



UNITED NATIONS UNIVERSITY
UNU-IIGH
(International Institute for Global Health)

5th IWEEE 2012, Granada, Spain

Presentation on

**Free Software Hospital Information System:
Sustainable Solutions for Developing Countries**

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The rise of open-source electronic records

World Report on www.lancet.com , Vol 377 May 14, 2011

- *Several developing nations are joining the revolution in electronic health records to improve efficiency in their health systems, but at a fraction of the usual cost*
- *The significant impact of free/open source software in Healthcare : Mexico, Belize, China, Brazil, India, Thailand, South Africa, Kenya, Rwanda, Ghana, Lesotho, Zimbabwe, Mozambique, Sierra Leone, Uganda and Tanzania*



The rise of open-source electronic health records

Several developing nations are joining the revolution in electronic health records to improve efficiency in their health systems, but at a fraction of the usual cost. Paul C Webster reports.

Luisa Sanchez-Garcia's praise for the electronic medical record system in the neonatal ward at the Centro Médico Nacional la Raza, a massive hospital complex in Mexico City, Mexico, is glowing. Standing in front of an incubator housing a 1-week-old child with a severe cardiac illness, she credits the electronic system with vastly improving his survival chances. "The system provides many elements for efficient work", explains Sanchez-Garcia, who is a paediatrician. "It helps us create a treatment plan, it helps prevent adverse drug events, it gives us drug dosage information, and much more."

If Sanchez-Garcia were posing for an advertisement for commercial health-information software, her praise would read like a marketing script. But the system she is praising, which is known as the Veterans Health Information Systems and Technology Architecture (Vista) is non-commercial. Developed by the US Government's Veterans Health Administration and widely credited for remarkable gains in quality of care and cost efficiencies across a health-care system with 1400 facilities serving 7 million patients within the health system for American military veterans, the US Government now distributes Vista software for free. In 2004, the Mexican Government began adopting Vista across 40 large hospitals serving 30 million patients within the health system operated by the Instituto Mexicano del Seguro Social (IMSS), the largest social insurance organisation in Latin America.

The decision to adopt the free software from the US Government was simple, says Alexis Diaz, an electronic health software consultant with IMSS. "Since we are a government institution we don't have a lot of money to invest in technology", he explains. "We considered a lot of commercial systems,

but the cost was huge. Vista was the only one we could afford." By using Vista, Mexico's social security health system avoided software licensing fees, although it did have to pay for about 20 000 h of programming time to customise the American system for Mexican use. Even so, Diaz estimates that commercially marketed software would have cost IMSS 40 times more than Vista has.

"Standing in front of an incubator housing a 1-week-old child with a severe cardiac illness, she credits the electronic system with vastly improving his survival chances."

As evidence grows that electronic health-information systems can improve health care while cutting costs, the marketplace for such systems has increased to an estimated US\$60 billion yearly. Commercially marketed products range from cheap health-monitoring applications that patients can purchase for their mobile phones, to multibillion dollar systems designed to integrate millions of patients and thousands of clinicians across large hospital networks. Whether simple or complex, every commercially marketed system is based on secret computer codes

owned by software inventors. But an increasing community of public-minded inventors opposed to the near-monopoly conditions in the commercial software industry are releasing their inventions for free. These non-commercial innovations—known as free and open-source software or, more simply, open source—can be downloaded without payment, and can be further refined by their users. In the health sector, numerous clinicians with programming skills are creating open-source products designed to improve health care at a fraction of the cost of proprietary products. The Vista system, says Alex Diaz, is the mother of all such open-source systems.

Commercial software companies warn that open-source health information systems are more vulnerable than proprietary products to bugs and security breaches. But this claim is debatable, according to a recent analysis published by Carl Reynolds of the University College London Medical School's Centre for Health Informatics, UK, and Jeremy Wyatt at the University of Warwick's Institute for Digital Healthcare, UK. According to Reynolds and Wyatt, open-source software is usually more secure from external attack than proprietary software because open-source codes

permit "independent assessment of the security of a system", which "makes bug patching easier and more likely, and forces developers to spend more effort on the quality of their code".

David Chan, developer of a Canadian open-source electronic medical record system known as OSCAR that is designed to help clinicians manage patient diseases and prescriptions as well as administrative tasks such as scheduling and billing, says that apart from substantial costs savings, the main advantage open-source health technologies hold over commercially secret competitors comes from the fact that clinicians can modify and improve the software. Jel Coward, a British Columbia physician who is president of the OSCAR Canada Users Society, says that OSCAR outperforms proprietary systems on functionality and cost, while using an open-source product, which means "no-one can hold us, our data or our patients to ransom".

As electronic health-information systems proliferate internationally—114 nations are working on national electronic health systems according to a recent WHO survey—open-source approaches are gaining traction, especially in developing countries where commercial systems are unaffordable and where local health problems might not match offerings from the software industry aimed at wealthy customers. According to Vital Wave, a US consultancy that tracks information technology in emerging markets, open-source software gives poor countries the capacity for advanced innovation in the health-information sector. By way of example, Vital Wave points to Belize, a small Latin American country with a population of 300 000 that used open-source innovations to develop what might be the most comprehensive national health-information system in the world.

According to a global survey by Actuate, a US software company that promotes open-source concepts, China, the world's fourth largest software market, now leads the

world in pursuing open-source solutions. Health-information systems based on open-source software are proliferating elsewhere in Asia as well. In Thailand, government efforts to contain costs after launching universal coverage spurred the development of Hospital OS, an electronic medical record system implemented in 95 small rural hospitals and 402 health centres serving at least 5 million patients.

Open-source health software is also gaining traction in Africa, says Chris Seebregts, a specialist in HIV management and informatics with the South African Medical Research Council. Seebregts has worked on several open-source health-information systems including the Open Medical Record System, which uses non-proprietary software to create medical record systems in resource-constrained environments and has been implemented in South Africa, Kenya, Rwanda, Ghana, Lesotho, Zimbabwe, Mozambique, Sierra Leone, Uganda, and Tanzania, as well as in various countries in Central and Latin America. Seebregts also helped develop the District Health Information System (DHIS), a South African electronic system based on open-source software that integrates local clinical data into district summaries.

With support from the Norwegian Government, DHIS has been widely adopted in Africa and Asia, as part of a programme backed by the WHO's Health Metrics Network. "Open-source health information systems have become hugely important in developing countries", says Seebregts. "It's providing access to health technologies they would not otherwise be able to afford."

The biggest implementation of open-source health information systems is in India, where a nationwide initiative of the National Rural Health Mission is introducing a health management information system employing the DHIS and other open-source tools on a massive scale, involving hundreds of thousands of health workers serving

hundreds of millions of patients. The deployment went live in India's 18 most populous states in October, 2008, and will eventually be expanded to cover the entire country.

Brazil is also implementing open-source electronic health care on a massive scale. In Sao Paulo, the SIGA Saúde Health Information System—built around open-source software—serves 14 million registered patients and stores data on 20 million patient encounters from 702 health facilities yearly. Without adding any new resources, health officials say that they have noted a 30% increase in patient visits and a 50% increase in patient satisfaction.

Some observers worry that the stampede toward open-source health information systems is leading to duplication. Joseph Dal Mollin, cofounder and vice president of WorldVista, an American charitable foundation that works with developing nations interested in adopting Vista, the open-source software system developed by the US Veterans Health Administration, worries that as open-source health technologies gather momentum, "a lot of work is being done on smaller projects in isolation from the bigger pieces, like Vista".

The risk, says Dal Mollin, who is currently working on implementing Vista in Jordan, is that small-scale innovations might not prove compatible with larger systems, which reduces their clinical usefulness, especially for users in poor countries. Pointing to work that he is now doing to integrate WorldVista and MyOSCAR, a platform designed to give patients online access to personal health records within OSCAR, the Canadian open-source electronic medical record system, Dal Mollin says that "cross-pollination between open-source projects is all-important. The power of open source is when you can do mesh-ups. And that's where we need to be heading."

Paul C Webster



Doctors view patients' records electronically on the Veteran Affairs Hospital system, Washington DC, USA



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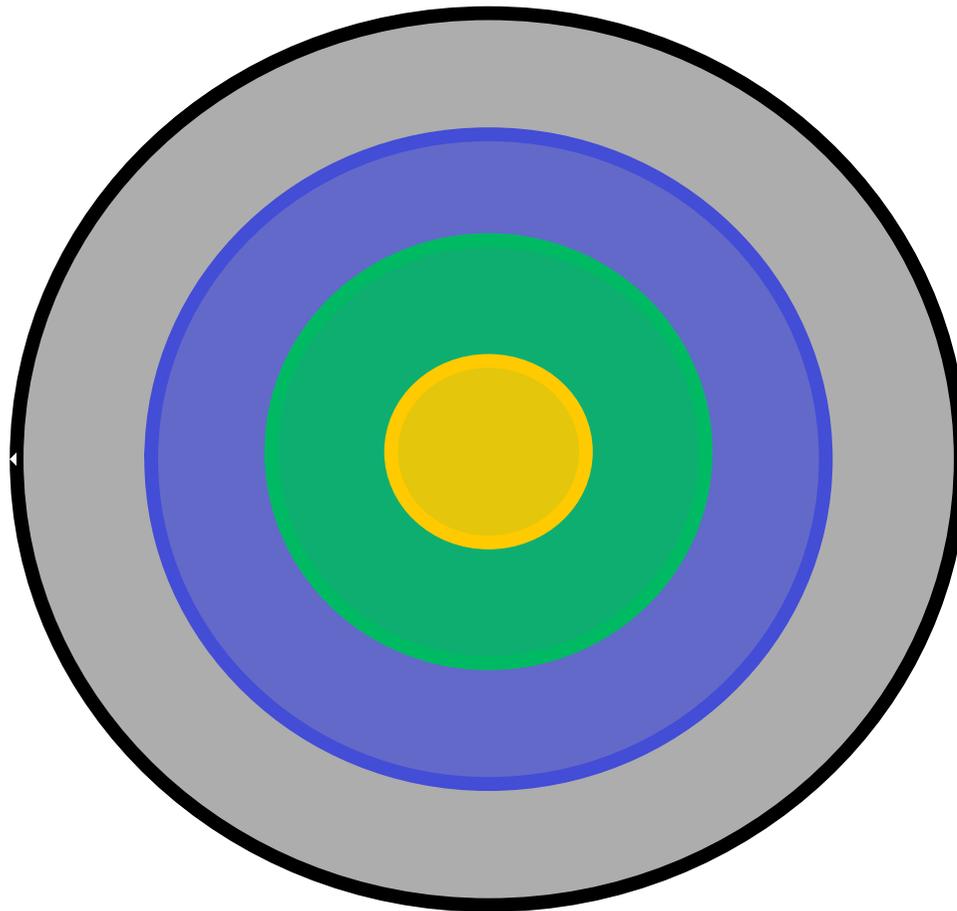
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Why Free/Open Source Software?

**The Software Development Model
cannot be challenged
by
any proprietary software companies**



“Onion” Model (Crowston *et al.*, 2004)



Core team –usually very small

- Less than 1% of community. About 15 people in Apache
- Composed of project leaders, release managers, active contributors or ‘Code Gods’

Contributors – significant

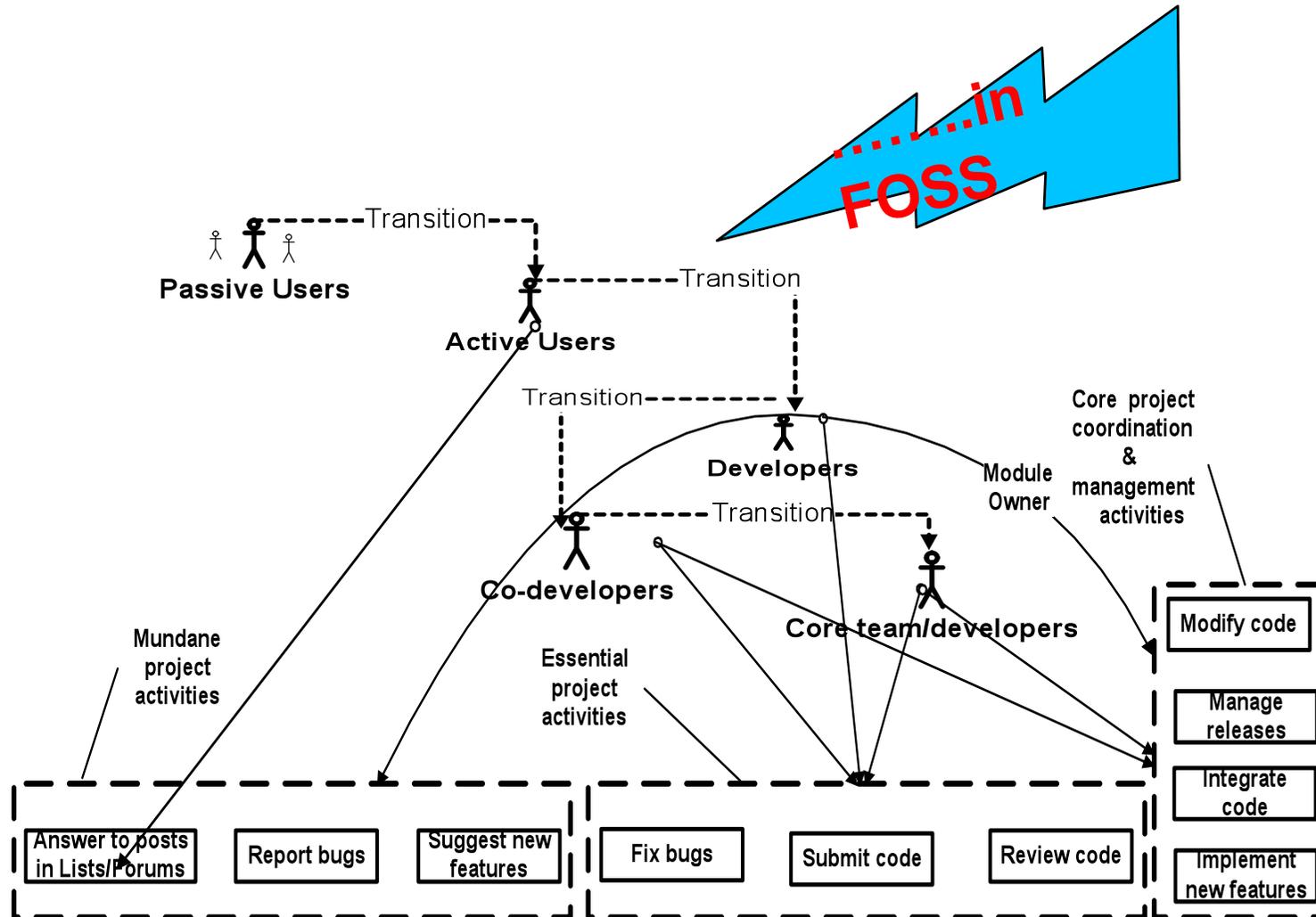
- 15% - 20% of community
- Composed of co-developers, bug/patches fixers

Active Users – large

- About 40% - 50% of community
- People who use & understand software, report bugs

Passive Users – very large

- About 90% of community
- People who ONLY download and use software, Lurk in community forums, ask questions
- Potential to be active future contributors, evangelists





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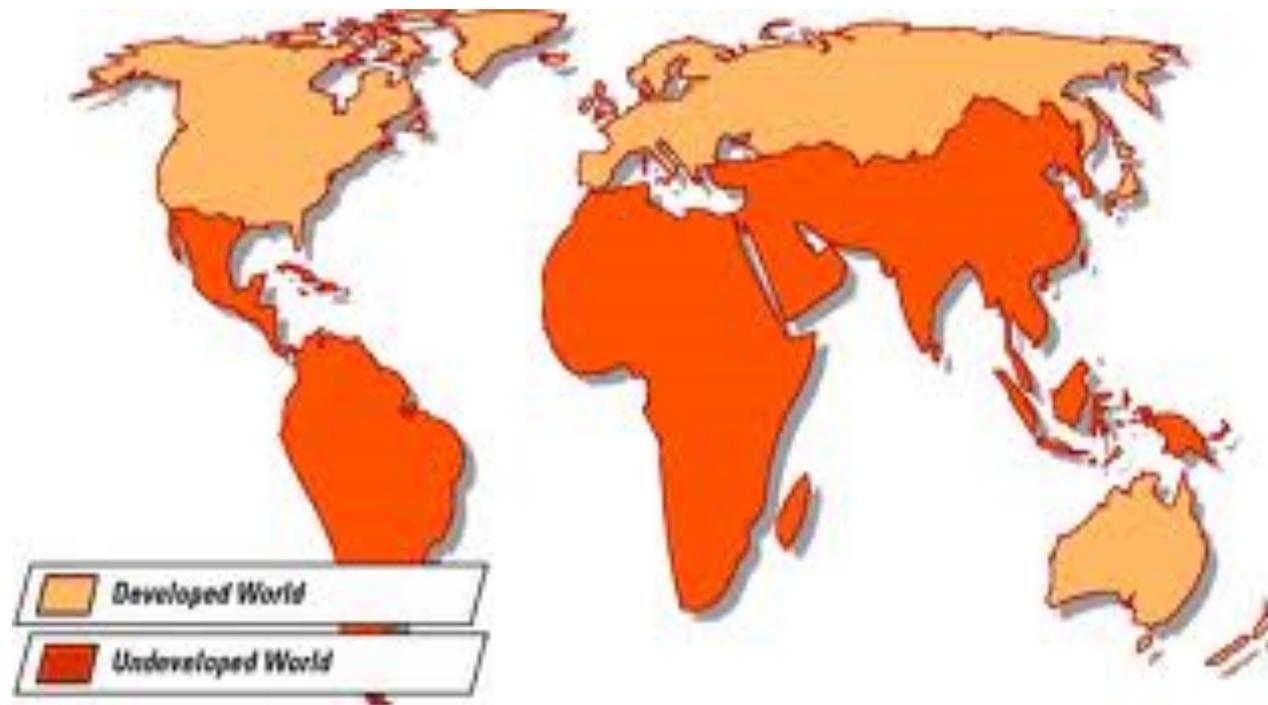
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MOU Between UNU-IIGH and GNU Solidario





Case Studies from Developing Countries





GNU Health implementation around the world

Hospitals

- The Academic Hospital Paramaribo, Suriname (470 beds)
- Mojowarno Christian Hospital, Jombang, Indonesia (135 beds)
- Griya Husada Hospital, Madiun, Indonesia (50 beds)
- Griya Waluya Hospital, Ponorogo, Indonesia (52 beds)
- Marcelo-Padilla Hospital, Philippines (45 beds)
- Neema Hospital, Kitui , Kenya (45 beds)

Clinic/Healthcare Centre

- Masaki International Clinic, Tanzania
- Sharq Medical Center, Doha, Qatar
- Dr Onativia Regional Center, Argentina
- San Vicente Primary Care Center, Argentina



Indonesia

- Rumah Sakit Kristen Mojorwano, East Java (145 beds)
- Rumah Sakit Griya Husada, Madiun, East Java (45 beds)
- Rumah Sakit Griya Waluya, Ponorogo, East Java (50 beds)

- Mr. Riza Kurniawan with his 2 programmers



Indonesia





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Previous Systems

- Windows FoxPro and MS Access since 1994
- Problems with database and technical supports
- Data redundancy and record duplication
- Started migration in 2010



Implementation Progress

- Bed and class reference (100%).
 - Patient Billing and payment (90%)
 - Warehouse and procurement (100%)
 - Accounting and Finance (70%)
 - Human Resource and payroll (90%)
- Total Progress Implementation = 80%**

Running of X486 machines

Cost around USD 30,000.00

Monthly patient records : 26,000



Four Critical Success Factor

- According to Riza Kurniawan, there are 4 factors to be considered:-

1. Top Management Commitment and Support
2. Human Resources
3. Hardware
4. Software

80% HIS implementation in Indonesia has failed due to these factors







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Scale document down





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Patient Administration

The screenshot displays the SIRUS Hospital Information System interface. The browser window title is "Administrasi Pasien IRNA - OpenERP - Mozilla Firefox". The URL is "http://192.168.1.1:8080/openerp/menu?active=512#url=%2Fopenerp%2Fexecute%3Fpayload%3DeJxdkk1r5DAMhv_K3Nz". The user is logged in as "RS. KRISTEN MOJOWARNO (SIRUS_RSKM_CENTRAL) Administrator".

The interface includes a navigation menu on the left with options like "Configuration", "Arahan Pasien", "Administrasi IRNA", "Administrasi Pasien IRNA", "Pasien", "Laborat dan Radiologi", "Invoices", and "Reporting". The main content area shows a search for "Administrasi Pasien IRNA" with filters for "No. Register", "Pasien", "Tgl. Masuk", "Kondisi Klinis", "Ruang IRNA", and "Status". The search results are displayed in a table:

NO. REGISTER	PASIENT	TGL. MASUK	TGL. KELUAR	RUANG IRNA	KONDISI KLINIS	STATUS
3483	YAHYA K	18/07/2011 07:20:00	18/07/2011 07:20:00	[IRNA15] Anggrek II.6-1	Sedang	rawat inap
3485	YENI	18/07/2011 09:25:00	18/07/2011 09:25:00	[IRNA02] Anggrek IA.2	Sedang	rawat inap
3510	Sestriningari	19/07/2011 13:15:00	19/07/2011 13:16:00	[IRNA07] Anggrek IB.2-1	Sedang	rawat inap
3512	MARSITI	19/07/2011 11:36:00	19/07/2011 11:36:00	[IRNA13] Anggrek II.5-1	Sedang	rawat inap
3506	Wenci	19/07/2011 11:38:00	19/07/2011 11:38:00	[IRNA22] Anggrek II.9-2	Sedang	rawat inap
3525	Dwiningsih	20/07/2011 11:43:00	20/07/2011 11:43:00	[IRNA04] Anggrek IA.4	Sedang	rawat inap
3526	Sutarsih	20/07/2011 18:51:00	20/07/2011 18:51:00	[IRNA20] Anggrek II.8-2	Sedang	rawat inap

The footer of the page shows the URL "http://192.168.1.1:8080/openerp/menu?active=512#" and the text "Powered by SIRUS RSKM".



Patient Itemised Billing

SIRUS
 HOSPITAL INFORMATION SYSTEM

RS. KRISTEN MOJOWARNO (SIRUS_RSKM_CENTRAL)
 Administrator

Arahan Pasien | Pembayaran Pasien

SALE PEMBELIAN GUDANG IPS MEDIS AKUNTANSI HRD DOCUMENT BILLING TOOLS ADMIN SIRUS

Sale
 Leads
 Opportunities
 Order Penjualan
 Address Book
 Meetings
 Phone Calls
 Faktur
 After-Sale Services
 Layanan dan Farmasi
 Documents
 Laporan
 Configuration

Sales Order POS

No. Billing/Resep : BILL/2011/05/045

Save Save & Edit Cancel

No. Billing/Resep : Tgl. Billing : R.S./Bagian :

Pasien : No. Pendukung :

Order Pembayaran Info Tambahan Catatan

PRODUCT	QUANTITY	UNIT PRICE	DISCOUNT (%)	SUBTOTAL W/O TAX	SUBTOTAL
[IR012] Visite Dokter Spesialis I	1,00	60.000,00	0,00	60.000,00	60.000,00
[RJ0002] Jasa pelayanan medik dokter Spesialis	1,00	55.000,00	0,00	55.000,00	55.000,00
[PRW01] Pemasangan Infus/Transfusi Set	1,00	35.000,00	0,00	35.000,00	35.000,00
[PRW02] Pelepasan Infus	1,00	15.000,00	0,00	15.000,00	15.000,00
[PRW04] Pemasangan Kateter	1,00	40.000,00	0,00	40.000,00	40.000,00
[PRW05] Pelepasan Kateter	1,00	20.000,00	0,00	20.000,00	20.000,00
[PRW14] Tensi (Rawat Inap)	12,00	5.000,00	0,00	60.000,00	60.000,00
[PRW37] Suhu / Temp (Rwt Inap)	12,00	1.000,00	0,00	12.000,00	12.000,00
[PRW36] Injeksi	5,00	5.000,00	0,00	25.000,00	25.000,00
[PRW001T] Vaginal Toalet	1,00	20.000,00	0,00	20.000,00	20.000,00
[OB144] Piton Drip	1,00	50.000,00	0,00	50.000,00	50.000,00
[IRNA05] Anggrek IB.1-1	3,00	125.000,00	0,00	375.000,00	375.000,00
[PMG-001] Penunggu	3,00	2.000,00	0,00	6.000,00	6.000,00
[OBB001] Partus Normal Bidan (KI)	1,00	250.000,00	0,00	250.000,00	250.000,00
[OBB004] Manual Bidan (KI)	1,00	175.000,00	0,00	175.000,00	175.000,00
[IRNA112] VK (I)	1,00	175.000,00	0,00	175.000,00	175.000,00
					1.373.000,00

Reports
 Cetak Billing
 Invoice
 Sales (summary)
 Pos Lines
 Payment Report For Sale

Attachments
 Add

Customize
 Manage Views
 Edit Workflow
 Customize Object

Other Options
 Translate
 View Log



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Samples of Report

RS. KRISTEN MOJOWARNO
 Jl. Merdeka No. 59, 61475 Jombang
 Indonesia
 Tel : 0321-492200, 495093
 E-mail : rskmjw@yahoo.com
 Institusi : RS. KRISTEN MOJOWARNO
 Petugas : Ruang Dahlia
 Tanggal : 2011-05-09 12:37:34

N^o : **BILL/2011/05/045**
 Pasien : **Herfi Ariyanti**

Item	Qty	Harga
Visite	1	60000.00
Dokter Spesialis I		Rp
Jasa pelayanan medik dokter spesialis	1	55000.00
		Rp
Pasang Infus/Transfusi Set	1	35000.00
		Rp
Pelepasan Infus	1	15000.00
		Rp
Pemasangan Kateter	1	40000.00
		Rp
Pelepasan Kateter	1	20000.00
		Rp
Tensi (Rawat Inap)	12	60000.00
		Rp
Suhu / Temp (Rwt Inap)	12	12000.00
		Rp
Injeksi	5	25000.00
		Rp
Vaginal Toalet	1	20000.00
		Rp
Piton Drip	1	50000.00
		Rp
Anonrek	3	375000.00

Rekap Pasien RSK Mojowarno

Periode : Mei 2011

No.	No. Arahan	Pasien	Tgl. Periksa
1	AP20110531/80	sarpini	31/05/2011 20:18:40
2	AP20110531/79	Sih Purwani	31/05/2011 20:17:27
3	AP20110531/78	Isroi	31/05/2011 20:15:12
4	AP20110531/77	lena herlina heryadi	31/05/2011 20:11:40
5	AP20110531/76	kaseno	31/05/2011 20:05:27
6	AP20110531/75	titno	31/05/2011 19:48:44
7	AP20110531/74	Nyuntiani	31/05/2011 19:45:28
8	AP20110531/73	Kasiran	31/05/2011 19:42:18
9	AP20110531/72	Guruh wahyu pamungkas	31/05/2011 19:38:13
10	AP20110531/71	Saiful Maulana	31/05/2011 13:26:46
11	AP20110531/70	Saiful Maulana	31/05/2011 13:24:30
12	AP20110531/69	Raihan Fitri M	31/05/2011 13:20:31
13	AP20110531/68	Sungati	31/05/2011 13:05:31
14	AP20110531/67	Umiati	31/05/2011 12:14:32
15	AP20110531/66	kartimah	31/05/2011 12:14:08
16	AP20110531/65	titi suryanti	31/05/2011 12:02:10
17	AP20110531/64	rio despantoro	31/05/2011 12:00:10
18	AP20110531/63	Theresia Valentina	31/05/2011 11:31:33
19	AP20110531/62	Muhammad Ihsan Ghozy	31/05/2011 11:30:29
20	AP20110531/61	Sumiyah	31/05/2011 11:30:10
21	AP20110531/60	Ponisan	31/05/2011 11:29:51
22	AP20110531/59	Agus Muhtarom	31/05/2011 11:19:48
23	AP20110531/58	YUSUF EFENDI	31/05/2011 11:19:09
24	AP20110531/57	SULASTRI	31/05/2011 10:51:52
25	AP20110531/56	suparah	31/05/2011 10:51:02
26	AP20110531/55	Rina Rizkiyah	31/05/2011 10:44:45
27	AP20110531/54	Alif Alfarisi	31/05/2011 10:42:21
28	AP20110531/53	supiyatun	31/05/2011 10:29:24
29	AP20110531/52	Kusman	31/05/2011 10:26:03
30	AP20110531/51	Ayanto	31/05/2011 10:24:11
31	AP20110531/50	Farida Utami	31/05/2011 10:23:24
32	AP20110531/49	Mariani	31/05/2011 10:19:32
33	AP20110531/48	Idi Retnani	31/05/2011 10:16:40
34	AP20110531/47	Suharti	31/05/2011 10:12:22
35	AP20110531/46	Imam suwito	31/05/2011 10:11:51
36	AP20110531/45	sukiyem	31/05/2011 10:10:05
37	AP20110531/44	Piah	31/05/2011 10:01:53
38	AP20110531/43	Sri Wahyunngsih	31/05/2011 09:50:32
39	AP20110531/42	HARNANIK	31/05/2011 09:50:09
40	AP20110531/41	Umroni	31/05/2011 09:47:28
41	AP20110531/40	Marcenda L	31/05/2011 09:45:01
42	AP20110531/39	Matdrais	31/05/2011 09:43:52
43	AP20110531/38	Suwarti	31/05/2011 09:41:00
44	AP20110531/37	elida Fitria	31/05/2011 09:38:49



Kenya





Neema Hospital

- Located in Kitui County, approximately 150 kilometres north-east of Nairobi, Kenya, provides primary and emergency care to a population of over 500,000 inhabitants.
- Annually, between 4,000 to 4,500 patients are cared for at Neema Hospital.
- The hospital has a bed capacity of 45 and also conducts other activities, such as periodic surveillance of low income areas, in order to help families and their children in sanitary



Project Phases

- The project was implemented over two weeks from mid November, 2011; and consisted of the following stages :
- The installation of Health Center Information System
- Training of the staff
- Design and implementation of the hardware and network infrastructure





Challenges Encountered

- Neema Hospital had previously implemented a propriety Hospital Management System and it was assumed that the existing network had been properly set up.
- The network had been configured with static IP addresses, making it unnecessarily complex. To ease the complexity, the network was redesigned to support dynamic IP allocation; and automatic resolution of local domain names.
- Being a maternity hospital, the staff are quite busy and was difficult to find sufficient time to carry out training satisfactorily. Because of this, user training took longer than expected.



GNU Health Modules Implemented

- Adults and pediatric patients database
- Outpatient medical appointments
- Patient's social environment, health care, personal data
- Patient's clinical record, based on evaluations and diagnoses
- Epidemiology reports.



GNU Health Success Story

1. The Hospital now has a centralised billing
2. Because of the use electronic medical records, duplication and loss of patient records has been mitigated
3. Increased efficiency because patient records such as prescription orders and lab reports, are available where required as soon as they are produced
4. Improved inventory management. With the automation of sale orders, purchase orders and stock level monitoring the pharmacy is able to anticipate and prioritise demand for certain drugs and medical equipment.



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Instituto de Provision Social – Asuncion, Paraguay (24-25th Nov, 2011)





New Interested Country...

Sudan





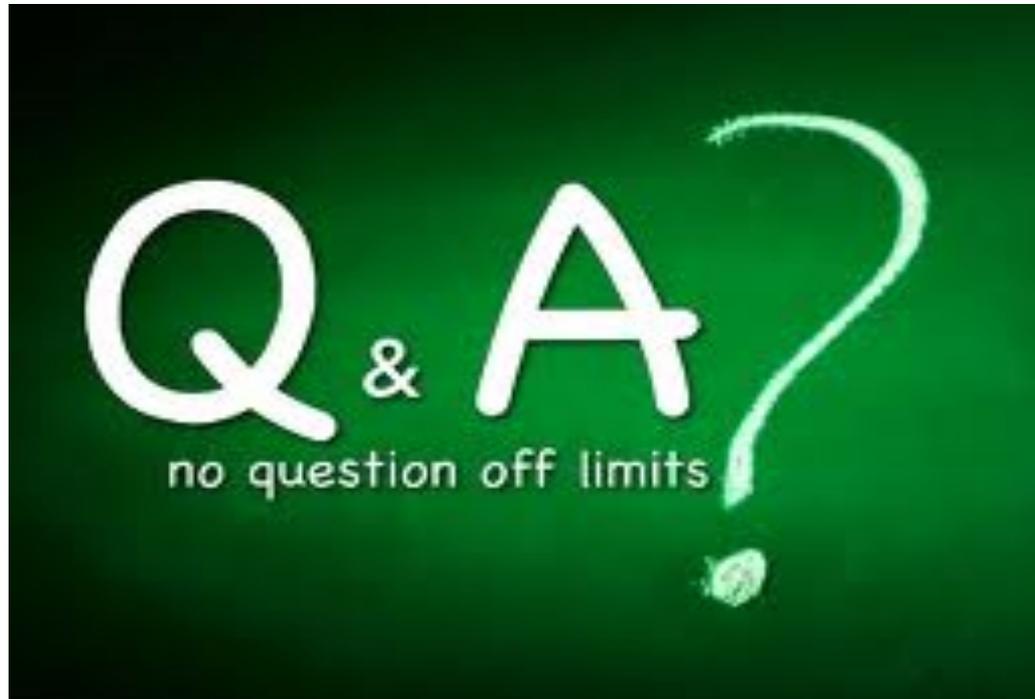
Factors contributing to the implementation of GNU Health

1. Planning and Strategy
2. Stakeholders role and responsibilities – government, ministries, hospitals
3. Social and Cultural Aspects
4. Capacity Development – Human resources training
5. Participation and Awareness
6. Financial Aspect, sustainability – Low resources
7. Technology – hardware and software



Conclusions

- Significant impact of free/open source software solutions in developing countries is irrefutable as the number of solutions currently available has grown to be rather substantial.
- UNU-IIGH will provide the following packages in the implementation:-
 1. Project management
 2. Business Process management
 3. Change management
 4. Capacity building



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