



Connected Living Programme – Future IoT Networks

IoT Use Case Summary

The following use cases were developed by the Connected Living Programme in 2014/15:

 Health	 Automotive	 Utilities	 Learning
Remote glucose monitoring	Emergency services	Energy management – demand response	Connected school – mobile payments
Assisted living bracelet	Infotainment	Smart city sensing	Connected school – smart watch
Connected ambulance	Remote service management		
Healthcare professional portable device			

A.1.1 Healthcare

Remote Glucose Monitoring: a blood glucose monitor that allows the user (patient) to regularly record their blood glucose levels and transmit readings via a short range wireless technology (e.g. Bluetooth) to a carer or healthcare practitioner via an associated mobile gateway.	
Health-RM-UC1-Login	User ID sent via gateway to database, PIN authentication request and then user submits PIN.
Health-RM-UC2-Read-Local	Measurement sent from glucose monitor to mobile gateway, measurement sent over mobile network to service provider and then measurement stored in database.
Health-RM-UC3-Read-Abroad	Measurement sent from glucose monitor to mobile gateway, measurement sent over foreign mobile network to home network service provider and then measurement stored in database.
Assisted Living Bracelet: a wristband with a built-in SIM which a patient/user wears. It provides alerts when a user exits a designated 'safe zone', emergency voice calls to call centre and fall detection alerts.	
Health-AssisLiv-UC1-Location	Wristband detects that user is outside of predefined geo-fence and sends information to service provider over the



	network, call centre notified of end-user location and then call centre phones the user on their device.
Health-AssisLiv-UC2-EmergCall	User pushed emergency button and call is opened between wristband and call centre.
Health-AssisLiv-UC3-Fall	Accelerometer activates emergency call between wrist band and call centre.
Connected Ambulance: a connected ambulance enables remote diagnosis, treatment and monitoring of patients. Functions include video call connection with expert healthcare practitioner at base/other hospitals, continuous data sharing with healthcare practitioner/hospital of patient vitals for monitoring, transmission of high resolution scans (X-ray) for remote diagnosis and automotive applications such as navigation, location tracking.	
Health-Ambul-UC1-VideoCall	Paramedic activates call which transmits via short-range technology to the mobile gateway within the ambulance.
Health-Ambul-UC2-ECGDataSent	Paramedic connects ECG to patient and activates device which creates connection to mobile gateway. The mobile gateway triggers connection to network to establish data link with the hospital and ECG output is displayed at the hospital.
Health-Ambul-UC3-ScanSent	Paramedic takes scan of patient and image is stored locally. Paramedic selects required destination and activates transmission of high bandwidth data package. Data package sent via network to recipient who receives and downloads data file to their mobile handset / tablet making. Healthcare practitioner is able via voice/video call to offer a diagnosis to the paramedic on the scene utilising the mobile gateway within the connected ambulance.
Healthcare Practitioner Portable Device: a portable data management device to be used by healthcare professionals in a hospital environment providing the following functionality: clinical decision support, update patient health record and NFC room access (2 factor authentication).	
Health-HCP-UC1-DecisionSupport	Healthcare practitioner (HCP) enters parameters/measurements into portable device, which transmits this information via a network. System sends back to the HCP a list of possible diagnoses. HCP records their chosen action and adds any further notes which are sent back via the network and stored on the central electronic health record (EHR).
Health-HCP-UC2-RecordUpdate	HCP 1 sends request via mobile network to EHR to obtain latest view of patient data on portable device. HCP 1 receives most recent patient data on their portable device and then updates locally-stored patient information on portable device following consultation/treatment. HCP 1 then synchronises again with EHR via the mobile network. If HCP 2 attempts to access patient data whilst HCP 1 is accessing the same patients data then HCP 2 is able to view a read-only version, is notified that the information is locked for editing and can opt to receive an alert once HCP 1 has



	finished their consultation and the file is synchronised and up to date
Health-HCP-UC3-RoomAccess	HCP touches their NFC-enabled device on door lock which requests from hospital network that the HCP submit their associated PIN on their portable device, which sends a request via the mobile network. The HCP enters their PIN, which is returned to the hospital network. Hospital network confirms correct PIN. A signal is sent via the network to release the door lock and access is granted.

A.1.2 Automotive

Emergency Call: a vehicle with an Embedded SIM which can provide emergency calling/notification service provided during a driving incident; location and vehicle data is required.	
Auto-Emerg-UC1-Activate	Original equipment manufacturer (OEM) request to mobile operator to activate the subscription for vehicle SIM, operator accepts request and the OEM is notified that the SIM in that particular vehicle is now active.
Auto-Emerg-UC2-EmergencyCall	The affected vehicle sends location and data to the emergency service provider (ESP). In the first case, the affected vehicle automatically calls the ESP. Alternatively, another driver reports an incident from their own vehicle using the emergency calling service (via button).
Auto-Emerg-UC3-CallBack	The ESP calls back the affected vehicle and sends relevant incident data to the deployed emergency vehicle.
Infotainment: high bandwidth infotainment (video/music streaming) services are offered to the driver of the vehicle via an embedded SIM. Multiple subscription models are possible.	
Auto-Info-UC1-Purchase	User selects subscription for streaming services via application and is asked to accept the monthly charges and choose a payment method. User selects to pay via mobile phone bill. A third party provides the content streaming service.
Auto-Info-UC2-Bill	Data/time limit of stream has been reached. MNO 1 calculates all data usage. Data used by OEM is charged back to OEM. Data used by driver (user) is charged back to MNO 2, which charges the user via their mobile phone bill.
Auto-Info-UC3-Activate/Deactivate	End user logs into service and there is a data flow to service provider to authenticate and allow access. Data flow back to vehicle confirming successful authentication and login allowed. Service is activated or deactivated.
Remote Service Management: remote service management is a service provided to two different categories of end consumer: the car owner and the OEM. Such a service provides diagnostic information about the vehicle and the ability to upgrade any software in the vehicle.	



Auto-Remote-UC1-DiagnosticsRead	The vehicle sends regular diagnostic data to the management server.
Auto-Remote-UC2-Repair	Vehicle detects an error and notifies server of the error. The management server relays the notification and details to the OEM which relays the error and details to the software provider, while requesting a repair. The driver is notified and requested to park car or to postpone the action (engine needs to be running). Software provider publishes repair update for parameter to OEM, which approves the update. The OEM relays the repair to the server which sends update to specified vehicle
Auto-Remote-UC3-FWUpdate	Firmware provider notifies OEM of required update and sends update package to OEM. OEM notifies server and, depending on type of device and level of criticality, driver will be notified and asked to park (switch off engine). Vehicle acknowledges it is ready for update and notifies server. OEM sends update package to server which sends update to vehicle and update is installed.
Auto-Remote-UC4-DynamicData	Other vehicles send data collected for applications to the server which relays this data to the various application providers. Application provider analyses and aggregates the data which it then sends to the server. Vehicle is in constant contact with management server to query for dynamic updates for various applications (e.g. traffic app, weather app, road conviction app). Server sends them out to the vehicle at a time/event-based frequency.
Auto-Remote-UC5-SWUpdate	Software provider notifies OEM of new update and sends update package to OEM. OEM relays notification to server which triggers notification to vehicle of the software update. Driver notified of update and requested to take action. Vehicle owner/driver can choose to either install update now or at later time (vehicle can be in use during this time as software is not critical for driving). Vehicle notifies server it is ready to receive update. OEM sends software update package to server and is installed.

A.1.3 Utilities

Energy Management Demand Response: service allows users to remotely manage appliances, view and adjust their energy consumption (i.e. via managing heating or hot water temperature). The Demand Response service allows a utility company to remotely manage appliances (e.g. turning them on/off) to balance the load on the electric grid.



Util-EnergMgmt-UC1-InstallActivate	User switches on the device, which finds the network or gateway. Then device authentication takes place followed by service activation. Mobile Identity is utilised for authentication.
Util-EnergMgmt-UC2-ApplianceControl	Activity is triggered by person on demand or according to schedule/ pre-determined event (presence, outside temperature) by machine. Command is sent to appliance via gateway and confirmation of the command execution is sent to the energy management service (EMS).
Util-EnergMgmt-UC3-Read	Appliances send activity data to gateway at frequent intervals to EMS. The gateway aggregates data then send the EMS.
Util-EnergMgmt-UC4-AlertNoResponse	EMS does not receive data, this triggers diagnostic from gateway to appliance. Result of diagnostics are sent to EMS. Depending on the result, the notification of diagnostics results are then sent to the user or third party (appliance manufacturer).
Util-EnergMgmt-UC5-AlertEvent	Reading is sent to EMS. Unusual behaviour is detected by EMS. Depending on the pre-determined process, diagnostics might need to be triggered. Depending on the outcome of diagnostics, a notification to user and/or third party is issued.
Util-EnergMgmt-UC6-ThirdPartyRead	User requests energy consumption details from EMS. EMS sends real time consumption details to user.
Util-EnergMgmt-UC7-FWUpdate	Firmware provider has released a new firmware version, and upgrade request is sent to the user via the appliance. Once the user approves, the appliance sends approval to firmware provider who sends upgrade to the appliance.
Smart City Sensing: services where data for environmental parameters, city assets, and city furniture is provided to local authorities and citizens. Some examples include: water irrigation management, environmental reports services, street lights management, traffic light management, monitoring of gas and sewage pipelines, monitoring of rubbish bins.	
Util-SmartCity-UC1-Activate	The gateway is turned on which automatically triggers authentication request to the service provider and MNO. The service is then activated via the gateway.
Util-SmartCity-UC2-Repair	The sensor is sending unusual data or no data to the gateway. The gateway requests diagnostic to sensor. The diagnostic is sent to service provider for repair. Service provider publishes repair update.
Util-SmartCity-UC3-Read	In the first case, the sensor sends data to the gateway which aggregates and sends the information to the service provider at regular intervals. Alternatively, the service provider requests data in real-time via gateway; the sensor sends data to the service provider via the gateway.



Util-SmartCity-UC4-Publish	The service provider publishes sensor data to the application provider.
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A.1.4 Learning

Connected School Mobile Payments: leverages a smart watch and intelligently connected touch points to help learners, parents, faculty and staff to safely and securely make payments and purchases at school. The watch has a SIM and is NFC-enabled.	
Learn-Payment-UC1-PaymentPurchase	User makes contact with touch point after activating the service with the push of a button, and payment or purchase is then rendered at the PoS. Purchase amount is transmitted to user's account which is then debited.
Learn-Payment-UC2-TransactionReport	Activity occurs on user's "money-on-the-move" account which generates an activity report. Report is sent to user (with option to be sent to parent or guardian) via a pop-up notification.
Learn-Payment-UC3-Locate	User uses a phone to report the lost or stolen smart watch and remote tracking is performed to determine location of the device. The smart watch is remotely deactivated and all personal data is wiped from the user's account. If the user indicates that the smart watch is in a familiar place it can be recovered and re-activated.
Connected School Smart Identification Watch: leverages a SIM and NFC enabled smart watch and intelligently connected touch points to help users securely identify themselves while on the grounds of educational institutions for the purposes of attendance monitoring and making bookings for use of educational institutions' materials, equipment and facilities	
Learn-IDWatch-UC1-Attendance	User passes an identification touch point and user details are transmitted over data to user's account and recorded.
Learn-IDWatch-UC2-OutofBounds	User moves outside their recorded geo-fencing area/time. User's location is tracked while they are out of bounds, and time stamps are recorded as new locations are noted. Alert is sent to relevant actors concerned.
Learn-IDWatch-UC3-BookResources	User authenticates their identity on their smart watch and then makes contact with the relevant touch point to complete the booking. User taps out when finished.