

# IHE/HL7 Implementation Guide for eSupply

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## Abstract

The use of eCommerce solutions in the German health care market is hindered by fragmented solutions and lack of guidance to the use of standards. Especially the area of procurement is mainly dominated by proprietary solutions. Also, the splits in the area of information transfer - which are attributable to the non-coverage usage of standards - result in delays, transcription errors, wrong orders and patient confusion. The project "Standards zur Unterstützung von eCommerce im Gesundheitswesen" (eCG) was launched in August 2012 and is funded by the German Federal Ministry for Economic Affairs and Energy - "Bundesministerium für Wirtschaft und Energie" (BMWi) - within the programme "Mittelstand Digital". The eCG project consortium consists of "Hochschule Niederrhein" (HSNR), "Zentrum für Informations- und Medizintechnik der Universitätsklinik Heidelberg" (ZIM), The German Medical Technology Association "Bundesverband der Medizintechnologie" (BVMed e.V.) and "Integrating the Healthcare Enterprise" in Germany (IHE Deutschland e.V.).

One of the main goals of this project is to design a sustainable supply system for healthcare and subsequently produce a significant increase of potentials for efficiency within the health sector by developing interoperability between different, already used standards in the healthcare and the logistics domain. After a literature research and analyses of business processes in hospital new IHE Integration Profiles were modeled in order to describe the interaction between different (software) actors in a hospital starting with ordering products in a point of care until buying it by an external vendor. These profiles are described in an implementation guide "eSupply in Healthcare". For transactions between the actors HL7 v2 messages and GS1 standard were used.

## Keywords

Health Information Systems, eSupply, Interoperability, eCommerce, eStandards, eProcurement, Health Level Seven

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## 1 Introduction

The use of eCommerce solutions in the German health care market is hindered by fragmented solutions and lack of guidance to the use of standards. Especially the area of procurement is mainly dominated by proprietary solutions. Also, the splits in the area of information transfer - which are attributable to the non-coverage usage of standards - result in delays, transcription errors, wrong orders and patient confusion. The project "Standards zur Unterstützung von eCommerce im Gesundheitswesen" (eCG) was launched in August 2012 and is funded by the German Federal Ministry for Economic Affairs and Energy -

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healthcare and the logistics domain. This article’s main focus is on the role of IHE Germany e.V. in terms of the desired interoperability between GS1 and HL7 standards and messages and associated terminologies.

## 2 Objectives

### 2.1 Integrating the Healthcare Enterprise (IHE)

”Integrating the Healthcare Enterprise is an initiative by healthcare professionals and [IT system] industry to improve the way computer systems in healthcare share information” [1]. In 1998 the initiative was founded by the Healthcare Information and Management Systems Society (HIMSS) and the Radiological Society of North America (RSNA). [2] IHE is an international organization with established national deployment committees in 17 countries across the world [3]. IHE does not provide additional standards but specifies the harmonized use of already established standards. The initiative develops and publishes comprehensive, generic technical profiles which

can be used for implementation of IHE compatible systems within the healthcare sector. Proven IHE profiles already exist for instance in the domains of radiology, cardiology and pharmacy. It is planned to develop and harmonize a profile specific for some new domain for ”eSupply in Healthcare” within the project eCG [4].

### 2.2 GS1

With large corporate members in over 100 countries around the world, the, non-profit organization GS1 is one of the key providers of supply chain related standards. In general logistics (”MaWi”) especially the GS1 identification standards e.g. GTIN (for orderable items), GLN (for addresses and contacts) and transaction standards like GS1 XML ”catalogue item notification” (for item master data) are widespread and widely-used. Since GS1 standards are predominantly used to enable an efficient electronic communication between commercial partners they are mostly used in the supply departments of clinical institutions – but not on the rather care-oriented IT systems. One of the main preconditions to avoid media discontinuity and interface problems is to integrate product infor-

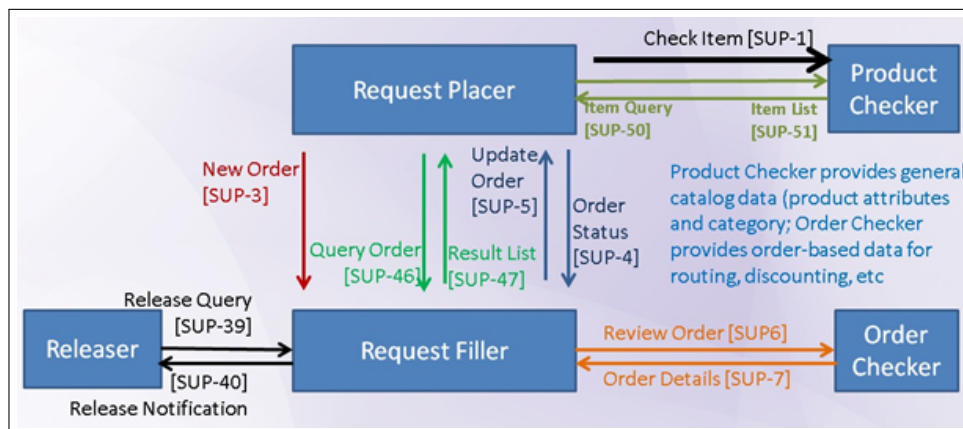


Figure 1: Possible IHE integration profile for Clinical Order.

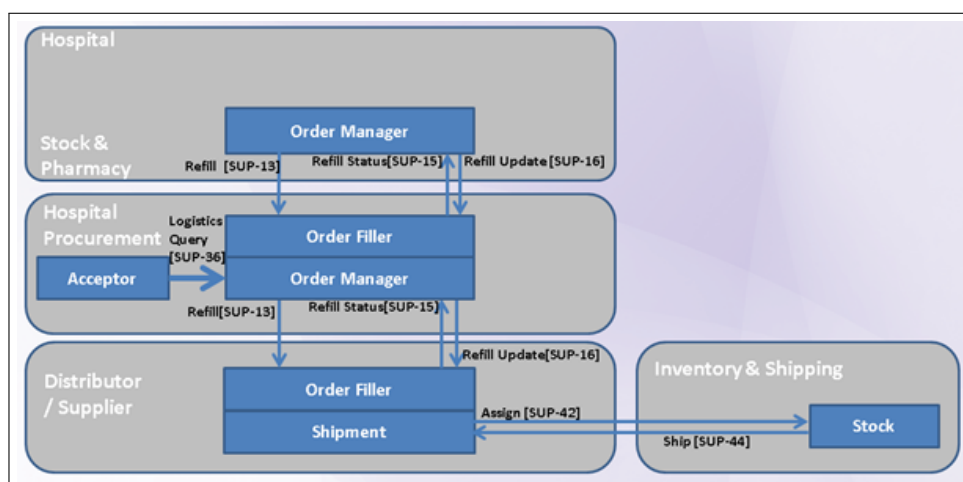


Figure 2: Possible IHE integration profiles for Supply and Stock management.

mation from the GS1 standard system into departmental IT and point-of-care IT systems [4].

### 2.3 GS1 & HL7 & IHE

Within a "Memorandum of Understanding" in the year 2007 HL7 and GS1 declared their purpose of cooperation with the aim of developing global standards to improve patient care. In October 2013 at GS1's semi-annual Healthcare Conference they renewed their Memorandum of Understanding to work together to reduce medical errors and improve the efficiency of the supply chain within the healthcare market [5]. "For example, it is requested to integrate GS1 identification standards and attributes into HL7 messages to make them available within the clinical information systems" [4]. Within the project eCG a specific guideline for "eSupply in Healthcare" is going to be developed which defines the interaction between HL7 and GS1 standards with terminologies such as eCI@ss, Pharmacy Product Number (PPN / PZN) and SNoMed CT in special integration profiles [4].

## 3 Methods

As a foundation for practical generic profiles IHE analyzes typical clinical use cases and – driven by the architectural principles of decoupling and information cohesion – defines IHE integration profiles with independent, stateful "actors". Each integration profile specifies actors by their information as well as their communication interface – the so-called IHE transactions. The content of these transactions is based on existing international standards like DICOM and HL7 and is defined in the transaction specification. The IHE integration profiles together with the related transaction specification make up a Technical Framework – each grouped for a medical domain.

IHE profiles offer a common language for both healthcare professionals and vendors to discuss their special needs. The development cycle for IHE integration profiles describes how these profiles have to be discussed, documented, reviewed and tested [6]. Both parties can refer to integration profiles when they identify required actors and transactions to describe a specific clinical IT solution. On the other hand the profiles are generic enough to allow adaption to a given IT environment.

The use-cases of project eCG describe mostly a "supply" scenario where an order is dedicated to fill the customer's local stock or notify consumption from the stock. That means that in the normal use-cases of the project eCG, there is no need to transmit patient data nor dispense or prescription data to logistics IT- systems.

The proposed Integration Profiles for eSupply shall integrate clinical IT systems with logistic IT systems and material management IT systems. Within the eCG – project IHE performed an initial analysis of the results provided by literature research, questionnaire survey and process and system analysis. Afterwards the Integration

Profiles were modelled and the transactions were specified as HL7 v2 messages or GS1 messages.

## 4 Results

Nine distinct areas where the IHE approach may improve the procurement and supply in hospitals have been identified. Those nine areas are potential candidates for IHE integration profiles for eSupply:

- "Point-of-care order: Order of stock-keeping or non-stock-keeping products performed by an end user like a physician or nurse
- Catalog management: Maintenance and distribution of product master data and supplier information
- Stock management: Reorder of stock-keeping products and stock-control
- Claims and payments: Management and handling of invoices, creditors, liabilities, demand notes and credit items (in case of product returns)
- Assets invested: Identification and tagging of assets for inventory and further tracing
- Supply chain intelligence: Methods regarding commercial and technical analyses of the supply chain and the procurement process
- Logistics and distribution: Management and optimization of the physical distribution regarding the ordered products
- Quality and validation: Total data quality management with regard to the entire procurement and supply process
- Medical reasoning and lookup: Clinical/pharmacological knowledge base for inference, e.g. as a support for searching a specific product" [7]

The eSupply scenario relies on a clinical IT-system which accesses a product catalog and compiles a clinical order that is being forwarded for further processing.

The eCG solution is to describe a generic sequence covering most of the practical clinical order use-cases, which suggests to identify the following attributes [8]

- Customer (order placer)
- Product
- Quantity and Packaging
- Global Trade Item Number (GTIN)
- Price
- Seller / Supplier

- Supply Contract

Two IHE integration profiles for eSupply are described exemplarily.

#### 4.1 Point-of-care Order

The IHE candidate integration profile Point-of-care order describes the creation and internal forwarding of an electronic procurement order starting from a REQUEST PLACER (former Order Placer) – at this point of the workflow the clinical order is not a legal order, but an internal request – at the point-of-care towards an internal REQUEST FILLER (former Order Responder) like e.g. an internal procurement office. Before the request is sent to the request filler the PRODUCT CHECKER verifies the clinical order which may contain one or multiple different items, each describing a product that is specified in a hospital's product catalogue. The REQUEST FILLER receives the checked items as a clinical order, subsequently the ORDER Checker (former Order Reviewer) examines the order as a whole and may respond with a modified order which may substitute the ordered items, change the units of measure or just adjust the quantities of the order [7]. The REQUEST FILLER is also responsible for the delivery, manufacture or purchasing of the items. REQUEST PLACER implementations do not manage state – neither product catalogue nor list of pending orders – and therefore can easily be implemented by lightweight clients at the point-of-care, as thin "apps" in the Hospital Information system (HIS).

#### 4.2 Stock Management

Another important IHE integration profile is Stock Management which describes the physical resupply of the department / hospital stock by the actor ORDER MAN-

AGER. According to appointed refill strategies, the ORDER MANAGER actor sends a refill request to the ORDER FILLER. It is responsible for providing the required items.

In a complex supply chain these actors can be cascaded. The "ORDER FILLER" itself can play the role of an "ORDER MANAGER" and send a refill order to another "ORDER FILLER". The Stock Management profile can therefore be used to implement several organizational levels of stock-keeping within a hospital and its suppliers. [8]

#### 4.3 Combination of different IHE integration profiles

It is also possible to combine various IHE integration profiles and its associated actors. Figure 3 shows the combination of the cascaded profile Supply and the profile Shipment.

It must be noted, that eSupply can also be combined with actors of the IHE profiles from Pharmacy, IHE Information Infrastructure or, Radiology.

#### 4.4 Transactions

The above mentioned transactions were described by HL7 v2 and GS1 transactions. HL7 messages were used for internal clinical messages and GS1 transactions to order products from an external vendor. Global Trade Identification Numbers (GTINs) can be used to identify products within RQD segments of OMS stock order messages in HL7 v2.

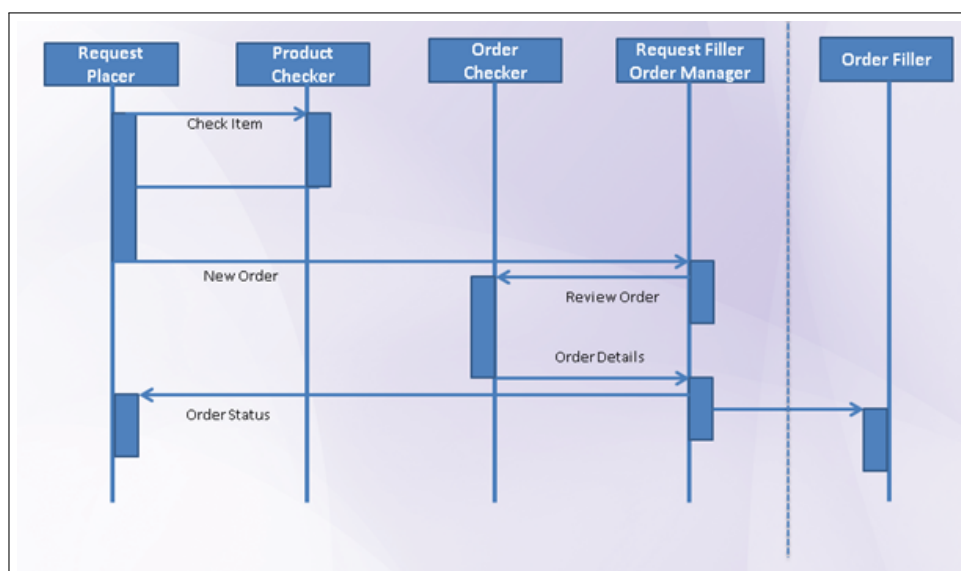


Figure 3: Example sequence for order process based upon potential IHE integration profiles.

## 5 Discussion

Almost every stakeholder within the healthcare industry expects a guidance regarding the realization and planning of electronically supported procurement and supply processes [7]. The proposed IHE integration profiles for Clinical Order and Supply specify a flexible, scalable architecture for electronic procurement in the hospital. Due to the use of GS1 identifiers in HL7 and GS1 based messages it is possible to bridge the gap between the clinical applications and external vendors.

These actors shall now be tested by implementation and integration into a Hospital Information System.

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