OPEN SYSTEMS & SERVICES
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Volcano Monitoring

As volcano monitoring involves more and different sensors from seismic to GPS receivers, from video and thermal cameras to multi-parameter probes measuring temperature, ph values and humidity in the ground and the air, it becomes important to design real-time networks that integrate and leverage the multitude of available parameters. In order to do so some simple principles need to be observed: a) a common time base for all measurements, b) a packetized general data communication protocol for acquisition and distribution, c) an open and well documented interface to the data permitting standard and emerging innovative processing, and d) an intuitive visualization platform for scientists and civil defense personnel.

Although mentioned as simple principles, the list above does not necessarily lead to obvious solutions or integrated systems, which is, however, required to take advantage of the available data. Only once the different data streams are put into context to each other in terms of time and location can a broader view be obtained and additional information extracted. The presentation is a summary of currently available technologies and how they can achieve the goal of an integrated real-time volcano monitoring system.

A common time base are standard for seismic and GPS networks. In different projects we extended this to video feeds and time-lapse photography. Other probes have been integrated with vault interface enclosures (VIE) as used in the Transportable Array (TA) of the USArray. The VIE can accommodate the sensors employed in volcano monitoring.
The TA has shown that Antelope is a versatile and robust middleware. It provides the required packetized general communication protocol that is independent from the actual physical communication link leaving the network design to adopt appropriate and possible hybrid solutions. This applies for the data acquisition and the data/information dissemination providing both a much needed collaboration platform, as well as, system hardening backup centers.
Moreover, Antelope, as typical middleware, allows the scientist and software developer to focus on the specific purpose of their application by providing well defined input/output interfaces. This will spur the development of original and inventive real-time processing schemes in the realm of volcano monitoring.

Whatever the underlying data and information engine is, it is only as good as the frontend. Such a frontend has to accommodate the dual purpose of putting data and information in a form that is conducive for scientist and the emergency responder. Current projects in Italy and Abu Dhabi with multiple display centers gave us insights into how difficult it is to develop a multipurpose situation room. Currently, we are experimenting with sophisticated emergency management software that ties strong-motion measurement, structural behavior, and loss estimation to a situation-driven response plan. Although different in content and timeline, this can be adapted for developing volcano eruptions.

A final word on remote sensing data, e.g. infrared imaging from an airplane: If the data can be streamed, there is a way to time tag them and include them in the broader real-time process. At least, batch processing should be considered in order to improve the overall information status pre- or post-event.

Please contact oss@kmi.com for more details or proposal requests.