

Practical aspects to realize data transfer between a patient administration mastersystem and clinical subsystems using ProtoGen/HL7



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1 Introduction

At the Medizinische Einrichtungen Bonn the module IS-H of SAP R/3 is used for patient administration. Now the new and updated demographic and visit information (admission, discharge, transfer; called ADT messages) regarding all patients are entered into IS-H. Every patient gets a persistent unique identification number to which all patient information is subordinated.

The availability of the ADT information makes the transmission of any patient information feasible; e.g., for sending an order to a laboratory, getting back the result report or admitting information and medical images inside a PACS.

2 Methods

2.1 Communication server e*gate

To eliminate custom interface design and reduce costs we decided to use HL7 – an application protocol for electronic data exchange in healthcare environments [1, 2]. Due to the planned introduction of DRG's in Germany HL7 version 2.3 was selected. SAP R/3 only supports HL7 in version 2.1. Therefore the communication server gets the ADT messages in HCM – a proprietary connection protocol of SAP R/3 – and converts it into the current HL7 version 2.3. Data filtering and transformation of the HCM messages is performed by a communication server (e*gate 3.6.2 from STC). IS-H offers over seventy events which we convert into fifty-one HL7 events. We have to decide which of the events include the significant information for the external system. For example, for an outpatient visit IS-H creates three different events:

- NP0100 open demographic patient information
- NP4000 open case
- NP4110 outpatient visit

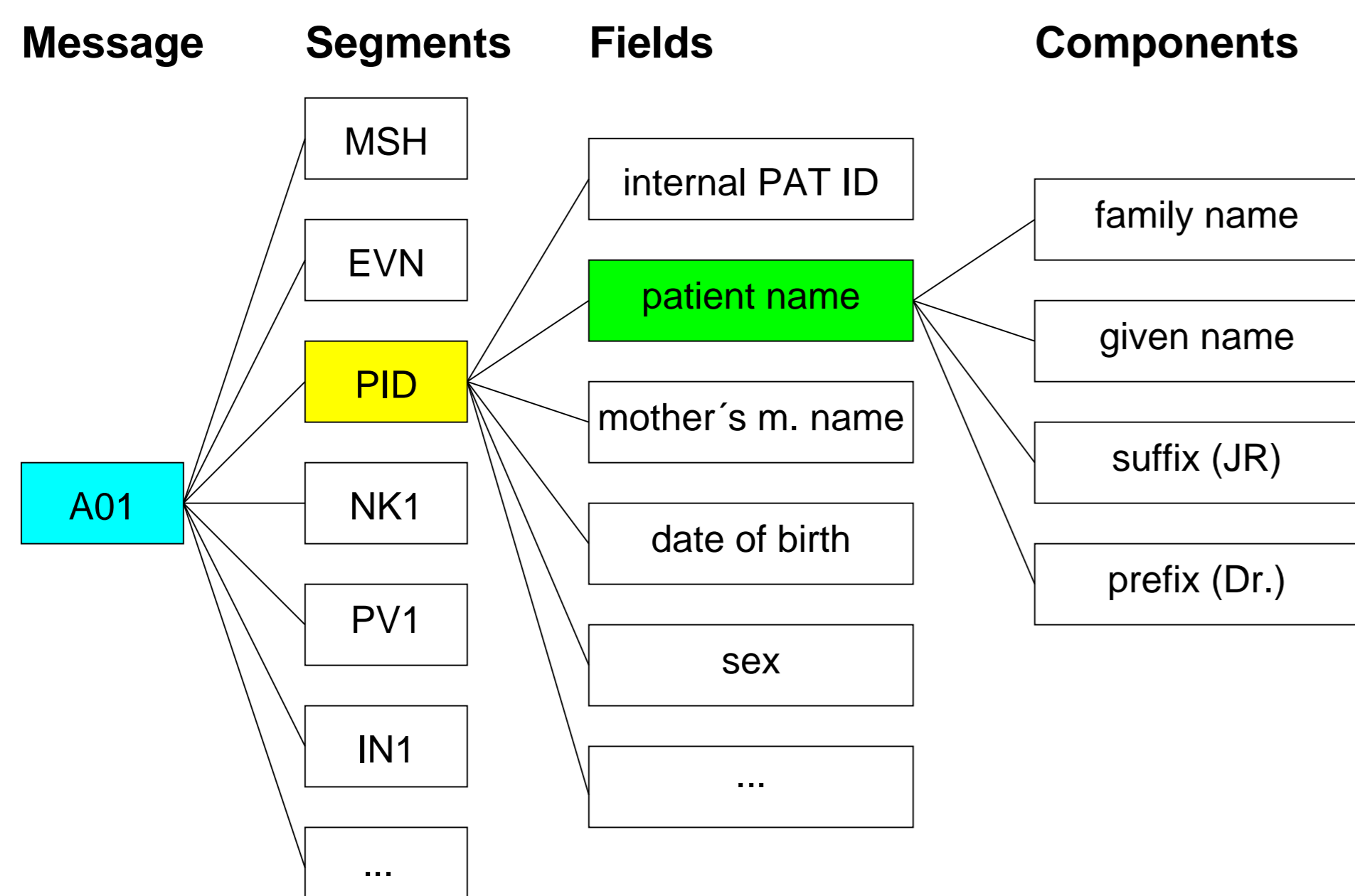
The communication server only recognises the NP4110 event and converts it to a A04 message. The pilot interface to the subsystem of the HNO-Klinik [6] supports the messages listed below:

Description	HCM-Event	HL7-Event	Description	HCM-Event	HL7-Event
admission inpatient	NP1110	A01	update transfer	NV1210	A08
admission inpatient/short form	NV0410	A01	update outpatient visit	NP4210	A08
admission inpatient/emergency	NV0710	A01	update outpatient visit/short form	NV4510	A08
Transfer	NV1110	A02	update outpatient visit/emergency	NV4810	A08
Discharge	NP9710	A03	update discharge	NP9810	A08
outpatient visit	NP4110	A04	update admission inpatient	NP1210	A08
outpatient visit/short form	NP4410	A04	update admission inpatient/emergency	NV0810	A08
outpatient visit/emergency	NP4710	A04	update admission inpatient/short form	NV0510	A08
change an outpatient to an inpatient	NWFASI	A06	cancel admission inpatient	NP121S	A11
change an outpatient to an inpatient/short form	NWFAKI	A06	cancel transfer	NV121S	A12
change an outpatient to an inpatient/emergency	NWFANI	A06	cancel discharge	NP981S	A13
change an inpatient to an outpatient	NWFSAI	A07	cancel outpatient visit	NP421S	A11
change an inpatient to an outpatient/short form	NWFSKI	A07	merge patient - internal ID	NP0600	A40
change an inpatient to an outpatient/emergency	NWFNSI	A07			

A HL7 message consists of several segments as shown in the following sample message for the admission of an outpatient visit:

```
MSH|^~\&|ISH|0001||19990927161439||ADT^A01|199909271615190164|P|2.3||NE|NE|DE
EVN|A04|19990926153853||P
PID||03021168^2^||Langenberg^Stefan^^^^|Langenberg|19670221|M||Bennauerstr. 24^^Bonn^^53115^DE|...
NK1|1|Langenberg^Julius|^ISH|Bennauerstr. 24^^Bonn^^53115^DE|^PH
PV1||O|00000451^^00000004|||||||||N|||02025617^7^|K||K|||||||||19990926153853
DG1|1|471.8^Sonstige Nebenhöhlenpolypen^I9|^ED
IN1|1|0004612031^AOK Rheinland Bonn|Heisterbacherhofstr. 4^^Bonn^^53111^DE||||||||||
```

Each segment is defined by three letters to represent its type, such as PID (patient identification). Segments are composed of fields which may be further subdivided by components:



A specialty of IS-H is the possibility of extensive customizing. Therefore we have to transform a lot of different attributes in user-defined tables for similar data fields. For example the EVN segment – used to transfer necessary trigger event information to receiving applications – contains in one field the reason for the event. For an outpatient visit IS-H offers the possibility of forty reasons. To minimize the expense of maintenance we decide to adopt all attributes as a string. However, the meaning of the attributes has to be forwarded to the managers of the subsystems if new attributes are added.

2.2 ProtoGen/HL7

Existing subsystems can be equipped with a HL7 interface using the class library ProtoGen/HL7 [5] written in GNU C++. The source code of this library is freely available under the GNU-copyright. The library defines distinct classes for data-types, segments and messages of HL7:

```

Message
class HL7Message:
public SegStruc
{
public:
MSHseg MesHea;
// ...
};

class EvnMessage:
public HL7Message
{
public:
EVNseg EventType;
// ...
};

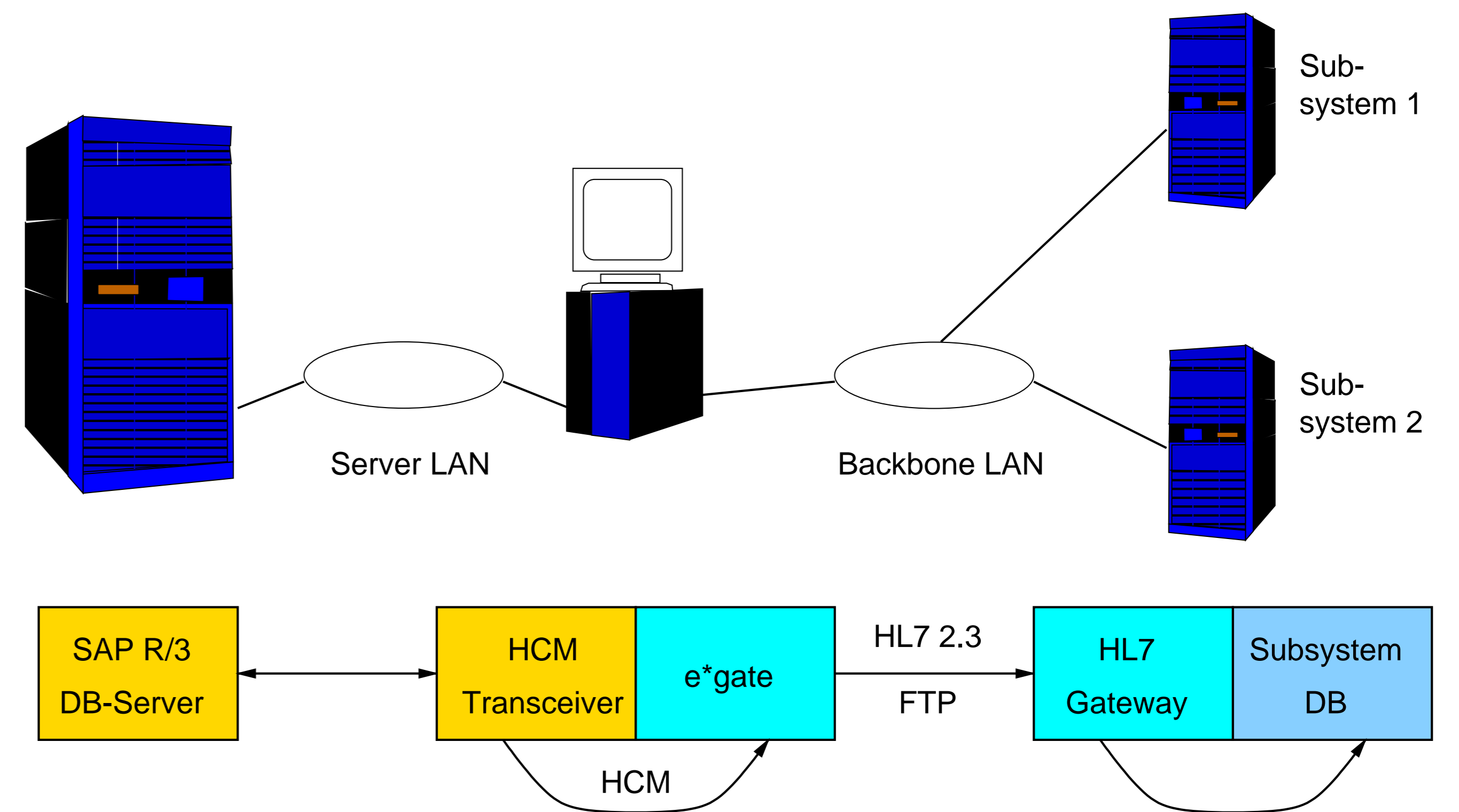
class ADT_A01msg:
public EvnMessage
{
public:
//patient identification
PIDseg PatId;
//next of kin
repstruc<NK1seg> NextOfKin;
//patient visit
PV1seg PatVisit;
//patient visit-add.inf.
PV2seg PatVisitAddInf;
// ...
};

Segment
class PIDseg : public Segment
{
public:
S1typ SetIdPatId;
CT1typ PatIdExtId;
//patient id (internal id)
repfield<CKtyp> PatIdIntId;
ST1typ AltPatId;
//patient name
NT1typ PatName;
//mother's maiden name
ST1typ MotSMaiName;
//date of birth
T1typ DateOfBirth;
//sex
SexCode Sex;
repfield<PNTyp> PatAlias;
//address
repfield<ADtyp> PatAdd;
ID1typ CouCode;
repfield<TNtyp> PhoneNumHome;
repfield<TNtyp> PhoneNumBus;
ST1typ LanPat;
MarStatusCode MarStatus;
// ...
};

Field
class PNTyp : public Composite
{
public:
ST1typ FamName;
ST1typ GivenName;
ST1typ MidIniOrName;
ST1typ Suf; //suffix
ST1typ Pre; //prefix
ST1typ Deg; //degree
// ...
};
    
```

With this library HL7 interface applications can be built which parse HL7 messages on the input and interact with a subsystem database on the output side using a native database interface or ODBC. The current version 1.3 of ProtoGen/HL7 implements the complete HL7 2.2 standard. Since the HL7 2.3 standard is not already supported by ProtoGen/HL7 the source code has to be extended in order to be capable to parse 2.3 messages. Especially the ADT-A40 message for patient data merging had to be added to the library.

We chose Linux as operating system platform for the HL7 interface application. Standard PC hardware can be used for Linux which is also GNU copyrighted. Further Linux supports a lot of networking standards (TCP/IP, IPX and others), thus a simple integration into heterogeneous Unix/Windows environments is possible. The HL7 messages are transferred from the communication server to the Linux HL7-gateway by using the ftp protocol. The HL7-gateway is acting as ftp server:



The use of secure socket shell copy scp instead of the ftp-protocol is intended for the future. In addition to the pilot Linux HL7-gateway two additional gateways are running in test mode at this time.

3 Discussion

Supplying the clinical subsystems with ADT messages and as well with a unique patient identification number allows a communication transfer between different hardware and application systems. This ensures that all systems are talking about the same patient. Multiple patient data acquisition is no longer necessary. This fact is especially important to guarantee a high level of quality in a healthcare system.

The transformation of HCM to HL7 implicates the loss of some information. For example the postal address of the admitting and consulting doctor is transmitted by HCM, but not by HL7, because HL7 lacks an address field in PV1 the patient visit segment.

Although some time has been spent to modify the ProtoGen/HL7 library and to build an interface application, time and money can be saved by interfacing subsystems via HL7 to IS-H, instead of building special interfaces for each subsystem on the communication server.

References

- [1] HL7 STANDARD VERSION 2.3 ©1997.
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- [4] G. Schadow, ProtoGen/HL7 – an implementation of HL7 in C++, <http://aurora.rg.iupui.edu/~gunther/>, 1996.
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