Seaside Risk Detection from Mesh Connected Consumer Devices

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Context

Information Technologies (IT) are commonly used since many years in risk management. Most dedicated systems are designed to assist the official response to a crisis and are handled by professionals: rescue team, army, etc.

However, a new trend seems to emerge: a direct link between the population and the officials relying on the more and more used mobile devices such as smartphones (Figure 1). This poster thus aims at proposing an architecture supporting that activity. A typical context of utilization can be found in a coastal area like in Reunion Island, located in the Indian Ocean next to Madagascar. There are many beaches around the island. Two main threats are identified: tsunamis and sharks. Such a system enables an early detection of the risk, a more efficient rescue management and an individual feedback reply to the population.

Principle

The first level of the process occurs on the terrain from the people living or standing on the shore near the ocean: it is the detection step, based on the multiple features embedded in the smartphone as described in Figure 2.

The second level concerns the network aspects. As the main infrastructure may be down because of the disaster, our proposition is to rely on mesh communication, that allows devices auto-configure themselves to transport data step-by-step to a safe place.

The third level is related to the response from the officials directly to the user. Rescue operations are managed by the professionals. But specific recommendations can be given, based on the data submitted. They can be computed in the cloud far from the area where the crisis occurs.

Architecture

Combining the three levels results in the architecture shown in Figure 3. It depicts a typical situation from the detection of a risk situation to its assessment and feedback.

In this example, the leftmost smartphone detects the occurence of a crisis thanks to its sensors and prepare a message for the rescue teams. It then tries 3 routes to reach the Coordination center. Route 1 is based on the normal cell phone infrastructure. Route 2 relies on a mesh auto-configured network that goes through peer devices. However, both fail. Finally Route 3 is successful, going through another mesh of smartphones to finally connect to an ADSL router, allowing the access to a Wide Area Network (WAN).

Data is sent to the Coordination Center which can delegate heavy processing to a Supporting Infrastructure. This is how the personal recommendations can be prepared and sent back to the terrain.

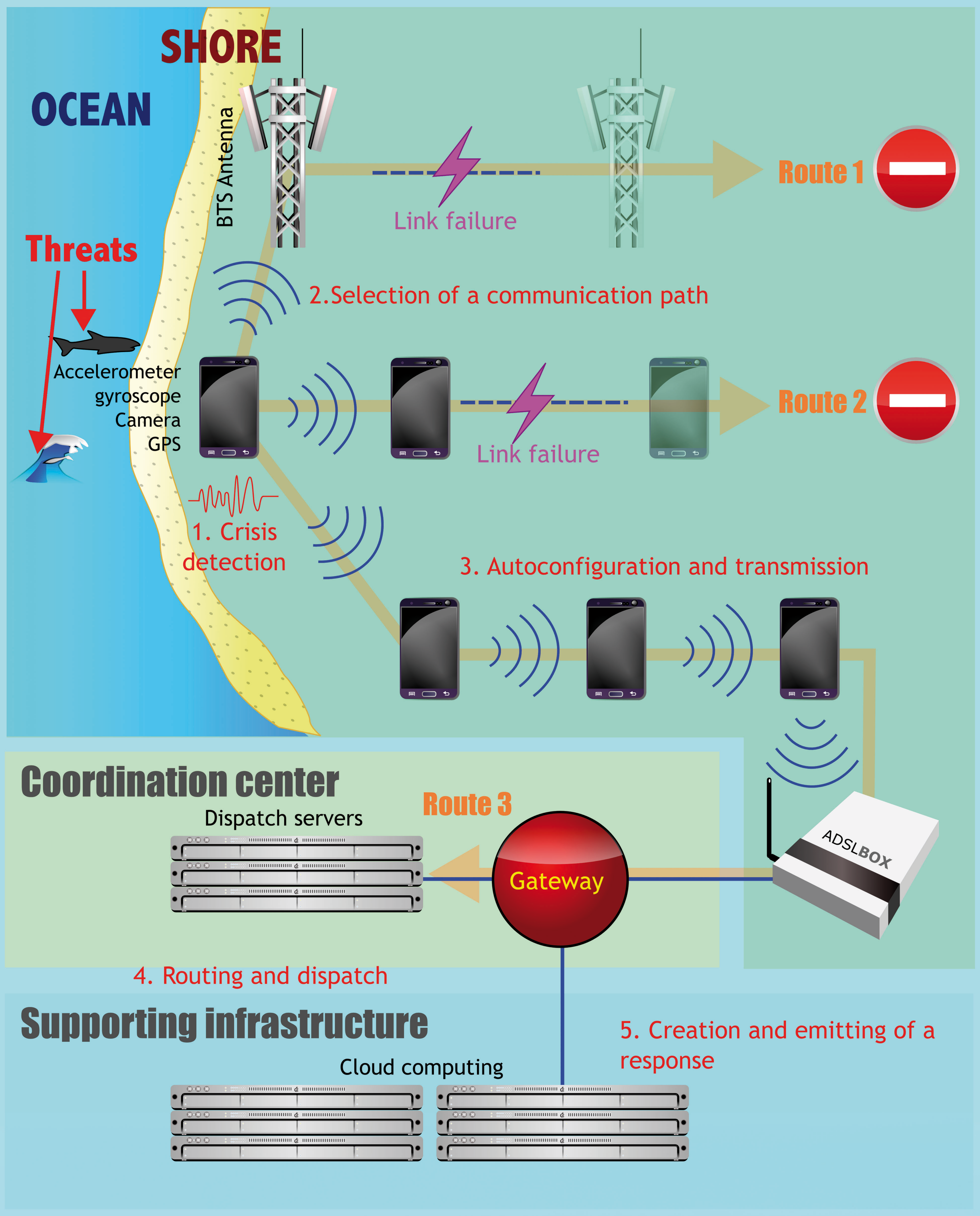

Fig. 3: architecture

Fig. 2: average Smartphone features and their role in crisis detection

Device equipment	Role
Network interfaces	Data exchange
GPS chip	Time and position capture
Camera	Photo and video for terrain view
Light sensor	At day, allows to know if one is buried
Accelerometer	Tremor pattern detection
Microphone	Voice and/or environment recording

Fig. 1: general overview

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