Information and Communication Technologies

EPIWORK

Developing the Framework for an Epidemic Forecast Infrastructure

http://www.epiwork.eu

Project no. 231807

D5.1 Design of the "Gold Standard", design and implementation of an Internet Database with English language documents

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Work package participants

The following partners have taken active part in the work leading to the elaboration of this document, even if they might not have directly contributed writing parts of this document:

- AIBV – **Acquisto Inter BV**
- ISI – **Institute for Scientific Interchange**
- FGC-IGC – **Fundaçao Calouste Gulbenkian**
- CREATE-NET – **Center for REsearch And Telecommunication Experimentation for NETworked communities**
- LSHTM – **London School of Hygiene and Tropical Medicine**
- KULeuven – **Katholieke Universiteit Leuven**

Change log

Version	Date	Amended by	Changes
1	**20/02/10**		

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1 Design of "Gold Standard"

The first objective of WP5 is to enhance the portability of the interactive Internet Monitoring Systems for diseases surveillance in Europe and to extend its implementation into four new countries: Sweden, France, Spain and Germany. At the moment, the system is active in five countries: The Netherlands, Belgium, Portugal, Italy and UK.

A large European-wide deployment of such a novel monitoring infrastructure will provide crucial advantage to modelers for real-time data feed to forecast algorithms. The first year of the collaboration involves the determination of a "Gold Standard" set of ILI symptoms, the database infrastructure preparation, the Internet database design, the translation of documents, and the overall testing.

Despite the work on the IMS platforms considers a common template web platform and database structure, the implementation of the IMS in each country represents a separate scientific challenge and research problem.

The task of designing a "Gold Standard" of ILI symptoms to be applied in all the participating countries has been coordinated by the KULeuven team. This task has been crucial for the project's aim of gathering cross-country surveillance data that do not suffer from national-related biases and methods. Epidemiological research has been translated into a tailored survey that best describes the need of different countries in the data collection method regarding the population (e.g. which demographic/stratification data to ask the user in order to match existing national statistics databases) and the infectious disease (e.g. related to different habits and/or law regulations for the absence from work).

These 'gold standard' questionnaires were developed for influenza-like-illness and also for other diseases as common colds, gastro-enteritis, and hay-fever, with the aim of expanding the IMS platforms to monitoring additional diseases in the next future. A final version of the questionnaires has been proposed to all partners. The new algorithm will be implemented in all IMS countries in the next few months. Standard description for flu, gastroenteritis, common cold and hay fever were defined as follows:

Flu

- Sudden onset of sickness (symptoms develop abruptly)
- Sudden high fever (≥ 38°C) & chills
- All over muscular aches & pain or (pos. severe) headache
- Possible cough ('dry cough'), **or** soar throat, **or** runny nose (rhinorrhea), **or** dyspnoea, **or** nausea & vomiting, **or** a combination of these symptoms, **or** none of these symptoms
- Feeling exhausted
- Loss of appetite
- Sick between 3 to 5 days (virus cycle can be 7 to 10 days)

Gastroenteritis or 'stomach flu'

- Low-grade fever, if present
- Possible chills
- **No** respiratory symptoms
- Acute diarrhoea
- Possible nausea & vomiting
- Possible loss of appetite
- Possible stomach or belly pain
- Worse symptoms 1 to 3 days

Common cold

- Symptoms develop gradually
- Low-grade fever, if present
- Possible slight headache
- Stuffy or runny nose with sneezing
- Feeling tired
- Possible soar throat
- Possible mild to moderate hacking cough
- Near normal appetite

Hay fever

- No fever and seasonal bound
- Stuffy or runny nose with sneezing (with clear, thin discharge)
- Possible postnasal drip
- Watery, bloodshot eyes (allergic conjunctivitis)
- Fatigue

These definitions were used to define 2 sets of questionnaires, one for new users registration and one for weekly evaluation of possible disease symptoms:

1) New user registration

This questionnaire is meant to have a general idea of the health and social situation of the user.

RegQ1

What is your gender?
▪ Male ▪ Female

RegQ2

What is your age?
▪ Select you month/year of birth

RegQ3

What is your occupation?
▪ Student ▪ Working ▪ Stay at home/work at home ▪ Retired ▪ Other

RegQ4

Which transport do you use? (Multiple answers possible)
▪ Walking ▪ Public transport (including carpooling) ▪ Private transport (e.g. bicycle, scooter, car, …)

RegQ5

How often a year do you have common colds or flu-like diseases?
▪ Less than 2 times a year ▪ Between 2 and 5 times a year

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- More than 5 times a year

RegQ6

Did you receive a vaccination for seasonal flu (not H1N1 influenza) this year?

- No
- Yes

RegQ7

Did you receive a vaccination for the H1N1 influenza (not seasonal flu)?

- No
- Yes

RegQ8

Do you have one of the following disorders?

- No

- Lung disorder (asthma, COPD, emphysema, …)
- Heart disorder
- Kidney disorder
- Diabetes
- Autoimmune disease
- Cancer
- Immunocompromised

RegQ9

Do you have one of the following allergies? (Multiple answers possible)

- No allergy

- Hay fever
- Food allergy (lactose intolerance, gluten, …)
- Medicine (aspirin, antibiotics)
- House dust mite
- Domestic animals/pets
- Another allergy

RegQ10

Do you follow a special diet?

- No special diet

- Vegetarian
- Veganism
- Low-calorie
- Other

RegQ11

Do you smoke?

- No
- Yes, sometimes
- Yes, everyday

RegQ12

With how many people do you live at home?

- I live alone
- Together with only adults, one or more (18+)
- Together with only children, one or more (18-)
- Together with other adults and children

RegQ13

Are one or more children going to school or day-care? (Multiple answers possible)

- No, they stay at home
- Yes, to school
- Yes, to day-care

RegQ14

Do you have pets at home? (Multiple answers possible)

- No
- Yes, one or more dogs
- Yes, one or more cats
- Yes, one or more birds
- Yes, one ore more other animals

2) Weekly evaluation of disease symptoms

Based on this questionnaire, the system assesses whether the user conditions are compatible with one of the diseases under study.

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RepQ1

Did you have one or more of the following symptoms since your last visit?
(Multiple answers possible)

- No

- Runny nose
- Stuffy nose
- Hacking cough
- Dry cough
- Sneezing
- Sore throat
- Muscle pain
- Headache
- Chest pain
- Feeling exhausted
- Feeling tired
- Loss of appetite
- Nausea
- Vomiting
- Diarrhoea
- Watery, bloodshot eyes
- Chills and feverish feeling
- Coloured sputum
- Other

RepQ2 (if symptoms)

When did the first symptoms appeared?

- Choose date

RepQ4 (if symptoms)

When was your temperature for the first time above 38°C?

- Choose date

RepQ5 (if symptoms)

Did the fever develop abruptly (sudden high fever or chills)?

- No
- Yes
- Don't know

RepQ6 (if symptoms)

Did you consult a medical doctor for these symptoms?
▪ No ▪ Yes

RepQ7 (if symptoms)

Did you take medication for these symptoms?
▪ Tamiflu, Relenza or another antiviral drug ▪ Antibiotics ▪ Antipyretics (paracetamol, etc…) ▪ Anti -inflammatory drugs (ibuprofen, naproxen, …) ▪ Vitamins ▪ Other

RepQ8 (if symptoms)

Did you change your everyday occupations due to these symptoms?
▪ No ▪ Yes, I staid at home ▪ Yes, but went to work/school as usual ▪ I staid at home, but was able to work

RepQ9 (if symptoms) & (if staid at home)

How long did you stay at home?
▪ 1 day ▪ 2 days ▪ 3 days ▪ 4 days ▪ 5 days ▪ 6 days ▪ 1 to 2 weeks ▪ 2 to 3 weeks ▪ More than 3 weeks

RepQ10 (if symptoms) & (coupled to RegQ12)

Do other people from your family/home have/had comparable symptoms?
▪ No ▪ Yes

RepQ11 (if no seasonal flu vaccine)

According to our data you did not receive a seasonal flu vaccination, please confirm
▪ Yes ▪ No, meanwhile I have received a seasonal flu vaccination

RepQ12 (if no Mexican flu vaccine)

According to our data you did not receive an H1N1 influenza vaccination, please confirm
▪ Yes ▪ No, meanwhile I have received an H1N1 influenza vaccination

2 European IMD Database

The design and implementation of a database infrastructure for the IMS in the countries already participating to the project and for the "new" countries include the following tasks:

- the joint preparation of a single centralized database;

- design of templates to be adopted by the country-level IMS.

Database contents of local IMS are designed to be consistent and have information that follow a standard visual identity, structure, and notation. In addition, they are linked to the centralized database that collects the surveillance data gathered locally in each participating country. The design and implementation of the database infrastructure is extremely important to allow each research team to have an easy access to the surveillance data to be used in WP4 for simulation comparison, not hampered by problems related to different standards, different languages, different accesses to computational and storage facilities across country borders. In this context, the design of the new IMS templates is in strong relation with the design of the database. While the existing IMS portals have been designed with a strongly regional target, the integrated and collaborative platform aimed at gathering participating countries' surveillance data relies on the design and implementation of IMS web templates that could be general enough in order to comply with the communication with the db, and also tailored to the specific national situation (see following section).

AIBV and its subcontractor UvA carried out the design and implementation of the European IMS database in the following phases:

- Identification of purpose and scope
- Requirements analysis
- Identification of resources and prior work
- Logical design of the software stack
- Specification of modes of interaction
- Conceptual design
- Physical design
- Planning and implementation

Of the available technology options, we selected the following as the most suitable for our specific aims:

- Web application framework: CherryPy

- Web server: nginx as a proxy to CherryPy's own web server

- Queueing system: RabbitMQ (uses Erlang)

- Main code: CPython 2.5.2

- Database: MongoDB and MySQL

- Python AMQP library (to access MQ): py-amqplib

- UUID library for PHP older than v5.2: Stripped down version of
  http://www.shapeshifter.se/2008/09/29/uuid-generator-for-php/

We elaborated, developed and implemented a four-component architecture:

1. epidb-server: the part of the complete server infrastructure that receives and processes data.

2. epidb-client: a programming library (python, php) to access the epidb-server.

3. epidb-admin: a remote server administration client.

4. the survey website package.

The architecture and server stack are illustrated in the figures below:
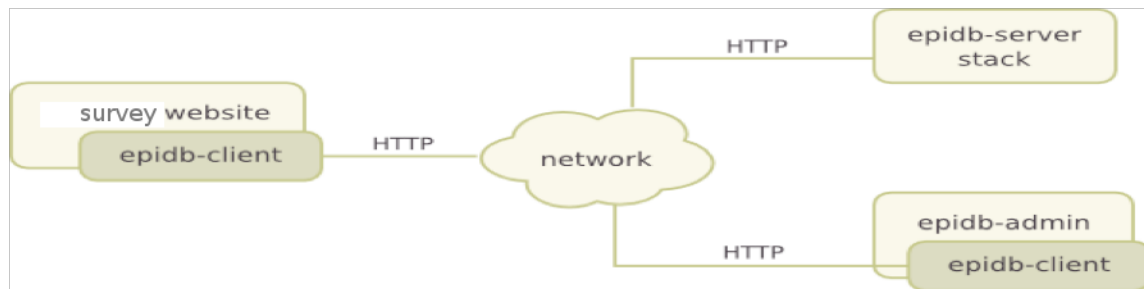
Figure 1: architecture of the database infrastructure
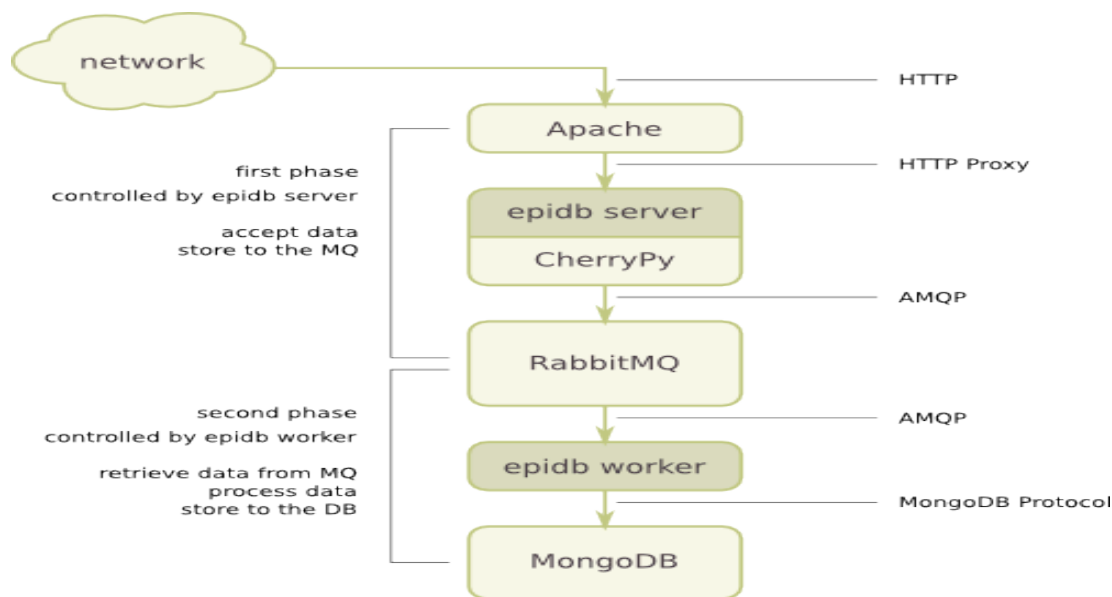
Figure 2: the server stack

3 IMS web portal design

In 2009 we also worked on the design of the new websites for the IMSs. The idea was to use a new, modern design as a basis for all nine Influenzanet websites. We therefore invited three designers to present their concepts before the WP5 meeting of 25 and 26 May in Amsterdam. The joint assembly of WP5 partners made a first selection, after which two designers worked out their ideas.

Out of these two, we have selected the one below, which is the new layout since October 2009 of the Dutch-Belgian site. For reasons of common visual identity, notation and efficiency, all partners will apply this website framework for their own, national websites, with local variations according to their own wishes.

An international websites with content in the English language will be launched in March 2010, when the European database is tested and ready. The international Influenzanet.com website will be based on the current design, with a focus on the European activities, including a map of Europe and links to all IMSs and the role of surveillance activities within the Epiwork project. It is predominantly meant to disseminate the surveillance results of Epiwork to a large audience.

Selected new design of Influenzanet.com, here as www.degrotegriepmeting.nl (and .be):
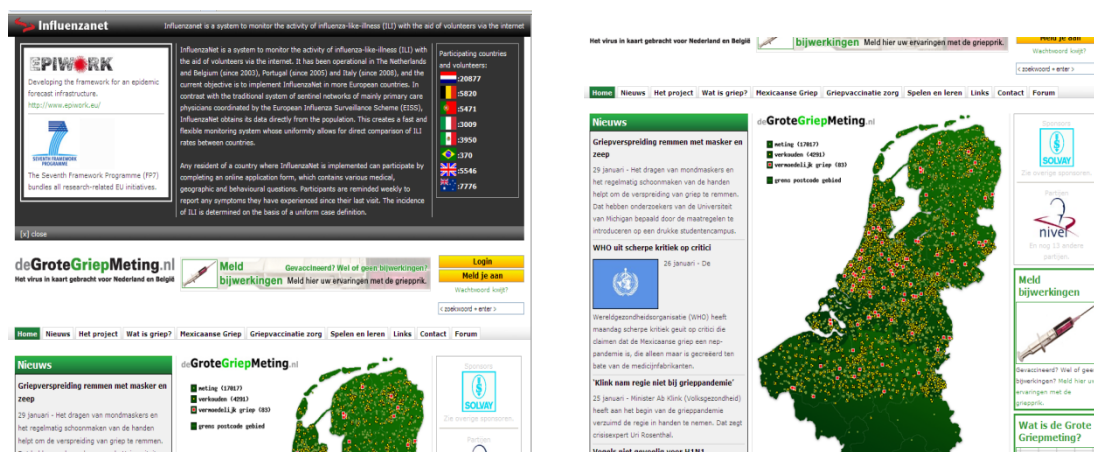
4 Information and Education at Influenzanet

In order to collect epidemic data on influenza-like-illnesses and cold with thousands of volunteers, the IMSs need to attract visitors to the Influenzanet websites and to persuade them to register and participate weekly by answering the symptoms surveys. This is done by means of:

- A professional marketing strategy, including an active press approach via press messages and networking among journalists, and a range of services for schools and interested laymen;
- The provision of 'reader ready' information and educational material or for the lay audience and the school children and their teachers.
- An up to date website, with a country map showing the 'flu-state-of-affairs' and providing news and accessible information on flu and cold, vaccination, health care and scientific research;

The information packages are in English, assembled in a single database. In January 2010, all information and education on the Dutch and Belgian Grote Griepmeting have been updated, reworked and/or uploaded as a new document on flu and vaccination. All material can be viewed and used on line, and most lessons are interactive and free to download. Here below we provide a list of the major developments in this direction.

New, educational material, including interactive lessons on arithmetic and flu, two films on influenza and the flu game for the ages *6 to 12* can be found on www.degrotegriepmeting.nl/?thissection_id=27
A (swine) flu web quest, an American, interactive movie on flu, and health care and biology lessons for the ages *11 to 15* are available on www.degrotegriepmeting.nl/?thissection_id=24. Build a virus and make a video on the prevention of flu, including instructions for ages *14 to 17* can be downloaded at www.degrotegriepmeting.nl/?thissection_id=92. Modeling material and the lessons on pandemic and new influenza H1N1 for the ages *15 to 20* are here to find: www.degrotegriepmeting.nl/?thissection_id=26. The *adults* and their *children* will find a quiz, a sudoku and a flu game or puzzle at www.degrotegriepmeting.nl/?thissection_id=93.

Much of this material has been translated into English, either as summary for a complete translation upon request by the partners or as a complete update in English, adapted to national school curricula. See few examples in the figures below. All on line material will be posted on the new European Influenzanet website with a European database, following Task 1 (March 2010).

Example 1: H1N1 Flu web quest for education and training for the 11 -15 years old:

Example 2: the Epidemic Flu Game instructions for teachers of the 8 – 12 years old:

Example 3: on line explanation of how flu 'travels' around, for the 11 – 15 years old: