Session 8: Synchronization

At the end of this session participants will be able to:

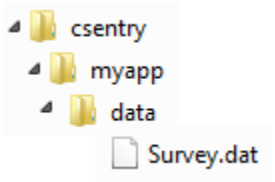
- Create synchronization specification files to synchronize data and programs between Android devices and Dropbox and FTP servers.
- Create synchronization specification files to synchronize data between Android devices using Bluetooth.
- Write and run synchronization specification files from CSPro logic.
- Concatenate data files from multiple devices.

A little bit about directories and paths

In order to understand synchronization in CSPro it is important to understand the fundamentals of how files are organized on the PC or the Android device. Every file has a parent directory (aka parent folder). Directories can also have parent directories. When we write the path of the file that means that we write the parent directory of the file, and its parent directory and that directory's parent directory… Directories and filenames are separated by "/". So if we have the path:

csentry/myapp/data/file.dat

This means that *file.dat* is in the directory *data* and the directory *data* is in the directory *myapp* which is in the directory *csentry*.



We say that *csentry* is the parent directory of *myapp* and that *myapp* is a child of *csentry*. We also say that *myapp* is a subfolder of *csentry*.

Paths that start with a "/" on Android, or paths that start with "C:" or "D:" on Windows are called absolute paths because they start at the root, the very top or beginning of the file system. Paths that are not absolute, paths that just start with a directory name, are called relative paths since they describe one directory relative to another. Relative paths must be combined with an absolute path in order to form a complete file path.

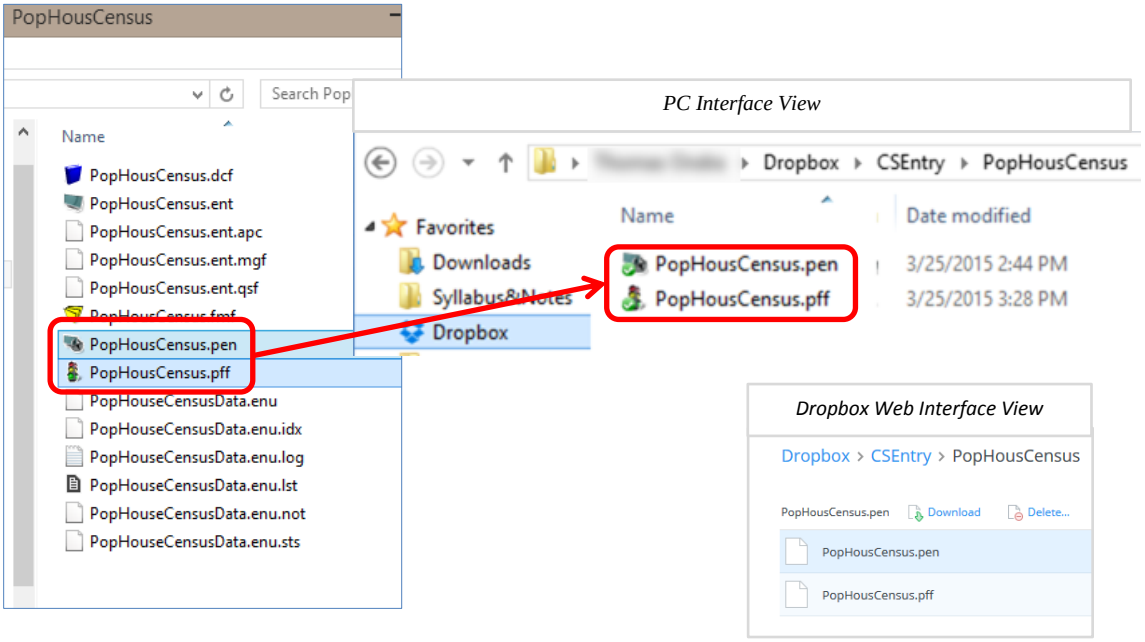
```
/mnt/sdcard/csentry/Survey – absolute path

photos/sweetpotato.jpg – relative path
```

Synchronization works by copying files from a directory on the Android device to/from a directory in Dropbox or on an FTP server. We specify which directories to use by writing paths like the one above.

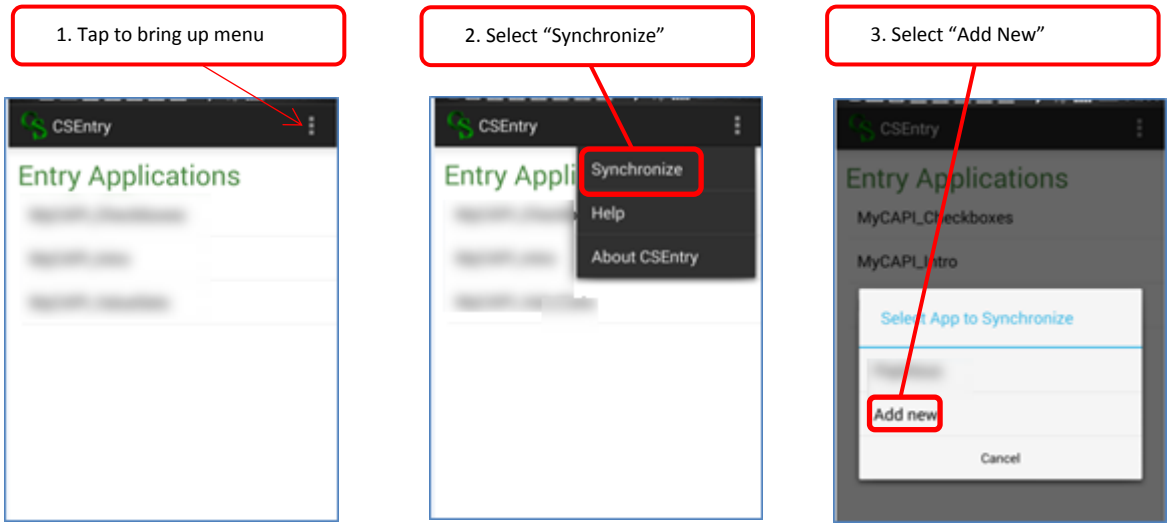
Simple synchronization from .PFF file

In cases where you would just like to send the data file to the server and download the .PEN and .PFF files from the server you can simply use the .PFF file for the application to initiate synchronization.

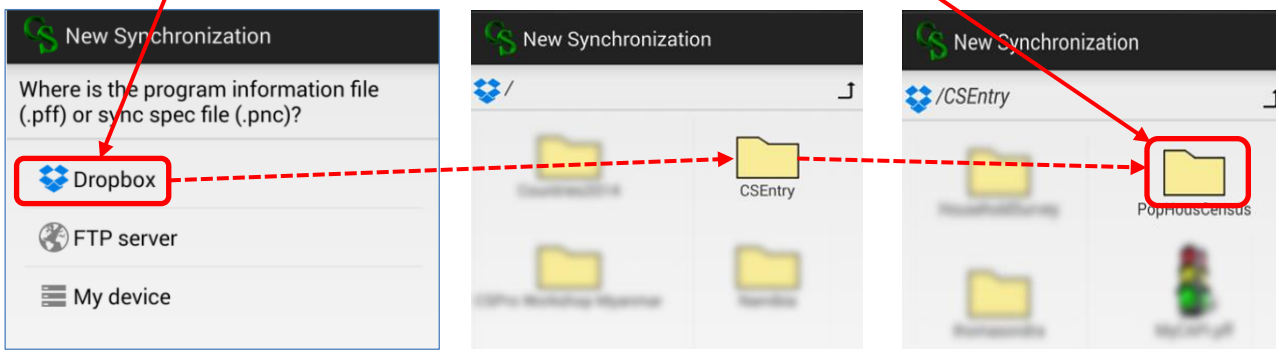
First, place the .PFF file and .PEN file into a directory on the FTP server or Dropbox or you can use a .PFF file that is already on your phone/tablet.



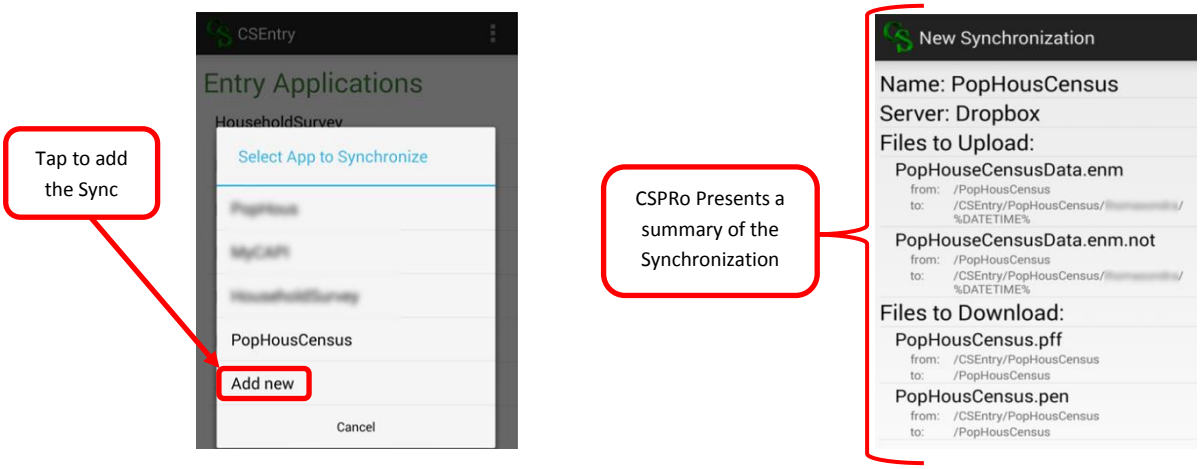
Then add a new synchronization on the phone/tablet using that **.PFF** file. From the first screen of CSEntry Android (the screen that lists the entry applications) select "**Synchronize**" from the menu and then "**Add New**".



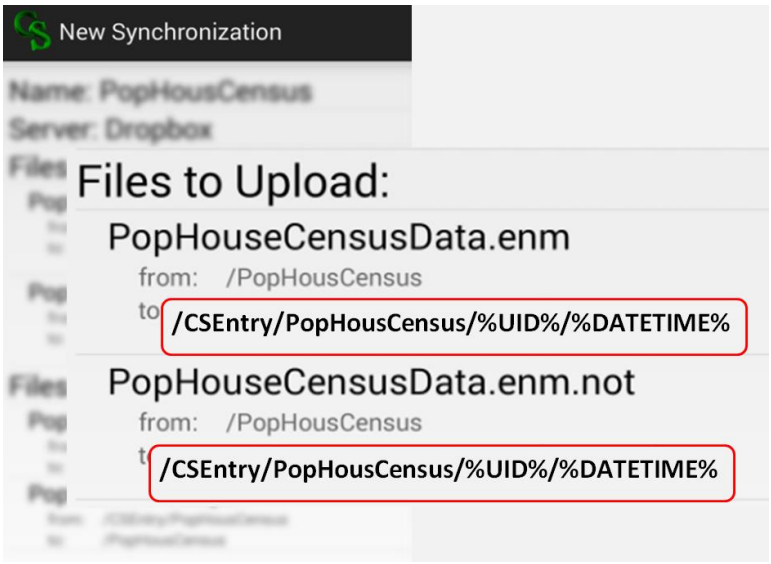
Choose the location (Dropbox, FTP server or My device) where you have placed the file and then browse to the location of the pff file and select it.



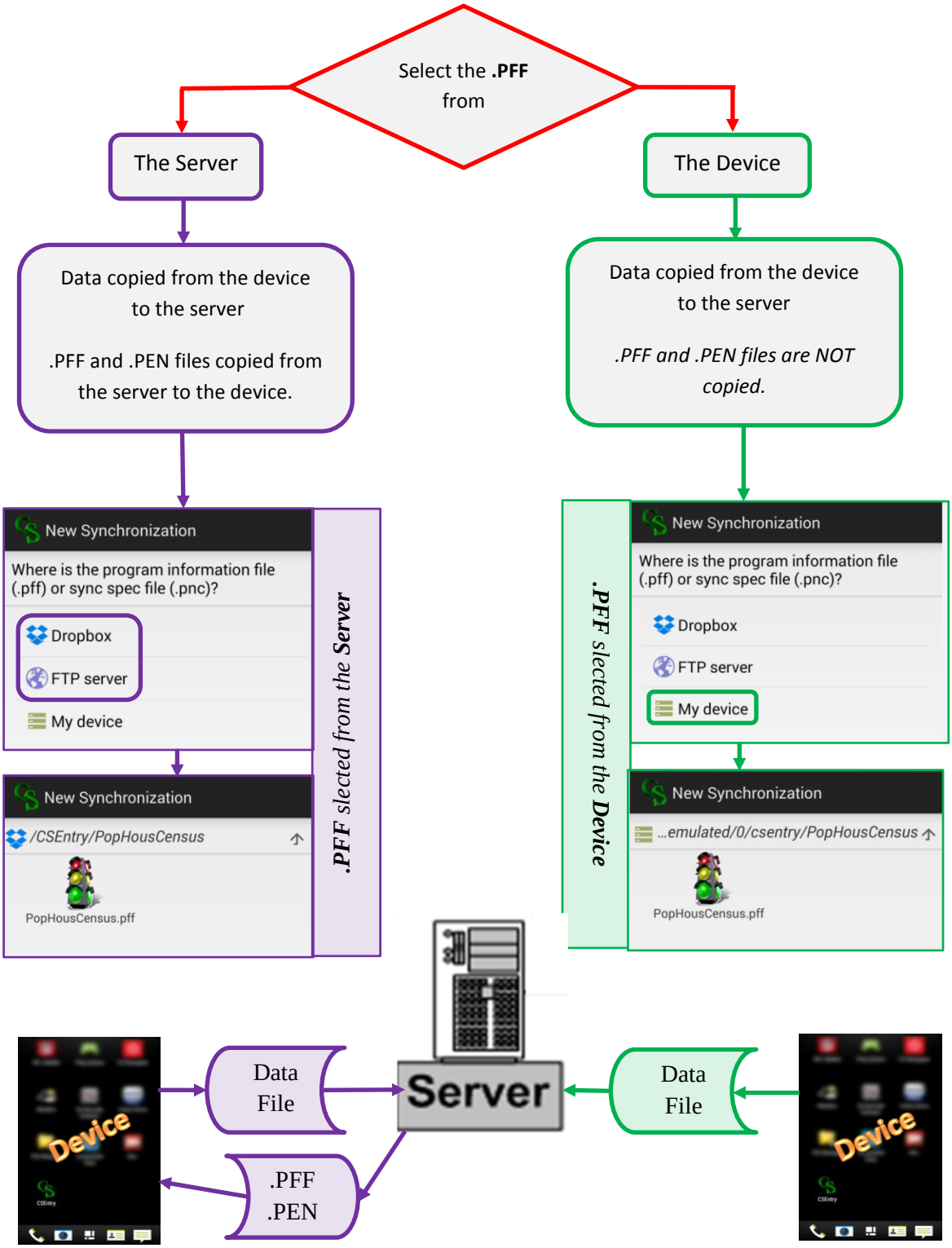
The synchronization is saved and you can now launch it from the Sync menu whenever you want.



The synchronization will copy the **.DAT.NOT** and **.DAT** files from your device to a directory("**%UID/%DATETIME%**") on the server and download the **.PEN** and **.PFF** files to the device from the server. Appending "**%UID/%DATETIME%**" to the path prevents the overwriting of files if multiple users use the synchronization.



If you choose the **.PFF** file from Dropbox or from and FTP server, the synchronization will download the **.PEN** and **.PFF** files. However, if you choose the .PFF file from your device it will not.



The synchronization specification file (.PNC)

For synchronization that are more complex that what can be done using the PFF file, you can customize the files that get uploaded and downloaded by writing a sync specification file (**.PNC** file) that lists all transfers of the synchronization. This file is a list of one or more of the following commands:

- **Get**=*FileName* -- download the file from the server to the client (the phone/tablet)
- **Put**=*FileName* -- send the file from the client (the phone/tablet) to the server
- **ServerPath**=*Path* -- change the path on the server for the **Get** and **Put** commands that follow
- **ClientPath**=*Path* -- change the path on the client (the tablet) for the "**Get**" and "**Put**" commands that follow
- **CreateServerPath**=*Path* -- create a new directory on the server (FTP or Dropbox)
- **CreateClientPath**=*Path* -- create a new directory on the client (the phone/tablet)

This is a client-server model where the tablet is the client and the server is either Dropbox or an FTP server. The client issues commands to transfer files and the server responds by receiving or sending files. Get commands copy files from the server to the client and Put commands copy from the client to the server.

For example, the following commands will copy the file "PophousCensusData.dat" from the directory "CSEntry/PophousCensus" on the phone/tablet to the directory "/PophousCensus/data" on the server.

```
[Sync]
ServerPath=/PophousCensus/data
ClientPath= /PophousCensus
Put=PophousCensusData.dat      // The data file is placed on the Server
                               // in the /PophousCensus/data folder
```

For commands that change the directory (**ClientPath**, **CreateClientPath**, **ServerPath**, **CreateServerPath**), if the path does not begin with "/", the specified path is concatenated with the existing path. For example instead of using the single ServerPath=/PophousCensus/data above we could have used the following two commands to get the same result:

```
ServerPath=/PophousCensus
ServerPath=data
```

In addition to these commands, the **.PNC** file must also include information about the server being connected to. For Dropbox, it is sufficient to indicate that the connection type is Dropbox:

```
[Connection]
Type=Dropbox
```

For FTP, you need to add the server URL, user name, and password:

```
[Connection]
Type=FTP
Host=ftp: //ftp.example.org/
Username=myname
Password=password123
```

Complete the **.PNC** file by adding a section at the beginning with the version. The complete file is listed below.

```
[SyncFile]
Version=CSPro 6.1

[Connection]
Type=Dropbox

[Sync]
ServerPath=/PophousCensus/data
ClientPath=/PophousCensus
Put=PophousCensusData.dat
```

To add this synchronization to the Synchronize Menu on the tablet, use the same method as used to add the synchronization from the .PFF file:

- Copy the **.PNC** file to the Dropbox folder, FTP server, or to the phone/tablet via the USB connection.
- Select “Synchronize” from the drop down menu
- Select “Add New"
- Choose the server where you have placed the file or choose My Device if it is on the phone/tablet
- Choose the location of the **.PNC** file

CSPro connects to the server and finds the **.PNC** file. The synchronization is now in the Synchronize Menu.

Once the synchronization is added to the Synchronize Menu, the **.PNC** file is no longer needed. It is copied to a hidden directory on the tablet that is secured to prevent the discovery of passwords. Any changes to the original **.PNC** file will have no effect on the synchronization. To modify an existing synchronization you need to repeat the process of adding a it in order to replace the existing version.

In the first section of the file we can also add a description:

```
Description=Synchronize Pophous Census Data
```

This description will be displayed on the screen while performing synchronization.

In this example, we want to synchronize our application with Dropbox. We need to send our data file (**PophousCensusData.dat**) to the server and download the files **PophousCensus.PFF** and **PophousCensus.PEN** from the server to the tablet.

All the files of the application are in the directory "**CSEntry/PophousCensus/**" so we'll use it as **ClientPath**. We will place the **.PEN** and **.PFF** files in the directory "**SyncPopHousCensus/app**" in Dropbox so it will be the "**ServerPath**" for "**Get**". We will place the data files in the directory **"/SyncPophousCensus/data**" so it will be the "**ServerPath**" for the "**Put**".

```
[SyncFile]
Version=CSPro 6.1
Description=Synchronize Household Survey application with Dropbox

[Connection]
Type=Dropbox

[Sync]
CreateClientPath=/PophousCensus
ClientPath=/PophousCensus
ServerPath=/SyncPophousCensus/app
Get=PophousCensus.PEN
Get=PophousCensus.PFF
ServerPath=/SyncPophousCensus/data
Put=PophousCensusData.dat
```

If multiple users use this synchronization, the second synchronization will replace the file first sent. To avoid this problem, specify different directories on the server for each user. %Date%, %DateTime%, %DeviceID%, or %UID% can be included in the directory name.

- %Date% -- is replaced by the date
- %DateTime% -- is replaced by the date and time
- %UID% -- is replaced by the name of the tablet user
  (this comes from the e-mail used to configure the tablet)
- %DeviceID% -- is replaced by the system generated unique ID of the device

For example, if the user name is "Tailo" and we change the "ServerPath" in our **.PNC** file as follows:

```
ServerPath=/SyncPophousCensus/data/%UID%/
Put=PophousCensusData.dat
```

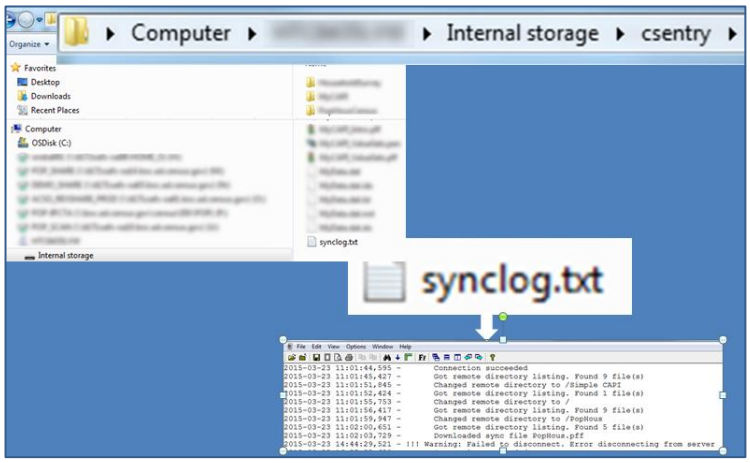
the file will be placed in the directory:

```
/SyncPophousCensus/data/Tailo/
```

It may be that this folder does not exist in which case you will get an error when your synchronization tries to copy a file into it. To avoid this, add the command “CreateServerPath” to create the folder:

```
CreateServerPath=/SyncPophousCensus/data/%UID%/
ServerPath=/SyncPophousCensus/data/%UID%/
Put=PophousCensusData.dat
```

If you ever have problems with synchronization, you can view the **synclog.txt** file in the CSEntry directory. This file contains a detailed log of all files transferred and all errors encountered during synchronization.



When do changes to the .PNC file take effect?

When changes are made to the .PNC file, they do not affect existing synchronizations added using that .PNC file. This is because when a new synchronization is added via “Add new” from the synchronize menu, the .PNC file is copied into secure storage on the device and only the copy is used when the synchronization is run. In order to modify an existing synchronization, you need to replace it by repeating the process of adding it. From the synchronize menu, choose “Add new” and locate the modified .PNC file in order to replace the existing synchronization with the modified version.

Group Exercise: Synchronization Race

Form teams of 3 or 4. Each team will need an Android tablet/phone and a computer. A USB cable to connect the computer to the Android device is not strictly needed but will give you an advantage. The instructor has a CSPro application on an FTP server. Each team must download this application onto their Android device, run the application and enter data and then use sync the send data that they entered back up to the FTP server into the correct directory. The first team whose data file arrives wins the race.

Here are the steps that each team must follow:

1. Connect your Android device to the Wi-Fi network cspro1 or cspro2. **THIS WILL NOT WORK IF YOU ARE CONNECTED TO ANY OTHER NETWORK!**
2. Use Sync to download the following files from the FTP server onto your Android device:
   - race.pff
   - race.pen

These files will be in the directory */race/app* on the server.
You should save them in the directory *csentry/race* on your Android device.

The FTP server details are:
Host: 192.168.10.103
Username: race
Password: CSProSync2015

2. Run the data entry application named "race" that you just downloaded. Complete the entire questionnaire and save the case.

3. Use sync to upload the data file containing the data that you just entered to the FTP server. You should send the two files:

- race.dat
- race.dat.not

They should be put in the directory */race/results/%UID%/* on the server. Any data files that are not in the correct directory on the server **DO NOT COUNT**.

Synchronization via Bluetooth

Using synchronization, you can exchange files between phones/tablets using Bluetooth even without an internet connection. In this scenario, one device takes the role of "Server" and the other is the "Client". Only the client issues **Get**, **Put**, **ClientPath**, and **ServerPath** commands.

On the client device, the only difference in the **.PNC** file for Bluetooth synchronization is the type of connection ("Bluetooth") and the addition of the ServerDeviceName indicating the name of the other tablet/phone that is acting as the server:

```
[Connection]
Type=BluetoothServer
ServerDeviceName=MyBluetoothServer
```

The server tablet will also have a **.PNC** file with a connection type of "BluetoothServer" and without any "**Get**" or "**Put**" commands. This is because all commands are initiated only on the client.

```
[SyncFile]
Version=CSPro 6.1
RootFolder=/sdcard/CSEntry/FilesToSynchronize
[Connection]
Type=BluetoothServer
```

The **RootFolder** line specifies the path on the tablet from which files are shared.

That is, that the path specified by the "**SetServerPath**" command is concatenated with the **RootFolder** to establish the full path on the server.

For example, say we want to use Bluetooth to copy data from the enumerator's tablet to the supervisor's tablet. On the enumerator's tablet, we have a data file "PophousCensusData.dat" in the "CSEntry/PophousCensus" folder. On the supervisor's tablet, we would like to place this file in the folder "CSentry/PophousCensus/ReceivedFromEnumerator/%UID%/". We can use:

- **CSentry/PophousCensus/ReceivedFromEnumerator/**-- as the root folder on the server
- **%UID%/** -- as the server path on the client

For the "Client" (the enumerator's tablet) we have:

```
[SyncFile]
Version=CSPro 6.1
Description=Send data to the supervisor

[Connection]
Type=Bluetooth
ServerDeviceName=Supervisor
```

*{The **ServerDeviceName** is the device name of the Android device. You can get this name by navigating to the Android device home screen and tapping on "Settings"->"Bluetooth" and choosing "Rename this device" or "Edit device name" from the menu}*

```
[Sync]
ClientPath=/PophousCensus
CreateServerPath=/%UID%/
ServerPath=/%UID%/
Put=PophousCensus.dat
```

For the "Server" (the supervisor's tablet) we have:

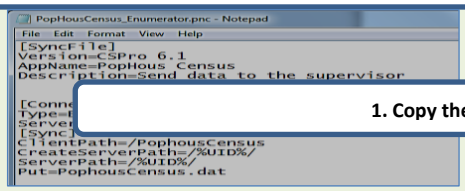
[SyncFile]
Version=CSPro 6.1
Description=Receive Data from Enumerator
RootFolder=/mnt/sdcard/CSentry/PophousCensus/ReceivedFromEnumerator

[Connection]
Type=BluetoothServer

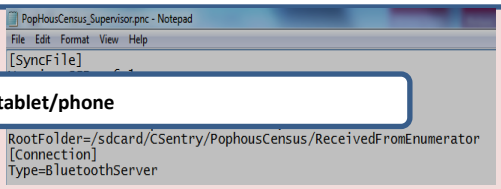
Creating the synchronization:

Client
Enumerator's Phone/Tablet

Server
Supervisor's Phone/Tablet

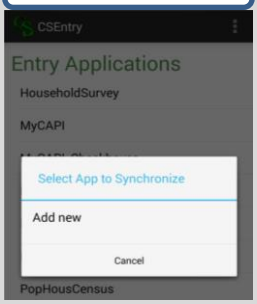


1. Copy the .PNC files to the respective tablet/phone

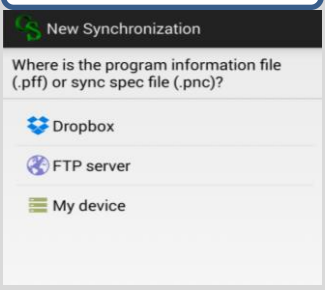


2. Select "Synchronize" from the Menu

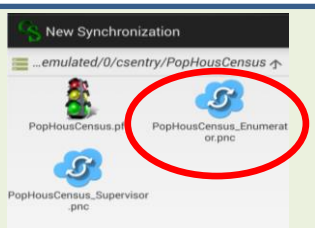
3. Select "Add New"



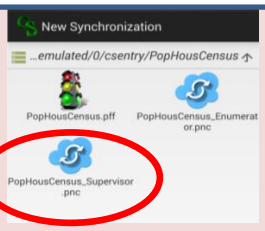
4. Select "My device"



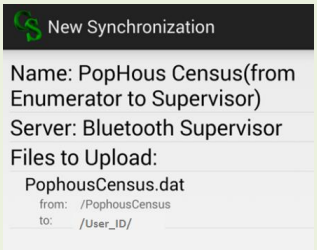
5. Select the .PNC file for the Enumerator



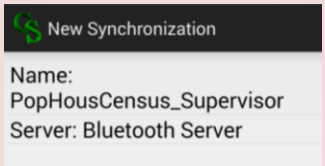
5. Select the .PNC file for the Supervisor



6. Synchronization is created for the enumerator



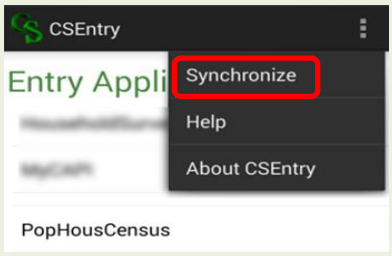
6. Synchronization is created for the Supervisor



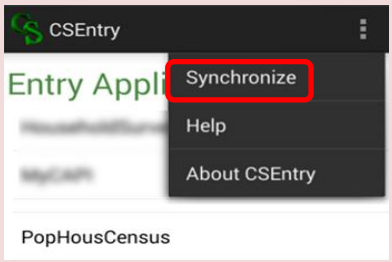
To synchronize:

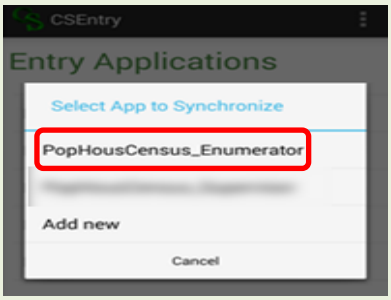
Client
Enumerator's Phone/Tablet

Server
Supervisor's Phone/Tablet

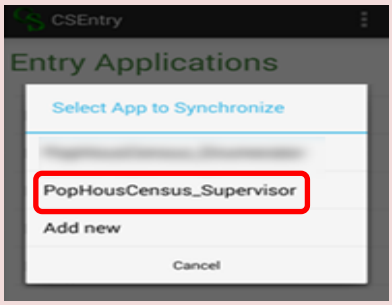


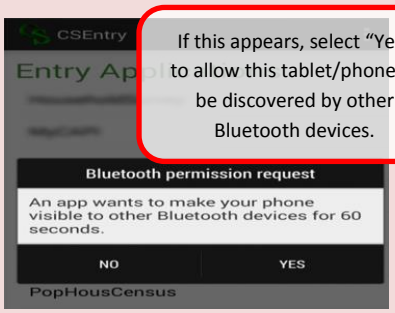
1. Select synchronize from the menu



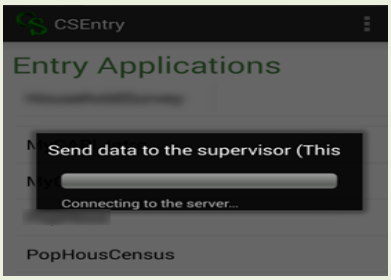


2. Select the App to synchronize
(The name is from the ***.PNC*** *file)*



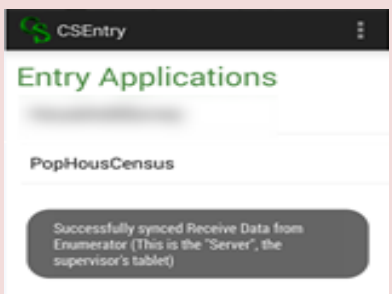


If this appears, select "Yes" to allow this tablet/phone to be discovered by other Bluetooth devices.



3. The Bluetooth devices connect and are synchronized bases on the specifications in the **.PNC** file

4. "Successful completion" message issues once the synchronization is complete



Group Exercise: Bluetooth Sync

Form teams of 3 or 4. Use the same tablet/phone you used for the sync race plus another Android device that does NOT have the sync race files on it. Write the synchronization spec (.PNC) files required to transfer the files *race.pen*, *race.pff*, *race.dat* and *race.dat.not* from the first device to the other using Bluetooth. Run the race application on the tablet that it was just transferred to and open the existing case in modify mode to make sure that the data matches what is on the first tablet.

Synchronization in Logic

You can launch synchronizations in CSPro logic using the **sync(***file-name***)** function which takes the name of the synchronization file (.PNC).

If file-name is a full path, the synchronization will look for the file in the specified path. Otherwise it looks for the .PNC file in the same directory as the **.PEN** file and if it does not find it there it searches for it among the .PNC files that are installed in the synchronization menu.

> **sync(***file-name,* Queue**)** has an optional second argument "queue" that will wait to start the synchronization after data entry is complete. This can be useful because during data entry the questionnaire being entered is not yet saved. Queue tells the **sync** function to synchronize after the questionnaire has been saved.

```
PROC SURVEY_QUEST
postproc
// Launch synchronization
sync("SyncSurvey.pnc", queue);
```

Concatenating Files

One the data files from the different interviewers devices have been received on the server we need to combine them together to make a single data file that can be used for editing and export. To do this we the Concatenate Data tool from the CSPro tools menu. To run a concatenation we need to choose the name of the output and then the names of all the input files and then hit run.

Once you have done a concatenation is useful to run a quick frequency using the CSPro Tabulate Frequencies tool to verify that you have total number of cases that you believe you should. This will also tell you if you have duplicate cases due to more than once case with the same id-items.

If you are repeating the same concatenation multiple times you can automate the process using a .PFF file. When you run the Concatenate Data tool, a .PFF file is automatically generated for you in the same directory as the output file that you chose. You can right click on this file and choose edit to view and modify the list of files to concatenate. Double clicking on the .PFF file will run the concatenation automatically based on the list of files in the .PFF file. This way you don't have to choose the files a second time.

Exercises

1. Add a button on the userbar in the survey application that will automatically upload the data file and the notes file to Dropbox. You will need to first write a synchronization specification file for

the synchronization and install it on your Android device using Synchronization→Add new. Your synchronization should upload the files Survey.dat and Survey.dat.not from your Android device to the following folder in your Dropbox:

Dropbox/CSProAndroidNairobi2015/07 - Synchronization/Exercise1/%UID%

Once your synchronization is working, add a userbar button to launch it. You will need to use the *sync()* function in logic.

2. In the Dropbox folder for today's lesson you will find a folder named *Exercise2/datatoconcat*. Use the Concatenate Data tool to concatenate all the data files in this folder and its subfolders. Use Tabulate Frequencies tool to make sure that the total number of cases is 50 and that are no duplicate cases.