Teaching Case
Implementation of an Interorganizational System: The Case of Medical Insurance E-clearance

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ABSTRACT

The patients receiving treatment from a hospital need to interact with multiple entities when claiming reimbursements. The complexities of the medical service supply chain can be simplified with an electronic clearance management system that allows hospitals, medical insurance bureau, bank, and patients to interact in a seamless and cashless manner. This case describes the implementation of such a system for the medical insurance bureau of Xiamen. Although the architecture was simple, the implementation faced a number of challenges. Although there were both organizational and technical challenges, the problems of co-ordination and communication between the different teams tended to dominate the process of implementation. The project leader was faced with the decision of prioritizing the complex challenges, and finding out ways to overcome them.

Keywords: Application development, E-commerce or E-business, Project management, System integration, Teaching case.

1. INTRODUCTION

Frank Tsai was sitting in his chamber and pondering over the three hour marathon meeting which he just presided. The meeting went over time. It was nearing midnight now, and his colleagues had all departed one after the other. The meeting ended without any strong conclusion, and he was wondering on ways to get the implementation of the e-clearance management system of the medical insurance clearance system (MEDICS) for the city of Xiamen back on track. As project manager he was responsible for timely delivery of the project. His company, Xiban Software, had beat many competitors in bagging this project from the medical insurance bureau of Xiamen and had a lot at stake in this project. The co-ordination between XBC (Xiamen Area Bank of China), hospitals of Xiamen, and the medical insurance bureau of Xiamen was proving to be the toughest challenge, apart from the many technical issues cropping up during the implementation. The fate of the e-clearance management system project was still far from clear, and the future plan to extend it to all types of cash management in other social insurance programs looked uncertain. Frank was worried that his success as a project leader was soon going to be questioned at Xiban. It was high time for Frank to sort out the technological and organizational glitches in the project if he had to keep his reputation, as well as his job, in place.

1.1 Medical insurance management in Xiamen

Xiamen was a coastal city located in south-east China, with a total population of about 1.5 million. It was a sub-provincial city under the Fujian province. Xiamen was one of the first five special economic zones in China. The growth rate of its GDP averaged 18.3% in the past 26 years. The local government of Xiamen had a lot of funds, and it had been investing heavily in a variety of information systems that were being used in government organizations. Among the various government divisions, the social insurance division was considered to be an important one, and it received sizable funding for

improving its information systems (Fujian Statistical Bureau, 2006). The electronic medical insurance management system for Xiamen was first implemented in July 1997. The system provided medical insurance service to 420,000 members who were based in Xiamen city. Each month, the billing subsystem calculated the amount that each insured should pay for medical insurance fee, and sent out billing notice. The system also dealt with insurance balance management for the insured. The most important function of the system was to provide billing service for the insured when they paid for the medical treatment that they received at the hospital. The MEDICS had direct network connection with all major hospitals and pharmaceutical shops in Xiamen, and it had a system interface to interact with the different hospital information systems. When an insured got medical treatment and wanted to check out, the hospital information system sent out relevant information to the MEDICS through the system interface, and immediately received feedback about how much the insured should pay, and how much the medical insurance bureau should pay. Next day, the medical insurance bureau would send electronic payment information to designated commercial banks to transfer the required amount of money from its account to accounts of the hospitals. The system had worked quite well in the past but it was increasingly leading to a number of inconveniences for the insured.

1.2 Evolution of medical insurance claims management

The MEDICS had evolved slowly and steadily to its current state. The clearance management systems was the latest in the evolution of the system that planned to provide a holistic and consolidated way of handling the overall insurance claims management process. The MEDICS dealt with the whole process involved in an insured getting treatment at the hospital, buying medicines in the pharmaceutical shops, and making payments for the medical service. It determined the amount of money to be paid by the medical insurance bureau and by the insured. The insured and medical insurance bureau paid the fees jointly according to the payment ratio of those medical treatments. The insured paid the amount in cash.

The MEDICS had to deal with many cash transactions, especially for people taking their treatment outside the city of Xiamen. In such cases the insured had to pay full amount, and then go to the medical insurance centre to collect the reimbursement. The medical insurance system of Xiamen did not have network connection with hospitals outside the city. About USD $0.5 million worth of cash refund transactions occurred in 2004. The above cash transactions were inefficient as they were subjected to security problems as well as human errors. The other major cash transactions involved were when the insured paid to the hospital directly. Whenever the insured got medical treatment in the hospital the charges were split into two parts: one part was paid by the medical insurance bureau, and the other part was paid by the insured himself (usually a cash transaction). In the year 2004, insured's total cash payment in hospitals of Xiamen was about USD $12.5 million. These cash transactions were one of the concerns in the existing MEDICS.

1.3 Medical service supply chain

The four key parties involved in the medical service supply chain in the city of Xiamen included the hospitals, the insured, the concerned bank, and the medical insurance bureau. The interactions that took place between these various entities in the medical service supply chain are shown in Figure 1.

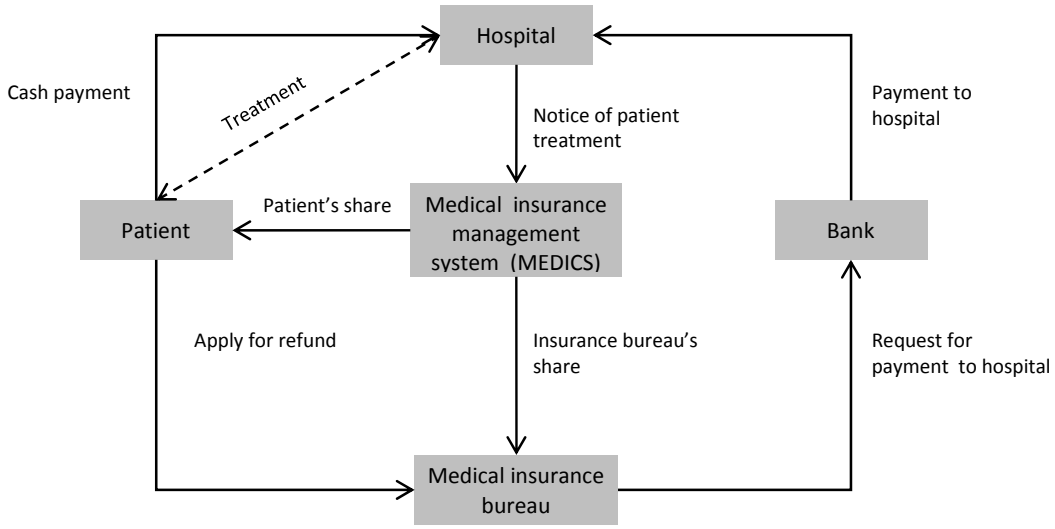


Figure 1. Medical service supply chain before the implementation of e-clearance management

1.3.1 Hospitals: Because of the heavy volume of cash transactions that took place, most hospitals issued their own payment cards. The insured needed to apply for a payment card, and deposit enough money into his or her account before (s)he could get medical treatment. (S)he used this payment card to pay the hospital whenever there was a need. Hospitals needed extra manpower to deal with the issuance of payment cards, cash deposit, cash refund, as well as various other paperwork related to the maintenance and management of payment cards.

1.3.2 Insured: The insured had to remember to bring the medical insurance card, hospital payment card, and enough cash when going to the hospital for receiving some treatment. If (s)he wanted to go to a different hospital than the one (s)he usually visited, (s)he had to apply for a different payment card. This was not only time consuming but also quite inconvenient when the insured needed urgent medical attention. If the insured wanted to do cash payments in the hospitals which didn't issue payment cards, they had to line up and wait in long queues as handling of cash transactions was very inefficient in these hospitals.

1.3.3 Medical insurance bureau: Every day the medical insurance bureau had to deal with hundreds of cash refund transactions for those who received medical treatments outside the city of Xiamen. The amounts involved in such transactions were usually small. This was a heavy non-value-adding workload. It was very difficult for the medical insurance bureau to forecast the amount of cash they needed each day. Keeping a large amount of cash in the medical bureau created security problems, and yet insufficient amount of cash in the medical bureau to pay the insured led to a lot of dissatisfaction among the recipients.

1.3.4 XBC: XBC was responsible for paying the hospital the part of the patient's claim that was due from the medical insurance bureau. The bank had to deal with a number of hospitals in the city of Xiamen, and the practices that they followed for the payment was not standardized. For example, it was possible for two different hospitals to charge slightly different fees for the same medical procedure or pharmaceutical order. Staff from the bank had to cross-check with the hospital in question to find out their treatment charges and their payment ratios. Since the bank regularly rotated staff between departments, those who did not have a prior experience in handling medical claims always had a hard time to deal with such transactions.

1.3.5 Xiban Software: The medical insurance bureau of Xiamen had recruited Xiban Software to implement the e-clearance management system. Xiban had won the contract after a long bidding process and going through two rigorous rounds of screening along with its competitors. Xiban was an up-and-coming boutique software firm that was much smaller in size compared to its client and XBC. Recently, it had been quite successful in implementing an ERP project for a regional insurance company. Frank Tsai was chosen as the manager of this project because of his prior experience in handling healthcare software development projects. He was to report to the Xiamen Area Manager of Xiban Software. Frank was a graduate from Fudan University and had more than ten years of work experience in the software development industry. He was also well-known in his company for his excellent communication skills, and ability to work under pressure with many internal and external partners. This project was an important one for Xiban because the successful implementation of e-clearance management in Fujian province could lead to other provinces in China implementing similar systems, thereby generating plenty of business for Xiban in future.

2. COMPONENTS OF MEDICS AND E-CLEARANCE MANAGEMENT

2.1 Description of subsystems of MEDICS

The MEDICS included the following sub-systems: medical insurance bureau subsystem, hospital information subsystem, and XBC information subsystem.

2.1.1 Medical insurance bureau subsystem: The medical insurance bureau subsystem was an integrated system providing the interface to the insurance users. This system controlled the issuance, freezing, and cancellation of the medical insurance card. The medical insurance card was the unique identity of the insured, and served as his identity in the medical insurance bureau subsystem. The system handled addition, deletion, modification, and query of insured's personal data. When the insured received medical treatment at a hospital, the system calculated the amount that the medical insurance bureau should pay for each treatment, and then paid the same amount to hospitals on behalf of the insured. At the end of each month, the system calculated the amount of insurance premium for each insured, generated accounts receivable, and sent bills to the insured. After collecting the insurance premium, the system recorded the payments received.

2.1.2 Hospital information subsystem: The hospital information subsystem was an integrated system consisting of order entry, administrative, clinical information and departmental systems within the hospital. This system sent requests and received feedback through a customized system interface between the hospital information subsystem and the medical insurance bureau subsystem. There were thousands of medical treatments and pharmaceutical orders that were handled by this system. In order for the three subsystems to recognize them, a common encoding scheme was used. Each medical treatment or pharmaceutical order had its own identification number that was listed along with the associated payment policy number of the insured. When the hospital information subsystem submitted the relevant identification number of the medical treatment or the pharmaceutical order purchased by the insured, the medical insurance bureau subsystem sent out the payment feedback immediately on the basis of the associated payment policy.

2.1.3 XBC information subsystem: XBC was the biggest commercial bank in China with a market capitalization of around US$ 35 billion. It had more than 21,000 domestic branches, and more than 100 overseas branches. The bank had a strong information technology infrastructure. XBC had implemented the Comprehensive Business System, which was a set of a large scale application software system, with the accounting subsystem acting as the core system. It included 23 business processing subsystems such as funds remittance, transfer and clearing, personal banking, finance, financial affairs, electronic banking, international business, credit account, and ex post supervision, etc.

2.2 E-clearance management system

The e-clearance management system was used to deal with the cash payment after insured received medical treatment at the hospital. The insured and medical insurance bureau jointly paid the fees according to a pre-arranged payment

ratio for the specific medical treatment. The payment ratio changed from time to time. After the record for the medical treatment received by the insured was uploaded, all payment related information was sent to the medical insurance bureau subsystem to calculate the amount that the insured should pay, and the amount the medical insurance bureau should pay. Then an electronic payment notification was sent to the bank to clear the accounts payable. The e-clearance management system would interact with the three different subsystems and would solve the problem created by cash payment. After the implementation of the system, the insured would need to present his/her insurance card to pay for all fees when (s)he received medical treatment at the hospital or put forward a pharmaceutical order at any hospital within the city of Xiamen. The e-clearance system would also transfer cash refund to the insured's bank account directly. Figure 2 provides a schematic diagram to show how the augmented the medical service supply chain would work in the presence of e-clearance management. The benefits of the e-clearance management system seemed to be high – increased productivity, lower administrative costs, reduced backlog, and increased efficiency (Microsoft, 2004).

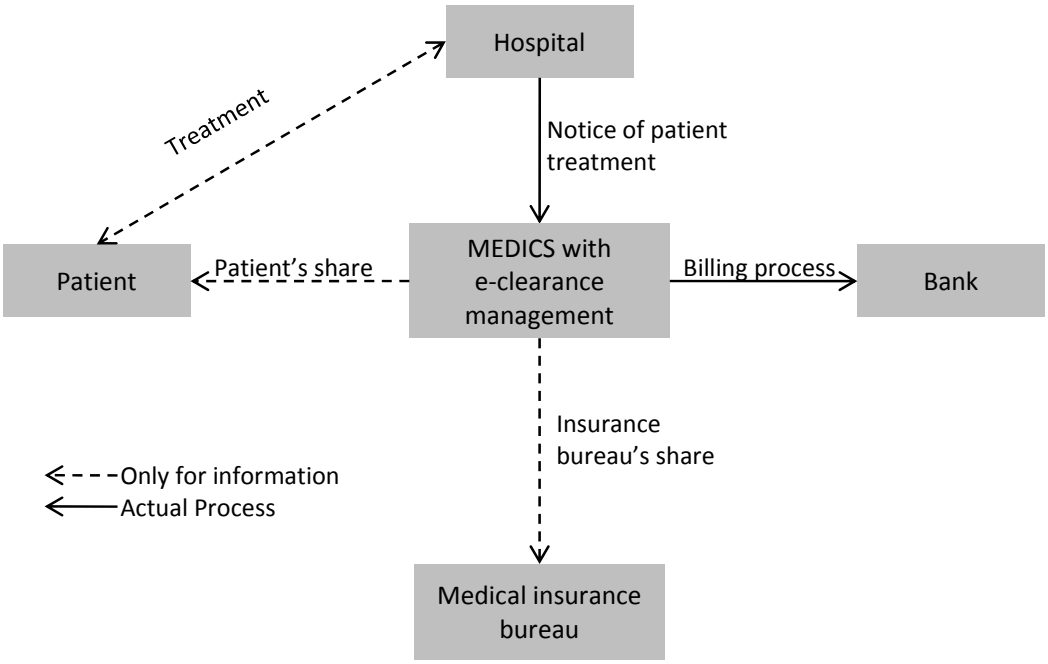


Figure 2. Medical service supply chain after the addition of e-clearance to the MEDICS

A number of new business processes would come into play after the implementation of the new system. The critical business processes that needed to be dealt with were: registration or de-registration of e-clearance service, payment transaction, and cancellation of payment transaction, freezing of medical insurance account or bank account of insured, cash refund, audit of all transaction records each day, and account clearing. Figure 3 provides a flow diagram of the various new processes that would take place in the new MEDICS.

2.2.1 System design: The coding language used was Java. The e-clearance management system included two integrated subsystems.

- Main process

It would deal with all transaction requests from the hospital including e-clearance service registration or de-registration, payment transaction, cancellation of payment transaction, and cash refund etc.

- Monitoring process

Monitoring subsystem would ensure that all on-going threads of communication between the various subsystems worked well, would provide security mechanism to the communication, and process request from the bank information system. The system would adopt ISO 8583 as the messaging protocol between the e-clearance management system and the bank information system.

Handling of the cash transactions was the main problem with the existing MEDICS. The e-clearance management system was designed to solve that problem. The integration with the information system of XBC gave rise to the flexibility to send electronic payment information directly to the insured accounts, and get the money debited from there. In this manner, the e-clearance management system bridged the gap between the medical insurance bureau and the bank with which the insured dealt with.

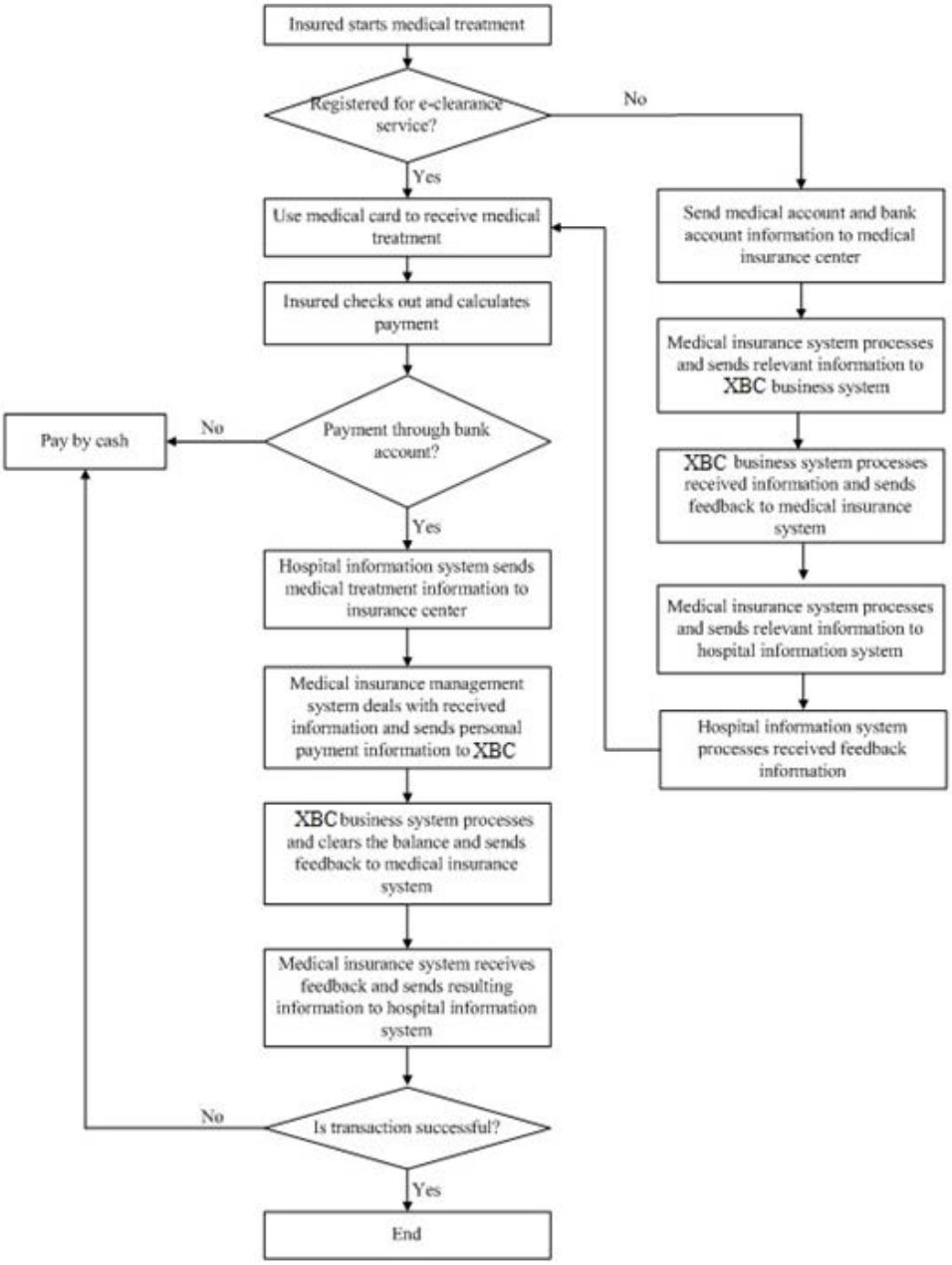
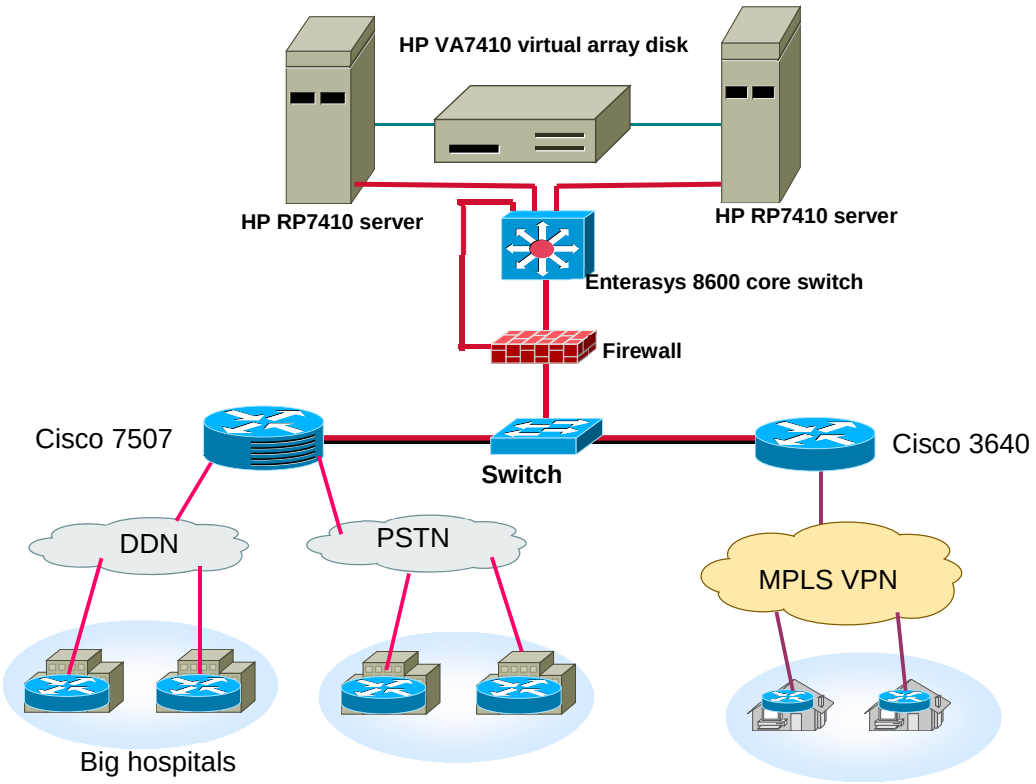


Figure 3. New business processes taking place after addition of e-clearance management

2.3 Overall architecture of the MEDICS

The MEDICS in Xiamen had been in place since 1997. It was based on cluster technology that gave it the flexibility to work with the backup data source during downtime. The system was designed using a thin client architecture. The thin client design meant that the client side had basic information display functionalities. It used two RP 7410 servers from Hewlett-Packard and one virtual array disk for storage (Hewlett Packard, 2004). The servers were hosted at the medical insurance bureau. The virtual array disk adopted Raid 0,1 for protection of the stored data. The database used was initially ORACLE 7.3.4, and later on it was upgraded to ORACLE RAC 9.02. The database adopted Oracle real application clusters to harness the processing power of multiple interconnected servers, and create a robust computing environment. The disaster recovery management system for the MEDICS included a primary data centre and a backup data centre. The storage area network of the two data centres were connected by a dark fibre with a speed of 1 Gbps. The distance between the primary data centre and the backup data centre was about 40 km. Using the Hewlett Packard Continuous Access data recovery software, all data updates on the storage of the primary data centre was backed up to the storage arrays of the secondary data centre on a real time basis. The hospitals had different network connections to the medical insurance bureau depending on the size of the hospitals. Bigger hospitals adopted a direct leased line from Data Direct Networks (DDN) with a high bandwidth of 2 Mbps, or they used the Multi Protocol Label Switching Virtual Private Network (MPLS VPN). On the contrary, smaller hospitals and pharmaceutical shops used the public switched telephone network (PSTN) for the network connection. There were about 55 hospitals, 75 pharmaceutical shops, and about 200 remote client sides, and all of them needed to connect to the medical insurance bureau. Figure 4 provides a snapshot of the overall architecture and connectivity of the MEDICS.



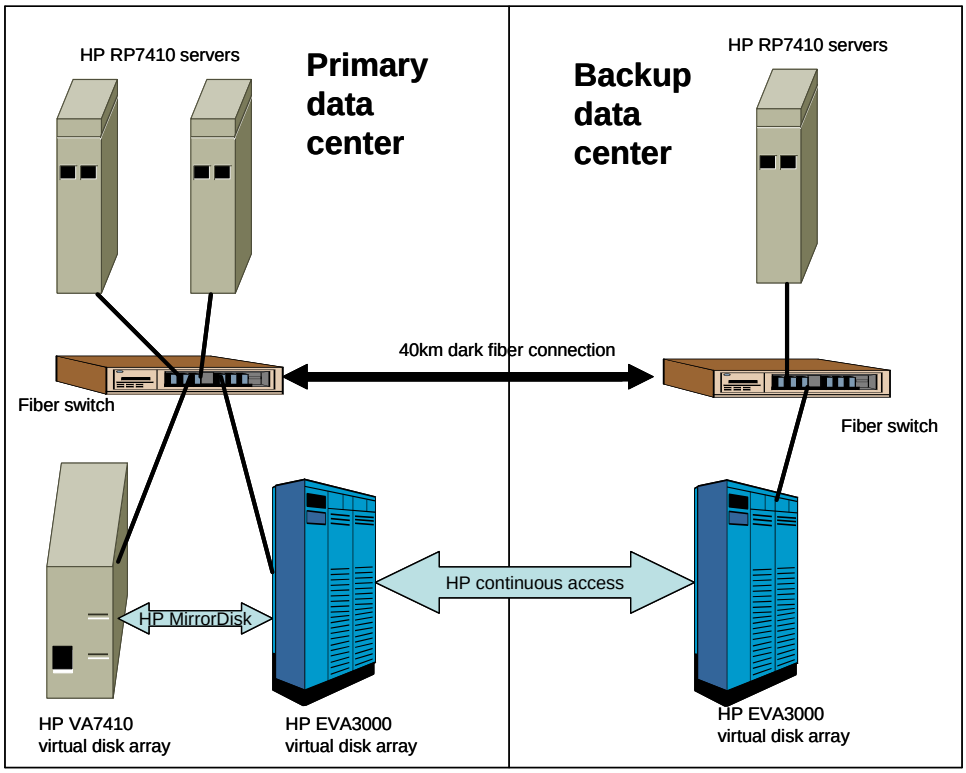


Figure 4. Server and connectivity structures for the MEDICS

3.1 Lack of co-ordination among the project teams

The first stage of the implementation included only one hospital and the system involved three entities in the medical service supply chain: bank, hospital, and medical insurance bureau. The implementation of the system lagged way behind schedule, and the main reason was the complex organizational structure of the implementation teams. Frank was the designer and developer of the e-clearance management system, and he was solely responsible for the timely delivery of the project. His team had focused too much on the technical aspects of the e-clearance management system, and sometimes lacked focus about the holistic picture of the project. The full picture included not only the e-clearance management system but the adjustment of the business system controlled by XBC, the adjustment of the medical insurance subsystem controlled by the medical insurance bureau, the adjustment of the hospital information system controlled by the hospitals, and the associated interfaces linking these various subsystems. The most important aspect was the coordination among all those systems so that the operations were smooth. Even after many attempts Frank had not been able to coordinate with all team members, and push the work of all involved parties forward. His formal authority was not enough for him to exert influence across organizations. Figure 5 provides a detailed organization structure for all units of the medical service supply chain that were involved in the project. Frank had to walk a tight rope in terms of understanding the official and personal relationship of the various team members. He needed to use the power distribution among the team members for the benefit of the project as well as for exerting influence across organizations.

3.2 Lack of co-operation from XBC project team

Team members from the hospital and the medical insurance bureau were quite cooperative. However, project team members from XBC were completely different, and it took Frank a lot of time to coordinate with them. Wang Xin was the Vice General Manager and in charge of the project at XBC. Unfortunately she didn't share a good rapport with the IT department manager of XBC due to some unknown reason. She was not able to influence the IT department manager based on her formal authority. The organizational structure at XBC was bureaucratic, and was responsible for slowing down the pace of the project. The IT engineers from XBC did not have any special incentive to work on this project. They got the same salary no matter how hard they worked. The project required tweaking of a system interface that needed to conform with the banking regulations. The IT engineers from XBC were familiar with their banking system, and the members of the other teams needed them to share this knowledge with them. However IT engineers from XBC were not willing to cooperate. Co-ordination with the IT department manager of XBC, and motivating the IT engineers of XBC turned out to be a big challenge for Frank Tsai and Wang Xin. Both of them decided to communicate the situation to the higher authorities at XBC.

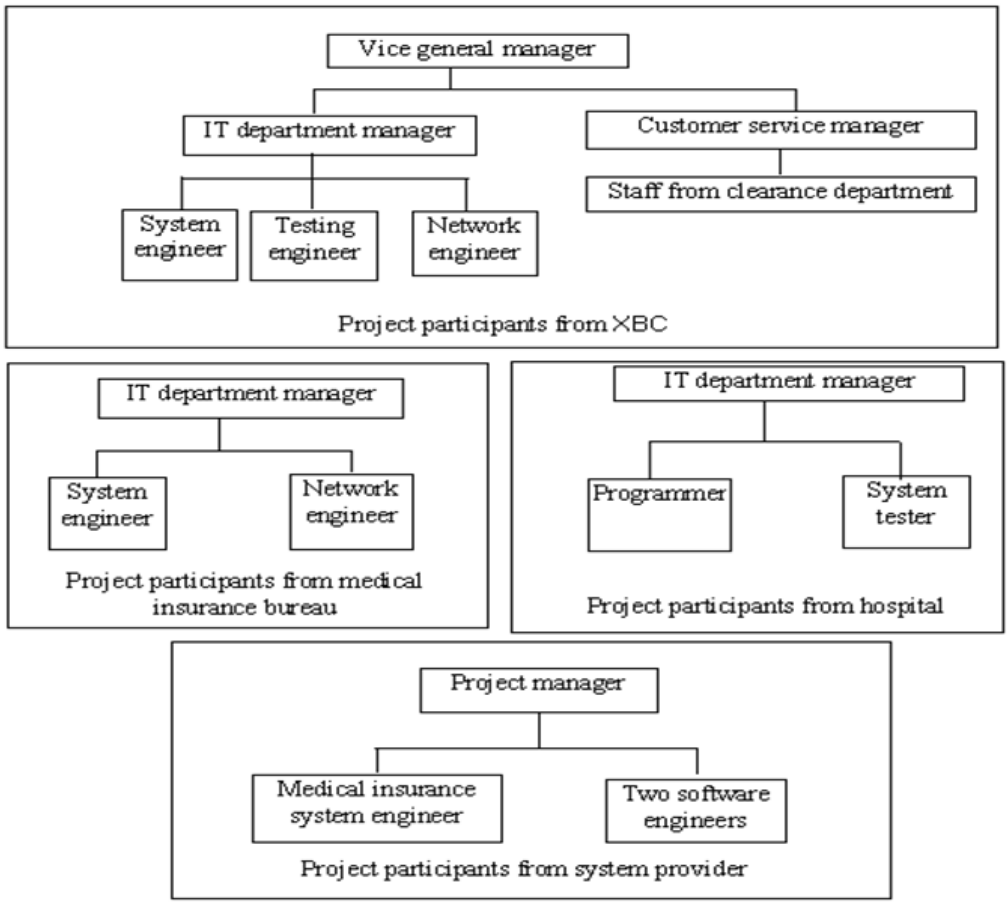


Figure 5. Organizational structure of the different project teams

3.3 Availability of testing management

The bank information system of XBC was hosted at their Shanghai data centre. There were some testing servers in this data centre that provided testing services for branches all around the country. The data centre would only allow a certain period of time during the day for testing to take place. As a result, the implementation team of the e-clearance management system usually just got one hour a day and three days a week to do the testing. To effectively and efficiently utilize those testing periods, the team made detailed testing plans to achieve diverse objectives, such as the conformance of software function to customers' demands, detection of bugs, and determination of effectiveness of the systems interface. The testing plan was still not comprehensive enough to achieve successful testing. Execution of the plan was also critical and needed special efforts from Frank Tsai and Wang Xin. Another problem that came up when the testing began was that of inconsistent records. Figure 6 provides an overview of the process that was used to detect inconsistent records. Given the current state and design of the system it was difficult to identify any inconsistent records. Frank was still in consultation with other groups to find a mechanism to solve the conflict between the bank and the hospital in case such a situation arose. He was yet to come to a resolution.

3.4 Scalability

One of the key issues in the process of implementation was to ensure that the hardware environment was stable, and the response time was acceptable under the condition of high volume of transactions. The system was a real time system and involved 420,000 users. A good hardware environment was very important for the performance of e-clearance management system, and for supporting the process and thread modes of the e-clearance management system. Frank was very sound technically and had a lot of experience in systems design. He was not very happy with the design of the system, and was worried that the system would not be able to scale up when all the hospitals were connected to it. Besides, a substantial amount of money had already been spent in this project. Table 1 provides a breakdown of expenses under the different categories. The system used the extra capacity of the hardware system in use. Therefore, no extra investment in hardware was needed for the project. Frank wondered that to make the system scalable for all hospitals he needed to ask for additional funds for getting extra hardware. He was not sure if such funds would be approved by the management.

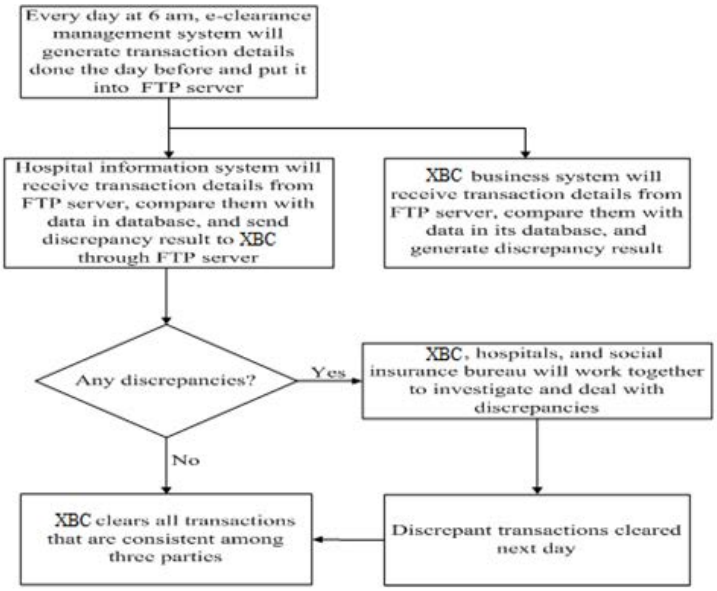


Figure 6. Process for determination of discrepant transactions

No.	Category	Cost (US$ 000)
1	Adjustment of medical insurance bureau system	80
2	E-clearance management system	120
3	Adjustment of system interface between hospital information system and medical insurance bureau system	20
4	Adjustment of hospital information system	30
5	System maintenance cost (First three years)	60
	Total	310

Table 1: Breakdown of expenses for the e-clearance management system project

3.5 Security and integrity

The system required high level of security due to the monetary transactions that it handled, and also due to the banking regulations that governed these transactions. For all transactions that involved more than RMB 500, the system required the insured to input the password of his/her bank account. Moreover, a special password input device with hardware encryption function had been installed to protect the security of the passwords. At the network level, there were multiple firewalls to insure the security of the database. The system interface between the medical bureau subsystem and the hospital information system used the text format without any encryption. It was likely to put the insured's banking account information and password at risk. Wang Xin had been monitoring the security related issues as she had a lot of experience in this area, but even she did not know how to deal with the textual interface related issues. Everyone involved in the project knew that the success of the project required high rate of accuracy of data and transaction records among all the involved subsystems. As the e-clearance management system would interact with three different subsystems, a mechanism to insure data integrity between those subsystems was very important. Frank was planning to set up a meeting with Wang Xin and the IT department manager to go through all the processes that were to be followed to ensure the sanity of records in all the different subsystems. One thing that bothered Frank was that the e-clearance management system did not have any built in protection to detect fraudulent medical claims. He had recently read in a report that "fraud accounts for 19% of the $600 billion to $800 billion in waste in the US healthcare system annually" (CAIF, 2008). He wondered what additional security controls could be put in the e-clearance management system to guard against such claims frauds.

3.6 Data backup and recovery

The project team established a local data backup and recovery system. An HP OpenView Storage Data Protector was installed to automatically backup the data in the virtual array disk to a tape. The HP OpenView Storage Data Protector was a backup solution that provided reliable data protection and high accessibility for fast growing business data. The software would do an incremental data backup after every 5 minutes. A full backup would be done every day at mid night. It was not clear if this backup arrangement was sufficient since the number of transactions that would take place when the entire system was operational was unknown. Frank had tried to contact the medical insurance bureau to find out approximately how many transactions took place with the

current MEDICS system but he hadn't received any numbers. This could be because the medical insurance bureau did not have such numbers available, or they were not willing to share those numbers with the implementation team.

4. THE WAY FORWARD

Insurance claims management systems have been in place for quite some time. These systems have been going through a number of critical changes. The major changes happening were automation of the whole system, and enhancement of the existing systems for providing a robust, efficient and comprehensive solution. The motive behind enhancement of the legacy systems was to reduce the administrative costs, improvement of the turnaround time, and improvement in the claims throughput (OECD Insurance Committee, 2004). The flow of data between the different players in an insurance claims management system had always been a cause of worry. The insurance industry was slowly adapting to the business operational benefits opened by the inter-connectivity of the Internet, and many clients who were no longer satisfied with their current claims management system or who still had no singular electronic data manager were turning towards on-line application service providers for a new solution. In a survey conducted by Deloitte Centre for Health Solutions in 2008, it was found that health care consumers "want to use online services to access their medical records and tests, manage claims, schedule appointments, and gather information about the cost and quality of care" (Bigalke et al., 2008). The America's Health Insurance Plans (AHIP) predicted that as the volume of health insurance claims continued to escalate, consumers could save billions annually by utilizing electronic submission and processing. The turnaround time was one of the parameters on which a claims system was judged, and a recent survey reported that electronic claims processing had reduced the turnaround time for 98% of the claims to be within 30 days (AHIP, 2006). The progress of technology made even real time claims adjudication without manual intervention a possibility (Rabinowitz, 2008).

The system being implemented in Xiamen was different from the medical insurance claims management systems as it had an added interaction with the XBC information system. The payment ratio for different types of medical treatments kept changing. In such a scenario the MEDICS kept calculating the amount needed to be paid by insured, and the amount needed to be paid by medical insurance bureau, at different ratios. The introduction of the e-clearance management system promised to solve this issue as the payment wouldn't be done in cash, and would be directly debited from the insured's account. However, obstacles in the implementation process made this a difficult project.

In future, there was a plan to extend the e-clearance management system to include all cash transactions in other social insurances, such as pension insurance and unemployment insurance. It would be established as a cash payment platform for the social insurance business. As soon as there were cash payments from the social insurance bureau to the insured, the social insurance system would send electronic data to the e-clearance management system to do the clearance. Except for the expansion of scope, the e-clearance management system could also expand its geographic coverage from the city of Xiamen to the whole of Fujian province. As the Chinese government was building countrywide social insurance network and social insurance information systems, the e-clearance management system had a large room to grow. At the same time, there was a need to build a province wide e-clearance centre for medical insurance, which would be used to calculate the insurance fee for the insured getting medical treatments in different cities within the Fujian province. At the same time, XBC bank wanted to share the e-clearance management system with other commercial banks. The e-clearance management system allowed multiple commercial banks to do the clearance. If this could be done, then not only the insured with bank account at XBC, but also the insured with bank accounts at other commercial banks would be able to receive the benefits of the e-clearance service. Another possible improvement in future could include the integration of the system with workflow tools since a number of insurance providers were already doing so in other countries (Harris-Ferrante, 2003).

5. CONCLUSION

Before the implementation of the e-clearance management system the insured had many cash payment transactions with the hospital, and this caused a lot of inconvenience for the hospital, insured, and the medical insurance bureau. The e-clearance management system attempted to use the e-clearance capability of the commercial bank to solve such cash payment issues. The e-clearance management system integrated the MEDICS, XBC information system, and the hospital information system. It coordinated the systems to deal with cash payment in a cashless fashion. The implementation of the e-clearance management system was very challenging as it involved team members from four parties. A good coordination among those team members was necessary for the success of the implementation. Frank Tsai remembered what his colleagues had said during the meeting: "We have high hopes that you will show us the way to overcome the challenges". There were so many issues to deal with, and so many tradeoffs. Any wrong step would raise the ire of the partner project teams, and put him in a tight spot not only with the other teams but even with his colleagues at Xiban Software. He made up his mind to prioritize the issues, and solve them one after the other. But which one should he start with first. He definitely needed some coffee to stay awake. It will be a long night!

6. SUGGESTED ASSIGNMENT QUESTIONS

a. What is e-clearance management? What is the role played by e-clearance management in MEDICS?
b. What were the technical and managerial challenges encountered by Frank Tsai and his team at Xiban software in implementing the e-clearance project?
c. What steps should be taken by Frank Tsai to solve the problems faced by him?

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