

WP3 Health Monitoring of Wireless Sensor Networks

By Sarah Pennington - Thales Research and Technology

Experimentation forms an important part of research into wireless sensor networks (WSNs).

Thales has consequently deployed a network of wirelessly connected sensor nodes at our TRT-UK premises to collect environmental data for monitoring the building. However, many problems with data not being received at the gateway were encountered, with possible causes such as low battery voltage or poor connectivity to the gateway.

With no easy means of monitoring the WSN, it was time-consuming to resolve problems. An easy to understand, visual method of monitoring the health of the WSN in real-time was therefore deemed essential.

A Google Earth-based user interface was created which clearly highlighted any problems in the WSN operation. Carefully positioned sensor nodes collect and monitor information about their health status e.g., battery voltage and link quality, and periodically send updates to the gateway, which stores the data in a MySQL database. A Java application periodically queries the database and provides the data in a format that is readable by Google Earth.

Figure 1 shows a screenshot of the Google Earth interface, which displays information on the health of the sensor nodes deployed in TRT-UK. Icons indicate the battery level of each node and coloured lines indicate the connectivity of each node to its neighbours as below:



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- High link quality: Green
- Moderate link quality: Amber
- Poor link quality: Red
- Out-of-date link quality data: Grey
- Chosen routing path: thin blue
- Nodes with no connected neighbours: Red icon

By employing this health-monitoring tool, an operator can easily locate WSN operational problems and resolve them.

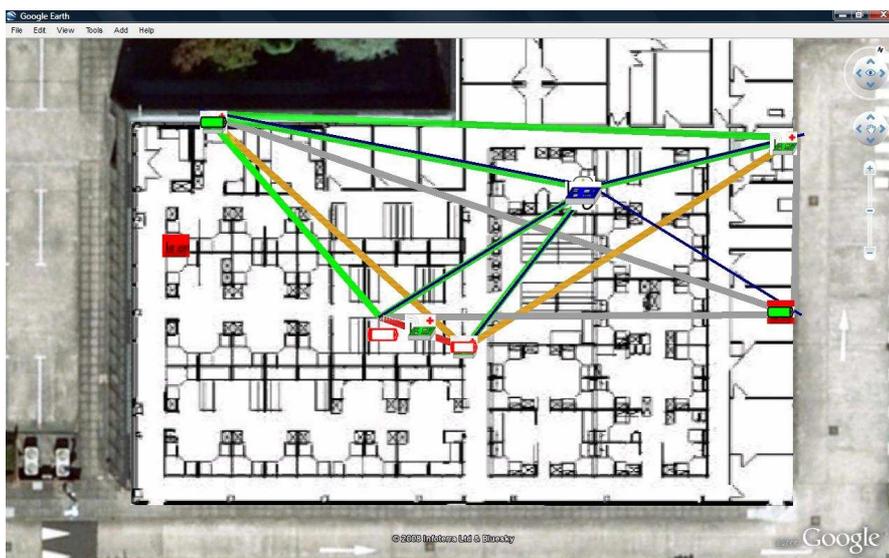


Figure 1 – Google Earth user interface and visualisation

WP2 I3CON Performance Based Business Models

by Iris Karvonen - VTT, Marian Negrea - Instapro, Sven Schimpf- University of Stuttgart, Miguel Segarra - Dragados

One of the objectives of I3CON Project is to provide new business reference models that add value to all the elements in the construction industry supply chain and, especially, to the customer. A decision-support tool, implemented in an Excel sheet, has been developed with the objective of helping companies (from big corporations to small entrepreneurs) to decide the most suitable business model for delivering greater value. Along with this, a guideline was employed (as a first step for industrial validation) to some proposals of new value-driven services presented in the field of Facilities Management. This represents an appealing sphere of activity for construction companies wishing to integrate towards building end users and establish a long-term contract with them.

I3CON is also developing a reference model for Lifecycle Performance Metrics and Criteria, based on previous developments of performance measurement in construction, where the different interest groups and their needs for building performance measures were identified, taking into account defined stakeholder requirements (also studied within the project).

The appropriateness of these current building performance measurement approaches for value-based business models was analysed, resulting in the definition of a Building Performance Measurement Reference model with three dimensions:

- WHY – with the objective to support Building Lifecycle Value-Based Business Models.
- WHAT – defining a Performance measure entity, which can be used to present different

performance measures (also existing and advanced metrics).

- HOW – what is the process for the specification of used metrics; this dimension will define the process for the specification of used metrics. The link between this performance measurement and benchmarking has been reviewed, in addition to the study of metrics in the field of Operation & Maintenance as applied in Mediterranean climatic conditions.

To develop innovative, performance-driven business processes, a networked collaboration between service and facility management providers and components manufacturers must be created, establishing new economic models (e.g., performance-based contracting) with the stakeholders. With the objective of taking this a step beyond, I3CON has revealed the state of the art in the following fields:

- The evaluation of the existing reference models for operational business processes; Purchasing, Manufacturing, Marketing, and Sales represent the operational business processes of interest since they are part of the core business and responsible for having a major influence in the creation of the primary value stream.

The aim is to provide guidelines for the development of a survey that is to be circulated among contractors, manufacturers and suppliers acting in the construction industry to evaluate common practices in the above mentioned processes and availability to allow changes in their organisations.

- Existing standard value creating mechanisms for operational business processes: essential issues contained in various phases of the building project and commissioning process have been discussed from the viewpoints of different stakeholders, from project requirements definition



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and programming to operation and maintenance, passing through the design phase, construction, testing, balancing and handing over.

- Design guidelines for the following areas of expertise with a special emphasis on renovation issues for existing buildings (reengineering):
 - Mechanical: HVAC (Equipment, air delivery, efficiency, Indoor Air Quality and control).
 - Electrical: Power distribution, lighting, ICT and control systems.
 - Plumbing: Hot water heating and pumping.
- Evaluation of business models (especially in UK, but pertinent to the rest of the EU).

WP5 Lifecycle Services and Facility Management

By Liza Wohlfart - University of Stuttgart, Aurelius Bernet - Perspectix, Lesya Straub-Bilan - University of Stuttgart, Fernando Cuesta - SAES Ingenieros, Marieke van den Berg, Paul Quak - Draaijer + Partners

Construction today faces numerous challenges at industry and society level. One of them is the increased focus on end-users as stakeholders of a building. As a consequence, innovative present-day planners do no longer design a building as a living or working premise, but as a living or working experience. This has increased the role of services as an incremental part of a building "solution". This development is in line with current trends of the European economy as a whole, where services have emerged – e.g. in machine building and plant construction – as an indispensable part of future solutions offered to customers. It is no longer products but product-service combinations efforts are concentrated on.

A field of vast opportunities but also challenges. The key problem of services is their intangibility, which makes it hard to communicate their value to the customers but also other stakeholders in the process. In addition, there is a lack of tools, especially in the construction industry, for the development, management and visualization of services.

Another problem of services in construction is that they are often still considered as some kind of "add-on" to the real product, so that their planning only starts once the building has been finished – which is way too late for designing a holistic product/service concept as other industries do. Apparent problems are that buildings, in an approach like this, are not planned for the future services – a fact that can make their later integration quite difficult. And there is often no possibility for providing feed-back loops in between the services and the building, with huge potentials for future improvement being lost.

I3CON tackles this interesting but difficult topic by focusing its work

specifically on lifecycle services, i.e. complete lifecycle, from services that optimise the performance of a building during its complete lifecycle, from definition to production, use and destruction/refurbishment.

Another focus is on service bundles, as there are usually various services



involved in a building that need to be coordinated and harmonized.

A first tool resulting from the I3CON work on services is the I3CON Service Engineering Approach, a step-by-step approach enabling the industrialized development of new services in a similar way as it is done for products. The approach is based on a sequence of five steps:

- assessment of the current status;
- definition of the service idea;
- development of the service concept;
- customisation of the service to client needs;
- operation and maintenance of the service.

These five steps are supported by a modular toolbox. Each step ends with a checklist that helps to assess if all aspects involved in this step have been successfully considered.

The service development approach has been tested for some new services that I3CON proposes.



Liza Wohlfart

A key target of this work is on managing the BMS independently from the manufacturers.

Another is on smell-sensitive sensors integrated within the HVAC system, so-called "e-noses". These e-noses keep track of the air quality to, for example, warn on hazardous fumes or high levels of atmospheric carbon dioxide.

The service configuration software tool, another I3CON result, helps to draft customer-specific service bundles out of single service modules in a visual way. To do so, the single service modules have been linked to specific building components.

The tool shows the lifecycle costs of each component including production, maintenance, cleaning, etc. and thus helps to consider them early in the design phase of a building, where the tool is supposed to be used.

(continued overleaf)

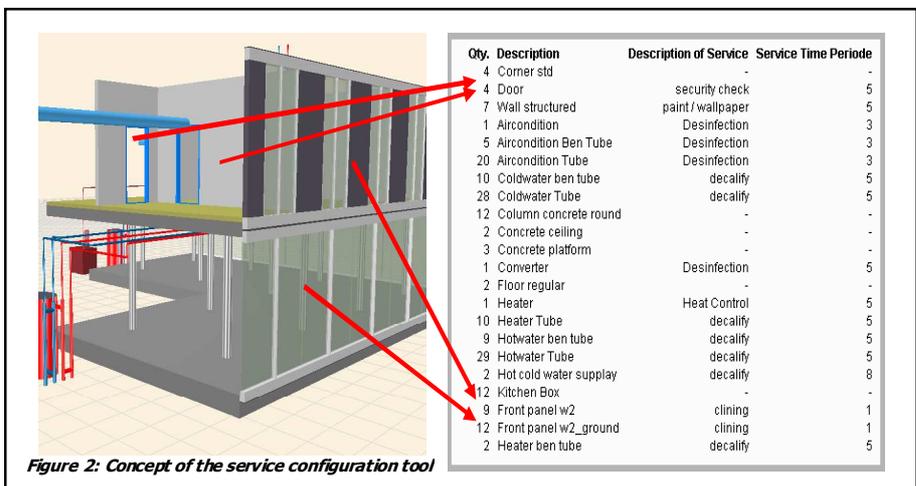


Figure 2: Concept of the service configuration tool

A key advantage is that all services can be selected on the basis of the building's graphical design, illustrated in a 3D tool. Additionally, due to the modularisation of the services, the components of a service can be easily selected and deselected, exchanged and modified, which eases the consideration of different alternatives.

Designing service bundles is one thing. Coordinating and communicating them are additional challenges I3CON deals with. Coordination of service bundle delivery will be done by means of a method that supports the collaboration with providers and customers through streamlining process flows.

Service communication is the focus

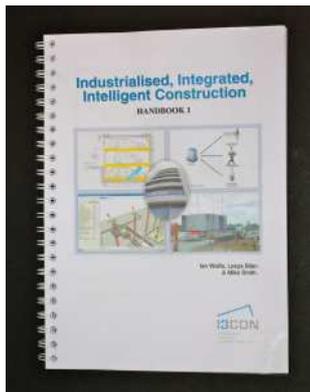
of another tool to be developed: a services dashboard. This will provide up-to-date information on services to customers, informing them in an effective and easy-to-use way about key figures like energy consumption.

Upcoming newswires will show more process flows. Service communication is the focus of details on the different tools and methods presented in this paper. As the work in I3CON faces the same problem as services in general do – how to present something intangible – a set of use case scenarios have been created in order to better illustrate them. Want to know more? Keep track of the next wires!

WP7 First I3Con Handbook published

By Lesya Bilan - University of Stuttgart

During the third year of the project, the first volume of the I3CON book has been published online. Beside the consolidated information on the project's approach in general, this issue contains project achievements at their current stage and introduces a number of industrialised, integrated, intelligent solutions for the construction industry.



The concepts that are introduced in this book are accompanied by the guidelines for their application in practice. Some papers include preliminary results and the initial feedback on the implementation of the new concepts.

The chapters of the book deal with different aspects of construction systems, service concepts and processes which are characteristic of the construction industry.

A method of performance measurement for the construction industry is introduced along with modelling approaches which are based on the profound analysis of the requirements of construction industry stakeholders: architects, project developers, suppliers, consultants, financial institutions and of course users of different types of buildings. The final section of the book is dedicated to the first demonstration results, as well as to the training concepts in scope of I3CON.

The published contents will not only be interesting and useful for industry practitioners, but also aim to attract attention of building owners and users as well as researchers and academia who are involved in the construction sector. The present volume of the I3CON book contains the contribution of project partners



Lesya Bilan

only, with the profound analysis of the current state in the construction sector and the outline of future actions for research and industry, introducing ideas, concepts and solutions.

It will be followed by the second volume, which will present most of the project results and will also be extended by the contributions of external authors who are inspired and motivated by the idea of I3CON: Industrialised, Integrated, Intelligent Construction.

Forthcoming Events

Date	Title	Format	Location
22nd September 2009	Building - BYGG REIS DEG	Exhibition	Lillestrom, Norway
23rd September 2009	Machine Building Construction of Equipment	Exhibition	Helsinki, Finland
24th September 2009	Energy Efficient Construction and Renovation RECONSTRUCT 2009	Exhibition	AFAG Augsburg, Germany
5-9th October	Changing Roles - New Roles, New Challenges	International Conference	Noordwijk Aan Zee, the Netherlands.
25th October 2009	Building Construction - INTERBUILD 2009	International Exhibition	NEC Birmingham UK
3rd November	Building and Construction PLAN EXPO	Exhibition	RDS Dublin, Rep. Of Ireland
17th-19th May 2010	16th International Conference of the CIB W104 Open Building Implementation on "Open and Sustainable Building"	International Conference	Bilbao, Spain

I3CON Newsletter

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