Bolidozor radio meteor detection network

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Detection Method

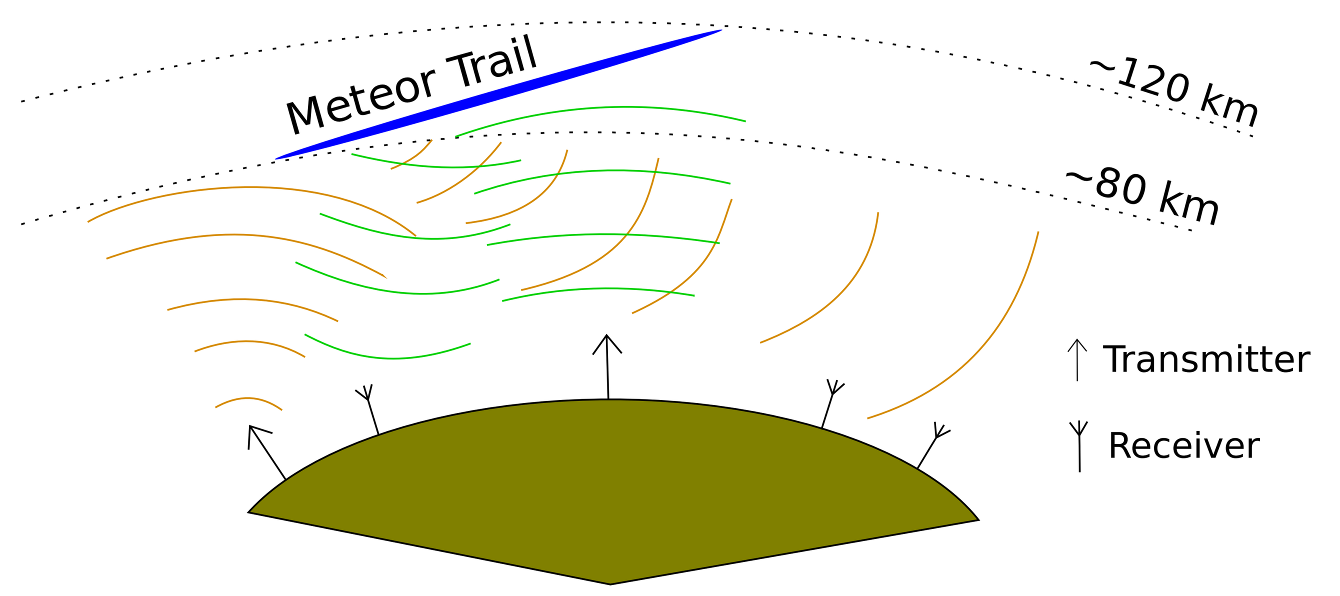
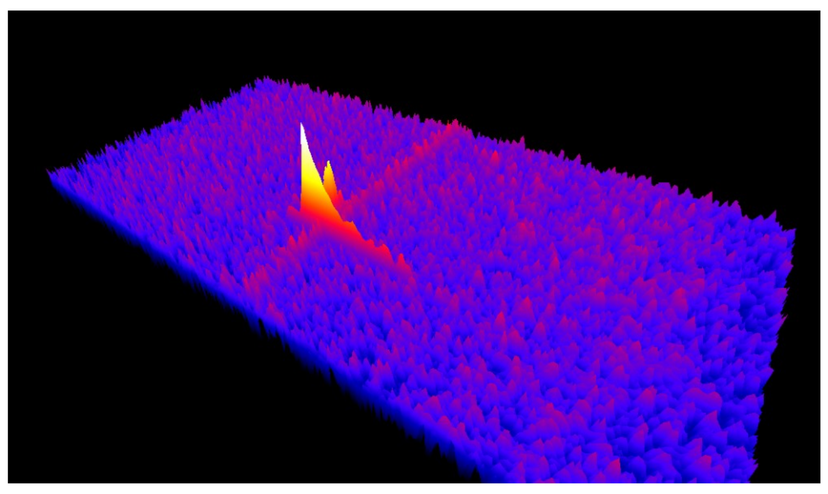
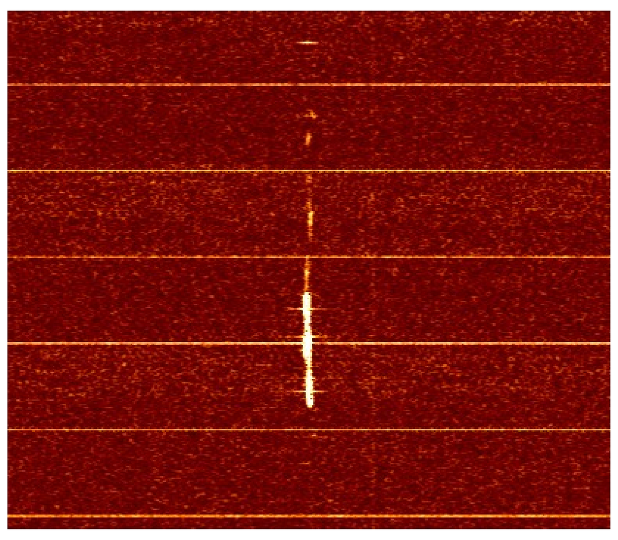


Figure 1 – General principle of meteor observing by forward scattering of radio waves from ionized trails.

The general principle of meteor observing by forward scattering of radio waves off their trails is illustrated in Figure 1. A lower VHF range radio receiver (30–200 MHz) is located at a large distance (about 500–2000 km) from a transmitter at the same frequency. Direct radio contact is impossible due to the curvature of the Earth. When a meteoroid enters the atmosphere, its meteor trail may reflect the radio waves from the transmitter to the receiver. At the receiver, where the signal of the transmitter is normally not received, the signal can then be received for a moment, as long as the meteor trail is present. Such reflections can last from a tenth of a second to a few minutes. The received signal characteristics are related to physical parameters of the meteoric event.



Freya Software screenshot



FITS of radio bolide event

Station Hardware

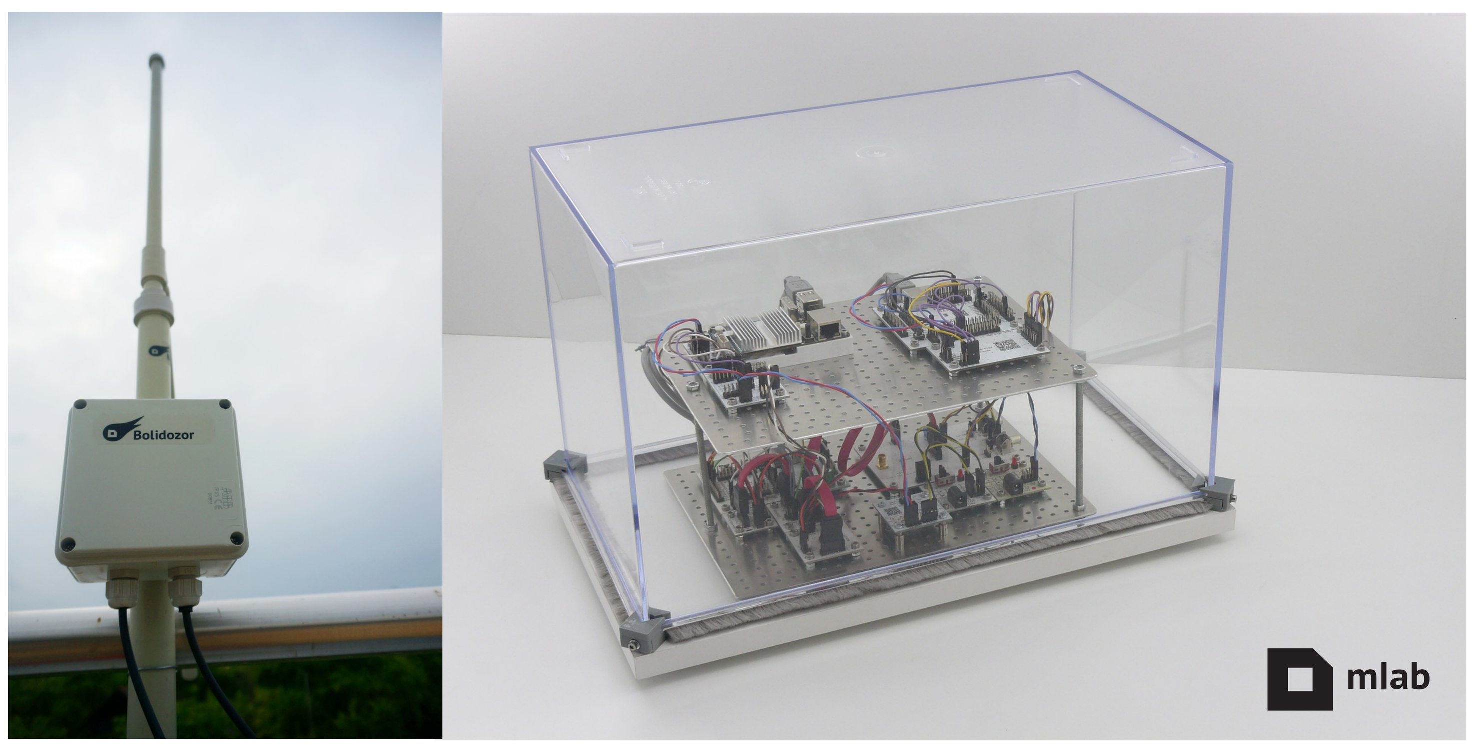


Figure 3 – Ground plane antenna of Bolidozor node (on the left) and the receiver in version RMDS02D (on the right).

Reception station is made from MLAB open source electronic prototyping system. Therefore the whole station is *open hardware design*.

open source hardware

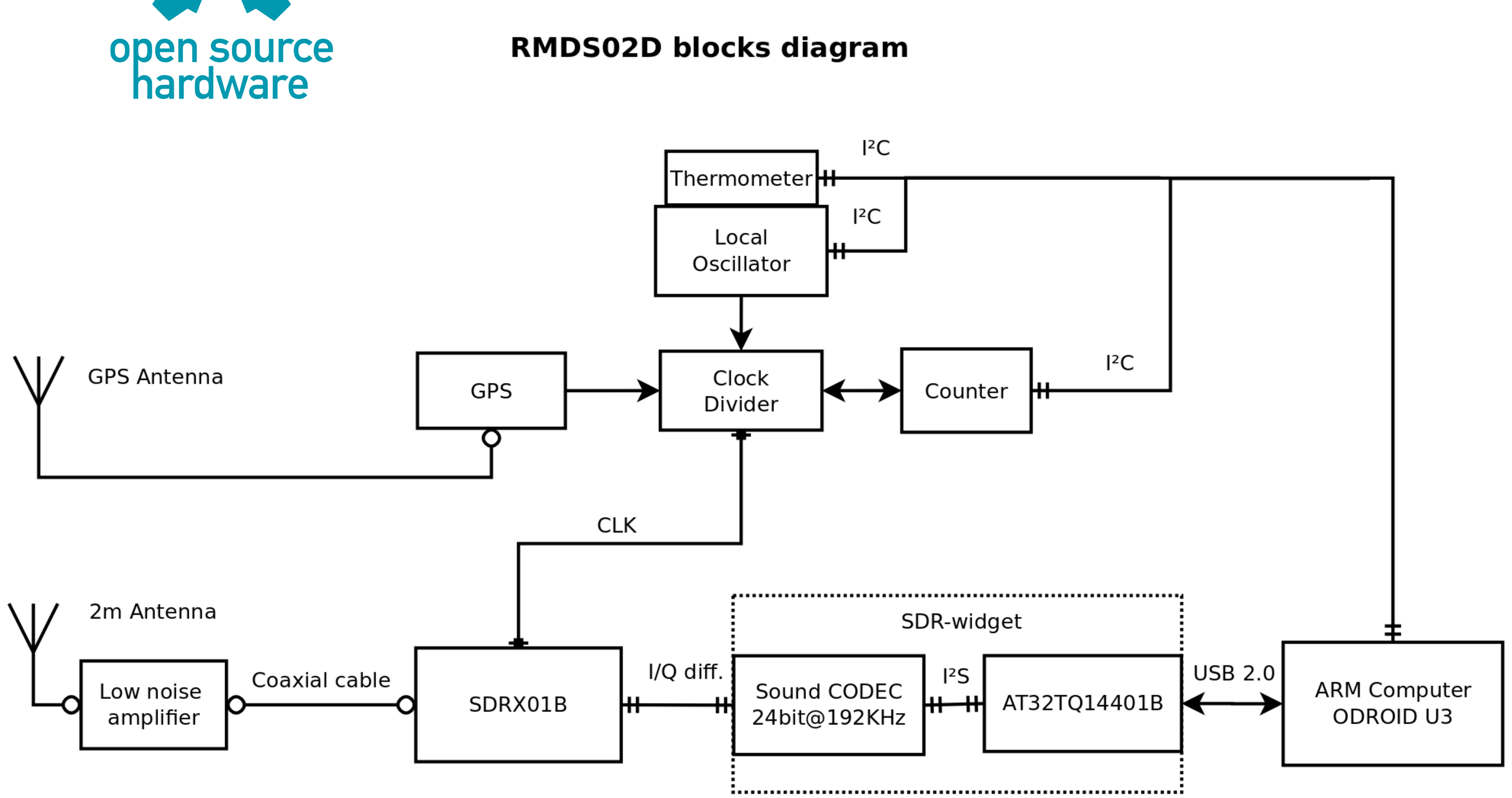
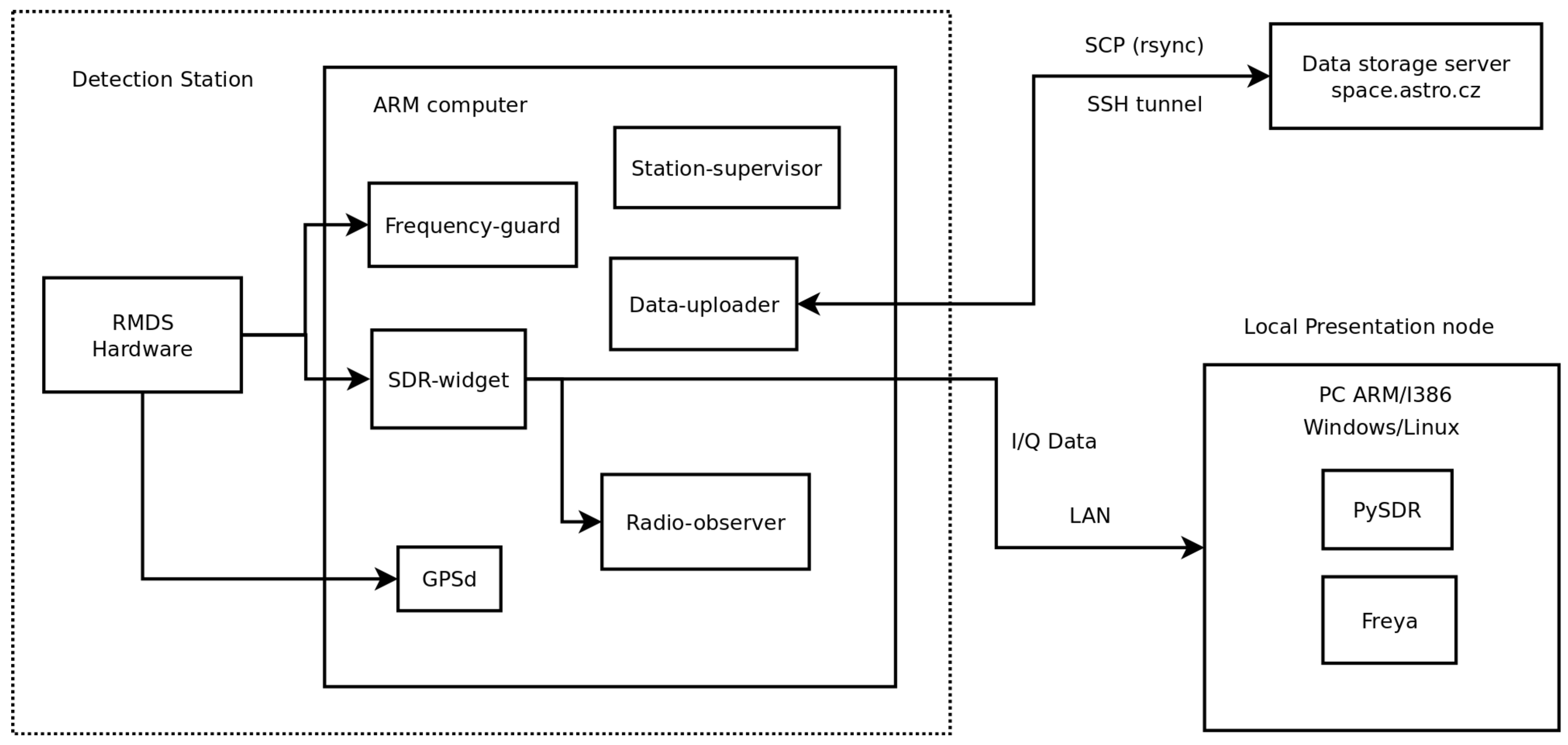


Figure 4 – Interconnection of MLAB modules in Bolidozor RMDS02D station.

Station Software

Each detection node runs our software on ODROID-U3 ARM based computer with Ubuntu Linux. The main software component is radio-observer code which detects the meteor events in data stream and create data records to FITS files.



Network Deployment

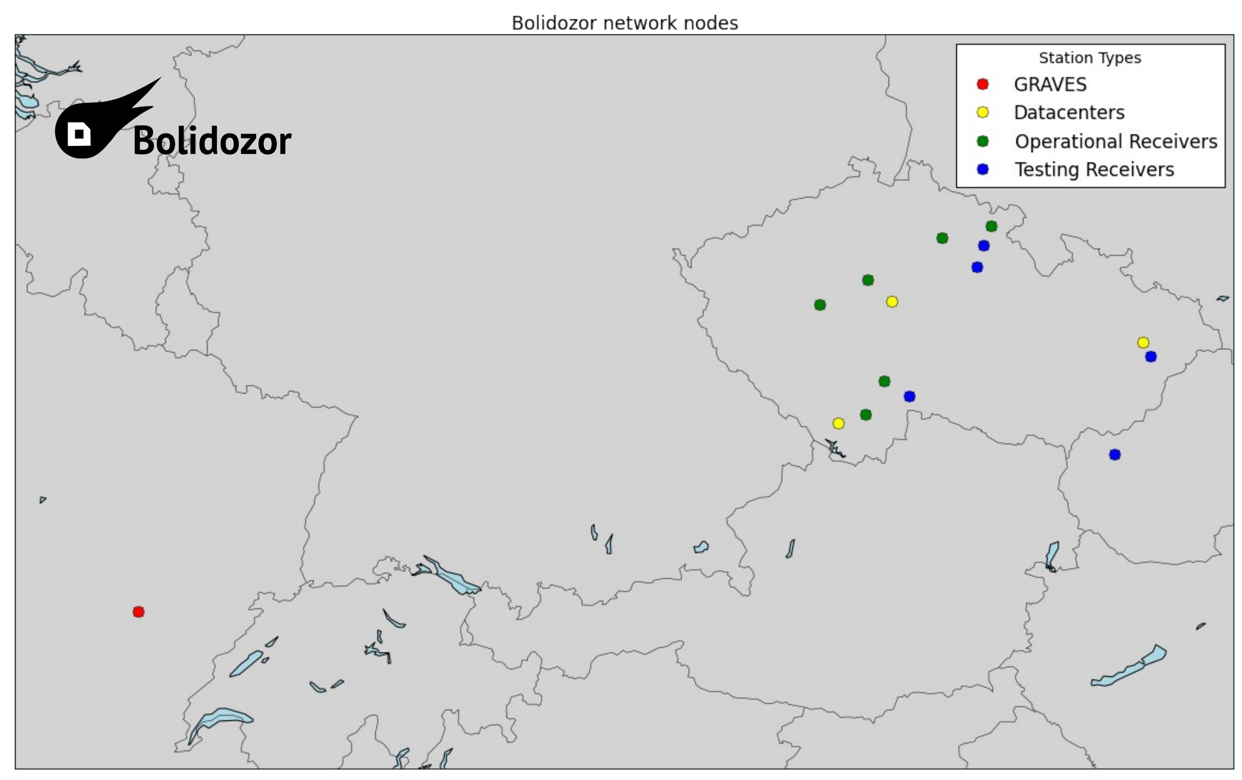
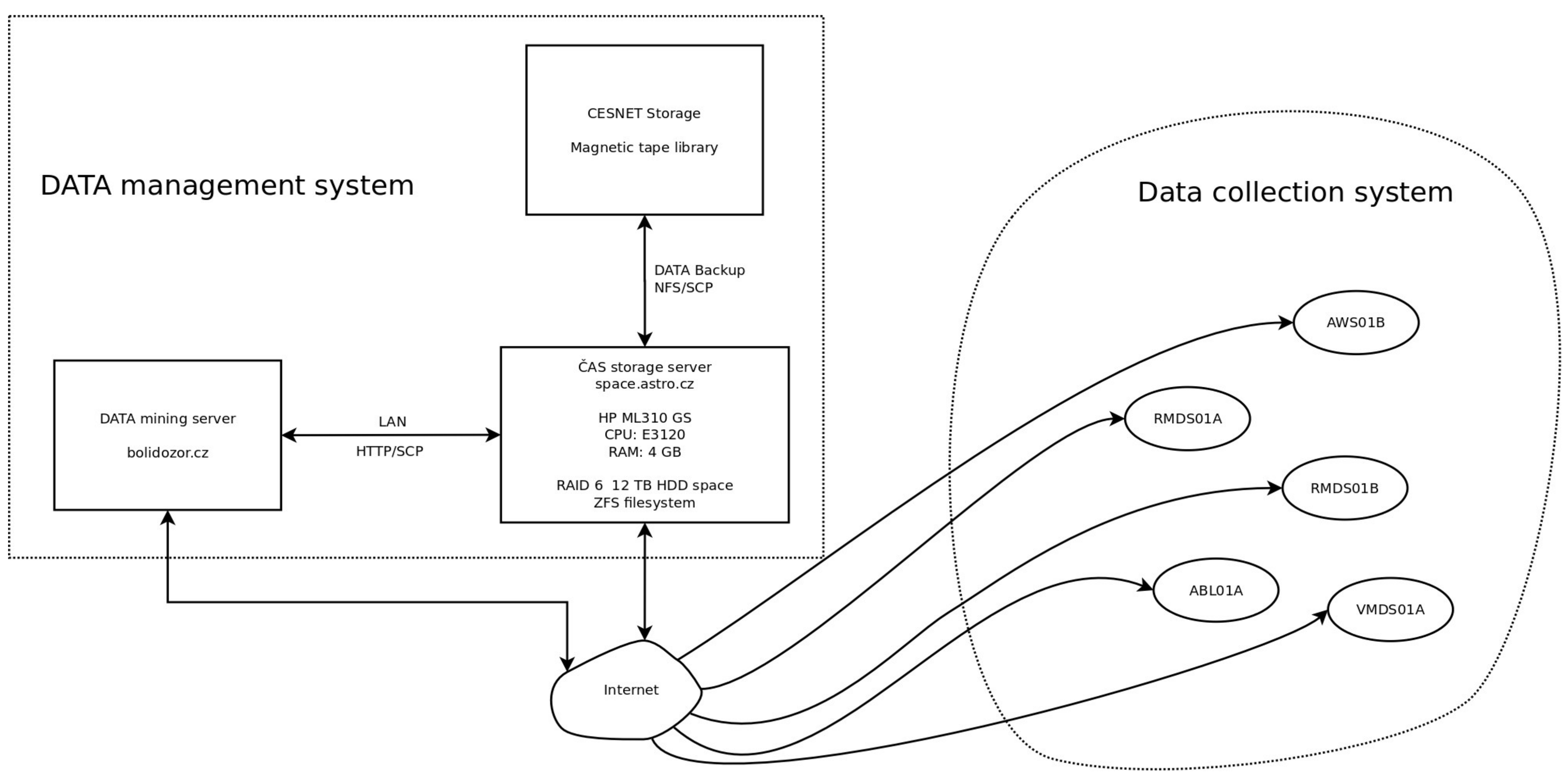


Figure 6 – A map of Bolidozor network nodes

Network Architecture



Measured Data

We currently have large database of meteor reflections from several stations. Some meteors are received on multiple stations as in figure 7 for example. Unfortunately we currently have not enough number of stations and suitable network geometry to obtain meteor trail vector. To overcome this issue the Bolidozor network *needs more stations* abroad from the Czech Republic.

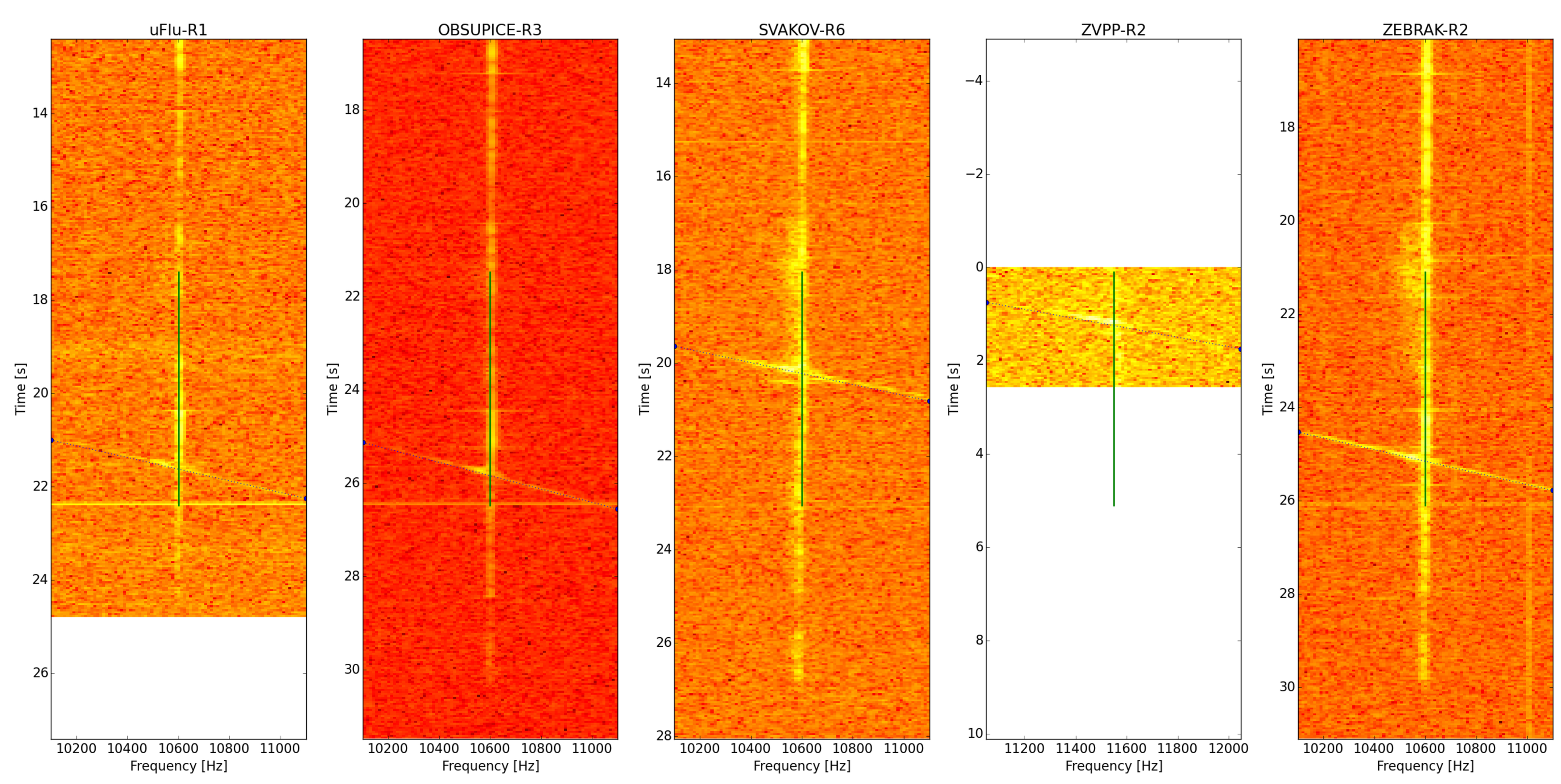


Figure 7 – An example of head echo from a radio bolide received on multiple stations. Pictures are aligned by time.