

Lessons Learnt in the Development of Applications for Remote Communities

By Alvin W. Yeo, Azman Bujang Masli, Siou-Chin Ong, Peter Songan, Jayapragas Gnaniah, Khairuddin Ab Hamid, Poline Bala,

Universiti Malaysia Sarawak (UNIMAS)

Abstract

In this paper, we highlight lessons learnt from our experience in the development of three applications for two small remote communities in Sarawak, a state of Malaysia, which has been provided with access to information and communication technologies. The applications developed include a digital library employed to capture oral traditions of the Kelabits; a website to promote tourism in Bario, and a word processor localised to accommodate the Kayan language. The Kelabits and Kayans are two of 27 ethnic groups found in Sarawak. The lessons highlighted will be discussed vis-à-vis the technological, operational, logistical, and strategic aspects of systems development for remote communities.

Keywords: Bridging the digital divide, eBario Project, ICT, Open Source, digital library, word processor, tourism website, community informatics, localisation.

1. Introduction

There are many projects aimed at bridging the digital divide that have been deployed all over the world — specifically in rural areas. Such projects have been implemented in the hope of bringing about the many potential benefits to these communities, in particular, to improve their social, economic and cultural well-being. Instances of these benefits include the elimination of the barriers to physical and virtual isolation, providing access to available information, and increasing opportunities to expand businesses to reach new markets. While many of these projects report on the provision of access of Information and Communication Technologies (ICTs) to remote communities, there are few studies that report specifically on development and its processes of specific technologies for the rural communities.

Thus, this paper aims to provide a description of and details on the lessons learnt from the development and processes employed in the implementation of three applications or systems. In the next section, this paper will provide details of the location of the two remote communities i.e., Bario and Long Bedian — the communities for which the applications were developed. In addition, the eBario project, which aims to bridge the digital divide, is also described. This project provides the context within which the three applications were developed. The ensuing section will then describe the applications that were built — in particular, the rationale for the development, the methodology employed, and the outcomes of the implementation. The lessons learnt are detailed in the form of an examination from technological, operational, logistical, and strategic aspects.

2. Bario

Bario is located in the Kelabit Highlands, near the Kalimantan and Sarawak border (see Figure 1). It is the 'unofficial capital'



www.skrivanek.com

In the world of language solutions
cubes are in fashion!

we do ■

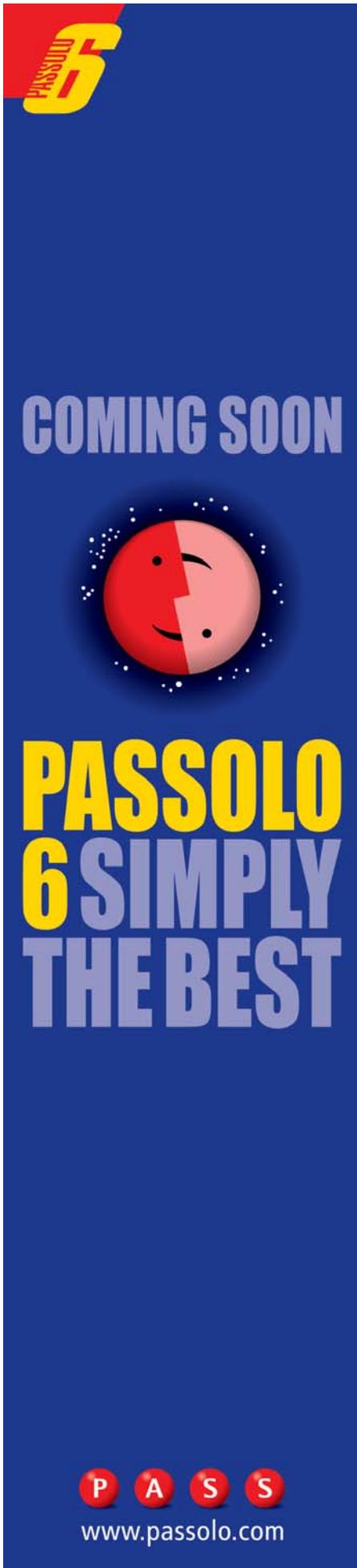
- > translations in all languages and language combinations
- > localizations
- > cross-cultural consulting
- > linguistic and professional proofreading by native speakers
- > DTP processing and graphic design
- > software solutions

our advantages ■

- > single contact point for all languages
- > a registered supplier for the EU
- > ISO 9001:2001 certified
- > 12 years in the market

International Management Centre Prague
info@skrivanek.com
+420 233 320 560

Belgium ■ Bulgaria ■ China ■ Czech Republic ■ Estonia ■ Germany ■ Hungary ■ Latvia ■ Lithuania ■ Poland ■ Slovakia ■ Slovenia ■ USA



COMING SOON

PASSOLO
6 SIMPLY
THE BEST

P A S S
www.passolo.com

of the 'land' of the Kelabits, one of the 27 ethnic groups in Sarawak. Prior to the introduction of a daily flight into Bario, the Kelabits only means of communication with the closest town was by foot — climbing mountains, following mountain ridges, and crossing and re-crossing rivers and valleys for several weeks. Today, flying (which takes about an hour) to Bario, the main Kelabit centre, is the only practical way to get there.

Bario has a number of government offices, and also provides education and health services to the Bario community and surrounding villages.

There are about 1,200 people living in Bario. The Bario district is occupied principally by the Kelabit (78%) (one of the smallest ethnic groups in Sarawak), with other ethnic groups including Penan, Kenyah, Iban, Bidayuh and Malays, Chinese, as well as some Indonesian immigrants. The majority are farmers (93%), planting wet rice as their main crop. About 5% of the population work in government offices, whereas about 2% operate personal businesses and trading. In addition to rice cultivation, the community also rears livestock such as buffalo, cattle, sheep, chicken and pigs. Some members of the community are also involved in hunting, fishing and forest gathering.

3. eBario: Bridging the Digital Divide

The idea of bringing the Internet to Bario was conceived as a research project to determine opportunities for social development available from the deployment of information and communication technologies (ICT) within remote communities in Sarawak. Desirable results from pilot studies in other developing countries have encouraged the team to work among those communities in Sarawak to have equal access to ICTs, specifically, the Internet which could provide significant improvements in their lives. This was included in the eBario project. Basically the goals of the eBario Project were to:

- Define the extent that contemporary ICTs can deliver sustainable human development and significant improvement to the lives of the community
- Demonstrate how significant and sustainable development can be achieved by remote communities through the innovative use of ICT

The objectives of the eBario project included to:

- Empower the Bario community to be able to employ ICTs to improve their livelihood through a people-centred/participatory approach

- Provide the Bario community and school children with access to ICTs through:
 - a computer laboratory at SMK Bario
 - a community telecentre at Bario

As part of the eBario project, numerous areas were identified as potential beneficiaries from the introduction of ICTs. These areas included education, culture, commerce, agriculture, health, community, technology, and human resource development.

...if you could successfully implement such a project in Bario, you could do so anywhere.

3.1 Why Bario?

While there were many communities in Sarawak that satisfied the criteria for choosing a rural remote location, Bario was selected because of its isolation. In addition, it has basic infrastructure (no 24-hour electricity supply, gravity-fed water) and no telecommunication service. This can be considered a real case of 'digital divide' and 'digital poverty'. Lastly, the community's readiness to participate, given that Universiti Malaysia Sarawak (UNIMAS) had conducted other research projects in the area and thus were known to the local Bario community. Because of its remoteness, the catch-phrase was that if you could successfully implement such a project in Bario, you could do so anywhere.



Figure 1: Map of Sarawak showing the location of Bario.

3.2 Benefits to Bario Community

Numerous benefits were realised in the areas of education, and commerce. With the community's access to ICTs, there is increased computer literacy among the students, teachers and members of the community. Students from Bario are no longer disadvantaged when they go to the urban areas to continue their studies — they would be just as adept at using computers as their urban counterparts.

The community is able to communicate with the rest of the world due to the avail-

ability of telephones and Internet (via VSATs). The community, especially those involved in tourism, have taken advantage of ICTs — they are able to communicate with potential tourists directly via email, and confirm accommodation bookings online.

At the state level, the project has served to sensitise the State Government towards the potential for ICT-induced rural development. In particular, it has demonstrated the importance of ICTs to isolated communities that are denied other forms of infrastructure. The Government of Malaysia is paying increasing attention to rural development; different rural ICT programmes have been run — such as the *Pusat InfoDesa*, and *Medan InfoDesa*.

4. Long Bedian

A second remote community that was involved in the project are the Kayans, who live in another isolated remote location known as Long Bedian. Long Bedian is located in the Apoh Tutoh region of the Baram district, in the Miri Division of Sarawak (see Figure 1). The village comprises 180 houses and has a total population of 1,686 people. There are only two ways to get to Long Bedian from Miri town — either an express boat journey of seven hours followed by an hour-long drive to Long Bedian, or a four-and-a-half hour drive (by 4WD) from Miri. The village functions as a trading centre for the nearby villages, particularly for the Penan community. It also provides education and health services to the Long Bedian and Penan community.

The Long Bedian community comprises several ethnic groups — such as Kayan, Kelabit, Kenyah, Morek, and Punan. The Kayans are the biggest group in the village making up 95% of the population, while the Kelabits make up 3.9%. The remaining 1.1% of the total population in Long Bedian comprises the Kenyahs, Moreks and Punans. The Long Bedian community are all Christians.

The primary occupation in the Long Bedian community is farming (68.4%) — planting paddy, oil palm trees, pepper, and other crops. About 5.2% of the people are government servants, with the remainder involved in either small businesses or the private sector.

The next section details the systems developed for the communities in Bario and Bedian.

5. Software Applications Developed

There are three applications that will be covered in this paper, namely, the *Bario Lakuh Digital Library*, a *Tourism Website* and a *Word Processor*. These applications were the outcome of three sub-projects funded by the Universiti Malaysia Sarawak.

5.1 Bario Lakuh Digital Library

This digital library project was aimed at preserving a Kelabit oral tradition, i.e., the traditional Kelabit songs known as '*lakuh*'. The *lakuh* is a means of passing information about significant events on to the next generation, as well as depicting one's feelings.

Thus, one of the objectives of the Bario *Lakuh* Digital Library (BLDL) project was to explore the cultural benefits of ICT in stimulating the production, protection and popularisation of Sarawak rural communities' oral traditions, which constitute part of an indigenous knowledge system. This project, in line with the objectives of the eBario project, aimed to record and transcribe some of these traditional songs, particularly the *lakuh* songs.

There were three main phases to the project; Data collection, *Lakuh* Translation and Documentation, and Building the Digital Library.

Data Collection and Translation: Both audio and video recordings of the *lakuh* singers were carried out by the researchers. As the Kelabit women were only fluent in Kelabit (and spoke little Bahasa Melayu or English), it was essential to have a Kelabit speaker present. During these recording sessions, the singers were also interviewed. After recording the *lakuh*, it was transcribed and translated

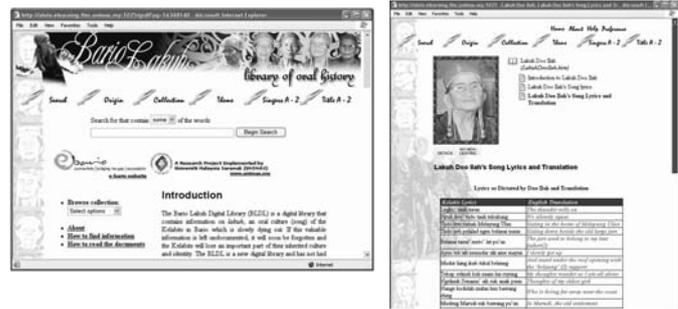


Figure 2: Screen shots of Bario Lakuh Digital Library

into English by Florence Apu, a qualified translator who is fluent in both written and spoken Kelabit as well as English. This translation was conducted in Bario.

Building the Digital Library: The next step was to digitise the audio and video recordings and store them in a digital library using the open-source Greenstone Digital Library Software (from the University of Waikato, New Zealand). This software allows more *lakuh* to be added into the existing library, if required.

Outcome: A prototype of the Bario *Lakuh* Digital Library was completed and has been published on CD-ROM. It contains nine *lakuh* sung by five Kelabit *lakuh* singers. The *lakuh* lyrics are available in Kelabit (with a translated version in English), as well as in audio and on a video recording (of the singer rendering the song). The background of the singers and details about the *lakuh* and its meaning are also provided.

Through this Digital Library, the cultural heritage can thus be preserved and the knowledge of the indigenous group can be passed down to the next generation. Linguists will be interested in the language used in the *lakuh* which has evolved over time; the *lakuh* are sung by women of the older generation, and thus use (untainted) Kelabit.

5.2 Tourism Website

The second application produced — a map-based tourism website — was developed as part of eBario to promote Bario as a tourist destination. It is believed that residents of Bario will benefit from eTourism.

The objectives in developing the map-based website were to:

- provide comprehensive information on Bario including maps
- provide information about lodges and homestays
- provide information about tourist guides and enable tourists to reserve a tourist guide in advance

This website was developed using the web-based system development life cycle; covering web page design, framework and content development. This website also included zoomable and interactive maps in Scalable Vector Graphic (SVG) format.

The website is now complete (see Figure 3 overleaf and also <http://www.ebario.com>). SVG was employed to provide maps of Sarawak, Kelabit Highlands, Bario Town, Pa Lungan and Pa Umur (villages in Bario). Key landmarks such as lodges, tourist attractions and government offices, such as the police station and immigration office, were also included.

Based on anecdotal evidence from visitors from Australia (on their way to Bario), the website provides the necessary information for visitors. Also, through the website, homestay owners in Bario have received emails from potential visitors enquiring about Bario. Presently, no data has been collected to determine the economic impact of the website. However, logged visits to the site show that there have been consistent numbers of visitors to the website, and not only Malaysian visitors (see Figure 3 overleaf). In eBario, the homestay owners are fully utilising the ICTs. They are using emails to contact their clients and are keen to use the Internet to promote their homestays and Bario itself.

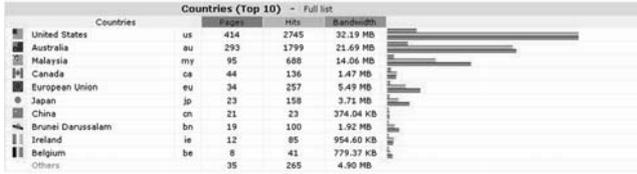


Figure 3: Top 10 countries that visited www.ebario.com (last update: 15 February 2006)

5.3 Word Processor

In this project, the word processor which allowed interaction in English was customised to accommodate interactions in Kayan and Kelabit. This was implemented as part of a thesis to determine the efficacy of the existing software development lifecycle (SDLC); current SDLC is a Western construct and it was argued that the SDLC may need to be adapted to suit local contexts (Azman and Yeo, 2004).

Our first plan was to use the Open Source Software (OSS), *OpenOffice*. However, obtaining a build environment of *OpenOffice* in Windows became a major obstacle. Due to time constraints, we decided to work with a less complex software application, i.e., *Abiword* which is an Open Source word processor.

The development was conducted in four stages. In Stage 1, we achieved a build environment to create the software, which could accommodate different languages. In Stage 2, we identified the computing terms to be translated and to translate these terms into Kayan and Kelabit (localisation phase). Translators were identified to conduct the translations; approximately 3,000 terms had to be translated in total. In Stage 3, we tested whether the Kayan and Kelabit language could be added to *Abiword*. In doing this we focused mainly on the menus and tooltips, and it was successfully carried out. The Kayan version was more complete and was evaluated by native Kayan speakers.

The results indicate that the usage by the Kayans was similar to that experienced by first-time users of software in their own language. Also those who had previously used English word processors



Figure 4: Screen Shots of the Word Processor in both Kelabit and Kayan

were able to identify the English equivalent first before looking for the Kayan word. Consequently, it was difficult to measure the functionality — as the users had to translate the Kayan commands back to English.

A word processor which can accommodate Kelabit and Kayan (see Figure 4) was achieved. However, the effort in adapting OSS in the project was underestimated. The team was not aware of difficulties and only decided to adopt the less complex word processor in the middle of the project. As OSS developers are located worldwide, Internet communication was the only way to get feedback. This involved participation in mailing lists and OSS community discus-

	Digital Library (DL)	Tourism Website	Kayan, Kelabit Word Processor
Goal	Capture indigenous oral traditions	Promote tourism	Localise a word processor
Requirements Analysis	Identify goals of DL Identify the singers ◊ Identifying translator ◊ Tasks to be completed	Identify goals and requirements of websites Identify people to interview and collect data from ◊	Language requirements/ idiosyncrasies ◊ Identification of applications available ◊
Design	Design interfaces, navigation structure, functionalities ◊	Website design: interface, navigation, databases, functionalities	Design: language-dependent components are as per screen interface
Implementation: Data collection	Recording audio, video (on-site) ◊ Interviews (on-site) ◊ Transcription & translation of songs (on and off-site) ◊	Recording and collection of information/content: interviews, information about culture & tourist attractions, accommodation, photos, maps (on-site) ◊	Translation of the language-dependent components into Kayan-Kelabit (translators were off-site) ◊
System Implementation	Building the libraries Digitisation of the songs Integrate into the DL CD-ROM produced (after evaluation)	Development of website: webpages, databases, SVG maps Incorporation of the different media and write-ups	Modification of code to accommodate target languages
Application(s) employed	University of Waikato's Greenstone	ASP, MS SQL Server, JavaScript	Abiword ◊
Testing and Evaluation	Testing of the system with users [◊] Refinement: Editing of the translation ◊	System testing & usability testing [◊] Accuracy of information ◊	Usability evaluation of the word processor: corrections of the translations ◊
Maintenance and Operations			
Current	CD-ROM distributed ◊	UNIMAS currently maintains the website	UNIMAS makes the modifications
Future	More lakuh to be added by local community after training provided ◊	Community makes changes and uploads information themselves ◊	Community updates the information/translation ◊

On-site: in Bario or Long Bedian; off-site (in Unimas); ◊ locals involved; [◊] Optional involvement of locals

Table 1: Overview of the Three Applications Developed

sions. Delays occurred as these developers are mostly volunteers, which curtails their availability to answer queries. At present standard computing terminology of Kayan and Kelabit does not exist. Thus, provision of a tool in the target language may be a way the community can preserve the language.

6. Lessons Learnt from the Application Development

An overview of the three applications is provided in Table 1. The overview is organised according to generic software development phases and details key activities conducted as well as activities that relate to involvement of the local community. The lessons learnt from our involvement in the development of the applications here are by no means exhaustive, but do provide guidelines for those interested in developing applications for remote communities.

6.1 Crucial to Form Rapport with Target Community

Forming a rapport with the target community is of immense benefit to both parties; the developers will have access to information otherwise not available elsewhere, and the local community contributes to the successful completion of the application. (Referring to Table 1, there are numerous areas whereby the locals were involved). In the case of Bario *Lakuh* Digital Library, during the data collection phase Florence Apu — a Kelabit and former English teacher — was able to identify *with whom, when, where and how* each interview could be conducted.

6.2 Identify a Local Champion

Where possible, the project team members should identify a local champion who provides the necessary information not only to the project team, but also to those on-site. The local champion would act as a motivator, at the grass-roots level, to get things done. In the case of the Tourism Website, John Tarawe was able to persuade the related parties to cooperate and provide the necessary information for the website.

6.3 Do Not Underestimate Logistical Problems

Travel to remote areas may impact on the scope as well as the project schedule and budget. Remoteness, long travel time and infrequent flights to such areas will increase the project duration. Also, such trips may be affected by inclement weather. For example, a flight delay in Bario due to bad weather could leave you stranded in Miri until the weather clears (which could take days).

The development of software for remote communities is not just about technology or logistical issues. It is about working with and for the people. As long as the needs of the people are taken into account, the technologies (regardless of what they are) will largely be accepted — albeit with some modifications to suit the local context.

6.5 System Development Both On- and Off-site

Given the difficulties of travel to remote areas (on-site), certain parts of the system development could be conducted off-site in order to reduce costs. Off-site implementation may be better since access to information/tools is easier than in the remote area. Similarly, usability tests can be conducted off-site if target users are available there.

6.6 Start Small

Where possible, applications to be developed/translated should be of a small, manageable size. Knowledge on the development envi-

ronment of the target application is also crucial. Success would act as an impetus for bigger applications/projects.

6.7 Sustainability of Software Use

Training of the target community with the software is necessary to ensure maintenance and use of software. In the case of the word processor, besides training to use the tool, members of the community had to be trained to make minor modifications to the translations (in addition to being able to create the build environment for more involved changes).

7. Summary

In summary, the development of software for remote communities is not just about technology or logistical issues. It is about working with and for the people. As long as the needs of the people are taken into account, the technologies (regardless of what they are) will largely be accepted — albeit with some modifications to suit the local context.

Acknowledgements

The authors acknowledge the funding provided by Universiti Malaysia Sarawak for the following Fundamental Research Grant projects 03/14/365/2002 (102), 01/32/381/2003 (118), and 02(01)/277/2002(15). The project team acknowledges the use of the Greenstone Software (<http://www.greenstone.org>) and AbiWord software (<http://www.abisource.com/>) and would like to thank all those involved — in particular, the Bario and Long Bedian community.

Bibliography

- Azman B.M. and Yeo, A. W. (2004). Unpublished report of Fundamental Research Grant 02(01)/277/2002(15), Building Software for Malaysians: An Application of Global-Software Development Life-Cycle.
- Bala, P., Harris, R.W., & Songan, P. (2003). E Bario project: In search of a methodology to provide access to information communication technologies for rural communities in Malaysia. In S. Marshall, W. Taylor, & X. Yu (eds.), *Using community informatics to transform regions* (pp. 115-131). Hershey, PA: Idea Group Publishing.
- Centre for International Development. Readiness for the Networked World. A Guide for Developing Countries. Retrieved July 1, 2005 from <http://www.readinessguide.org>.
- Kano, N. (1995). *Developing international software for Windows 95 and Windows NT*. Microsoft Press. Redmond, WA.
- Gnaniah, J., Yeo, A., Songan, P., Hushairi Z. and Khairuddin A. H. (2004). A Comparison on the Implementation Approaches for the e-Bario and e-Bedian Project. Proceedings of the Seventh Conference on Work With Computing Systems, Kuala Lumpur, Malaysia, 29 June-2 July.
- Gnaniah, J., Songan, Yeo, A., P., Hushairi Z. and Khairuddin A. H. (2004). Communication Patterns of the Long Bedian Community: Implications for the Development of a telecentre. Proceedings of the Seventh Conference on Work With Computing Systems, Kuala Lumpur, Malaysia, 29 June-2 July.
- Liew, J., Yeo, A., Khairuddin A. H., and Al-Khalid O. (2004). Implementation of Wireless Networks in Rural Areas. Proceedings of the Seventh Conference on Work With Computing Systems, Kuala Lumpur, Malaysia, 29 June-2 July.
- Songan, P., Khairuddin A. H., Yeo, A., Gnaniah, J., and Hushairi Z. (2004). Community Informatics: Challenges in Bridging the Digital Divide. Proceedings of the Seventh Conference on Work With Computing Systems, Kuala Lumpur, Malaysia, 29 June-2 July.
- Unimas. (2004). eBario Web Site. Retrieved July 1, 2005 from <http://www.unimas.my/ebario>.

Dr Alvin Yeo may be contacted at Alvin@fit.unimas.my