We present an earthquake alert system for Germany that automatically provides comprehensive and reliable information on earthquakes. It consists of the following components:

1. **Seismometer Network**: A network of five selected stations of the German Regional Seismic Network (GRSN) and two additional new stations.
2. **Data Recording and Processing System**: The implemented CDA.0 communication protocol allows the creation of an instantaneous, simultaneous transmission of recent and historical earthquake data. This ensures immediate access to the most current data at any time.
3. **Data Processing**: The software makes use of improved procedures for seismic phase identification and phase association. Moreover, several consistency checks are included. The application of these automatic methods provides reliable estimates of the source parameters. Data processing is the most important element of the alert system.

**Overview**

A forward grid-search method computes synthetic onset times. If a certain number of onsets determined by the Murdock-Hutt detector have corresponding synthetic onsets, these are grouped together and the corresponding source parameters are used as an initial solution for further processing.

**Onset Determination and Grouping**

To estimate the impact of an earthquake in Germany, the instrumental intensity (after MSK) is determined from source parameters. On base of the instrumental intensity map and vulnerability maps, the impact of an earthquake can be assessed.

**Impact Quantification**

**Epicenter Determination**

For a precise epicenter determination, it is necessary to (1) find the correct phase types and (2) reject those phases which lead to small errors of the epicenter solution. The location is determined from a grid-search method.

**User Interface**

A graphic user interface was developed for testing new algorithms of the automatic data processing. The user can switch between different view types.

**Signal Definition**

Smoothed envelopes of seismograms are used to define the signal windows. These are needed by the waveform algorithms that compute various signal parameters such as dominant frequency, polarization, etc.

**Dominant Frequency**

The dominant frequency is an additional quality of the phase identification. It is acquired from the number of zero crossings of the signal. This simple but robust technique provides more stable values of the so-called power spectra. The comparison with characteristic frequency windows of known seismic phases allows the determination of the phase type.

**Polarization Analysis**

Three component polarization analysis is applied to the seismic signals to determine the back azimuth. The quality of the results depends on the signal to noise ratio and the station characteristics like ground composite. Results of polarization analysis is shown in the two figures above with a probable P-phase on the left and S-phase on the right side, respectively.

**Consistency Checks**

Consistency checks are used to estimate the quality of the epicenter determination. On the left side, the result of the spatial consistency is shown. A numerical algorithm is used to calculate the consistency value between the epicenter solution and the distribution of the contributing phases. Results of the automatic data processing with epicenter locations in the blue area will be rejected.

**Earthquake Alert System**

The principal workflow of the earthquake alert system is shown on the left side. After determination of the epicenter location, these data are provided by several media like SMS and email and are available on a webpage together with geological information.