

Interactive Health Solutions

XpertSMS 2.0

Installation and Operation Guide

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# Overview

XpertSMS is an open source software developed by Interactive Health Solutions with funds from project TB REACH [1]. It automatically receives test results from GeneXpert[[1]](#footnote-1) machines and forwards them to patients and/or caregivers via SMS, while also storing them at data aggregation servers.

Setting up XpertSMS requires installations on the server, the computers linked to the GeneXpert machines, and an Android phone. After successful deployment, text messages are sent out for every GeneXpert results in the GX Dx software[[2]](#footnote-2) to a given phone number(s). Subsequently, patient reports can be generated for the data stored in the server.

XpertSMS system is designed to enable transportation of GeneXpert results through internet as well as cellular networks. It uses another application, smstarseel[[3]](#footnote-3) to send SMS messages to target machine. Other than that, it can also export results as CSV file; send to [GXAlert](http://www.gxalert.com/)[[4]](#footnote-4); save in preconfigured [OpenMRS](http://openmrs.org/)[[5]](#footnote-5) and send to XpertSMS web application through internet/intranet.

**Server** **Client**

The webapp on server reads the message from the table, parses it and stores it into the genexpertresults table if the parsing was successful.

The client contains the GX DX Software which uploads the result and XpertSMS client receives it and stores it in the outboundmessage table in smstarseel schema. Then this message is picked up by mobile connected to it.

After getting the message, smstarseel app sends the message to the desired number.

After receiving the message, smstarseel app puts it into the inboundmessage table.

# Requirements

## Server-side Pre-requisites

* IBM compatible Intel or AMD Desktop or Server machine with minimum 40GB HDD and 4GB RAM. (Windows 7 or higher)
* Web archives: “xpertsmsweb.war” and “smstarseelweb.war”\*
* Android phone with OS version 4.0 (Ice cream sandwich) or higher\*
* Mobile runnable apps: “smstarseel.apk”\*
* Database snapshots: “xpertsms.sql”, “smstarseel.sql”
* MySQL Server 5.x or higher
* MySQL Workbench 5.x or higher
* Java Runtime Environment (JRE) 6.x or 7.x
* Apache Tomcat Server 6.x or 7.x

## Client-side Pre-requisites

* IBM compatible Intel or AMD Desktop or Server machine with minimum 20GB HDD and 2GB RAM. (Windows 7 or higher)
* Connection with GX Dx Software
* Android phone with OS version 4.0 (Ice cream sandwich) or higher\*
* Mobile runnable apps: “smstarseel.apk”\*
* Database snapshots: “xpertsms.sql”, “smstarseel.sql”
* MySQL Server 5.x or higher
* MySQL Workbench 5.x or higher
* Java Runtime Environment (JRE) 6.x or 7.x
* Apache Tomcat Server 6.x or 7.x

*\* These are required only when transporting messages via SMS. If you are not using SMS protocol, you must have an internet connection.*

# Installation Instructions for Windows

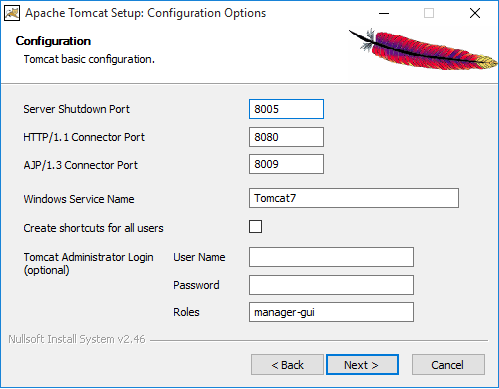
## Install JDK (Java Development Kit) 7.0:

Download and install from here: [http://www.oracle.com/technetwork/java/javase/downloads/jdk7-downloads-1880260.html](#_Server_Installation_Instructions). You need to select the correct JDK for windows depending on your windows operating system (32-bit or 64-bit). You don’t need to make any changes to the default settings.

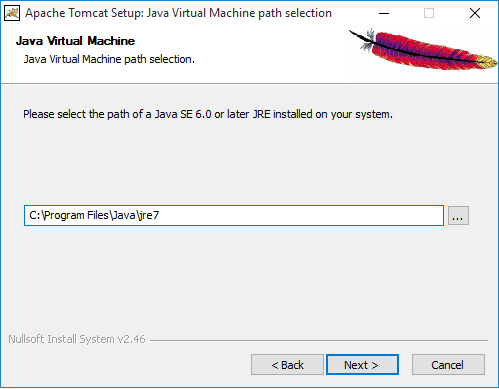
*\* The system is compatible with JRE version 6.x and 7.x ONLY. Please do not use any other version.*

## Install Apache Tomcat 7.0:

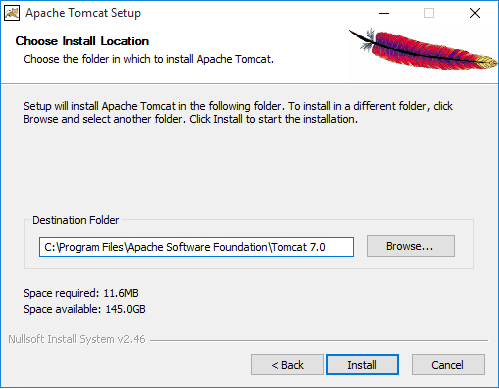
* Download and install from here: <http://tomcat.apache.org/download-70.cgi>**.** Choose '32-bit/64-bit Windows Service Installer' in Binary Distributions.
* Run the downloaded installer.
* After finishing installer, run configuration wizard.
* Assign the appropriate ports and login credentials for tomcat. Credentials will be used to deploy web applications on the server, while the assigned port no. to Http/1.1 Connector port will be used to access the web apps deployed on the tomcat server. Hence, these ports shouldn’t be blocked by any service.



* If JRE was previously installed successfully, the following page will show the jre6/7 path noted earlier by default.

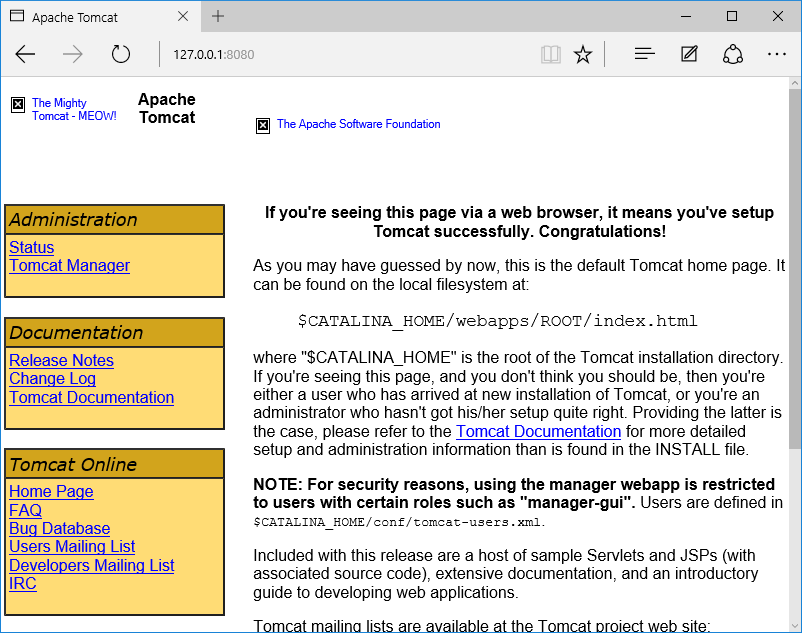


* Choose the location “c:\apache-tomcat-6.0” or “c:\apache-tomcat-7.0” instead of default location

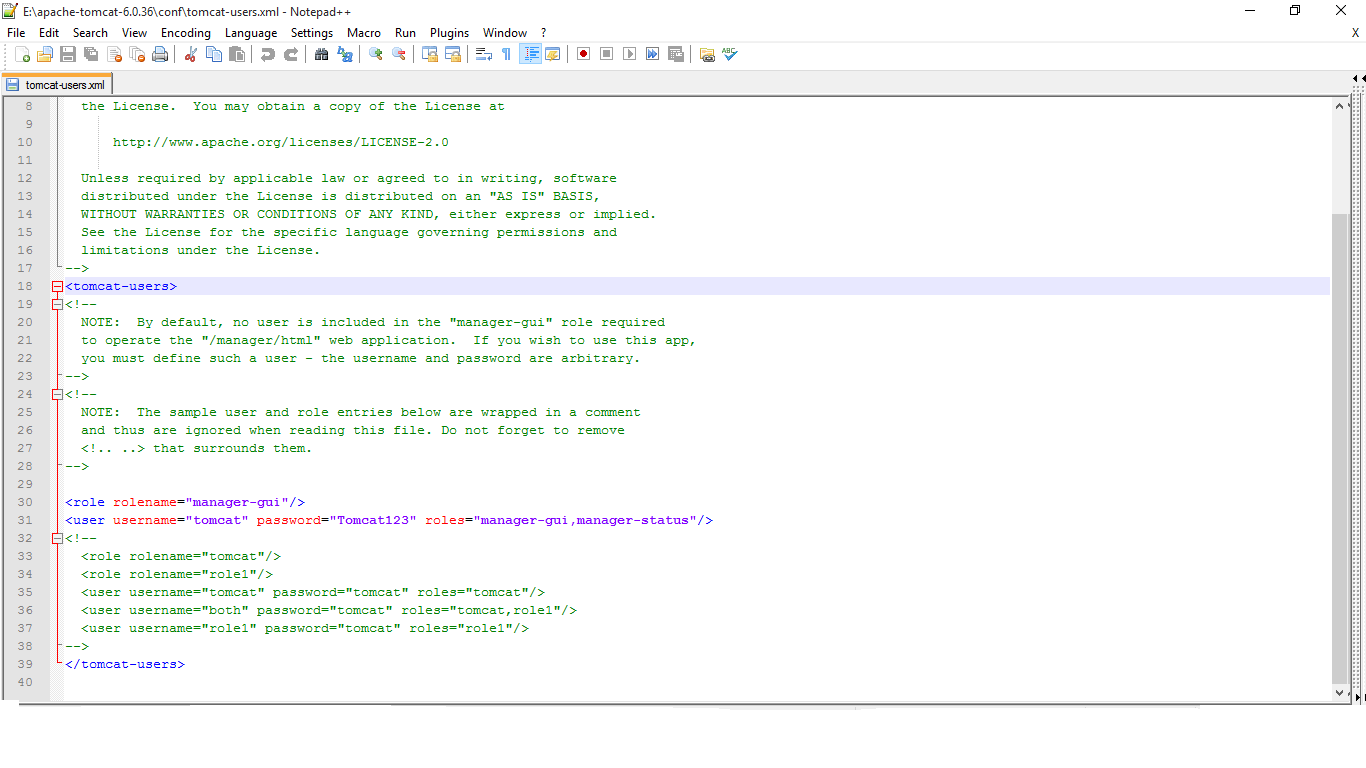


* After completing all the Apache Tomcat installation steps, start browser. Type in [http://localhost:< Connector Port>](http://localhost:%3c%20Connector%20Port%20No.%3e) in address bar and Go. If installation was successful, you should be able to see the Apache Tomcat Homepage.

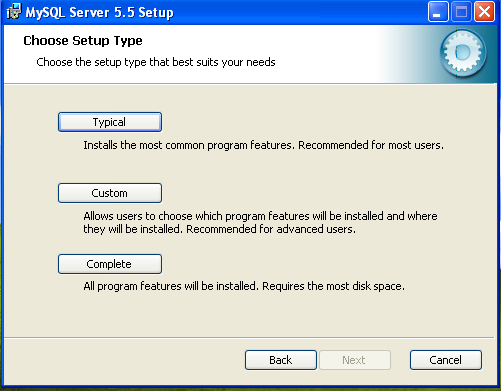
*\* Connector Port No refers to assigned port to HTTP/1.1 Connector Port at configuration page during the Tomcat Apache installation setup.*

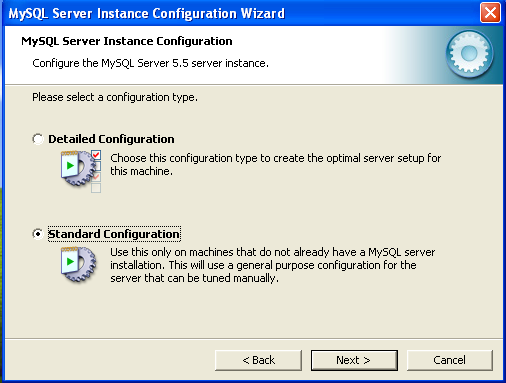


## If the browser asks for username and password, then go to the directory “C:\Apache Software Foundation\Tomcat6.0\conf” and edit/open the file “tomcat-users.xml” with Notepad/Notepad++. Type the following two tags of <role> and <user> inside the <tomcat-users> tag. Enter username and password of your choice.



## Install MySQL-Server:

* Download and install from here: <http://dev.mysql.com/downloads/mysql>. Just follow the instructions of setup guide. Important steps are given below.
* Click on ‘Typical’ installation type.
* After installation, MySQL Server Configuration will launch. Choose “Standard Configuration”.



* Choose the options as shown:



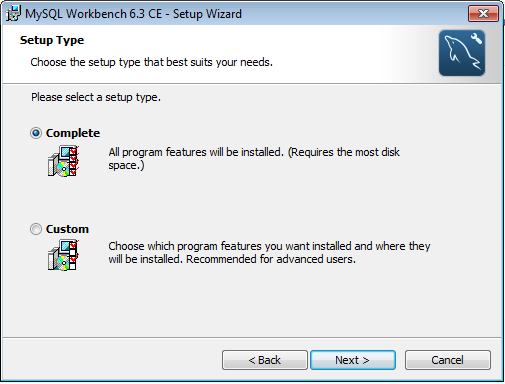
* In instance configuration, define a secure password and keep it safe.

****

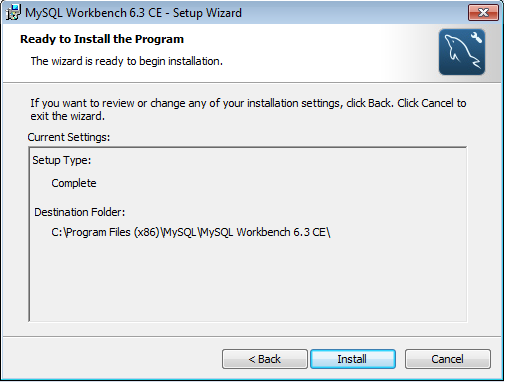
* Finish the wizard.

## Install MySQL Workbench:

* Download MySQL Workbench from: <http://downloads.mysql.com/archives/workbench/>. Just follow the instructions of setup guide. Important steps are given below.
* Click on ‘Complete’ installation type.

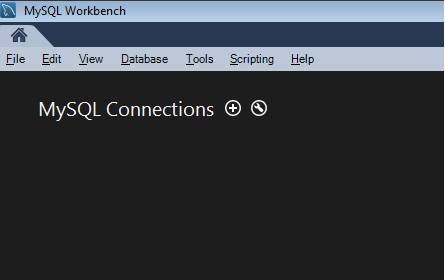
****

* Review your settings and click on ‘Install’.

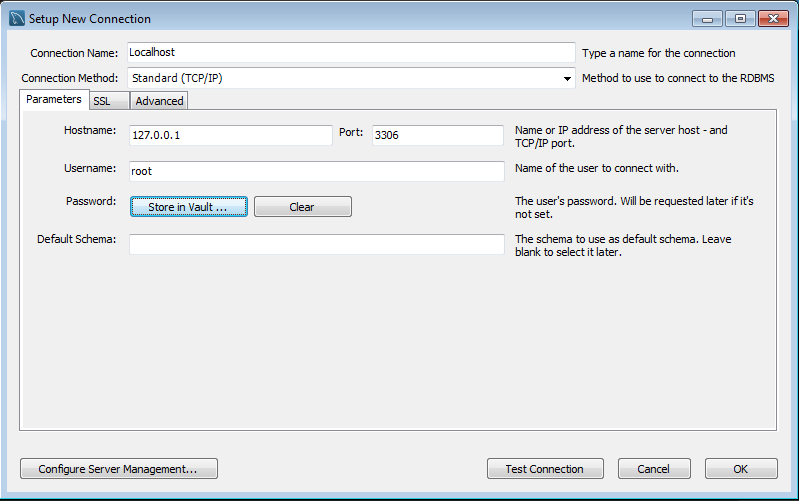
****

## Configuring Database(s):

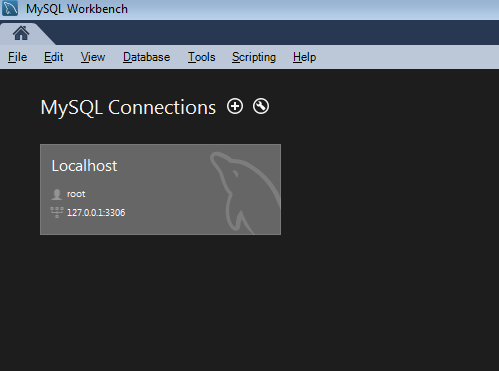
* Launch MySQL Workbench. To make a new connection, click on ‘+’ symbol.

****

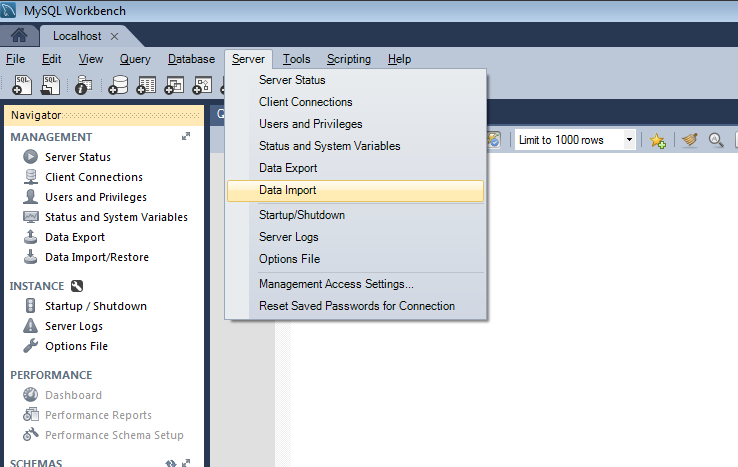
* Give a name to your connection like ‘Localhost’ given below. Do not meddle with the settings. Click on ‘Store in Vault..’ to enter the password. Type in the password you wrote while installing MySQL Server. If you didn’t give any password, write the password of your choice. Remember this password. To test whether the connection works or not, click on ‘Test Connection’ and if it says ‘Successful’, then the connection parameters are correct otherwise check your password.



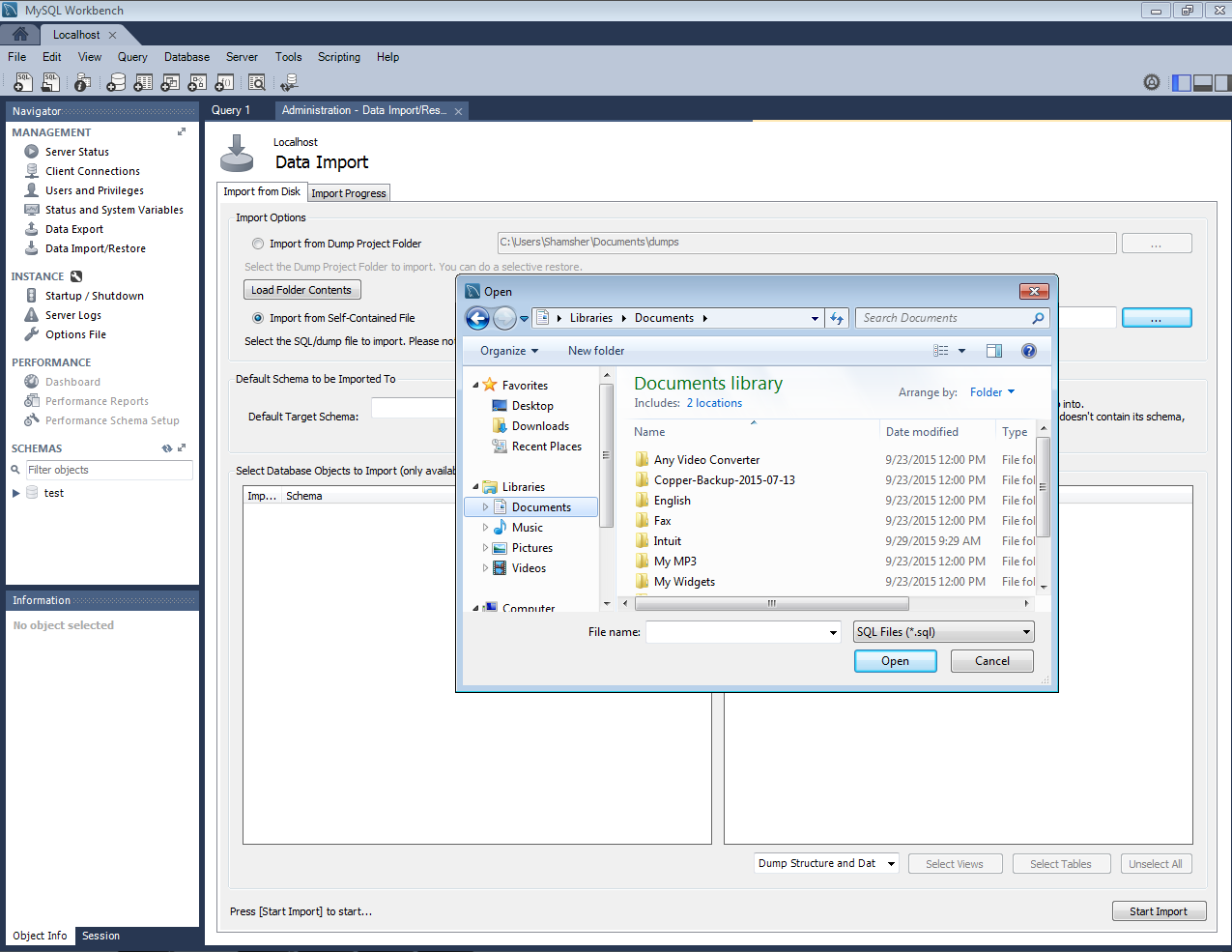
* After making the connection, the following will be seen on the screen.



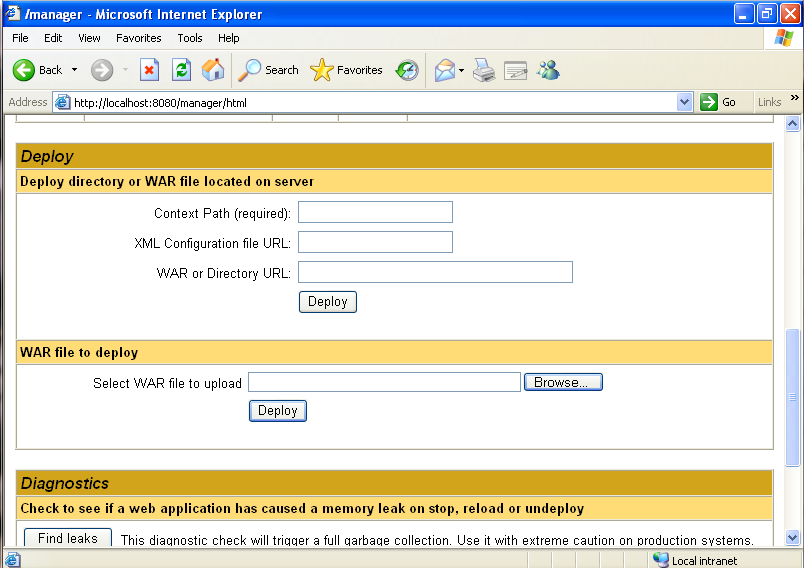
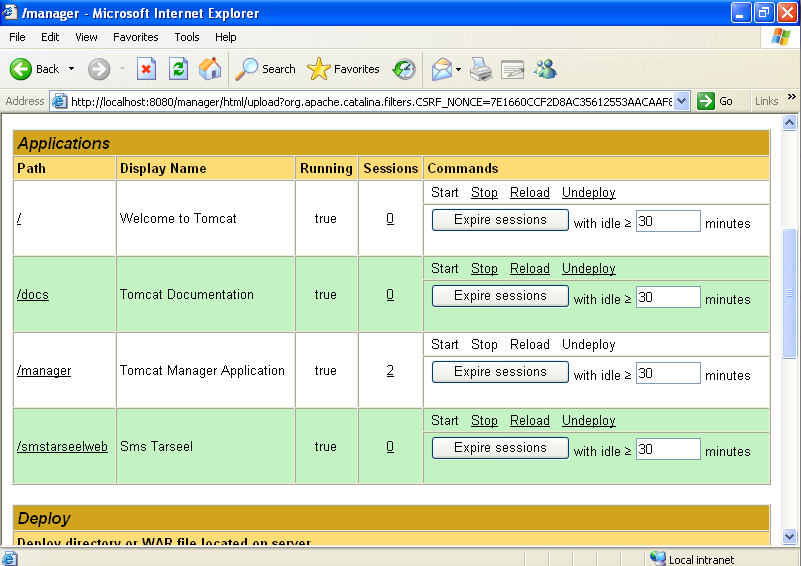
* Click on the connection to open it. After opening, click on ‘Server’ and ‘Data Import’ to import the tables.



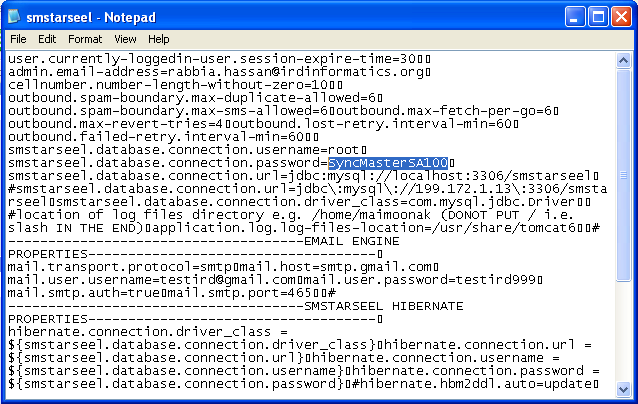
* Check ‘Import from Self-Contained File’. Click on ‘…’ button to select the .sql file. Select XpertSMS.sql. Click on ‘Start Import’ after selecting the file. Repeat the same steps for smstarseel.sql file.



## Deploying Web application archives on Server:

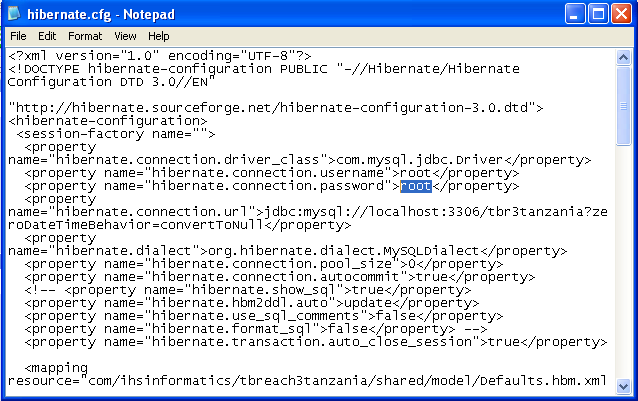
* Go to tomcat manager page by starting tomcat and then typing [<ip>:<port>/manager/html](file:///C:\Users\Safwan\Downloads\%3cip%3e:%3cport%3e\manager\html).
* Under Deploy>WAR file to deploy heading, browse and select ‘smstareseelweb.war’ and click deploy button.
* On successful deployment, smstarseelweb will be added to application list above on the same page
* Similarly repeat the process with ‘xpertsms.war’.
* Now go to directory “C:\Apache Software Foundation\Tomcat6.0\webapps\smstarseelweb\WEB-INF\classes” and open file “smstarseel.properties” in notepad and edit the password to MySQL server root password.

*\*If there is a rectangular block icon in the end line, don’t remove it.*

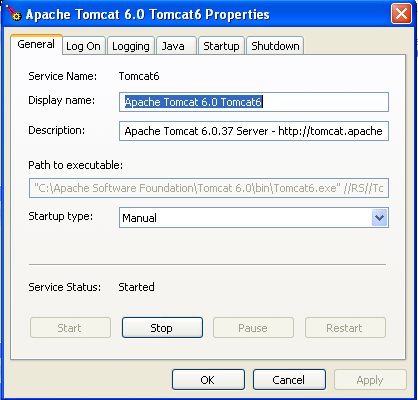


p@s$w0rD

* Similarly, now go to directory “C:\Apache Software Foundation\Tomcat6.0\webapps xpertsms\WEB-INF\classes” and open file “hibernate.cfg.xml” and edit the password to MySQL server root password.

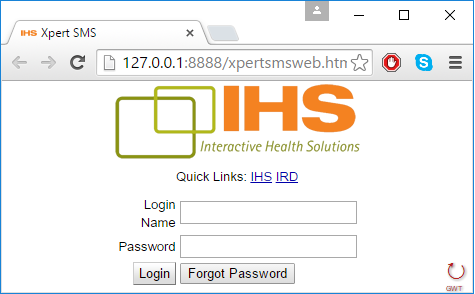


Now go to “C:\Apache Software Foundation\Tomcat 6.0\bin” and double-click “Tomcat6w”, an application will open. Or, open 'Monitor Tomcat' from Start Menu in Windows 7. If it says 'Configure Tomcat' in Start menu, rick click and 'Run as Administrator'.



Click on Stop button. Then close the application, re-open it and now click on start button.

1. Close the application and Start Browser. Type in “http://localhost:< *Connector Port No*.>/xpertsmsweb.html” [[6]](#footnote-6) in address bar and Go. If the deployment was successful, you should be able to see the login page in a few seconds.

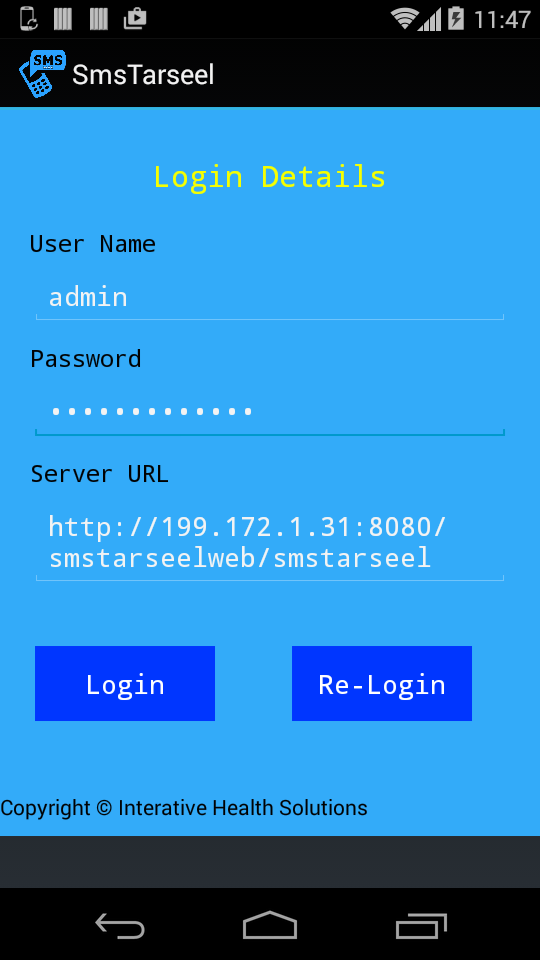
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# Android Configuration

Android versions 4.0 and higher.

## Installing and configuring smstarseel.apk

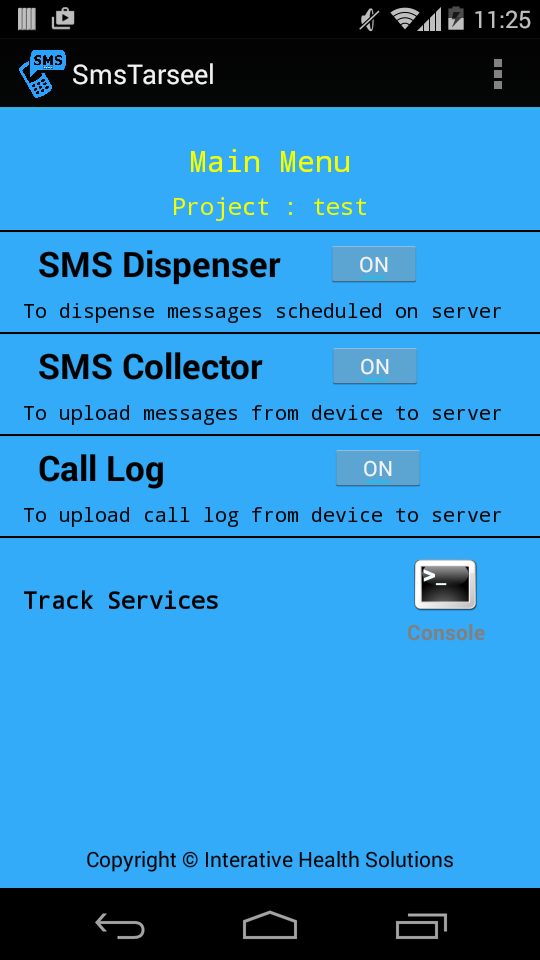
* Copy and install “smstarseel.apk” into the Android phone using USB cable/Bluetooth/Email
* Open SMS Tarseel App and Login using given credentials by the IT team(username:admin, password: administrator, server URL: http://<ip>:<port>/smstarseelweb/smstarseel)



* Enter your phone number and 'Register' your phone with the server.



* Turn on SMS Dispenser and SMS Collector Services by tapping the buttons on right side. A pop-up will appear. Click “yes” to start the service.



# Software Configuration on GeneXpert computers

## Install and edit XpertSMS settings:

* Copy XpertSMS jar file to the GeneXpert PC's desktop

*|Note| The software Java is needed to run XpertSMS. If the PC does not already have it installed, download it from here:* [*http://www.oracle.com/technetwork/java/javase/downloads/jdk7-downloads-1880260.html*](#_Server_Installation_Instructions)

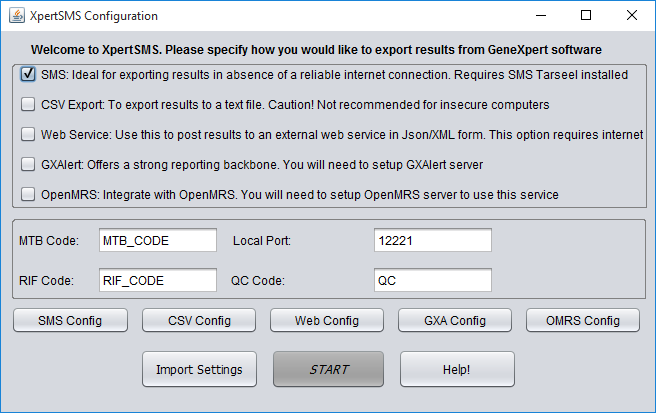
* Open XpertSMS and make change the settings to look like this:

MTB code: MTB\_CODE

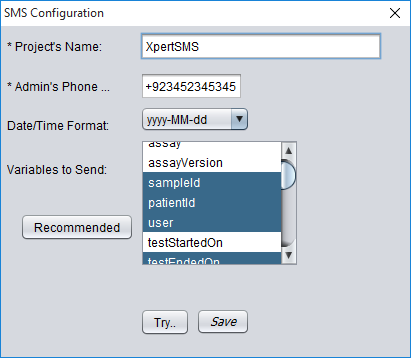
RIF code: RIF\_CODE

QC code: QC

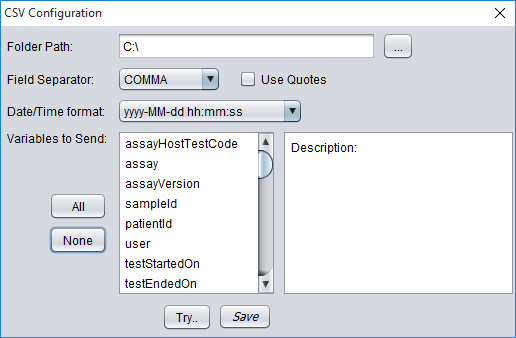
Local Port: 12221

*Fields are case-sensitive*

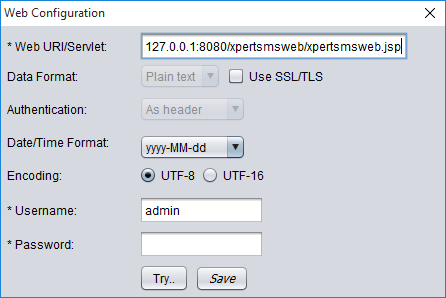
* To configure the sms settings, click on “SMS Config”. The following dialog will appear:



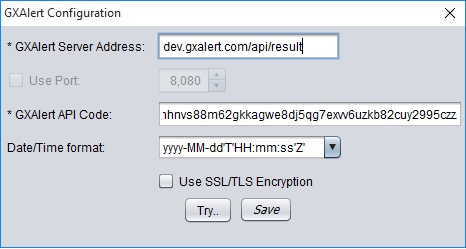
* The project name must be kept as “XpertSMS”.
* The Admin’s Phone is the number which has to receive the sms.
* Date/Time Format is the format in which format you want the date.
* ‘Variables to send’ is a list in which values are stored. You may select the variables you like to send but there are some recommended variables which are selected on clicking the “Recommended” button.
* The “Try” button checks whether the connection is successful or not.
* The “Save” button saves the current settings.
* To configure the csv settings, click on “CSV Config”. The following dialog will appear:



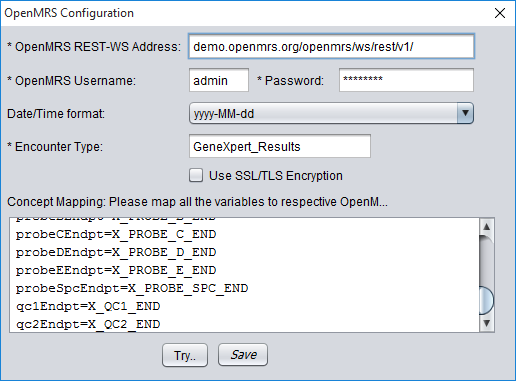
* Folder Path is the path where you want to store the CSV file.
* Field separator is the character used to separate fields in the csv file. By default it is a comma and must not be changed.
* Date/Time format is the format in which you want the date to appear.
* Variables to send are the variables you want to be there in the csv file. On the right side is the description of the variables selected.
* The “Try” button checks whether the connection is successful or not.
* The “Save” button saves the current settings.
* To send the results via web, click on the “Web Config”. The following dialog will appear:



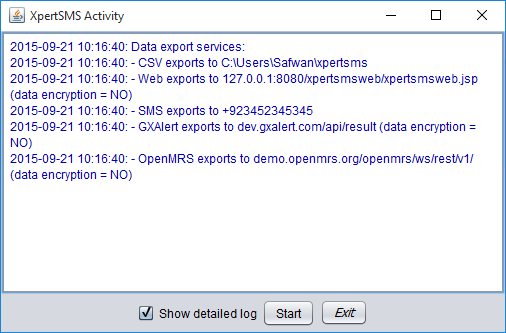
* The Web URI/Servlet is the uri/url of the server which will be receiving the results. Make sure to write the correct <ip>:<port>/xpertsmsweb/xpertsmsweb.jsp
* Date/Time Format is the format that you want to send in the result.
* Encoding is the scheme by which data is encoded and send to the server.
* Username and password should be of a valid user that has admin privileges.
* To send result to the GXAlert server, click on the “GXA Config”. The following dialog will appear:



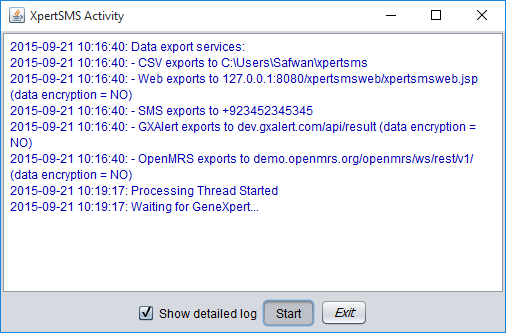
* GXAlert Server Address is the address of the GXAlert server.
* API code is code given to you by the GXAlert developers.
* Date/Time format is the format in which result should be sent.
* To configure the settings for OpenMRS, click on “OMRS Config”. The following dialog will appear:



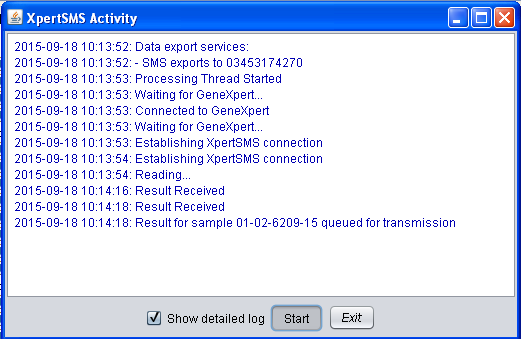
* OpenMRS REST-WS Address is a rest service that sends the data to OpenMRS. It should be written as “demo.openmrs.org/openmrs/ws/rest/v1/
* OpenMRS Username and Password are the ones of the user with privileges that is allowed to push the data to OpenMRS.
* Date/Time format is the format in which you want to send the date and time.
* EncounterType is the type of encounters you want to see. This should not be changed.
* After making all the changes, click on “START”. The XpertSMS Activity will start and the following screen will appear showing some information.



* Check the log that all the settings are updated or not. Then click on “Start” again. More details will appear telling that XpertSMS is waiting for the GeneXpert machine to send the data. The following screen will appear:



* After uploading the result from GeneXpert, the log shows that the result is received as follows.

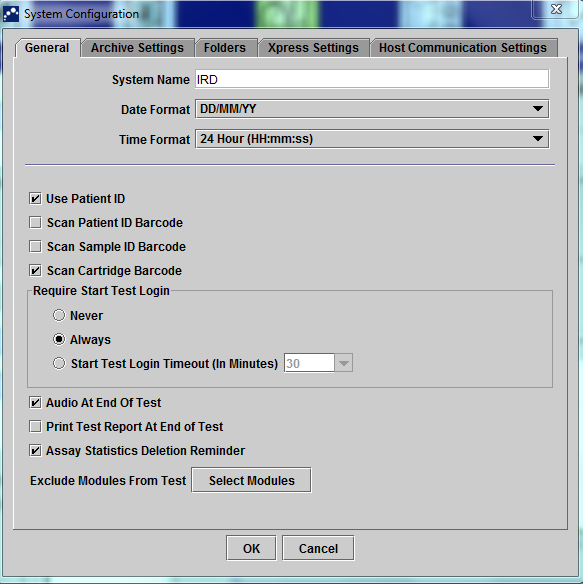


## Change GeneXpert Dx software settings:

* Login using an admin account
* Go to:

Setup-->System Configuration--> General

Ensure 'Use Patient ID' box is checked.

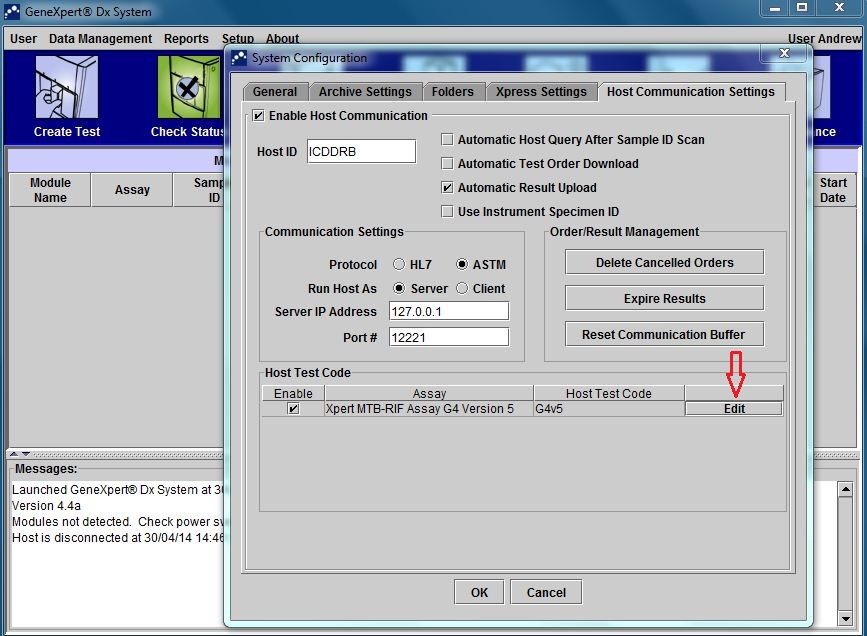


*Other settings in 'General' might look different, which is okay.*

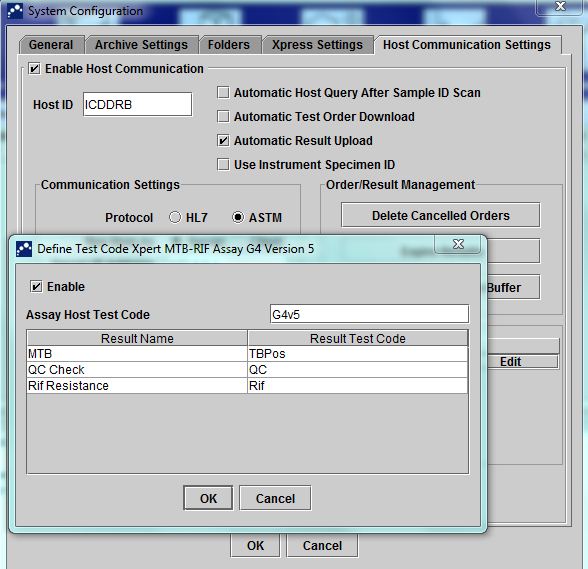
* Now, go to:

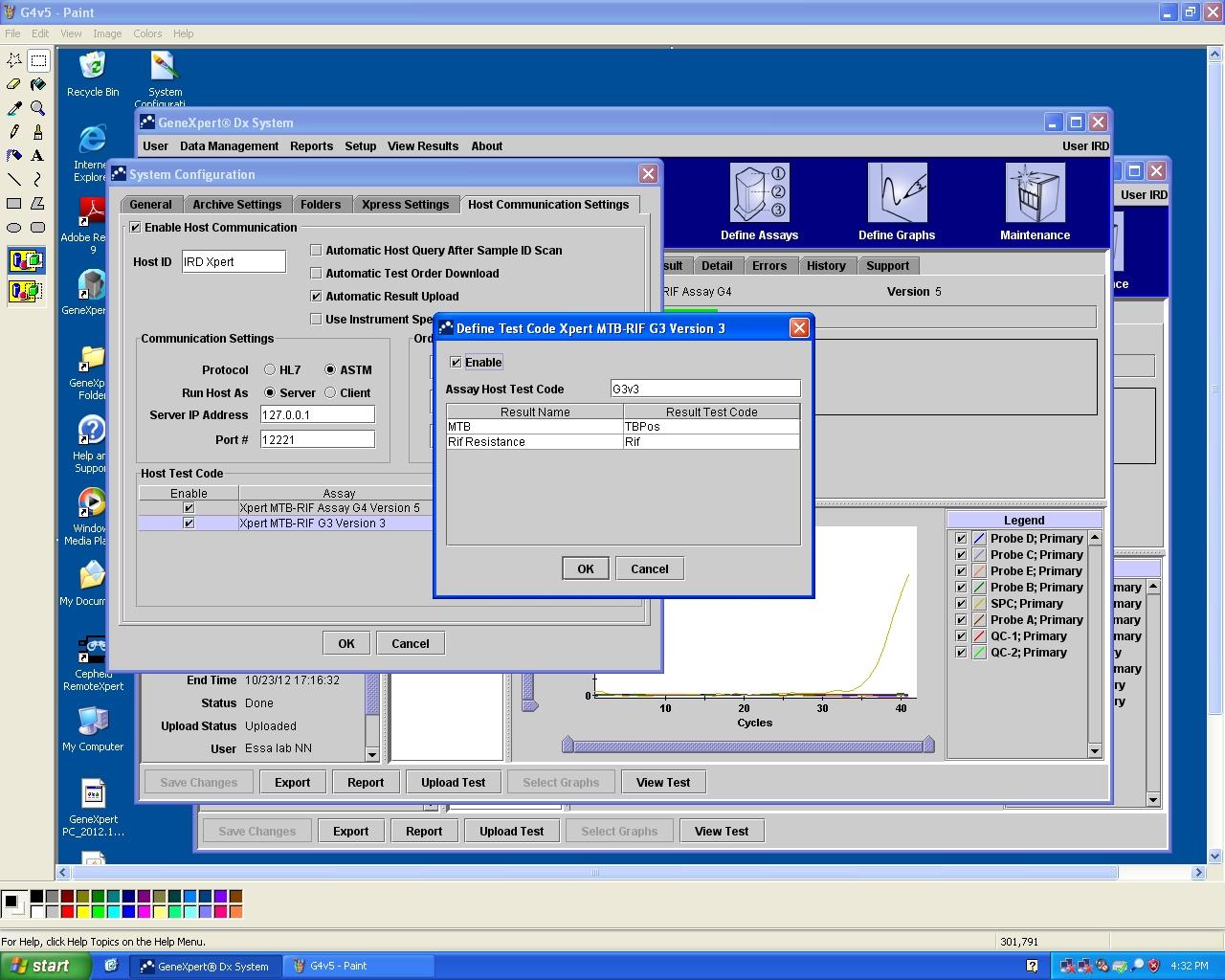
Setup --> System Configuration --> Host Communication Settings

Make sure the settings look like the picture below. Host ID should be changed to any unique name you want to identify the GeneXpert machine with.

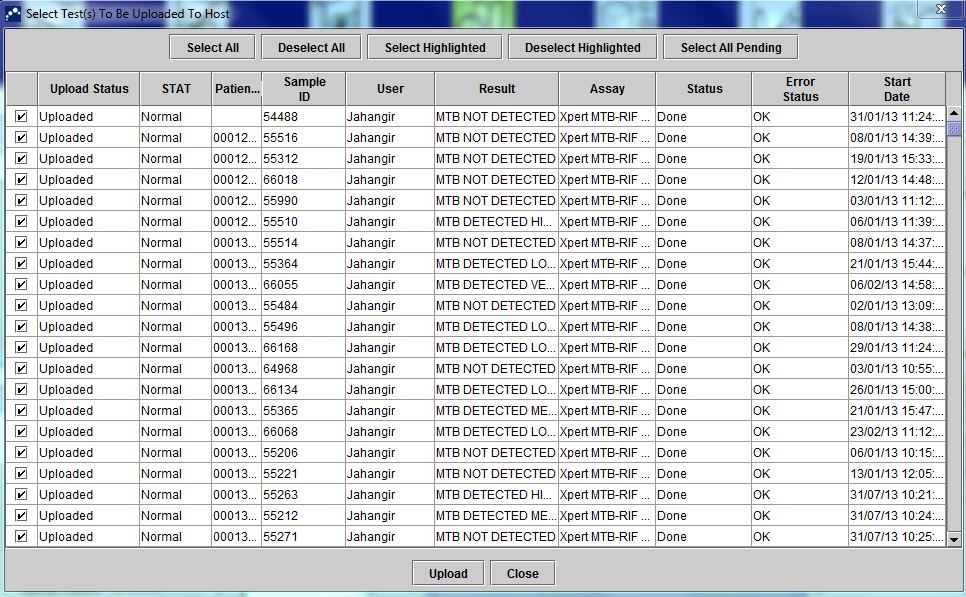


*Note: If you do not want results to be uploaded automatically as soon as XpertSMS starts, you can uncheck the 'Automatic Result Upload' option above and upload them manually by going to 'View Results' and then 'Upload Test'.*

* Set the G4v5 Assay as follows by checking the 'Enable' box and clicking 'Edit':
* Some PCs will also have the G3v3 Assay, which should look like this:



*Results should start uploading when both XpertSMS and GeneXpert Dx settings are set as shown above and 'Start' is clicked on XpertSMS.*

Click on the fourth icon ‘View Results’ to open the below screen. Click on ‘Upload’ button to upload the data patient records. The XpertSMS client will then receive the results.

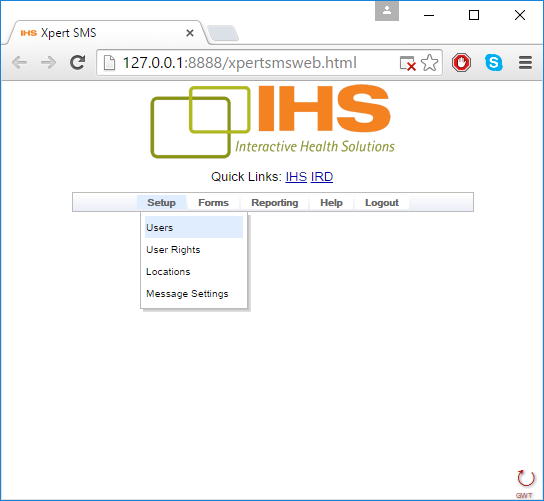
# Web App Setup (Server)

## Deployment

* Place the xpertsmsweb.war file in tomcat/webapps folder.
* Restart/Start tomcat.

## Creating User accounts

* Type <ip>:<port>/xpertsmsweb.html in browser.
* Login with the admin credentials.
* Go to Setup --> Users
* Fill in the info and choose the privilege (Admin/Guess/Screener) accordingly.
* Click ‘Create User’ to create the user.



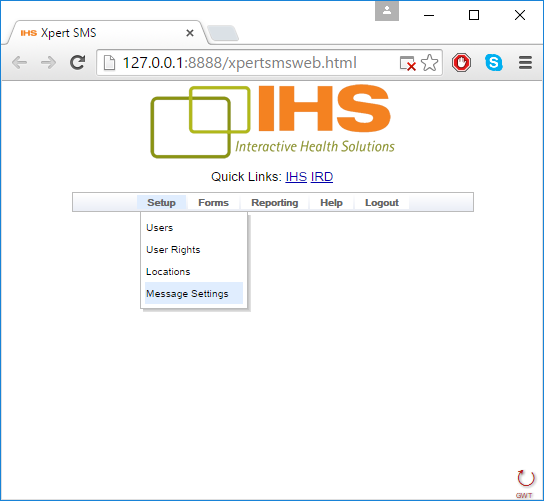
*|Note| A provider refers to a treatment worker or somebody whom the actual test result will be forwarded to through SMS. Accounts are made for providers by the admin, which later appear in a dropdown menu in Suspect ID form. The user account is set up just once for every provider and requires a phone number to be entered. So when filling in the Suspect ID form the user chooses a certain provider from the dropdown, he does not have to enter the phone number for the provider again because it is stored in the system.*

*You can make one 'default' screener accounts as it is does not have much use in XpertSMS*

*A 'User' is anybody who can log into the web app. Users created with screener privileges do not have the rights to view reports or make system changes.*

## Message Settings

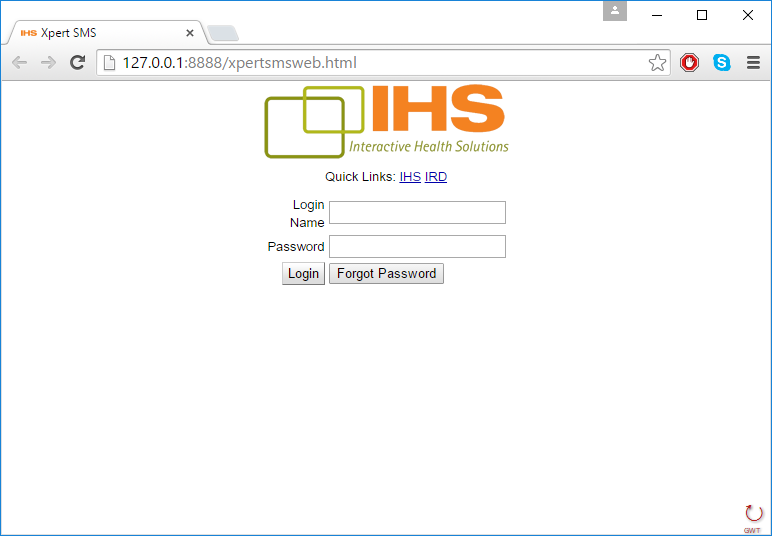
XpertSMS is capable of sending results via SMS to 4 numbers. The numbers can be changed/added from Setup --> Message Settings in the web app.



# Workflow with XpertSMS

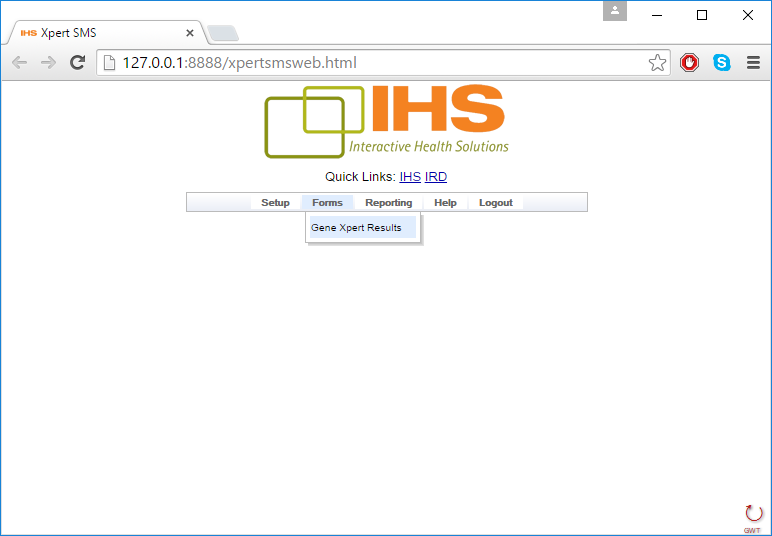
## Fill in Web Forms

* Enter URL in browser: http://<ip>:<port>/xpertsmsweb.html

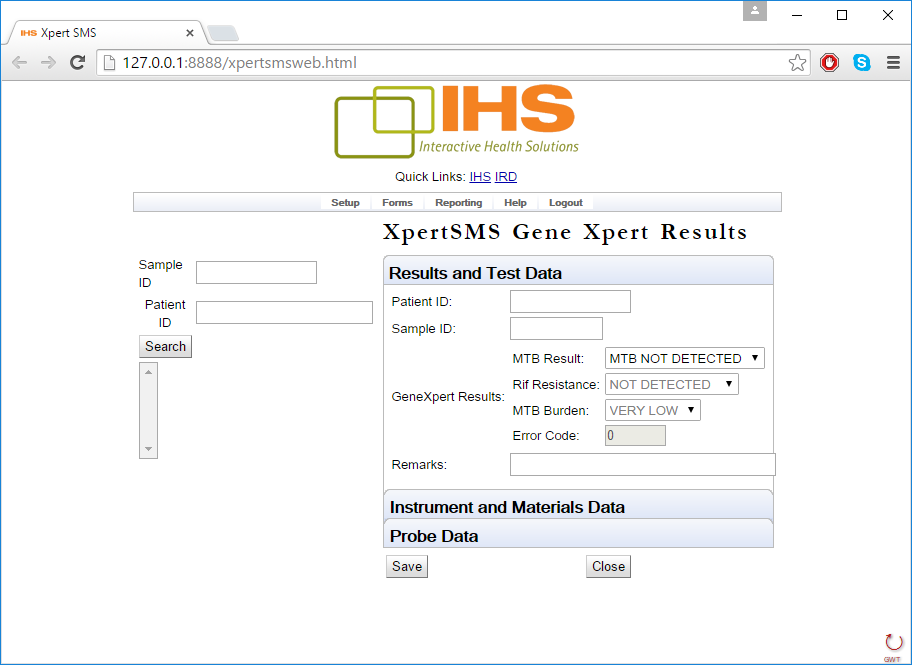


*[username: admin | password: jingle94]*

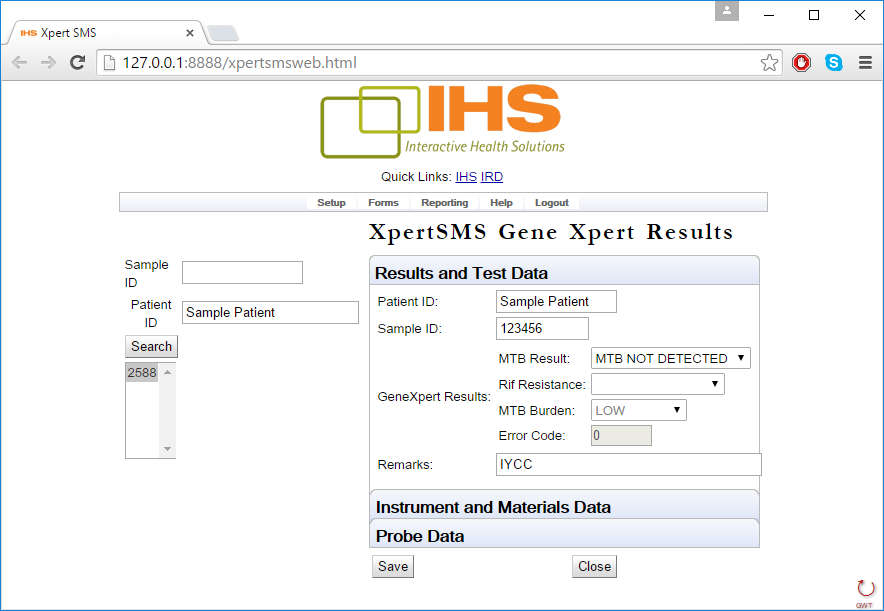
* Click on Forms



* Click on GeneXpert Results and fill out the details and click Save. Patient ID must be the same as the one entered in GeneXpert.



* To search for a patient, either write the Sample ID or patient ID and the fields will be populated with the data.



* Run GeneXpert Test. After running the GeneXpert test, results will automatically be pushed to XpertSMS and uploaded to the server.

*|Note| When results are uploaded from GeneXpertDx, if it says "Uploaded", it only means the result was successfully pushed to XpertSMS, not necessarily the server. So, if there was a communication error between XpertSMS and the server, the 'uploaded' result should be uploaded again from GeneXpertDx. If you Upload 3 results from GeneXpert Dx to XpertSMS, make sure you count 3 “Successfully Transmitted” messages on XpertSMS. A poor internet connection will result in failure to send to server, as will characters such as full stops or commas in the Patient ID or Sample ID.*

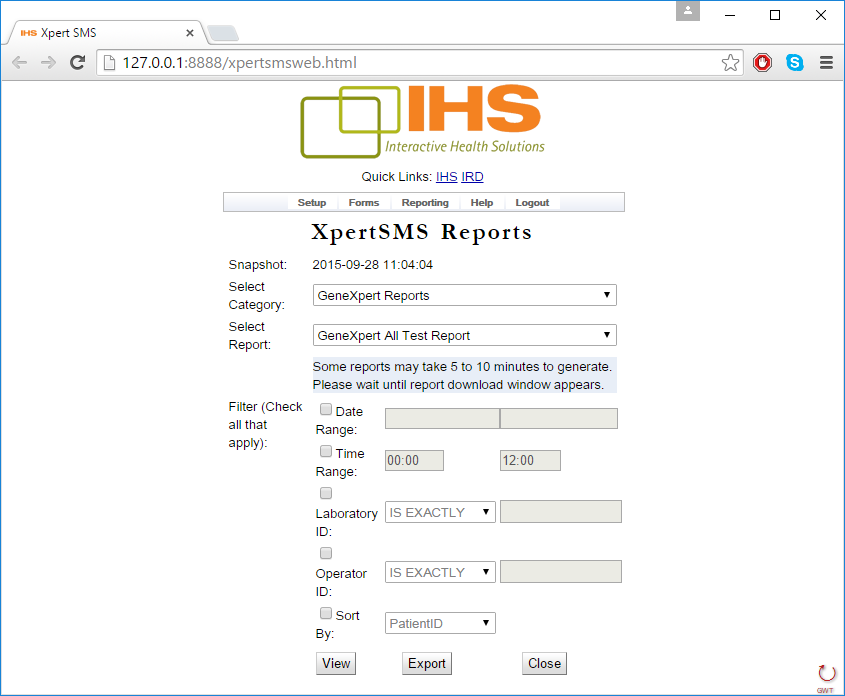
## Ensure SMSTarseel is Running

* The Android must be switched on and SMSTarseel running on it.
* The phone's SIM must have enough money to send out SMSs.
* The phone must be connected to the internet.

SMSs will be sent out at this point.

## Use Reporting Tool

Generating Reports



The web app has the functionality of generating reports on the patient data entered into the system. Data can be filtered by applying result type, data, time etc parameters. 'View' gives a pdf report and 'Export' creates a csv downloadable file.

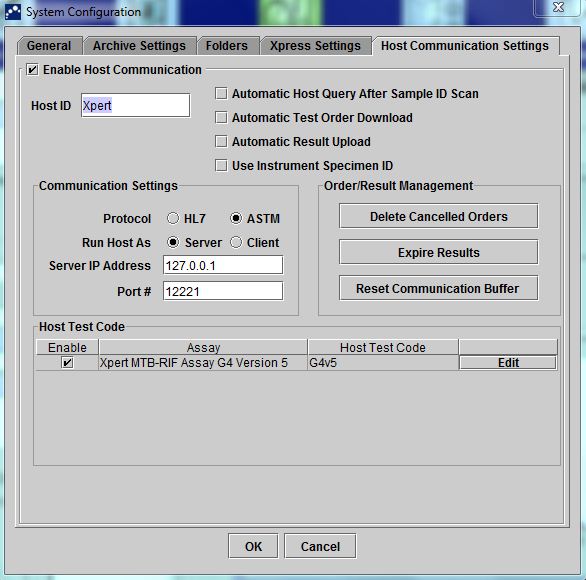
To download csv report, click Export and Control+S on the page that opens, and file will be saved to your computer.

GeneXpert Dx configuration

1. Login using an **admin** account

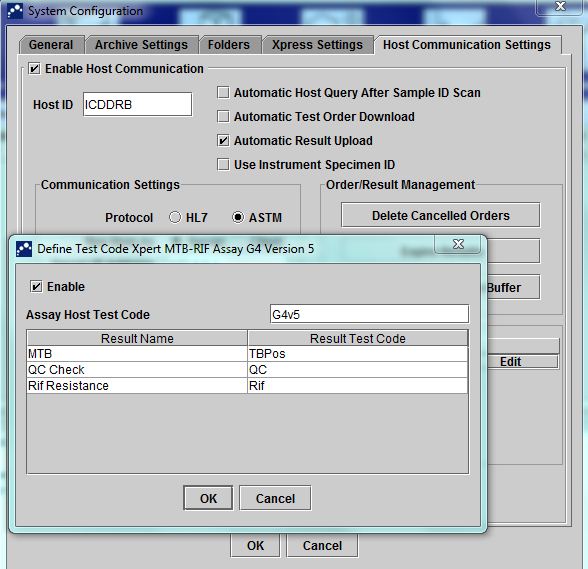
3. Go to: Setup --> System Configuration --> Host Communication Settings

Change the settings to look like this:

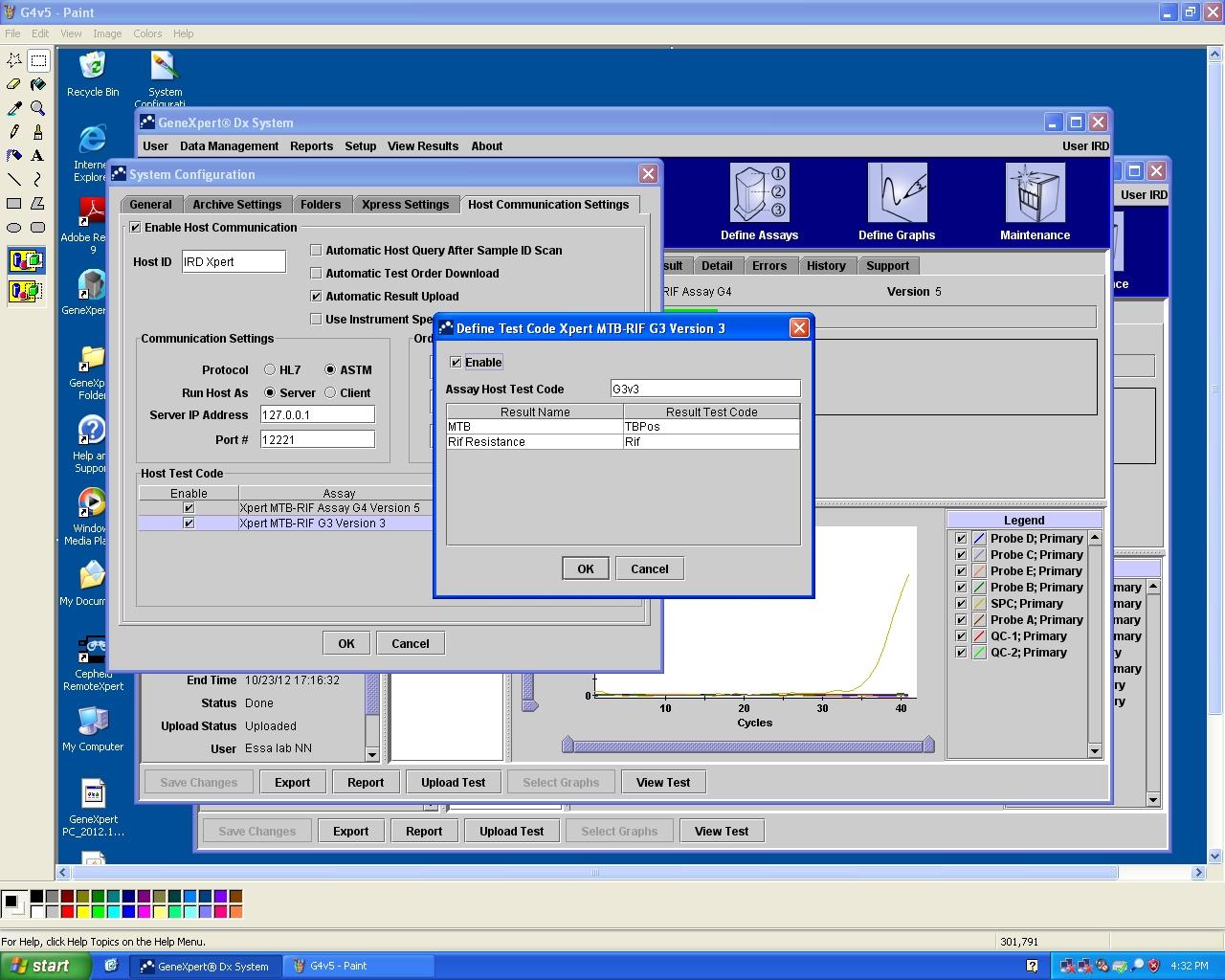


4a. Set the G4v5 Assay as follows by checking the 'Enable' box and clicking 'Edit':

(screenshots on next page)



4b. Some PCs will also have the G3v3 Assay, which should look like this:



5. Click OK to save changes.

6. Exit out of Host communications settings to the Main page.

# Troubleshooting

## Server-side issues

First of all you need to copy the smstarseel.war and xpertsmsweb.war files in the tomcat directory. Then start the tomcat. If the folders with the same name aren’t created, then there’s something wrong with the war file. Stop tomcat, copy the war files again and then start tomcat.

If the client end is sending the sms and the mobile is receiving it but not reading it, then you need to check your password in smstarseel.properties file. If it still doesn’t work, check that whether the services are working properly or not. You need to check your password in the case that

If the sms are there in database but are not being ‘READ’, then check the xpertsmsweb.properties file and check the password of the database.

The recommended browser is ‘Google Chrome’. If another other browser is used then the person won’t be able to see the reports or some functions won’t work. If, even after using ‘Google Chrome’ the reports are not being generated, then you need to check the path of the reports.

## Client-side issues

First of all, the order in which to run these software(s) should be known.

1. Tomcat
2. Xpertsms client
3. GX DX software
4. Smstarseel

The database passwords needs to be checked as the xpertsms client saves the results in database and the smstarseel password should be checked too.

If you see Figure 1.1 instead of Figure 1.2, it means that the port 12221 is still in use. To handle this, click on ‘Start’ -> ‘Exit’. Close the screen from where you are uploading the results and then start xpertsms client again after 2-3 minutes.

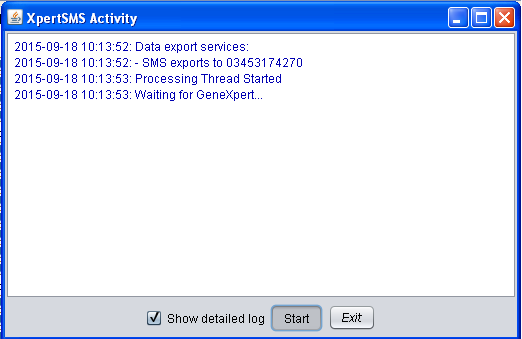


Figure 1.1

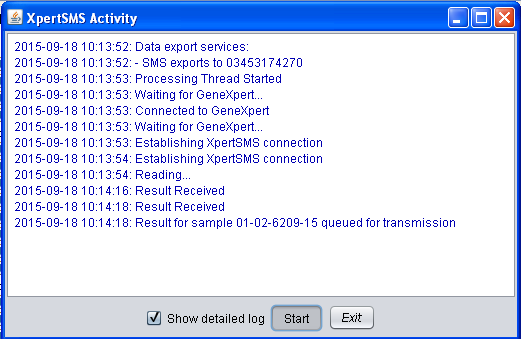


Figure 1.2

* If you see Figure 2.1, then it means that there is a problem with the ip address. Try the ‘ping *ip*’ in command prompt from a different computer on the same network.
* If the message comes as shown in Figure 2.2, then try turning your ‘Firewall’ off.
* If the message comes as shown in Figure 2.3, then it means that the machine is turned off.
* The message should come as shown in Figure 2.4 i.e. ‘Reply from *ip*’.
* If it doesn’t, then there’s something wrong with the ip. Also, another way to check it is by web by typing in the following url : <ip>:<port>/smstarseelweb/login.htm. If it works then something is wrong with connection. The router might not have been configured properly or is not generating the signals.

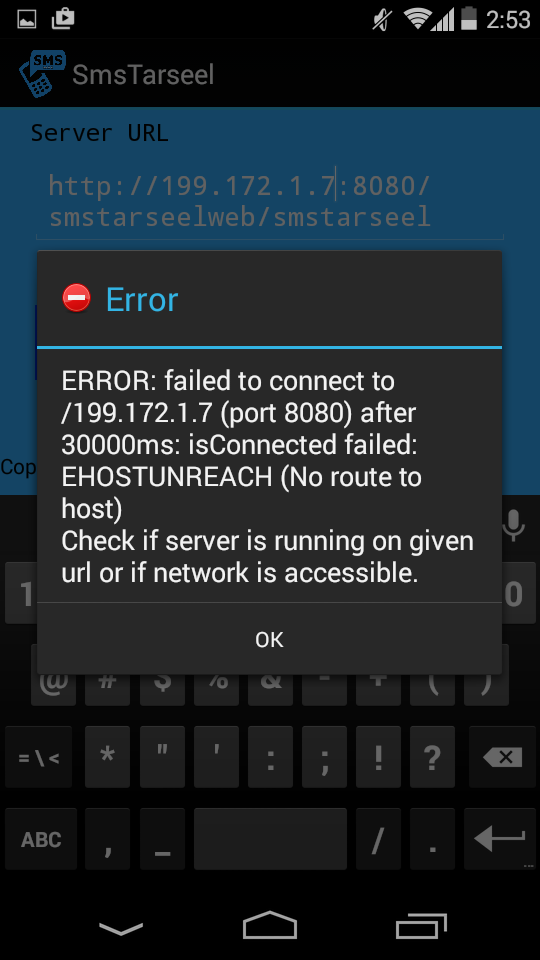


Figure 2.1

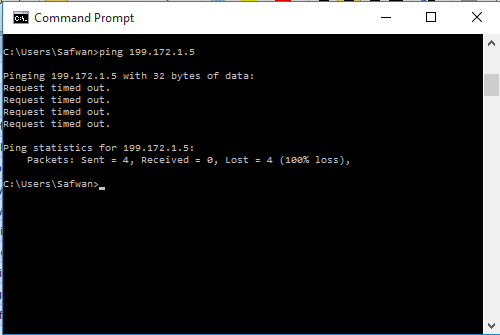


Figure 2.2

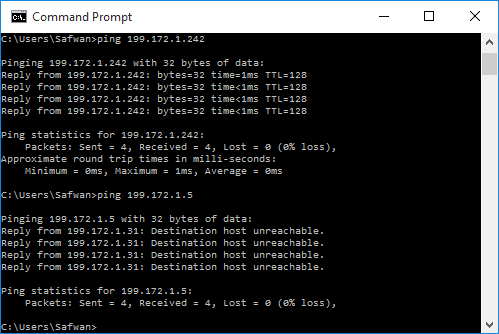


Figure 2.3

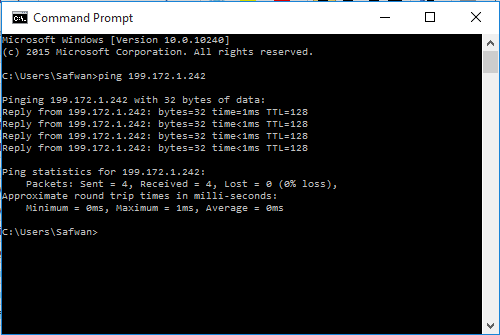


Figure 2.4

* If there comes an error about the buffer is full, then go to Settings -> Host -> Clear Buffer.
* If the XpertSMS client shows a message “Retrying Sample Id *“sample id”* for Patient: *patient*! Attempts = 1, it means that the client is retrying to send the message. The numbers of attempts are 3. After that the client will ask you to send that record manually.

1. The Xpert MTB/RIF assay is a nucleic acid amplification (NAA) test that uses a disposable cartridge with the **GeneXpert®** Instrument System. A sputum sample is collected from the patient with suspected TB. [↑](#footnote-ref-1)
2. GX Dx software is a tool built by Cepheid®, which interacts with GeneXpert machine and provides interface to manage its data. [↑](#footnote-ref-2)
3. Android based system for sending/receiving SMS and call logs [↑](#footnote-ref-3)
4. GxAlert is designed to enable Ministries of Health and programs to set up various alerts based on the data flowing from GeneXperts. [↑](#footnote-ref-4)
5. OpenMRS is a collaborative open source project to develop software to support the delivery of health care in developing countries. [↑](#footnote-ref-5)
6. *By default the default ip is 8080.* [↑](#footnote-ref-6)