Extended NDC-in-a-BOX (EU/CTBTO Joint Action V): Integrated data acquisition, processing and analysis platform for NDCs

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**NDC-in-a-Box**

- Software package, that gives the NDCs the capability to receive and analyze seismic, hydroacoustic, infrasound and radionuclide data.
- Supports treaty verification and civil and scientific applications at NDCs.

**Objectives of the Extended-NDC-in-a-Box (eNIAB) project**

- Enable NDCs to more easily combine IMS SHI data and IDC processing results with data from local and national stations and from other global networks.
- Significantly expand NDCs processing capabilities, in particular with real-time automatic processing, as well as in the area of infrasound data processing.

**Project Timeline**

<table>
<thead>
<tr>
<th>Project initiation</th>
<th>Design of the Architecture completed</th>
<th>1st software release provided to alpha testers</th>
<th>Testing of first release completed</th>
<th>2nd software release ready for testing</th>
<th>Project end</th>
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Real-time automatic processing capabilities using the existing SeisComP package for acquisition and analysis of seismic data.

Integration modules
- between SeisComP and IDC processing
- between SeisComP and other Extended NDC-in-a-Box components

**Why SeisComP?**

- Open source, widely distributed software for seismological real-time data acquisition and processing.
- Modular, extensible architecture, uses standards for exchanging seismological data (SEED/miniSEED) and SeisComP3XML (derived from QuakeML and SEED)
- Already in use at many NDCs.

*Extended NDC-in-a-Box: an exercise in opening up the IDC platform for integration with automatic processing software running at NDCs.*
THREE ASPECTS OF INTEGRATION

**Data**

*IMS station data available in widely supported waveform data formats*
- CTBTO data distribution mechanisms (for continuous or segmented data) adapted to support miniSEED

**Station Configuration**

*Ability to import and update IMS station configuration into the processing pipeline running at the NDC*
- Tools to convert complete station configuration including instrument response into SeisComP3XML (derived from SEED),
- Challenge: instrument response information maintained at the IDC sufficient for IDC processing needs but does not cover the complete SEED standard specification.

**Processing Results**

*Ability to consume IDC processing results (detections, events) and integrate them into NDC processing*
- Tools to export IDC processing results to SeisComP3XML (data model for Event parameters based on QuakeML 0.5).
- Challenge: transferring full information for detections on derived waveforms (beams).
INTEGRATING IDC AND NDC PROCESSING

IDC

- CSS waveform data
- IDC data acquisition and processing
- CSS schema
- CSS instrument response files

Data and product conversion and dissemination modules

- Continuous waveforms (CD1.0, CD1.1)
- Segmented waveforms (miniSEED)
- Station configuration (SC3XML)
- Detections & events (SC3XML)

NDC

- Import & conversion modules
  - cd2seed
  - scart
  - scconfig
  - scdispatch

- Third party real-time analysis system

- Convert processing results to CSS
- Extended NDC-in-a-Box interactive analysis tools
  - Geotool
  - PMCC
  - DIVA
  - JADE

Detections & events (CSS)
Scenario 1: Real-time automatic processing using SeisComP

- NDC runs the SeisComP for real-time automatic processing to process data from selected IMS and non-IMS stations.
- SeisComP real-time automatic processing pipeline ingests detections on selected IMS stations from the IDC automatic processing pipeline and associates them to events.
- Events produced by the SeisComP automatic pipeline can be further reviewed and analyzed in Geotool.

Scenario 2: Interactive review with Geotool integrating IDC results with local data

- NDC imports IMS waveform data and IDC events into Geotool for further processing and manually associates detections on non-IMS stations.
Other new features in Extended NDC-in-a-Box (see poster T3.3-P11)

- DTK-PMCC and DTK-GPMCC: new infrasound detector and viewer;
- DTK-DIVA: tool for analyzing the detection background of seismo-acoustic stations over long period of time;
- DTK-JADE: monitoring tool for scrutinize waveform signals while scrolling very long waveform segments;
- Support for PostgreSQL in all SHI tools in Extended NDC-in-a-Box;
- Support for miniSEED (CSS-miniSEED) in all tools in Extended NDC-in-a-Box;
- Support for database replication between IDC database and NDC database.

Thank you for your attention!