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Remote vital signs monitoring

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Foreword

This Technical Reference (TR) was prepared by the Healthcare Informatics Technical Committee under the direction of the Information Technology Standards Committee (ITSC). The ITSC endorsed the TR on 11 February 2016.

Singapore has embarked on a Smart Nation initiative to create networks of linked sensors and communication infrastructure, as part of a solution, to improve city planning and provide integrated public services, safety and security, urban mobility, urban living and healthcare for citizens.

The ITSC is developing a suite of Singapore Standards/Technical References to support Singapore's goals to become a Smart Nation. These standards are clustered into three broad categories:

- Sensor networks
  These standards relate to sensor networks in different settings such as public areas, homes and buildings. TR 38 [Sensor network for Smart Nation (public areas)] and TR 40 [Sensor network for Smart Nation (homes)] provide a recommended set of coherent international or industry communication and application interface standards for the development and deployment of sensor network(s) in public areas and homes. Both TR 38 and TR 40 support TR 45 (remote vital signs monitoring).

- Internet of Things (IoT) foundational services
  These standards for IoT foundational services define the basic building blocks to aid the development of cross-domain IoT systems and sharing of sensor data, information and IoT instrumentations.

- IoT domain-specific standards
  These standards focus on specific vertical domains applications such as healthcare, mobility and urban living. TR 45 is one of the domain-specific (healthcare) standards.

Annex A provides additional details on the IoT suite of TRs for Smart Nation and how TR 45 relates to them.

This TR is a provisional standard made available for application over a period of two years. The aim is to use the experience gained to update the TR so that it can be adopted as a Singapore Standard. Users of the TR are invited to provide feedback on its technical content, clarity and ease of use. Feedback can be submitted using the form provided in the TR. At the end of the two years, the TR will be reviewed, taking into account any feedback or other considerations, to further its development into a Singapore Standard if found suitable.

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Special acknowledgement is made to Cadi Scientific Pte Ltd for providing invaluable assistance and support in the development of the reference implementation covered in this TR.

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Technical Reference for remote vital signs monitoring

0 Introduction

0.1 Motivation

Today's patients, caregivers, and consumers are well informed and educated, and have much higher expectations from the healthcare system. They are no longer passive recipients of healthcare services and want to actively manage their health, and make empowered choices.

These challenges have necessitated novel ways of tackling them. Many changes are taking place in the healthcare system: New models of care are being explored and healthcare delivery is becoming further integrated.

There is also increasing use of technology in the delivery of care, a greater emphasis on preventive care, and a move away from treatment of episodic illnesses to managing diseases proactively. Patients are also increasingly being empowered to manage their own health.

Two key initiatives are being developed to promote the use of technology to support new models of care:

- Tele-health – to deliver care for patients and link up care providers through technologically-enabled communication channels. This is driven by the need for:
  - Timely access to care anywhere
  - Improved care experiences
  - Efficient utilisation of resources

- Personal Health and Wellness – to equip consumers, patients and informal caregivers with the information, knowledge, tools and services to take greater ownership of their own health and wellness. Solutions for personal health and wellness address the needs of individuals who are well and those with health problems.

In view of these developments, there is an increasing need to integrate patient data collected by devices at patient's home or in the community with hospital Electronic Medical Record (EMR) systems and patients' Personal Health Record (PHR) systems. PHR systems allow care providers and patients or caregivers to monitor and review the data collected and take timely actions.

With the increasing use of remote vital signs monitoring devices, there is a need to integrate the patient data collected with EMR and PHR systems. If the device data collected is not interoperable, integration cost can go up exponentially and it will also result in much inconvenience for patients and caregivers.

0.2 Usage of medical devices for patient care

0.2.1 Hospital outreach and community healthcare support services

Broadly speaking, hospital outreach and community healthcare support services involve medical devices deployed in the patient's home. In some circumstances this can be seen as an extension of the hospital-based monitoring (the ward at home concept) to support functions such as early discharge and prevention of re-admission. Such home-based monitoring services and infrastructure are often used for a limited period of time with equipment provided by the hospital outreach or community health service. Longer-term monitoring may be used to support consumers to remain in their own home, rather than move to a care facility or setting where closer personal monitoring can be

performed. Examples of this are home alarm or duress systems and monitoring to detect emerging illnesses.

In both scenarios some form of control centre will be needed to monitor the data and information collected from the home and take appropriate action:

- In the case of hospital outreach services, this may occur by leveraging existing hospital clinical information and alerting systems – as if the patient is still occupying a warded bed.

- In a more long-term or community-based approach, the care coordination centre may operate independently, and be the place where home collected data is managed and action initiated.

0.2.2 Personal devices and the Internet of Things

The other community scenario is the use of consumer controlled monitoring systems which leverage on the Internet of Things (IoT) technologies to transmit data directly via a mobile phone, or when the device is synchronised with an internet-connected mobile device or computer. As such a consumer may have data collected by several devices, and stored in several data management services.

1 Scope

1.1 Objectives

This TR provides guidance on the information and exchange standards needed to:

- improve the interoperability of patient data collected by the remote vital signs monitoring services and their integration with the EMR and PHR systems. This will help to reduce the cost of deploying medical device integration solutions.

- ease the development of innovative applications that utilise vital signs data collected by medical devices, based on industry standards.

Users are advised to check with the Health Sciences Authority (HSA) if additional regulatory requirements apply to their medical devices. The definition of medical devices according to HSA is given in 2.1.1.

The TR applies to the following two scenarios:

- Integration of vital signs data collected by consumer-owned medical devices for patient/caregiver's self-monitoring, and sharing with care providers;

- Integration of patient's vital signs data with care provider's or other service provider's provisioned devices for the remote monitoring of patients at home.

Figure 1 provides an overview of the scope of the TR.