Automated Multilingual Seismic Event Reporting Module for SeisComP Pipeline Based on Python for NDCs

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INTRODUCTION AND MAIN RESULTS

This work presents a Python-based tool tailored for NDCs. It automates the creation and sending of seismic event reports, enhancing the efficiency and speed of critical data communication, allowing the generation of information in multiple languages. It provides a flexible and adaptable tool to each NDC's specific needs, fostering cooperation and knowledge exchange, and supporting the CTBT.
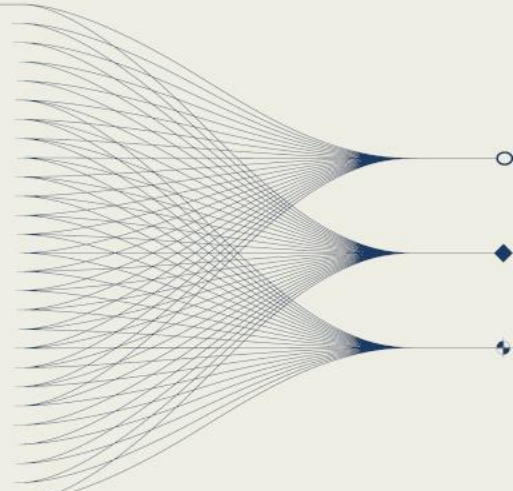
Introduction

This work presents the result of developing a customized and innovative tool for National Data Centers (NDCs), based on Python. This tool automates the creation and sending of seismic event reports, enhancing the efficiency and speed of critical data communication, allowing the generation of information in multiple languages. It provides a flexible and adaptable tool to each NDC's specific needs, fostering cooperation and knowledge exchange, and supporting the Comprehensive Nuclear-Test-Ban Treaty (CTBT).

The module generates reports adaptable to each NDC's needs, using web technologies like HTML5 and CSS for functional design. A key feature is the configuration of the geographic window of the area of interest using GMT, allowing precise customization. Additionally, the system includes parameterization and automatic report generation, facilitating relevant information collection and presentation without manual intervention once events are detected by SeisComP.

Reports are automatically disseminated to authorized users through multiple channels, including email and Telegram, ensuring quick and effective data distribution. This development optimizes operational processes within NDCs for nuclear event detection and strengthens response capabilities to seismic events. It improves the efficiency of information management and decision-making during emergencies, while promoting cooperation and knowledge exchange, thereby reinforcing support for the CTBT.

Methodology

The implementation of the reporting module was structured into four key stages, each designed to ensure seamless integration with the SeisComP pipeline and to support multilingual dissemination for National Data Centres (NDCs) as illustrated in Figure 1:
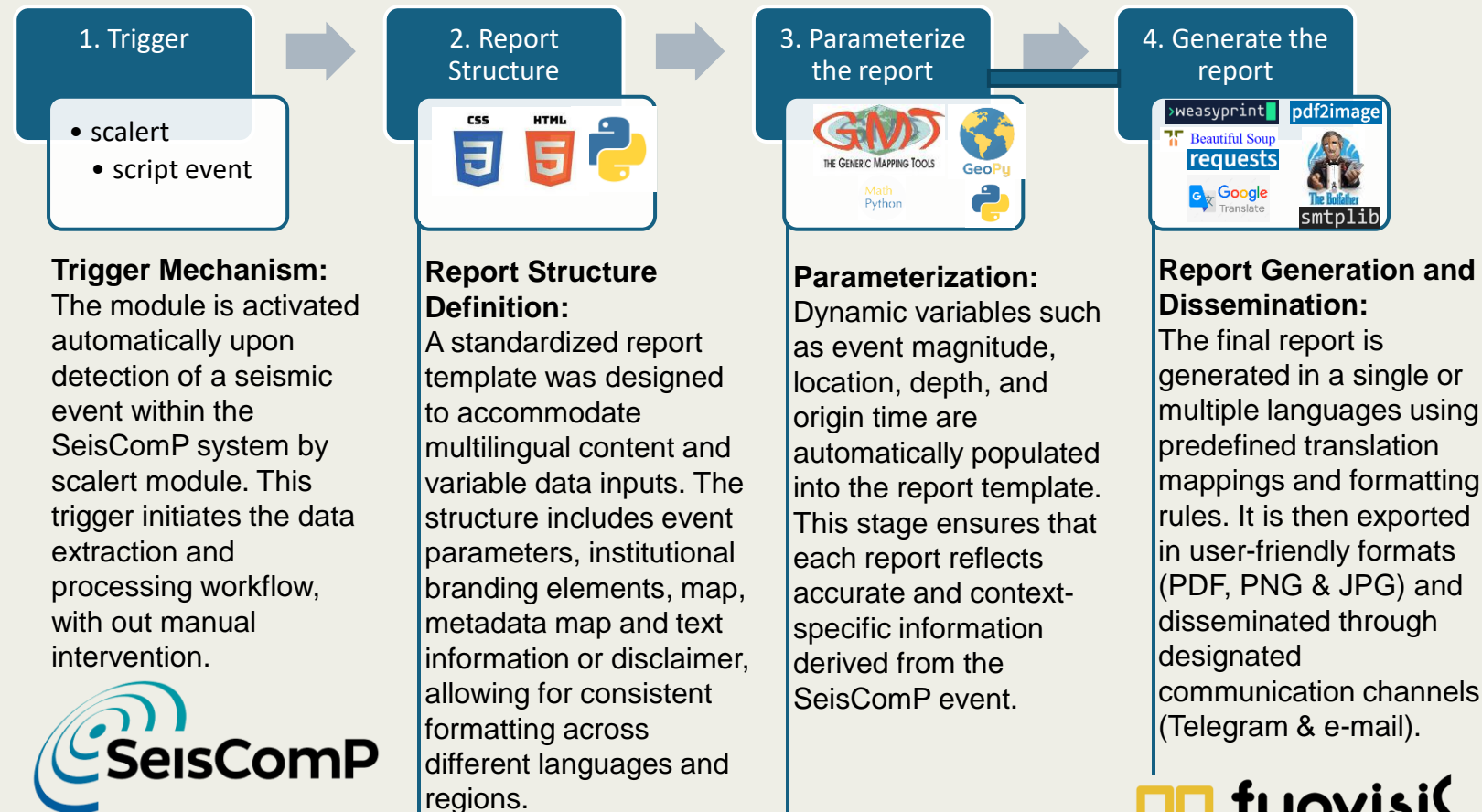

1. Trigger
- scalert
  - script event

2. Report Structure

3. Parameterize the report

4. Generate the report

Trigger Mechanism:
The module is activated automatically upon detection of a seismic event within the SeisComP system by scalert module. This trigger initiates the data extraction and processing workflow, with out manual intervention.

Report Structure Definition:
A standardized report template was designed to accommodate multilingual content and variable data inputs. The structure includes event parameters, institutional branding elements, map, metadata map and text information or disclaimer, allowing for consistent formatting across different languages and regions.

Parameterization:
Dynamic variables such as event magnitude, location, depth, and origin time are automatically populated into the report template. This stage ensures that each report reflects accurate and context-specific information derived from the SeisComP event.

Report Generation and Dissemination:
The final report is generated in a single or multiple languages using predefined translation mappings and formatting rules. It is then exported in user-friendly formats (PDF, PNG & JPG) and disseminated through designated communication channels (Telegram & e-mail).

Figure 1. Key stages of Automated Multilingual Seismic Event Reporting Module.

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Results

The module was developed using Python (Figure 2) and integrated with SeisComP's event detection framework. It employs a parameterized configuration system that allows each NDC to define its geographic region of interest for visualization using GMT (Generic Mapping Tools), enabling precise customization of report content. Web technologies such as HTML5 and CSS were used to design the report layout, ensuring readability and adaptability across platforms. The system automates the entire reporting process, including dissemination through channels such as email and Telegram. Multilingual support is implemented via translation libraries, enabling reports to be generated in each recipient's preferred language (Figures 3 & 4).

Figure 2 library descriptions
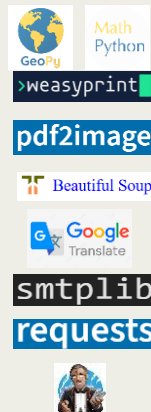
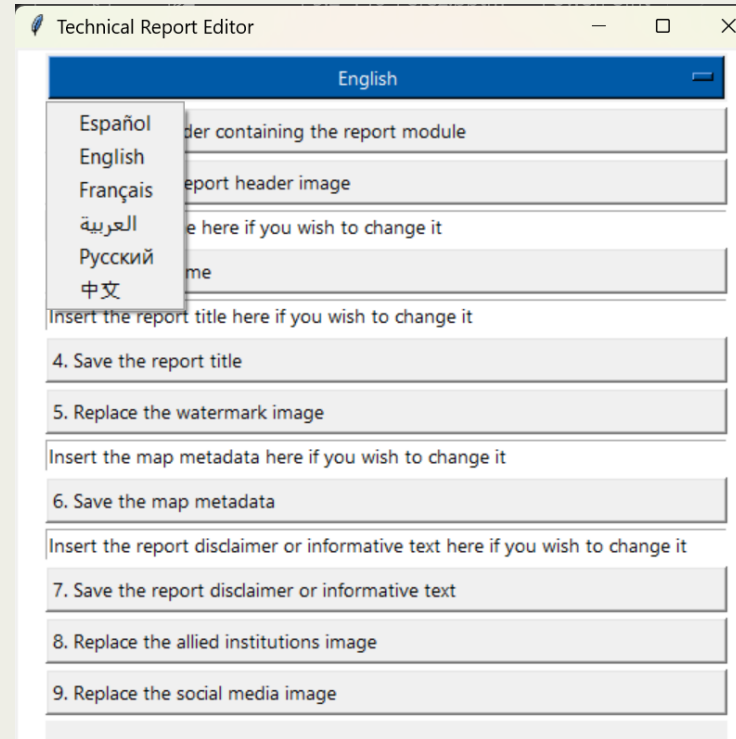| Library	Description
GeoPy / Math Python / weasyprint	Calculation of distances between two points on the Earth's surface
	Convert HTML and CSS content into PDF files
pdf2image	Convert PDF files into images
Beautiful Soup	Convert PDF files into images
Google Translate	Translate text into multiple languages
smtplib	Provides an SMTP (Simple Mail Transfer Protocol) client session object
requests	Simplify the process of making HTTP requests in Python
	Create new bot accounts

Figure 2. Description of the main libraries used.

Figure 3. Multilingual Interface (United Nations official languages).

Technical Report Editor — English

Español / English / Français / العربية / Русский / 中文

...der containing the report module
...report header image
...e here if you wish to change it
...me
Insert the report title here if you wish to change it
4. Save the report title
5. Replace the watermark image
Insert the map metadata here if you wish to change it
6. Save the map metadata
Insert the report disclaimer or informative text here if you wish to change it
7. Save the report disclaimer or informative text
8. Replace the allied institutions image
9. Replace the social media image

Report Structure

Customize fields
- Header
- NDC's Name
- Report´s Name
- Map, epicenter and water mark
- Metadata of de map
- Event parameters
- Location Reference
- Disclaimer
- Branding elements
- NDC´s RRSS
- License - Copyleft

Figure 4. Spanish Automatic Seismic Report Model.

Conclusions

The developed module provides an effective tool to enhance the dissemination of information generated by NDCs. Reports were successfully produced in multiple languages (aligned with the official languages of the United Nations) and delivered to authorized users within 18 to 40 seconds after event analisys. The use of geographic window configuration via GMT enabled customized visualizations tailored to the operational needs of each NDC. The tool enhances data communication, supports multilingual dissemination, and strengthens the CTBT's verification infrastructure. Its flexibility and scalable, allows adaptation to diverse operational contexts, promoting interoperability and collaboration among NDCs.

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