White Paper

Alarm Handling with the Skyresponse Platform

Internet of Things

Internet of Things (IoT), i.e. vehicles, buildings and other items with embedded sensors having network connectivity, are becoming an everyday reality. Intelligent objects that can be sensed and controlled remotely are creating opportunities for more direct integration of the physical world with computer-based systems, resulting in improved efficiency, accuracy, and economic benefit.
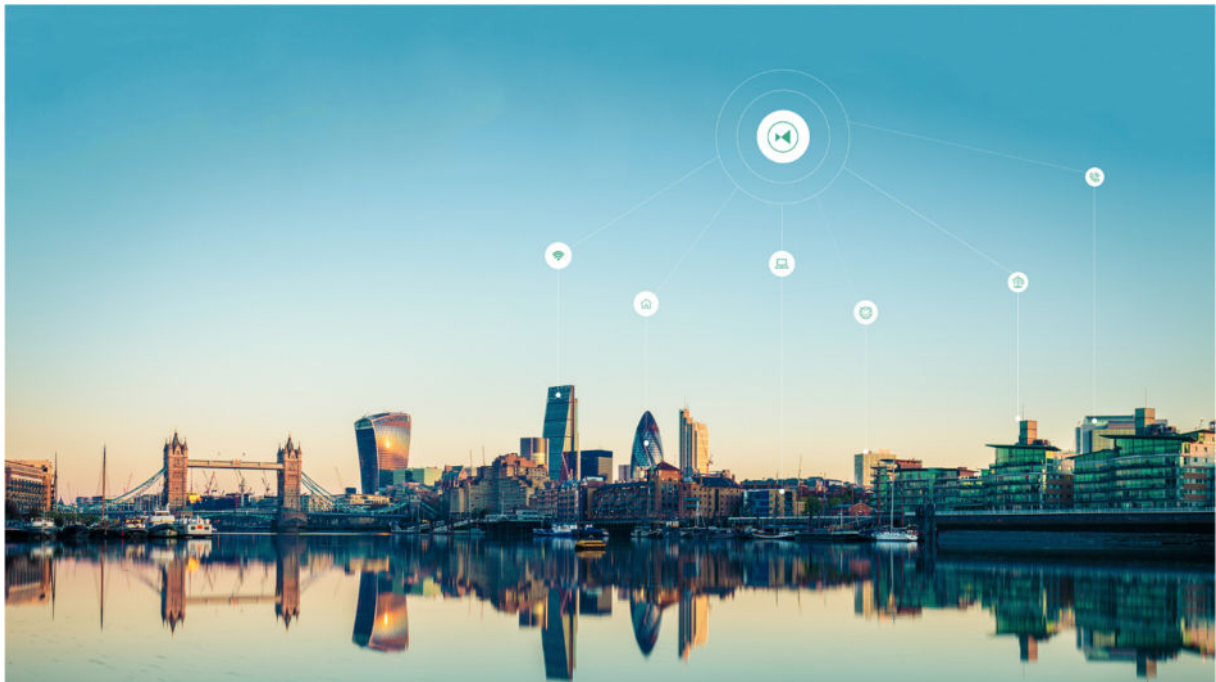

Figure 1. Internet of Things (IoT)

"Things," in the IoT sense, can refer to a wide variety of devices such as environmental control systems, burglar alarms, biochip transponders and automobiles with built-in sensors. The devices collect useful data to be forwarded to cloud-based services and raise alarms when attention is needed.

But how to handle the plethora of events reported by all these intelligent devices? And how to manage all the alarms generated within this new environment? To leverage the IoT concept there is obviously a need for an "event handling machine" that can forward alarms and other events to the most appropriate receiver, based on flexible rules and with a high level of reliability.

Take for example facility management. What used to be simple burglar and fire alarm installations have now become intricate electronic environmental monitoring systems for "smart buildings", using a myriad of sensors to supervise the status of the house. Some sensors generate extremely critical

messages, such as a fire or flooding alarm, while others supervise overall temperature and air quality, generating less urgent alarms. All these various reported events must be sorted and sent to the appropriate receiver, may it be the fire department or just a technician that can fix a thermostat the next day. And the alarms need to be tracked so that the precise delivery to the correct recipient is guaranteed, ensuring that proper action is taken.

Figure 2.   "Smart buildings"

Or take a home care application, where elderly call for help, and where different alarms may need to be directed to anything from the emergency room at a hospital to a nearby home helper. While many elderlies are quite active and can manage their everyday life on their own, the number of very old and others needing help increases rapidly. Many of these elderlies continue to live at home, which creates a challenging demand for home helpers and effects the economy of many local authorities.

Figure 3.   Elderly care

The increasing number of care takers and their demand for more services mean that local authorities and healthcare providers are forced to find new technical solutions and more efficient ways of working. Otherwise, they will not live up to the expectations of the coming, digitally mature generation of elderly.

Characteristics of a Modern Event Handling Platform

An event handling platform for the era of Internet of Things must exploit the dominating technology trends of today and enable the flexibility needed when creating new services for employees and citizens that are digitally mature, mobile, and connected.

- The platform must be adaptable to future, optimized, workflows and processes of the organization. Workflows must be simplified so that the person or organizational entity to carry out the task is informed directly on what to do at an alarm. Services that today involve a response centre operator may tomorrow be "shortcut", so that e.g. a home helper receives the alarm from an elderly directly in his/her mobile phone.

- The platform must be optimized for fully digital alarm units using Internet and the mobile network as the main information carrying infrastructure, both from the alarming device and to the respondent. Only a mobile network and mobile broadband gives the ubiquitous coverage asked for by todays mobile users.

- The platform must be open, having open API:s, making it possible to take advantage of the continuous development of advanced alarm transmitters and presentation devices. A closed system can never keep up with the advances in device technologies, instead the platform must support a fruitful eco-system of multiple HW and SW vendors leveraging the open API:s. Adapting to this new digital world also means that the platform continuously must follow new standards for interfaces and protocols to enable large scale deployments at a reasonable cost.

The global expansion of broadband connectivity makes it possible to increase the availability of the event handling platform and reduce its vulnerability: When the logic of the platform is implemented as a cloud service reachable over fixed and mobile broadband, the platform becomes independent of any specific computer hardware. Execution of the logic is shared between several, geographically separated, clusters of servers, and as long as the user has Internet connectivity, he/she can always raise an alarm or act as a receiver of alarms. Not only does such a cloud-based implementation increase the overall availability of the system, but it also increases the security and minimizes the risks of unwanted intrusions when compared to earlier, local, server installations.

The Skyresponse Platform

The *Skyresponse platform* – the alarm handling system from Skyresponse – forwards digital and analogue alarms from objects to receivers and response centres using a decentralized, cloud-based, IT platform. The system ensures that all connected units can forward their alarms and related information, following flexible rules, to the most appropriate receiver.
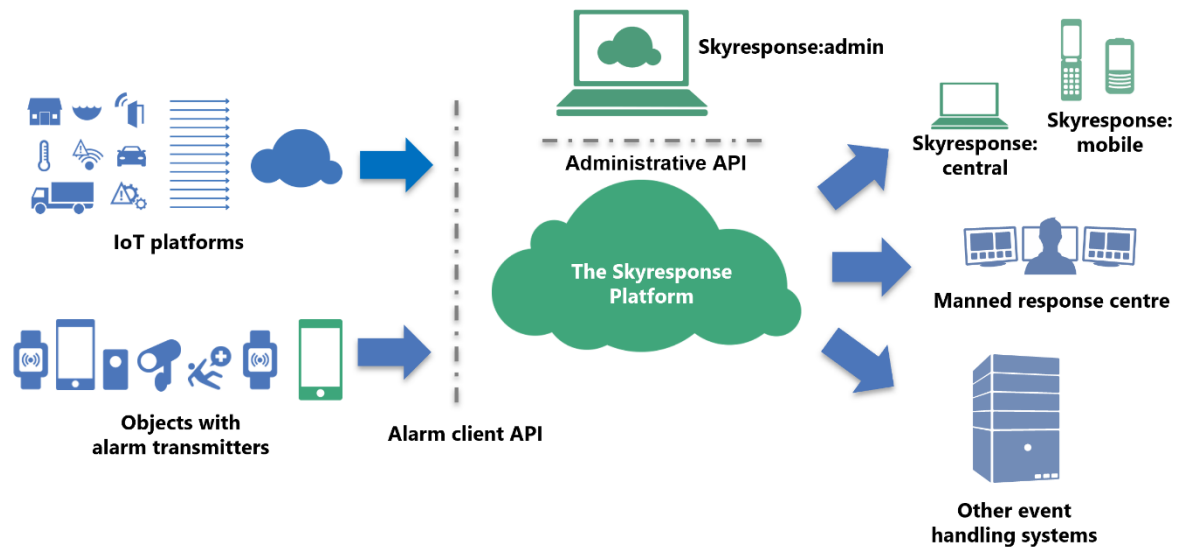

Figure 4.   The Skyresponse platform and its eco-system

The alarm transmitters belonging to an object/user connect to the platform via mobile or fixed broadband, but legacy protocols using analogue transmission over the telephone network, SMS and other technologies may also be employed. Similarly, the operators in a response centre and the field staff receive the alarms over fixed or mobile broadband using a web-based interface or a dedicated app in their smartphones. Skyresponse also offers a free, alarm generating app with advanced positioning features for Android and iOS smartphones, if the customer does not want to use his own type of alarm transmitters.

Thanks to its open architecture and because the system is implemented as a cloud service (SaaS) there is no upper limit to the number of alarms that simultaneously can be handled. The platform will dynamically and without delay adapt its resources to the current demand.

The alarms are automatically forwarded to the right receiver, based on the alarm origin, type etc. as governed by rules defined via the platform's administrative interface. The receivers can be one or more response centre operators, or alternatively field staff that receive the alarm or event notification directly in their mobile phones. The Skyresponse platform can also forward incoming alarms to other alarm handling systems in e.g. a manned response centre, using standardized alarm handling protocols. Furthermore, thanks to its well documented programming interfaces (APIs), the Skyresponse platform can control and interoperate with other types of IT systems, for example trouble ticket systems or an external user data base.
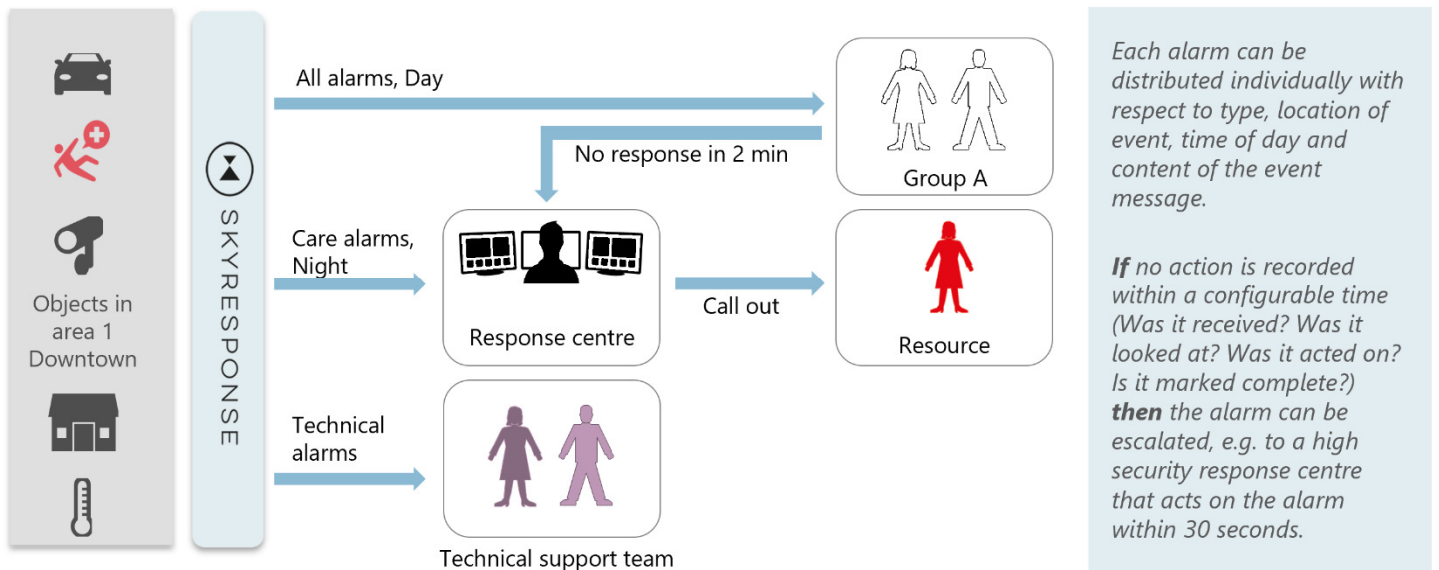
Figure 5.   With the Skyresponse platform, alarms are forwarded according to pre-defined rules.

The Skyresponse platform is built with focus on the most rapid handling possible of each incoming alarm. The objective has been to create a system that provides exactly the right information needed for each step in the event handling process. The platform can also easily be adapted to current and future work processes; a major advantage in letting response centres maintain their work flows also when the Skyresponse platform is introduced.

With the Skyresponse platform, the user interface seen by the response centre operator is generated by a presentation template in the web browser. Skyresponse provides standard presentation templates, and these templates can then easily be modified when it comes to text, language, colour and how information is shown. The standard templates for handling of personal care events, panic alarms and video alarms all have a high degree of similarity, but are also distinctly different, highlighting important information and hiding unnecessary details as needed.

The data presented at an alarm includes dynamic information such as transmitter position or a camera view, and static information stored about the user in the system. The Skyresponse platform logs all incoming alarm data and also supports manual logging of alarm cause and actions taken. The data presented can be adapted so that the response centre operator only has access to information relevant for the event, while a technician can see technical data but no information about the alarming user.

With the Skyresponse platform the customer can choose between using the fully integrated call handling functions or to integrate the platform with a local, already existing, telephony system. Using the fully integrated functions of the platform the operator handles voice calls as an integral part of incoming alarms. The operator can conveniently call the person who has raised the alarm, take an incoming call, set up group calls, and put a call on hold. The only requirement for managing alarms using the fully integrated telephony functions is that the computer in use has a headset.

Integration with an external telephony system is done directly in each operator terminal, using a thin client communicating with the Skyresponse platform. The system supports basic call handling via SIP, and this functionality can be expanded when integrated with external digital phone systems.

Alarm Handling

Alarms from alarm units and external services are received by the Skyresponse platform using the standard protocol defined for each unit (e.g. SCAIP for personal care alarms). Incoming, not attended to, alarms are placed in the relevant alarm queue, sorted by priority and type, and displayed to the operators of the web-based Skyresponse:central alarm reception as an alarm list, including alarm type and alarm code. All alarms can be shown in a single list, or alternatively, as shown in the illustration below, the operator switches between active, taken, and deactivated alarms by clicking the appropriate coloured symbol. The alarm list(s) is/are scrollable and may be sorted on alarm code, alarm type and on when the alarm was received.
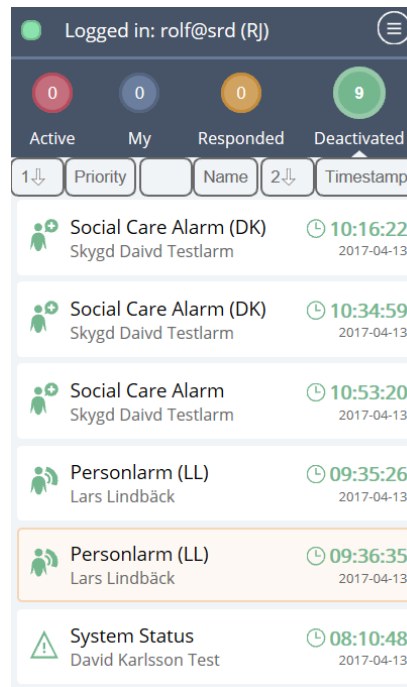
Figure 6.   Alarm list example

Which alarms to be displayed by the alarm list can be set individually per operator, so that e.g. specially trained operators can handle panic alarms, which are not shown to other operators dealing with e.g. technical alarms.

All operators have an easy overview of his/her own alarm queues and by use of shortcut commands he/she can view which other operators that are logged in and what alarms they are handling.

When an operator chooses to take an alarm, he/she just clicks the appropriate row in the alarm list (or uses a shortcut command) which displays the corresponding alarm page with detailed information about the alarm. For each type of alarm, the alarm page displays the relevant actions to take as predefined by the customer. Information from external data bases and other information systems may also be presented on the alarm page in a format defined by the customer.

Depending on the configuration chosen for the customer, the alarm page may include call functions for establishing a telephone call to the alarming user or to other involved persons, lists of resources to call upon, contact persons that can be called by phone or mail, and camera views related to the alarming user/object.

Figure 7.   Example of part of an alarm page with detailed information

The Skyresponse platform allows for great flexibility in how alarms are managed by the response centre. It is possible to control how alarms are transferred between operators, how alarms are returned to a common alarm queue, if an operator should be required to enter a note in the alarm log before deactivating the alarm and if the operator must empty his/her own alarm queue before logging out.

All operators can effortlessly track their own open alarms and list alarms being handled by other operators. The operator may choose to deactivate his/her own alarms or to park the alarm with an automatic reminder that the parked alarm shall be presented again later. When the fully integrated call handling functions are used, the phone call will automatically be set to the same status as the alarm.

For each alarm, there is also a quick summary of the alarm history, showing earlier alarms from the same alarming user/object. A full history for each such previous alarm, including logged information, is conveniently retrieved by clicking the corresponding item in the summary.

Figure 8.   Summary of alarm history

Alarms can also effortlessly be handled by the dedicated response app – *Skyresponse:mobile* – which makes it possible to take and act on alarms directly in the mobile phone. Alarm queues and the alarm handling are fully synchronized with the web-based interface for response centres and the workflow is the same. A customer taking full advantage of Skyresponse:mobile can for example optimize his work processes so that low priority technical alarms are sent directly to a technician in his/her mobile phone for action, while emergency alarms are handled by a nurse working in the response centre.
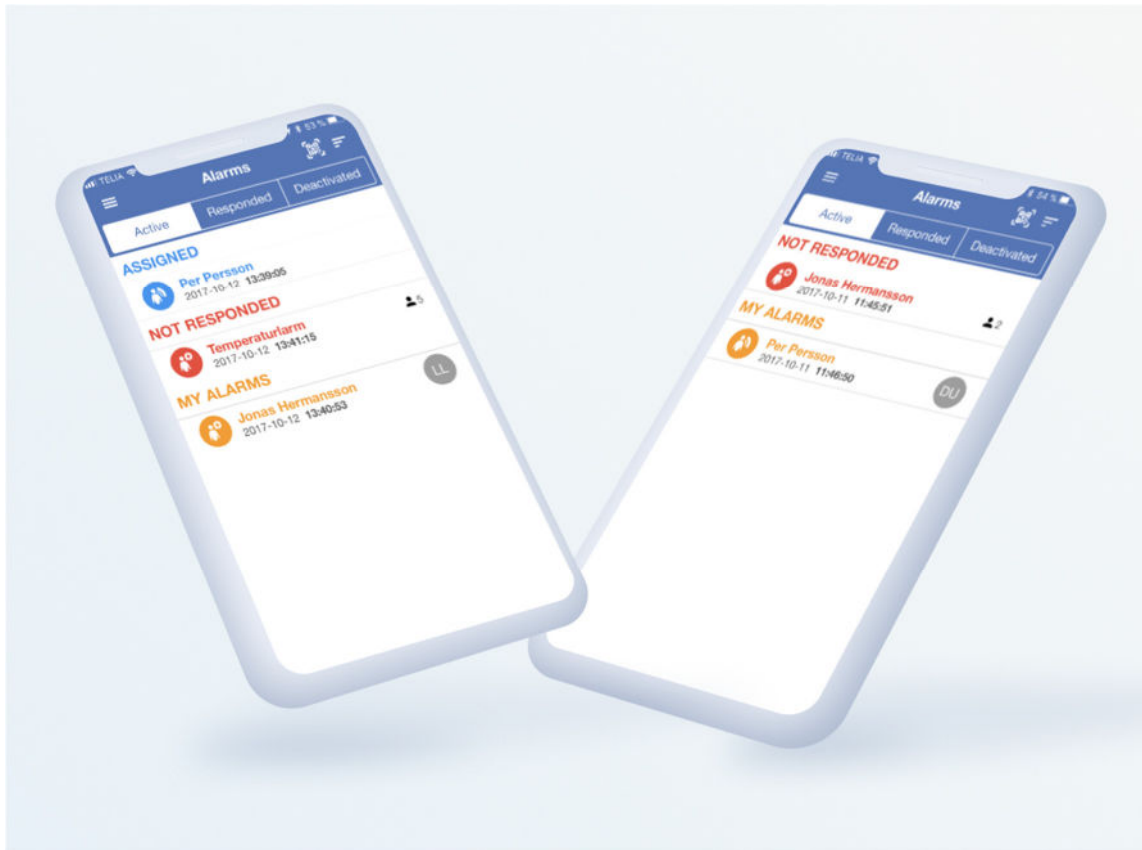

Figure 9.   *Skyresponse:mobile for mobile handling of alarms*

Alternative applications of the Skyresponse:mobile app can be found in hospitals and nursing homes with alarm lists displayed on wall mounted tablets for personnel to see and act on. In this case only the alarm list is displayed, and the nurse must enter a PIN-code to open the alarm page and get additional information about the alarming user. When combined with the advanced positioning features supported by the Skyresponse platform, the alarm page can include detailed information about the patient's location, also when he/she is not in his/her normal room.

A more extensive description of alternative workflows enabled by the Skyresponse platform can be found in the Skyresponse White Paper M20-020 "Creating Efficient Workflows for your Alarm Handling".

Assign Resources to an Alarm

The Skyresponse platform automatically stores information about available *resources* – e.g. field staff such as technicians or mobile home care teams – and presents it to the response centre operator in list format at the alarm page. The platform can handle both common resources for all users/objects (e.g. a medical alert team) and user specific resources for the alarming user/object (e.g. Mary Grant – daughter). The operator may then call the resource by phone directly from the alarm page, using the integrated call handling functions.
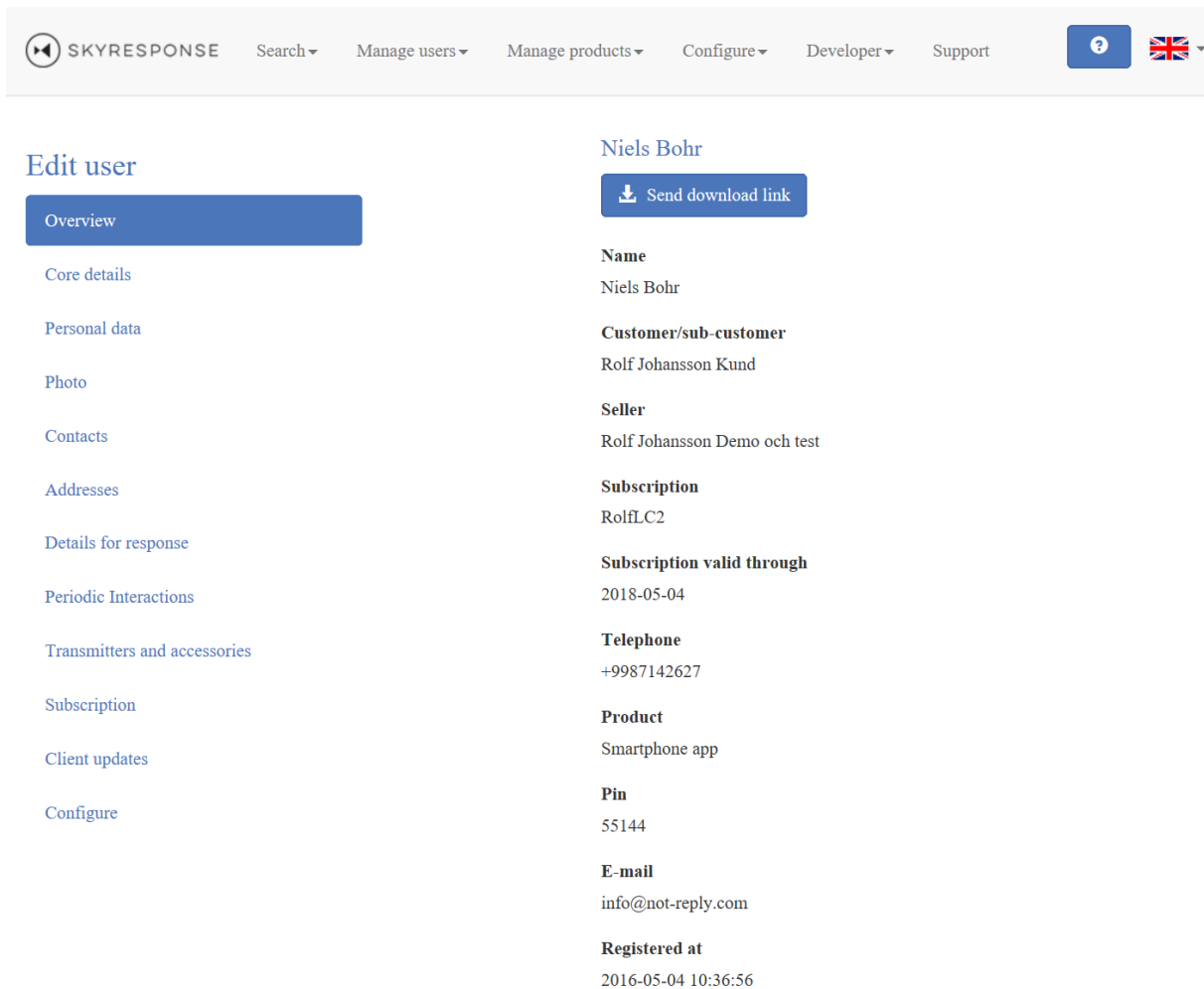
If the resources use the Skyresponse:mobile app, the response centre operator may alternatively assign an alarm action directly to a person in the field staff from the alarm page. A resource being assigned an alarm action in this way automatically gets access to all relevant alarm information, including the operator's alarm log, and can chose to accept or decline the assignment. Assignments of alarm actions may also be done by use of an SMS sent to the resource.

The planning of available resources is done via the administrative interface to the Skyresponse platform, where resources can be added and removed. When resources are using the Skyresponse:mobile app, the information on available resources and their locations will also be updated automatically, dependent on who is active or not.

A unique function to increase family participation in personal care applications is that the customer may choose to automatically share alarms with the relatives of the user: A mail with a web link to an alarm page having a subset of information is sent to the chosen person.

The Administrative Interface

All client information, e. g. user details in a home care application, action lists in a personal safety application and location data in a smart building application, is handled via the Skyresponse platform's administrative web portal – *Skyresponse:admin*. Using this web-based interface, authorized administrators can register, update, search for and export data about the supervised objects. The administrative interface also supports bulk handling of multiple objects, for example if a group of users has changed alarm units and the user information needs to be updated for all of them. Objects are registered in pre-defined templates in the administrative interface or by import of data from other response centre systems or data bases.

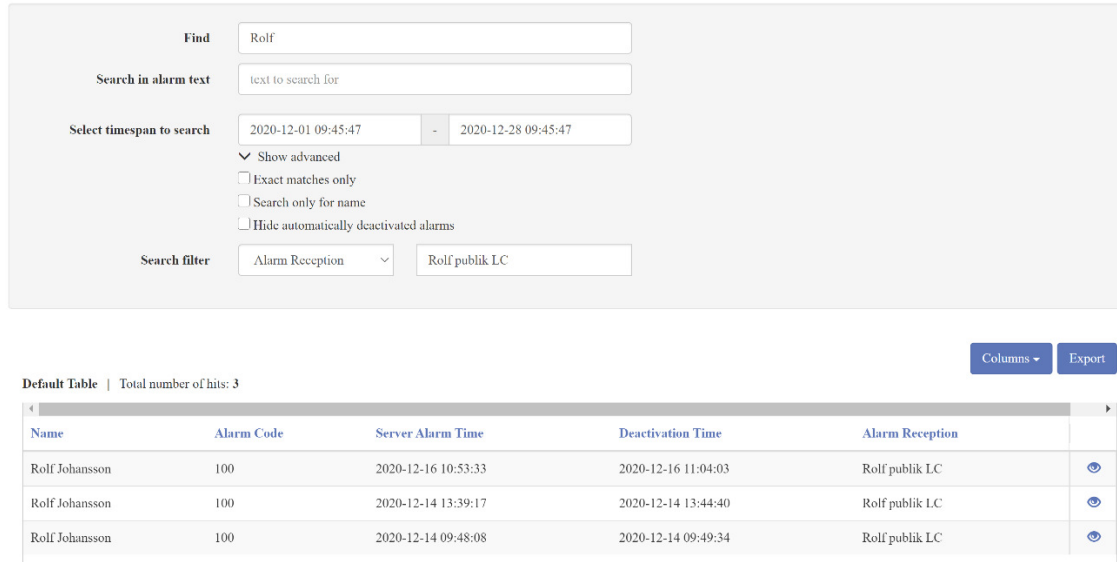*Figure 10. Editing of user details via the administrative interface*

All administrators that log in to the administrative interface have their own individual authorization profile which defines which functions they can access and the content of their administrative interface. By changing the authorization profile, a main administrator may define which functions that shall be available to each administrator and operator. Tailor-made access to the administrative interface can for example be given to response centre operators, technicians and various types of experts.

Security is guaranteed by two-factor authentication using SMS or a dedicated app, when an administrator or response centre operator logs in. The platform also supports integration with external authentication systems such as Microsoft Active Directory for sign-in through federation, so that the administrators can use the same credentials as for other systems in the organization.

Logging and Alarm History

The Skyresponse platform automatically logs all information about incoming and handled events. All information is time-stamped including when the operator receives the alarm, logs actions and deactivates/parks an alarm. The log includes information on to whom the alarm is sent, who has picked up the alarm, who has acted on the alarm, who has logged information, and who has deactivated/put an alarm on observation.

Figure 11. Alarm search done on part of name and time

The administrator and the response centre operator have access to an alarm search function where earlier alarms can be retrieved based on e.g. user/object name, phone number, time, alarm recipient and alarm code. Clicking an item in the search result list takes the operator to the corresponding alarm page, comprising information from the alarm event and the log entries made for the alarm. All alarms can be kept searchable for 6 months or longer at customer request. Older alarm data is normally only made searchable for the main administrator.

All alarm data is stored for a minimum of two years by Skyresponse. Data from external systems which are retrieved dynamically without being stored permanently in the Skyresponse platform will contain the information possible to retrieve at search time, i.e. not when the alarm was logged.

Statistics, Reports, and Data Lakes

All basic alarm statistics can be retrieved via the administrative interface to the Skyresponse platform. The platform can also automatically generate reports about data and events of interest associated with one or more objects/users. The report format can easily be configured by the customer, defining which information that shall be included in the report, the layout of the report and who should receive the report.

The reports can be downloaded for continued work in e.g. Microsoft Excel or be sent out automatically as planned mailings. Mailings of reports can also be requested by administrators wanting to have e.g. a daily report on all alarms raised in a geographical area or from a certain type of vehicles.

For more advanced off-line analysis of alarm data, the Skyresponse platform supports the concept of data lakes, i.e. external access to structured raw data in the system for partners and customers that want to take their insights of how their applications are used to new heights.

The Skyresponse Data Lake Service has standard APIs for connecting to third party Business Intelligence (BI) applications such as Microsoft Power BI, Crystal Reports and Tableau. In addition, any ODBC/JDBC compatible application can be set up to query the data lake. Read only access to the individual data items can easily be configured.

Security and Technical Availability

The Skyresponse platform is a *cloud service* (Software as a Service, SaaS). In a cloud service the software performing the desired IT functions is residing on a distributed group of computer servers with users accessing the service via the Internet.

To achieve the highest possible level of availability and to ensure redundancy the Skyresponse platform uses a set of geographically distributed clusters of servers in an active-active configuration. All changes of data are automatically stored in each server cluster, so the platform for digital event and alarm handling will always continue to work, also if a server cluster fails.

The backup handling is fully automatic. As long as the alarm unit has Internet access (fixed or mobile) the routing algorithms of Internet and the cloud service load sharing routines will ensure that the alarm is received. And as long as the operator is logged in to the Skyresponse platform and the terminal/mobile phone in use has Internet access, the same routines will ensure that the alarm/event is displayed to the operator.

Thanks to the powerful potential of the cloud-based service, disaster recovery routines can be made simple. Normally the customer must only reserve a set of portable lap top computers with Internet access plus headsets as a backup, to guarantee that alarms can be received and handled at alternative sites. Even if the entire response centre loses its Internet connection, operators having the Skyresponse:mobile app and mobile phones with Internet access can still handle incoming alarms.

Figure 12. The Skyresponse platform allows for easy integration with existing response centre systems and workflows.

All communication between the Skyresponse platform and the response centre operators is encrypted according to the Hypertext Transfer Protocol Secure (https) standard. Data is stored in encrypted format in the platform and only authorized persons can access the information. Each log-in to the platform is personal, protected by two-factor authentication, and the main administrator decides

which user data an operator or administrator shall have access to and have the right to edit. Furthermore, all administrator and operator actions are logged by the platform.

All administrative and alarm related data handled by the Skyresponse platform is logged in real time. The logs are available to authorized users over the Internet in real time and as reports. The platform registers for example all technical details about the communication between the cloud-based servers and an alarm unit. This makes it easy for a technician to analyse the communication, if a fault is reported for a specific alarm unit.

The availability of the Skyresponse platform is supervised at two levels:

1. The availability of the cloud service as such is continuously supervised for each server cluster by the cloud service provider (Amazon AWS).

2. The Skyresponse platform performs real time supervision of all parts of its own application and presents the result to authorized technician/administrators. The platform also generates alarms with associated escalation indicators, depending on the severity of the fault. Serious system errors are escalated to the Skyresponse 24/7 manned support service, which then calls for local technicians according to established routines.

Additional facts about the availability benefits of using a cloud-based alarm handling platform can be found in the Skyresponse White Paper M19-006 "Cloud Services for Secure Alarm Handling".

Release Handling and Functional Upgrades

The release process followed by Skyresponse has great handling and stability advantages. The Skyresponse platform takes full advantage of the cloud service implementation, allowing roll out of new production releases without any down time or lost alarms. The platform functionality is released to its users in three distinct steps, where the code in all three steps can handle alarms and administrative data.

1. Access to the most recent code base – Only for internal users within Skyresponse, for example Skyresponse software designers for testing and evaluation purposes (alfa testing). Is not run towards the live production environment.

2. Access to a planned release via a staging server for beta testing – This gives designated users the possibility to test and verify functions in a coming release. The staging server uses the Skyresponse platform production data base and alarm handling, which means that selected operators may test new functions when handling live alarms and administering user data, but before the functions are introduced in the production environment.

3. Access to the production code base in the Skyresponse server clusters. – This is the approved and released code base and the live production environment normally used by the operators.

This step-by-step release of new functionality makes it possible to have new functions tested by selected operators at the response centre before they go live for all operators.

Integration with Other Systems

The Skyresponse cloud-based alarm handling platform has support for a wide range of standard alarm protocols and includes distinct and simple to use REST APIs for alarm generation, administration and alarm handling. This makes it easy for third party vendors to develop both hardware and new functions which are compatible with the platform.

The *Skyresponse Client Software Development Kit (Client SDK)* can be used by any alarm unit vendor wanting to integrate his device with the Skyresponse platform and enabling his device to send alarms

via the platform. The platform can be adapted to interpret almost any incoming signal as an alarm, which makes it easy to expand the system to handle other types of digitally reported events, e.g. fire alarms and all the alarms from the new connected devices of the future.

The Skyresponse platform has well established functions that enable interworking with other response centre systems. The platform also includes support for import and export of user data with some of the other existing response centre systems. Moreover, the platform supports Sign-in through federation which makes it possible for the users to sign in to Skyresponse services through a third-party identity provider (IdP) so that they can login with the same identities and passwords they use in their daily work.

Summary

Skyresponse provides a cloud based and future proof platform for flexible and secure handling of alarms and other events in an emerging Internet of Things world. Thanks to the great flexibility of the platform, it is well suited for applications in many different areas such as personal safety, personal care and for smart buildings. The advanced alarm reception, where incoming alarms can be handled both by response centre operators and directly by field staff, permits streamlining of the workflow for anyone acting on an alarm, may they be home care workers or technicians. A distinct graphical presentation of alarm queues and alarm details, availability of extensive statistics and reports, all built on a secure and reliable infrastructure makes the platform easy to use and easy to expand with new services.