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Using Event Processing To Prevent Violencia De Género (Gender Violence)

by Charles Brett

for Application Development & Program Management Professionals

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Using Event Processing To Prevent *Violencia De Género* (Gender Violence)

EP+GPS+GPRS+Web Services Enables A Multiagency Solution To A Pressing Social/Political Issue At 1/10 The Cost

by Charles Brett
with Mike Gilpin and Wallis Yu

EXECUTIVE SUMMARY

Violencia de género (gender violence, where males most often hurt but sometimes even kill their female partners) is a significant social and, therefore, political problem in Spain and many other countries. It is a complex issue to address, with multiple agencies involved. Most existing attempts to prevent it are reactive, and all too often, agencies are not able to react fast enough to help the victim. As this case study describes, Navento Technology, a Madrid-based company, has created an innovative solution that — by combining global positioning systems (GPS), general packet radio service (GPRS), event processing, and Web services — enables a proactive, preventative approach at one-tenth the cost of the traditional reactive approach. The relevance to application development professionals is the way in which Navento's solution demonstrates how combinations of technologies plus event processing and Web services can generate solutions relevant to mainstream IT (in this case, the many agencies trying to cope with *violencia de género*). As this case study makes clear, such an approach may also be relevant to agencies working to address multiple other social issues in other countries — from pedophilia to criminal probation to stalking to sexual harassment.

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Forrester interviewed Navento Technologies (Madrid, Spain) to learn more about its innovative solution using EP, GPS, GPRS, and Web services.

Related Research Documents

"A Taxonomy Of Event Processing For Enterprise Architects"
August 18, 2008

"A Taxonomy Of Events For Your Application Development Strategy"
May 16, 2008

"What Are Events, And Why Do They Matter To Application Development Professionals?"
February 29, 2008

VIOLENCIA DE GÉNERO IS A SIGNIFICANT SOCIAL AND POLITICAL PROBLEM

In Spain and some other developed countries, day after day, week after week, the newspapers report instances of *violencia de género* (generally translated as gender violence). All too often, deaths or critical injuries are the result of men (typically) injuring their partners and even children. The Secretaria de Estado de Seguridad (SES), the part of Spanish Homeland Ministry responsible for policing and other security and penal infrastructure, has 84,000 people registered as victims of *violencia de género*. Of these, SES considers at least 2,000 to be at high or very high risk. Necessarily these figures do not include a much larger population of unregistered victims of *violencia de género;* neither does it include the numbers of aggressors. The number of people affected — direct victims, indirect victims (for example, children or close relatives), and aggressors — probably adds up to more than 350,000 in a population of around 45 million.

To make the situation worse, a large number of those imprisoned for committing *violencia de género* will try to commit new acts of *violencia de género* within a few weeks of leaving prison.

Addressing *Violencia De Género* Is Expensive And Too Reactive To Be Adequately Effective

Fighting *violencia de género* in Spain takes more than 22,000 employees working in multiple central and local government agencies — including the Guardia Civil, the national police, local police, corrections, Social Security, and the justice system. Each of these has different responsibilities with some overlap among them.

The common objective is to prevent *violencia de género* from ever occurring. Yet this continues to prove complex:

- **Time is of the essence.** The typical scenario involves a male (the aggressor) wishing to harm a female (the victim). Even if the victim is unharmed, she may feel victimized by the simple threat of violence. Thus, both the victim and the authorities need to know when the aggressor comes within a specified range (say 500 meters) of the victim, an alarm needs to occur, and then the authorities need to take action to prevent the violence. Unfortunately, with current technologies, the alarms may be set off when it is simply too late to initiate preventative steps — with the result that the authorities find not a potential victim but an actual one.

- **Current prevention measures are reactive.** Given the technologies and approaches available, current solutions have to work in reactive mode. For example, bracelets worn by an aggressor and victim will only identify that both are within a certain distance of each other when that distance is relatively small. This may be as low as 200 meters — a consequence of the limitations of Radio Frequency (RF) technology. Discovering the proximity of the aggressor and victim only when they are this close means that there is little time for a preventative reaction (the alert) to occur, much less time to actually send the police to intervene.

- **Existing solutions are technologically limited and highly expensive.** The most prevalent solution available today uses RF technology that sends out an alert when an RF receiver (worn by the victim) receives a signal that the RF transmitter (worn by the aggressor) is within a certain range. Not only do RF limitations circumscribe this range, but the solution also costs some thousand Euros per aggressor/victim pair per year. Such a high cost means that too few victims are protected — and inadequately at that, given RF's limitations.

- **Access to relevant information and integration of support systems is negligible.** While the many government departments know that they need to work together to prevent *violencia de género,* their related systems are not integrated. This makes coordination difficult, which in turn makes proactive actions that much harder to deliver.

The Spanish government, at all levels, is acutely aware of the problem, which has become a politically sensitive issue. But this is not just a Spanish issue; *violencia de género* is a problem common to other developed countries as well. And even in countries where *violencia de género* is not as widespread, similar issues arise — for example, the need to prevent pedophiles from coming near children, stalkers from following targets, probationers from breaking their probation terms, etc.

To its credit, the Spanish government has decided that the current reactive approach is no longer acceptable. It is now taking a leading role in looking for technological initiatives that are predictive and preventative rather than reactive.

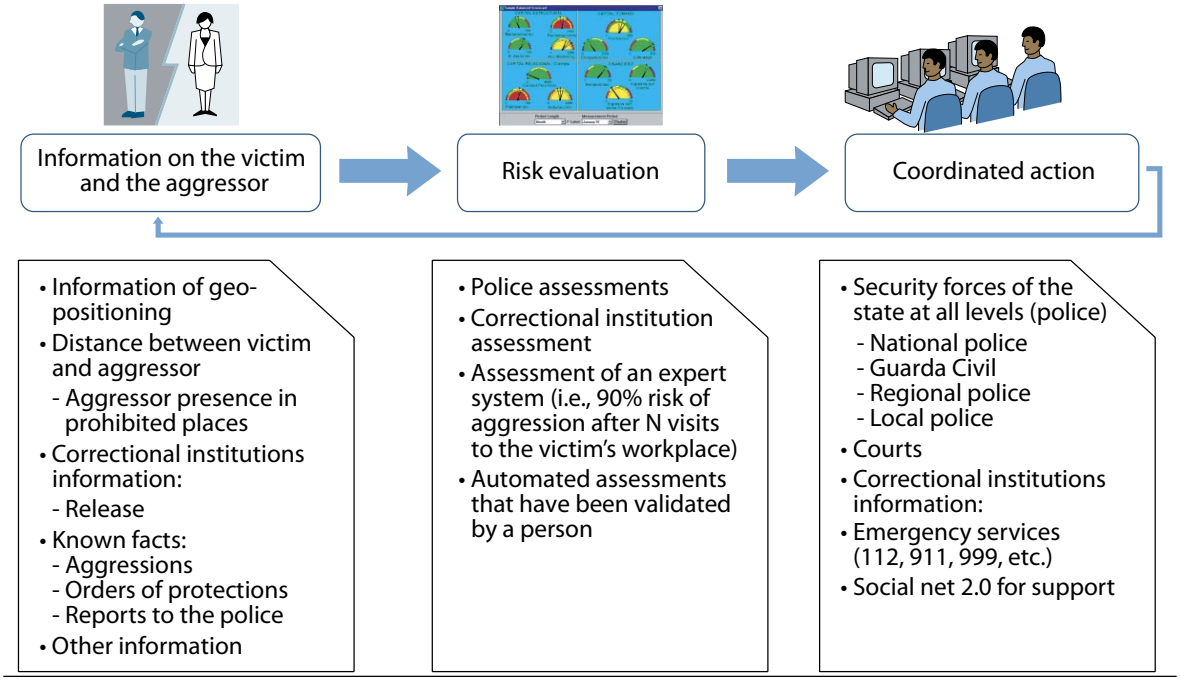
DEFINING THE CHALLENGE

The challenge has many dimensions, but at its heart is the commitment to initiate a coherent, preventative approach to *violencia de género.* This can be illustrated as a *system for the protection of victims* (see Figure 1).

For this to work, there must be:

- **Information.** A preventative system must know not only the position of both aggressor and victim but also the habits of each. For example, any system needs to know where the victim lives and works as well as schools or other common places where the victim goes (parking, relatives, etc.) so that if the system detects the aggressor near these, it can initiate corrective actions. Similarly, the system needs information about the aggressor; this can include data about when the aggressor is about to leave prison, where the aggressor lives and works, what forms of aggression have occurred in the past, what police information exists, etc. The system needs to gather all this information, store it in a common place, and set it up for appropriate access.

Figure 1 Information + Risk Evaluation = When To Act



47338 Source: Forrester Research, Inc.

- **Risk evaluation.** Risk evaluation uses the information stored in the system. Reviewing an aggressor's past history (police records, prison assessments, and other data) enables a risk assessment that will allow authorities to classify victims into appropriate categories of risk (high, medium, and low). The category of risk may also change depending on whether the aggressor and victim live or work near each other or whether there is a degree of geographical separation. For example, if the victim lives in one city and the aggressor lives in another city 600 kilometers away, this will shape the risk assessment differently than if both are living and working in the same city.

- **Coordinated action.** For successful prevention to occur, there must be coordinated action among the various authorities involved — from the courts to the police (in Spain — national and local police) to social agencies, correctional institutions, and emergency services. The reactive approach often fails victims because of the separation and spread of responsibilities among so many agencies. Prevention has to overcome this, which needs coordination and then action. For example, the authorities must respond to an alert that an aggressor has gone too near the home of the victim so that the nearest police officer (no matter if that officer is from the Guardia Civil, the national police, or the local police) can not only be found but can receive the action/command to intervene.

The Importance Of Event Processing And A Common Delivery Mechanism

Event processing is a means by which evaluation of many parallel data points can occur in real time. For example, event processing can continually analyze the position of each aggressor or victim and any associated information, such as altitude or speed. Other monitoring requirements include:

- **Understanding a complex web of identities.** A system to prevent *violencia de género* must be able to distinguish aggressor/victim pairings, and each individual, too. There are at least 2,000 high-risk aggressor/victim pairs in Spain. Each pairing has different parameters. Each pair will have differently circumscribed movements and a specific set of locations (home, workplace, schools) with circumference thresholds that an aggressor must not cross.

- **Awareness of the importance of time.** An aggressor might choose to wait for a victim in a location, so it is important to be able to see when an aggressor is forming a "waiting habit" and to identify other aggressor trends.

- **Sensitivity to the significance of speed.** A motorbike can transport an aggressor across 10 kilometers in minutes, whereas on foot traversing this distance would take more than an hour — considerably changing the risk profile of the moment.

Therefore, the ability to evaluate event information and relative times, speeds, and locations in parallel across multiple aggressor/victim pairings in real time against a set of predefined parameters and constraints is essential to identifying and initiating preventative actions. However, just detecting important events is not enough; the authorities must take timely action, so the system also requires a widely supported means of communication that can convey prevention information to all the right agencies. The answer? Web services, based on a set of widely accepted standards for interaction and communication of information. This approach makes it much easier for the disparate systems that various Spanish agencies use to see the same information and thus take concerted action. Most applications can integrate with Web services, thus reducing the integration burden. And developers can combine event processing and Web services in innovative ways to overcome unexpected hurdles.

BUILDING AN ALTERNATIVE SOLUTION

As described above, existing solutions are expensive (several thousand Euros a year per aggressor/victim pair), are limited by the technology used, and are reactive rather than preventative. Navento Technologies, the Madrid-based subsidiary of the Avanzit Grupo, has come up with a different approach to deliver prevention.

One advantage that Navento possesses is experience in building custom solutions using Global Positioning Systems combined with global system for mobile communications (GSM)/GPRS solutions for vehicle, people, or asset tracking, for security, management, or tele-assistance.[1] This experience includes working with major mobile telephone carriers as well as designing its own

hardware and Web service delivery for any tracking. For example, customers of the vehicle tracking solution can see a record of their vehicles' locations, as well as where they have been in the past, on Google Maps. This is available from an ordinary Web browser over HTTP or via a mobile phone with visualization software; alternatively, the position and all related data may be accessed and downloaded as file or stream data for processing by a customer's own applications, a solution based on Web services using SOAP.

The bottom line for application development professionals? Web services provide event data, whether in batch or in near-real time, in a form that is easily available for processing by existing applications.

The Significance Of GPS And GPRS When Combined

Global Positioning System (GPS) technology has come a long way since it was developed for the US military. It is now almost universal. Auto manufacturers now include GPS devices for navigation — for example, TomTom International BV or Garmin — in most new cars, and many people possess them as portable devices. But most relevant of all is that mobile telephones increasingly include GPS technology (Nokia estimated that it would ship as many as 35 million GPS-enabled handsets in 2008 — equal to the total GPS device market in 2007).[2] This has multiple implications. It provides:

- **Geopositioning information.** This consists of latitude, longitude, and altitude, which software can use to pinpoint a location on Google Maps or any other mapping or data processing system. In addition, other data tracked includes speed, stop times, and sequences of positions that can indicate direction or intention. This data can help in decision-making for any circumstance; someone moving in a car requires a faster and different response than does someone on foot. Furthermore, software can compare pairs of positions (from aggressor and victim) to see if the aggressor crosses any threshold of proximity defined in the risk evaluation.

- **Common (and worldwide) communications.** GSM mobile telephones use GPRS for data communication — for example, surfing the Web and looking at emails.[3] For Navento, GPRS is the means by which their devices send GPS information to servers for location processing. Furthermore, GPRS is the mechanism by which information can be communicated to the device or to the user (GSM voice capabilities are another way to communicate to the owner of the phone). Thanks to the near-ubiquity of GSM — and worldwide GPS availability — these solutions are country-independent and so can provide support not only in common places (home, work, etc.) but also in any other place during any period of the year — which is useful for holidays, business travel, and weekend trips.

- **Victim anonymity.** This is particularly important. The authorities have no desire to create an unnecessary "victim stigma" by causing the victim to carry something as obvious as a bracelet (RF bracelets still tend to be large and conspicuous). A mobile phone is a device that most people do not forget — it is an integral part of their lives. (In contrast, concerns about stigma when applied to a convicted aggressor are far lower in the light of that aggressor's past record of violence.)

Mobile phones and PDAs are not unique in combining GPS and GPRS. Alternative devices with this combination are possible. Such devices are likely to be purpose-specific, such as for anti-theft installations in vehicles, or for asset and people security and tracking. Bracelets, cuffs, or other similar devices are examples of such specialization, although in the past these have depended on alternative technologies such as RF.

The significance of GPS and GPRS when combined is that GPRS can transmit positioning information over a commonly available and proven data communications mechanism that works in most locations and countries. Even if updated GPS information is lost (for example, when a victim enters inside some buildings or a plane), this will likely not matter, as knowing that the individual is inside will be sufficient. As soon as he or she enters a building or plane, the system knows the position. As soon as he or she leaves, the device sends the new location for recording. If an aggressor comes too close to that building, this event generates the alert(s). In order to provide this functionality, in all of its devices, Navento is using A-GPS (Assisted-GPS), an improved GPS technology that provides a faster fix on the person's position and improved sensitivity alike in areas with poor GPS signal conditions (indoor, urban canyons, etc.).

The bottom line for app dev pros? A GPRS network can provide a dependable, common, two-way access method to devices and events that previously had been thought to be too remote for inclusion in IT plans.

Devising The Architecture Of The Solution

To address the *violencia de género* problem, Navento decided to change the way it approached vehicle tracking. It needed to:

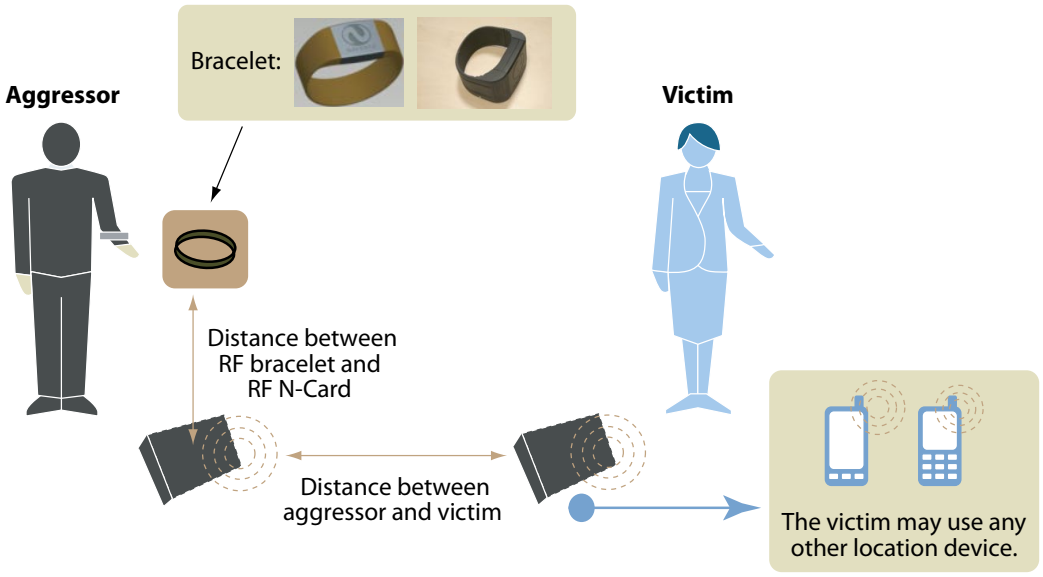
- **Define and build a secure bracelet solution for the aggressor.** This was complex. After periods in prison, many aggressors are criminally "well-trained" or know where to go for assistance to try to "break the bracelets" (for an aggressor to be in one place and the bracelet in another is unacceptable). To solve this, the aggressor wears a Navento bracelet that communicates by low-power RF over a short distance of up to, say, 10 meters to a combined A-GPS/GPRS device that is small enough to go in a pocket (it can be up to 10 meters away, for example, when recharging). So long as the bracelet communicates with the locator, all is well. If the battery of the locator device runs down, it issues an alert to both aggressor and control center to recharge the locator device. If the aggressor breaks the bracelet or exceeds 10 meters from the locator, then the locator device issues an alert; if the locator is damaged, the absence of the expected events initiates alerts (see Figure 2).

- **Create the data store.** Navento has defined a database to contain the information on each victim and aggressor — including proscribed and agreed locations (home, workplace, schools — known in geographic information systems [GIS] jargon as POIs [points of interest]) plus zone thresholds and degrees of risk and threat. The event processing analyses use this data in combination with the position events to determine when and at what levels the system should issue alerts as well as to whom it should send an alert.

- **Develop the event processing analyses.** The system's designers adopted an approach to regard each message from the aggressor's and victim's GPS devices as an event. These events, communicated into the Navento platform, are made available for processing and for representation on (for example) Google Maps (see Figure 3).[4]

- **Exploit its existing Web services to deliver information to the appropriate authorities.** Relatively little new development here was necessary. Web browser access was already available, as was the ability to download event data directly to those authorized to use it. Any authorized agency data processing system can download or replicate this data using Web services via SOAP.

Figure 2 The Bracelet And Device



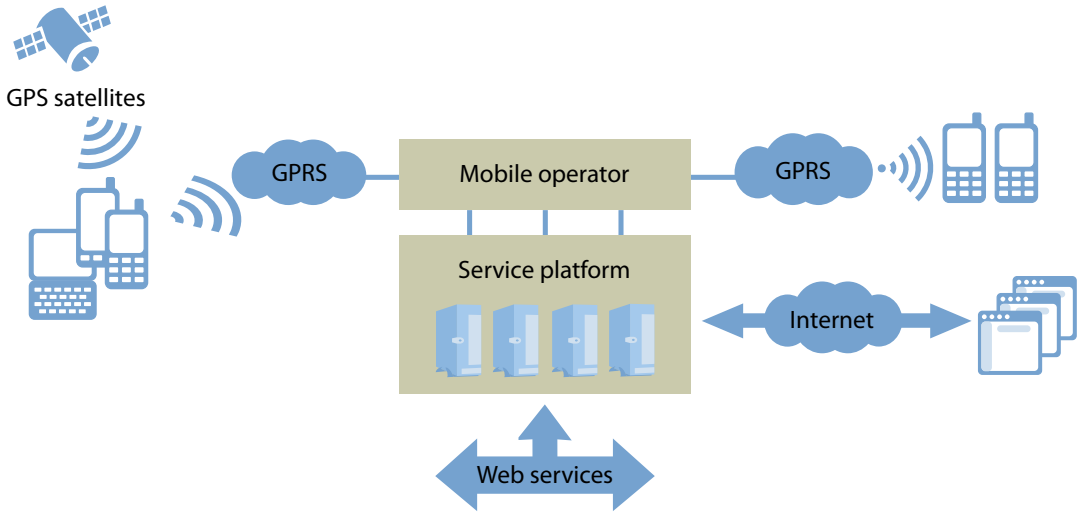
47338 Source: Forrester Research, Inc.

The System In Action: Enrolling The Aggressor And The Victim

There are three basic steps to initiate prevention of *violencia de género,* all included in the Navento solution:

- **Step one: Identify each aggressor/victim pair.** This will usually happen because of a court order or before the aggressor leaves prison after completing a sentence. Authorities must define the minimum safe distance between aggressor and victim so that the system can dynamically and automatically detect — during victim and/or aggressor movements — any violation of that minimum distance violation and notify the authorities. This "enrollment" process also defines restricted areas associated with the victim (home, workplace, schools, and wherever else is relevant) and the areas the aggressor must not enter. This data becomes the basis for threat analysis and for comparing position events prior to issuing alerts of a particular severity.

Figure 3 The Navento Platform With Its Connecting Parts



47338 Source: Forrester Research, Inc.

- **Step two: Equip the aggressor with the sealed bracelet and locator device.** In addition, the aggressor has to learn how the devices work together, his legal obligations, and any other implications that he needs to know about (including informing him that he can be tracked — an incentive in itself not to reoffend).

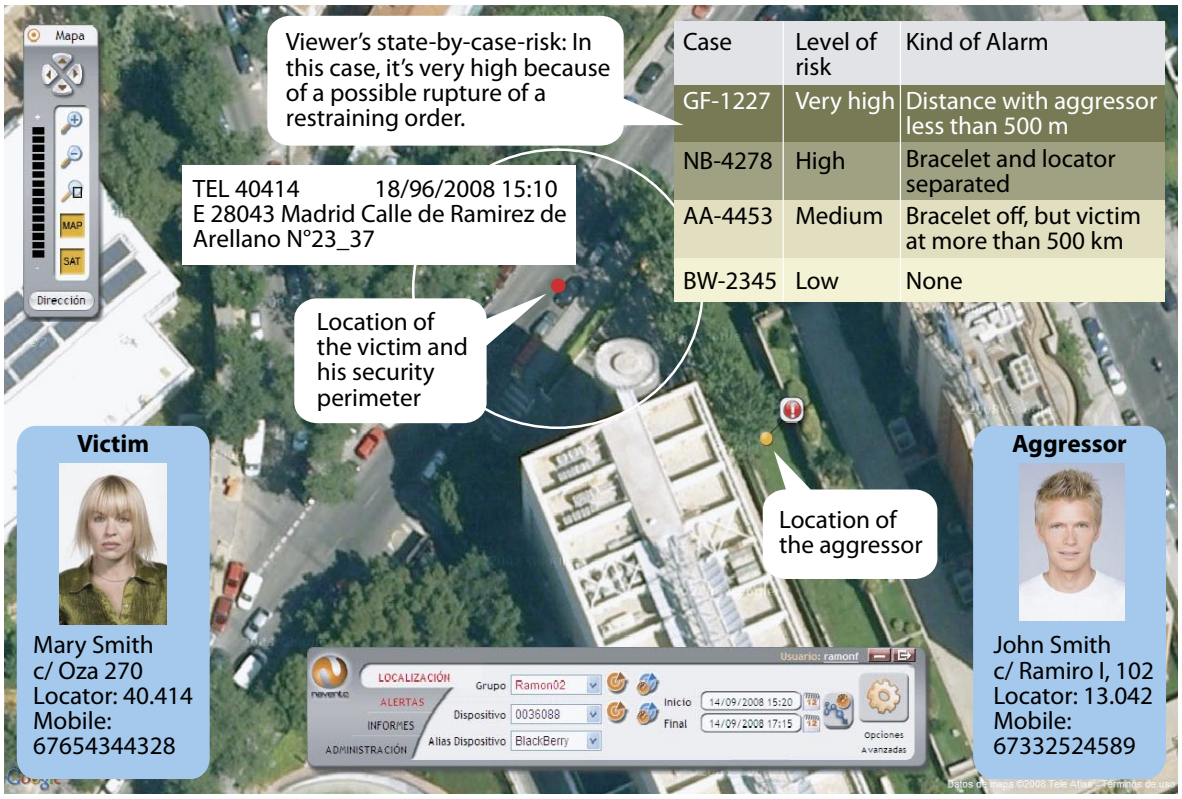
- **Step three: Equip the victim with a mobile phone.** The victim's mobile phone (which needs to be GPS-enabled) must be loaded with the appropriate software for issuing GPS events. Other location devices are also feasible, within bounds that avoid any social stigma.

Now the essentials are in place to deliver prevention. If the aggressor movements transgress the set locations and thresholds, then alerts occur and the relevant authorities can intervene. Furthermore, "intelligence" is part of the solution.

The System In Action: Raising An Alert

When an aggressor approaches a high-risk victim, the system issues a red alert along with pictures and locations of both aggressor and victim (see Figure 4). Any authorized device with a Web browser can see these alerts. The alert can warn not only the victim and aggressor but also the appropriate security forces. The knowledge that such positioning knowledge is available should also help deter the aggressor, which is why educating the aggressor is so important.

Figure 4 Control Panel Example: High-Risk Victim Being Approached By An Aggressor



47338 Source: Forrester Research, Inc.

Some situations are more dangerous to the victim that others. For example, distance matters:

- **Losing track of an aggressor when the victim is far away is not so important.** If the aggressor goes off the grid in one city when the victim is 600 kilometers away in another, then there is enough time to warn the victim if necessary as well as to initiate the search for the aggressor.

- **Losing track of or seeing the aggressor when he is near the victim may be critical.** If the aggressor and victim are within, say, 1,000 meters of each other, whether intentionally or unintentionally, and the risk assessment indicates that urgent prevention is necessary, then an urgent alert and action — for example, sending a police officer — may be the minimum desired response. In such instances, the security forces can see (from the Navento platform feed using a PC or mobile phone with Navento visualization app) the near real-time position of victim and aggressor. Judges may even subsequently be able to request location or tracking information on the offender's locations at specific moments in time or real time.

Indeed, one of the attractions of this solution is that, if it is integrated closely with the departments or security forces that have equipped people or vehicles (like police cars) with GPS location devices, then only the nearest officer or police car needs to go to the protection of the victim (assuming the urgency requires it). Using event analysis to spur actions avoids unnecessary or time-consuming decisions, which often occur when humans are part of the process. Furthermore, the automated matching process focuses on pinpoint service delivery; for each situation, there is no need to send more than the nearest and necessary resource(s) — which means that resource allocation also improves. Using PDAs or mobile phones with Navento-type visualization applications, the designated unit tasked to respond (a police officer or police car) can use the real-time victim and aggressor tracking and thereby deliver both an accurate approach and swift execution. In addition, a short message service (SMS), or even a phone call, can go to the victim, advising her to find a safe location (a police station, a place with many other people, etc.).

A second major attraction of Navento's solution is that it is one-tenth of the cost of the current imperfect solution and is likely to fall still further. That means that 10 times as many victims can obtain protection than was possible before. In addition, the authorities are able to both reduce their workload and make it more focused.

BEST PRACTICES AND LESSONS LEARNED

As Navento developed this solution, the following best practices and lessons emerged:

- **The key to successful delivery lies with an integrated seamless combination of elements.** Developers needed three such critical elements for addressing *violencia de género:* 1) the complete A-GPS/GPRS combination solution, including both devices and open platform; 2) a data store with all the relevant information about the aggressor/victim pairings; and 3) the event processing capability. Miss any one of these, and the solution fails. For application development professionals, the significance is that all three have to work together. Event processing of the *violencia de género* form may seem outside the bounds of normal IT, but this case study suggests quite the contrary. Indeed, mainstream IT systems and capabilities — for example in the Court systems, in policing, in the prison system, and in social services — were all a part of solving the problem, showing the relevance of events to IT.

- **Service-oriented architecture can overcome incompatible systems issues.** Spain has more than 22,000 people working in the multiple agencies and departments involved in fighting against *violencia de género.* Although all have the same objective — prevention — their various supporting systems do not work together in real or even near-real time. Mere interoperability of these platforms is necessary but not sufficient. A service-oriented platform that is accessible by all those who need involvement, from emergency services (911, 112, 999, etc.) to justice departments and social agencies, can overcome what would otherwise be inhibiting incompatibilities. For application development professionals, this represents a confirmation

that service-oriented solutions are not restricted to mainstream IT; they also apply to event processing in its many unconventional forms.

- **Easy-to-use interfaces are a necessity.** While these words emanate from one Spanish ministry, they have great significance. Possessing a single visual interface that mobile telephones and similar devices can exploit, whether in control rooms or in police cars, makes the communication of critical information simpler as well as easier to interpret. This is vital in preventing aggressors from making new attacks. For application development professionals, the point to note is that easy-to-use interfaces can have life-saving implications, and this needs careful consideration and design. Easy-to-use interfaces also facilitate interoperability, even when there is complex system at the heart of the solution.

ENDNOTES

[1] For additional information about Navento and its tracking devices, see www.navento.com

[2] Nokia CEO Olli-Pekka Kallasvuo said in May 2008 that he expected Nokia to ship "35 million GPS-enabled Nokia devices in 2008, which is equal to the entire GPS device market in 2007." Source: "Flavour of future GPS services tasted today," May 22, 2008 (http://conversations.nokia.com/home/2008/05/flavour-of-futu.html)

[3] GPRS is not the latest or fastest data communication standard for GSM. Many carriers have partially completed the build-out of support for the faster 3G standard, HSDPA. But not all carriers/networks have 3G in all places, so GPRS is the common fallback, and all GSM networks have GPRS. Also, GPRS is cheaper, given the small amount of data sent each time for this particular application.

[4] The Navento end-to-end architecture for addressing *violencia de género* possesses five main parts, as shown in Figure 3.

The starting point is a device with A-GPS plus GPRS data transmission capability. Such devices can be a Navento-designed bracelet, a Navento credit-card-sized module for the pocket, a two-way Navento location voice-enabled device that enables a control room to talk with the person carrying it (using mobile phone technology), a PDA, or that most ubiquitous and common of devices — a mobile phone. All of these have a GSM SIM card for data and voice communications. If PDA or mobile phone is chosen as location device, Navento software can be installed to include all capabilities (downloadable to any mobile phone or PDA — Symbian, Windows Mobile, BlackBerry and, under development for October 2008, the iPhone).

The next element is a GPRS network, most commonly operated as a GSM mobile phone network. GPRS offers the capability to transmit and receive data across a GSM network. Navento has negotiated with carriers in the US, Latin America, Europe, North Africa, and Asia-Pacific to carry all data as the GPS information or alert and device status and, if required, voice contact.

Navento built its platform on Microsoft technologies — including a Windows OS, SQL Server, IIS, the .NET application framework, and Navento applications (including event processing). This also runs the Web

services stack, based on HTTP/SOAP, which can be accessed by suitably authorized agencies.

Access to the Web services can be over secured via Internet or some form of direct attachment (for security reasons) such as leased lines or VPN to the Navento platform.

The final part of the architecture, but not delivered by Navento, includes the systems of the various agencies that can be involved. In Spain this is as diverse as the Guardia Civil, the national police, local police, correctional institutions, the 112 emergency call centers (like 911 or 999 in the US or UK), and the judicial system. All these have independent and diverse systems — but all can obtain the same information obtainable from the Navento platform thanks to the Web service/SOAP solution put in place.

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