Terrestrial Real-Time Volcano Monitoring

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Terrestrial Real-Time Volcano Monitoring

Real-time volcano monitoring networks need to integrate a multitude of sensors leveraging the wealth of available parameters. In order to do so, some *simple* principles need to be observed:

- a common time base for all measurements
- a packetized general data communication protocol for acquisition and distribution
- an open and well documented interface to the data permitting standard and emerging innovative processing
- an intuitive visualization platform for scientists and civil defense personnel.

Common Time Base

- A common time base are standard for seismic and GPS networks
- In different projects UCSD extended this to video feeds and time-lapse photography
- Other probes have been integrated with the vault interface enclosures (VIE) as used in the Transportable Array (TA) of the USArray

=> The VIE can accommodate the sensors employed in volcano monitoring

Middleware & Communication

- Antelope has shown in many network deployments, in particular, in the Transportable Array its versatility and robustness in terms of data types and number of stations
- Antelope provides the required packetized general communication protocol that is independent from the actual physical communication link
- This leaves the freedom to adopt communication solutions appropriate for the network design including the possibility of elaborated hybrid solutions
- This applies for the data acquisition as well as the data/ information dissemination providing both a much needed collaboration platform, as well as, system hardening backup centers.

Middleware & Process Development

- Antelope provides providing well defined input/output interfaces
- Antelope allows the scientist and software developer to focus on the specific purpose of their application
- This shall spur the development of original and inventive real-time processing schemes in the realm of volcano monitoring

Visualization

- The 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
  - 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

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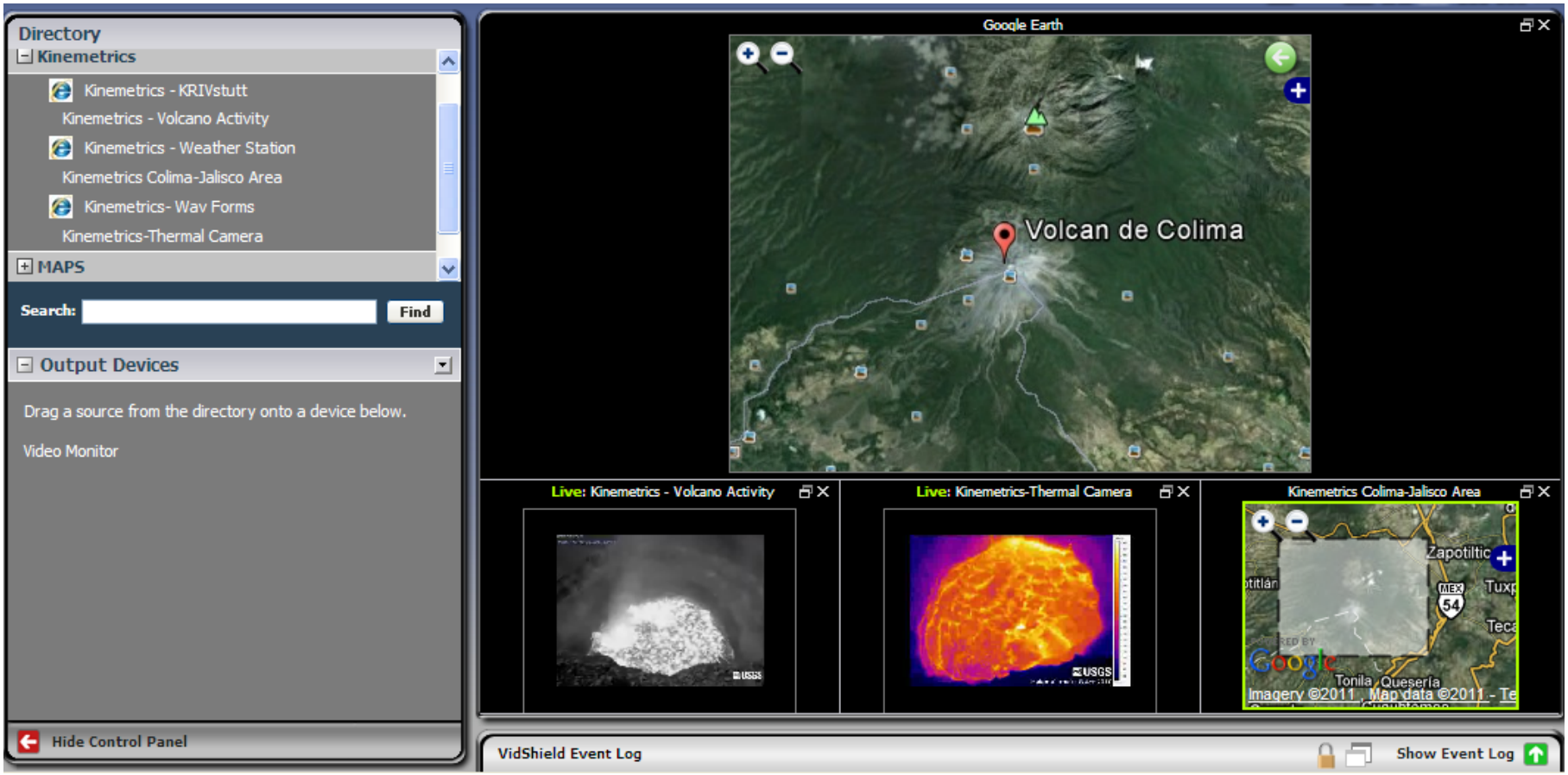
Visualization



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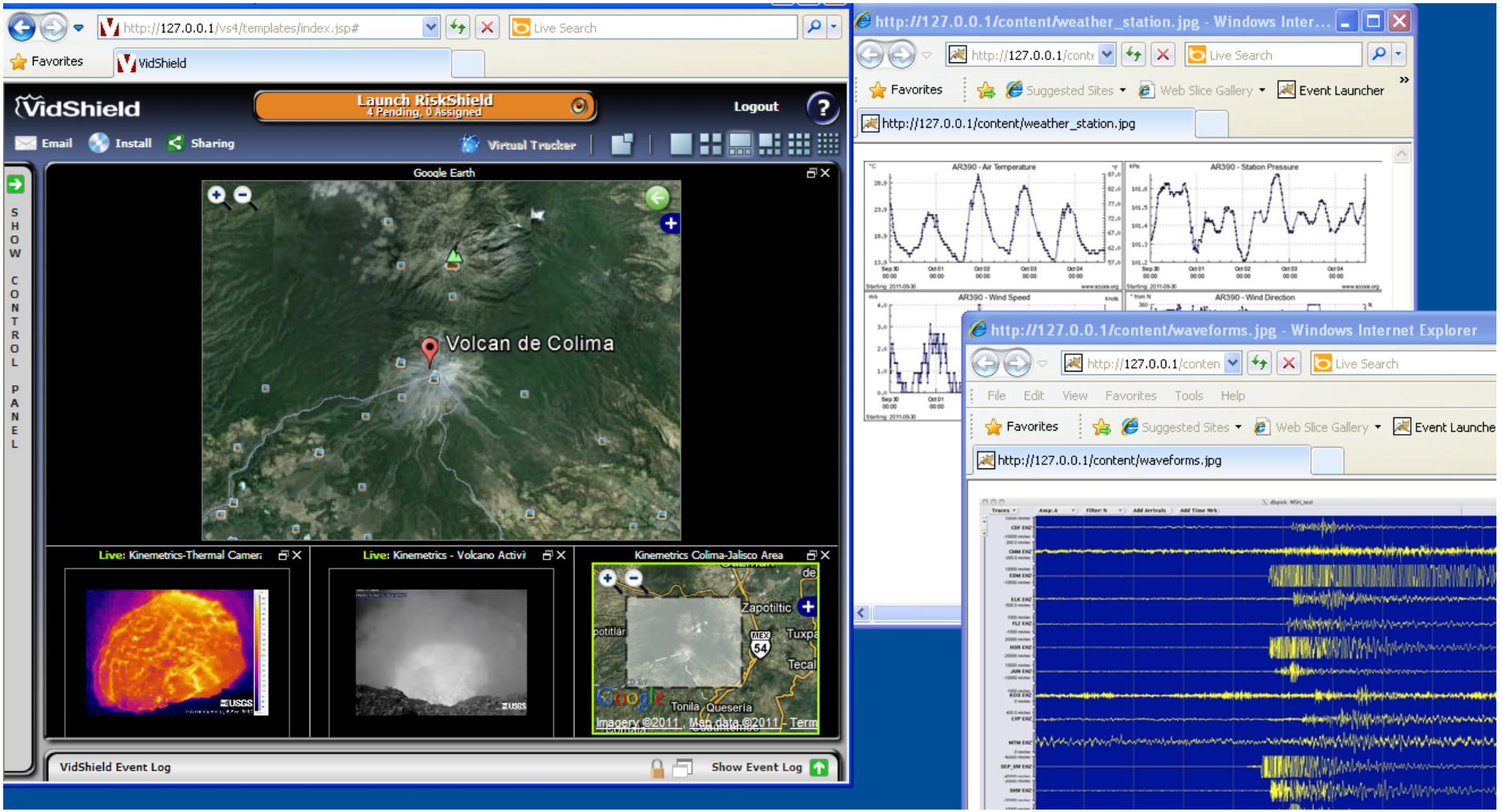
Visualization



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Visualization

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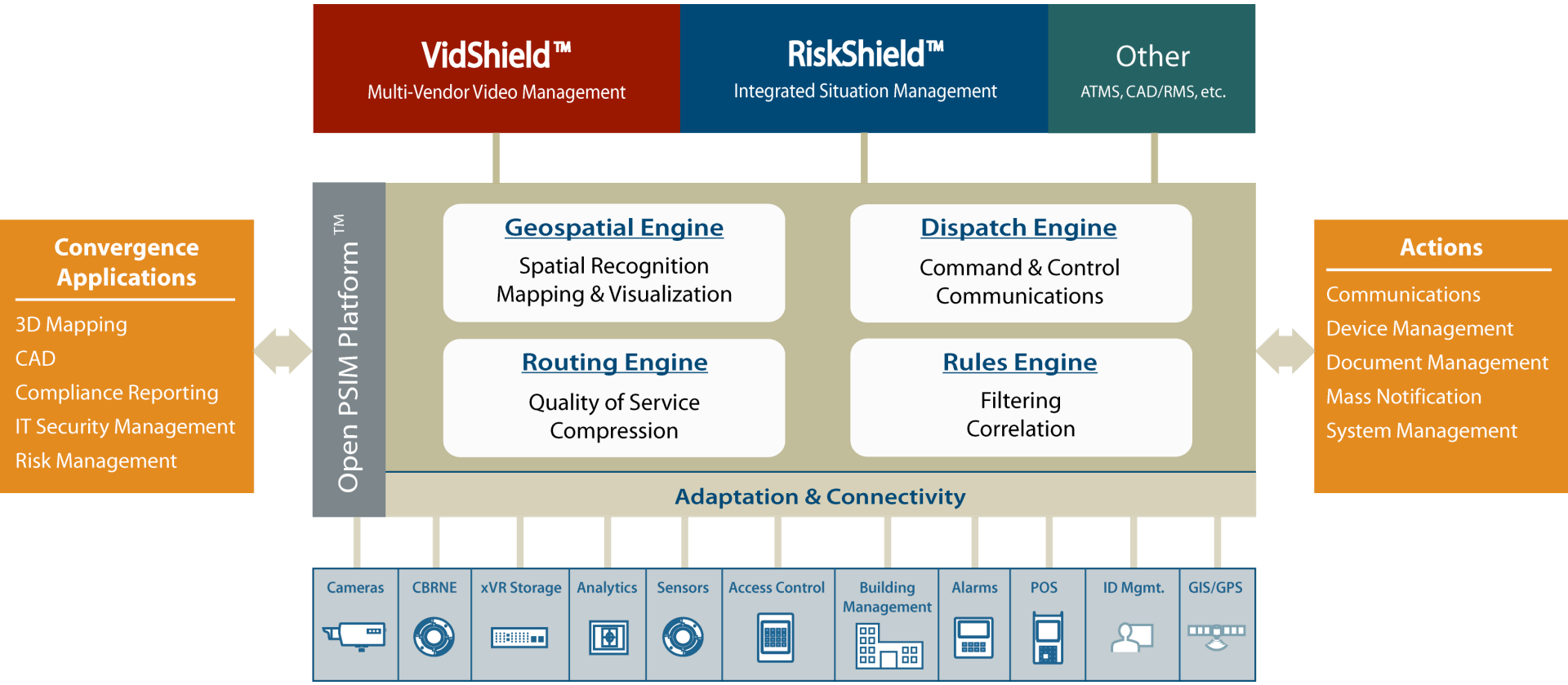
“Manage The Situation
Not The Technology”

Architecture



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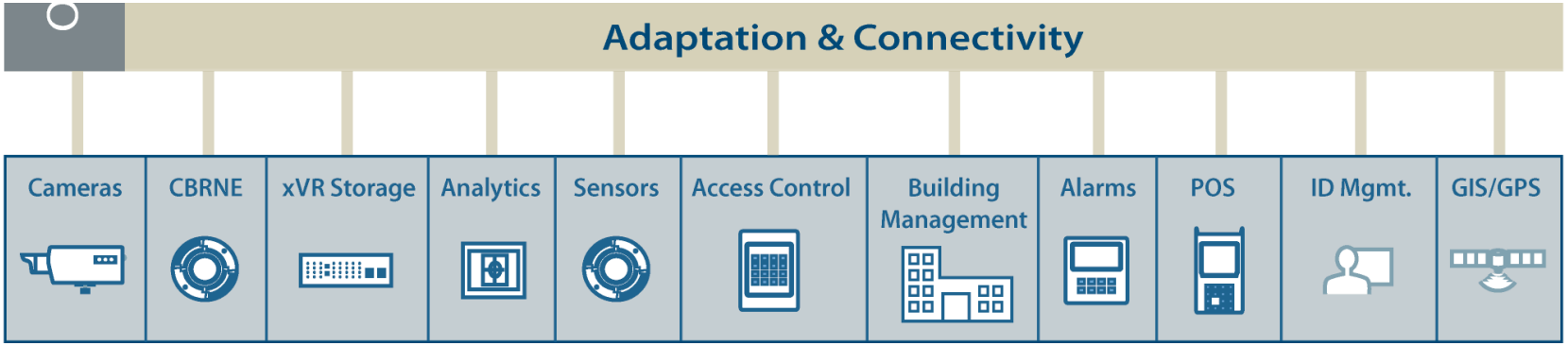
Adaption and Connectivity



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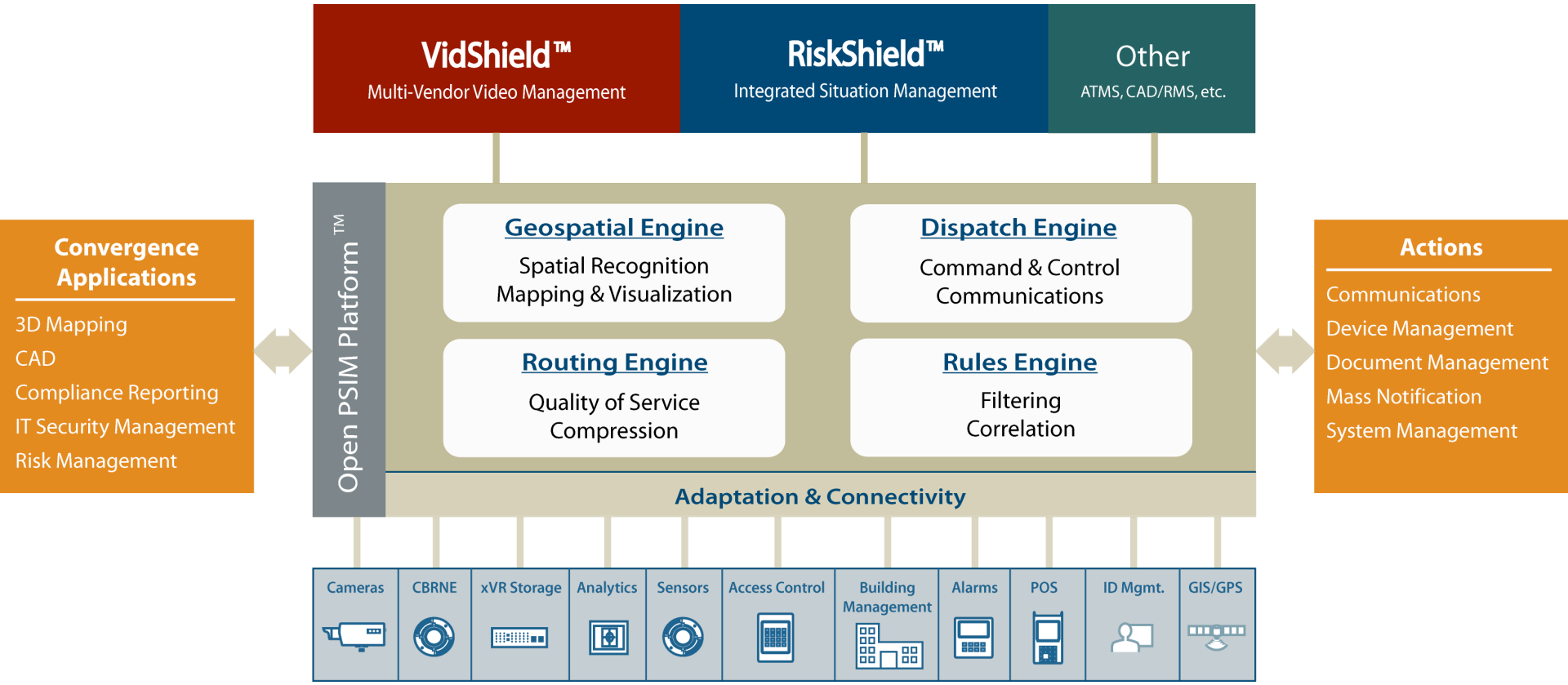
Architecture



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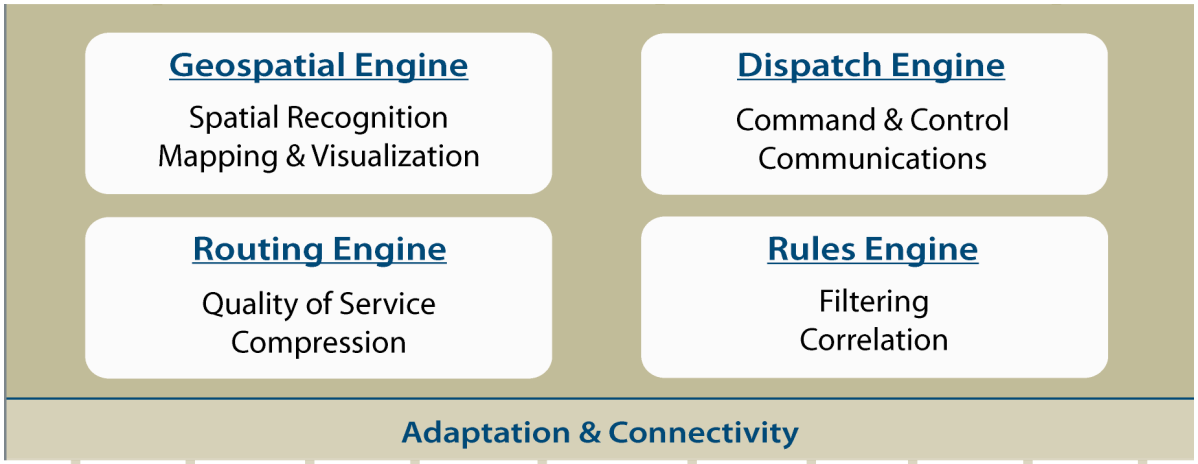
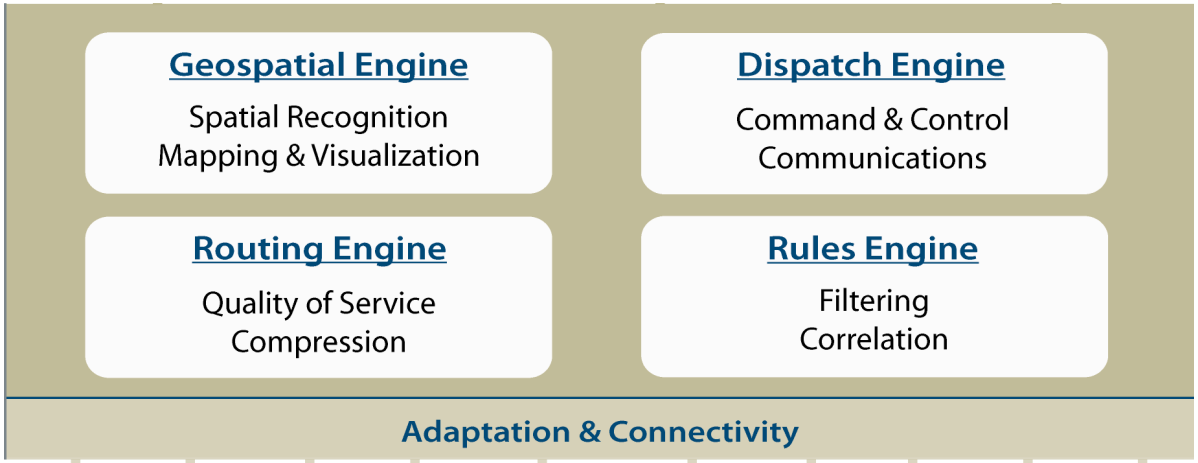
Geospatial Engine



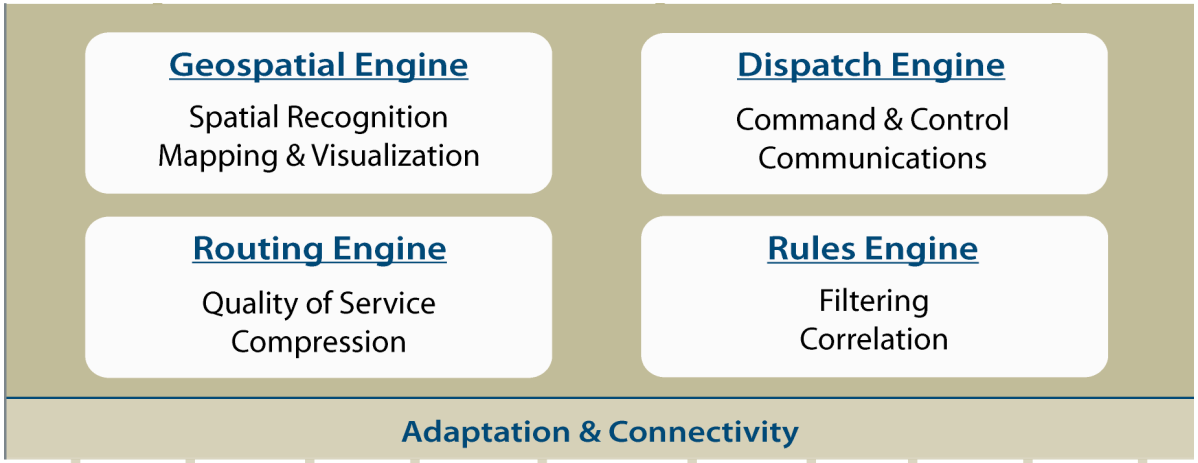
Provides spatial recognition for geo-location of devices and supports situation mapping functionality

Routing Engine



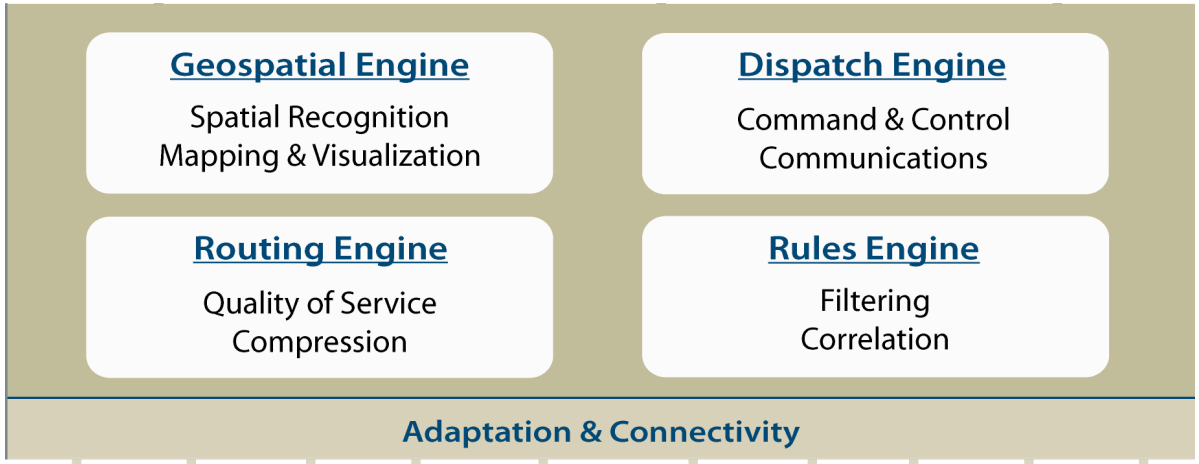
This engine optimizes the use of the network and identifies sources of information and destinations to move the data without going back to the command center thereby, avoiding possible bottlenecks that would arise from routing all traffic through a single centralized server.

Rules Engine



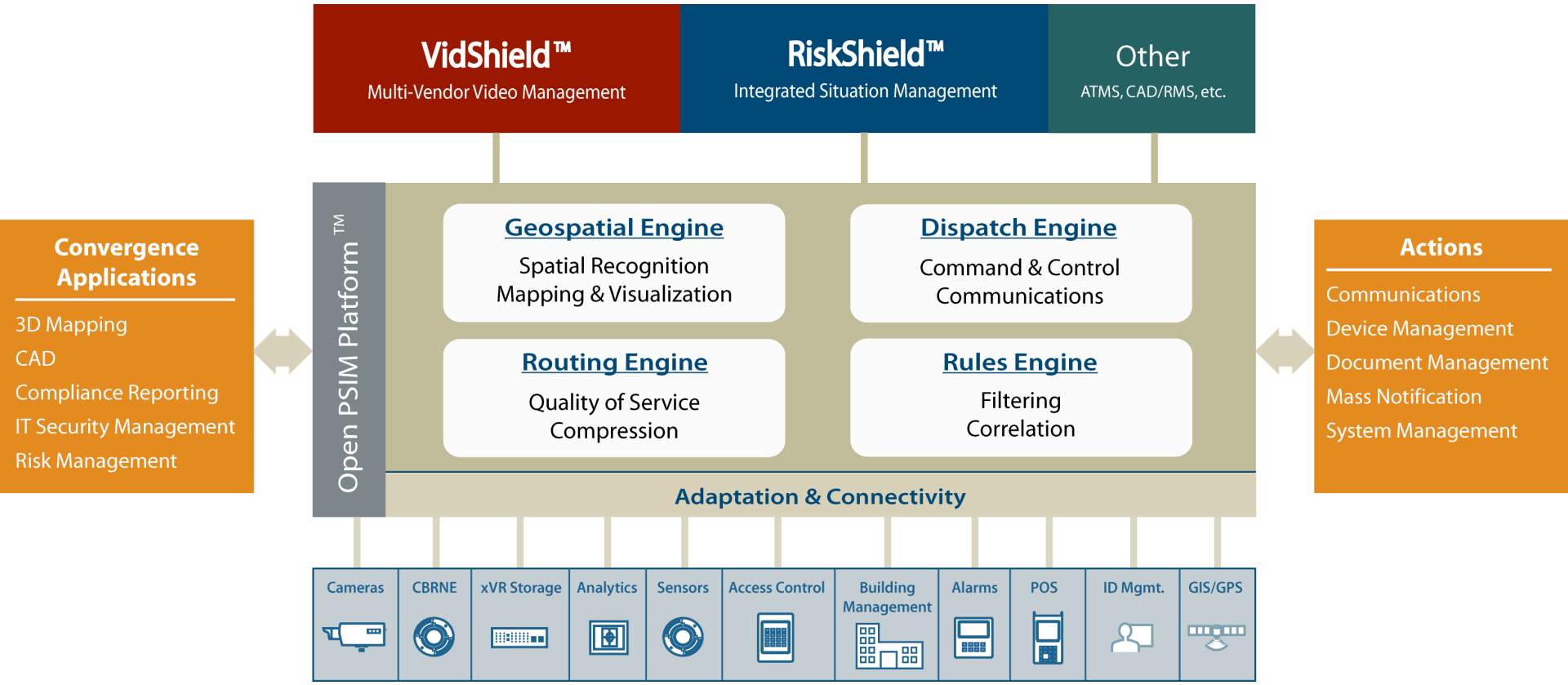
The Rules Engine analyzes event and policy information from multiple sources to correlate events, make decisions based upon event variables and initiate activities.

Dispatch Engine



This component integrates with communication infrastructure to "dispatch" external information such as messages, data and commands as well as automates the execution of other applications.

Architecture



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Operator Interface

- The situation management information and services are shared with the VidShield and RiskShield software applications to provide a complete situation awareness.
- Enables situation awareness, management, and resolution of situations according to standard business processes and policies.
- After situations are identified, based on pre-defined business rules, operators can view a situation summary with video and text details.
- Operators can drill in to more detail to further diagnose the situation.
- All information and activities are recorded for tracking and later forensic analysis.

Thank you

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