First Experience in Implementing an Open Source Health Information System for a City Hospital in a Developing Country

Jose Eugenio Quesada

**Asia Pacific College
Integrated Open Source Solutions**

Context: The Need

- **The Need:**

  - **A newly built, 50 bed public hospital in the Philippines was in need of Information Technology systems.**

  - **This was the first local government hospital for Navotas, a 250,000 population city in North Metro Manila.**

Context: The Challenges

- **The Challenges:**

  - **The lack of knowledgeable Information Technology resource persons within the Hospital and Local City Government organization.**

  - **The People, Process, Technology, and Sustainability requirements needed for a successful deployment of a Health Information System for the Navotas City Hospital**
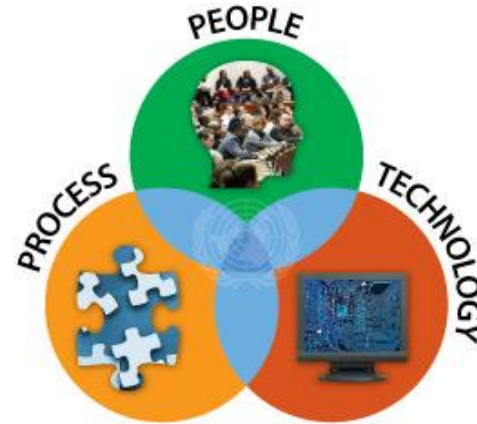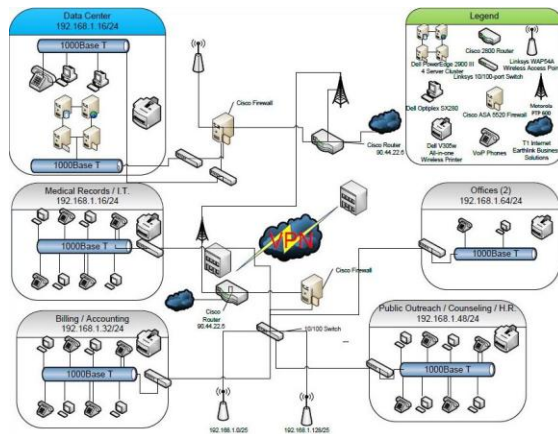
- **Health Information System Software**
  - **The Navotas City Health Department had decided to implement GNU Health, a Free, Libre Open Source Software, created and maintained by Dr. Luis Falcon.**
  - **They engaged a Medical Informatics consultant from the National Telehealth Center, a research unit of the University of the Philippines.**

Addressing the Challenges: I.T. Expertise

- **Local Information Technology Consultant**

  - **Integrated Open Source Solutions was contacted by NTHC, to provide the Information Technology consultancy services for the Navotas City Hospital.**

 - **iOSS is a certified partner of GNU Health.**

Addressing the Challenges: I.T. Expertise

- **iOSS provided the following I.T. Consultancies:**

  - **Hardware requirements for the hospital including, network (wired and wireless), server, firewall, desktops, laptops, printers.**

  - **Network architecture, design, physical layout and configuration**

  - **Server configuration using Server Virtualization Software**

  - **GNU Health Localization and Customization**
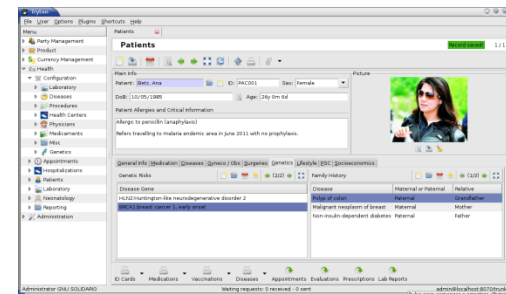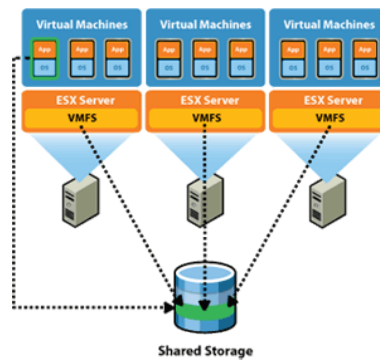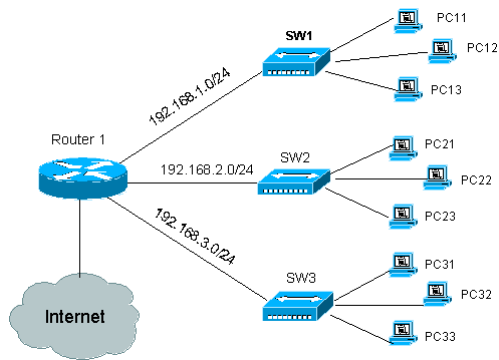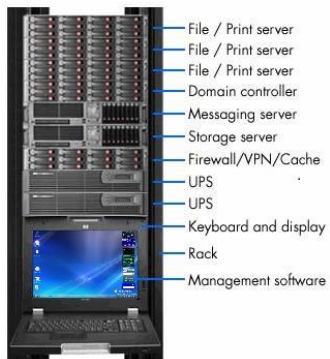
Addressing the Challenges: People

Stakeholders in I.T. Implementation at Navotas City Hospital

Stakeholder Title	Stakeholder Position
Project Funder	Mayor's Office
Project Owner	Hospital Director
Project Manager	Hospital Administrative Assistant
System Admin (Functional)	Hospital Administrator
System Admin (Technical)	Hospital I.T. Analyst
System Users	Hospital Section Heads (16)
Consultant - Medical Informatics	External Consultant (U.P. NTHC)
Consultant - Information Technology	External Consultant (iOSS)

Addressing the Challenges: People

- **Stakeholders in I.T. Implementation at Navotas City Hospital**

  – **Project Funder (City Mayor) and Project Owner (Hospital Director) were on board and committed to the project.**

  – **New medical staff applicants were required to take computer literacy tests as part of hiring evaluations.**

  – **Processes s and workflows still had to be defined implemented for the new hospital operations. (No baggage of existing workflows)**

  – **The main challenge from the people perspective was in getting the section heads and hospital administration to commit to meeting regularly, and to allocate a separate time, aside from their current duties, to study and work with the consultants to customize and map the workflows into GNU Health.**

- **The Cobit 5 framework was recommended by the author to be used for the I.T. project implementation for NCH.**

- **The Project Team applied the Scrum Methodology to iteratively define and deploy customizations to GNU Health for the hospital.**

Addressing the Challenges: Technology

Free/Libre and Open Source Software used for the I.T. Server Infrastructure

Server Function	Software Deployed
Firewall	**PFSense** -VLAN - For separation of machines by section/ - Controlled Internet Access based on VLAN membership - Internal Domain Name Server
Server Virtualization	**Proxmox** - Implemented Proxmox with software RAID 10 in order to easily create and deploy virtual machines, and to maximize the use of the physical server
Internal Communication and Collaboration Tools	**Nethserver** -Email, Calendar and Event Scheduling, Instant Messaging, Shared folders, Open LDAP for single sign-on. **Moodle** - Open Source Learning Platform that the hospital will use as a document repository and as a collaboration and learning resource

Addressing the Challenges: Technology

Free/Libre and Open Source Software used for the I.T. Server Infrastructure

Server Function	Software Deployed
Reporting Tool	**Jasper Reports:** -For generating custom reports needed by the hospital management and staff.
GNU Health Servers	**GNU Health Test Server:** This environment is for individual users/sections to study/ explore/ learn GNU Health. **GNU Health Data Preparation Server** : This environment is to be used for importing/entering/preparing initial data needed for production use. **GNU Health Integration/Training Server** :This environment is to be used for integrating process flows across sections, and for testing the system with production ready data **GNU Health Production Server** :This environment is to be used for production/live use by the hospital.

Addressing the Challenges: Sustainability

Timeframe of engagement of iOSS with the City of Navotas

Year and Month	Activity
2013 July	First exploratory talks with the client were initiated
2014 March	Navotas City hired a new Hospital Director/City Health Officer
2014 August	iOSS unofficially was engaged by the City of Navotas to customize and implement GNU Health for the new hospital that was under construction
2014 November	The Navotas City Hospital was inaugurated and blessed
2015 June	- The Navotas City Hospital officially began accepting patients - The agreement between iOSS and the City of Navotas for the GNU Health customization and implementation was finally signed and approved
2015 September	The first payment on the contract was released

Addressing the Challenges: Sustainability

- **From the timeline listed above, it took 2 years and 2 months from the first meeting up to the first payment by Navotas City to iOSS.**

- **From a sustainability point of view, iOSS could not maintain a team and pay for their salaries for two years, while waiting for the contract to be awarded, signed and the first payment to be released.**

  – **iOSS engaged with the City of Navotas with a team of one person, the author of this paper.**

  – **The author also retained his current work as I.T. professor at Asia Pacific College throughout his engagement with the City of Navotas.**

  – **The author was the local developer, implementer, system administrator, project manager, and technical requirements analyst for the project**

Addressing the Challenges: Sustainability

- **Additional technical expertise for GNU Health was provided by Dr. Luis Falcon, creator and maintainer of GNU Health.**

- **A Jasper Reports developer was also sourced through Upwork, and engaged through a deliverables based arrangement.**

- **The author initiated and cultivated close personal ties with Dr. Luis Falcon and with the GNU Health community.**

  - **Because of the relationship that was cultivated, the author could make requests to the community and get replies regarding technical issues of the software.**

  - **This relationship was key in allowing the author to do his own customization development on GNU Health, thus not requiring iOSS to source and hire a separate developer for the project.**

Results and Discussion:

- **The Navotas City Hospital I.T. project is still on-going at this time.**

- **The internal collaboration and communication tools have been implemented and are now in use by the hospital staff.**

- **Current mapping of workflows into GNU Health and testing by the users is on-going.**

- **The method for implementing the systems is a phased approach, beginning with the patient admission and administrative modules, and then continuing on with the clinical aspect (electronic medical records) of the patients.**

Phases in Implementing I.T. Systems for a Health Organization

- **Stand Alone manual, paper based work flow**

- **Stand Alone manual, paper based/electronic workflow with non-networked computers**

- **Networked, loosely coupled I.T. Systems, using Internal Communication and Collaboration tools.**

  – **Shared Network Folders, Email, Instant Messaging, Electronic Calendar, Home Page Portal**

- **Networked, tightly coupled I.T. Systems**

  – **Integrated Health Information System, Hospital Information System, and Electronic Medical Record System**

Conclusion:

- **The Navotas City Hospital I.T. project has provided the author with a unique opportunity to apply a complete range of Free/Libre and Open Source Software for all of the I.T. requirements of the hospital.**

- **Keys to success of the project hinges on:**

  - **Commitment and buy-in of all stakeholders involved**

  - **A phased, incremental deployment**

  - **A sustainable, long term engagement of the I.T. consultant implementing the project.**

Conclusion:

The Greatest Challenge:

Changing People's Behavior in accepting and learning new and better ways of doing things.

Some Pictures:

Navotas City Hospital

The Author, Dr. Luis Falcon, The Navotas City Mayor, The Navotas City Hospital Director

The Author, with the NCH I.T. Administrator

Dr. Luis Falcon with the NCH Management

Questions?

Joe Gene Quesada
Asia Pacific College
Integrated Open Source Solutions

Email: jlquesada@ioss.com.ph

joegeneq@gmail.com