INTERIM REPORT No. 1

Strengthening of Statistics Health Information System and its Harmonization with EU Requirements

Information System of Health Indicators

Contract No. 200300499503-0601-0003

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Contents

Used abbreviations

Abbreviation	Description
ASCII	American Standard Code for Information Interchange
CCTA	Central Computer and Telecommunications Agency
CFCU	Central Finance and Contract Unit
CRHCP	Central Register of Health Care Providers
CRMS	Central Register of Medical Staff
CSV	Comma Separated Value
DMZ	Demilitarized zone
DRY	Don‘t Repeat Yourself
EU	European Union
GUI	Graphical User Interface
HCP	Health Care Provider
HCSA	Healthcare Supervision Authority
NHIC	National Health Information National Centre
IHIS	Institute of Health Information and Statistics, since 01. 03. 2005 transformed into National Health Information Centre.
ISO	International Organisation for Standardisation
ISHI	Information System of Health Indicators
J2EE	Java 2 Platform Enterprise Edition
LAN	Local Area Network
MIS	Managerial Information System
MS	Microsoft
ODBC	Open DataBase Connectivity
OECD	Organisation for Economic Co-operation and Development
OLAP	Online Analytical Processing
OMG	Object Management Group
PPN	Public Private Network
RU	Reporting Unit
SAD	Small Auxiliary Database
SR-MH	Ministry of Health of the Slovak Republic
SR	Slovak Republic
SRU	Set of Reporting Units

Abbreviation	Description
STN EN ISO	Slovak Technical Standard for the Quality Management System
SW	Software
UML	Unified Modelling Language
WHO	World Health Organisation
XLS	Microsoft Excel File Format
XML	Extensible Markup Language

1. Introduction

1.1. Document objectives

The submitted document contains the Interim solution status report of the project Development of ***Information System of Health Indicators*** (hereinafter referred to as ISHI) as compared to the goals and project schedule approved within *the Inception Report* of the project after the closing of project stages Development of **SW Solution** and **Documentation Elaboration.**

Formally, delivery with ID 2 under 2.4 Project outcomes is concerned.

1.2. Document contents

In the first chapter, document objectives, its contents, references to other documents and the list of terms and abbreviations are provided.

The second chapter contains goals, stages, detailed working plan and overview of project deliveries according to the approved *Inception Report*.

The third chapter provides the description of closed stages *Development of SW Solution* and *Documentation Elaboration,* summarizes results of individual stage phases or of the whole stages, describes major issues being solved within the stage as well as resulting modifications in the project scope and working plan.

The fourth chapter depicts the modified project working plan.

In the fifth chapter, requirements laid on recipients cooperation, providers obligations and limits of remaining project stages are outlined.

In the last sixth chapter, risks potentially affecting successful and timely project closure are being identified.

1.3. Document references

This document refers to the documents listed in the following table:

Document ID	Document name
CR	Competition requisites
CON	Contract
OFR	Offer of the company Softec s.r.o.
INREP2	Inception Report of the ISHI project, version 2.0
Mi	Minutes of the i-th analytical meeting, i being 1 to 16
DesignV2	Design of the ISHI system, version 2.0 – referred to in the document as approved design of the ISHI system.

1.4. Terms and abbreviations

The following list of terms provides the terms in alphabetical order which may be differently interpreted. For each term the detailed explanation is provided. Abbreviations with definitions are also included. In the definition part, single standing terms are indicated in bold.

For the sake of completeness, the list contains terms and abbreviations defined in the requirements analysis and new terms and abbreviations used in this document are added.

Term	Definition
Application function	Named part of the programming code with defined inputs and outputs providing specific functionality of software system for the respective application / objective field, as opposed to technologic functionality.
ASCII	American Standard Code for Information Interchange
Attribute	Basic element of the class.
CCTA	Central Computer and Telecommunications Agency
CFCU	Central Finance and Contract Unit
Class	Complex data type with structure consisting of basic elements. Basic elements are attributes (synonym for items). Database table is the mostly used data entity in conventional relational database. In more modern technologies, data structure can be more complex and may include functionality.
Component	Term introduced in SAD. Statistical data serving for the calculation of statistical indicator. Majority of HI is represented by just single component.
Cost centre	Part of the organization being monitored and evaluated for economic data.
CRHCP	Abbreviation for the Central Register of Health Care Providers. It contains licence data for healthcare provision completed by data resulting from statistical survey.
CRMS	Abbreviation of the Central Register of Medical Staff.
CSV	Comma Separated Value – type of a text file containing items separated by agreed separator. Following separators are assumed within this project - comma, semicolon or tabulator.
Data diagram	Diagram containing data entities and relations between them. In the UML language it is called class diagram (or static structure diagram).
Data element	Status of data entity within the given attribute, individual data for a statistical unit; this can be also sorting character, e.g. items in reports.
Demilitarized zone	Part of computer network separated from the internal organization network as well as from the internet. It shall provide safe separation of internal computer network from the internet.
Design	Stage of the software system development. In the RUP methodology, it follows after the stage *Analysis.* The goal of this stage is to specify the system architecture in detail as well as use cases for the selected programming environment.
Diagram of activities	UML language diagram. Often used for graphic presentation of *Process*.
DMZ	Abbreviation for demilitarized zone.
DRY	Don‘t Repeat Yourself – a slogan being principle of WAFT framework which is applied for the design of ISHI web application.
EPIS	Infectious Disease Monitoring Information System for Public Health Offices
EU	European Union

Term	Definition
External Interface	Interface to the other software system. In the case of conventional software systems, data structure for sending data from the one system to the other was assumed. For modern systems, also another aspects can be added such as the name of called service / function etc.
FAAST (FAAST C++)	Framework developed by the company Softec for the design of client/server applications featuring thick client.
FK	Foreign Key.
Framework	Supporting structure applicable for the development of software systems. Typically its consists of code libraries, auxiliary software and scripting languages helping the developer to design and interconnect software system components.
GUI	Graphical User Interface
HCP	Abbreviation for Health Care Provider.
HCSA	Healthcare Supervision Authority
Health Care Provider	a) NP or LP providing healthcare based on permission under the Act No. 578/2004 § 3 Section 4 b) or b) NP, providing licensed healthcare under the Act No. 578/2004 § 3 Section 4 c) or the Act No. 578/2004 § 3 Section 4 d).
Health Indicator	Numeric data item of the ISHI system being object of outputs which are provided to various users.
HI	Abbreviation for Health Indicator.
NHIC	National Health Information Centre. The organization, the original project recipient ISHI – IHIS was transformed into.
HTU	Higher territorial unit. Self-governing body with the competence to approve operation of the medical facility.
IDMIS	Infectious Disease Monitoring Information System for Public Health Offices (also abbreviated as EPIS)
IHIS	Institute of Health Information and Statistics
Indicator	Aggregated statistical data.
ISO	International Organization for Standardization
ISHI	Information System of Health Indicators
Item	Synonym for attribute.
J2EE	Java 2 Platform Enterprise Edition
LAN	Local Area Network
Logical collection	It is defined by single form – and by reporting duty of the RU towards the form.
LP	Legal Person.
Manager information system	Software technology based on data storage in the form of multidimensional cubes. It is primarily applied for complex or ad hoc data analyses.
ME	Abbreviation for Medical Employee.
Medical Employee	Physician, dentist, pharmacist, nurse, midwife, laboratory technician, assistant, technician, other medical staff.
Medical Facility	Facility in which healthcare is provided on the basis of licence granted by SR-MH or HTU. Field of activities provided in the respective facility shall be specified in the licence. Relation between medical facility and its special departments is not exactly regulated.

Term	Definition
MF	Abbreviation for Medical Facility.
MIS	Abbreviation for Manager Information System
MS	Microsoft
NP	Natural Person.
NUTS	Categorization system of regional and statistical units (according to the French name Nomenclature des Unités Territoriales Statistiques) elaborated by Eurostat which serves for purposes of social, economic and structural analyses of territorial units.
ODBC	Open DataBase Connectivity
OECD	Organisation for Economic Co-operation and Development
OLAP	Online Analytical Processing
OMG	Object Management Group
Permission holder	NP or LP granted permission by competent administration body to operate health facility.
PGSS	Abbreviation for Program of Governmental Statistical Surveys.
Physical collection	For the respective RU it is defined by any forms having reporting duty to RU.
PK	Primary Key.
VPN	Virtual Private Network
Process	Sequence of work activities applied in the respective organization/enterprise in line with the mission of the organization/enterprise usually leading to production or provision of services. Activities can be both non-automatized and automatized (supported by software system).
Rational Unified Process (RUP)	Methodology developed by the company Rational (at present, part of IBM) for the development of software systems. This methodology is based on the application of UML language for the specification of system architecture, utilization of use cases and iterative/incremental system design.
Report	Status of statistical unit provided by reporting unit within single collection. It contains cumulated statistical data.
Reporting (report or message)	It includes data of a single person – patient or insured person or HCP, ME.
Reporting Unit	Person (natural person or legal person) (e.g. HCP, drug dealer, HCSA, Statistical Office of the SR etc.) or ME's employer. Only a person (natural person or legal person) can be obliged to reporting duty. RU is regulated by the following Acts: the Act No. 540/2001 Coll. on State Statistics and the Act No. 576/2004 Coll. on healthcare, services related to healthcare provision and on amending and supplementing certain acts.
Role (user's role)	Type of the software system user. Usually, it is equivalent to the working position in the organization. In the case the working position comprehends several different types of activities, multiple roles are being created. With the organization, one role can be assigned to more employees.
RU	Abbreviation for Reporting Unit.
SAD	Abbreviation for Small Auxiliary Database. Database of health indicators which was part of procurement documents.
SD	Abbreviation for Special Department.
Set of Reporting Units	Set of reporting units which are obliged to submit report/message within the respective collection.

Term	Definition
SGML	Standard Generalized Markup Language.
Specialized department	Part of medical facility providing specialized activity which is the object of statistical monitoring (e.g. ward, outpatients, workplace, etc.). The term has not its own legislative definition.
SR	Slovak Republic
SR-MH	Ministry of Health of the Slovak Republic.
SSU	Abbreviation for Set of Statistical Units.
Statistical Unit	Elementary unit, element of statistical survey.
STN EN ISO	Slovak Technical Standard for the Quality Management System
SW	Software
SU	Abbreviation for Statistical Unit.
Testing procedure	Sequence of steps to verify certain system functionality.
UML	Abbreviation for Unified Modelling Language
Unified Modelling Language	System of graphical languages for the specification of software systems from various perspectives. It is standardized by the OMG consortium and is applied de facto as an industrial standard for software graphic specification.
Use case	Sequence of activities exercised by system user and software system during system utilization by user.
Variable	Within this document, it has the meaning of the synonym to data entity item.
W3C	World Wide Web Consortium
WAFT	Framework developed by the company Softec for the development of web applications.
WHO	World Health Organization
XLS	Microsoft Excel File Format
XML	Extensible Markup Language – standard of the W3C consortium representing simplification of the markup language SGML. Due to its extensibility, XML language is mainly applied for defining interfaces between software systems. Definition of parameters of flexible systems represents another common XML language application.

2. Project goal, stages, plan and deliveries

In this Chapter, project goal, stages, plan and deliveries are specified as they were approved according to the *Inception report* to this project.

2.1. Project goal

The goal of the project Development of *Information System of Health Indicators* (hereinafter referred to as ISHI) is the development of information system supporting standardized solution process of requirement of new health indicators. ISHI shall standardize and automatize the whole process, from the collection of necessary data via statistical reports and reports, appropriate data storage, calculation of health indicators up to availability of indicators data in the form required by international and domestic institutions and analysts in respective fields.

2.2. Project stages

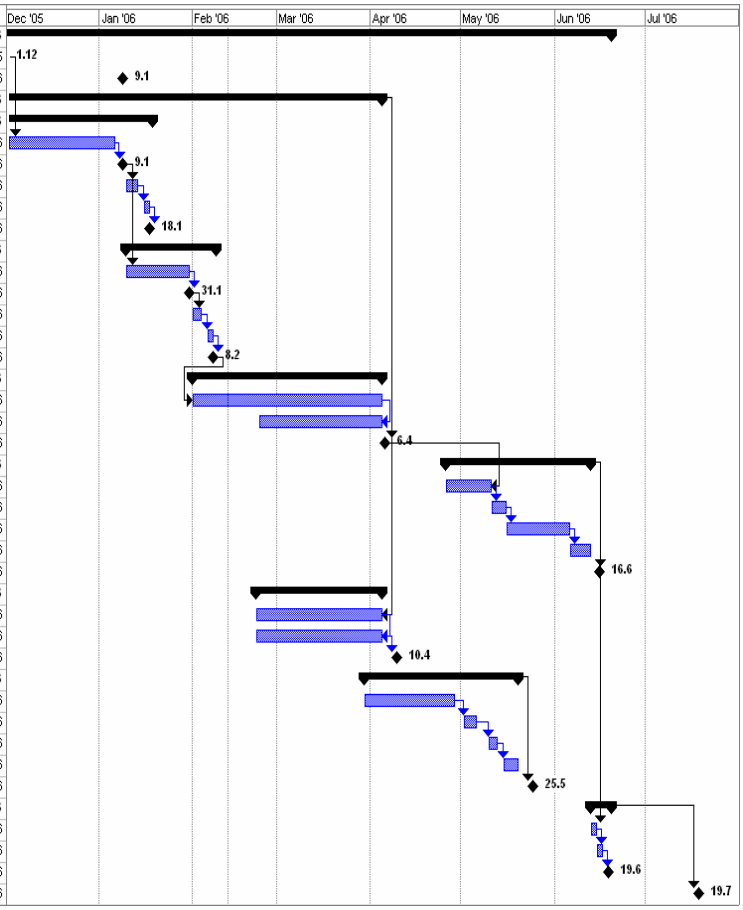
According to the *Inception report*, project goals shall be attained in the following stages[1]:

Development of SW solution:	Development of the information system in the following steps: requirements analysis, system design, programming and internal testing in the environment of the company Softec.
Implementation and testing:	Implementation of developed information system in the recipients environment (NHIC and SR-MH) as well as acceptance testing of the information system functionality during pilot run in the recipients environment.
Documentation elaboration:	Delivery of system and user documentation to the information system.
Trainings:	Training of administrators, operators and advisers to the information system.
Handover:	Project handover.

[1] This document represents a report after marked stages are completed.

2.3. Detailed project working plan

ID	Úloha	Trvanie	Začiatok	Koniec
1	**ISZI**	**137 d**	**Thu 1.12.05**	**Mon 19.6.06**
2	*Administrative start of the project*	1 d	Thu 1.12.05	Thu 1.12.05
3	***Inception report***	1 d	Mon 9.1.06	Mon 9.1.06
4	**Development of SW solution**	**86 d**	**Fri 2.12.05**	**Tue 4.4.06**
5	**Analysis**	**32 d**	**Fri 2.12.05**	**Wed 18.1.06**
6	Requirements analysis	24 d	Fri 2.12.05	Thu 5.1.06
7	Delivering Requirements analysis	1 d	Mon 9.1.06	Mon 9.1.06
8	Examining Requirements analysis	4 d	Tue 10.1.06	Fri 13.1.06
9	Amending Requirements analysis	2 d	Mon 16.1.06	Tue 17.1.06
10	Delivering Requirements analysis amended	1 d	Wed 18.1.06	Wed 18.1.06
11	**Design**	**22 d**	**Tue 10.1.06**	**Wed 8.2.06**
12	System design	15 d	Tue 10.1.06	Mon 30.1.06
13	Delivering System design	1 d	Tue 31.1.06	Tue 31.1.06
14	Examining System design	3 d	Wed 1.2.06	Fri 3.2.06
15	Amending System design	2 d	Mon 6.2.06	Tue 7.2.06
16	Delivering System design amended	1 d	Wed 8.2.06	Wed 8.2.06
17	**Programming**	**45 d**	**Wed 1.2.06**	**Tue 4.4.06**
18	Software solution development	45 d	Wed 1.2.06	Tue 4.4.06
19	Internal testing	29 d	Thu 23.2.06	Tue 4.4.06
20	***Interim report after development of SW solution***	1 d	Thu 6.4.06	Thu 6.4.06
21	**Implementation and testing**	**32 d**	**Wed 26.4.06**	**Mon 12.6.06**
22	Implementation and testing plan elaboration	9 d	Wed 26.4.06	Wed 10.5.06
23	SW solution implementation	3 d	Thu 11.5.06	Mon 15.5.06
24	Testing during pilot production	15 d	Tue 16.5.06	Mon 5.6.06
25	Pilot production evaluation and amending	5 d	Tue 6.6.06	Mon 12.6.06
26	***Interim report after implementation and testing***	1 d	Fri 16.6.06	Fri 16.6.06
27	**Documentation elaboration**	**30 d**	**Wed 22.2.06**	**Tue 4.4.06**
28	System documentation	30 d	Wed 22.2.06	Tue 4.4.06
29	User documentation	30 d	Wed 22.2.06	Tue 4.4.06
30	***Interim report after documentation elaboration***	1 d	Mon 10.4.06	Mon 10.4.06
31	**Training**	**33 d**	**Thu 30.3.06**	**Fri 19.5.06**
32	Training preparation	20 d	Thu 30.3.06	Fri 28.4.06
33	Administrators training	4 d	Tue 2.5.06	Fri 5.5.06
34	Operators training	3 d	Wed 10.5.06	Fri 12.5.06
35	Instructors training	5 d	Mon 15.5.06	Fri 19.5.06
36	***Interim report after training***	1 d	Thu 25.5.06	Thu 25.5.06
37	**Handover**	**5 d**	**Tue 13.6.06**	**Mon 19.6.06**
38	SW solution reimplementation	2 d	Tue 13.6.06	Wed 14.6.06
39	Closing protocol handover	2 d	Thu 15.6.06	Fri 16.6.06
40	Closing handover of SW solution and documentation	1 d	Mon 19.6.06	Mon 19.6.06
41	***Final report***	1 d	Wed 19.7.06	Wed 19.7.06



2.4. Project outcomes

2.4.1. Overview of deliveries

ID	Name[2]	Contents	Deadline
1	Inception report (document)	Detailed working plan including list of activities and time schedule of the contract performance. Identification of potential risks, limits, requirements and list of persons intended for the contract performance by Softec, if already known. Conclusions resulting from the analysis of current state. Clear defined functions of designed system of the software application of health indicators according to the Softec's offer to ISHI. Detailed design of working plan of the contract performance including detailed description of project stages, procedures, rules and methods applied during the contract performance with exact definition of contents and acceptance of processes for each provided procurement object.	09.01.2006
2	Interim report (document)	Important information of works progress allowing check of tasks fulfilment resulting from the working plan of the inception report. Identification of important modifications, problems and ways of solutions arisen in the course of contract performance.	Within 5 workdays after closing of each stage
3	Final report (document)	Realization summary of the contract performance. Strong and weak points of the project. Effectiveness of project application and project efficiency. List of seminars and meetings (if appropriate). Critical study of main problems (also operation-related) with recommendation how to avoid future similar situations.	Within 30 days after the contract performance handover
4	Requirements analysis (document)	Reconsidering of system requirements, requirements for international reporting, identification and description of relevant processes, data formats and tools, information resources and contents, future system users with their specific needs and abilities, evaluation of available infrastructure of hardware environment.	09.01.2006
5	Requirements analysis after amendment procedure (document)	Same as ID 4	16.01.2006
6	System design (document)	ISHI architecture design including design of databases replication between IHIS and SR-MH, elaboration of data model which will include health indicators data, as well as necessary metadata. Functional description, Web application screen flows, menu system of internal application, definition of interfaces, defining the control set of indicators and its subset whose metadata will be filled by Softec, fulfilling requirements of the requirements analysis by designed system functionality and initial metadata filling.	31.01.2006
7	System design after amendment procedure (document)	Same as ID 6	08.02.2006

[2] Administrative delivery with ID 1 has been realized, objective deliveries ID 4 to 7 have been realized within closed project stages which are being evaluated in the present report.

ID	Name[2]	Contents	Deadline
8	Implementation and testing plan (document)	Time schedule of SW solution installation, databases and metadata filling. Testing scenarios, acceptance criteria of SW solution, plan of acceptance testing during pilot run.	26.05.2006
9	Training of administrators, analysts and officers	Training of all types of staff including delivery of related documentation. Technical documentation will include: ✓ architecture description, ✓ description of conceptual and physical system design, ✓ description of database structure, ✓ description of metadata and mechanism of application, ✓ technical description of defined indicators and OLAP cubes. Administrator documentation will include system administration manual and manual of system filling by other metadata, new indicators, new input forms and interfaces. User documentation will include system user manual also available on-line when using the application.	17.05.2006 – 02.06.2006
10	Handover of the contract performance object to customer.	Under presence of recipient's project manager and customer, Softec performs acceptance and control tests. Upon handover of the contract performance objective Softec shall submit results of executed tests providing fulfilment of requirements of realized contract performance to recipient's project manager.	16.06.2006
11	Protocol handover of project solution (SW product + documentation)	Developed SW solution on CD carrier in two identical copies. Developed SW solution shall be delivered in the form allowing eventual further modification. Installation tools for the developed SW solution shall be part of the delivery. System (operational) documentation in two identical printed copies and in two identical electronic copies for any partial documentation. User (instruction) documentation in two identical printed copies and in two identical electronic copies for any partial documentation.	19.06.2006

Reports are project administration deliveries, other deliveries are of objective character.

Takeover and approval of administration project delivery including items 10 and 11 shall be confirmed by recipient's and provider's project manager upon signing the reports and completion certificate with indication of takeover and approval date.

Takeover of other project deliveries shall be confirmed by recipient's and provider's project leader upon signing the completion certificate with indication of handover date. One copy of completion certificate of other project deliveries shall be given to recipient's project manager (SR-MH).

Completion certificates shall be elaborated in three copies: one copy is given to customer, recipient and provider.

2.4.2. Process of orders acceptance

ID	Order name	Process of order acceptance
1	Inception report (document)	By approval of recipient's project manager. Comments on the report shall be submitted within 15 days. Should no opinion on the report be submitted within 45 days since the date of report submission, the report shall be regarded as approved.
2	Preliminary report (document)	Same as ID1
3	Final report (document)	Same as ID1 but the period for submission of project manager's opinion on the report is 30 days instead of 15 days.
4	Requirements analysis (document)	Provider presents the contents of the document Requirements analysis to recipient's project solvers at a special meeting being a place of discussion of respective document issues, and makes an agreement on those issues. Recipient shall deliver comments to provider within terms set out in the detailed project working plan.
5	Requirements analysis after amendment procedure (document)	Upon signature of completion certificate by the recipient's project leader.
6	System design (document)	Provider presents the contents of the document System design to recipient's project solvers at a special meeting being a place of discussion of respective document issues, and makes an agreement on those issues. Recipient shall deliver comments to provider within terms set out in the detailed project working plan.
7	System design after amendment procedure (document)	Upon signature of completion certificate by the recipient's project leader.
8	Implementation and testing plan (document)	Upon signature of completion certificate by the recipient's project leader.
9	Training of administrators, operators, trainers and system users	Upon signature of completion certificate of delivery of training attendance lists.
10	Protocol acceptance of the contract performance object.	Upon signature of acceptance protocol by recipient's project leader immediately after fixing all registered critical issues of the contract performance objective (those preventing the product from utilization). Other issues shall be removed within warranty period not later than 30 days since protocol acceptance of the contract performance objective.
11	Protocol handover of project solution (SW product + documentation)	Upon signature of handover protocol.

Acceptance protocols shall be elaborated in three copies: one copy is given to customer, recipient and provider.

3. Project solution status

This chapter provides important information on the progress of works and identification of important changes, issues and ways of their solution which occurred during the contract performance.

3.1. Closed stages

In the ISHI project, following stages ***Development of SW solution*** and ***Documentation elaboration*** (see *2.2 Project* stages) have been closed.

Result of the stage *Development of SW solution* are deliveries with ID 4, 5, 6 and 7 of the *Inception report* (see *2.4 Project outcomes*) as well as the ISHI software solution which is not part of the stage *Development of SW solution*.

Result of the stage *Documentation elaboration* is represented by the documentation of ISHI software solution which is a delivery at the administration stage ***Handover***.

Software solution and documentation depend on each other. Modification of the software solution may result in respective modification of the documentation. Both results represent input into the next stages *Implementation and testing* and *Training***.** They are formally under the delivery with ID 11 which is to be delivered after the closing of the project objective stages.

3.1.1. Stage Development of SW solution

It is the first stage of the project objective solution divided into three phases according to the Detailed project working plan (see the part *2.3 Detailed project working plan*):

- Analysis
- Design
- Programming

Relations between stages were as follows:

- works within the phase **Design** depended on the outcome approval of the phase **Analysis,**
- works within the phase **Programming** depended on the outcome approval of the phase **Design**.

Outcomes at this stage are the following project deliveries within the terms of the *Inception report* (see *2.4 Project outcomes*). Along with the scheduled date, the real handover date and the date of approval of the second document version by recipients' project leader are also specified.

ID	Name of delivery	Scheduled date	Handover date	Approval date
4	Requirements analysis (document)	09.01.2006	09.01.2006	
5	Requirements analysis after amendment procedure (document)	16.01.2006	16.01.2006	18.01.2006
6	System design (document)	31.01.2006	31.01.2006	

ID	Name of delivery	Scheduled date	Handover date	Approval date
7	System design after amendment procedure (document)	08.02.2006	20.02.2006	20.02.2006

Software solution for ISHI being not part of the delivery at the stage, is also an outcome and simultaneously an input into the next stages *Implementation and testing* and *Training*.

Analysis

The goal of the phase *Analysis* was to reconsider and make real recipients requirements laid on ISHI as compared with those stated in procurement documents [CR] and in Softec's offer [OFR].

The result should be the approved document ISHI Requirements analysis which represents the binding determination of the ISHI project scope.

The requirements analysis was executed mainly by interviews and evaluation of recipients' documentation. Provider's staff made records from interviews which were commented by recipients' employees in the form of amendments.

List of interviews during the phase **Analysis** is shown in the following table:

Interview No.	Interview contents	Date
1	Specification of requirements defined in the offer, explanation of intended solution of requirements, description of the steps to follow.	07.12.2005
2	Data model, data warehouse, data collection process, input data controls	09.12.2005
3	Specification of the meaning of parts of the provided data Model 1, acquisition of information on input reports and reports, on their subsequent processing, acquisition of information on input controls, description of the steps to follow.	14.12.2005
4	Specification of acquired information on controls, description of transformation process of input data to output indicators, description of the steps to follow.	16.12.2005
5	Specification of acquired information on inputs, outputs and processes in current data processing. Agreement on testing and acceptation conditions. Description of the steps to follow.	21.12.2005
6	Specification of output documents handover and approval procedure. Extension of NHIC information and agreement on operation conditions. Description of the steps to follow.	03.01.2006
7	Presentation of the document Requirements analysis, version 1.0. Discussion to the document. Description of the steps to follow.	11.01.2006

The document ISHI Requirements analysis includes the following chapters:

1. Introduction including the project context and glossary.
2. Analysis of current state including conclusions which were provided in the part 7.2 of the *Inception report*.
3. ISHI analysis with the identification and description of relevant processes, resources a information contents, data formats and tools, with future system user, requirements laid on reports to international organizations, available infrastructure and hardware of the environment.
4. Functions of designed system by subsystems, as indicated in the Softec's offer [OFR].

5. List of requirements on future system.

Results of requirements analysis summarized in the first document version were presented to recipient's employees at the workshop on 11. 01. 2006 (interview No. 7) to facilitate and accelerate amendment procedure to this document and to create the second version of the document with included remarks of recipients' staff related to the first version. Amendment procedure has been approved by the project leader on 18. 01. 2006.

Results summary of the phase Analysis

Results identifying changes in the scope of actual requirements laid on ISHI as compared with those stated in procurement documents [CR] and the Softec's offer [OFR], were presented in the *Inception report* in the part 7.2 Summary of current state analysis conclusions as follows:

Current process of data acquisition and processing of statistical reports features several problems to be solved by the designed ISHI.

a) Currently, data of individual report forms are not stored in uniform structure and single database which makes analytical view of collected data more complicated.
b) Catalog of available data elements does not exist and therefore, it is not clear in the case of a new indicator requirement whether the indicator can be calculated from existing data or a new finding is necessary, or an existing finding can be modified.
c) With respect to legislative ambiguity of terms medical facility and specialized department, these terms are differently interpreted by various administrative institutions which results in problems related to the update of the Central register of health care providers (CRHCP) and of the Central register of medical staff (CRMS). This also results in problems during generation of reporting units set as well as it will be considerable problem for the assumed granularity change of reporting units (transformation from details at the district level to the details at the level of specialized departments).
d) Process of SSU establishment and subsequent control of plan realization is not automatized which results in increased workload.
e) Statistical reports are delivered to NHIC usually in print, thus requiring manual typing in the system by NHIC staff.
f) Processing of reports and messages is not metadata-controlled, which results in modifications of program equipment in the case the reports are changed. The same applies for generation of output reports and messages.

Currently, acquisition of reports in the electronic form is introduced within the new Universal system. Acceptance of the Universal system data by the ISHI system is assumed (after their check and consolidation by the Universal system).

NHIC staff regards the part of the future IHIS system - Model reality – to be conceptually fixed with the following characteristics:

- ✓ NHIC logically divided Model reality into two parts: Model 1 and Model 2.

- ✓ Central entity of Model 1 (which is referred by the majority of other entities in Model 1) is HCP. Model 1 contains the HCP Central register (CRHCP), Central register of medical staff (CRMS) and statistical reports related to HCP and ME which do not contain personal data.
- ✓ Model 1 is described by the entity-relation diagram and contains a MS Access database partially filled with data.
- ✓ Central entity of Model 2 (which is referred by the majority of other entities in Model 2) is patient or insured person. Currently, Model 2 represents NHIC data of hospitalization records and of reports, i. e. medical registers and registrations. Model 2 is still under construction.
- ✓ Agenda Hospital will be a part of Model 2 which is currently in the phase of internal completion in NHIC.

IN the ISHI system, Softec shall initialize within the delivery of pilot run metadata for SAD database indicators, being not regarded by NHIC as current ones because they contain indicators required by international organizations, which are effective just by the end of 2004. Moreover, no algorithms of calculation from reports and messages data are defined. Due to this fact and to the provision of standard tools for the introduction of a new health indicator by NHIC it was agreed that the acceptance criterion of the ISHI project will not be the metadata filling for indicators of the SAD database but indicators of the verification set which will be defined in the document System design. For the sake of pilot run, metadata of part of the indicators shall be filled by ISHI staff of the Softec company and those of another indicators part by the NHIC staff.

It is acceptable for NHIC to use user-friendly definitions of indicators calculation in most cases. In the remaining cases SQL language will be used.

It is acceptable for NHIC that ISHI provides thick client user interface for internal users in LAN of NHIC in the following cases:

g) CRHCP and CRMS – they are crucial for the determination of reporting liability of individual data collections and specification of the set of reporting units. It is assumed that ISHI will provide the user interface for administration of these registers by NHIC staff based on documents of other organizations. Due to the ambiguity between CRHCP and CPZP structures, which have been continually amended, it is acceptable to build within ISHI CRHCP and CRMS registers based on metadata defining roles, relations and liabilities for legal or natural persons.

h) Management of metadata defining health indicators, input report forms, input interfaces, and data input from report forms, output reports.

IHIS shall be transformed into the National Health Information Centre in the first quarter of 2006, having competencies of a Slovakia-wide methodological guarantee and operator of central registers of healthcare providers, medical staff and register of appearance of tracked clinical events. The ambition of NHIC is to approach architecture and functionality of the ISHI system to these goals as close as possible which is, with respect to project goals and project time and capacity limits, only partially acceptable.

- ✓ CRHCP a CRMS central registers shall be used in the future not only to support SSU generation but also to maintain full information on health care providers and medical staff which is updated by various external subjects within allocated competencies as well as to analyze included information. Support of this functionality is not required within ISHI. Extending maintained information as well as updating specialized web

interfaces by external subjects within their competencies is assumed within future projects.

- ✓ On the basis of reports, various registers of monitored clinic cases (e.g. register of oncology diseases, register of cardiovascular diseases, and register of children's congenital defects) are being elaborated. It is assumed to integrate registers into common register of occurrence of clinic cases. This intention goes beyond the ISHI project scope. However, realization of this project may help to execute this intention.

Design

The goal of the *Design* phase was to define hardware and software system architecture, provide data model specification as well as the way of meeting system demands resulting from the approved document Requirements analysis by the system user interface.

The output document ISHI System design shall provide recipients with the way how their requirements will be met by the system as well as serve to provider's solvers as the specification for software solution.

Discussing preliminary results and gaining information necessary for the system design were mainly realized in the form of interviews and evaluation of required documents sent by e-mail.

List of interviews during the phase **Design** is shown in the following table:

Interview No.	Interview contents	Date
8	Specification of information on health indicators calculation. Determination of the verification set of health indicators.	17.01.2006
9	Presentation of the design of the ISHI application data model and discussion	18.01.2006
10	Report states, collection states	20.01.2006
11	Presentation of the document System design, version 1.0, discussion of the presented document, next steps to follow.	02.02.2006
12	Mapping of classes of Model 1 (NHIC is the author) to administrative registers (Softec is the author).	06.02.2006
13	Continuation of discussion on the document System design – version 1.0	09.02.2006
14	Identification of data for administrative registers including description.	14.02.2006

The document ISHI System Design consists of the following chapters:

1. Introduction providing the document scope, contents, references and glossary of terms and abbreviations.
2. System data model divided into following groups: code lists (enumerations) and dimensions, Catalog of data elements, Definition of inputs and outputs, Definition of forms, Reports, Definition of views, Management of inputs and outputs, Administration registers.
3. Functional description defining functionality and the user interface for the four parts of ISHI system: Web application, Metadata administration application, Analytical application (Excel) and Generation of standard outputs (MS Access).

4. Specification of the verification set of indicators providing that all metadata for the calculation of indicators of L1 report and Hospital report being in force for the year 2004 shall be defined by provider and be ready for pilot run within the stage *Implementation and testing*.
5. ISHI architecture design providing system technical architecture at the NHIC and SR-MH, workplaces, mechanism of data replication from NHIC to SR-MH, security aspects, data archiving, hardware and software requirements to the system operation.
6. Requirements laid on cooperation of recipients and provider during upcoming phases and stages.
7. Meeting of requirements defined in the List of requirements of the approved document *Requirements analysis* by the system design.

During the programming and internal testing phase, provider reserved the right to modify the data model as well as details of screens shown in the design to get better solution.

Results of the phase Design were submitted to recipients as the first version of the document ISHI System Design. This document has been presented by provider's staff within the series of workshops on 02. 02. 2006 -14. 02. 2006 (interviews No. 11, 12, 13, 14). Within these workshops, the document was also commented upon. Due to the complexity of the document as well as its binding character with respect to the programming phase, some topics must have been discussed more thoroughly and longer time, e.g. the data model of administrative registers and the functionality for data entry, initial filling of administrative registers, database structures for reports saving. Recipients commented on the first version of the document by approving records of the respective interviews. Last comments were submitted on 20. 02. 2006. Amendment procedure was approved by recipients' project leader on 20. 02. 2006.

Results summary of the phase Design

Data model of the system as well as the functionality were designed in line with the requirement on the metadata-controlled system where is no need to modify the database structure and software due to the introduction of a new statistical survey. Only new metadata are to be added.

System contains the set of **code lists**. For the code lists a **hierarchy** can be defined to serve for summarizing of additive data, structured by lower-level code lists, by higher-level code lists (e.g. municipality, district, region).

Methodological tool of data description save and stored in the system is the **Catalog of data elements**. **Data element** shall name data of equal significance and data format. Data element may be of numeric, sorting or descriptive type. E.g. for each **code list**, sorting data element which corresponds to the code item, is defined. The sorting data element can be also defined without the code list – e.g. ZIP code, personal identification number, company registration number. Numeric data element can be structured according to various code lists – this is the mechanism for merging report items representing the same data element for different code list values (e.g. number of abortions – it can be structured by the age categories).

Data of the data element are collected either by statistical surveys or they are calculated – from the collected or calculated data elements.

Numeric data element can be the **indicator.** In such case, it is extended by descriptive and

classification attributes.

Output view is used for the calculation of numeric data elements. Output views are primarily applied for the data analysis, data publishing and delivery to external organizations. When defining views system offers a wizard.

According to recipients expectations, the system should be metadata-controlled up to the following level:

- ✓ The system shall have necessary code lists whereas each code list is represented by one table.
- ✓ Reports with the majority of equal modules are represented by a single physical table in the database.
- ✓ Administrative registers have fixed structure with tables complying with legislative terms and relations (NHIC proposed the data model of administrative registers).

To stick to this metadata level would mean:

- ✓ Each code list has its own database table. We suggested single table for all code lists.
- ✓ For each statistical form to define new database table and form processing functions. We suggested two storage structures – the first one shall be universal for standard reports, the second is reserved for the Hospital reports. Decrease in data amount in the universal storage structure is provided by the division of data into annual database tables according to the year of the collection.
- ✓ To fix the structure of administrative registers complying with past and present legislation frameworks and to extend the system data model as well as functionality of the administrative registers user interface upon legislation changes (this is equivalent to the proposal of administrative registers data model elaborated by NHIC). We suggested fixed table structure for storage of participants, participant roles and relations – whereby new participants, roles and relations shall be defined upon the legislation change while the database structure and software remain untouched.
- ✓ For each output view a new database table shall be defined. New storage structure shall be defined for the view but not at the level of database maintenance, the system provides the respective user interface.

The central tool for attaining system flexibility going beyond the expected meta level is the structure of the **record type.** The record type provides table view of data of similar character – it contains the list of items. The **record item** associates semantics of data element with storage of data element in the database: data element as well as table column of the storage structure shall be defined for the record item.

For **administrative registers,** an analytical model *Responsibility* according to Martin Fowler, later extended by Dr. Šešera to manage N-tuple relations (Šešera, Mičovský, Červeň: Datové modelování v příkladech (Data modelling in examples), Grada 2001). The user defines record types for the **participant** (e.g. natural person, legal person, medical facility, specialized department), **participant's role** (e.g. HCP, professional representative) or **relation** (e.g. permission to provide MF). Any types of records are physically stored in 6 database tables: participant, participant's attributes, participant's role, participant's role attributes, relation and relation attributes.

From the user perspective the designed system shall consist of 4 parts:

- Application for metadata management (ISHI meta) created by using FAAST C++ technology. It is intended for:
  - user administration and classification of users into groups,
  - definition of code lists and their hierarchies,
  - definition of data elements and indicators,
  - definition of record types and record items,
  - definition of forms and form modules,
  - definition of output views and related calculations,
  - definition of input and output interfaces, suppliers and customers, data flows.
- Application for the management of collection, inputs and outputs as well as administrative registers maintenance (ISHI web) developed by using WAFT web technology, which is intended for:
  - collection management (with the generation of reporting duty, storage of reports, collection closing),
  - management of administrative registers,
  - report data import in defined forms,
  - administration of outputs with defined interfaces,
  - for statistical units, filing web form of reports and storage their data in compliance with reporting duty,
- Excel application for the output views data analysis,
- MS Access application for the generation of output reports.

ISHI internal users were divided into the following detailed roles:

Role name	Role description
Administrator of data elements and indicators	Configuration of indicators, administration of data elements, code lists maintenance
Administrator of forms	Metadata administration for statistical syrveys, input forms, collections, reporting duty
Administrator of collection	Collection closing, approval of additional collection corrections
Administrator of register metadata	Administrative registers metadata management
Administrator of registers	Administrative registers data update
Administrator of output views	Output views metadata management
Administrator of data imports	Preparation of data imports, necessary XSLT transformations, potential imports into administrative registers
Administrator of standard outputs	Generation of standard print outputs in MS Access
Analyst	Viewing and analysis in MS Excel data (OLAP)
Contact person	Filling input reports
System administrator	Technical system management, user maintenance and classification of users into user groups according to user roles

Suggested principles of administrative registers were presented at a special meeting where providers presented design of HCP register metadata and showed an example data storage by users.

Recipients expressed their concerns about administrative registers and collected data designed in such way. These concerns were partially cleared by the following facts:

✓ Data in the database will be not available (for the bulk correction by using SQL commands update, read) in the tabulated form according to the record type.	Reports as well as administrative registers can be modified individually by using user interface. A view of report data and administrative registers data can be created which corresponds to single storage structure in the database. It may potentially contain annual tables which can be applied for the identification of data large-scale error.
✓ How will administrative registers data be imported from external sources?	This is a requirement going beyond the scope of the ISHI system. Function of individual filling of administrative registers and initial filling of administrative registers for pilot run as well as routine operation were supportively included in the solution. This will require individual solution of each import depending on the source data structure and structure of that part of administrative registers metadata which is to be filled.
✓ How will administrative registers data be exported, e.g. for the use by other organizations?	This is also a requirement going beyond the scope of the system. However, it may be solved by output views. An output view containing data of administrative registers (also by applying stored database procedure) in the respective structure may be defined, its data can be calculated and exported with defined interface.
✓ Processing of reports stored in the universal storage structure may not be effective due to the way of storage: each report item has single database table entry.	Storage structures of reports contain so-called annual tables, one table per year. This would decrease amount of data in single database table. In the case of collection with large amount of reports, separated storage structure shall be defined (this is the case of Hospital). Other reports will be included in so-called universal storage structure. Effectiveness of reports processing will be verified during the pilot run on L1 form reports for the year 2004 – and convenient table indexing of the universal storage structure may be adjusted.
✓ They would like to have the option to define custom storage structures for reports.	Defining the new storage structure is a serious procedure. It may potentially cause the system consistency failure. Therefore, the system executes

		this activity for views automatically. For reports and administrative registers, storage structures as well as respective database tables were created by provider's staff. Provider can not guarantee those storage structures which were not verified by him.
✓	They would like to allow storing certain data for external users in the future (e.g. HCSA)	This is requirement going beyond the scope of the project. Ideal solution would be the generation of a special web interface for the respective part of administrative register for users authorized to store and modify certain type of data (e.g. physician codes).
✓	Register of patients / reported persons shall be part of administrative register.	In this issue NHIC staff divided into two groups. According one of them and the provider, not the register of patients is concerned but the record keeping of tracked changes of health condition of patients. Required data can be generated as a single view from all records.

Programming

The goal of the phase *Programming* was to create and internally test the ISHI software solution according to the approved system design. Within this phase, communication between recipients and provider in the form of workshops was decreased. Both parties communicated through e-mail and solved issues related mainly to the software solution details, semantics of the data to be entered in the system by provider because they shall be part of the system installed for the pilot run to be implemented within the next stage *Implementation and testing*. Data part of the system was also discussed at common meetings.

List of interviews during the phase **Programming** is shown in the following table:

Interview No.	Interview contents	Date
15	Design of code lists for the standardization in the competence of the Ministry of Health	16.03.2006
16	Clarification of understanding and definition of data elements, specification of administrative registers structure and solution of issues related to the filling of registers.	12.04.2006

Designed software solution will be installed in the recipients environment for purposes of pilot run.

Results summary of the phase Programming

Software solution consisting of 4 parts according to the approved document System Design was created and internally verified:

- Application (developed by using Faast C++ client-server technology) for the metadata administration (ISHI meta). It is intended for:

- user administration and classification of users into groups.
- definition of code lists and their hierarchy,
- definition of data elements and indicators,
- definition of record types and record items,
- definition of forms and form modules,
- definition of output views and related calculations,
- definition of input and output interfaces, suppliers and customers, data flows.

- Application for the management of collection, inputs and outputs as well as administrative registers maintenance (ISHI web) developed by using WAFT web technology, which is intended for:
  - collection management (with the generation of reporting duty, storage of reports, collection closing),
  - management of administrative registers,
  - report data import in defined forms,
  - administration of outputs in defined interfaces,
  - for statistical units, storage of reports in compliance with reporting duty.
- Excel application for the output views data analysis.
- MS Access application for the generation of output reports.

Plan of design and verification of the software solution corresponded to the dependencies of application functions:

1. Generation of the ISHI Meta application, because all metadata used by other applications are to be entered within this application. Following activities were stepwise realized:
   1.1. Generation of system menu.
   1.2. Modification of screens to allow easy user orientation to the maximum extent and to provide maximum amount of related data to users (implemented by the object data model).
   1.3. Completion of programming of semantic restrictions which can not be included in the data model but they result from semantics.
   1.4. Programming of application functions (output views wizard etc.)
   1.5. Data model modification (improved design)
   1.6. Update of screen forms, as well as functionality update due to the data model modification
   1.7. Testing using test data
   1.8. Filling by real data for purposes of pilot run (administrative registers, metadata definition for collection by using L1 and Hospital forms for the year 2004, demographic data, collection data outputs: code lists (all supplied), data elements, indicators, record types, forms, forms of input/output, suppliers, customers, data flows, views for the calculation of indicators).

2. Generation of the ISHI web application. It was delayed by two weeks as compared to the ISHI meta application. It can not be generated at once. It has to be programmed by pages subsequently. The usual procedure is as follows:
   2.1. Specification of screen design, of all buttons and links
   2.2. Programming of the screen
   2.3. Programming of the button functionality
   2.4. Testing using test data
   2.5. Incorporation of the final design
   2.6. Modification resulting from the testing or data model change
   2.7. Preparation for testing during the pilot run: Generation of report duty for the L1 and Hospital form collection for the year 2004, data import from L1 reports from files.
3. Verification of data cubes from the data of calculated output views in MS Excel.
4. Generation of reports from the data of calculated output views v MS Access.

In the course of solution, modification of data model as well as of the user interface was implemented, mainly due to the functionality improvement. Most important modifications are as follows:

- ✓ Code length must be defined for code lists. When code list is generated, the system defines a data element for the code item.
- ✓ For record types some items may be marked as identification items (e.g. year of processing, month of processing, company registration number, district). Using these identification items an input report will be coupled with the planned report due to reporting duty .
- ✓ Reporting duty – statistical unit must be a participant's role (originally, it was the participant itself).
- ✓ Planned report – providing unit must be a participant's role. Identification items of the planned report were added as the tool for planned report coupling with a form filled by the providing unit which is a part of the statistical unit.
- ✓ Interface for the collection: determination of reporting duty will be implemented by the output view to allow application of a stored database procedure (i.e. unlimited options of data selection from administrative registers) and to take advantage of the already provided mechanism of the output views calculations.
- ✓ Generation of reporting duty for the collection: it is based on data of the output view which shall contain items identifying: statistical unit, providing unit, identification data of providing unit except for the year and month of processing.
- ✓ To calculate views, planning, record keeping of performed calculations and view calculations log were added.
- ✓ Information on record types of statistical and providing units was added to type record of the input report. This allowed adding values of administrative registers attributes to the view item within the definition of view.

- ✓ Addressing of statistical units was separated from the reporting duty because each statistical unit can be addressed by multiple duties just by single addressing. Moreover, generation of addressing was separated from the delivery. This allowed to realize addressing selectively by mail (upon generation into a Word template) or by e-mail, also repeatedly.
- ✓ For the management of administrative registers was improved the user interface to facilitate user's orientation and see the participant, its roles and mutual relations. If possible, semantics of participant's identifier, of the role and relation (e.g. in case of legal person, company registration number (ICO) is displayed, in case of natural person, Personal Identification Number are displayed instead of identifier).
- ✓ All system tables are included in single database scheme. Multiple schemes were designed to allow replication mechanism to work with tables of each scheme separately. Now, replication mechanism works with the group of tables in single database scheme. In case of multiple schemes, conventional user working with view data should dispose of high-level administrator rights at the database level.

3.2. Stage Documentation elaboration

The goal of the stage *Documentation elaboration* was to elaborate the documentation to the ISHI system.

At this stage, we started from the system design and data model which were strictly developed in Telelogic Tau system and software solution provided at the stage *Development of SW solution*.

The elaborated documentation will be installed in the software solution implemented in the recipients' environment for purposes of pilot run and user trainings.

Results summary of the phase Documentation elaboration

System and user documentation was elaborated.

System documentation is provided in the form of Word document. It contains description of system architecture, conceptual and physical system design, data model, metadata a mechanism of its application, defined indicators and OLAP cubes.

User documentation was created as the set of interconnected xml files with the application of DocBook elements. The aim was to utilize the same documentation for various purposes: to link individual documentation parts as a context help with screens of the ISHI web application, to make the whole user documentation available in html format within the ISHI meta application as well as outside of the system. The user documentation structure is as follows:

- Working procedures (those of administrator, metadata management, executives, data analysis, generation of reports) – refer to identified parts of the documentation for individual ISHI applications.
- ISHI meta application (by classes and application functions)
- ISHI web application (by pages)
- Analyses in Excel
- Generation of reports in MS Access

During documentation elaboration, individual system parts were tested and modification of appearance or control of respective application was suggested to make orientation or utilization easier for the user.

3.3. Issues

The most serious issues solved in the course of closed stages are described in the following sections.

3.3.1. Filling data of administrative register

This is a conventional issue of **data migration** from the old system to the new one. Migration of administrative registers (which consist of HCP register and ME register) was added to the project based on the NHIC requirement.

NHIC provided two data sources for migration:

a) Data of the Model 1 structure representing the reference state of data model for administrative registers – incomplete data (empty, wide-spaced, error-loaded data) because NHIC does not dispose of data of the required range. This structure was analyzed by provider's staff in the phase *Design*. Data were acquired from the data described under b) by NHIC staff at a certain time. Data were not updated because there are no appropriate update tools available.

b) Data in the structure which was valid for the year 2004 (this structure was not analyzed by the user in the phase *Analysis)* with briefly described structure.

Due to updated character of data and denser, less scattered filling was chosen the paragraph b) as the basis for data migration.

These data was analyzed, metadata for filling administrative registers were defined and by using special algorithms applying the import function from XML of the ISHI meta application and XSLT transformations, the HCP Register was partially filled.

During the HCP Register analysis we identified errors in source data (duplicated personal identification numbers, missing data). Errors are being continuously reported and discussed with recipient's staff.

Filling of administrative register by HCP Register data is precondition of testing of the following ISHI functions on real data:

- Generation of reporting duty and planned reports for L1 and Hospital reports.
- Data import from L1 and Hospital for the year 2004 and their coupling with planned reports.

Data filling and testing on real data shall be finished prior to the phase *Pilot run* of the stage *Implementation and testing*.

Capacities necessary for filling of administrative registers for pilot run are assumed to be 20 man-days. Works shall be realized within the preparation phase of the stage *Implementation and testing*. Therefore, they will not affect the total terms of delivery.

3.3.2. Standardization

At NHIC, standardization activities are underway in the field of health statistics. With respect to deadlines of the ISHI project they seem to be substantially delayed because problems related to standards absence should be solved within pilot run and routine operation.

Some examples follow:

- ✓ Database of health indicators SAD as a result of foregoing twinning light project represented project input. It turned out to be insufficient for ISHI because it lacked definition of the calculation of indicators from data collected by statistical reports and messages .
- ✓ As a replacement for SAD indicators, verification set of indicators was established for which was analyzed what kind of data serve as the source of indicator calculation and what is the procedure. Also collection forms and methodological instructions of form completion were analyzed.
- ✓ It was identified that many indicators represent single indicator but at various detail levels or they are calculated from another source data. Therefore, the term Indicator Classification was defined. It allows to link all indicators containing the same data type from the viewpoint of semantics but they are calculated based on another algorithm or from another source data.
- ✓ The problem of identifying data elements had to be dealt because data elements are a basis for data collection and calculation of indicators. The methodology how to check whether two collected data represent the instance of the same data element or not was looked for. Possibilities of classifying of data elements as numeric (which can be indicators), sorting (which can get values from code lists) and descriptive. The problem of data elements explosion has to be solved because decision of introduction of a new element is frequently subjective. One of possible solutions can be definition of classification of data element which provides information whether two collected data belong to the same data element but to different classification values (e.g. number of hospitalized persons for different fields of a department).
- ✓ The system was filled with data of all code lists. However, duplicate code lists are often used which contain redundant information from higher hierarchy level (e.g. district or municipality contains the code of the region),
- ✓ Usually, only code lists locally valid for the respective form are defined for the collection in the text of methodological instructions. They are unnamed, just with listed values. One has to create code list in the system and to fill it with the list of values. Using of such unnamed and unregistered code lists may lead to diverse activities in the system. E.g. another methodologist (or even the same person) may define different set of values with the same semantics for another collection. Important information may be lost in this way.
- ✓ Definition of so-called summary codes in code lists which serve for aggregation purpose only and are not used at the level of collection is a bad habit. In reality, single providing subject does not correspond to them. Such code shall be included in a hierarchically higher code list (e.g. bed medical facilities have the code 1000. No real medical facility is assigned to this code, it only serves for summing up the results for all types of bed medical facilities).
- ✓ Another bad habit is to generate the new code list of the respective code list by concatenating codes of other code lists without naming all the source code lists.

3.3.3. Storage of large-scaled modules in ISHI web application

Storage of large-scaled modules (e.g. 5101 of the L1 form) in the web technology is problematic from the user perspective. The user can view just a part of rows and columns without seeing the left and upper description. We added display of bubble over the report items which shows information on the row and column number as well as provides descriptive text in the row and column upon moving the mouse pointer over the report field.

3.3.4. Single-step development of SW solution

For the large-scaled project of this kind utilizing massively metadata, single-step development is not acceptable (analysis – design – programming – implementation – testing – routine operation).

It should utilize iterations to verify applicability of designed principles, optimisation, finalisation of user comfort, finalization of system upgrade functions (e.g. output views), migration data from other systems.

3.4. Modifications

3.4.1. Project scope

Requirement of recipients to extend system functionality beyond the offer framework [OFR] by the management of administrative registers and by initial filling from data supplied by NHIC was accepted.

The requirement of filling the system by metadata for the calculation of indicators from SAD database, which was attached to the offer [OFR], was changed to the filling by metadata from the verification set of indicators which was determined in the approved document ISHI System Design. For purposes of the pilot run, provider's staff will fill indicators calculated from L1 and Hospital reports being valid for the year 2004. Remaining indicators will be filled by NHIC staff during the pilot run.

Both changes were confirmed by recipients through the approval of the document ISHI System Design.

3.4.2. System architecture

System architecture was extended by two applications:

- Application of metadata management (ISHI meta) exclusively developed for internal users in recipients local network. It is a two-layer client-server architecture developed in Faast C++ provider's custom technology. The reason was an unexpectedly large amount of system metadata. For the purpose of their processing, this type of application is more appropriate as well as compensation of project size increase because development using this technology is faster than working with the web technology.
- Application MS Access – to generate reports from data of calculated views which were defined and calculated in the system.

The change was confirmed by approval of the document ISHI System Design.

3.4.3. New dates of related stages

Due to the migration of NHIC into new premises it will be possible to install Oracle database system and the developed software solution on the server in recipients new premises from 11. 05. 2006. We suggest to adjust dates of trainings to be organized in recipient's premises (the original time schedule set for the first training: 02. 05. 2006, modified schedule: 17. 05. 2006.)

The result of the long term of commenting on the ISHI System Design in the phase ***Design*** of the stage ***Development of SW solution*** (planned: 08. 02. 2006, real: 20. 02. 2006) is that the deadline for the closing of stages ***Development of SW solution*** and ***Documentation elaboration*** was shifted by 8 working days (planned: 04. 04. 2006, real: 18. 04. 2006). Deadlines for the stage ***Documentation elaboration*** were shifted accordingly.

The original time schedule was elaborated sticking to the principle that trained users should participate in pilot run. Because training dates were to be shifted due to the NHIC migration, we suggest to shift the beginning of the phase ***Pilot run*** of the stage ***Implementation and testing*** by two weeks to allow all trained users to participate (administrators and other users) within the originally set period of 3 weeks.

At the stage ***Trainings*** we introduced a new phase ***Environment*** i***mplementation for training*** prior to trainings realization. The same environment will be used for the pilot run. However, it will be reinstalled within the phase ***Implementation SW solution*** of the stage ***Implementation and testing***.

We also agreed with NHIC a new structure of user trainings oriented on user roles with the training duration corresponding to the functionality range to be mastered by individual participants.

Modification of dates of remaining objective project stages is shown in the following table:

Stage / Phase	Beginning date	Ending date	Duration/days
Implementation and testing	**26. 04. 2006**	**25. 06. 2006**	**42**
Elaboration of implementation and testing plan	26. 04. 2006	26. 05. 2006	20
Reimplementation of SW solution	30 .05. 2006	01. 06. 2006	2
Testing during pilot run	02. 06. 2006	19. 06. 2006	15
Evaluation of pilot run and amendment procedure	20. 06. 2006	26. 06. 2006	5
Trainings	**26. 04. 2006**	**02. 06. 2006**	**26**
Preparation of trainings	26. 04. 2006	11. 05. 2006	10
Environment implementation for training	11. 05.2006	12. 05. 2006	2
Training of administrators and analysts	17. 05. 2006	26. 05. 2006	8
Training of contact persons	29. 05. 2006	29. 05. 2006	1
Training of administrators	31. 05. 2006	02. 06. 2006	3
Handover	**27. 06. 2006**	**03. 07. 2006**	**5**
Reimplementation of SW solution	27. 06. 2006	28. 06. 2006	2
Final acceptance protocol handover	29. 06. 2006	30. 06. 2006	2
Final handover of SW product and documentation	03. 07. 2006	03. 07. 2006	2

4. Modified project working plan

4.1. Remaining project phases

Two development stages are to be realized within the project:

- ✓ Implementation and testing
- ✓ Trainings

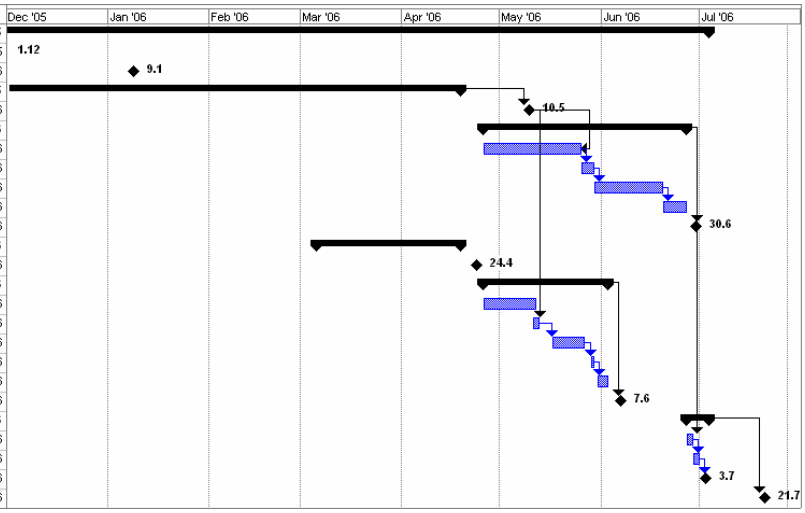
and one handover stage:

- ✓ Handover

4.2. Detailed project working plan

Detailed project working plan after modification of dates proposed in the part *3.4.3 New dates of related stages* :

ID	Úloha	Trvanie	Začiatok
1	**ISZI**	**147 d**	**1.12.05**
2	*Administrative start of the project*	1 d	1.12.05
3	***Inception report***	1 d	9.1.06
4	**Development of SW solution**	**94 d**	**2.12.05**
20	***Interim report after development of SW solution***	1 d	10.5.06
21	**Implementation and testing**	**42 d**	**26.4.06**
22	Implementation and testing plan elaboration	20 d	26.4.06
23	SW solution implementation	2 d	26.5.06
24	Testing during pilot run	15 d	30.5.06
25	Pilot production evaluation and amending	5 d	20.6.06
26	***Interim report after implementation and testing***	1 d	30.6.06
27	**Documentation elaboration**	**30 d**	**6.3.06**
30	***Interim report after documentation elaboration***	1 d	24.4.06
31	**Training**	**26 d**	**26.4.06**
32	Training preparation	10 d	26.4.06
33	Training environment implementation	2 d	11.5.06
34	Metadata administrators and analysts training	8 d	17.5.06
35	Contact persons training	1 d	29.5.06
36	System admnistrators training	3 d	31.5.06
37	***Interim report after training***	1 d	7.6.06
38	**Handover**	**5 d**	**27.6.06**
39	SW solution reimplemantation	2 d	27.6.06
40	Final acceptance protocol	2 d	29.6.06
41	Final handover of SW solution and documentation	1 d	3.7.06
42	***Final report***	1 d	21.7.06



4.3. Project monitoring

During the stage *Development of SW solution,* a workshop of administrative and objective management of ISHI and IDMIS (EPIS) projects was convened by recipient's project manager. Minutes of the workshop are enclosed.

After closing each project stage, the Interim report is to be elaborated and the Final report will be elaborated after the project handover.

To monitor communication by delegated recipient's and providers team members, an e-mail address iszi@softec.sk was established on provider's side.

5. Requirements and limits

Realization of remaining project stages requires fulfilment of necessary requirements on customer's side. It results, however, in certain limits.

5.1. Requirements laid on recipient

- ✓ Close cooperation of recipient's staff during the stage *Implementation and testing*.
- ✓ Continuous and operative provision of relevant information by individual experts in objective fields during filling data for pilot run.
- ✓ Providing consistency of the HCP Central Register data valid for the year 2004 with reporting duty for L1 reports and Hospital messages for the year 2004 prior to pilot run.
- ✓ Preparation of necessary HW and infrastructure for pilot run and routine operation within terms resulting from the project working plan and in sufficient configuration defined in the approved document ISHI System Design .
- ✓ Selection of responsible staff for defining requirements of change prior to pilot run and provision of its participation in the ECHO application training (application of the Softec company for submitting and user monitoring of status of comments solution).
- ✓ To comment on minutes of meetings within 2 working days since the delivery by provider.
- ✓ To provide workplaces for provider's staff during pilot run.
- ✓ To appoint employees to be trained within individual terms and to provide their participation in trainings.
- ✓ To prepare room for the training including data projector and personal computers connected to the local network. Ideally, one computer per one trained person, maximum one computer per two trained persons.
- ✓ To provide data structure of HCP register and ME register to fill data of administrative registers for production operation by 15. 05. 2006.
- ✓ To provide data of HCP register and ME register with given structure to fill data of administrative registers for routine operation 20 working days at the latest prior to the beginning of the stage Handover.
- ✓ Recipient shall provide standard administration of ISHI operational and database system at its own cost.

5.2. Provider's guaranteed tasks

- ✓ To fill data of administrative registers valid for the year 2004 by the data supplied by NHIC for purposes of pilot run.
- ✓ For purposes of pilot run to fill metadata for the calculation of indicators from the verification set of indicators which was defined in the approved Collection System Design for the year 2004 by forms L1 and Hospital.

- ✓ To help trained recipients' users during the pilot to fill metadata for the calculation of remaining indicators from the verification set of indicators.
- ✓ To install ORACLE database system on the NHIC server for purposes of ISHI system and for the pilot run prior to the phase *Implementation SW solution* of the stage *Implementation and testing* .
- ✓ To fill data of administrative registers by the data supplied by NHIC for purposes of real operation.

6. Identification and elimination of risks

For remaining project phases, the following project risks were identified:

Risk description	Risk evaluation	Measures of risk mitigation
Short term of realization	high	Consequent project management, timely indication of possible delays, immediate implementation of corrective measures and providing information to recipient's project manager.
Requirements of changes during development	high	To discuss requirements beyond the project scope at a meeting of project management.
Recipient's cooperation	medium	Eventual delay in the provision of recipient's cooperation shall be discussed at the project management meeting.
Insufficient cooperation of professionals in a filed	medium	Elimination of this risk shall be based on motivating experts and in illustration of practical usefulness of the developed solution.
Failures of key experts	low	Consequent planning of capacities, application of motivation factors, education of full-valued deputies.
Inconsistency of migrated data	high	Data of HCP register and ME register are not consistent or not sufficiently filled or semantics of items is not sufficiently defined in some cases.

6.1. Risk management

Well-proven risk management of the Softec company allows to control the project risks. The project shall be monitored: from the viewpoint of risk priority changes, new risks occurrence as well as events leading to possible risk and indicating the need of taking adequate steps. Risk management shall be regular part of the implementation process. It will be reapplied in any event of project change, issue or risks related to important decisions on project progress. Methods of risk management shall include:

- ✓ Identification of risks.
- ✓ Evaluation of risks.
- ✓ Defining measures of risk management.
- ✓ Introduction of resulting tasks in the project schedule.
- ✓ Regular monitoring of each risk status.

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