

BROADCAST MANAGEMENT (BM) FOR TV-ONLINE



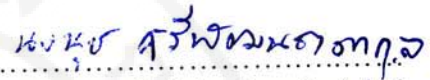
NONGNUCH SRIPATTANATHADAKUL


**A THEMATIC PAPER SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR
THE DEGREE OF MASTER OF ENGINEERING
(ENTERPRISE ARCHITECTURE)
FACULTY OF GRADUATE STUDIES
MAHIDOL UNIVERSITY
2015**

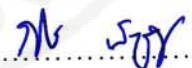
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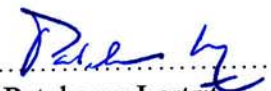
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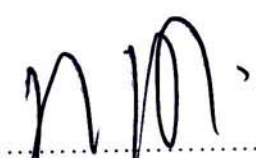
Thematic Paper
entitled
BROADCAST MANAGEMENT (BM) FOR TV-ONLINE


.....
Miss Nongnuch Sripattanathadakul
Candidate


.....
Lect. Tatcha Chulajata,
Ph.D. (Electrical Engineering)
Major advisor


.....
Lect. Korporn Panyim, Ph.D.
(Telecommunications and Networking)
Co-advisor

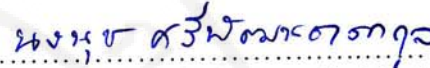

.....
Prof. Patcharee Lertrit,
M.D., Ph.D. (Biochemistry)
Dean
Faculty of Graduate Studies
Mahidol University



.....
Assoc. Prof. Pongsatorn Sedtheetorn,
Ph.D.(Electrical Engineering)
Program Director
Master of Engineering Program in
Enterprise Architecture
Faculty of Engineering
Mahidol University

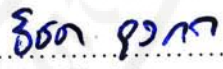
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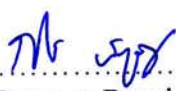
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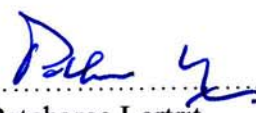

Miss Nongnuch Sripattanathadakul
Candidate



Assoc. Prof. Phumin Kirawanich,
Ph.D. (Electrical Engineering)
Chair


Lect. Tatcha Chulajata,
Ph.D. (Electrical Engineering)
Member


Lect. Korporn Panyim, Ph.D.
(Telecommunications and Networking)
Member


Mr. Panachit Kittipanya-Ngam,
Ph.D. (Computer Vision)
Member


Prof. Patcharee Lertrit,
M.D., Ph.D. (Biochemistry)
Dean
Faculty of Graduate Studies
Mahidol University


Lect. Worawit Israngkul,
M.S. (Technical Management)
Dean
Faculty of Engineering
Mahidol University

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Nongnuch Sripattanathadakul

BROADCAST MANAGEMENT (BM) FOR TV-ONLINE

NONGNUCH SRIPATTANATHADAKUL 5637527 EGEA/M

M.Eng. (ENTERPRISE ARCHITECTURE)

**THEMATIC PAPER ADVISORY COMMITTEE: TATCHA CHULAJATA, Ph.D.,
KORPORN PANYIM, Ph.D.**

ABSTRACT

In this thematic paper, the improvement of True TV online services is focused on. There are more than 100 channels from Truelife, True vision, and H TV services. The broadcast signals of these services come from two stations – Tipco Tower and True Tower 2 Phatthanakan. Conventionally, the channel lineup file, which is in MS Excel format, is used to store and update information for each channel, such as encoder type, channel number, and channel name. The channel lineup file is shared among users in Google Drive. However, the major problem is the data duplication that makes the number of actual available channels unknown.

To tackle such a problem, a broadcast management system is introduced so that the duplication is resolved, and the capacity is fully used.

It is expected that after the BM system is employed, the time dedicated to checking data for channel addition can be reduced, eight channels can be added, and the cost of purchasing eight additional sets of devices can be cut.

**KEY WORDS: TV-ONLINE MANAGEMENT / BROADCAST MANAGEMENT /
ENTERPRISE ARCHITECTURE**

60 pages

ระบบจัดการการออกอากาศสำหรับทีวีออนไลน์

BROADCAST MANAGEMENT (BM) FOR TV-ONLINE

นางนุช ศรีพัฒนธาดากุล 5637527 EGEA/M

วศ.ม. (สถาปัตยกรรมการจัดการองค์กร)

คณะกรรมการที่ปรึกษาสารนิพนธ์: ธัชชช จุลชาติ, Ph.D., ก่อพร พันธุ์ยิ้ม, Ph.D.

บทคัดย่อ

บริการดูทีวีออนไลน์จาก เว็บไซต์ทรูไลฟ์ , ทรูวิชั่นเอนี่แวย์ และ เอช ทีวี ที่มีมากกว่า 100 ช่อง ได้รับสัญญาณที่มาจาก Head end 2 แห่ง – อาคารทิปโก้ และ ทรู ทาวเวอร์ 2 พัฒนาการ. มีการจัดเก็บข้อมูลช่องที่ออกอากาศ กับตัวอุปกรณ์รับสัญญาณ ด้วย Excel จัดเก็บขึ้นบริการ Google Drive ทำให้เกิดปัญหาพบข้อมูลซ้ำซ้อนและไม่สามารถสรุปได้ว่าจำนวนช่องที่ยังคงสามารถเพิ่มได้เป็นเท่าไร

เพื่อช่วยแก้ไขปัญหานี้ จึงได้นำเสนอระบบ Broadcast management เพื่อประโยชน์ในการจัดการกับข้อมูลช่องที่ใช้สำหรับการออกอากาศ ไม่ให้มีการทับซ้อน เพื่อให้สามารถใช้ Streaming ได้อย่างเต็มความสามารถของ Bandwidth ที่มีอยู่ได้อย่างมีประสิทธิภาพอย่างสูงสุด

ประโยชน์จากการใช้งานระบบนี้คาดว่าจะลดการทำงานในการตรวจสอบข้อมูลในการเพิ่มช่องได้ และ รองรับจำนวนช่องเพิ่มขึ้นจากเดิมได้ 8 ช่องหลังจากใช้ระบบ รวมถึง ลดค่าใช้จ่ายในการซื้ออุปกรณ์เพิ่มได้ 8 ชุดอุปกรณ์อีกด้วย

60 หน้า

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CHAPTER I

INTRODUCTION

Currently, streaming TV is internet media gaining higher popularity as a result of the growing number of wireless-device users each year and increased demand for watching free TV channels, digital TV channels, and channels neighboring countries via wireless devices. Streaming TV widely meets users' needs; users do not need sophisticated equipment to expose themselves to streaming TV. They can watch TV anywhere and anytime if they have a smart phone connected to the Internet. Realizing the growing use, True Corp has invested in the addition of channels to deal with the increasing number of users in the future.

True Corp has provided two stations to transmit streaming signals – Tipco Tower and True Tower 2 Phatthanakan. To allow both stations to share streaming signals, there must be a use-friendly system that allows them to share the same data without errors or duplication.

1.1. Problem Statement

The live streaming TV-online service from TRUE is available via the three channels:

- TRUELIFE (<http://tv.truelife.com/live/listall>)
- TV ANYWHERE (Mobile application)
- H TV APPLICATION (Mobile application)

The received signals of these services come from the same sources. Conventionally, the channel lineup file, which is in MS Excel format, is used to store and update information of each channel such as encoder type, channel number, and channel name. The channel lineup file is shared among users in Google drive, as shown in Figure 1. However, some problems have been found, which are as follows:

1. Channel Lineup database was not designed to support the integration of TrueLife, TV anywhere and HTV.
2. The same TV Channel may be redundantly tuned via several encoders.
3. Transmission bandwidth is not efficiently used because of some duplicated channels.
4. TV Channels cannot be updated because existing channel lineup database is not properly designed for this function.
5. Channel Lineup database is not correctly updated.

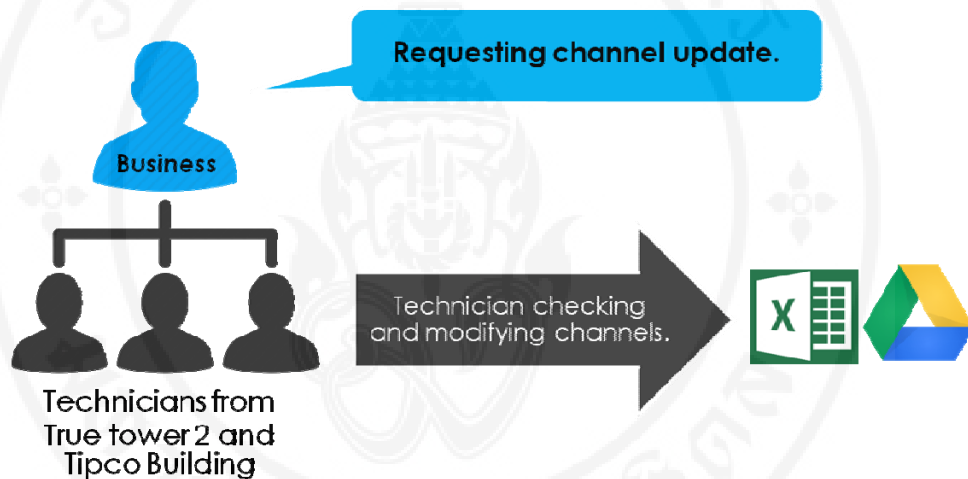


Figure 1.1 Business processes of the current Broadcast management system

Therefore, the broadcast management (BM) for TV-Online system has been proposed as a method of managing channel lineup for the following purposes: to prevent duplicated tuning for the same TV channel; to allow transcoders provide streaming with the full capacity of bandwidth for concurrent connections; and to allow the Operator to answer the Manager's queries responsively when TV channel addition is needed, as illustrated in Figure 2.

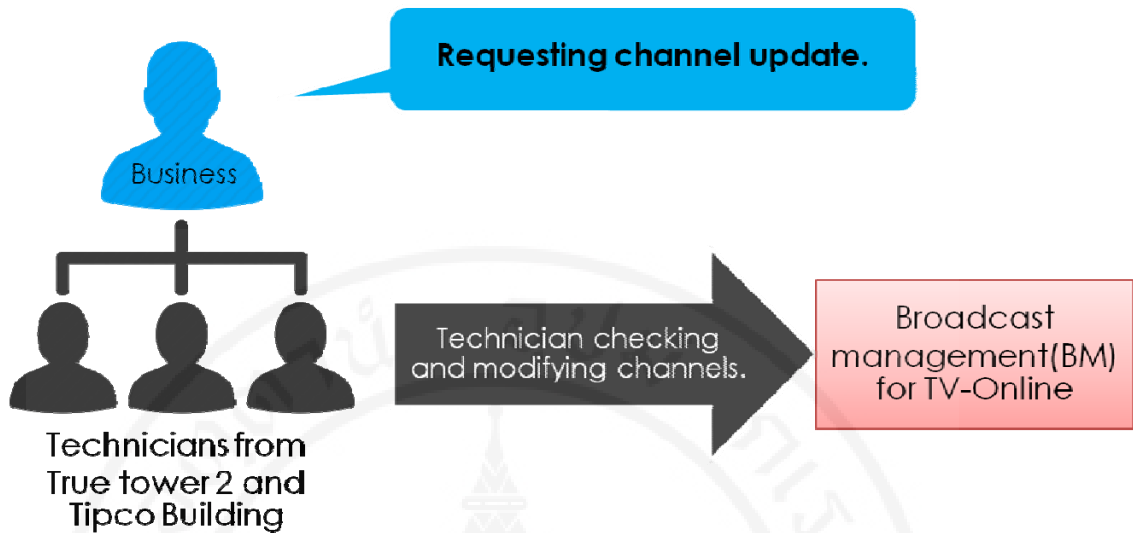


Figure 1.2 Business processes of the expected Broadcast management system

1.2 Objectives

The objectives of this research are:

1. To accurately calculate the number of added TV channels.
2. To effectively utilize transmission bandwidth from True Tower 2 to Muangthong.
3. To easily manage TV channels lineup.
4. To properly invest for the hardware when needed for channel addition.

1.3 Scope of Work

The scope of this work includes:

1. Investigate and identify problems of duplicated data in the operation process.
2. Collect requirements from the operator.
3. Design database for the BM system.
4. Develop the BM system.
5. Test the BM system.

6. Launch the BM software.

7. Assessing the impacts of the BM system on the EA framework based on the following KPIs:

- Time reduction in channel update.
- Increase in additional TV channels after launching the BM system
- Reduction in equipment costs after launching the BM system.

1.4 Work Plan

Activities	2015																			
	JAN				FEB				MAR				APR				MAY			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Preliminary Design																				
1. Identify problems and collect requirements from the operator.	█																			
2. Analyze the data of encoder, transcoder in excel file be stored by the operator.		█																		
3. Conduct an analysis to explore solutions to problems and supporting technology.			█																	
Production																				
4. Present a work plan with the operation and business teams.					█															
5. System Design						█														
6. Development and Testing							█													
7. Documentation software								█												
8. Launch software									█											
9. Measuring for result of research.										█										
Summary																				
10. Write the thematic paper.																			█	
11. Edit the thematic paper based on suggestions made by the advisors.																				█
12. Format and bind the thematic paper.																				█

1.5 Major Contributions

1. The system can reduce equipment costs by 8 channels after launching the BM system.

2. The system can reduce data-checking workload by approximately 8 hours per month, which saves around 14,000 baht per year.

3. The system can support 8 channels increase in TV channels after launching the BM system.

1.6 Chapter Outline

Chapter II Enterprise Architecture Analysis

The chapter discusses the analysis of the broadcast management (BM) system for online TV using the EA framework, which comprises As-Is, To-Be and Gap of four architectures, as follows:

1. Business Architecture
2. Information Architecture
3. Application Architecture
4. Technology Architecture

Chapter III Literature Review

This chapter discusses the comparison between the existing data management systems, e.g. the CMS and the broadcast management (BM) system for online TV.

Chapter IV Materials and methods

This chapter discusses the tools, which are hardware and software, as well as model technologies used for the development of the broadcast management (BM) system for online TV.

Chapter V Results and Discussions

This chapter discusses the results and analytical thinking related to the benefits of the broadcast management (BM) system for online TV, based on KPIs.

Chapter VI Conclusion and Future Work

This chapter presents problems and results from the use the broadcast management (BM) system for online TV to solve problems and solving potential problems and future work that can help develop a system to support the growth of data.

CHAPTER II

ENTERPRISE ARCHITECTURE ANALYSIS

Enterprise architecture analysis is analysis of, and planning for, strategies for business, information, applications, and technology, in which the organizational vision and goals serve as the key elements of the analysis to yield benefits to the organization, in terms of money, time and efficiency of the business. The principles of enterprise architecture analysis have been applied in broadcast management (BM) for online TV in order to evaluate the potential gaps in four types of architecture, which include:

1. Business architecture
2. Information architecture
3. Application architecture
4. Technology architecture

The details are presented in Section 2.2.

2.1 Organization/Enterprise Background

As Thailand's leader of convergence lifestyles, True Corporation Plc provides an incomparable range of integrated communications services and solutions.

Its services and solutions include TrueMove, TrueOnline, and TrueVisions. TrueMove is the country's third largest mobile provider, and its largest business by subscriber numbers and revenue. As for TrueOnline, it is the country's largest broadband and dial-up Internet provider and the largest fixed-line phone operator in Bangkok. TrueVisions is the sole nationwide paid-TV company.

The other two major parts of its business include TrueMoney and TrueLife. TrueMoney offers e-commerce services. TrueLife renders digital content across the Group and includes the chain of True Coffee shops.

As one of the strongest and most recognizable brands in Thailand, True is supported by the Charoen Pokphand Group (CP), Asia's largest agro-conglomerate. As of 18 March 2009, the CP Group has a shareholding representing 58.2 percent of the total registered and paid-up capital of 77,757 million baht.

At the end of 2009, True Group's annual turnover equated to 63 billion baht (including interconnection charges), and its infrastructure investments were equal 200 billion baht. It hired 14,641 permanent staff members.

2.1.1 Vision & brand values

Its vision is to become the only 'true' convergence play, fulfilling people's lives through innovative convergence platform and devices, so people and businesses can share and give 'values' and 'togetherness', which are the true value of life.

Its main mission is to be a company that is equipped with infrastructure that links families, people, businesses, economy and societies, which will lead to sustainable value. Also, its mission is to become an organization that is conscious of opportunities and is committed to giving something in return to Thai society, world society, customers, partners, shareholders, stakeholders, the management, and employees. It believes that the true value of life is 'togetherness' with true happiness and freedom on the basis of sharing to achieve love, good living, and knowledge that leads to sustainable growth of individuals, families and society as a whole.

2.1.2 Mission 2014-2019

The missions that True Group will implement from 2014 to 2019, which will lead it to truly become no. 1 in a sustainable way are:

1. Pushing 90% of Thais to access information through both wire and wireless high-speed networks within 5 years.
2. Mobilizing its existing capacity to implement its plans in Thailand, becoming a regional player, and investing in foreign countries, especially in ASEAN countries.
3. Expanding its digital platforms globally and reaching 10% of the world population within 5 years.

4. Becoming a national, regional and global highest-quality service provider because the success of business relies on quality.

5. Being committed to provide investors, shareholders and co-investors with returns on investment in True Group within the next 5 years.

6. Becoming one of 10 organizations that conducts business with social responsibility at the Asian level, based on the belief that "the whole society's goodness is followed by the company's or organization's goodness."

2.2 Enterprise Architecture analysis

As a well-defined practice for conducting enterprise analysis, design, planning, and implementation, enterprise architecture (EA) always uses a holistic approach to achieve the successful development and implementation of strategies. Enterprise architecture applies architecture principles and practices to lead organizations via the business, information, process, and technology changes that are needed for strategy execution. These practices use many aspects of an enterprise to identify, motivate, and get the changes (as shown in Figure 2.1), which consists of:

1. Business architecture (BA) is the bridge between the enterprise business model and enterprise strategy and the business functionality of the enterprise.

2. Information architecture (IA) comprises models, policies, rules or standards that control which data is collected and how it is stored, arranged, integrated, and put to use in data systems and in organizations.

3. Application architecture (AA) describes the structure and behavior of applications used in a business, which is focused on how they interact with each other and with users. AA is focused on the data used and generated by applications instead of their internal structure. In general, in application portfolio management, the applications are mapped to business functions and to application.

4. Technology architecture (TA) focuses on the organization's infrastructure; it includes both software and hardware technology on application architecture.

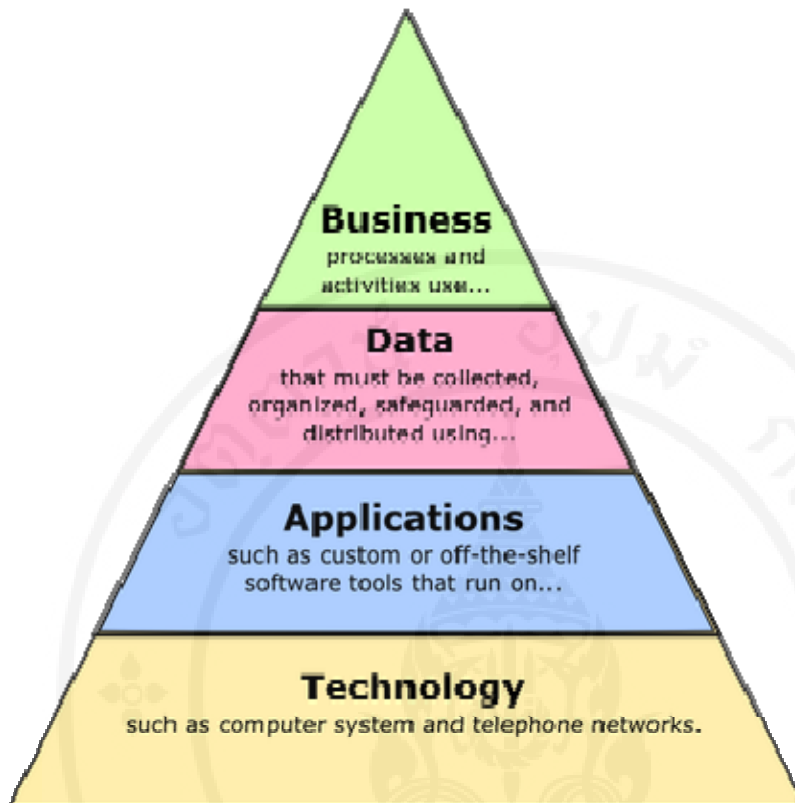


Figure 2.1 Enterprise Architecture model

2.3 Business architecture analysis

Business architecture analysis deals with analysis of the business structure and process to identify which strategies should be improved in line with the organizational vision and goals.

As its vision is to become the only ‘true’ convergence play, fulfilling people’s lives through innovative convergence platform and devices, so people and businesses can share and give ‘values’ and ‘togetherness’ , which are the true value of life, providing online TV service is building the capacity of devices that can be used for viewing online TV. Handling on-air data is essential for online TV service provision.

The unit that takes charge of the system development and maintenance is TrueLife, which is under True Digital Plus, Truecorp’s subsidiary.

Rendering digital content and access to mobile and online digital communities, TrueLife serves as a digital convergence and communicator platform for

consumer-to-consumer, business-to-consumer and business-to-business transactions.

All its services are as follows:

1. Online portal
 - Truelife.com renders an online community and communicator platform, which allows users' interaction, communication and sharing.
 - Its main content categories include TV, movies, music, and sport.
2. Online games
 - True Group provides several leading online games for Thailand, which include Special Force, Lineage II, Guild Wars and Point Blank.
3. TrueLife shops
 - TrueLife shops provide a full range of True products and services, which include True Coffee, True Music, and True Broadband.
4. TrueLife Plus
 - TrueLife Plus represents True products and services, which give customers greater value via packages that are suitable for their lifestyle.
5. Online shopping
 - www.weloveshopping.com, which is TrueLife's online shopping service, has over 150,000 online shops, where more than 2 million items are available.

The team responsible for online portal will develop and maintain Online TV so that it can serve several media, including web portal, mobile application, and future products, such as Internet TV.

The web portal organization's major systems are as follows:

- Business Team, which selects channels and requests the Operation Team to increase or decrease channels and requests a summary of the remaining number of channels that can be added.
- Operation Team, which checks the channels that Business Team would like to add. Using data recorded in Microsoft Excel, Operation Team has to identify if:
 - the desired channels are already on air;
 - the remaining bandwidth is sufficient for the service; and
 - the broadcast devices are sufficient. These are presented in Figure 2.2:

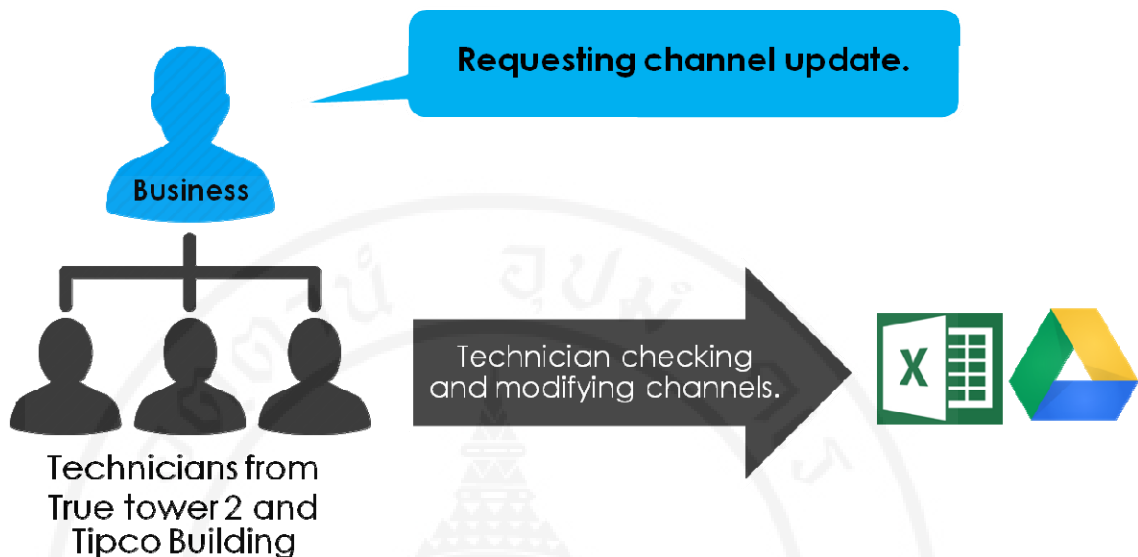


Figure 2.2 Baseline Business Process Flow

- **Baseline of business**

For channel addition, Microsoft Excel is used for recording data of the encoder serial numbers and the transcoder server to identify which channels have been tuned in the system and for recording other relevant data.

1. Sharing data via Google Drive.

2. Changing data by many staffs.

3. The management wants to know the number of channels that can be added, which is revealed by means of calculation by staff each time.

- **Problems of existing business process flow**

1. The same channels are tuned via various encoders.

2. It is impossible to identify in which services each channel is displayed.

3. Channels cannot be added immediately as a result of repeated and non-updated data.

4. The fact that the same channels are tuned via various encoders results in the insufficiency of encoders, so there is need to purchase more encoders and IRD (receivers).

- **Target Business Process Flow**

1. Using the BM system for online TV to manage data about all channels in the system, as presented in Figure 2.3.

2. Using the BM system for online TV to broadcast programs and calculate the remaining number of channels instead of calculation by humans.

3. In the target business process, the benefits from the BM system for online TV are as follows:

- Solving the program of tuning the same channel via the different encoders, which helps increase the number of channels.
- Assisting the operator in accurately checking the image signals for problem-solving.
- Serving added channels immediately due to non-repeated and updated data.
- Calculating the number of channels that can be added accurately.

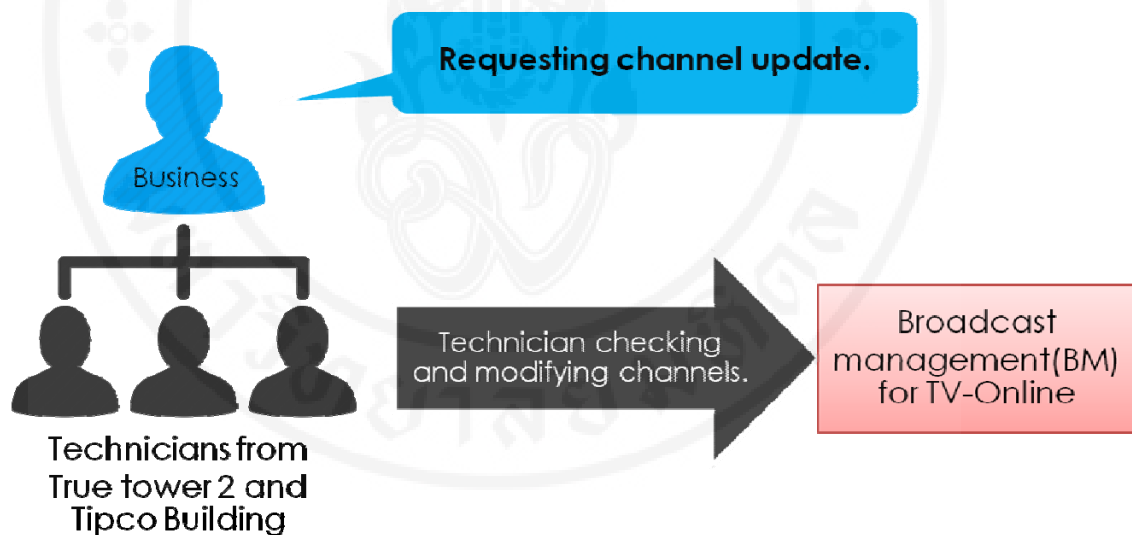


Figure 2.3 Target Business Process Flow

• **Gap Analysis of Business Architecture**

Table 2.1 Gap Analysis of Business Architecture

Baseline	Target	Gap	Reason
Work relating to data about on-air channels and devices via Microsoft Excel.	Using the BM system for online TV via Internet browsers.	Update	To receive real-time and accurate data.

2.4 Information/Data Architecture Analysis

This part presents information/data used in the BM system today and shows what modifications should be made to reduce and solve the problem of duplicated work of information/data.

- **Baseline information/data process**

1. Business Team requests Operation Team to adjust channels to broadcast.
2. Operation Team, composed of Tayan Team and Tipco Team, uses information/data from shared Excel files to manage programs and broadcast devices. Figure 2.4 shows existing data management.
3. Business Team requests the information on the number of channels that can be added.
4. Operation Team would like to inform Business Team of the total number of channels aired in three services – H TV, Truevision Anywhere, and Truelife web portal.

Source From	Status	Channel	Type	CMS Content
TT2-1 SAT	Online	yhai / Thai Chiyo	SD	105009
TT2-1 SAT	Online	Cartoon Club	SD	105021
TT2-1 SAT	Online	T Sport Channel	SD	105016
TT2-1 SAT	Online	Gang Cartoon	SD	105014
TT2-1 SAT	Online	K Ch.	SD	105011
TT2-1 SAT	Online	FTV India (Fashion)	SD	105018
TT2-1 SAT	Offline	Blue Sky Channel	SD	Free
TT2-1 SAT	Online	You Ch.	SD	105024
TT2-1 SAT	Online	Channel 7 (Myanmar)	SD	3186760
TT2-1 SAT	Online	D Channel(One Channel)	SD	105019
TT2-1 SAT	Online	Dragon TV(BOX FILM)	SD	105020
TT2-1 SAT	Online	Money Channel	SD	104628
TT2-1 SAT	Online	True Music	SD	104638
TT2-1 SAT	Online	Media Channel	SD	105001
TT2-1 SAT	Offline	Asian TV	SD	Free
TT2-1 SAT	Online	INTV-24 hr	SD	105026
TT2-1 SAT	Online	Joo Music	SD	105027
TT2-1 SAT	Online	Sexy Women TV(MY TV)	SD	2917419
TT2-1 SAT	Online	Thai Thai(Farm Channel)	SD	105032
TT2-1 SAT	Online	TV 5 Global / TGN	SD	105033
TT2-1 SAT	Online	MYSTERY	SD	2917378
TT2-1 SAT	Online	Gen C	SD	105035
TT2-1 SAT	Online	Nice Ch.	SD	105036
TT2-1 SAT	Offline	Hot TV	SD	Free
TT2-1 SAT	Online	Star Max / day 2	SD	3073714
TT2-1 SAT	Offline	MY_NEWS	SD	Free
TT2-1 SAT	Online	Channel 6	SD	3073877
TT2-1 SAT	Offline	MY_Variety	SD	Free
TT2-1 SAT	Online	Happy Home	SD	2917330
TT2-1 SAT	Offline	Dhamma TV	SD	3073883

Figure 2.4 Handling of Currently On-air Channels

- **Problems of existing data**

1. Non-integrated working on the shared Excel files makes it impossible to know which Operation Team, between Tayan Team and Tipco Team, has modified the data.
2. There is a problem about handling channels with duplication.
3. Figure 2.4 shows the complexity of data management. For example, if we want to inactivate any channels, we have to switch from Online to Offline identified in the red font and cross some data in some columns as agreed.

- **Target information/data process**

1. Reducing data duplication using the BM system for online TV.

2. Specifying clearly which applications are used for broadcasting in each channel.

3. Providing a data access system in which the name of the last person who made modification to the data and the latest modification time are shown.

- **Gap Analysis of Information/Data Architecture**

Table 2.2 Gap Analysis of Information/Data Architecture

Baseline	Target	Gap	Reason
Data stored in Excel.	-	Eliminate	To export data from Excel to the database.
-	Collecting data in the database (RDBMS)	New	To export data from Excel to the database.
Providing a summary of the remaining number of channels that can be broadcast to Business Team through Microsoft Excel calculation.	-	Eliminate	Real-time data do not need the summary from Operation Team.
-	Reporting the remaining number of channels using the BM system for online TV.	New	To use it through Internet browsers.

2.5 Application Architecture Analysis

- **Baseline application process**

1. Currently, both Tayan Team and Tipco Team are using Microsoft Office Excel to manage data for broadcast.

2. The work must be accessed via Google Drive shared by Tayan Team and Tipco Team.

3. When Business Team requests the report, Operation Team will send them Excel files via email.

- **Problems of existing application**

1. As Excel is a desktop application, when there is a need to change data in Excel files, the files have to be shared in the cloud system, which is Google Drive. Bigger files require more upload time. Despite small data to change, file downloading and uploading still take a long time.

2. Although Google provides Google Doc, it has some problems. For example, the format of data in Google Doc always changes from the original one. To see data in a right format, it is needed to download the data to work on it.

3. After receiving Business Team's request for any report, Operation Team has to attach the file report to an email and send the email to Business Team, which causes delay.

4. Opening files to see Excel data via Google Drive is very difficult; it does not allow sorting or filtering data or seeing data in hidden cells.

- **Target application process**

1. This deals with development of the BM system via an Internet browser instead of Microsoft Excel shared on Google Drive, which can solve users' downloading and uploading problems or users' lack of skills in using Excel. The system is designed to be user-friendly, as shown in Figure 2.5, in which inactivation can be done via a single click by ticking off the checkbox in the logo.

2. The reports can be seen real time by Business Team, as the BM system provides real-time reports.

News



Figure 2.5 Handling Channels with Local Displays

- Gap Analysis of Application Architecture

Table 2.3 Gap Analysis of Application Architecture

Baseline	Target	Gap	Reason
Microsoft Excel	BM System	New	To develop a system to manage on-air data
Sharing data using Google Drive	BM System	New	To use the BM system, which does not need file uploading.
Sending report files by attaching them to an email	Report function on the BM system	New	To offer real-time reporting, which allows Business Team to access the BM system right away.

2.6 Technology Architecture Analysis

This part is dedicated to the adoption of technology architecture to support application architecture.

- **Baseline Technology process**

1. Data is managed via Microsoft Office Excel, which is a desktop application operated via a personal computer.
2. Sharing Excel files via Google Drive relies on the Internet.
3. Sending a report to Business Team has to be done via email.

- **Problems of existing Technology**

1. To manage data via Office Excel, users have to install the program in their computer. This is not convenient for users who do not have this program.
2. Uploading Excel files to share via Google Drive takes a long time. Also, uploading a file to the cloud system by many users simultaneously will result in data non-integrity.
3. Report sending has to be done via email, which takes a long time.

- **Target Technology process**

1. The DB server is used for storing data; it is freeware that handles data via MySQL, as shown in Figure 2.6
2. Using the web server (Internet information services) to store BM files to serve users via the Internet.
3. Report sending has to be done via email, which takes a long time.

Server: 172.30.200.124 Database: webdev Table: live

Field	Type	Collation	Attributes	Null	Default	Extra	Action
<input type="checkbox"/> live_id	int(11)			No	None	auto_increment	[Icons]
<input type="checkbox"/> channel	varchar(50)	utf8_general_ci		Yes	NULL		[Icons]
<input type="checkbox"/> title_en	varchar(50)	utf8_general_ci		Yes	NULL		[Icons]
<input type="checkbox"/> title_th	varchar(50)	utf8_general_ci		Yes	NULL		[Icons]
<input type="checkbox"/> synopsis_en	mediumtext	utf8_general_ci		Yes	NULL		[Icons]
<input type="checkbox"/> synopsis_th	mediumtext	utf8_general_ci		Yes	NULL		[Icons]
<input type="checkbox"/> path_url	mediumtext	utf8_general_ci		Yes	NULL		[Icons]
<input type="checkbox"/> filename	varchar(255)	utf8_general_ci		Yes	NULL		[Icons]
<input type="checkbox"/> filenameold	varchar(255)	utf8_general_ci		No	None		[Icons]
<input type="checkbox"/> live_category	varchar(255)	utf8_general_ci		Yes	NULL		[Icons]
<input type="checkbox"/> ActiveMenu	enum('yes','no')	utf8_general_ci		Yes	NULL		[Icons]
<input type="checkbox"/> signal	enum('yes','no')	utf8_general_ci		No	yes		[Icons]
<input type="checkbox"/> isPPV	enum('no','yes')	utf8_general_ci		Yes	NULL		[Icons]
<input type="checkbox"/> isTPL	enum('no','yes')	utf8_general_ci		Yes	NULL		[Icons]
<input type="checkbox"/> ratio	varchar(255)	utf8_general_ci		Yes	NULL		[Icons]
<input type="checkbox"/> orderMenu	varchar(255)	utf8_general_ci		No	abc		[Icons]
<input type="checkbox"/> urlRefer2	varchar(255)	utf8_general_ci		No	None		[Icons]
<input type="checkbox"/> orderEncoder	int(11)			Yes	NULL		[Icons]
<input type="checkbox"/> onTV	enum('yes','no')	utf8_general_ci		No	yes		[Icons]
<input type="checkbox"/> monitored	enum('yes','no')	utf8_general_ci		Yes	no		[Icons]
<input type="checkbox"/> monitor_alert	enum('yes','no')	utf8_general_ci		No	None		[Icons]
<input type="checkbox"/> live_category2	varchar(255)	utf8_general_ci		Yes	NULL		[Icons]
<input type="checkbox"/> freeNonTrue	tinyint(4)			No	None		[Icons]
<input type="checkbox"/> link_refer	mediumtext	utf8_general_ci		No	None		[Icons]
<input type="checkbox"/> schedule_file	mediumtext	utf8_general_ci		Yes	NULL		[Icons]
<input type="checkbox"/> provider	text	utf8_general_ci		Yes	NULL		[Icons]
<input type="checkbox"/> key	varchar(50)	utf8_general_ci		No	None		[Icons]
<input type="checkbox"/> memo	mediumtext	utf8_general_ci		Yes	NULL		[Icons]
<input type="checkbox"/> live_category_tv	varchar(255)	utf8_general_ci		Yes	NULL		[Icons]
<input type="checkbox"/> uri_m3u8	mediumtext	utf8_general_ci		No	None		[Icons]
<input type="checkbox"/> script_player	mediumtext	utf8_general_ci		No	None		[Icons]

Check All / Uncheck All With selected: [Icons]

Figure 2.6 MySQL Managing On-air Data

- **Gap Analysis of Technology Architecture**

The technology of web application facilitates and optimizes work on different types of data, including centralized data. Also, it can be accessed via different media, e.g. mobiles and desktop, if they are connected to the Internet.

Table 2.4 Gap Analysis of Technology Architecture

Baseline	Target	Gap	Reason
Client computer	Client computer	-	To use BM via Internet browsers
Google Drive	Web server (IIS)	NEW	To create the BM system for online TV
Microsoft Excel	Database server (MySQL)	NEW	To input data into the database (RDBMS)
Email system	-	-	To stop using the email system because reports no longer need to be sent via email.

CHAPTER III

LITERATURE REVIEW

Broadcasting on-line TV needs systematic data management as it involves many parties, which utilize shared data. A lack of data tuning from each party will result in duplicated data. For example, Voice TV at the Tipco Building is broadcasted in Truevision Anywhere. At the Tayan Building, the same channel is tuned for H TV and TrueLife Portal, as shown in Figure 3.1. Actually, the three services – Truevision Anywhere, HTV, and Truelife Portal can share the same streaming source. Using different streaming sources causes unnecessary expenditures on broadcast devices. Thus, there is a need to use the shared data appropriately without storing duplicated data in order to achieve efficient use of data, devices, and channels.

Broadcasting data involves a huge amount of data on broadcast devices in order to support more than 100 TV channels. The data is stored in Microsoft Excel, so many errors arise as a result of data duplication and miscalculation. This research aims to compare three data management systems, namely Data Grid, the interface of which is similar to online Excel; the content management system (CMS); and the broadcast management system for online TV (the BM system for online TV).

3.1 Data Grid

Data Grid or Grid is the most desirable way to display data in the list format, and there is a large quantity of jQuery Grid plugins available with many features.

jQuery is a JavaScript library that is quick, small, and full of features. It helps to make HTML document traversal and manipulation, event handling, animation, AJAX and so on less sophisticated as a result of its user-friendly API that works across a very large number of browsers. Due to its versatility and extensibility, jQuery has proposed a new way of writing JavaScript.

3.1.1 SlickGrid

As a JavaScript grid/spreadsheet component, SlickGrid is an advanced component and is a little bit more complex to learn and configure. However, if its full potential is realized, it has great effects. Its user interface is as shown in Figure 3.1.



#	Title	Duration	% Complete	Start	Finish	Effort Driven
0	Task 0	5 days	<div style="width: 100%; background-color: green;"></div>	01/01/2009	01/05/2009	✓
1	Task 1	5 days	<div style="width: 20%; background-color: gray;"></div>	01/01/2009	01/05/2009	
2	Task 2	5 days	<div style="width: 100%; background-color: green;"></div>	01/01/2009	01/05/2009	
3	Task 3	5 days	<div style="width: 100%; background-color: green;"></div>	01/01/2009	01/05/2009	
4	Task 4	5 days	<div style="width: 20%; background-color: gray;"></div>	01/01/2009	01/05/2009	
5	Task 5	5 days	<div style="width: 10%; background-color: red;"></div>	01/01/2009	01/05/2009	✓
6	Task 6	5 days	<div style="width: 20%; background-color: gray;"></div>	01/01/2009	01/05/2009	
7	Task 7	5 days	<div style="width: 10%; background-color: red;"></div>	01/01/2009	01/05/2009	
8	Task 8	5 days	<div style="width: 5%; background-color: red;"></div>	01/01/2009	01/05/2009	
9	Task 9	5 days	<div style="width: 10%; background-color: red;"></div>	01/01/2009	01/05/2009	
10	Task 10	5 days	<div style="width: 5%; background-color: red;"></div>	01/01/2009	01/05/2009	✓
11	Task 11	5 days	<div style="width: 100%; background-color: green;"></div>	01/01/2009	01/05/2009	
12	Task 12	5 days	<div style="width: 20%; background-color: gray;"></div>	01/01/2009	01/05/2009	
13	Task 13	5 days	<div style="width: 1%; background-color: red;"></div>	01/01/2009	01/05/2009	
14	Task 14	5 days	<div style="width: 100%; background-color: green;"></div>	01/01/2009	01/05/2009	
15	Task 15	5 days	<div style="width: 100%; background-color: green;"></div>	01/01/2009	01/05/2009	✓
16	Task 16	5 days	<div style="width: 20%; background-color: gray;"></div>	01/01/2009	01/05/2009	
17	Task 17	5 days	<div style="width: 20%; background-color: gray;"></div>	01/01/2009	01/05/2009	
18	Task 18	5 days	<div style="width: 100%; background-color: green;"></div>	01/01/2009	01/05/2009	

Figure 3.1 User Interface of SlickGrid

3.1.2 jqGrid

jqGrid for ASP.NET is a server-side component that is built on top of the most popular jQuery plugin, which is jqGrid. In addition to blazing speed, its features include minimum view state and minimum HTML. Also, it comes with themeroller support. Figure 3.2 shows its user interface.

Order	CustomerID	OrderDate	Freight	ShipName
<input type="checkbox"/> x	[All] x	<input type="text"/> x	[All] x	<input type="text"/> x
1	VINET	1996-07-04	32.3800	Vins et alcools Chevalier
2	TOMSP	1996-07-05	11.6100	Toms Spezialitäten
3	HANAR	1996-07-08	65.8300	Hanari Carnes
4	VICTE	1996-07-08	41.3400	Victuailles en stock
5	SUPRD	1996-07-09	51.3000	Suprêmes délices
6	HANAR	1996-07-10	58.1700	Hanari Carnes
7	CHOPS	1996-07-11	22.9800	Chop-suey Chinese
8	RICSU	1996-07-12	148.3300	Richter Supermarkt
9	WELLI	1996-07-15	13.9700	Wellington Importadora
10	HILAA	1996-07-16	81.9100	HILARION-Abastos

Page 1 of 100,000 | 10 | View 1 - 10 of 1,000,000

Figure 3.2 User Interface of jqGrid

3.1.3 DataTables

As a plug-in for the jQuery Javascript library, DataTables is a tool that is very flexible, based on the foundations of progressive enhancement, which will add advanced interaction controls to any HTML tables. Some of its features include variable length pagination, on-the-fly filtering, smart handling of column widths, multi-column sorting, display data from almost any data source, etc. Its user interface is illustrated in Figure 3.3.



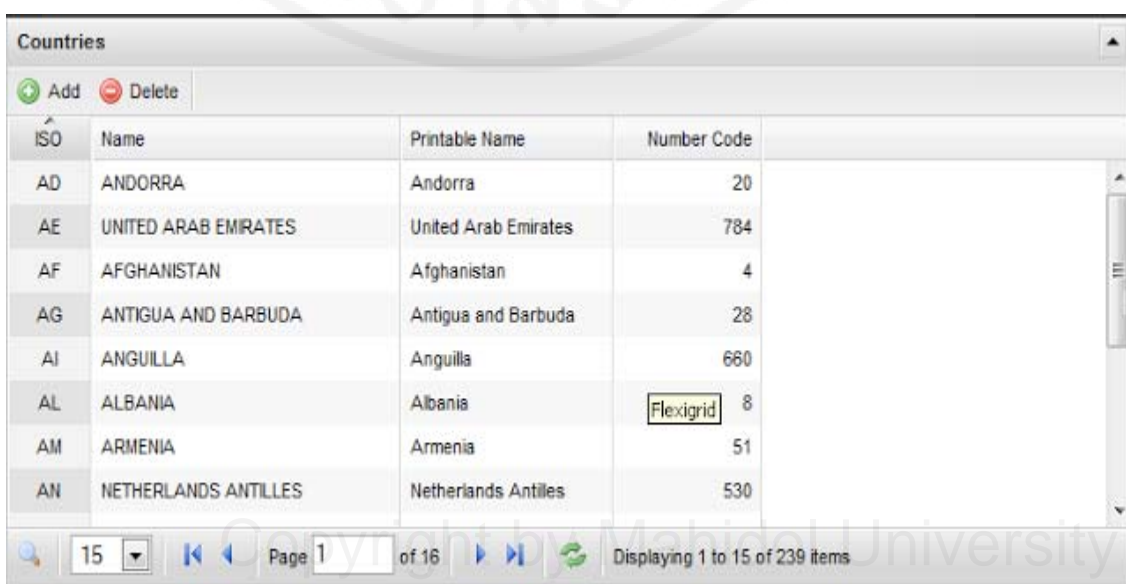
The screenshot shows the DataTables user interface. At the top, there is a search bar and a dropdown menu set to '10 entries'. Below this is a table with the following columns: Rendering engine, Browser, Platform(s), Engine version, and CSS grade. The table contains 10 rows of data, all with a green background. At the bottom, there is a pagination control showing 'Showing 1 to 10 of 58 entries' and navigation buttons for 'First', 'Previous', '1', '2', '3', '4', '5', 'Next', and 'Last'.

Rendering engine	Browser	Platform(s)	Engine version	CSS grade
Gecko	Firefox 1.0	Win 98+ / OSX.2+	1.7	A
Gecko	Firefox 1.5	Win 98+ / OSX.2+	1.8	A
Gecko	Firefox 2.0	Win 98+ / OSX.2+	1.8	A
Gecko	Firefox 3.0	Win 2k+ / OSX.3+	1.9	A
Gecko	Camino 1.0	OSX.2+	1.8	A
Gecko	Camino 1.5	OSX.3+	1.8	A
Gecko	Netscape 7.2	Win 95+ / Mac OS 8.6-9.2	1.7	A
Gecko	Netscape Browser 9	Win 98SE+	1.7	A
Gecko	Netscape Navigator 9	Win 98+ / OSX.2+	1.8	A
Gecko	Mozilla 1.0	Win 95+ / OSX.1+	1	A

Figure 3.3 User Interface of DataTables

3.1.4 FlexiGrid

Despite being lightweight, FlexiGrid is a rich data grid containing resizable columns and a scrolling data to match the headers. Also, it has the ability to connect to an xml based data source by means of AJAX to load the content. Some of its features include resizable columns, resizable height and width, sortable column headers, cool theme, ability to connect to an AJAX data source (XML and JSON), paging, and so on. Its user interface is illustrated in 3.4.



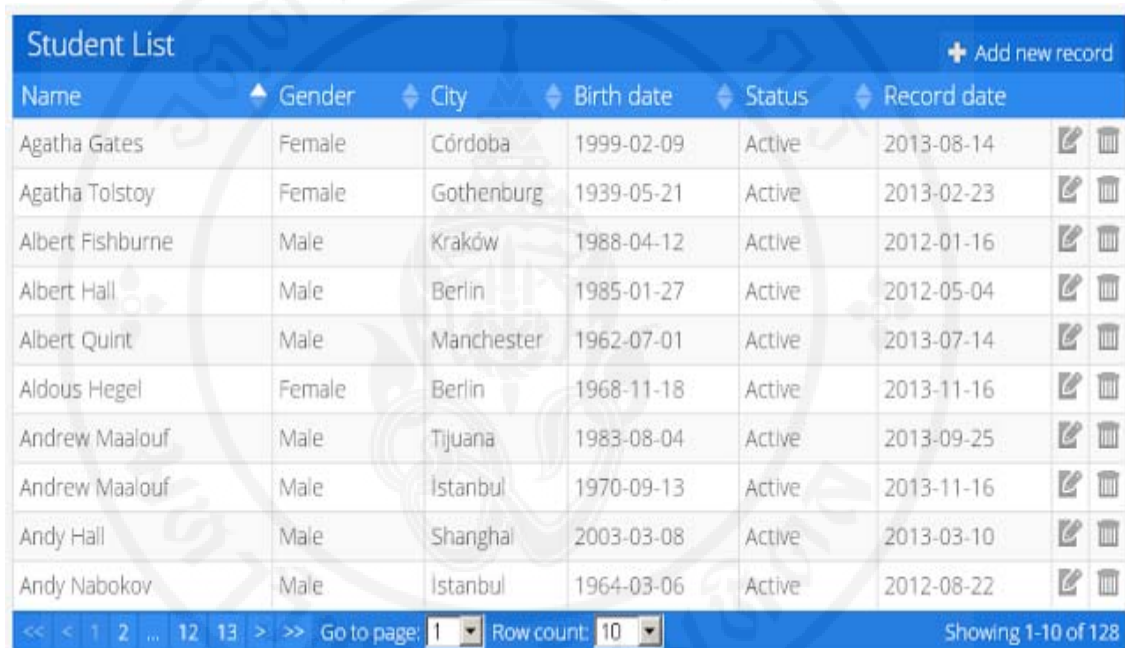
The screenshot shows the FlexiGrid user interface. At the top, there is a title 'Countries' and two buttons: 'Add' (with a green plus icon) and 'Delete' (with a red minus icon). Below this is a table with the following columns: ISO, Name, Printable Name, and Number Code. The table contains 8 rows of data. At the bottom, there is a pagination control showing 'Page 1 of 16' and 'Displaying 1 to 15 of 239 items'. There are also navigation buttons for 'Previous', 'Next', and 'Refresh'.

ISO	Name	Printable Name	Number Code
AD	ANDORRA	Andorra	20
AE	UNITED ARAB EMIRATES	United Arab Emirates	784
AF	AFGHANISTAN	Afghanistan	4
AG	ANTIGUA AND BARBUDA	Antigua and Barbuda	28
AI	ANGUILLA	Anguilla	660
AL	ALBANIA	Albania	8
AM	ARMENIA	Armenia	51
AN	NETHERLANDS ANTILLES	Netherlands Antilles	530

Figure 3.4 User Interface of FlexiGrid

3.1.5 jTable

jTable is a jQuery plugin that can create AJAX based CRUD tables without a need to code HTML or Javascript. It can automatically create HTML tables, load records from a server using AJAX, support server side paging using AJAX, support master/child tables, resize columns, show/hide columns, can be localized, and so on. Its user interface is shown in Figure 3.5.



Name	Gender	City	Birth date	Status	Record date		
Agatha Gates	Female	Córdoba	1999-02-09	Active	2013-08-14		
Agatha Tolstoy	Female	Gothenburg	1939-05-21	Active	2013-02-23		
Albert Fishburne	Male	Kraków	1988-04-12	Active	2012-01-16		
Albert Hall	Male	Berlin	1985-01-27	Active	2012-05-04		
Albert Quint	Male	Manchester	1962-07-01	Active	2013-07-14		
Aldous Hegel	Female	Berlin	1968-11-18	Active	2013-11-16		
Andrew Maalouf	Male	Tijuana	1983-08-04	Active	2013-09-25		
Andrew Maalouf	Male	Istanbul	1970-09-13	Active	2013-11-16		
Andy Hall	Male	Shanghai	2003-03-08	Active	2013-03-10		
Andy Nabokov	Male	Istanbul	1964-03-06	Active	2012-08-22		

Navigation: << < 1 2 ... 12 13 > >> Go to page: 1 Row count: 10 Showing 1-10 of 128

Figure 3.5 User Interface of jTable

3.1.6 ParamQuery Grid

ParamQuery grid is an open source jQuery grid plugin for displaying and manipulating tabular data in rich AJAX applications. Containing ideas of MS Excel and Google spreadsheet, it can deal with almost all problems. Its user interface is presented in Figure 3.6.

Companies listed on the NASDAQ

Search Company Name Selected 2 of 3 match(es).

	Company Name	Symbol	Price	Change	% Change	Volume
1	Sirius Xm Radio Inc.	SIRI	↑ 2.70	+0.01	+0.37%	81,250,806
2	Intel	INTC	↑ 20.26	+0.07	+0.35%	69,433,790
3	Microsoft	MSFT	↑ 26.74	+0.22	+0.83%	57,179,237
4	Research in Motion Limited	RIMM	↑ 9.58	+0.38	+4.13%	42,529,737
5	Cisco Systems	CSCO	↑ 18.31	+0.32	+1.78%	40,616,346
6	Yahoo! Inc.	YHOO	↑ 18.36	+0.50	+2.80%	32,997,005
7	Dell	DELL	↑ 9.12	+0.26	+2.95%	29,800,460
8	Apple	AAPL	↑ 566.06	+38.38	+7.27%	29,398,995
9	Oracle	ORCL	↑ 30.14	+0.14	+0.47%	22,551,075
10	Applied Materials	AMAT	↑ 10.35	+0.20	+1.97%	15,542,402
11	Brocade Communications Systems	BRCD	↑ 5.56	+0.30	+5.70%	14,598,474
12	News	NWSA	↑ 23.96	+0.67	+2.88%	14,096,772
13	Dynavax Technologies	DVAX	↑ 2.64	+0.20	+8.20%	12,758,155
14	Qualcomm Incorporated	QCOM	↑ 62.12	+0.19	+0.31%	12,169,272
15	Activision Blizzard					

Page 1 of 6 Records per page: 15 Displaying 1 to 15 of 85 items.

Figure 3.6 User Interface of ParamQuery Grid

3.1.7 jqWidget -> jqxGrid

The Grid is a jQuery widget that displays tabular data. It provides a lot of support for interacting with data, including paging, grouping, sorting, filtering and editing. Figure 3.7 shows its user interface.

Product Name	Quantity per Unit	Unit Price	Units In Stock	Discontinued
Chai	10 boxes x 20 bags	\$18.00	39	<input type="checkbox"/>
Chang	24 - 12 oz bottles	\$19.00	17	<input type="checkbox"/>
Aniseed Syrup	12 - 550 ml bottles	\$10.00	13	<input type="checkbox"/>
Chef Anton's Cajun Seasoning	48 - 6 oz jars	\$22.00	53	<input type="checkbox"/>
Chef Anton's Gumbo Mix	36 boxes	\$21.35	0	<input checked="" type="checkbox"/>
Grandma's Boysenberry Spread	12 - 8 oz jars	\$25.00	120	<input type="checkbox"/>
Uncle Bob's Organic Dried Pears	12 - 1 lb pkgs.	\$30.00	15	<input type="checkbox"/>
Northwoods Cranberry Sauce	12 - 12 oz jars	\$40.00	6	<input type="checkbox"/>
Mishi Kobe Niku	18 - 500 g pkgs.	\$97.00	29	<input checked="" type="checkbox"/>
Ikura	12 - 200 ml jars	\$31.00	31	<input type="checkbox"/>

Go to: Show rows: 1-10 of 77

Figure 3.7 User Interface of jqWidget -> jqxGrid

3.1.8 jui DataGrid

jui_datagrid is an AJAX-enabled jQuery plugin, which is used for manipulating database data in the tabular format. Its features include fully customizable, simple yet powerful API, jQuery themes compatible, and localization support. With its modular design, it uses a jui_pagination plugin for paging and jui_filter_rules plugin for searching. Its user interface is shown in Figure 3.8.

Customers				
#	Lastname ↑	Firstname ↑	Email	Gender
81	Holland	Kessie	semper.tellus.id@egestasDuisac.edu	female
82	Holloway	Aiko	commodo@faucibus.org	female
83	Holt	Raymond	sem.vitae.aliquam@augue.org	male
84	Howe	Malik	in@Sed.ca	male
85	Hubbard	Brielle	enim.Sed@temporerat.com	female
86	Huff	Aimee	velit@Proin.org	female
87	Hurley	Branden	velit@vitaeratvel.com	male
88	Jackson	Gray	fringilla.ornare@nislsemconsequat.ca	male
89	Jacobs	Ivor	amet.risus.Donec@Naminterdum.org	male
90	Jacobs	Justine	sit.amet@velvulputate.ca	female

Selected: 2

Page 1 ... 4 5 6 ... 10 20 81-100 of 200 records

Figure 3.8 User Interface of jui DataGrid

3.1.9 Ingrid

Ingrid is a jQuery component that is not easily noticed; it adds datagrid behaviors (column resizing, paging, sorting, row and column styling, and so on) to tables. Its user interface is shown in Figure 3.9.

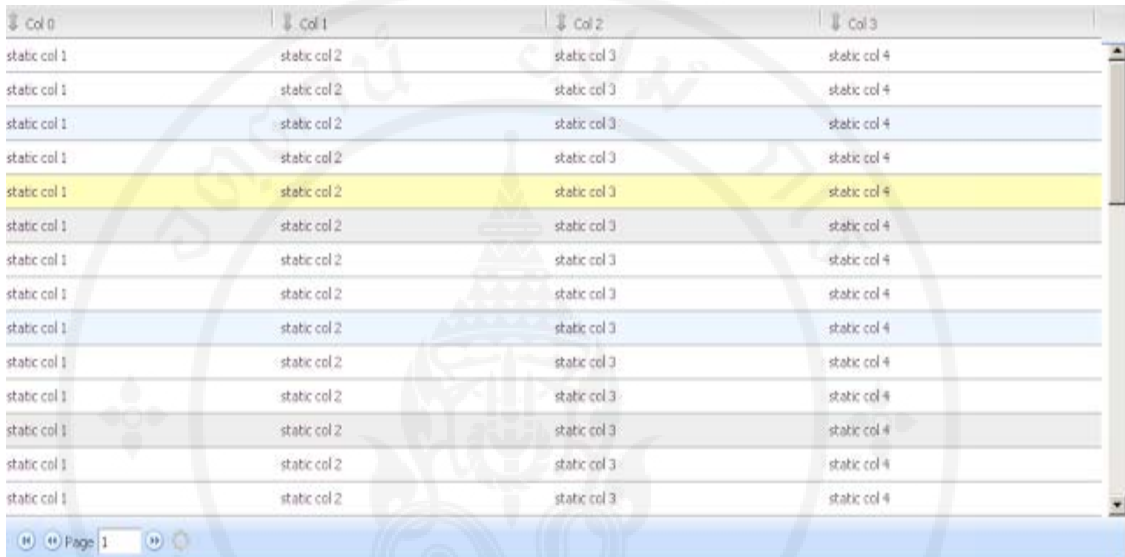


Figure 3.9 User interface of Ingrid

3.1.10 Open JS Grid

Equipped with a MySQL class, JS Grid can perform database work. Its user interface is presented in 3.10.

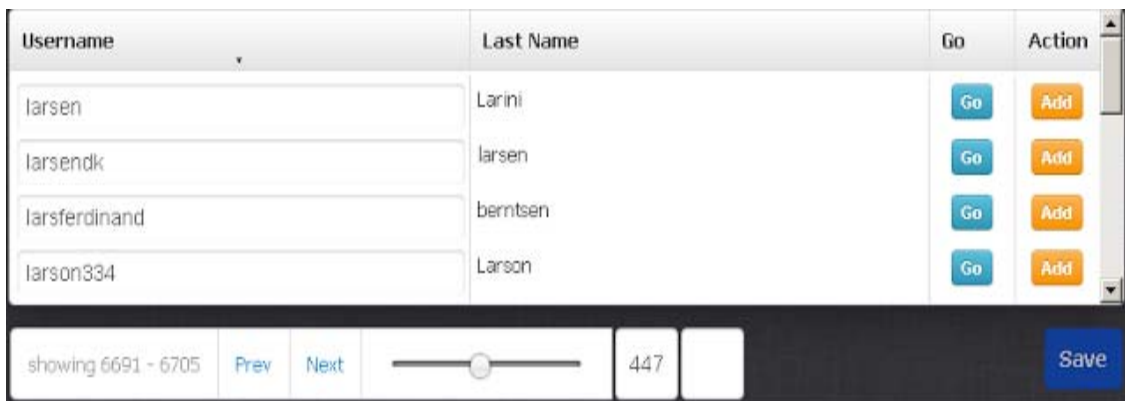


Figure 3.10 User Interface of Open JS Grid

3.2 Content Management System (CMS)

The content management system (CMS) comes with the function of managing contents on the website via "Admin," which is created by Webmaster. CMS facilitates editing texts, contents, banners or other parts without a need to open the files of the website to edit texts and upload them to the server. Figure 3.11 shows CMS' main abilities.



Figure 3.11 CMS's Major Abilities

As a computer program, it contains two features, as follows:

1. It has the Admin system that handles different parts of the website.
2. Files of the website do not need to be edited.

There is a lot of CMS software to serve different purposes, such as:

- CMS for blogs – Wordpress, Drupal.
- CMS for web boards – SMF, phpBB.
- CMS for e-Learning – Moodle, Sakai.
- CMS for e-Commerce – Magento, VirtueMart, osCommerce, PhpShop

3.2.1 Major CMS Software

The diagram shows the first four popular CMS software – Wordpress, Joomla, Drupal and Plone, as illustrated in Figure 3.12. The following are its advantages and disadvantages, which come from the research paper prepared by <http://idealware.org>, issued in March 2009.

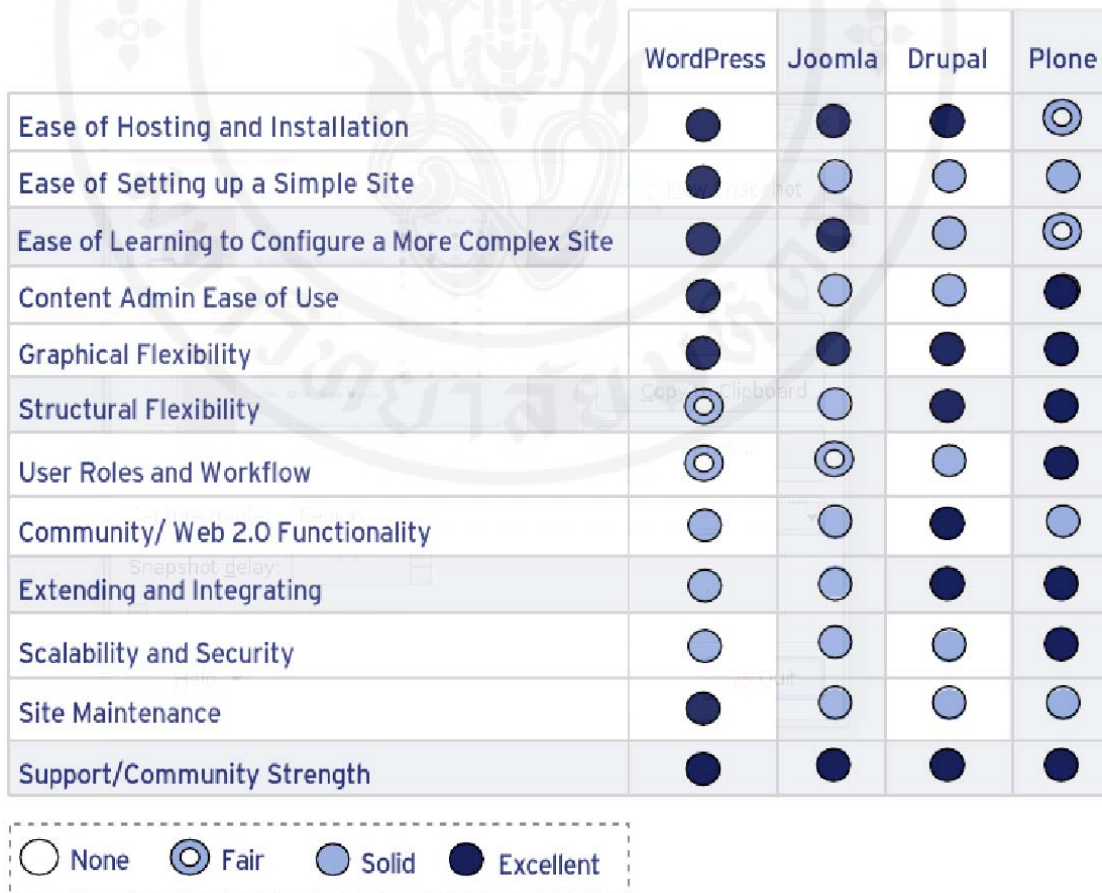


Figure 3.12 CMS’ Advantages and Disadvantages

3.2.2 Advantages of the CMS

1. Users need no knowledge about website development.
2. It saves time and money for website development.
3. It is easy to manage, and it comes with all supporting systems.
4. It allows added management systems, e.g. the gallery system.
5. It can adjust the website theme by downloading themes provided by the CMS.

3.2.3 Disadvantages of the CMS

1. To design the web theme, users need to possess extraordinary expertise as it involves several systems, which is very complicated.
 2. Users need to study the developed CMS, such as, where to insert texts and images, which is difficult at first.
 3. Setting up the CMS in the web server for the first time is complicated.
- However, there are many web servers that offer free CMS setting up service. Overall, CMS is a preferable system.

3.2.4 Application of the CMS

The CMS can be applied in many tasks, for example:

Creating websites of educational institutions, entertainment business, newspapers, finance, banking, stocks and investment, real estate, human resources, auction, tourist attractions, and customer service.

1. Tasks of government agencies, such as news, public relations, and presentations.
2. Creating personal websites or websites of clubs, associations, and federations, by means of job division, which results in harmony and teamwork spirit.
3. Creating websites for SMEs, especially for OTOP, which have gained high popularity.
4. Replacing licensed software to save money and time and facilitate development.
5. Creating Intranet web sites.

3.3 Broadcast Management (BM) for Online TV

BM system is in-house software developed by software developers from Truelife Team. It is a web application developed using PHP connected to the MySQL database, which aims to manage data for broadcast, broadcast devices, and report on the remaining channels, bandwidth and broadcast devices. Its advantages are as follows:

1. Can handle data on broadcast devices, as shown in Figure 3.13.
2. Can issue reports as needed by Teams.
3. Can calculate the number of channels that can be added.
4. Can prevent data duplication.
5. Is easy to access as it is a web application.
6. Shows logins/which users have changed the data.

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Figure 3.13 Handling of On-air Data

3.4 Comparison between Solutions

The BM system for online TV can be customized to channels or devices. As for Data Grid, despite being an easy tool with various user interfaces to choose from, it requires high customization for displaying, especially preparing a summary of the remaining number of channels. As for the CMS, its disadvantages are as follows:

1. Setting up the CMS needs extraordinary expertise as it is complicated.
2. Users need to study the developed CMS, for example, where to insert texts.
3. It is difficult or impossible to do editing as this software does not perform calculation.

In conclusion, the BM system for online TV saves time for system development compared with the CMS or Data Grid, which take longer time for customization and installation. The BM system meets Operation Team's needs and can issue real-time reports. Both Tayan Team and Tipco Team use web applications connecting to the same database.



CHAPTER IV

MATERIALS AND METHODOLOGY

The unit that takes charge of broadcasting needs to gain accurate information about programs to broadcast and broadcast devices. The head-ends at Tayan Building and Tipco Building have to rely on the same data, and data duplication has resulted in unnecessary costs of additional devices for channel addition. Thus, the broadcast management (BM) system for online TV was developed to tackle this problem.

This chapter presents tools for developing the BM system and methodologies that were applied to develop BM software to resolve the problem of data duplication from operations by both teams at Tayan and Tipco building.

4.1 Materials

The BM system deals with the development of web application, which consists of hardware and software. Its main components, as shown in Figure 4.1, are as follows:

4.1.1 Web Server

A web server is an information technology that processes requests through hypertext transfer protocol (HTTP), which is the basic network protocol that is used for distributing information on the World Wide Web. This term refers to the entire computer system or the software that accepts and supervises the HTTP requests, as shown in Figure 4.1.

The BM system chooses the internet information server, which is the internet information services (IIS) from Microsoft, whose advantages are as follows:

1. Secure the server by diminishing the attack surface area – Decreasing surface area is one of the best ways to secure a server system. With IIS,

individuals can remove all unused server features, and this can achieve the minimum surface area possible while maintaining the functionality of their application.

2. Optimize performance and reduce memory footprint – If individuals remove unused server features, they can reduce the amount of memory that the server uses and optimize performance by decreasing the amount of feature code that executes on every request to their application.

3. Build custom/specialized servers – By selecting a particular set of server features, individuals can create custom servers that are optimized for performing a specific function within their application topology, such as edge caching or load balancing. They can add custom features to extend or replace any existing functionality by means of their own or third party server components that are built on the new extensibility APIs. The componentized architecture gives long-term benefits to the IIS community. That is, it helps the development of new server features as they are needed both inside Microsoft and among third-party developers.

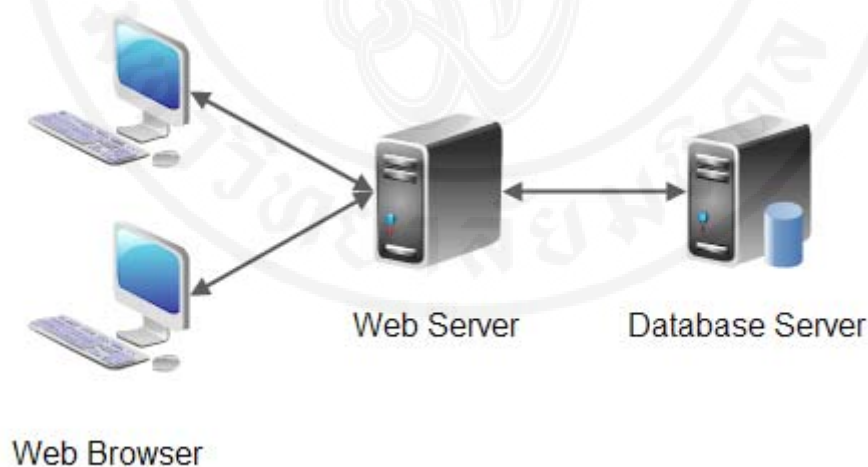


Figure 4.1 Web server and Database server Architecture

4.1.2 Database Server

A database server is a dedicated server that gives database services to other computer programs or computers, as defined by the client-server model. This term can refer to a computer used for running the program. Database management systems usually provide database server functionality, and some database management systems

(DBMSs), such as MySQL rely only on the client-server model for database access, as presented in 4.1.

The server is accessed either via a “front end” that runs on the user’s computer, which displays requested data, or the “back end” running on the server and handles tasks, for example, data analysis and storage.

In a master-slave model, database master servers are centralized and the primary locations of data. Database slave servers are synchronized backups of the master acting as proxies.

Most of the database servers work with the base of Query language. Understanding its query language, each database converts it to server readable form and executes it to retrieve the results.

Some proprietary database servers include Oracle, DB2, Informix, and Microsoft SQL Server; examples of GNU General Public Licence database servers include Ingres and MySQL. All servers use their own query logic and structure. The SQL query language is almost the same in all relational database servers. DB-Engines lists over 200 DBMSs in its ranking.

The BM system selects MySQL for system development, because MySQL is RDBMS, which is a relational database management system, RDBMS is a program that allows creating, updating, and administering a relational database. Most commercial RDBMS use relies on the Structured Query Language (SQL) to access the database, but SQL was created after the development of the relational model and is not necessary for its use. These are the benefits of MySQL

1. Cost Effective

MySQL database is an open source system, and any individuals can use it as it is under General Public License. This provides developers with the opportunity to build MySQL Database. At the same time, individuals can make changes to the code and customize the same as per their requirement. With the features that are available anyone would like to choose MySQL database. Nonetheless, there are some limitations for those who plan to use MySQL database for commercial use. This is because they may have to buy standard edition of SQL server for a very nominal charge.

2. Cross Platform Operability

One major reason why MySQL is the most popular form of database is its Cross Platform Operability. It can be installed in all major platforms, e.g. Linux, Windows and Solaris, and performance is not affected. In addition, its application programming interfaces (APIs) makes its integration with C, C++, Perl, Java and Python etc. quite easily.

3. Security

Databases that are set up on MySQL are extremely secure because of the fact that all the passwords that are stored are in encrypted form. Therefore, this can restrict unauthorized access to the database.

MySQL database has only basic advantages. There are plenty, and this attracts most large companies to select MySQL databases. However, small companies can keep these features as the option of choosing Free MySQL database.

The cost of maintenance is quite low, so it is a good option for small-scale companies. As there is a lot of free MySQL Training, people can learn and handle MySQL databases without facing any serious problems. MySQL databases are designed for all people and are suitable for all kinds of requirement.

4.1.3 Web Development

Web development deals with the process of developing websites or webpages hosted on the Internet or intranet. To create websites, including a blog, social network, online video streaming service, e-commerce store, or other types of Internet application, it has to be developed by a web developer.

The web development process can be divided into three key components, which are server-side coding, client-side coding and database technology, as shown in 4.2.

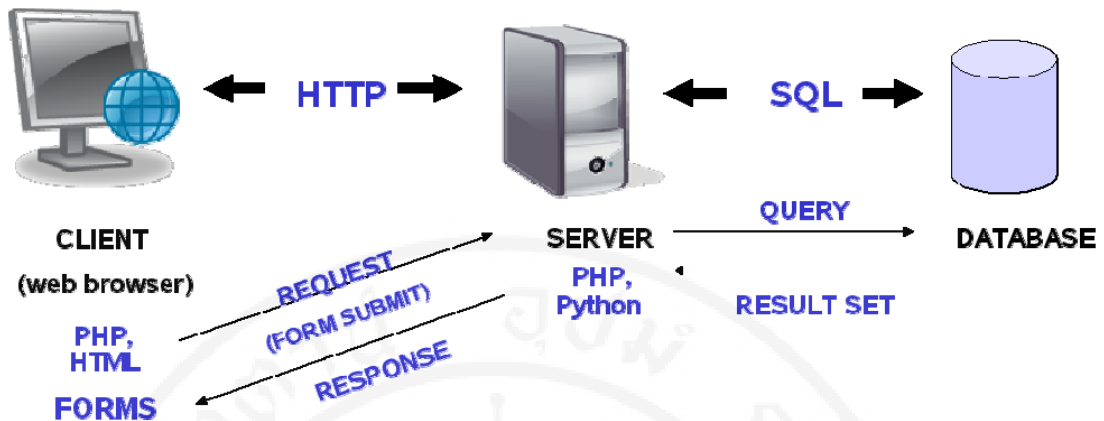


Figure 4.2 Overall functions of Server-side, Client-side and Database technology

4.1.3.1 Client-Side Coding

When an individual is viewing or using a website, he or she is called a ‘user’ or a ‘client.’ Accordingly, web applications or computer programs executed by a user’s web browser are called client-side scripts. This means the program requests any files that it needs to run from the web server, and then runs within the client’s web browser.

This equips a webpage with unique and alternating content, which depends on a user’s input or other variables. Ajax, Flash, JavaScript, jQuery, Microsoft Silverlight, HTML5, and CSS3 are among, plugins, popular languages, and libraries that are used in client-side scripting.

4.1.3.2 Server-Side Coding

On the contrary, server-side scripts are executed on the web server when a user requests a document or service. The server then generates the document, frequently in the form of hypertext markup language (HTML), which can be read through the client’s browser.

The document that has been sent to the browser may often contain client-side scripts. ASP.NET, PHP, Java, ColdFusion, Perl, Python, and Ruby are among languages used for server-side coding.

The BM system uses PHP for system development – As PHP is an open source, any individuals have free access to the source code and can use it for their own development purposes. A main advantage of the open source model is individuals can avoid vendor lock-in.

There has been a huge increase in PHP adoption, and many large web applications have been developed in PHP. PHP has several benefits, as follows:

1. Short Time to Market

PHP allows complex solutions to be quickly implemented. The faster a new application enters the market, the higher their cost efficiency and the greater their competitive advantage will be.

2. Easy Integration

Apart from Linux, PHP runs on any platforms, such as Windows, Unix, and IBM's System. Furthermore, as PHP can smoothly integrate with other technologies (e.g. Java), their current software components can be reused. This is one of the major benefits because re-development is not needed for the existing software.

3. Flexibility

During and after the initial project, PHP also gives high flexibility. This is important because functionality often changes during a project's lifetime. A benefit of PHP is that changes can be implemented even after the development is started, without wasting a lot of time.

4. Resource Availability

Resources refer to two things. First, because of PHP's popularity, there is a steady growth of the number of online and offline resources. It is very likely that someone has already developed something very similar, be it related to frameworks, CMS, blogs, ecommerce, or something else. Individuals might find someone in the PHP community that is willing to help them.

The second aspect of resources refers to the large number of PHP developers on the market. If one chooses PHP as their main web language, their recruitment process might become very easier. Qualifications, such as the Zend Certification, will help with choosing the best.

4.1.3.2 Database Technology

To allow a website to function on the Internet, it must be hosted within a database on a web server. The database has all the files that are necessary for a website and its applications to function. Normally, websites use some forms of a relational database management system (RDBMS).

4.1.4 Specification of hardware and software

As mentioned in Section 4.1.1 and 4.1.2, the specifications can be outlined as below.

Table 4.1 Hardware/Software Specifications for the Web Server and Database Software

Category	Software/Hardware
Server	- IBM Intel(R) Xeon(R) CPU E5620 @ 2.40GHz, 2394 Mhz, 4 Core(s), 8 Logical Processor(s) - Microsoft Windows Server 2008 R2 Standard 6.1.7601 Service Pack 1 Build 7601
Web server	Information internet services(IIS) version 8.5.9600.16384
Database server	Database server : MySQL version 5.1.73
Server side script	PHP version 5.5.25 PHP extension: mysqli

4.2 Research Methodology

The BM system development involves the framework of the Agile software development as it is appropriate in several ways, based on the agile development's concept, especially fast delivery of software to users and focus on response to change, as illustrated in Figure 4.3. The figure shows feedback from user through fixed time cycles using rules about program development like extreme

programming (XP), which focuses on all members in the team to reach the common goal.

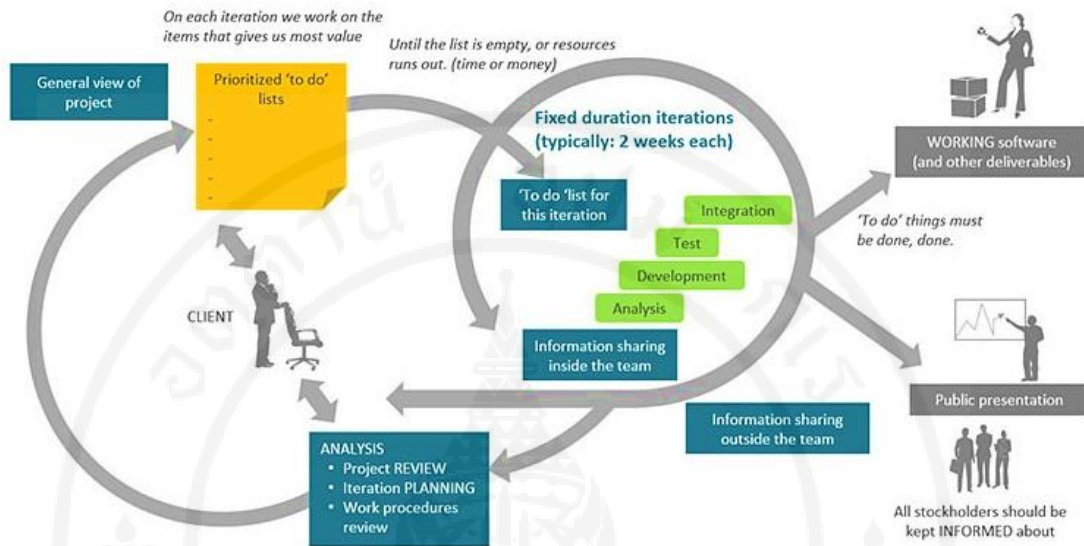


Figure 4.3 Agile software development model

Agile software development is a group of software development methods where requirements and solutions change gradually via collaboration between self-organizing, cross-functional teams. It promotes evolutionary development, adjustable planning, early delivery and continual improvement. Also, it encourages fast and flexible response to change.

4.2.1 The Agile Manifesto

The Agile manifesto is based on 12 principles, as follows:

1. Customer satisfaction by fast delivering useful software.
2. Welcome changing requirements, even late in development.
3. Working software is frequently delivered (weeks rather than months).
4. Close, daily cooperation between business people and developers.
5. Projects are created around motivated individuals, who should be trusted.
6. Face-to-face conversation is the optimal form of communication (co-location).

7. Working software is the main progress measure.
8. Sustainable development, which can maintain a constant pace.
9. Continuous attention to technical excellence and good design.
10. Simplicity, which is the art of maximizing the amount of work not done, is essential.
11. Self-organizing teams.
12. Regular adaptation to changing circumstance.

4.2.2 The Advent of Agile Methodologies

Extreme programming (XP) is a software development methodology which aims to enhance software quality and responsiveness to changing customer requirements. It is a type of agile software development, so it advocates frequent “releases” in short development cycles, which is intended to enhance productivity and introduce checkpoints at which new customer requirements can be adopted.

Four basic activities that XP proposes for software development process are as follows:

1. Coding

In XP, coding is the only important output of the system development process. XP programmers start to develop codes at the very beginning; therefore, there has to be a program at the end.

2. Testing

XP emphasizes on checking if a function works by testing it. XP uses Unit Tests, which are automated tests. Also, the programmer writes as many tests as possible to try to break the written code.

3. Listening

Coding and testing need to be done no matter how a system is developed, but listening is essential in XP. For XP developers, the ability and expertise in technical aspects should come with the ability to be good listeners. This ability will allow them to gain the knowledge about customers’ needs and create solutions that match the needs. .

4. Designing

XP's simplicity principle does not mean that it can exclude designing process. If proper design is not present, in the long term, the system will become too complicated, and projects may stop. Therefore, it is important to develop a design structure that organizes the logic in the system in order to avoid too many dependencies in the system.

4.2.3 XP's strengths

The strengths of the application of XP to the development of the BM system are as follows:

1. Customer-focused (user's stories)

The customers write user stories as something that the system needs to do in their terminology without techno-syntax. They are similar to usage scenarios, but they are not limited to describing a user interface.

2. High visibility on the project status

Teams do the minimum work that are needed to meet requirements.

3. Good support for volatile requirements

Working software is often delivered (mostly on a weekly basis).

4. Quality via regular tests

Unit and functional tests are automated and tested continually. Developers check each other's code through pair programming.

5. Regular focus on the identification and delivery of critical user stories

Face-to-face conversations are the optimal mode of communication.

4.3 Key performance indicator (KPI) of the BM system

Data collection for the comparison of the results before and after the use of the BM system is outlined below:

1. The duration of data collection before and after the use of the BM was equal, which was one month. The data before the usage of the BM system was collected from 1 April 2014 to 13 March 2015; the data after the usage of the system was gathered between 16 March 2015 and 10 April 2015. Table 4.2 shows data before

the launch of the BM system, and Table 4.3 shows in data after the launch of the BM system

Table 4.2 Past Data before the Launch of the BM System

No.	Month	Human error from data duplication (channels)	The number of channels that had not been corrected in terms data duplication (channels)
1	March 2014	3	0
2	April 2014	3	0
3	May 2014	2	0
4	June 2014	1	0
5	July 2014	1	0
6	August 2014	2	0
7	September 2014	1	1
8	October 2014	2	2
9	November 2014	2	2
10	December 2014	1	1
11	January 2015	1	1
12	February 2015	1	1
Total		20	8

Table 4.3 Data after the Launch of the BM System

No.	Month	Human error from data duplication (channels)	The number of channels that had not been corrected in terms data duplication (channels)
1	March 2015	0	0
2	April 2015	0	0
Total		0	0

2. The frequency of the data collection stemmed from the duration and man hour of each request that Business Team filed to Operation Team concerning the addition or adjustment of the list of programs and the report on the number of channels and remaining bandwidth.

3. Number of times of errors from work resulting in non-integrity of data, e.g. duplicated data and non-updated data before and after the use of the BM system.

The performance of the developed BM system based on the above-mentioned principles can be measured through three KPIs, as follows:

1. Data-checking workload – The system can reduce the workload for channel update by around 8hrs/month.

2. Number of supported TV channels.

After the BM system is launched, it will be able to support eight channels.

3. Equipment costs

After the BM system is launched, it can decrease the cost of devices for eight channels.

The next chapter presents the analysis of data collected before and after the use of the BM system based on the aforementioned KPIs.

CHAPTER V

RESULTS AND DISCUSSIONS

The previous chapters present the process of analyzing the guidelines for the development of the Broadcast management for TV-online (BM) system to achieve the organizational goals. This chapter discusses the results of the application of the BM system and discussions of the results.

The assessment of the results of the application of the BM system is presented based on the respective KPIs:

- Time reduction in channel update.
- Increase in additional TV channels after launching the BM system.
- Reduction in equipment costs after launching the BM system.

5.1 The Result of Implementation

After the BM system was launched on 16 March 2015, changes in the results analyzed based on the enterprise architecture principle were recorded. This resulted in some change in the working system of Operation Team and Business Team.

The duplicated data each month as presented in Table 4.2 and 4.3 can be illustrated in Figure 5.1, as follows:

Data duplication from human error

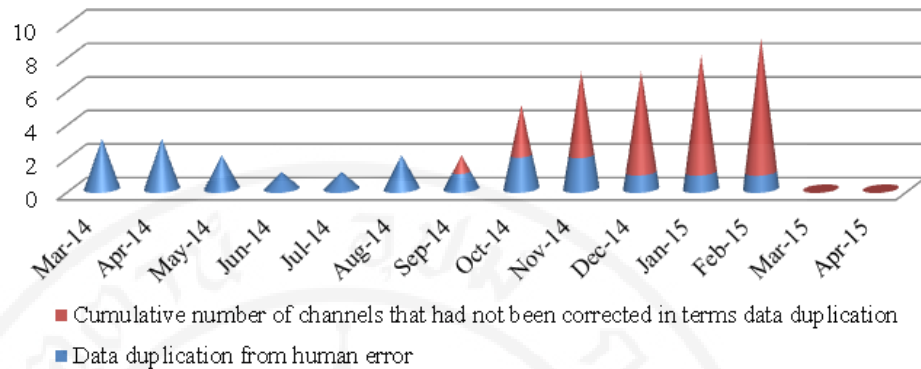


Figure 5.1 Data Duplication from Human Error

From Figure 5.1, the BM system eliminates data duplication as a result of human errors as it cleans up duplicated data in eight channels. After the BM system is launched, no channels have duplicated data in March and April.

Originally, Business Team relied on the summary report on remaining bandwidth as shown in Figure 5.2. The report was prepared by Operation Team and sent to the Business Team via email, which caused delays in work. The BM system summarizes the remaining channels that can be added, which can be accessed immediately by Business Team, thus facilitating Business Team, as shown in Figure 5.3.

สรุปประมาณการ Bandwidth	
Description	MBPS
ใช้งานนอกอากาศ(One2 HD+Digital TV)	95.484
Truelife Channel	67.68
Over Head (10%)	16.3164
MCR Monitor&FTP	5
สรุปใช้งานทั้งหมด	119.282
ขอใช้บริการไว้	150
เหลือ BW ที่สามารถใช้งานได้	30.718

Figure 5.2 Bandwidth Report before the Use of the BM System

REPORT BANDWIDTH USAGE: 2014 | April 2015 | [Home](#)

April 2015	Total Bandwidth usage(mbps.)	Number of remaining channels that can be tuned in SD.	Number of remaining channels that can be tuned in HD.
1	119.282	27	14
2	119.282	27	14
3	119.282	27	14
4	119.282	27	14
5	119.282	27	14
6	119.282	27	14
7	120.41	26	14
8	120.41	26	14
9	120.41	26	14
10	120.41	26	14
11	120.41	26	14
12	120.41	26	14

Figure 5.3 Bandwidth Report Using the BM System

Table 5.1 shows the comparison of the results of work based on the KPIs. The data during the period was recorded.

No BM Period: From 1-APR-2014 To 13-MAR-2015

With BM Period: From 16-MAR-2015 To 10-APR-2015

Table 5.1 The Result of BM on respective KPIs and measurement comparisons

Key measurement	'Without' BM	'With' BM
1. Time reduction in channel update.	8 hrs/month	Real-time
2. Increase in additional TV channels after launching the BM system.	0 channels	8 channels
3. Reduction in equipment costs after launching the BM system.	0 set	8 sets

Table 5.1 shows the comparative results based on the KPIs. It can be explained that operating cost reduced by 8 hrs./month as a result of the decrease from 8 hrs./month channel update to real-time channel update. Furthermore, the number for

additional TV channels increased from 0 to 8 channels after launching the BM system. This can affect the quantity of broadcast devices to be procured.

5.1.1 Time reduction in channel update

The inspection of data duplication reveals that before the BM system was used, it took 8 hrs. to update channels each month. Most time was used for checking data in Excel files, preparing reports for Business Team, downloading and uploading Excel files shared in Google Drive, and emailing the report on the remaining number of devices and channels that can be added. The BM system is a web application that can be immediately accessed, and its report can be immediately viewed too.

Figure 5.4 shows that the use of Excel make it difficult to notice which channels have been tuned because there is no agreement on channels among different units responsible for data handling. The BM system has been designed to manage data very quickly, by representing individual channels with their logos to prevent confusion. This is because the same channel may be filled in under different names. The solution is improving the interface so that staff involved see channels in use, as shown in Figure 5.5.

No.	Brand	Channel Lineup		
		in	Ch.	Streaming
WEN01	Dell Power Egde R610	A	1	TVK
		B	2	VVT4
		C	3	8 Infinity/PVR
		D	4	MWD Movies (Test)
WEN10	IBM X3550 M3	A	31	Ch. News Asia
		B	32	Now (Sat)
		C	33	Lotus Marcau
		D	34	Ch 8 (Sat)
WEN11	IBM X3550 M3	A	35	3 SD (Sat)
		B	36	Mono Tv (Sat)
		C	37	MCOT HD (Sat)
		D	38	One (Sat)
WEN12	IBM X3550 M3	A	39	Thairath TV (Sat)
		B	40	Thai PBS/PVR
		C	41	Ch 3/PVR
		D	42	Ch 5/PVR
WEN13	IBM X3550 M3	A	43	3 HD (Sat)
		B	44	CH9/PVR
		C	45	DTV_Ch18_NEW
WEN16	IBM X3550 M3	A	55	RS Sun Channel
		B	56	Ch.8 (Test PVR)
		C	57	
		D	58	DTV_Ch19_Spring News

Figure 5.4 Data Duplication from Using Excel for Data Management

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Figure 5.5 Design of Interface to Show Logos

5.1.2 Increase in additional TV channels.

The chance to increase the number of channels in the broadcast is the result of no data duplication. Unlike Excel, the BM system does not allow the same data to be recorded, so it is impossible to broadcast the same channels.

Before the BM system was used, human errors were detected in the update channel lineup. The duplicated broadcast was found to be eight channels, which means the loss of opportunities to add channels. The BM system makes it possible to add up to eight channels. When channels are mistakenly added using the same name, the system will send notifications, as shown in Figure 5.6.

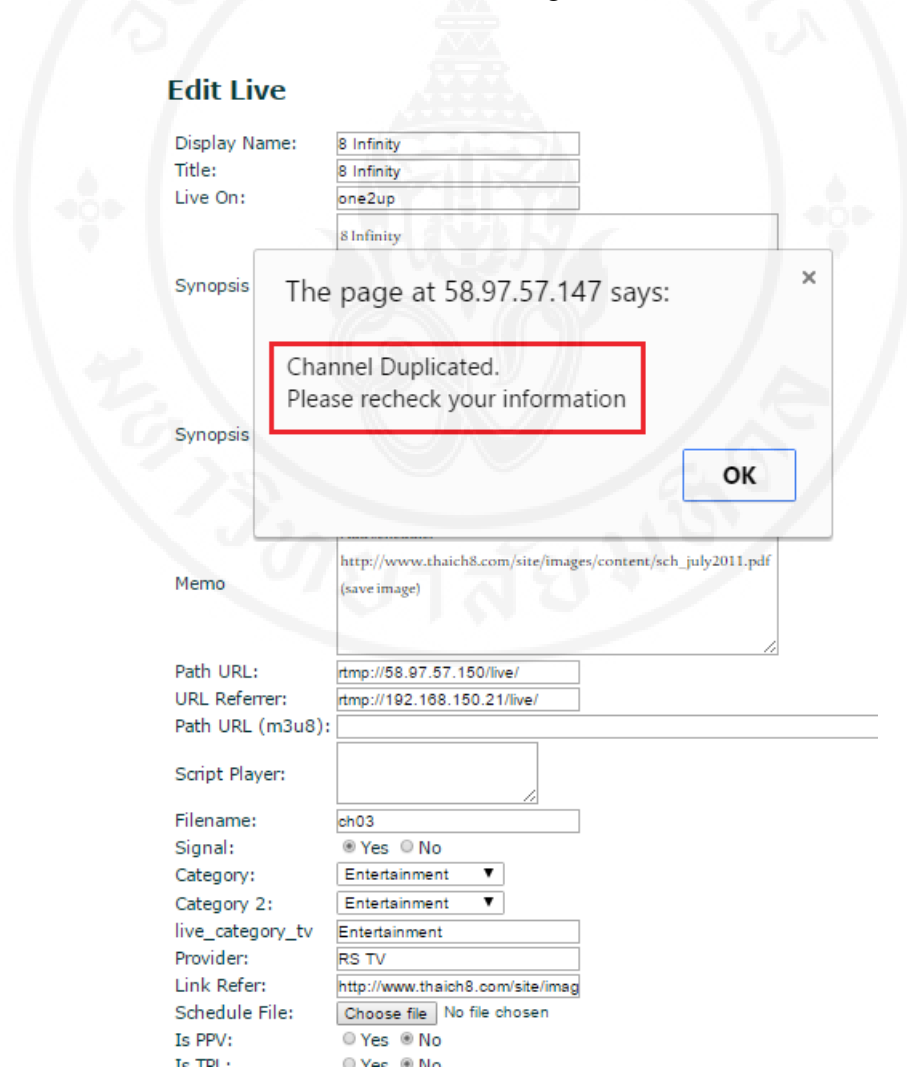


Figure 5.6 The BM System’s Ability to Send Notification for Data Duplication

5.1.3 Reduction in equipment costs

As for the reduction in the cost arising from data duplication as mentioned in Section 5.1.2, before the BM system was utilized, additional devices had to be purchased because of errors in the data record, which resulted in inaccuracy in the report. Since the BM system was utilized, the cost of the devices to purchase in line with the increasing number of channels has been reduced.

In conclusion, reducing the amount of duplicated data resulted in reduced time and cost reduction and increased number of channels. Eight sets of devices could be reduced after launching the BM system.

5.1.4 Financial Analysis

With regard to the BM system development, the break-even point is shown in Figure 5.7.

Year	0	1	2	3	4	5	6	7	8	9	10	11	12
Investment	-103,049.92	-6,600.00	-6,600.00	-6,600.00	-6,600.00	-6,600.00	-6,600.00	-6,600.00	-6,600.00	-6,600.00	-6,600.00	-6,600.00	-6,600.00
Saving costs		30,799.92	14,000.00	14,000.00	14,000.00	14,000.00	14,000.00	14,000.00	14,000.00	14,000.00	14,000.00	14,000.00	14,000.00
Balance saving	-103,049.92	24,199.92	7,400.00	7,400.00	7,400.00	7,400.00	7,400.00	7,400.00	7,400.00	7,400.00	7,400.00	7,400.00	7,400.00
Payback / Cumulative	-103,049.92	-78,850.00	-71,450.00	-64,050.00	-56,650.00	-49,250.00	-41,850.00	-34,450.00	-27,050.00	-19,650.00	-12,250.00	-4,850.00	2,550.00

Figure 5.7 The Result of the Break-event Point Figure

Figure 5.7 shows the payback period. The investment in the first year is based on the following data:

- BM system development cost
- Maintenance cost
- Software/Server cost (leased from True Internet)

The saving cost is based on the calculation outlined in Section 5.3, which will be presented next. In conclusion, the break-even point for the BM system development can be reached within 11.65 years.

5.2 Discussions

Table 5.1 presents the results of the application of the BM system. Although the values of KPIs measurement comparison were not very high, the change during a period of just one month shows the benefits of the BM system according to the KPIs.

Accordingly, the continual use of the BM system will increase the amount of money that can be saved for the Company. It can be seen that within one year, 30,799.92 baht can be saved, as shown in Table 5.2

Table 5.2 The Result of BM on respective KPIs and financial gain each year

Key Measurement	‘Without’ BM	‘With’ BM	Financial gain/month	Financial gain/year
1. Time reduction in channel update.	8 hrs./month	Real-time	1,166.66	13,999.92
2. Increase in additional TV channels after launching the BM system.	0 Channels	8 channels	N/A	N/A
3. Reduction in equipment costs after launching the BM system.	0 set	8 sets		16,800.00
			Total	30,799.92

Table 5.2 shows the amount of money saved. The cost/month calculation is as follows:

5.2.1 Financial gain of time reduction in channel update

Table 5.2 shows reduced costs as a result of the use of BM system, which is capable of providing real-time data management. Operation Team spent 8 working hrs./month on reviewing data in Excel.

Thus, it can be said that the BM system reduced working time, which can be converted into financial value. Based on HR's information, the annual income of an operation-level staff is 420,000 baht, which is 35,000 baht per month. This means the BM system helps reduce working time by 8 hrs./month. That is, it can reduce the employment cost about 14,000 baht, out of 420,000 baht, per year.

5.2.2 Financial gain of increase in additional TV channels

Despite no financial data for the copyright cost of channels broadcast, including free or paid TV was shown, income opportunity could be realized when more channels are available. However, the cost is not revealed because it has not been disclosed.

5.2.3 Financial gain of reduction in equipment costs.

This derives from the price of a set of a signal box with an antenna, which is 2,100 baht (including an installation fee), which is the average price in the market.

As the system solves the problem of data duplication for 8 channels, there is no need to buy 8 sets of new equipment, which can save 16,800 baht after launching the BM system (2,100 baht x 8 sets).

One of the organizational missions as mentioned in Chapter 2 is "pushing 90% of Thais to access information through both wire and wireless high-speed networks within 5 years." The better the public access the Internet, the better they access information. As for online TV, it is the number of channel that has gained increasing popularity every year.

The BM system does not only minimize data duplication or costs but also provides timely services from Operation Team and Business Team, which is a sustainable benefit. Operation Team is responsible for managing data/information on broadcast devices and channels. Business Teams takes charge of management and assessment of situations of all channels broadcast in each service product (HTV, TRUELIFE, and TRUEVISION) as they have the data/information in hand without a need to request it from Operation Team.

CHAPTER VI

CONCLUSION AND FUTURE WORK

6.1 Conclusion

This chapter discusses research works and works that make a contribution to, or optimize, this study in the future. It presents the problem statements, proposed solutions, results, conclusion and further work. All these aim to achieve one of the organizational missions: “Becoming a national, regional and global highest-quality service provider because the success of business relies on quality.”

This will be achieved by the development of BM system to support working of Operation and Business Teams to deliver the highest-quality online TV service to the general public.

6.2 Proposed solution

This section is dedicated to problems and solutions of online TV broadcast that relies on channel lineup data recorded in Excel shared by both teams.

1. The head-end at Tipco and Tayan Building is responsible for the livestream, data on broadcast channels, and broadcast devices.
2. Business Team is responsible for managing the number of broadcast channels in line with the limited bandwidth.

There are several services that share the livestream source, which include HTV, TRUELIFE, and TRUEVISION. Problems related to recording broadcast data on Excel and sharing it on Google Drive are as follows:

6.2.1 Problems

1. The channel Lineup database has not been designed to support the integration of TrueLife, TV Anywhere, and HTV.

2. The same TV Channel may be redundantly tuned via several encoders.
3. Transmission bandwidth is not efficiently used because of some duplicated channels.
4. TV Channels cannot be updated because the existing channel lineup database is not properly designed for this function.
5. The channel lineup database is not correctly updated.

6.2.2 Proposed solution

From the problems mentioned in Section 6.1.1, the principle of the Enterprise Architecture (EA) was analyzed before the development of the BM system. The BM system is in-house web application software, which uses the Agile and extreme programming approaches. Its features consist of fast delivery of software to users and adjustability to users' actual needs. The main goals are to address issues as mentioned in Section 6.1.1 and above all to achieve the organizational mission. The BM system's abilities are as follows.

1. It can accurately calculate the number of added TV channels.
2. It helps management to effectively utilize transmission bandwidth from True Tower 2 to Muang Thong.
3. It can easily manage the TV channel lineup.
4. It can properly invest in the hardware when needed for channel addition.

6.3 Summary of results and discussions

The results of the usage of the BM system in replacing the use of Excel based on the three KPIs are:

1. Time reduction in channel update.
1. Increase in additional TV channels after the BM system is launched.
2. Reduction in equipment costs after the BM system is launched.

From Table 5.2, it is shown that the BM system can reduce unreasonable costs arising from problems presented in Section 6.1.1 by over 30,000 baht after launching the BM system. Accordingly, the system is cost-effective in the long run as shown in Figure 5.5, the break-event point can be reached within 11.65 years.

When Business Team has up-to-date information, it no longer needs to request reports from the Operation Team. This results in faster allocation of broadcast channels in response to change in channels. Also, Operation Team does not need to purchase more broadcasting devices to deal with data duplication.

In conclusion, the BM system is beneficial to all parties working on broadcast in terms of speed of data management and channel utilization and provides the maximum benefits for all users of online TV (HTV, TRUELIFE, and TRUEVISION), as a result of fast channel management.

6.4 Unfinished tasks/ Obstacles

The BM system is an internal system originally developed to solve problems for Operation and Business Teams. However, it does not cover connecting information on the livestream source to applications of different service providers (HTV, TRUELIFE and Truevisions). Currently, the information on the livestream source is requested, it must be sent via email.

6.5 Future work

In the future, there will be more products and services for watching online TV from True, including the set-top-box and internet TV, which relies on the same livestream source. Therefore, linking data to different applications takes long time for development. The best way of providing the livestream source for the developers of each application who want the livestream source from the BM system is to prepare it as the application programming interface (API), as shown in Figure 6.1.

The API allows a piece of software to make use of the functionality of, or data available to, another one. It gives a consistent, programmatic method for

accessing a resource. It is simply a structured way of exposing functionality. Its advantages are:

1. Developers are able to accelerate the application development process through easily integrating remote tools and systems.
2. Companies do not need to purchase many software applications and hardware to make all of them work.
3. If companies integrate conferencing functionality into existing applications, they do not need to provide IT staff and employees with training in administering and utilizing new software.
4. The company that launches the API gives permission to its customers to have access to their conferencing services in new and more efficient ways. This can improve brand recognition and customer loyalty.

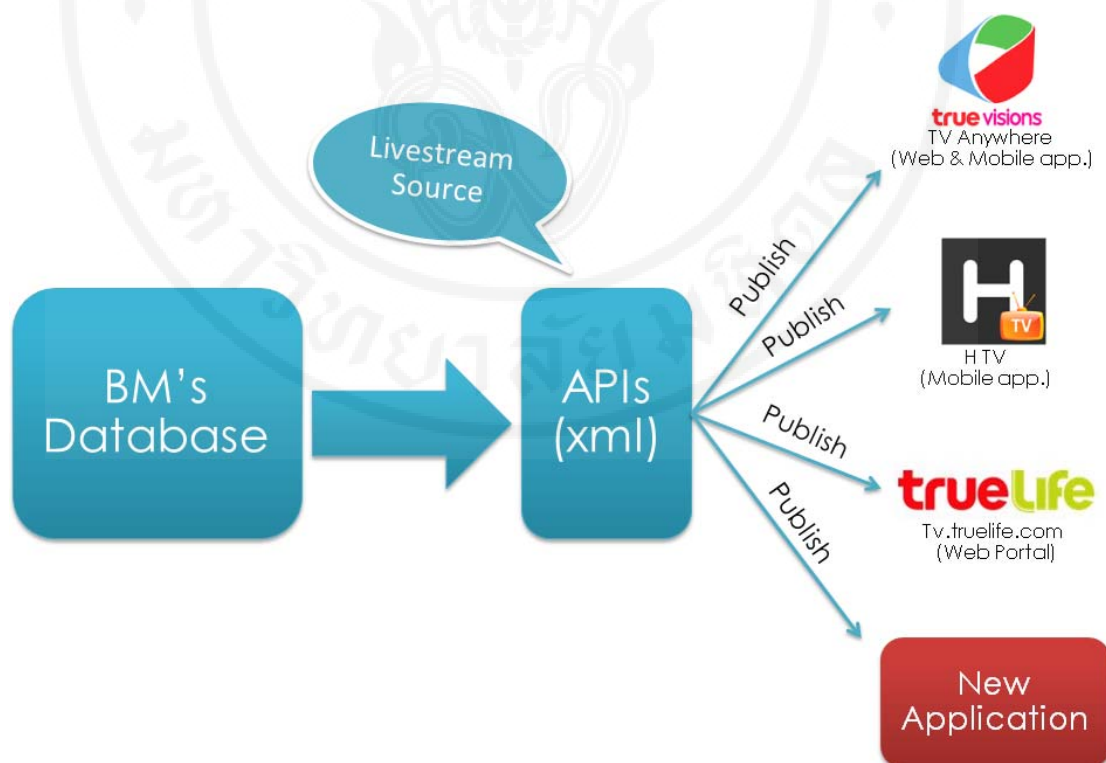


Figure 6.1 Use of BM's API that Supports Multi Endpoints

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BIOGRAPHY

NAME Nongnuch Sripattanathadakul

DATE OF BIRTH July 19, 1979

PLACE OF BIRTH Ratchaburi, Thailand

INSTITUTIONS ATTENDED King Mongkut's University of
Technology Thonburi, 2001-2004
Bachelor of Science
(Information Technology)
Mahidol University, 2013 - 2015
Master of Engineering
(Enterprise Architecture)

HOME ADDRESS 364/159, Praram 9 Road,
Bangkapi District, Bangkok, 10310.

EMPLOYMENT ADDRESS 1252 Tayan Building, Phatthanakan Rd,
Suan Luang, Bangkok 10250
Tel. 089-797-9713
E-mail: jiknongnuch@gmail.com