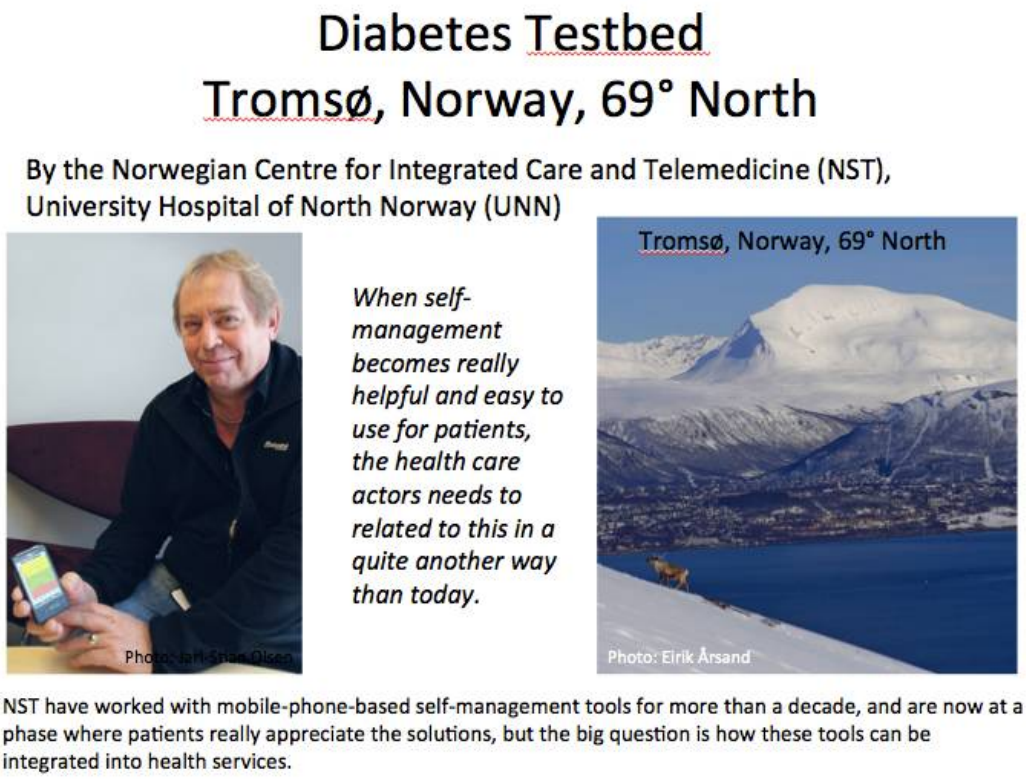
Diabetes Use Case Scenario:
Diabetes Care using Mobile Platforms, Integrated- and Virtual Internet Technologies

At the small town Tromsø, Norway – 69 degree north, where this use case scenario is planned, a joint research group coming from NST, UNN, UiT and TLL, has over the last 10 years worked with patient-involved design of mobile tools for people with diabetes. Such tools are especially important in rural areas where distances are long and expertise often a scarce resource. It is estimated that 366 million people worldwide have diabetes mellitus, comprising both Type 1 and Type 2 diabetes. Lifestyle factors and blood glucose management are important in reducing long-term diabetes complications, which lead to both personal sufferings and enormous costs. In 2011, diabetes caused 4.6 million deaths in the adult population, and health care expenditures to treat and prevent diabetes and its complications exceeded $465 billion, indicating a huge opportunity and growing need to develop cost effective support tools and interventions for diabetes self-management.



NST have worked with mobile-phone-based self-management tools for more than a decade, and are now at a phase where patients really appreciate the solutions, but the big question is how these tools can be integrated into health services.

At the same time, in Slovenia a joint team of scientists, researchers and strategists from UL has been involved in a variety of advanced and QoE-enabled communication systems and services, systems for education, virtual care and proactive e-health assistance, as well as virtual and integrated Internet systems, real-time big data analysis and visualization solutions, and innovative IoT/M2M-inspired systems and services tailored to the needs of specific end-user groups, while the VPD team has designed and successfully launched an innovative certified blood glucose measurement solution 2in1 SMART for iPhone. Such technologies and systems play a vital role in enabling virtual, remote and integrated diabetes patients' care and assistance in an efficient and user-friendly way. By using mobile tools and technologies, advanced Internet solutions, and IoT devices and applications powered by innovative contextual, semantic and cognitive back-end

environments, the latest technology finally delivers user-centricity and care to the patient, hence enhancing their quality of life.

The diabetes use case scenario will be a holistic system tailored to both patients' needs and the health care system services. It will utilize advanced Internet-based and IoT technologies, and build on the FI-STAR Service Consumer Edge Cloud Platform and the architectural building blocks designed under FI-PPP phase 1 projects, such as in particular FI-WARE.

The scenario will engage real users (people with diabetes) who will receive two enhanced mobile smartphone applications, a *Few Touch Application* (FTA) and a DeStress Assistant (DeSA) application, together representing a virtual diabetes patients' care system.

A *Few Touch Application* (FTA) has for a long time been developed and tested as a tool for self-management for people with diabetes, and has so far proved to be constructed in a way that makes users endure and appreciate the tool for long periods of time. The redesign and usage of this system through the FI-STAR project will be strongly coordinated with the health care services and will lead to new services that support instant operability between new and existing services, the patients' self-management system, and new, beneficial interactions between these. The self-management system is realized as an application that communicates with a blood glucose management function, and incorporates physical activity management functions, nutrition management functions, medication management functions, personal goal functions, and other self-management functionalities. Using the FI-STAR infrastructure, these functions will now be possible to share, both among peers with similar profiles and needs, and between patients and health care personnel.

The features and services of the DeStress Assistant (DeSA) application represent the results of extensive and interdisciplinary work aimed at delivering to the end-user an assistive stress control application. DeSA is able to track important parameters, contexts and patterns, which are interesting in terms of stress the end-user is under, and delivers user-friendly alerts and visualizations that assist in becoming aware of, recognizing and avoiding stressful situations. The application relies on the fact that personal wellbeing tracking is no longer a trend for enthusiasts but is becoming a lifestyle with a fast increasing consumer base and a rich variety of IoT-inspired consumer devices and applications to choose from. Throughout the FI-STAR project, this application will be substantially upgraded to deliver specialized contexts and services related to the user's specific conditions and interests, in this case diabetes. DeSA will deliver to the end-user the ability to observe how daily activities and the level of stress are correlated with their blood glucose level, hence representing a real-time diabetes control and stress prevention tool as well as means for preventive care and healthy lifestyle awareness raiser. The application will rely on a variety of IoT devices and applications, the exact choice of which will be left to the end-user; among these are smartphone sensors, 2in1 SMART for glucose measurement and reporting, a variety of consumer IoT devices (such as pedometers, sports watches with GPS tracking, skin permeability measurement devices etc.), and intake and insulin self-reporting services.

Conceptually similar design of FTA and DeSA applications will allow for a coherent and consistent delivery of a virtual diabetes patients' care system, with possibility of tight or loose application integration and interactivity. The results of this work are of great importance for the health care sector for future diabetes care, and also for care within other diseases, such as asthma, obesity, cardiovascular diseases, allergies, etc. The relevant mobile, IoT and Internet technologies finally seems to get more ready for these kind of services, allowing the possibilities of giving patients far better services than today.

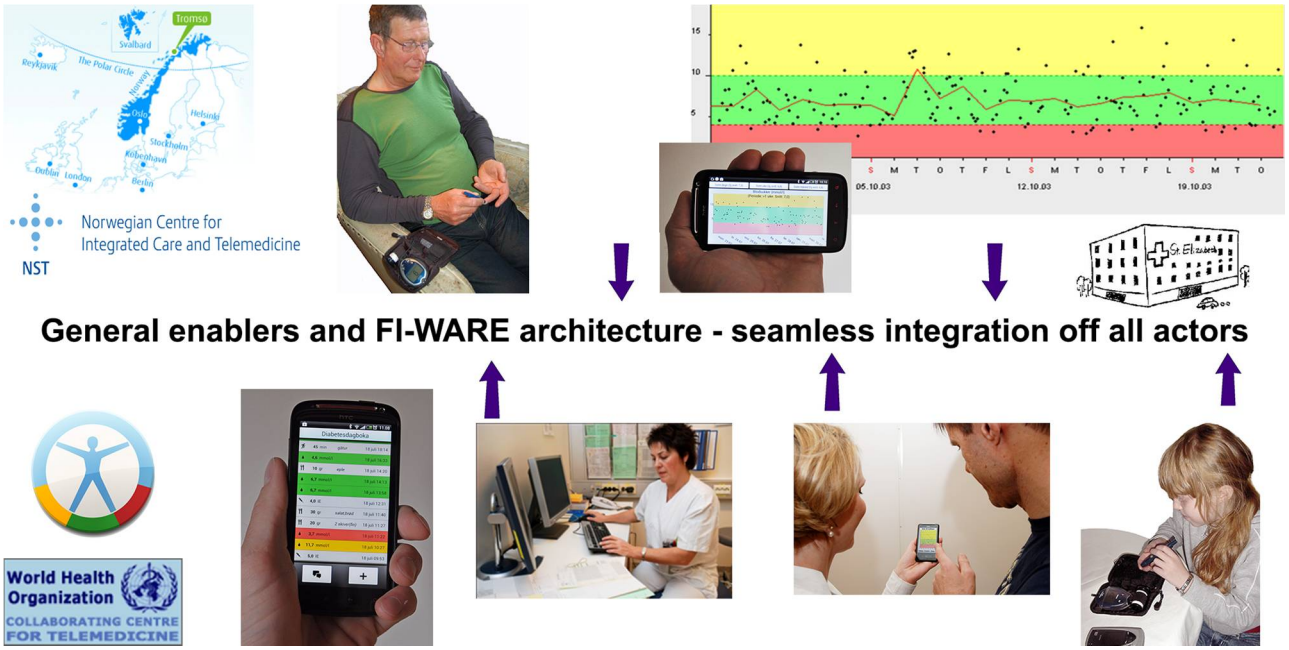


Figure 1. Illustration of some of the components in the Diabetes Use Case Scenario.

The Norwegian centre for integrated care and Telemedicine will run the Diabetes scenario case experiment. This experiment will use mobile technology integrated in the GEs and FI-WARE architecture to enhance self-management and increased cooperation in the diabetes care along with offering targeted assistive diabetes care services. UNN, UL and VPD will coordinate the experiment between them as the trial will involve applications from both UNN and UL and VPD will contribute with their support on diabetes devices and applications. Through mobile-phone-based applications, the users, individuals and health care personnel will conduct the follow-up, motivation, goal-setting and information for the patients themselves as well as the interaction between the caregiver and the patient. To be able to implement this, close cooperation between diabetes nurses, specialists and the project team will be essential. A diabetes nurse will be engaged especially for this experiment.

The purpose of this use case scenario is primarily to provide the patient with a better overview of their situation in order to boost motivation and capability for improving their health parameters, secondary to provide the health care personnel better data for individual care. The novelties are the mobile and easy-to-use application, and the integrated way of sharing the care between the patients themselves and the health care workers.