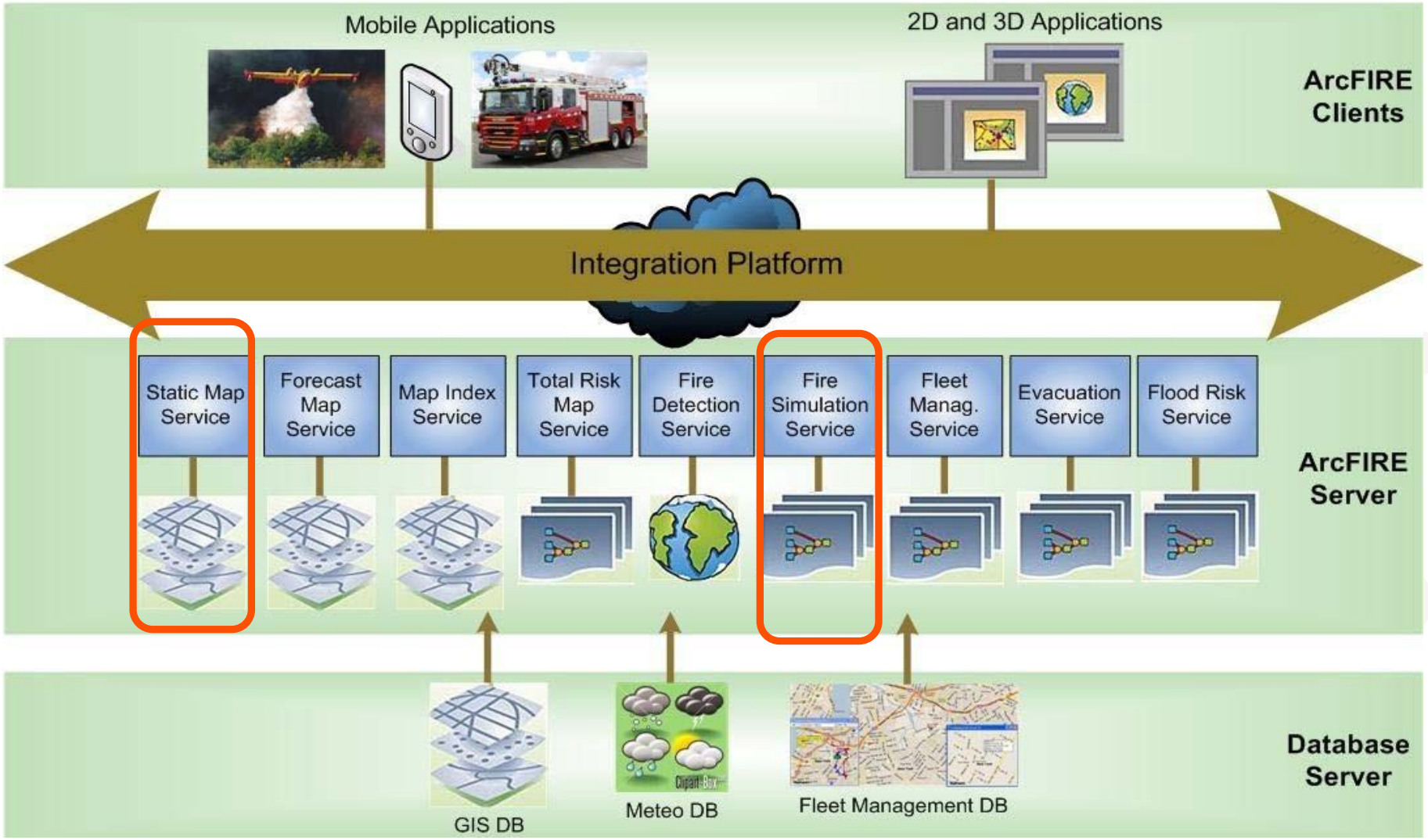

eENVplus Technology

- **Asynchronous Ingestion Service**
  - ➔ Creation of spatio-temporal data (meteorological forecasts and indexes)
  - ➔ ingestion of data to the eENVplus SDI
  - ➔ return data via OGC sevices: WMS, WCS, WFS

- **WPS orchestration**
  - ➔ calculation of fire simulation (FAT: fire access time) – INSPIRE
  - ➔ calculation of total risk by combining a series of services
  - ➔ calculation of optimal route avoiding the fire

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eENVplus Architecture

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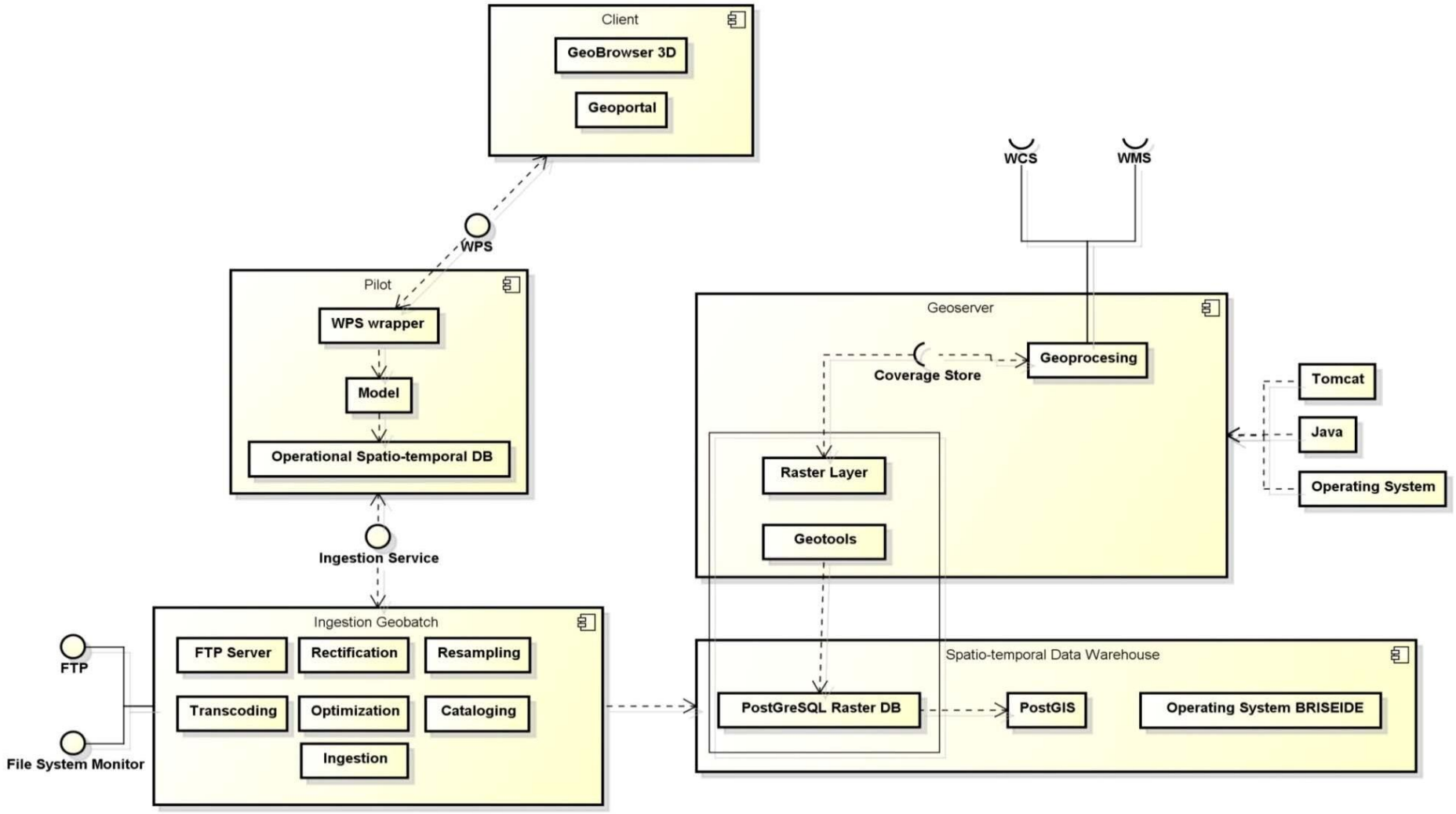

ArcFIRE Ingestion Service

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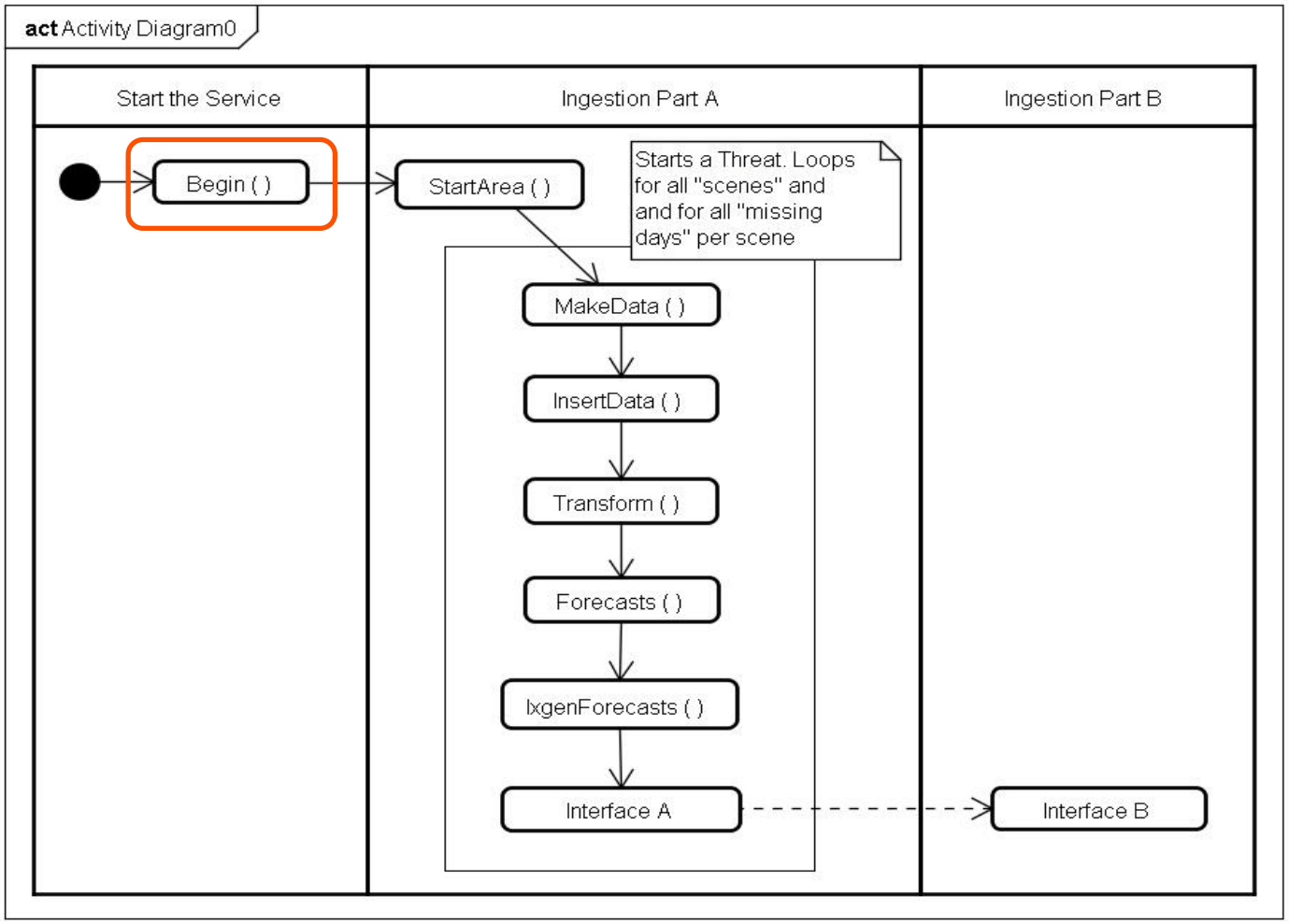

ArcFIRE Ingestion Service

- **Begin ()**
  - ➔ sets the parameters to download the raw meteorological data for all the active pilot areas called “Scenes”
  - ➔ defines the BBOX with particular CRS and EGU (e.g.20m.)
  - ➔ all available and activated “Scenes” are stored in an XML structure which contains only one data type called “Meteo Territory”
  - ➔ copies the XML attributes in the root directory of the machine where the service is running

ArcFIRE Ingestion Service

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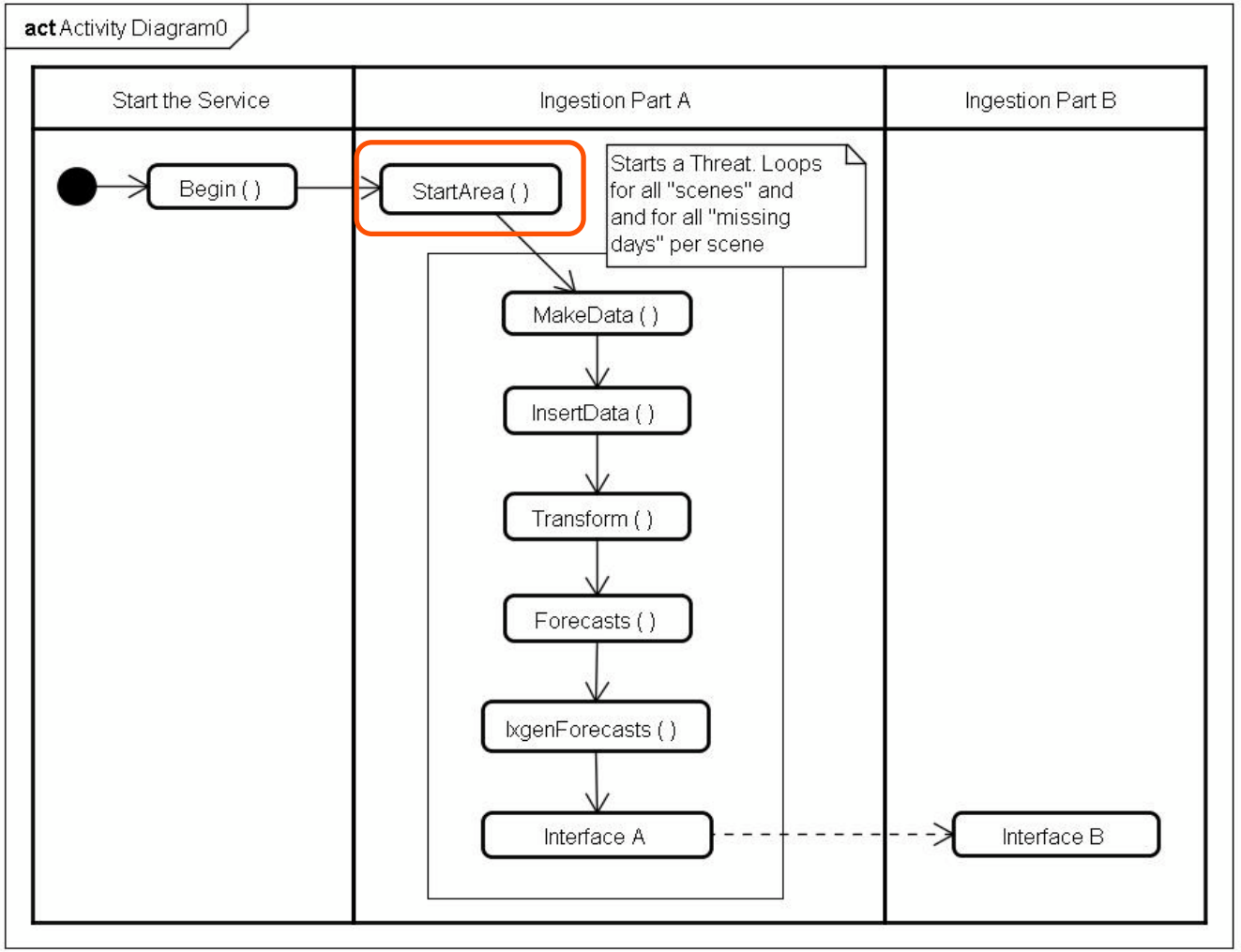
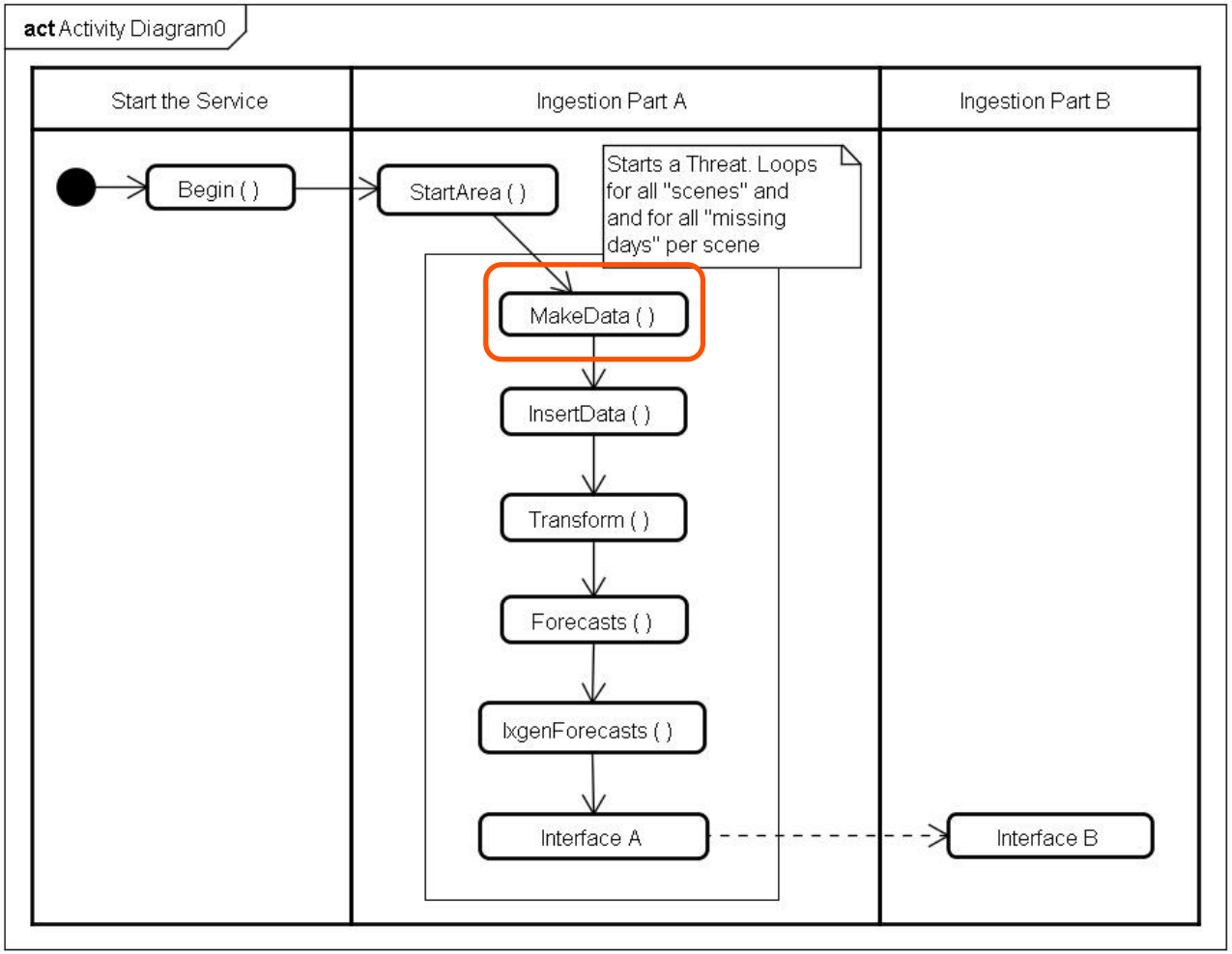


ArcFIRE Ingestion Service

- **Start Area ()**
  - ➔ queries the FTP services given by the "Meteo Territory" in a sequential order (e.g. UoA)
  - ➔ if any problem occurs in the query, the function attempts after 10 min
  - ➔ if an FTP area fails to respond, the function searches for the next available FTP server
  - ➔ compares the "ddmmyy" folders available on the FTP folder structure against the sets of raw data already downloaded
  - ➔ starts a threat for each day missing and is not prior to "Server installation date" or the "last backup date"

ArcFIRE Ingestion Service



ArcFIRE Ingestion Service

- **Make Data ()**
  - ➔ downloads the raw meteorological forecasts (7 parameters) for each day missing - usually 121 files (per hour for 5 days, i.e. 5x24+1=121)
  - ➔ keeps the names of the files as given by the FTP server (e.g. seihsu_LL.hhh, where hhh=forecast horizon)
  - ➔ U10: x-component of wind speed (m/s)
  - ➔ V10: y-component of wind speed (m/s)
  - ➔ T2M: air temperature at 2m height (K)
  - ➔ RH2M: relative humidity at 2m height (%)
  - ➔ CLOUD: cloud fraction (%)
  - ➔ MSL: mean sea-level pressure (Pa)
  - ➔ RAIN: accumulated precipitation for the last 1h (mm)

ArcFIRE Ingestion Service

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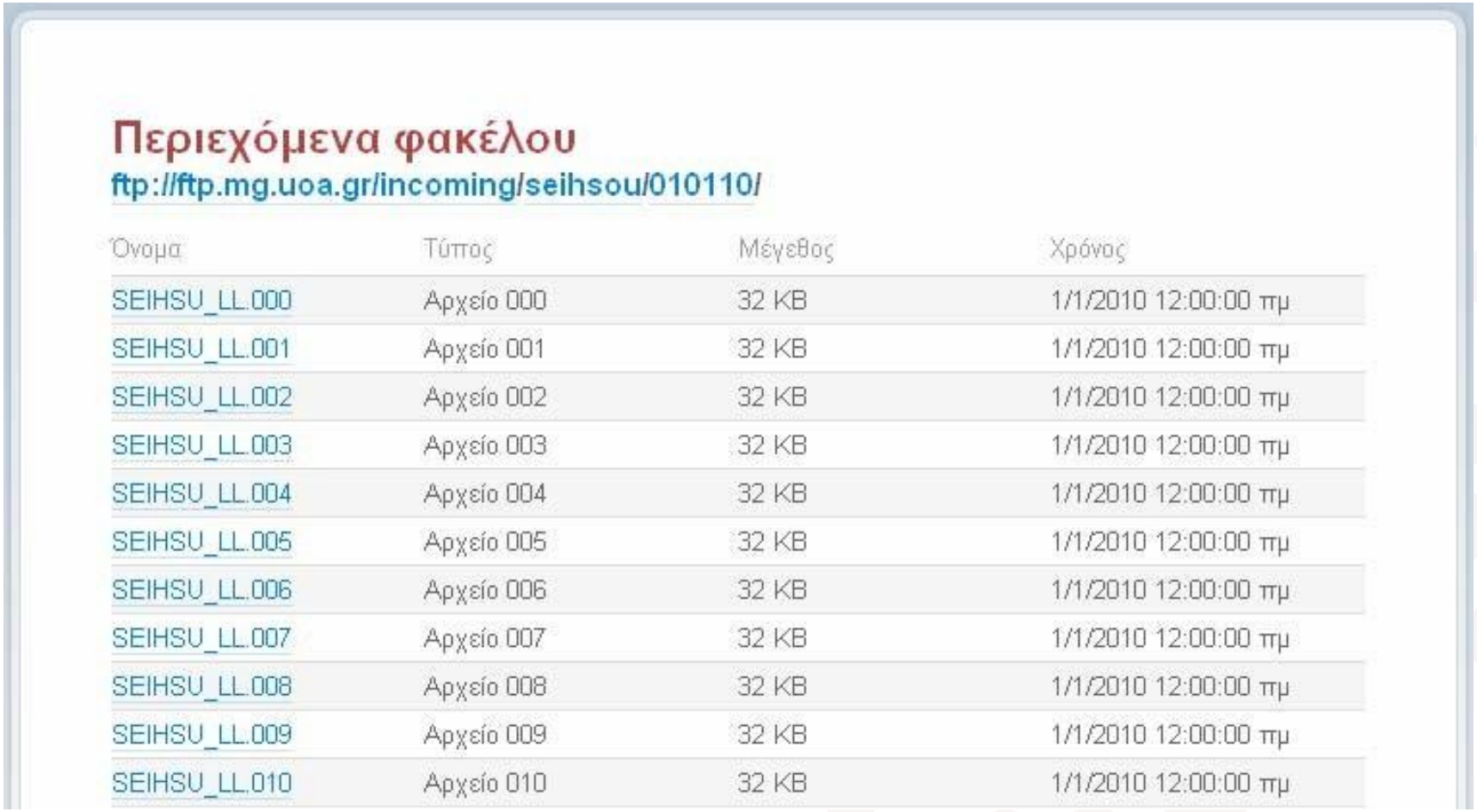
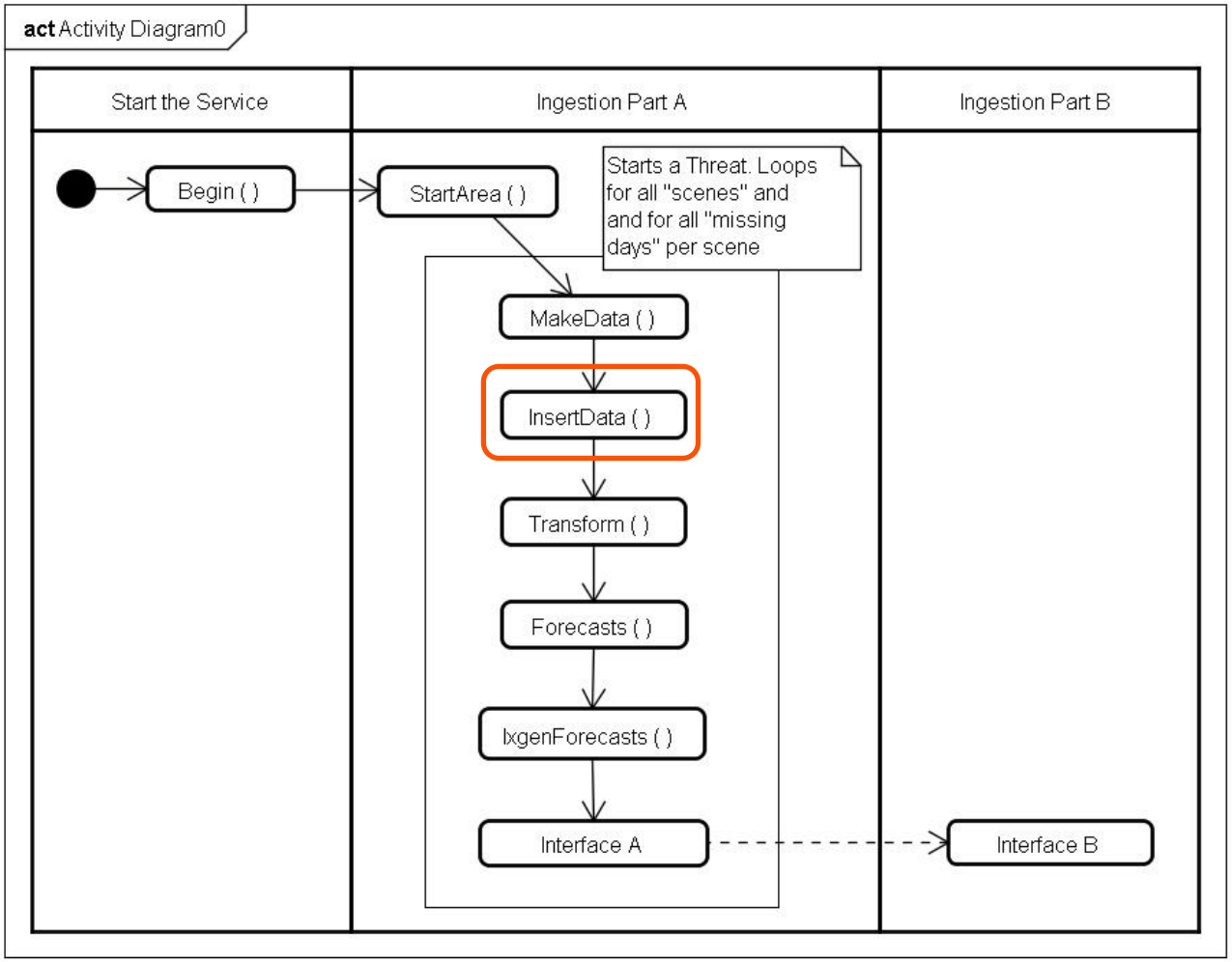


Περιεχόμενα φακέλου

ftp://ftp.mg.uoa.gr/incoming/seihsou/010110/

Όνομα	Τύπος	Μέγεθος	Χρόνος
SEIHSU_LL.000	Αρχείο 000	32 KB	1/1/2010 12:00:00 πμ
SEIHSU_LL.001	Αρχείο 001	32 KB	1/1/2010 12:00:00 πμ
SEIHSU_LL.002	Αρχείο 002	32 KB	1/1/2010 12:00:00 πμ
SEIHSU_LL.003	Αρχείο 003	32 KB	1/1/2010 12:00:00 πμ
SEIHSU_LL.004	Αρχείο 004	32 KB	1/1/2010 12:00:00 πμ
SEIHSU_LL.005	Αρχείο 005	32 KB	1/1/2010 12:00:00 πμ
SEIHSU_LL.006	Αρχείο 006	32 KB	1/1/2010 12:00:00 πμ
SEIHSU_LL.007	Αρχείο 007	32 KB	1/1/2010 12:00:00 πμ
SEIHSU_LL.008	Αρχείο 008	32 KB	1/1/2010 12:00:00 πμ
SEIHSU_LL.009	Αρχείο 009	32 KB	1/1/2010 12:00:00 πμ
SEIHSU_LL.010	Αρχείο 010	32 KB	1/1/2010 12:00:00 πμ

ArcFIRE Ingestion Service



- **Insert Data ()**
  - ➔ parses all the files 1-by-1 per day available
  - ➔ separates the file in 7 blocks (one for each parameter)
  - ➔ stores the data into the database (PostGIS)

U10			V10		
43.05000	16.25000	-6.421691	43.05000	16.25000	4.696099
43.05000	16.30000	-6.457536	43.05000	16.30000	4.403107
43.05000	16.35000	-6.510066	43.05000	16.35000	4.069227
43.05000	16.40000	-6.572003	43.05000	16.40000	3.720452
43.05000	16.45000	-6.495194	43.05000	16.45000	3.239167
43.05000	16.50000	-6.255976	43.05000	16.50000	2.421854
43.05000	16.55000	-5.981557	43.05000	16.55000	1.219716
43.05000	16.60000	-5.560592	43.05000	16.60000	8.2355142E-03
43.05000	16.65000	-5.352507	43.05000	16.65000	-0.7028813
43.05000	16.70000	-5.281198	43.05000	16.70000	-1.087345
43.05000	16.75000	-5.349058	43.05000	16.75000	-0.7199348
43.05000	16.80000	-5.518385	43.05000	16.80000	-2.2914171E-02
43.05000	16.85000	-5.525542	43.05000	16.85000	0.1791499
43.05000	16.90000	-5.250029	43.05000	16.90000	0.1292210
43.05000	16.95000	-5.191285	43.05000	16.95000	2.9865503E-02
43.05000	17.00000	-5.138137	43.05000	17.00000	-0.1486912
43.05000	17.05000	-5.143550	43.05000	17.05000	-0.2149214
43.05000	17.10000	-4.976244	43.05000	17.10000	-0.1832494
43.05000	17.15000	-4.257140	43.05000	17.15000	-8.2013965E-02
43.05000	17.20000	-3.607817	43.05000	17.20000	3.1595100E-02
43.10000	16.25000	-6.438410	43.10000	16.25000	4.747495

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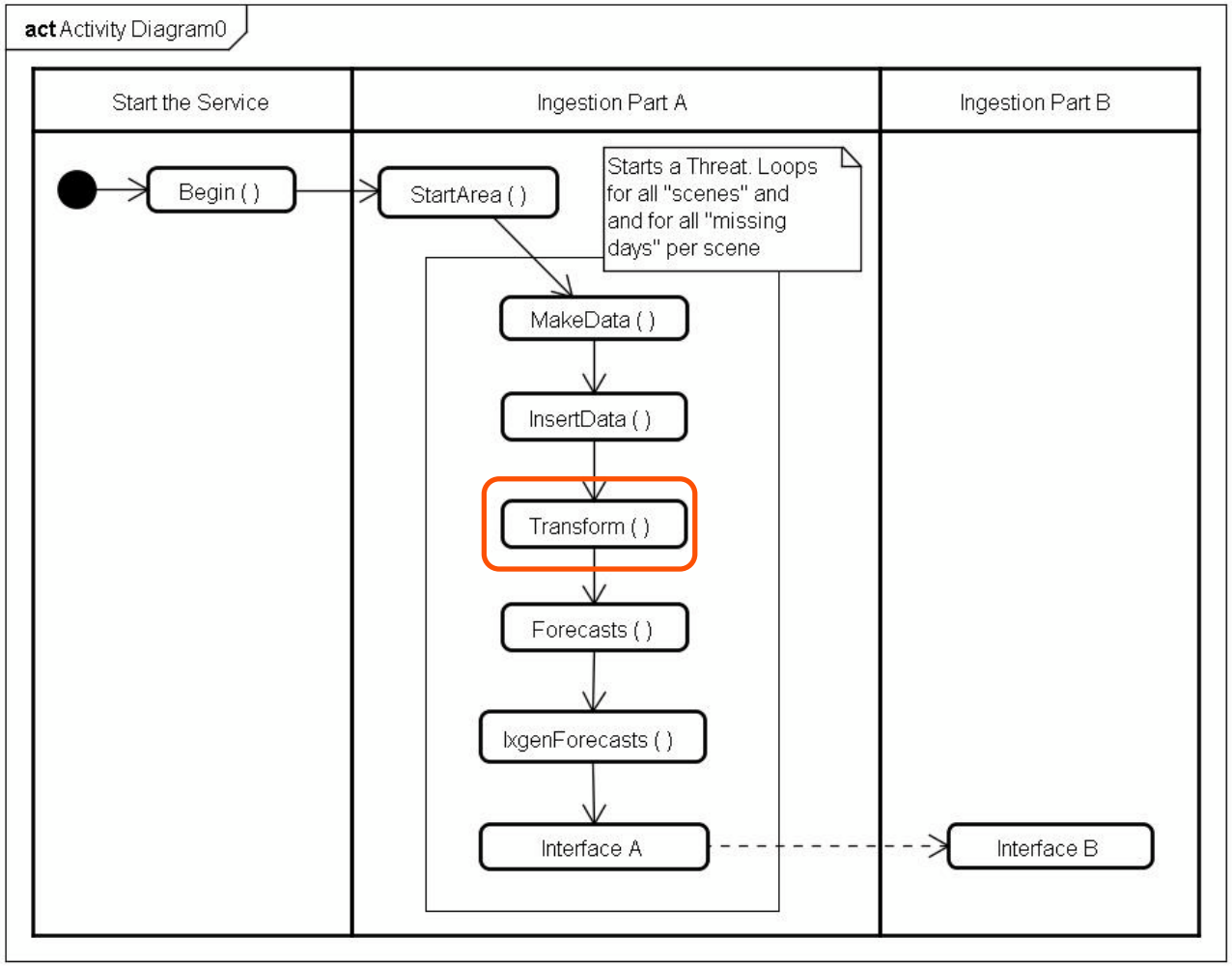


- **Transform ()**
  - ➔ Wind Speed (WSP) transformation
    - transforms U10 (x component, m/s) and V10 (y component, m/s) to WPS (m/sec)

$$WSP = \sqrt{U10^2 + V10^2}$$

  - ➔ Wind Direction (WDI) transformation
    - transforms U10 (x component, m/sec) and V10 (y component, m/sec) to WDI (degrees)

$$\tan\theta = \frac{x}{y} = \frac{U10}{V10} \Rightarrow \theta = Arc\tan\frac{U10}{V10}$$

- **Transform ()**
  - ➔ Temperature (TEM) transformation: Transforms T2M (Kelvin) to TEM (Celsius)

    TEMCelsius = TEMKelvin - 273.15

  - ➔ Rain precipitation (PPD) transformation: Transforms RAIN (rain precipitation per hour, mm) toPPD (rain precipitation per day, mm) >> 5 PPD files are produced

$$PPD_{001-012} = PPH_{001} + PPH_{002} \ldots + PPH_{012}$$

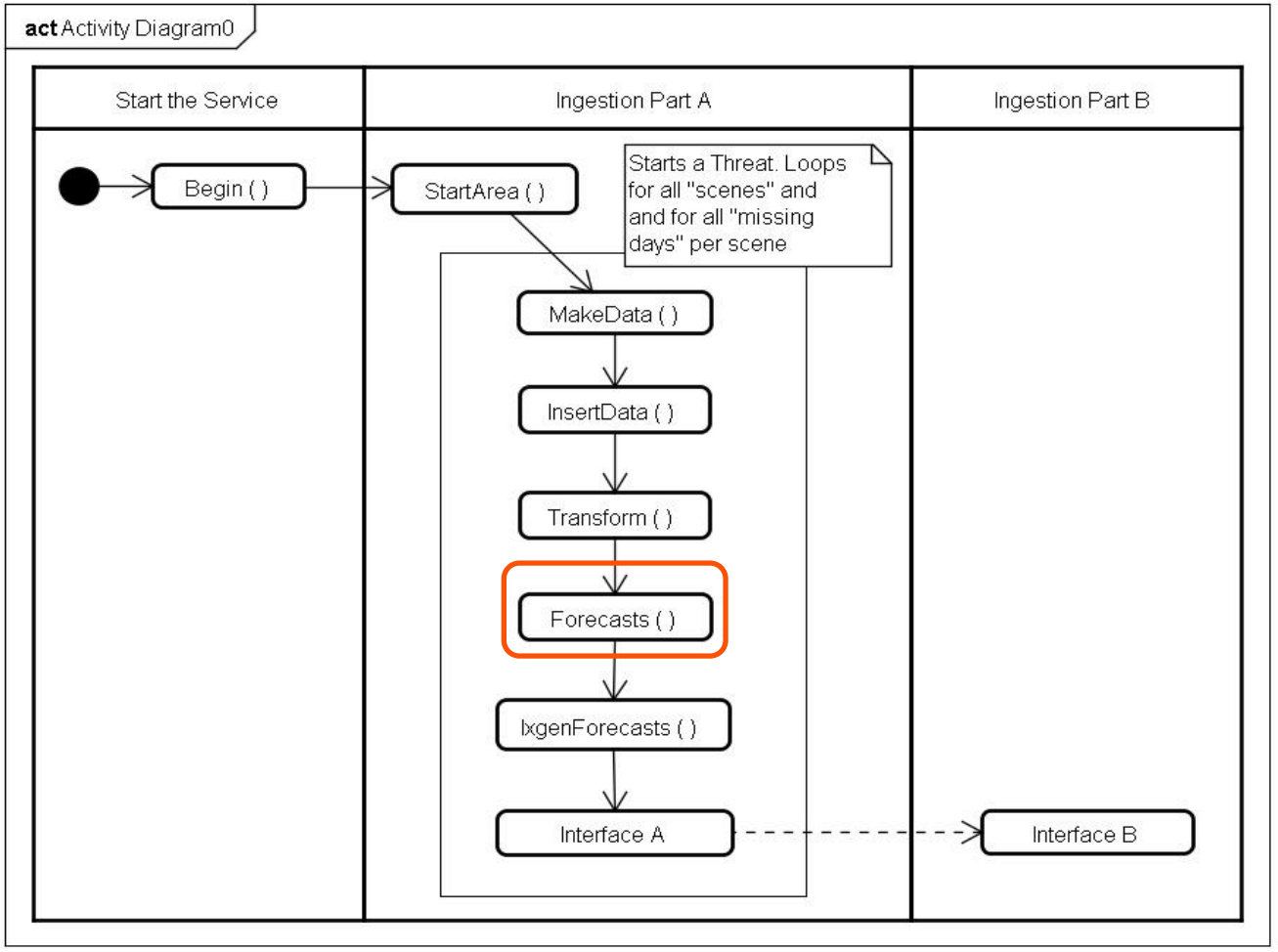
$$PPD_{013-036} = PPH_{013} + PPH_{014} \ldots + PPH_{036}$$

$$PPD_{037-060} = PPH_{037} + PPH_{038} \ldots + PPH_{060}$$

$$PPD_{061-084} = PPH_{061} + PPH_{062} \ldots + PPH_{084}$$

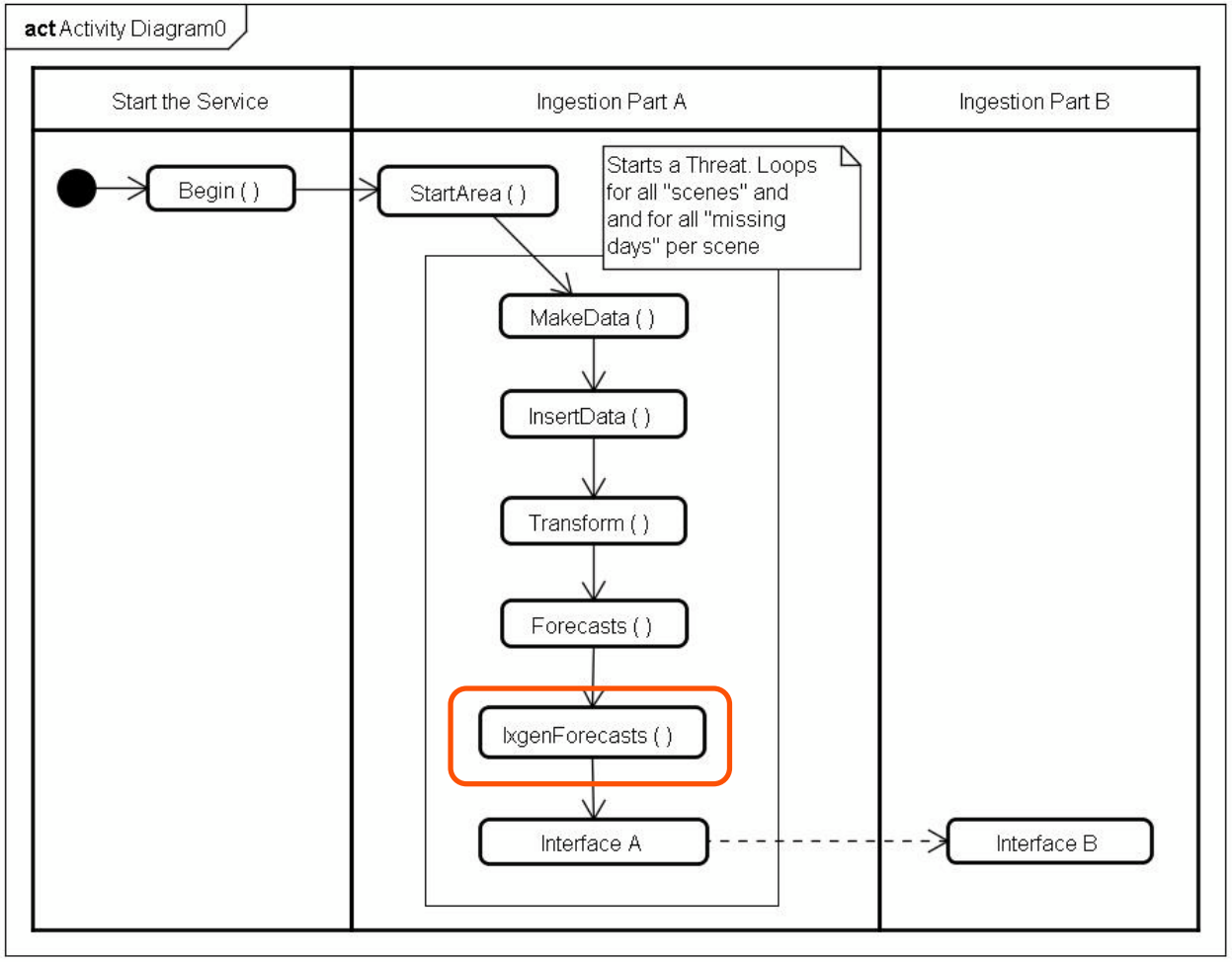
$$PPD_{085-108} = PPH_{085} + PPH_{086} \ldots + PPH_{108}$$

ArcFIRE Ingestion Service



- **Forecasts ()**
  - ➔ georeferences the raw data to forecast maps
  - ➔ resample data at higher resolution (e.g. from 1km to 20m to make them operational at regional level)
  - ➔ creates 7 sets of 121 ascii files and stores them to the DB
  - ➔ follows the name convention SSS_YYYMMDDHHNN_hhh_XXX
    - SSS: scene identifier (e.g. 001)
    - YYYY: year
    - MM: month
    - DD: day
    - HH: hour
    - NN: minutes
    - hhh: forecast identifier (e.g. 001 to 121)
    - XXX: code identifier for each parameter (e.g. WSP)

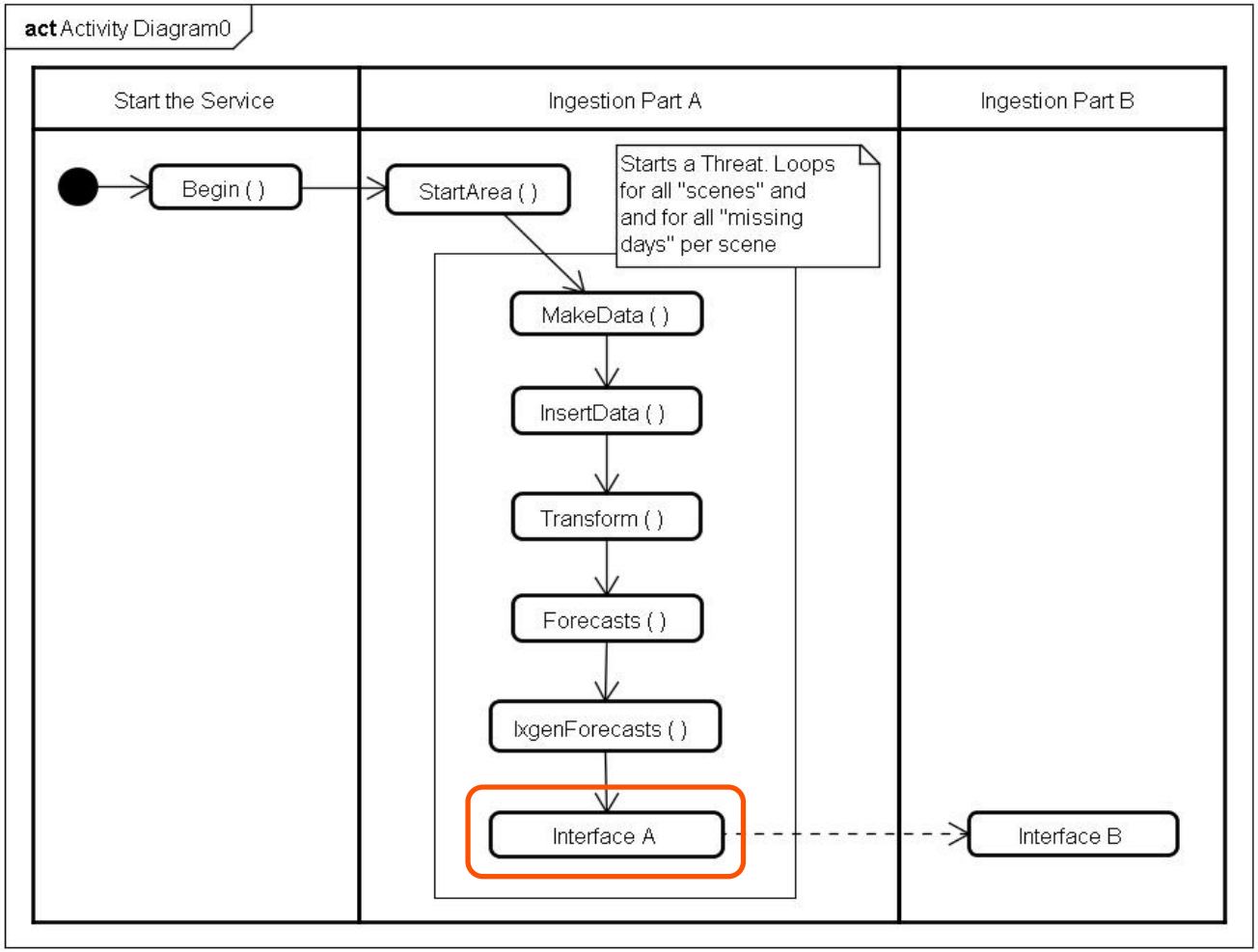
ArcFIRE Ingestion Service



ArcFIRE Ingestion Service

- **Ixgen ()**
  - ➔ creates 8 meteorological indexes related to forest fires
  - ➔ stores the indexes into the database
  - ➔ follows the name convention *SSS_YYYMMDDHHNN_hhh_XXX*
    - SSS: scene identifier (e.g. 001)
    - YYYY: year
    - MM: month
    - DD: day
    - HH: hour
    - NN: minutes
    - hhh: forecast identifier (e.g. 001 to 121)
    - XXX: code identifier for each parameter (e.g. WSP)

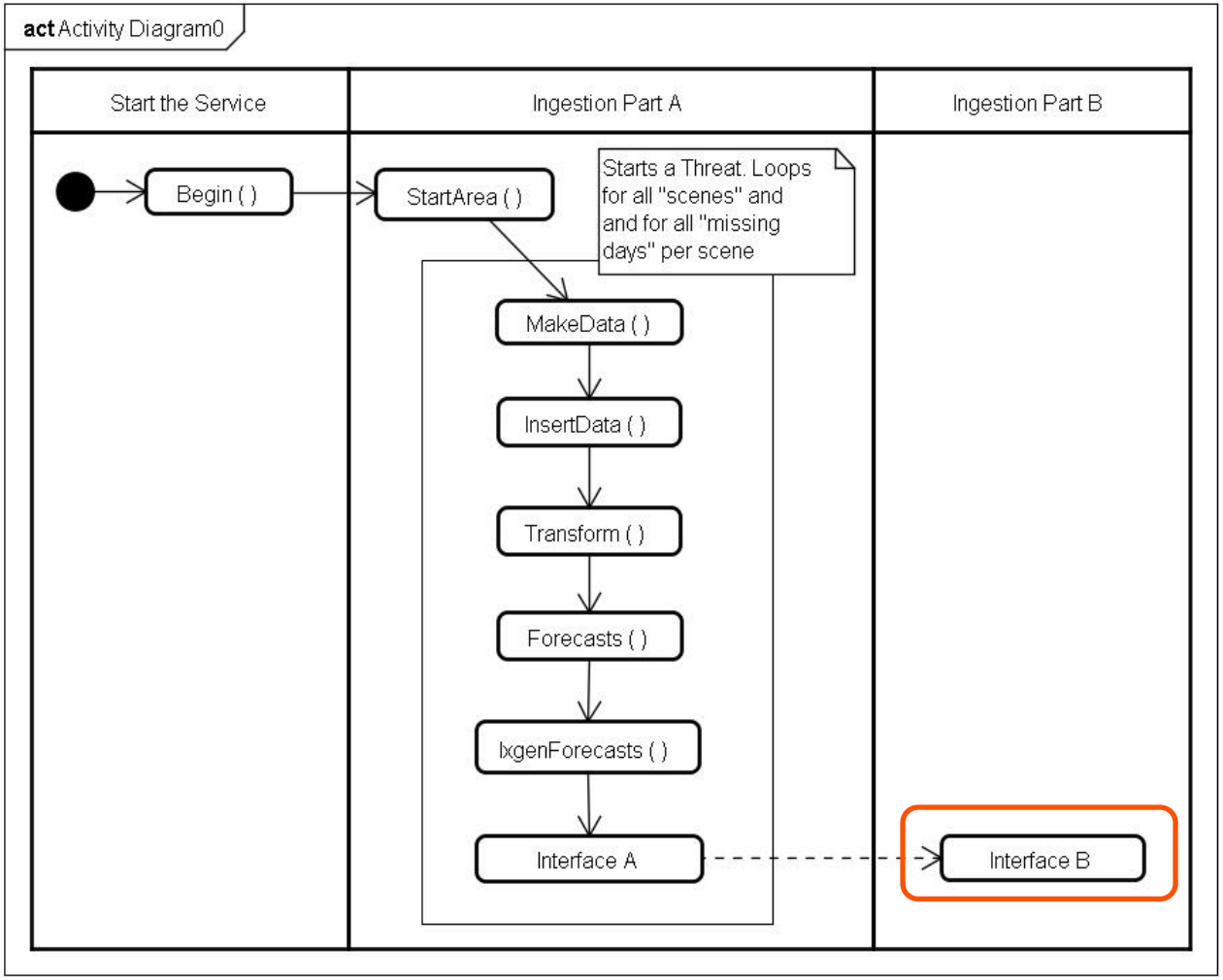
ArcFIRE Ingestion Service



ArcFIRE Ingestion Service

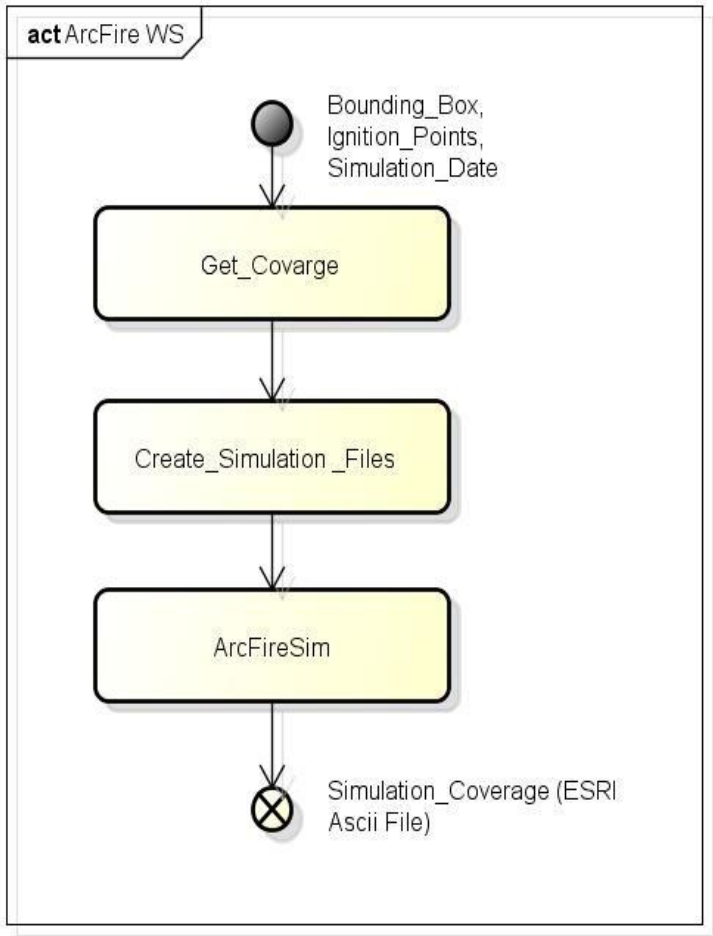
- **Interface A () → Geobatch**
  - → collects the categories, zips the packages and sends them to the eENVplus Geoserver
    - BYR: fire maximum linear intensity, KW/m
    - CLO: cloud coverage (%)
    - DFM: dead fuel moisture (%)
    - HRE: air relative humidity (%)
    - PIG: probability of ignition (%)
    - PPD: air precipitation per day (mm)
    - PPH: air precipitation per hour (mm)
    - TEM: air temperature (celsius)
    - WDI: wind direction (degrees)
    - WSP: wind speed (m/sec)

ArcFIRE Ingestion Service



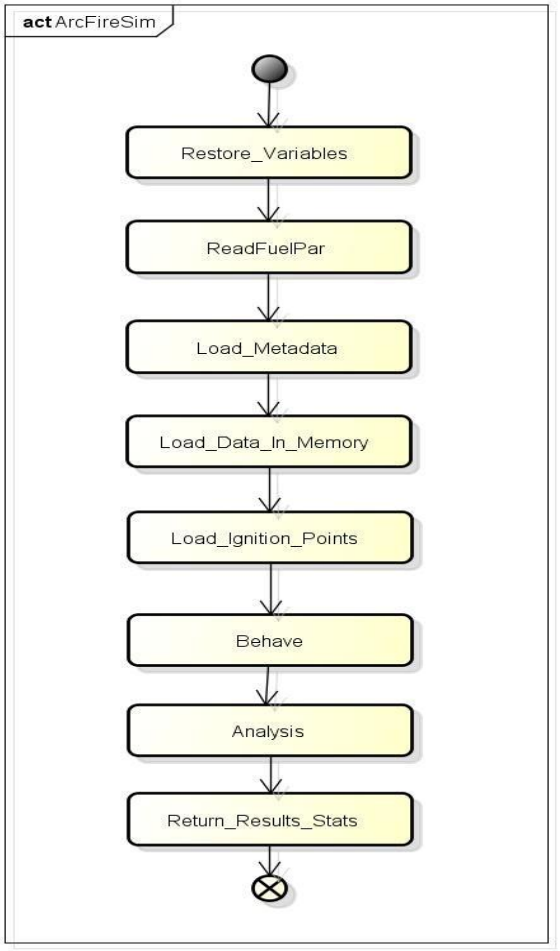
ArcFIRE Web Service

- Defines the BBOX, the ignition points and the simulation date
- Requests the necessary data using a WCS GetCoverage request
- Creates the simulation folders
- Runs the ArcFireSim
- Produces the simulation coverage output



ArcFIRE Simulation module

- restores the variables
- reads fuel parameters -**INSPIRE**
- loads the metadata in memory (reads the files ASP, SLO, FMO, DFM, WDI, WSP)
- loads ignition points
- Behave () does all the pre-calculation for all fuel models
- Analysis () does the cellular automatic analysis process
- returns the results and statistics



Contact

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