# Dam that Social Networking: Connecting South Africa's Major Dams to Social Media

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## Abstract

*South Africa is a semi-arid country and water resources need to be monitored. The Internet of Things is the phenomenon of more and more things (as opposed to people and services) becoming connected to the Internet. This paper describes a project where four major South African dams are connected to Twitter and Facebook (and other social media such as MXit and Google Chat) in a mechanism which would be easy to replicate for additional dams or rivers. Data is supplied by the South African Department of Water Affairs. Beachcomber (a Mobicents based JEE application) routes the data to appropriate service building blocks and resource adaptors to ensure that the information is widely disseminated.*

## 1. Introduction

South Africa is a semi-arid country and droughts are a common occurrence [1]. The rain which does fall, however, does not fall uniformly across the country. As was recently seen in the December, 2010, - January, 2011, period, in the inland province of Gauteng, dams were dangerously overflowing while in the coastal town of Port Elizabeth, dams were perilously low. And, amid that, residents were often not necessarily aware of either situation. Many residents in Gauteng province were unexpectedly caught by the flooding while many residents in the Port Elizabeth area were not aware of the need to conserve water.

Could the Internet of Things help in such situations?

Prior research by the author and colleagues connected the Vaal Dam to social media [2] and investigated its effectiveness in dispensing information to the public.

This paper describes a project where different mechanisms were investigated to find the best way to connect dams to social media. Four major dams in South Africa (the Vaal Dam as previously reported, Bloemhof Dam, Gariep Dam, and van der Kloof Dam) were given a presence on Twitter and Facebook along with other social media. This gave residents in the area easy access to information about water levels. By connecting four major dams, the researcher has shown that the method is repeatable.

These four dams were connected to Twitter and Facebook using different mechanisms and different utilities. These mechanisms and utilities will be described in full and the conclusion will provide the author's opinion on which is the best way to connect large things to social media.

As more and more things becoming connected to the Internet, the Internet of Things grows. More and more things are posting their status on Twitter and Facebook [3]. A quick search on Twitter provides interesting things tweeting including telescopes, plants, faults, and, embarrassingly so, a marital bed.

## 2. Research Question and Methodology

The data provided by the South African Department of Water Affairs is excellent and accurate [4, 5]. Unfortunately, the majority of South Africans are not aware of the data which is available to them. This project was to make the data provided by the Department of Water Affairs more widely accessible to residents by the use of Twitter and Facebook. Other social media including MXit, Google Chat, email, and Google Earth would also be used.

Although this had been done once before using the Vaal Dam, this research was to find the best mechanism which was easy to reproduce.

This data would be extremely valuable during periods of flooding (to warn people) and during periods of drought (to encourage people to save water). However, even during non-extreme periods, knowledge of the current state of South Africa water reserves could help people make wise decisions when building houses or planning buildings.

The research question, therefore, is:

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> Can major South African dams be connected to social media in a way that is easy to reproduce?

Because there are numerous ways to accomplish these tasks, an iterative research methodology was used with each iteration handling one specific mechanism.

## 3. Beachcomber

Beachcomber is a Mobicents based JEE application specifically designed to link the Internet of Things with the Internet of People [6]. It provides bearer agnostic communication through the use of Mobicents resource adaptors. At the time of writing this paper, Beachcomber supports communication via HTTP (HyperText Transfer Protocol) client, HTTP servlet, XMPP (Extensible messaging and Presence Protocol), MXit, POP3 (Post Office Protocol Version 3) email, Twitter, and JMS (Java Messaging System). Messages which come in via any of these protocols are converted into a common format and forwarded to a business process (which is implemented as a Mobicents service building block) which handles the data. Any response from the business process is converted back into a specific message format.

Previous research indicated that Beachcomber could be used to allow a wide variety of physical things to post their statuses on Twitter [7]. In this prior research, Beachcomber successfully received information from an collection of different types of physical devices including private weather stations, temperature gauges within computer kiosks, and electricity consumption monitoring equipment.

Data was retrieved from the Department of Water Affairs via the HTTP resource adaptor. This data was converted into a common format and sent the the central Beachcomber routing facility. Depending on configuration options, Beachcomber forwarded this data to the Landmark service building block. Beachcomber then made the data available via various resource adaptors including MXit, XMPP, POP3 email, and Twitter.

As will be more fully described in following sections, all communication with Facebook was done via Twitter. At the point of writing this paper, Beachcomber did not communicate directly with Facebook.

The following sections will deal individually with the various social media platforms which were involved.

## 4. Google Earth

Although Google Earth is not normally classified as a type of social media, this was an integral part of this project. This was done simply by publishing a KML (Keyhole Markup Language) file. KML is an XML notation for expressing geographic information. The KML file contained the appropriate geographical information about the dams and the current water information. Table 1 provides an example of a KML file for the Vaal Dam.

```
<Placemark>
<name>The Vaal Dam</name>
<description>
    At  2011-05-19 11:00
    I am flowing at 14.43 cubic
    metres per second.
</description>
<Point>
    <coordinates>
        28.11596,-26.882323
    </coordinates>
</Point>
<LookAt>
    <longitude>28.11596</longitude>
    <latitude>-26.882323</latitude>
    <altitude>00</altitude>
    <heading>165</heading>
    <tilt>70</tilt>
    <range>600</range>
    <altitudeMode>
       relativeToGround
    </altitudeMode>
</LookAt>
</Placemark>
```

*Table 1: Sample KML for Vaal Dam*

The flow and level information found in the description field was updated periodically depending on information received from the Department of Water Affairs. The geographic information was hard coded for each dam. This KML file provides a nice fly-in approach to viewing the Vaal Dam. The data provided in the description field of the KML is reproduced in the side bar.

## 5. Twitter

All communication with Twitter was done via the Twitter4J library. Twitter4J is a Java library for accessing Twitter [8]. Although the complete

Twitter4J library provides facilities to update status, search time lines, search for mentions, and search for retweets, for this project, only the facility to post status updates was used.

A conscious decision was made to have the tweets done in the first person. The dam's status begins with "I am" to convey a personal message to the reader.

## 6. Facebook

At the time of development, there was no stable Java implementation to access Facebook which catered for the needs of this project. For that reason, all access to Facebook was done via Twitter. In other words, Beachcomber posted information to the various Twitter feeds and then Twitter and/or Facebook would ensure that the statuses were forwarded to Facebook.

For this project, four different mechanisms were investigated. Each will be dealt with in a separate sub-section.

### 6.1 Facebook Person

For the first attempt to move statuses from Twitter to Facebook, a normal Facebook user was created. This was only done for the Vaal Dam as has been previously reported [2]. There are numerous Facebook applications which link Facebook and Twitter accounts. Assuming that three million people could not be wrong, we originally used the Facebook application entitled Twitter.

This application worked well. Anything which was posted on Twitter would also appear as a Facebook status change within a very short period of time. People who were friends with this Facebook person would see the status updates in their own story line.

The problem with the solution, however, was that in view of the fact that there was no stable Java Facebook API, friend requests had to be manually confirmed. Although this would not be a problem when there were only a few hundred Facebook friends, if this grew to thousands, then this solution would not be acceptable.

Another problem which arose with this solution was Facebook friends tagging the account with inappropriate content which was embarrassing to the stakeholders of the project. This occurred a handful of times and needed to be constantly monitored.

#### 6.2 Facebook Fan page

For the second attempt to move statuses from Twitter to Facebook, a Facebook fan page was created which was administered by the Facebook Person described in Section 8.1 above. The Facebook person and the Facebook Fan Page could be linked together ensuring that anything that was posted to the Facebook Person (via Twitter) would also appear on the Facebook fan page. This removed the requirement of having to accept friendship requests. Visitors to the page could merely "like" the fan page instead.

However, the problem with this solution was that posts appeared on a specific Twitter tab on the fan page and were not written to the Wall of the fan page. This meant that people who "liked" the page did not receive the updates in their story line.

#### 6.3 Twitter RSS Feed and Facebook Notes

For the third attempt to move status information from Twitter to Facebook, only a Facebook fan page was created for the Bloemhof Dam. The Facebook fan page was configured to have the Facebook Notes application. The Facebook Notes application was configured to point to the RSS feed of the Bloemhof Twitter account. According to the documentation, Facebook Notes would periodically access the Twitter RSS feed and post that information on the Facebook page.

The Twitter RSS feed could be found at the following URL:

http://api.twitter.com/1/statuses/user_timeline.rss?screen_name=XXXXX

where XXXX is the screen name of the Twitter user. This creates a normal RSS feed of the Twitter account which could be read by normal RSS readers. The Notes application is designed to read RSS feeds.

Unfortunately, after unsuccessfully waiting more than an hour for these updates to appear, this method was abandoned.

### 6.4 Selective Tweets

For the fourth and most successful attempt to move status updates from Twitter to Facebook, the Facebook Application Selective Tweet was used. Using this application, only Facebook fan pages were created. Selective Tweet then allows the administrator of those fan pages to link various Twitter accounts to various fan pages. Posts which are forwarded via the Selective Tweet application appear on the fan page wall and appear in the story line of people who "like" the fan page.

### 6.5 Twitter-Facebook link conclusion

After experimenting with these four different mechanisms to move status information from Twitter to Facebook for this project, Selective Tweet was the most successful. This was due to

1. There were no friendship requests which needed to be handled
2. People could not tag inappropriate content
3. Posts appeared timeously on Facebook
4. One Facebook user could administer many fan pages

For that reason, future work on this project will also be done using the Selective Tweet application.

## 7. Additional Information

In order to make the water level information appealing to the general public, the Internet was trawled for additional information. This additional information was appended to the water level status updates.

Sites such as YouTube, Google Scholar, Google Books, and Google News were automatically searched on a regular basis for various keywords such as “Vaal Dam Sluice Gates” and “Bloemhof Dam fishing”. The information which was retrieved on those automatic searches was randomly appended to the water level information.

## 8. Evaluation

The Vaal Dam was the first of the four dams which we connected to social media and the results of that project has already been reported [2].

This project was to search for the best mechanism for doing this and to see if the solution was easily replicable.

It was found that posting to a Twitter feed using Twitter4J and then having this forwarded to a Facebook Fan Page via the Selective Tweets application was the best solution.

Subsequent to this evaluation, this mechanism of using the Selective Tweet application to move status information from Twitter to Facebook was also used for a water quality monitoring application where sensors tested the purity of the water, forwarded this information to Beachcomber. Beachcomber then posted the information on Twitter which was then forwarded to Facebook.

## 9. Conclusion

Water resources are scarce in South Africa. A mechanism to push information to residents in a way that is non-intrusive and yet interesting needs to be found. This mechanism needs to be easily replicable for all water resources in South Africa.

This project was to connect four major dams in South Africa to social media including Twitter and Facebook. The project was to investigate which mechanism was easiest to replicate and maintain.

It was found that using Twitter4J in conjunction with the Facebook application Selective Tweets was the easiest way to post information on Twitter and Facebook Fan Pages in a manner which was easy to replicate and maintain.

## 10. References


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