Abstract: The Open Bike Initiative (OBI) is an ad hoc project focused on developing, piloting and disseminating an open source-inspired model for bike sharing. OBI was developed to address two primary issues that drove its creators to take action: 1. a corporate transportation system in need of alternatives to motorized transport and 2. a bike share market in need of greater choice to empower consumers. With these concerns in mind, the OBI creators set out to use technology and the open source ethos to design a different type of bike sharing program. Due to technology challenges, the OBI team has created two types of bike sharing programs, a low-tech OBI 1.0 model and a more technologically sophisticated OBI 2.0 model. This white paper outlines and discusses the technical setup for OBI 1.0, which operates through text messaging, a few spreadsheets and a bit of human power. This guide is a companion document to the non-technical Open Bike Initiative 1.0 Implementation Guide, available at http://openbikeinitiative.org/.
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Open Bike Initiative 1.0 Technical Guide

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1. Introduction
The Open Bike Initiative (OBI) was created by employees at Intel’s campuses in Hillsboro, Oregon to develop technology that would usher in the next generation of bike sharing. OBI strives to combine technology and the open source ethos to create, share, and iterate technological solutions to the challenges of bike sharing. The team has been developing technology that will include the following features: bikes equipped with GPS trackers, a smart lock system, an anti-theft alarm, and web and mobile user interfaces. OBI was scheduled to conduct a pilot program for the technology from July until September, but the technology was not ready to test at that time. The OBI team made the decision to pilot bike sharing at Intel even without the new technology and quickly developed the following system as a low-cost, easy way to manage a bike sharing program on the Intel campuses. While originally intended as a stop-gap measure, the success of the OBI pilot has demonstrated that the OBI 1.0 program is a practical option for implementing a do-it-yourself bike sharing program. Thus, OBI has decided to publish the blueprints for both the low-tech OBI 1.0 as well as the more advanced OBI 2.0 (forthcoming). As part of its commitment to the open source philosophy, OBI has created this guide about the technical preparations necessary to run the OBI 1.0 program. This guide is a companion document to the non-technical Open Bike Initiative 1.0 Implementation Guide, available at http://openbikeinitiative.org/.

2. Overview
The OBI Pilot was conducted with 30 bikes stationed at 4 locations on Intel’s Ronler Acres and Hawthorn Farms campuses. The bikes were locked to dedicated OBI bike racks with combination cable locks. Thus, the key function of the OBI 1.0 technology was to provide users with the codes to unlock the bikes. This was accomplished through using program code to modify several Google applications so they created a system for managing the bike share. The result was a simple system in which users send text messages to a phone number and receive messages containing the lock codes to unlock bikes. Figure 1 shows the exact process participants used to access the bikes.
The technical preparations primarily consist of setting up the various Google applications and installing and modifying the program code. The following list provides a sequential overview of the steps of the technical setup of the OBI 1.0 program.

1. Create a Google account just for bike share purposes
2. Set up Google Voice
3. Set up Gmail
4. Create spreadsheets in Google Drive
5. Install the program code
6. Modify the program code to fit the particulars of your bike sharing program
7. Record lock combinations for the bikes and the helmet boxes into the spreadsheet
8. Test the system with various types of text messages from activated and non-activated phone numbers
The OBI 1.0 program operates through interactions between human users and bike share managers, the program code, and the Google applications. The following diagram provides a simplified view of these interactions.

**Figure 2: OBI 1.0 Program Diagram**

1. User texts Bike Share GV number
2. GV forwards text to GM
3. GM sorts text based on key content
   - Text contains the word “activate”
   - Text contains a bike number
4A. Text sent to “Activate” folder
4B. Text sent to “SMS” folder
5A. Server tells GV/GM to auto reply
5B. Server checks GD sheet for user activation status
6A(i). Manager activates registered user
6A(ii). Manager sends reg. info. To unregistered user
6B(i). GV/GM texts unlock code back to activated user
6B(ii). GV/GM texts error message to non-activated user

**Abbreviations:**
GV = Google Voice
GD = Google Drive
GM = Gmail
3. Setting up the Google Applications\(^1\)

OBI used several Google applications as the backend tools. The OBI Pilot occurred in the summer of 2013; you should ensure that Google still offers the services (Gmail, Google Voice, and Google Drive) that are necessary to create this system. If Google no longer offers some of these services, other programs could be substituted into the OBI 1.0 program. For example, Skype could provide an alternative should Google discontinue Google Voice. Below is a hyperlinked list of the Google applications utilized as well as their primary functions.

- **Google Voice**: routes communications between users and bike share managers as SMS messages or phone calls

- **Gmail**: categorizes and stores incoming messages; serves primary interface for creating communications to users

- **Google Drive**: stores the lock combination and user information spreadsheets that the server scans to determine what response to send to users

The advantages of using Google:

- one login for everything
- easy to use tabs to navigate between functions (like during activation)
- remotely accessible
- can also run on phones through the app
- free

Google’s current applications provide the suite of functions needed to run the OBI 1.0 program. However, changes in application offerings could require the use of other sites to run the program. Additional challenges and considerations related to using the Google applications are discussed in the Lessons Learned.

\(^1\) All images of Google applications used in this guide were captured in November 2013. The appearances of updated versions of the different applications could differ considerably from what is presented in this guide.
3.1 Google Account Setup
Creating a Google account gives you access to all of the Google applications used in the OBI 1.0 program. The email address created for the account should be dedicated to carrying out the functions of the OBI 1.0 program; a separate email account should be used to manage general communication about the bike share. Go to https://accounts.google.com and click on the link on the bottom of the page to create your new account.

![Google Account Creation](image)

3.2 Google Voice Setup
Google Voice provides the main channel of communication between the bike share system and its participants. Most communications happen via text, but the phone call option is also available for person to person conversations.

**Step 1:** Go to google.com/voice and sign in with the account information for the bike sharing program.

**Step 2:** Click on “Get a Voice Number” to start the process of getting a Google Voice phone number. Then choose the option to get a new number.
You can choose a brand new number from Google or use your existing mobile number to get the full set of Google Voice features, like:

- one number that rings all your phones
- online voicemail with transcriptions, sent to you by email or text
- custom greetings and call blocking, and much more

I want a new number  I want to use my mobile number
Step 3: Choose a phone to forward Google Voice calls to.

Please note that the phone number used at this stage can only be linked to one Google Voice account. Therefore, if a phone number is already in use with another account, the number will be removed from the pre-existing Google Voice account to be available for use for the new account.

Step 4: Verify the forwarding phone by following the Google instructions.

This is the message that appears for a phone that is already linked to a Google Voice account.
Step 5: To add more phones that can receive Google Voice calls, texts, and voicemails, click on the account phone number on the left of the window.
Step 6: Click on “Add another phone” at the bottom of the page to enable forwarding to more phones. Then fill in the required information in the pop-up box.
Once the phone has been added, the check boxes to the left of the phone names can be used to choose which phones receive calls, texts, and voicemails.

Step 7: Click on the Settings symbol in Google Voice. Then click on “Settings” in the drop down menu.

Step 8: Once within Settings, click on the “Voicemail and Text” tab to configure Google Voice settings to link to your bike share email address. This will forward text messages to the email account, which will appropriately sort and respond to incoming texts.
3.3 Setting up Gmail
The Gmail account organizes incoming and outgoing communications.

Step 1: From your Google Voice account, access Gmail by clicking on “Gmail” in the upper part of the window.

Step 2: Click on the Settings icon. Then click on “Settings” in the drop down menu.

Step 3: Click on the “Labels” tab to see the menu for creating labels. There should be labels for “Activate,” “Notes,” “SMS,” and “Voicemail Issues.”
Step 4: Next click on the “Filters” to create a filter for activation messages.

Step 5 (Optional): Click on the “General” tab to set an automatic signature that will appear every time you hit “Reply.”
3.4 Setting up Google Drive
Google Drive stores all the user and lock combination information that the OBI software uses to determine the correct response to incoming text messages. Click here to view a copy of the spreadsheets you will be creating.

Step 1. From your Gmail account, click on the applications icon in the top right hand corner of the page. Then click on the Google Drive logo.

Step 2: Click on the “Create” icon and then click on “Spreadsheet” icon on the drop down menu.
Step 3: Create a new spreadsheet and title it “Assets.”

Step 4: Then scroll to the bottom of the page and add a new sheet by clicking on the plus sign. Title the new spreadsheet “Users.”

Assets Spreadsheet- This sheet contains the bike numbers and the codes to unlock their locks.
Note: The lock combinations sent in the reply texts to participants can be changed by changing the text in the spreadsheet. However, this does not change the codes on the actual locks.

**Users Spreadsheet** - This sheet contains the participant information such as name, email address, and phone number. This sheet should have the following fields:

<table>
<thead>
<tr>
<th>From</th>
<th>Active [Y/N]</th>
<th>Name</th>
<th>Email</th>
<th>Phone</th>
</tr>
</thead>
</table>

The “From” field is where you will copy and paste the Unique Google Identifier\(^2\) address that appears when the system receives text messages.

### 4. Installing and Running the Program Code

The OBI 1.0 program requires a server with the following specifications:

- 1-2MB of HD space.
- Around 12-13MB of memory for running the program.
- A .NET Framework to run (4.0), so any OS that can run that .NET Framework could run it.
- If running as a Windows Service, a Windows OS to run, in addition to the .NET Framework requirement.

#### 4.1 Introductory Note

The installation provides a default configuration file in the program directory which needs to be modified to suit a third party's needs.

The OBI website has the downloadable configuration file used for this implementation to be used with a contingency setup. After installing the MSI, you can drop this file over the other one (or rename the existing one first, if you'd like to keep a vanilla configuration file around to aid in documentation purposes) before running the program.

The installation provides a Windows service, which is set to 'Manual' by default. The instructions include a screenshot for recommended recovery settings. The service can be started manually when required, or it can be set to 'automatic' to ensure it restarts itself in the event the workstation/server is restarted.

Alternatively, the EXE can just be launched in a 'console' mode. The log level should be set higher (perhaps 2 or 3) in the console mode to get feedback each time it 'wakes up' to process something. The log level can be set at 1 when running as a Windows service.

\(^2\) For more information on the Unique Google Identifier and its role in managing participants, please refer to page 20 of the OBI 1.0 Implementation Outline.
4.2 Instructions
Step 1: Download the files
- You will have one main “.msi” install file

Step 2: Run the “.msi” install file
- Follow instructions
Click yes to the message “Do you want windows to install…..” – this is the automatic windows generated message asking for administrative access.
NOTE: You are done with installing, but nothing will be “working” yet. You still need to setup the configuration file and turn on the program.

**Step 3: Update the configuration file settings**

Go to the install file location and open the file “OBI.SMSLocks.exe.config” in your favorite text editor
You must update a minimum of 3 fields in the xml configuration file (two of these highlighted below). The other settings are optional for options like message settings, logging options, Windows service options.

- Email
- Pass
- AdminEmail

```xml
<configuration>
  <configSections>
    <sectionGroup name="userSettings" type="System.Configuration.UserSettingsGroup, System, Version=4.0.0.0, Culture=neutral, PublicKeyToken=31bff9eb0919c101" allowDefinition="MachineToLocalUser" requirePermission="false" />
    <section name="OBI.SMSLocks.Properties.Settings" type="System.Configuration.ClientSettingsSection, System, Version=4.0.0.0, Culture=neutral, PublicKeyToken=31bff9eb0919c101" allowDefinition="MachineToLocalUser" requirePermission="false" />
  </configSections>
  <startup>supportedRuntime version="v4.0" sku=".NETFramework,Version=v4.0" /></startup>
  <userSettings>
    <OBI.SMSLocks.Properties.Settings>
      <setting name="email" serializeAs="String">
        <value>email@gmail.com/value</value>
      </setting>
      <setting name="Pass" serializeAs="String">
        <value>password/value</value>
      </setting>
    </OBI.SMSLocks.Properties.Settings>
  </userSettings>
</configuration>
```

Step 4A: Turn on the OBI SMS Locks program (option 1 – Windows Service)

- CAUTION: This is one of two options. DO NOT run both at the same time. Also do not have these programs running at the same time on two different machines.
- Open the Services from Admin tools in Control panel (Note: This service is set to manual by default)
Right click on OBI.SMSLocks and click on the “Properties” option to make the following recommended settings:

On the General options tab: Change start up type from Manual to Automatic and then click start
Close the dialog and service should be started.

**Step 4B: Turn on the OBI SMS Locks program (option 2-console)**
- **CAUTION:** This is one of two options. DO NOT run both at the same time. Also do not have these programs running at the same time on two different machines.
- Run the OBI.SMSLocks.exe file below to start the console application.
- Clicking on the OBI.SMSLocks.exe file will open a window that you need to leave running.

![OBI.SMSLocks.exe file locations](image)

**5. Changing Automatic Outgoing Messages**
The automatic outgoing responses to text messages are controlled in three different areas: the configuration file, the Assets spreadsheet, and the signature setting in Gmail. The messages in the configuration file are automatically sent to users depending on the message they sent. The messages in the Assets spreadsheet are the codes for the bike and helmet box locks. The message contained in the Gmail signature is sent anytime someone hits “Reply” to an email in the Gmail account, regardless of the content of the incoming message.
Configuration file (in the OBI SMS Locks folder in the OBI 1.0 Source Code zip file):

```xml
<setting name="MsgUnregistered" serializeAs="String">
    <value>
        We don't recognize you as registered. Please call for assistance.
    </value>
</setting>
<setting name="MsgInactive" serializeAs="String">
    <value>
        We show you as inactive. Please call for assistance.
    </value>
</setting>
<setting name="GoogleSpreadsheetActiveTitle" serializeAs="String">
    <value>
        Active [Y/N]
    </value>
</setting>
<setting name="AdminEmail" serializeAs="string">
    <value>
        admin@gmail.com
    </value>
</setting>
<setting name="MsgRegister" serializeAs="String">
    <value>
        Thank you for activating your OBI account. Please allow 24 hours for your account to be activated.
    </value>
</setting>
```

Assets Spreadsheet:
Gmail signature settings:

The signature message can also be changed on a case-by-case basis by editing the text as you normally would in an email.

6. Lessons Learned
The OBI 1.0 program proved to be an effective system for creating and managing a bike share. The ease of use for OBI managers and participants played a large role in ensuring smooth daily operations. OBI never sought to modify the OBI 1.0 program because it worked very well for most of the pilot, but there are some changes to the program that could improve it. By providing these lessons learned as well as the current version of the program code, the OBI team hopes to provide a solid jumping off point for other organizations to experiment with creating and running their own bike sharing programs.

The modified Gmail account is programmed to respond in specific ways to specific incoming messages. This means that messages that deviate from what the program anticipates will result in error messages. For example, the Gmail account will respond to a 2-digit number (e.g. 04) with the appropriate lock code, but if the incoming text looks like “#04” the system will say that it does not recognize the request. Thus it is important to communicate to participants exactly how to format texts to the bike share phone number to prevent them from receiving error messages.

The focused functionality of the Gmail account also makes it impractical to use the Gmail account as the bike share’s primary means of communication with participants. The Gmail account should be used only for activation and responding to texts for lock codes. The OBI team used an independent email account for responding to general emails about the program. This helped prevent participants and from receiving error messages to their inquiries and prevented the Gmail system from becoming clogged with messages it did not recognize.
If voicemails accumulate in the Gmail inbox, it can slow down the system. Voicemails were deleted once they had been responded to so they did not make the system sluggish. Having calls forwarded to bike share managers also prevents voicemails and provides better service to bike share participants.

As with any program, it is recommended to have a backup copy of the OBI program ready on a different server in case of a crash or other issue. If Google’s servers experience any issues, that can also prevent the program from working correctly. To overcome this challenge, the OBI team kept local files containing the lock combinations and told the codes to participants who called after not receiving codes by text.

The system cannot automatically activate participants; only manpower can do that. This means that bike share managers must regularly check for new activation emails and activate participants in a timely fashion.

7. Conclusion
The OBI 1.0 program provides an easy, effective system for managing a bike sharing program. The OBI team hopes that this guide and the implementation guide will make bike sharing accessible to a variety of organizations. The team also hopes that sharing the program code will enable others to tinker with and maybe even improve the current technology. The OBI team welcomes all questions and feedback about its work; please contact us at info@openbikeinitiative.org.
Appendix A: Data and Source Code Links

Here are the links to the source files used to run the SMS application. Two third-party libraries were used, in addition to the Google Data API.

Third-party dynamic link libraries:
· GmailHelper.dll
· InterIMAP.dll
· Google.GData.Client.dll
· Google.GData.Extensions.dll
· Google.GData.Spreadsheets.dll

Program Install file

Program source code

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4 https://code.google.com/p/google-gdata/