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# Cloud Versus Clouds: Emergency Response Communications at Large Scale Festivals and Special Events – Innovative ICT Applications

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## 1. Introduction

While considerable effort, if not always success, has been made in terms of the adoption of emergency response and communication technologies on a government level, the ability of private enterprise to adopt such emerging technology has for financial reasons been limited to only certain larger industries, e.g. power industry etc. Here we address the potential use of such systems, through the adoption of emerging technology in situations with short active time-frames, high potential impacts on significant populations, and low management resource contexts. In this chapter we focus on the specific context of special events and festivals as an example of these circumstances.

Studies on risk emergency response to extreme natural events, in the festivals & special events literature, is rare and requires more research (Getz, 2007). There is a lack of research focus on the application of theory to practice covering 'heat of moment' live risk response situations (Sonmez, Backman & Allen, 1993). Special events have been defined as one-off 'specific rituals, presentations, performances or celebrations that are consciously planned and created' (Allen, O'Toole, McDonnell & Harris, 2011, p. 11). They include sporting, cultural, business and celebratory live events. In the typology of specials events, festivals are seen as 'themed, public celebrations' (Getz 2007. p. 31).

Risk management practices, and in particular emergency management planning and response systems, are integral parts of modern special event management practice (Getz, 2007; Allen et al., 2011). The use of technology in special event management is widely adopted but little evidence of its holistic integration into the work practices of event managers has been identified (Knox, 2009). Recent event risk management texts (Tarlow, 2002; Silvers, 2008) accent the project management functions related to risk management but largely fail to address the potential use of ICT (information and communication technology) systems, including emerging technologies, as key components of this knowledge area.

The ability to provide affordable technological infrastructure that can be quickly ramped up in size and is widely accessible to stakeholders is essential when seeking to create a user-friendly and efficient system that enables time critical and multiple-direction decision making communication amongst stakeholders. A potential example of this might include

the adoption of smart phone applications as part of such an integrated system. Examples of Mobile Apps being created for specific special events are becoming more commonplace. An example of this is the business event focused Infosalons Group, (Info Salons - Event Technology). This type of targeted communication system is yet to be integrated into a more holistic communication system that covers areas such as emergency management functions.

Extreme Natural Events (ENE), such as cyclones, intensive storms leading to flooding, gale force winds, hailstorms etc., have historically impacted on many areas of the world to one extent or other. Climate change proponents forecast a more rapid increase in both the number and severity of such events. In addressing the risk involved for the tourism industry in managing these types of events Alison Sprecht (2008, p. vii) states that:

*'Risk is described simply as resulting from three main factors: (i) the nature of the hazard; (ii) the exposure of the elements to risk; and (iii) the vulnerability of those elements. Vulnerability can be further defined as the product of the susceptibility and resilience of the community and environment to the identified hazards. ENE's are a force of nature and cannot be modified, but risk of loss or damage can be reduced by modifying exposure and vulnerability. For this, a good knowledge of the likely ENE's is fundamental.'*

For ENE's and other risk management situations, governments have a long history of utilising a blend of broadcasting media such as television and radio for alerting the public as to the nature and severity of the ENE, and delivering "what to do" information to citizens. Studies suggest the use of different mobile technologies to deliver emergency information in forms of weather warning and location based precautions (Krishnamurthy, 2002; Weiss et al., 2006). Other studies discuss issues of transmitting information through short message service (SMS) via mobile phone broadcasting system (Aloudat et al., 2007). However, these solutions do not provide an independent holistic and systematic framework in which key decision makers such as event managers can ensure appropriate collaboration for transmitting critical information. As such, the designing of an independent ICT based decision support solution, through a new web based sharing provision where decision makers from different agencies can actively communicate and perform decision making is proposed.

Delivering information to and from event attendees would be achieved through systematic and interactive communication linkages with relevant authorities and data sources, hence enabling the prioritising of action-taking in real time. As a specific ICT application, decision support systems (DSS) are gaining popularity to meet the domain-specific demands of clients for informed decision support. New technological provisioning platforms such as cloud computing show significant potential benefits, for the business/supplier as well as for public access requirements, when addressing significant access load demand in a very short time frame. Cloud computing may offer the advantage of a cloud (e.g. Internet or web based provisioning) based DSS service that can meet the emergency communication and decision making needs of key agencies and stakeholders in a wide variety of contexts and populations.

The chapter is organised as follows. Following on from the introduction (section 1) the next section (2) contextualises the major issues being addressed in a case study based on the Woodford Folk Festival in Queensland, Australia. The following section (3) examines the stakeholders and their relationships within the emergency communication system. The next section (4) examines cloud based approaches, while section (5) contextualises this through application to the case study and section (6) considers other advanced technologies for emergency management. The final section (7) provides for discussion and conclusions.

## 2. Case study Woodford Folk Festival

Our case study, the Woodford Folk Festival, is an Australian regional festival that is held over a six day period each December/January, originally at nearby Maleny it moved to its own property near the town of Woodford in Queensland Australia, in 1994. Here, 400 acres of farmland is being progressively reclaimed as 'environmental parkland'. It's mixed of natural landscape and built physical components can be described as a Blended Festivalscape (Gration, Arcodia, Raciti & Stokes, 2011), with the integration and preservation of natural elements of the environment being critical to consumer satisfaction with their festival experience. Woodford is a regional festival of music, arts and performance managed by the not-for-profit Queensland Folk Federation (QFF) and it currently attracts 100,000 - 120,000 attendees per year from a diverse demographic background. The site was transferred to the local government authority in 2011 with a long term lease being granted back to the QFF.

Fig. 1. Woodfordia Storm Damage – January 2011.

*'The Queensland Floods have been a life changing event for many thousands of people and I know that our organisers will rise to the challenge presented to us and build a stronger future'*

Bill Hauritz, CEO, Queensland Folk Festival – 14TH March 2011(Woodfordia Mail Media Release)

The sheer size of the site, the numbers attending and the temporary nature of most of the venues on-site make this event vulnerable to significant exposure to risks associated with extreme weather events. The timing of this event, in the Australian Summer 'wet season' increases the likelihood of this type of risk. In many ways the festival site is the equivalent of a temporary small city that has been created to last only a few short days each year. In common with all large scale outdoor special events and festivals, Woodford Folk Festival, is temporary in nature and yet must incorporate risk management plans that reflect the potential magnitude of the risks, the number of people involved (20,000 – 25,000 per day) and the potential for severe negative impacts should the worst occur. Its temporary nature does not lessen the complexity of the risk management task; indeed it can increase the management challenges to be faced.

Risk Management practices at the Woodfordia site are well defined and follow standard industry practices with a comprehensive risk management plan in place and training of all staff, both volunteers and paid, being undertaken. Festival management is required by legislation to manage and control risks associated with the conduct of the festival to ensure the safety of employees, stall-holders, on-site agencies personnel, contractors, volunteers and visitors (WFF Safety, Emergency and Incident Management Plan, 2010, Section 1.3) In addition a 24 hour Emergency Communications Centre (ECC) has been established to liaise with all venues, staff and emergency services. Indeed, both police and ambulance services, alongside a purpose-built medical centre, have a presence on the site during the festival. In the case of an emergency the ECC is converted into the Emergency Incident Control Centre (EICC) by the addition of a room extension to accommodate external; emergency services personnel for coordination purposes.

In terms of web based communications the festival has been increasingly moving to integrate areas as diverse as ticketing, production, administration, volunteer management, customer information and merchandising, alongside the more established promotional functions. In terms of Risk Management, the pro-active workplace health and safety training provided for all volunteers via their website and the reactive monitoring of on-line Bureau of Meteorology (BOM) warnings about weather conditions, as well as accessing of risk management documentation by staff, are the only web based communication activities identified.

During and after the 2010/11 Woodford Folk Festival severe weather conditions resulted, despite extensive drainage works on the site, in excessive disruption on the festival site. There were subsequent significant cost implications in terms of site restoration and future mitigation activities on top of significant box office decreases (approx. 20% downturn). The Courier Mail Newspaper reported that 'while Woodford was dubbed "Mudford" on social networking site Twitter yesterday, visitors continued to arrive into the afternoon' (Courier Mail - *Rain can't dampen Woodford punters' spirits*). The impact on people who attended the event was, while not life threatening, at times significant. Camping areas suffered flooding, car parks became a quagmire, roads and pathways were slippery and increasingly pot-holed leading to risks. The organisers spent a considerable amount of time and resources focused on maintaining safety for the public and allowing the venues to continue to operate. A literal sea of volunteers and paid staff worked to ensure the show could go on – and it did.

The 'wettest ever' festival was followed by an extreme downpour on 11th January 2011 when 180mm was recorded at Woodford. Remedial work on the physical damage to the site was

commenced, funded by a combination of fundraising, insurance payouts and government grants. This work will help to restore the site and mitigate some of the potential impacts of similar ENE's in the future. The reality however is that no amount of physical works can fully protect such an exposed site from the ravages of nature without taking away the atmospherics or 'feel' of this blended festivalscape. If the grounds were concreted and all performances were in permanent indoor venues then the desired 'experience' from this festival would be compromised. If we take as a given that mitigating actions have been taken in terms of physical works, within the given boundaries, then it is the non-physical 'human' and 'technology' based systems that deserve closer attention.

The need for cost effective mechanisms for planning, monitoring & controlling risk through improved means of sharing and disbursing knowledge between key stakeholders at events is evident. These stakeholders involve internal and external active participants in the risk management communications process and provide the basis for decision making that will impact on the third stakeholder group, being those travelling to, are on-site, or departing from the festival site (figure 2).

## 3. Emergency communication network

As can be seen in figure 1 the emergency communication networks utilised by the majority of event managements are vary basic and unidirectional in nature.

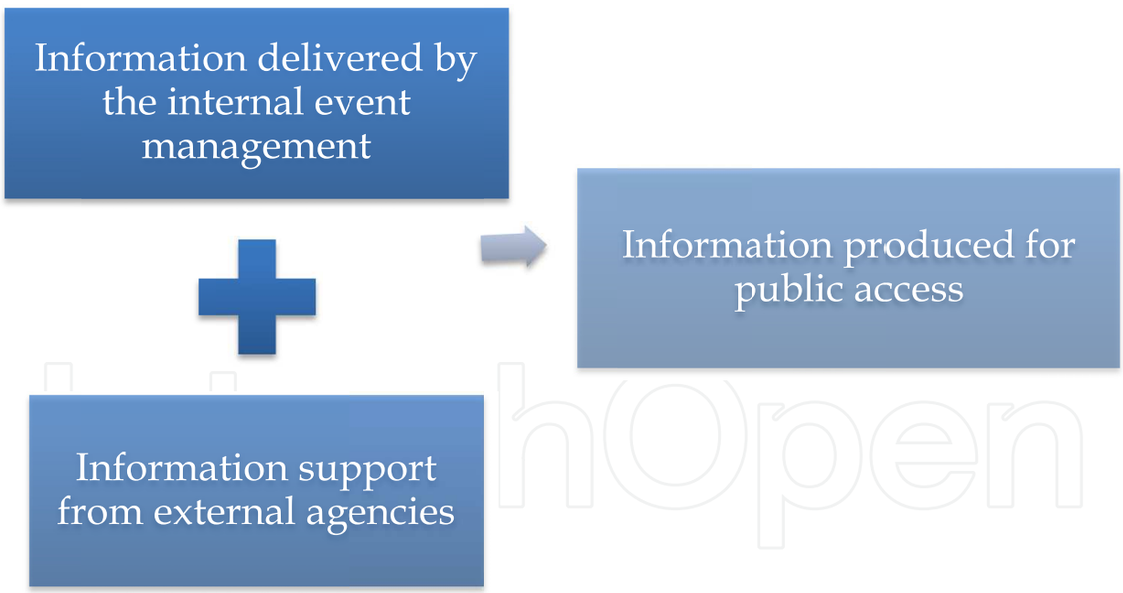


Fig. 2. Information exchange for emergency risk management communication.

In terms of our festival case study, emergency response management relies primarily on a layered communications approach based on private (in venues and offices on site) and public telephone services, mobile telephones supported by two mobile service provider towers and a series of radio communication systems operating during the festival by both festival management and external emergency services. Communications to the Public is via a number of public address systems located in the venues and verbal announcements, with

no easy ability for two way communication. A professionally developed risk management plan is accessed through printed and online manuals, notices and other desktop materials and training processes.

The research literature is largely silent on the ways in which effective communications can happen in the 'danger zone', when extreme weather conditions are either happening or threatening to happen. Concentration is primarily on the early stage identification, assessment and mitigation strategies. What is needed is a clear means to bring together up to date information from a variety of sources, combine this data in a manner than integrates with the risk management plan and then enables this information to be communicated, in a timely manner, to relevant stakeholder groups as required. Weather updates from the Bureau of Meteorology (BOM) need to be available to all stakeholder groups to enable them to make personal and corporate decisions. Internal and external management groups need to have access to information from multiple sources (input) and to be able to communicate messages detailing new information to hand, decisions made and actions needing to be taken (output). This information exchange enables the managing, controlling and balancing of risk exposure scenarios directly with each other in real time to avoid confusion and potential duplication. The public need to receive live information updates from BOM, so they can assess this on a personal risk basis, as well as 'massaged' updates from the Emergency Incident Control Centre (EICC) that collates action recommendations from Internal and External management stakeholders. An ideal system would necessitate a feedback loop that provides the Public with the ability to contact the Emergency Incident Control Centre (EICC) in cases of actual or perceived risk to self, others and property being encountered during the event. This feedback loop would enable resources to be better allocated and new or additional information to be placed within the decision-making system.

Given the wide variance in potential input expertise a user-friendly layered approach would be needed. For example volunteer workforces, at events such as Woodford, would require easily learnt and operated risk response tools that ensure the capacity of volunteers is not exceeded (Earl, Parker, Edwards & Capra, 2005). Indeed information flowing back from these volunteers could range from verbal to use of mobile smart phones to, for example, send photographs of a dangerous earth subsidence. How these varied communications are delivered, received, shared, analysed in relation to other information, responded to, and used in deciding on coordinated actions requires a sophisticated communications system which the authors suggest is best handled through cloud based solutions.

## 4. Cloud based solutions

The term "*cloud computing*"[1] has become popular since October 2007 when Google and IBM jointly announced their collaboration (IBM website announcement, 2010 cited in Vouk, 2008) due to its main benefits such as reduced IT overhead and flexibility in offering cheaper user access. Fitzgerald and Dennis (2010) described cloud based design as a "*circuit-switched service architecture*" that is easier to implement for organisations because "*they move the burden of*

[1] Cloud computing refers to a computing platform in which users have options to use lease connection points into a network for establishing a temporary operation between computers (Fitzgerald & Dennis, 2010). Hayes (2008) described cloud computing as a software application migration from local PCs "to distant Internet servers, users and developers alike go along for the ride" (p.9).

*network design and management inside the cloud*" (p. 297). As such, Cloud computing provision has been used as a modern architecture of shared computing services. These services are mainly elevated through computing utility rental by service providers on the Internet.

After the introduction of web-based utility services by Amazon.com, many service providers became increasingly interested in utilising the cloud computing platform for launching new services that met their client group demands, including minimising labour and implementation expenses (Santos, Gummadi & Rodrigues, 2009). It is therefore surprising that the use of cloud based services for the effective communication and decision making of multiple parties is still largely overlooked given the potential benefits. As such we provide a conceptual approach of cloud provision to improve communication in event risk management contexts. In theory our concept represents a convergence of communication and decision making through the use of cloud based services.

## 5. Proposed approach

A SWOT[2] (Strengths, Weaknesses, Opportunities and Threats) analysis of cloud computing within different business perspectives has been described by Marston, Li, Bandyopadhyay, Zhang and Ghalsasi (2011) in which the importance for understanding the business related issues were highlighted. In other words, it is important to thoroughly analyse business problems before implementing the cloud based application. The study (Marston et al., 2011) identified two major trends that create and represent effective cloud computing application. These were 1) "IT efficiency, whereby the power of modern computers is utilized more efficiently through highly scalable hardware and software resources" and 2) "business agility, whereby IT can be used as a competitive tool through rapid deployment, parallel batch processing, use of compute-intensive business analytics and mobile interactive applications that respond in real time to user requirements" (p. 177). According to Marston et al. (2011) the concept of efficiency represents effective use of the computing resources located in geographical areas mainly for offering cheaper access to different services over the Internet. On the other hand, the concept of business agility implies that cloud computing must able to play differing roles for businesses, enabling the use of computational tools on the Internet as free or public access points that can be deployed and scaled as quickly as possible. It also helps reduce the need for the huge upfront investments that characterize enterprise IT setups today (Marston et al., 2011). Following the second principle we propose that the use of cloud based applications for event risk management emergency situations provide a significant improvement to traditional managerial and communication tools.

Cloud based provisioning supports event based emergency management strategies through enabling an appropriate collaboration. This approach, as illustrated in figure 3 below, allows for greatly improved information flows between the multitudes of stakeholders involved in event emergency situations.

Emergency stakeholders at events can be categorised as to their needs, powers and interaction methods (Table 1).

The conceptual model (figure 3) connects different decision makers with public for improved risk and event management practices. It offers a collaborative environment in

[2] SWOT analysis is a tool for evaluating artifacts or organization and its environment

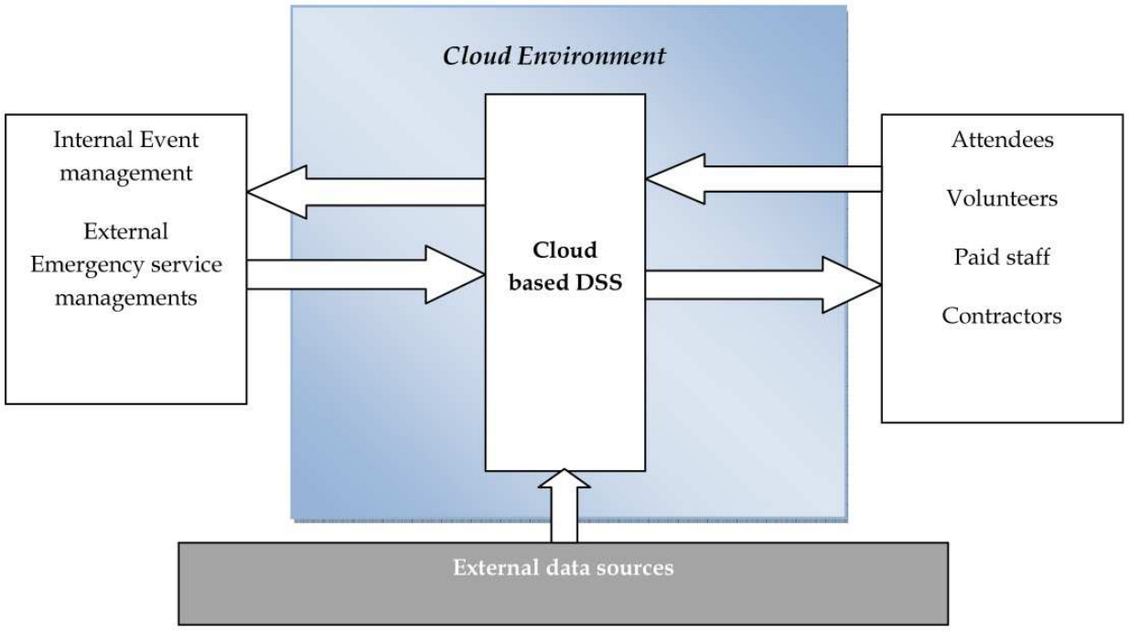


Fig. 3. A conceptual model of cloud based communicational decision support tools (CDST).

which information can propagate freely between multiple stakeholders simultaneously. This approach is far beyond current warning systems of emergency management, as it does support real time information sharing for complex decision making tasks concerning risk situations such as fire control, flooding and, crowd control etc. while at the same time communicating public/attendee announcements and updates through the web based applications on different mobile devices.

Barr et al. (2009) suggested that deploying cloud based applications as an effective management tool makes management significantly easier. However, the system needs to support all of the software management needs for their entire range of activities. For instance, it implies that management needs a systematic way, similar to that of an assembly production line process as opposed to a manual approach. Marston et al. (2011) identified five key advantages of cloud based system including 1) it makes lower the cost of entry for business if there is a lack of resources for widespread deployment of IT services, 2) it can provide an almost immediate access to technological resources, with no upfront capital investments for internal and external users, 3) it can make lower IT barriers to innovation, as can be witnessed from the many promising start-ups, from the popular online applications such as Facebook and YouTube, 4) it can make it easier for enterprises to extend their services – which are increasingly reliant on accurate information to meet the client demand continuously and finally 5) it also makes possible new classes of applications and delivers services that were not possible before.

These benefits (Marston et al., 2011) are applicable in our special event risk management context. 1) The proposed cloud based communications system would lower the entry/conversion costs, 2) it would be easily established without significant infrastructure costs to stakeholders, 3) it would enable the system to be tailored to new trends in communications rather than being tied to existing technology, 4) it can enable event

| Stakeholders | Descriptions | Interaction mechanisms |
|---|---|---|
| **Internal Event Management:** | Includes decision-making management positions within the event organisation. | In-person<br>Mobile network<br>Radio network<br>Telephone land lines |
| **External Emergency Service Managements:** | Includes Police, Fire, Ambulance, and other decision-making positions with a legal/regulatory responsibility for the event and/or location | In-person<br>Mobile network<br>Radio network<br>Telephone land lines |
| **External Data Sources** | External bodies which provide important updates of factual data. Examples could include meteorological monitoring services, traffic monitoring services etc. | Web based<br>Mobile network<br>Public broadcasters (TV, Radio etc.)<br>Telephone land lines (recorded messages)<br>*Note: this is primarily a one-way generalised communication.* |
| **Event Attendees** | Includes members of the public travelling to, at, or exiting from the event venue | Public address systems<br>Signage<br>Verbal announcements |
| **Event Volunteers** | Voluntary staff working on behalf of event management | On-line training & manuals<br>Verbal communications<br>Public address systems<br>Limited mobile network<br>Limited telephone land lines |
| **Event Paid Staff** | Staff working in a paid capacity directly for the event management | On-line training & manuals<br>Verbal communications<br>Public address systems<br>Radio network<br>Mobile network<br>Telephone land lines |
| **Event Contractors** | Service providers including artists, technical production companies, caterers etc. who are contracted by the event management to provide event services. | On-line training & manuals<br>Verbal communications<br>Public address systems<br>Mobile network |

Table 1. Emergency management stakeholders and their commonly employed communication mechanisms at special events and festivals.

managements to match their communications methods with the changing patterns of their stakeholders (e.g. warnings via Facebook updates to Smart Phones) and 5) the interactivity would enable a whole new range of services to be provided (e.g. traffic congestion updates and suggested alternate exit routes).

The proposed emergency communication framework would provide the foundation upon which future advanced emergency planning, management decision-making and response systems can be grown.

## 6. Advanced technologies for emergency management

Various applications of advanced technologies for emergency management are being trialed and tested in a number of settings. In their work on the large scale outdoor music festivals, Mogensen and Thomsen (2010) described an integrated approach, the @aGalance System, that provides overview and support collaboration between designated emergency responders. Key components of the communication technological solution proposed by Mogensen and Thomsen (2010) are:

1. GPS and Radio receivers: The media allows communication channel for transmitting information.
2. 3D environment: This enables visual communication through captured live video and digital pictures in the controlled display environment
3. Tracking devices: As an activity indication such as larger movements at the festival area this device tracks down though GPS driven static and remotely controlled cameras.
4. Handheld field devices : This is to connect with centrally located stationary monitors at, for example, the local emergency control centre or with specific response coordinators

However, the system does not provide for a direct communication loop between festival attendees and key management and associated stakeholders.

Bessis, Asimakopoulou and Xhafa (2011) reinforce the argument for a technological roadmap that enables improved application of computational intelligence in disaster management. This study described the merits of cloud computing services for emergency management. In addition, the study also identified next generation emerging technologies for emergency management and decision making. According to Bessis et al. (2011) the next generation technologies are as follows:

*Grid computing:* Grid computing combines high-end computing nodes, networks and databases in an integrated computing technology. In the emergency management, such infrastructure can support synchronous and asynchronous communication in a collaborative manner.

*Web services:* Web services use a *service-oriented approach* (SOA) to provide stateless, persistent services. An important merit of this service model is that it is always present for users to meet their information service needs.

*Web 2.0:* Web 2.0 offers a web based platform where users as individuals or communities are able to communicate online their ideas and feelings on shared topics of interests using available collaborative services. Different Web 2.0 technologies include wikis, blogs, photosharing, bookmarking. All of these technologies can be used as information sharing platforms.

*Pervasive computing:* Pervasive computing embeds computing and information technologies into our environments by integrating them seamlessly into our everyday lives (Weiser, 2001). Bessis et al. (2011) suggested that pervasive computing has many potential real-world applications ranging from health to environmental monitoring systems through the use of a number of mobile devices such as mobile phones, PDAs, sensors and computers.

*Crowd computing:* According to the information provided by Bessis et al. (2011), crowd sourcing or crowd computing is a new technology for crowd management. Some studies

have proven the potential worth of so-called 'crowd-sourced' mobile phone data (Paulos, 2009; Bessis, 2010). Some of these pilot studies have shown that mobile phones and mobile sensors can be used by ordinary 'citizens' to gather data that could be useful in various settings (Paulos, 2009).

*Collective intelligence/complex event processing:* According to the information provided by Bessis et al. (2011), the concept of collective intelligence creates a free-flowing system of knowledge with no bureaucratic controller. According to Lévy (1997) the platform can also provide an informational free-for-all where no-one decides what knowledge is worthy of contribution and what should be left out. Gualtieri and Rymer (2009) suggested that complex event processing is best for applications that require near-real-time responses to dynamic, multifaceted, rapidly changing situations (cited in Bessis et al. 2011).

## 7. Discussion and conclusion

This chapter does not claim to provide answers that will prevent future emergency situations at festivals and events, it does however open up potential ways in which such situations can be managed more effectively and efficiently. Human error and extreme acts of nature will still occur. However, the use and integration of emerging ICT systems into the field of festival and special event management provides great promise in terms of risk mitigation and emergency planning, monitoring, controlling and response management functions.

As mentioned earlier, in many ways the festival site described is the equivalent of a temporary small city with a daily population of between 20,000 and 25,000 residents and visitors. This requires sophisticated risk management plans supported by sophisticated decision making and communications systems. The cost of creating such a system to cover such a short period of time, less than one week, is a challenge that requires innovative approaches. While setting up extensive emergency communications systems to respond to major incidents may be justifiable when addressing the concerns of a major, 1,000,000 or more, city, it becomes increasingly harder to justify major expenditure on infrastructure for smaller towns and indeed, in our research context, festivals and events. Yet, what price can be put on the potential risk to human lives in the event of an extreme emergency incident? Realistic solutions must therefore be sought to mitigate the potential likelihood and consequences of such events through the use of systems that are both affordable and context appropriate.

The future use of pervasive smart phone and pad type technologies are critical to the ability of event and emergency service organisations to create a communications delivery system that can meet the real time challenges of pro-actively responding to emergency situations at events. Many festivals and events are moving towards creating smart phone applications that create an informational relationship between potential and actual consumers of events and the organisers of those events. These applications enable programming, ticketing, site etc. information to be delivered to attendees and purchases to be made. This technology can potentially be used to provide emergency management updates and advice from both event organisers and third parties to attendees. Imagine getting the imagery of approaching storm fronts overlaid onto the festival site map or having the safest road to travel home based on latest road flooding advice from the local roads authority automatically downloaded onto

your vehicles GPS system, these propositions are now becoming technologically both feasible and affordable. Communications is a multi-way activity. Such applications could also incorporate means by which attendees could communicate on-site updates of emerging real-time risk issues back to the organisers, providing many more 'sets of eyes' on emerging risk situations.

Examples for potential usage of such systems can be seen with increasing frequency internationally. In 2010 a music festival called 'The Love Parade' was held in Duisburg, Germany. Logistical crowd management issues resulted in more than 500 attendees being injured and 21 deaths with subsequent cancellation of the event and on-going legal cases (Spiegel Online International - *Prosecutors Investigate 16 over Deadly Event*). Critical to the issues involved in this case was the need for better planning, decision-making and communications infrastructure while ensuring information was received and acted on in a timely manner (Spiegel Online International - *Blind Leading the Blind*).

Similarly there was spate of stage collapses in 2011, including the Indiana State Fair disaster in where severe winds of over 60mph had a hand in the deaths of 6 people and many more injured. Media reports stated that 'State Fair management knew and was tracking the weather conditions, yet took no timely action… (in contrast) a local symphony that was to perform nearby cancelled its outdoor performance because of weather and urged spectators to seek shelter' (USA Today - *Safety standards are under a critical eye after stage collapse*). Improved communications, including automated systems, could have vastly improved safety outcomes in these instances.

These more serious examples show the vital need to have the ability to implement an integrated communications strategy that brings together real-time facts and key stakeholders. Such a strategy needs to enable critical decision making in sometimes life threatening circumstances. Given the potential consequences, a system that is robust, affordable, user-friendly and quickly brought on line with sufficient capacity is essential. We believe that cloud based provisioning can provide the framework on which future emergency management systems will be established for special events and festivals. In 'cloud versus clouds' the future is bright.

## 8. Acknowledgment

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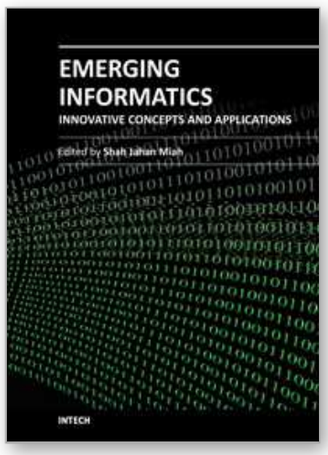


**Emerging Informatics - Innovative Concepts and Applications**

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The book on emerging informatics brings together the new concepts and applications that will help define and outline problem solving methods and features in designing business and human systems. It covers international aspects of information systems design in which many relevant technologies are introduced for the welfare of human and business systems. This initiative can be viewed as an emergent area of informatics that helps better conceptualise and design new world-class solutions. The book provides four flexible sections that accommodate total of fourteen chapters. The section specifies learning contexts in emerging fields. Each chapter presents a clear basis through the problem conception and its applicable technological solutions. I hope this will help further exploration of knowledge in the informatics discipline.



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