

# eSARS (Electronic Severe Acute Respiratory Distress Syndrome System) – Development and Technical Perspective

Anthony Cheung<sup>a</sup>, N T Cheung<sup>b</sup>, Andre Greyling<sup>c</sup>, Michael Fung<sup>d</sup>, James Kong<sup>e</sup>

<sup>a</sup> Senior Systems Manager, Information Technology Department

<sup>b</sup> Executive Manager, Health Informatics Department

<sup>c</sup> Deputy Director, Information Technology Department

<sup>d</sup> Senior Systems Manager, Information Technology Department

<sup>e</sup> Consultant, Health Informatics Department  
Hospital Authority, Hong Kong SAR

## Abstract

First discovered in Hong Kong in mid-March 2003, SARS (Severe Acute Respiratory distress Syndrome) is a potentially fatal respiratory illness. As in early April 2003, the HA head office management decided to develop an eSARS for capturing the clinical case details of SARS patients that were admitted to the public hospitals. This eSARS, developed on a Web-based 3 tiers platform, consists of 2 components, namely the data capture module and the reporting module. The data capture module can be deployed to any CMS workstations already with the corporate modules of Patient Master Index, Patient activity movement, laboratory results, XR examination results, medication and other specialty clinical information. The reporting module can be deployed at any HA intranet workstation for easy access and retrieval of clinical and disease trend information and statistics. Moreover, the eSARS data is required to be transmitted to the health department for disease monitoring and surveillance mechanism, to the police department for contact tracing and tracking; and to the universities for clinical research. The relevant SARS data is transmitted to the DM ZONE using SSL, PKI, eCERT technological components. Due to the urgency, the eSARS has to be developed within 72 hours (3 days) while the data transmission to the DM ZONE with contract tracing modules has to be developed within 7 days.

## Key words

eSARS

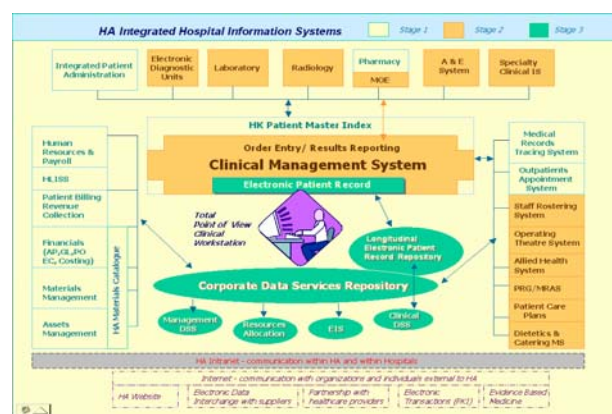
## Introduction

The Hospital Authority (HA) has been established for more than 12 years. During this period the HA has totally transformed the public healthcare system. Hong Kong now has one of the highest life expectancy and lowest infant mortality rates in the world.<sup>1</sup> HA today manages 44 public hospitals with 1.2 million in-patient discharges annually. There are 15 Accident and Emergency facilities handling 2.4 million visits annually, and 42 Specialist Outpatient Clinics handling 8 million visits annually. HA manages a

budget of HK\$30 billion annually and a total staff of more than 50,000 of which 4,000 are doctors and 20,000 nurses.

The HA IT/IS Strategic Plan (1992-2002) set out to achieve fully integrated information systems across all HA institutions. The HA has implemented over 36 major computer applications in settings ranging from major acute hospitals to primary care clinics.<sup>2</sup> The major clinical systems were fully implemented in all hospitals by April 2002. A web-based enquiry system provides access to the clinical data generated in the hospitals and specialist outpatient clinics to authorized users from any point in the HA network.

As well as implementing the operational systems to collect data and support the clinical processes, HA is building the databases to establish the HA Data Warehouse (DW) and Decision Support Systems. We currently have over 280 Gigabytes of data in the Data Warehouse, which includes all operational data and human resources data since 1992. Over 300 million records are available for on-line enquiry. The blue print of the information systems is highlighted below to illustrate the correlation of the various functional components:



## Outbreak of SARS

First discovered in Hong Kong in mid-March 2003, SARS (Severe Acute Respiratory distress Syndrome) is a potentially fatal respiratory illness. Victims' symptoms include a high fever, cough, myalgia and shortness of breath.<sup>3</sup> Since HA manages all the public hospitals and

clinics in Hong Kong it played a key role in combating the spread of SARS in the territory. Information flow is crucial at a time like this with communications becoming essential at local and global levels. Within Hong Kong public hospitals, corporate clinical information systems like Clinical Management Systems (CMS) with necessary network infrastructure, databases servers and clinical workstations have been in place acting as a infrastructural foundation for helping to capture new SARS cases at various outlets of the public hospitals and analyze trends at the central office.

### Foundation for building eSARS system

The HA clinical information systems are integrated around the Clinical Management Systems (CMS) architecture and the information integration for all systems is achieved via the Data Warehouse. The aim is to have a clinical workstation that provides the physician with a total point of view for all clinical data related to the patient under care. The following is the useful figure in relation to CMS for reference: -

- No. of CMS users : 29,000  
(about 4,000 doctors, 20,000 nurses and 5,000 paramedical staff)
- No. of CMS workstations : 6,000
- No. of hospital/clinics linked up: Over 80
- No. of data centers : 14
- No. of WAN lines : Over 100

With this network infrastructure, workstation penetration and user base, the eSARS could be developed and deployed at an extremely accelerated mode for the end users to enter the SARS case information and for the management to study the trend.

### Development and technical platform of eSARS

As in early April 2003, the HA head office management decided to develop an eSARS system for capturing the clinical case details of SARS patients that were admitted to the public hospitals. This system, developed on a Web-based 3 tiers platform, consists of 2 components, namely the data capturing module and the reporting module.

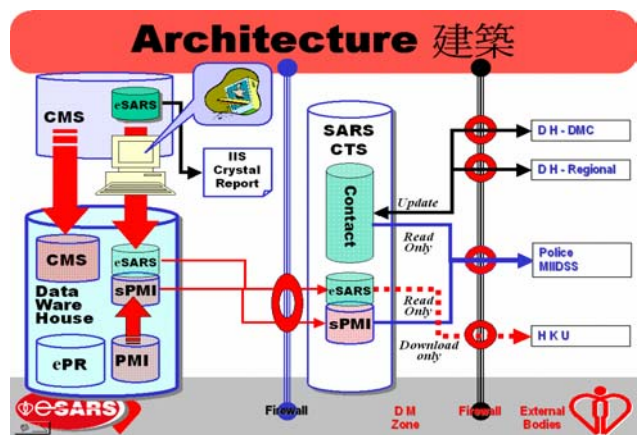
The data capturing module has incorporated the entry of SARS case information including the probable contact details, its symptoms, initial treatment protocol (medication). Once the suspected patients are brought into the hospitals, the ward staff will enter this information on top of the normal clinical data that will be kept in the CMS. This module is deployed to any CMS workstations already with the corporate modules of Patient Master Index, Patient activity movement, laboratory results, XR examination results, medication and other specialty clinical information.

The case and management reporting module generated statistical and trend information for the HA management to study and analyze at their daily steering committee meetings.

This module is deployed at any HA intranet workstation for easy access and retrieval of clinical and disease trend information and statistics.

Moreover, the eSARS data is required to be transmitted to the health department for disease monitoring, surveillance and outbreak management, to the police department for helping in contact tracing and tracking for suspected and possible suspected cases; and to the universities for clinical research and study.

Regarding its technical platform, the relevant SARS data is transmitted to the DM ZONE using SSL, PKI, eCERT technological components. Due to the urgency, the eSARS has to be developed within 72 hours (3 days) while the data transmission to the DM ZONE with contract tracing modules has to be developed within 7 days. The architectural diagram is illustrated below to highlight the major components: -



The major technical platform components that have been used for building this eSARS are listed below: -

- a. Hardware Server components
  - UNIX server – IBM RS6000 with operating system of AIX 4.3X
- b. Software components
  - Backend - Sybase 12.5 ASE DBMS (same platform as CMS)
  - Informix DBMS (for datawarehouse)
  - Middle tier - Windows 2000 server (OS)
  - IIS 5.0 (as Web Server)
  - Crystal Report (for reporting)
  - Frontend tier - PowerBuilder 6.5 (same platform as CMS)
  - IE 5.0 (for browser) or above
- c. Authentication components
  - Tools: SSL, PKI & eCERT

### Conclusion

After 3 days' system development, the eSARS system including data capture and reporting functions were

deployed for use by all 29,000 CMS users at all 6,000 CMS workstations on 9 April 2003. With information collected across the public hospitals, HA head office generated the statistical data and trend data through the eSARS system. The HA management utilized the generated information for daily reporting and management planning on fighting against SARS. The eSARS information was also transmitted to the Department of Health for further public health measures.

At the end of 23 June 2003, the SARS episode 1 outbreak was come to an end with the following figures:-

- Duration : early March – 23 June 2003 (about 110 days)
- No. of SARS patients reported: 1,755
- No. of death cases : 299

## References

- [1] United Nations Health Indicators (2003). Available on-line  
[<http://unstats.un.org/unsd/demographic/social/health.htm>]
- [2] **40.** Cheung NT, Fung KW, Wong KC, et al. Medical informatics--the state of the art in the Hospital Authority. *International Journal of Medical Informatics*. 2001;62(2-3):113-119.
- [3] Lee N, Hui D, Wu A, Chan P, Cameron P, Joynt GM, et al. A major outbreak of severe acute respiratory syndrome in Hong Kong. *New Engl J Med* 2003 May 15; 348(2): 1986-94

## Author

Mr. Anthony CHEUNG

Email: [cheungwm@ha.org.hk](mailto:cheungwm@ha.org.hk)

Tel: 852-2300 6538

Anthony CHEUNG is an IT professional working in Hospital Authority Head Office, HKSAR for more than 12 years. He was borne and educated in HKSAR. At present, he is responsible for the development and implementation of the Clinical Management Systems for all public hospitals including specialist out-patient clinics in Hospital Authority.