

# DATA INTEGRATION PLATFORM USING WSN FOR RIVER MONITORING AND MANAGEMENT

Shao-Ang Chen<sup>1</sup>, Hsiu-Yi Ko<sup>1</sup>, Joyu Liu<sup>3</sup>, Ping-Cheng Lin<sup>4</sup>, Yao-Ming Fang<sup>5</sup>, Zhi-Da Hung<sup>6</sup>,  
Hong-Bin Yang<sup>6</sup>, Rui-Bin Wu<sup>7</sup>

<sup>1</sup>System Engineer, GIS Research Center, Feng Chia University,  
No. 100, Wenhwa Rd., Seatwen, Taichung 40724, Taiwan, E-mail: filbert@gis.tw

<sup>2</sup>Project Manager, GIS Research Center, Feng Chia University,  
No. 100, Wenhwa Rd., Seatwen, Taichung 40724, Taiwan, E-mail: sherry@gis.tw

<sup>3</sup>Project Manager, GIS Research Center, Feng Chia University,  
No. 100, Wenhwa Rd., Seatwen, Taichung 40724, Taiwan, E-mail: katt@gis.tw

<sup>4</sup>System Engineer, GIS Research Center, Feng Chia University,  
No. 100, Wenhwa Rd., Seatwen, Taichung 40724, Taiwan, E-mail: benson@gis.tw

<sup>5</sup>Associate Professor, Geographic Information System Research Center, Feng Chia University,  
No. 100, Wenhwa Rd., Seatwen, Taichung 40724, Taiwan, E-mail: Frankfang@gis.tw

<sup>6</sup>The 9th River Management Office, Water Resource Agency, Ministry of Economic Affairs

<sup>7</sup>Water Resource Agency, Ministry of Economic Affairs

**KEY WORDS:** Web Service Notification, WSN, Data Integration

**ABSTRACT:** In Taiwan, illegal quarrying is an important issue. Making the river management and surveillance are urgent to the government. Water Resource Agency (WRA), Ministry of Economic Affairs, has 10 offices managing major rivers in Taiwan. Each office owns its surveillance stations to monitor the river area. The stations have multiple sensors, which provide alarms and monitoring data.

The large amount of data, however, is not easy to be integrated. In this study, a broker service based on the Web Service Notification (WSN) standards has been built, which include a Subscription Manager and a Publisher Registration Manager to handle the data publishers and subscriptions. The publishers have to register at the broker service and identify the topics of provided data, and then the Publisher Registration Manager will keep the information. On the other side, the endpoint clients also subscribe to the broker service and select their interested topics, and then the subscription will be saved as Subscription Manager. In the broker service, when a publisher announces a notification message to the broker, the service will filter the related subscriptions and transmit the message to the client. When a new publisher joins to the broker, clients will get the data automatically. Based on this platform, a large number of sensors can be integrated easily.

## 1. INTRODUCTION

The protection and management of water resource are important issues in Taiwan. For this reason, The Ministry of Economic (MOEA) created Water Resources Agency (WRA) on 2002, which includes 10 River Management Offices to manage the major rivers. Each office owns its monitoring stations in the management regions. However the land use of river area is complex, it is hard to be monitored. Therefore, the river management offices have built many monitoring station which use the imagery detection technique for river area, entrance and restricted area. The goal is to use limited human resource to handle the major river region. The monitoring station has many cameras, which are used to detect the illegal quarrying and other anomalous events. The number of cameras is approaching one thousand, and they usually produce a lot of events every day. Because of the River Management Offices have their own system and data format, we need to design an integration platform to manage a large-number of data provider and assign general data formats. The platform also provides a unified interface for client subscription.

In 2006, the Organization for the Advancement of Structured Information Standards (OASIS) has published Web Services Notification (WSN) standard, which define message publisher and subscription patterns under the web service interface. WSN is described in three specifications, WS-BaseNotification, WS-BrokeredNotification and WS-Topic. The WS-BaseNotification defines basic rule for the message producer and consumer; The WS-BrokeredNotification extents base notification and provide broker rule to manage multiple publishers and

subscribers; The WS-Topic is used to describe the message topic format. In this study, we propose to implement the WSN standard on the large amount of data exchange service. The service can manage multiple data publishers and subscribers easily and more efficiently.



Figure 1, the location of river management offices, Water Resources Agency.

**2. THE WEB SERVICE NOTIFICATION IMPLEMENTATION**

**2.1 The Web Service Notification Structure**

In traditional system, if we have multiple data providers, the endpoint client need to subscribe to each one of them (Fig. 2a), and the provider will notify the subscribers when new data comes (Fig. 2b). However, this system has low efficiency when the data publishers are too much; the clients need to remember what type of topics the providers have. When the clients want to change the topic of subscription, they should resubscribe to each publisher, and it will cause lower system efficiency. Therefore, we implement the WSN for our system to solve this problem.

In this case, we build a broker service, the kernel service, is used to manage all data publishers and subscribers. First, we need to write the topic expression document which describes all the topics of data. All data publishers have to register to the broker include what data topics they have, and then the information will be recorded in Publisher Registration Manager. Clients can select their interested topic to subscribe, and the subscription information will be saved in Subscription Manager. The subscription and register examples are shown in the Fig. 3. When a new publisher joins to the broker, clients will get the data automatically (Fig. 4). As the example, clients don't need to know the data types of each publisher; they only have to subscribe their interested topics to the broker. If client want to change the selected topic, it just need to renew the subscription to the broker. Clients also can decide the terminal time and the other parameters for the subscription. This system is more efficient than the traditional one, the registration and process of subscription can be simplified.

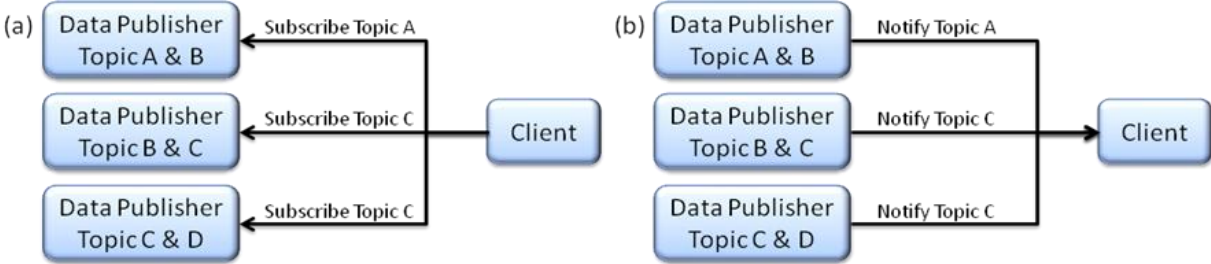


Figure 2, the traditional subscription system, (a) subscribe to each data publisher, (b) receive data from each data publisher.

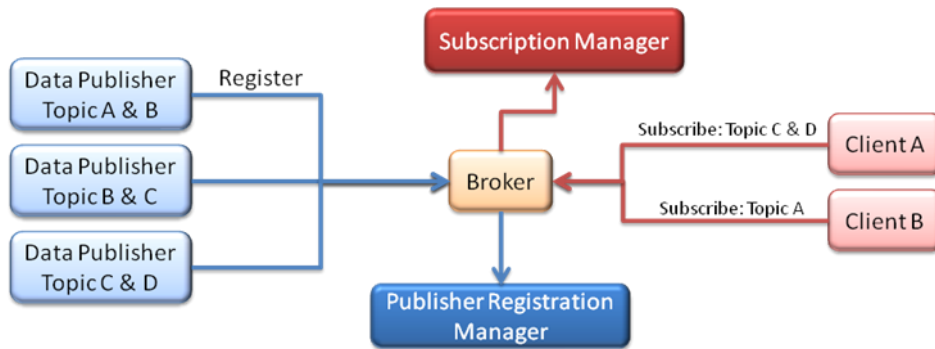


Figure 3, the flowchart of registration and subscription in WSN.

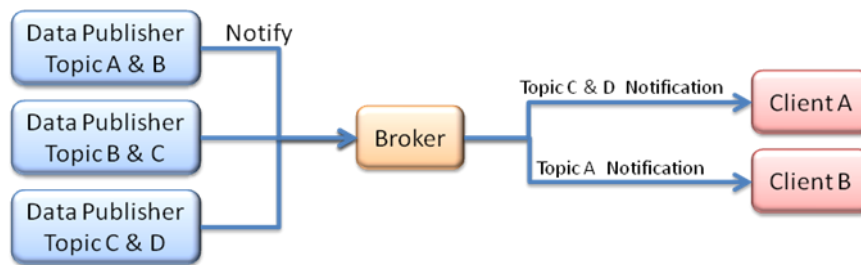


Figure 4, the notification flowchart of WSN

## 2.2 Implementation of Data Integration Platform

In our implementation, the topic expression includes event types and connection types. The broker is the Water Resource Agency Management and Integration Platform. The cameras and water level meter of monitoring stations are the data producers (Fig 5), which notify the broker with the information of anomalous events. The announced events should contain the event type, including motion objects, video lost, disconnection alarms or water level alarms. The same, clients not only select their interested event type, but also provide their connection types, like the phone number of SMS, the Email address and so on. When the broker has got the notification messages, it will use the topic content to query the matched subscriber list from subscription managers. Finally, the broker will send the message to the client from the matched subscriber list. Clients also can ask the broker for the last message if the message is lost.

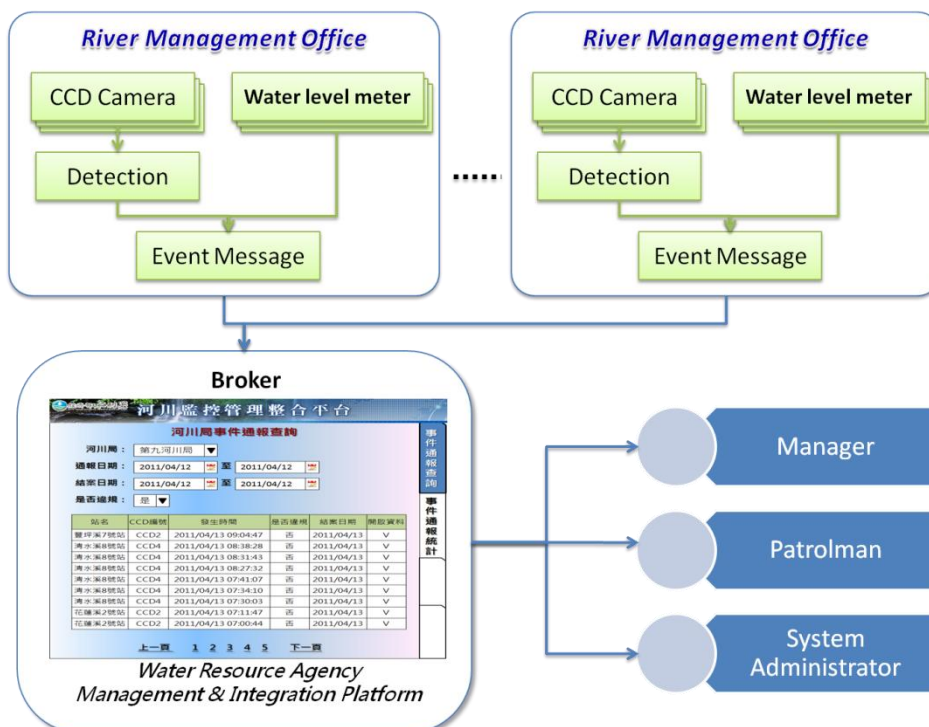


Figure 5, the WSN structure in Water Resource Agency Management and Integration Platform

### **3. CONCLUSIONS**

To apply the web service notification in the data integration platform, the process of data publishing and subscription can be simplified. The broker and the publisher registration manager are used to integrate large number data publishers and notification messages; the broker and the subscription manager are used to merge information of clients. This system uses the broker to separate the data publishers and clients, and provides higher efficiency than the traditional data publishing system. In our implementation, the events of each monitoring station are published to the integration platform, the broker. The broker will find the matched subscribers from the subscription manager, and sends the events to clients. Clients can receive the suitable messages as their required topics.

### **4. REFERENCES**

wsn-ws\_topics-1.3-spec-os, Web Services Topics 1.3(WSTopics), OASIS Standard.

wsn-ws\_brokered\_notification-1.3-spec-os, Web Services Base Notification 1.3 (WS-BaseNotification), OASIS Standard.

wsn-ws\_base\_notification-1.3-spec-os, Web Services Brokered Notification 1.3(WSBrokeredNotification), OASIS Standard.

John Lee and Ron Ben-Natan., 2002, "Integrating Service Level Agreements: Optimizing Your OSS for SLA Delivery", John Wiley & Sons, Inc., New York, NY, USA.

Weerawarana, Sanjiva, 2006, "Web services platform architecture: SOAP, WSDL, WS-policy, WS-addressing, WS-BPEL, WS-reliable messaging and more. 4. printing ed. Upper Saddle River", N.J. u.a.: Prentice Hall/PTR.