Bolidozor radio network in 2024

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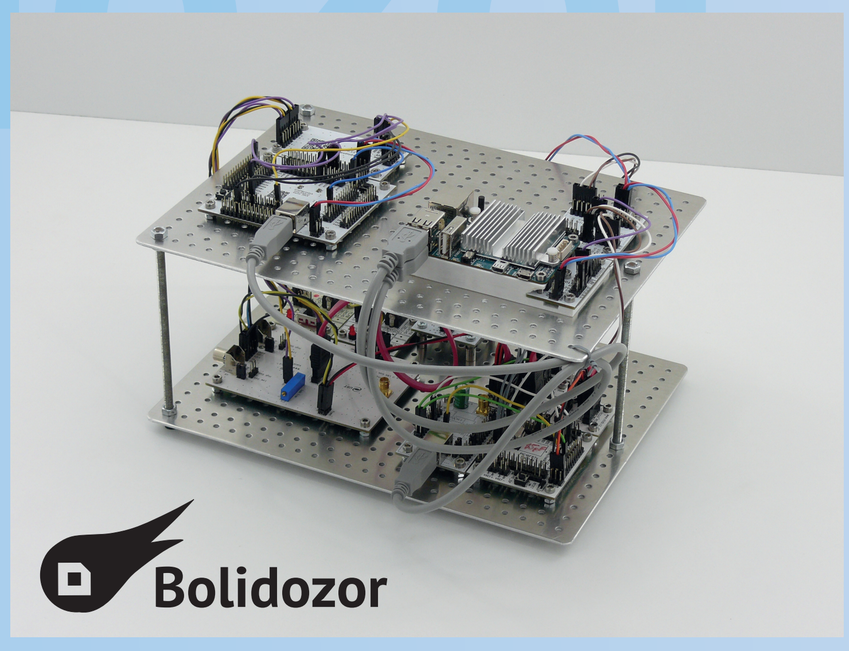
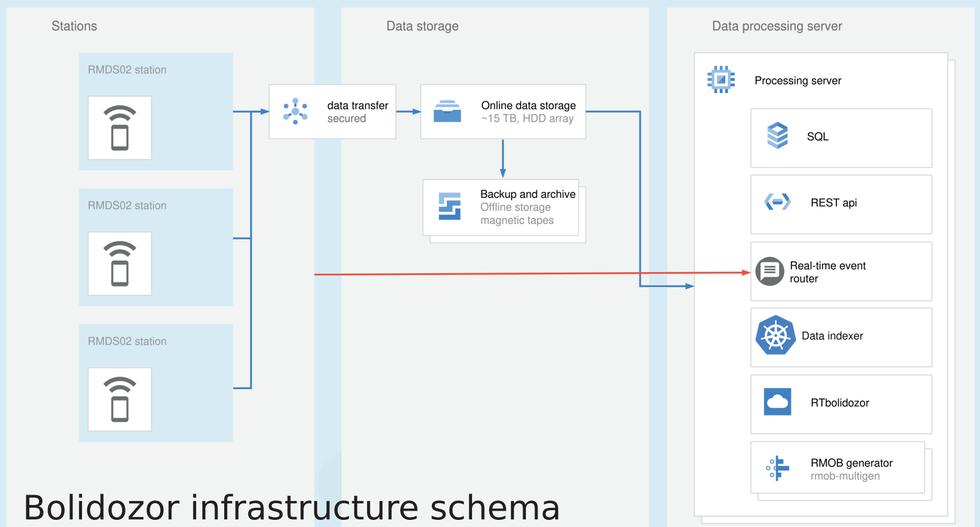
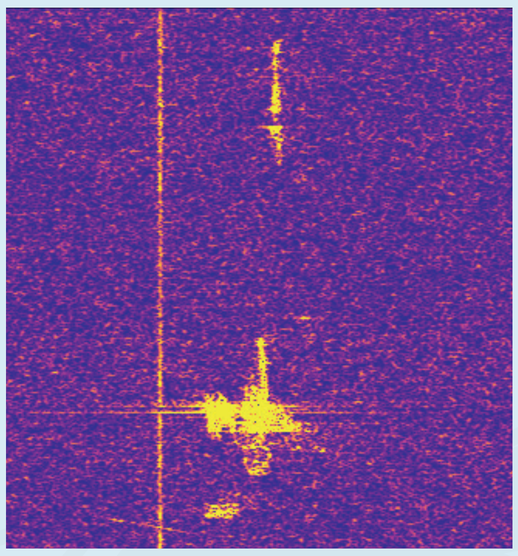
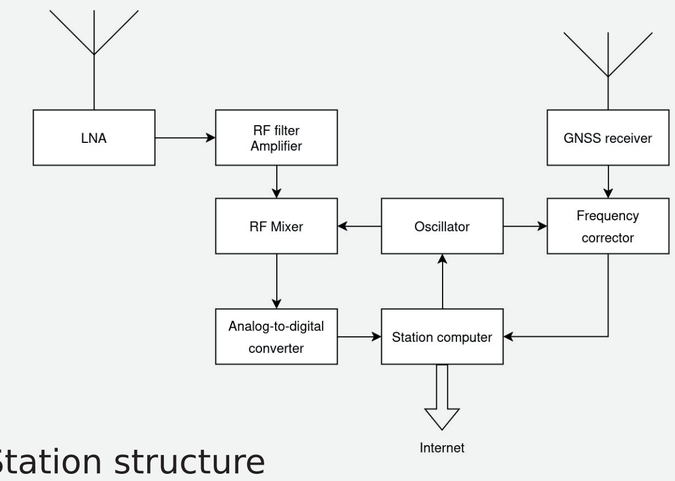
Bolidozor is a network for detecting meteor by processing radio signals. The network utilizes stations that capture and, in real-time, detect reflections of signals from ionized gases in the trajectory of body. The project's goal is to provide accurate data on meteor passes through atmosphere and, in the future, to determine their paths. The network emphasizes high-quality, open-access data, making it available for everyone. In 2024, the Bolidozor network continues to expand its stations and implement new technologies, further enhancing its capabilities.





Bolidozor infrastructure schema





Station structure

Each Bolidozor station consists of hardware optimized for detecting radio signals, enabling continuous monitoring of bolides. The primary components are:

- **Software Defined Radio (SDR)** adapts high-frequency signals from the antenna for sampling via the ADC converter SDR-Widget.
- **SDR-Widget** converts of analog signals into digital form, allowing precise real-time processing and analysis through software.
- **Ground Plane Antenna** recieves mirrored signals from the Graves transmitter. The antenna provides a wide radiation pattern, suitable for use in Central Europe in combination with the Graves transmitter.
- **One-board Computer (OBC)** is placed in each station, controlls the peripherials and process the received signals. The computer analyzes data in real time and sends them to the central data storage for further processing and visualization.
- **GPS Receiver** ensures precise time synchronization.
- **Oscillator Calibration** based on GPS PPS signal reduces temperature dependence and increase measurement accuracy.

The station hardware is largely designed and manufactured using the open-source MLAB kit, offering a highly flexible platform for hardware development.

The Bolidozor station software is designed as an autonomous system that independently ensures real-time detection and processing of radio signals. The main functions of the software include:

- **Hardware Controller** controls the SDR receiver and other instruments. This process runs without user intervention.
- **Detection Algorithms** analyzes the digitized signal and uses detection ofartifacts that indicate a bolide's passage.
- **Feedback Oscillator Calibration** improves measurement accuracy, the firmware automatically performs correction of oscillator.
- **Real-time Event Information** is immediately published to the central system for further use.
- **Data Stream** provides on-situ visualization of incomming signal on another computer as a live waterfall.
- **Data Transmission:** Measured data is regularly sent from the station to the data storage system. This data, in FITS format, includes both raw bolide recordings and preview images.

The entire software is optimized for long-term and stable operation with minimal need for user maintenance.

Upcoming Goals

The upcoming goals for the Bolidozor network include developing additional graphical outputs for visualization tools. Some of these outputs will be suitable for presentation to the general public, such as at observatories that host a station or are interested in the data. Other data outputs aim to reach a point where the network can determine the trajectory of a bolide's passage. Another goal is to simplify the station hardware to enable production in larger quantities.

Bolidozor

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