ANIMA
Aviation Noise Impact Management
through Novel Approaches

D4.11 Noise Management Toolchain

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[1] Use one of the following codes: R=Document, report (excluding the periodic and final reports)
DEM=Demonstrator, pilot, prototype, plan designs
DEC=Websites, patents filing,press & media actions, videos, etc.
OTHER=Software, technical diagram, etc.
[2]Use one of the following codes: PU=Public, fully open, e.g. web
CO=Confidential, restricted under conditions set out in Model Grant Agreement
CI=Classified, information as referred to in Commission Decision 2001/844/EC.

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1 Introduction

In ANIMA WP4 an airport noise management tool chain has been developed, with which a variety of interventions for noise reduction can be simulated. This tool chain is described in detail in ANIMA deliverables D4.9 (Virtual Community Tool), D4.12 (Emissions Inventory model) and D4.14 (Noise Reduction Solutions Simulator).

Due to its complexity, this tool can only be used by aircraft noise experts. In order to extend the power of the tool to a wider audience, the most relevant parts of the tool chain have been implemented in an on-line tool. Two versions of this tool are available:

- Public Noise Toolset
  This version has free public access and is mainly used to illustrate concepts related to airport noise management, as provided on the ANIMA Noise Platform. It only contains pre-defined user cases for educational purpose.

- Noise Management Toolset
  This version is intended for professional users, providing them with an easy-to-use tool to assess different scenarios. It is available upon registration only.

The present document provides a description of the tool chain as implemented as a web service, covering both versions. The User Manual for this tool is available through ANIMA D4.15.

2 High-level design of the tool chain

Figures 1 and 2 present the different elements of the complete tool chain, developed in ANIMA WP4.
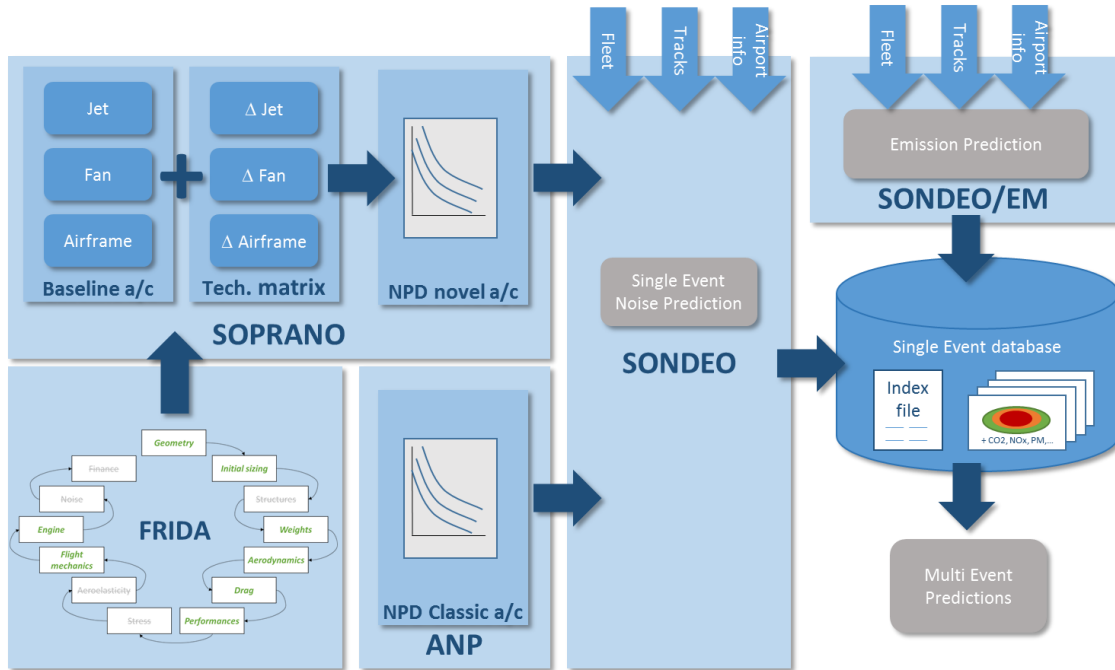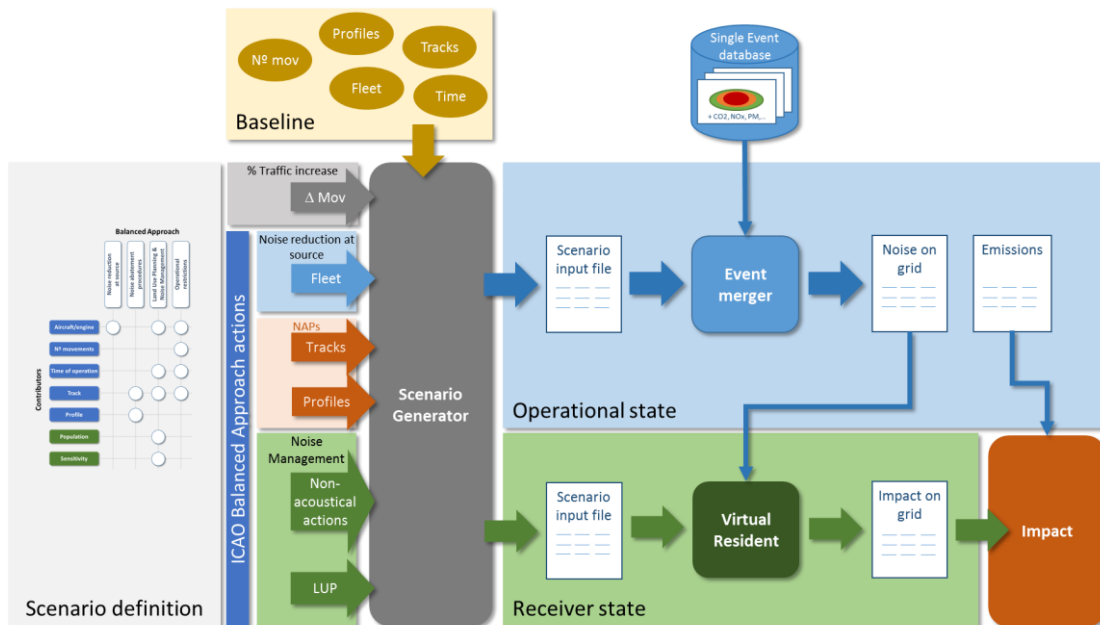

Figure 1 – WP4 Tool chain – Single event branch

Figure 2 – WP4 Tool chain – Multi event branch

In the single event branch the databases for all aircraft related noise reduction solutions are generated in the form of footprints valid for single events. For those aircraft of the fleet that do not incorporate any noise reduction solutions, the

standard NPDs from the ANP database will be used to generate the corresponding single events.

Each single event is defined by:

- Aircraft type
- Type of operation: Arrival or Departure
- Vertical flight procedure („Profile")
- Distance flown (indicator for the weight at take-off)
- Runway
- Track

If needed, this single event database can be enhanced with emissions data. After this, an airport scenario can be generated in the multi event branch, defining an operational state (fleet mix, number of operations, track usage, etc) which will combine the corresponding single events to derive overall noise levels and impact related metrics.

More details on the different components of the tool chain can be found in ANIMA D4.14.

Due to its complexity, this tool can only be used by aircraft noise experts. To make this tool available to a wider audience, the most relevant parts of the tool chain have been implemented in an on-line tool. Two versions of this tool are available:

- Public Noise Toolset (PNT)
- Noise Management Toolset (NMT)

For both versions the main step to simplicity was made by starting from a pre-established database of single events for an airport, generated off-line (by ANOTEC) with the single event branch of the tool chain. The resulting single event database can then be used to generate Scenarios. A scenario is defined by:

- Number of operations of each single event
- Time of these operations (exact local time or period (Day, Evening, Night))

In the case of the PNT the scenarios have already been generated and stored in the database. For the NMT the user can generate his/her own scenarios.

2.1 Public Noise Toolset (PNT)

The main objective of the Public Noise Toolset is to support, in an interactive manner, the explanations provided in the Noise Platform under the topic "Noise Mapping" (https://anima-project.eu/noise-platform/noise-mapping), on how airport noise footprints are calculated following the methodology defined in the Environmental Noise Directive. It makes use of a virtual airport that allows the user to interact with the tool in order to visualize relevant inputs and outputs of a

noise mapping tool. A set of traffic scenarios has been included, with variations derived from the base scenario (the reference scenario) to allow the user to understand different effects in noise contours. This version has free public access.

2.2 Noise Management Toolset (NMT)

This version is intended for professional users, providing them with an easy-to-use tool to assess different scenarios. It is available upon registration only.

The NMT is designed to generate new scenarios (by cloning existing scenarios or by uploading traffic data), modify the flight operations, run processes, compare the results, and save changes.

Figure 3 gives an idea of the components of the tool chain included in the NMT.
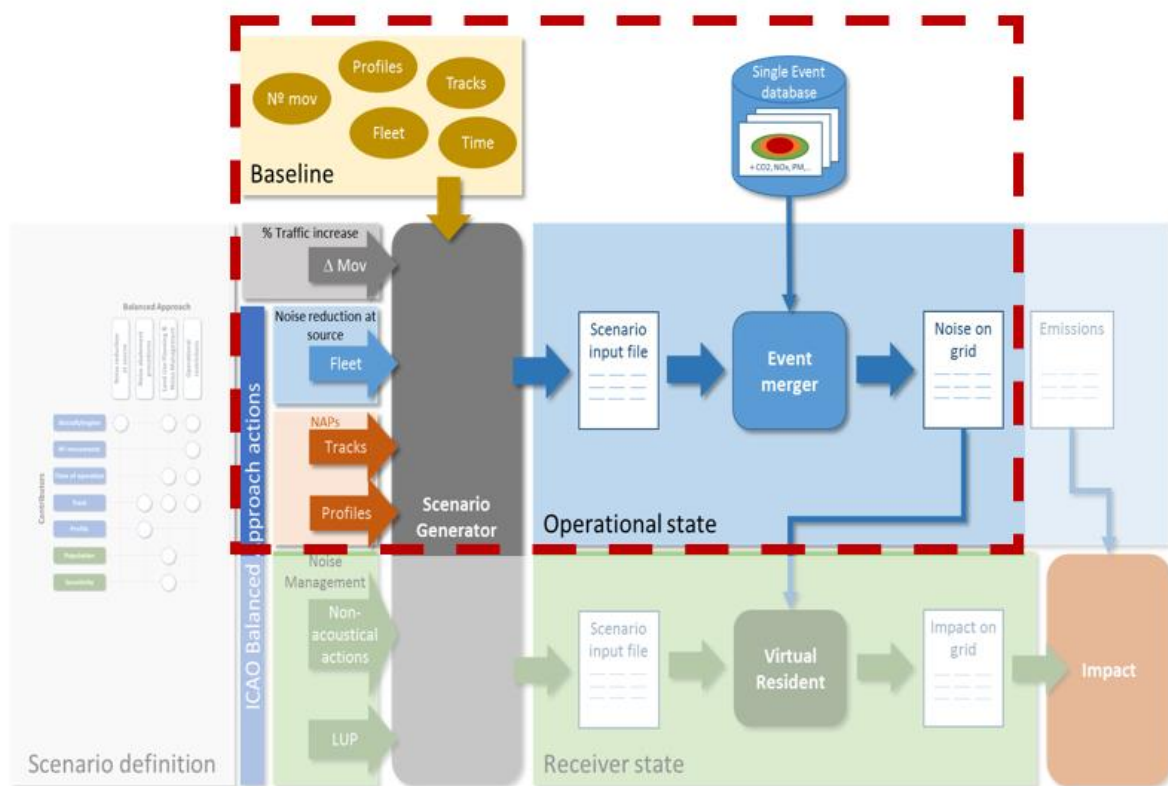

Figure 3 – Tool chain components included in the NMT

3 Implementation

The ANIMA Noise Toolsets is a Software as a Service (SaaS) providing a powerful bridge between the last web technologies using a thin client such as web browser over the Internet, and a multi-tenant service architecture running on Unix-like systems.

3.1 Server

The SaaS noise toolsets are designed and hosted by Anotec Engineering on a 48x CPU core system with 96 GB of RAM, running the FreeBSD operating system.

3.2 Databases

The SaaS database service is MySQL 8 working together with the HTTP Apache Server Project and the PHP Hypertext Pre-processor Language. This provides the effective bridge between the client and the server. The server-side application of the ANIMA Noise Toolsets is a combination of UNIX shell scripts, Python and Fortran providing direct access to the SONDEO Software of Anotec Engineering.

The PNT data with the virtual airport and the precooked scenarios can be found on the default database designed for public access (see Figure 4).

The NMT data of the registered accounts is a complete clone of the PNT data provided during the account validation procedure. Therefore, the new registered accounts have individual databases with PNT data, that are ready to be changed on-demand in their user space.
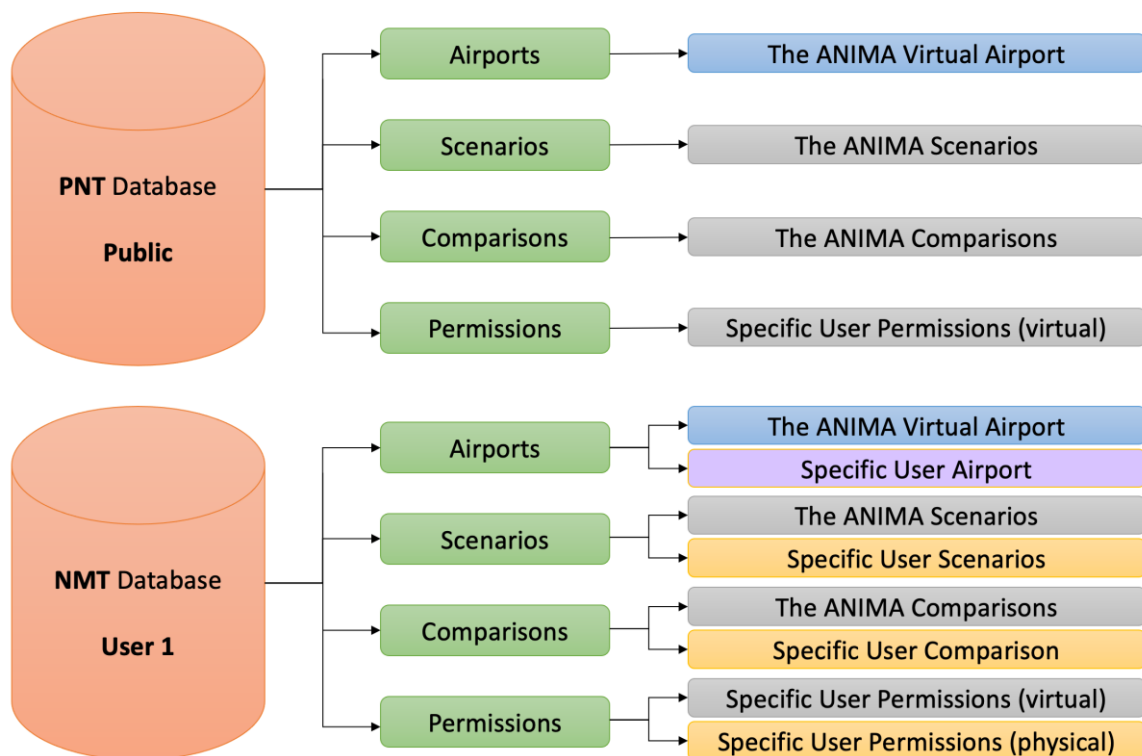

Figure 4 – Noise Toolsets databases

Such a siloed structure is also ensuring an appropriate level of confidentiality, hence preventing a user's data to be disseminated toward other users.

3.3 Web-based User Interface

The **PNT** is available at https://anima.anotec.es/home/map

The **NMT** is available at https://anima.anotec.es/user/map, after following the registration procedure at https://anima.anotec.es/user/register.

3.4 User administration

The users requesting a new NMT account, must pass the registration process where the account validation is manually done for a better control of false user requests, but also for checking the authenticity of the user requesting the account registration. This applies to real entities such as Authorities, Airports, Land use planners, Research Institutes and Universities. Figure 5 gives a flowchart of the registration process.
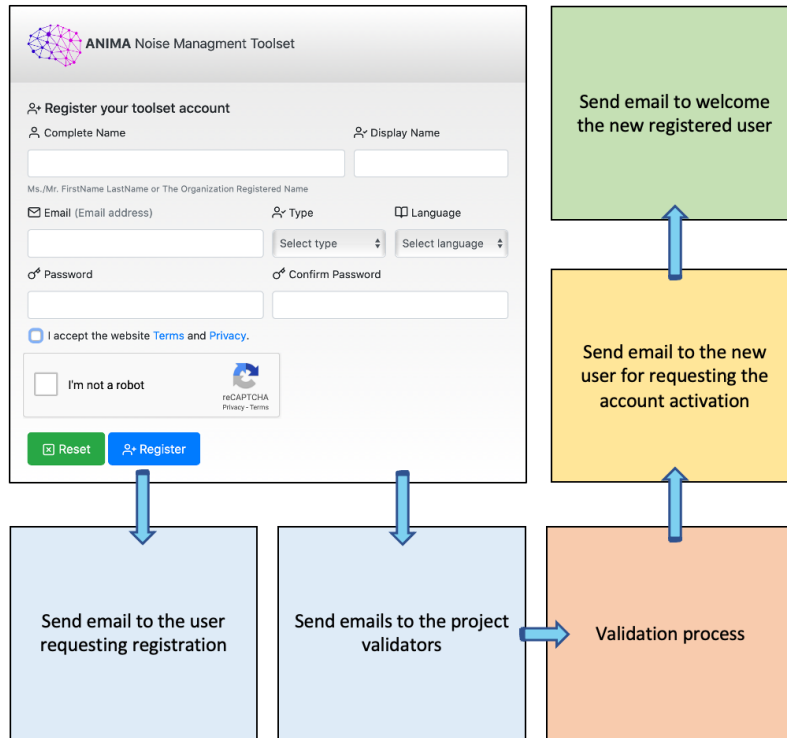
Figure 5 – Flowchart of the registration process

The Noise Toolsets are designed for handling four main user types from which the registered "User" (the NMT account) extends to six user categories as shown in the figure below.
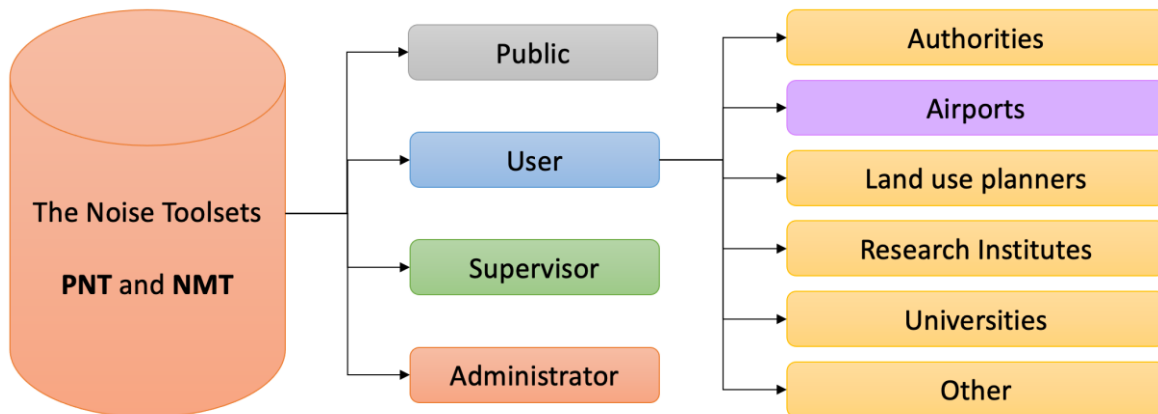

Figure 6 – User types and categories

The following table gives an overview of the main differences between the PNT and NMT users.

Functionality / Noise Toolset	PNT	NMT
Access the precooked scenarios and comparisons	✅	✅
Clone, modify and delete the precooked scenarios	❌	✅
Run scenarios, compare scenarios and save changes	❌	✅
Delete the *Base scenario - The reference*, No. 21	❌	❌

The "Public" users can access the precooked scenarios of the generic airport without registration.

The registered "User" users will be the professionals that can take advantage of the NMT functionalities. Special permissions may be granted to specific users (like Airports) to handle information of "their" airport, stored in the databases.

From the system support side (ANOTEC), "Supervisor" users will control the working of the system, including e.g. detecting Process Id (PID) errors that might occur with unexpected user data. The "Supervisor" users can also handle the registration process for validating new NMT accounts.

The "Administrator" users are in charge of taking corrective actions and solve the reported issues by analysing the PID errors and improve the SaaS.

4 Future work

The initial version of the toolsets made available on-line in ANIMA is just a first step. The following functionalities are the first candidates for implementation in a future version:

- Include impact metrics (together with population)
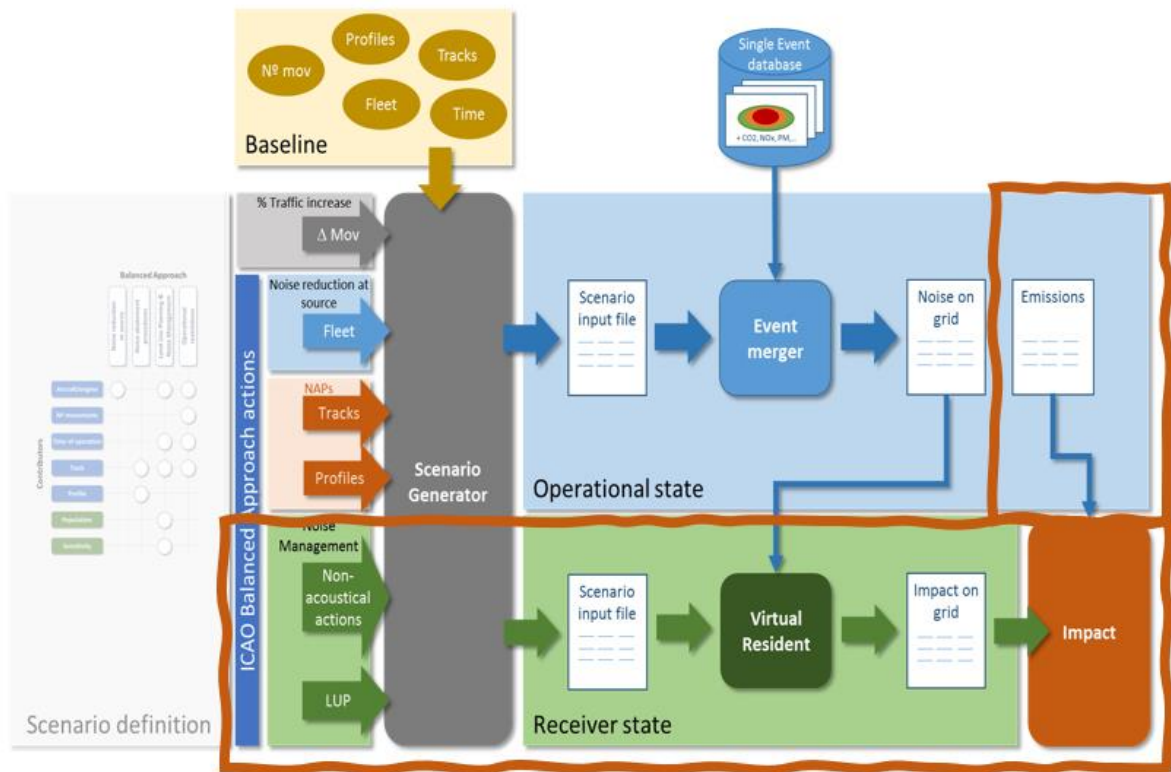- Include emissions

Figure 7 – Tool chain components to be included in future versions of the NMT

Depending on user feedback and market requirements, additional functionalities may be identified and implemented. The main advantage of the SaaS model is that these new functionalities will be available to all users directly after being implemented. No software update packages will need to be distributed.