Introduction

To compare the buildings at the Camperdown campus, a DataFrame will be constructed where each row will correspond to some building and the appropriate measures taken from the USYD_Wifi and the USYD_Buildings will be attached in corresponding fields in the collumns. The “WifiBuildings” dataframe will be constructed via the Rscript located in the appendix. In order to construct other measures, a “WifiUsers” dataframe will also be constructed mapping the orderings of destinations for each user (containing a column with non-unique sequencing and also a column with unique sequencing).

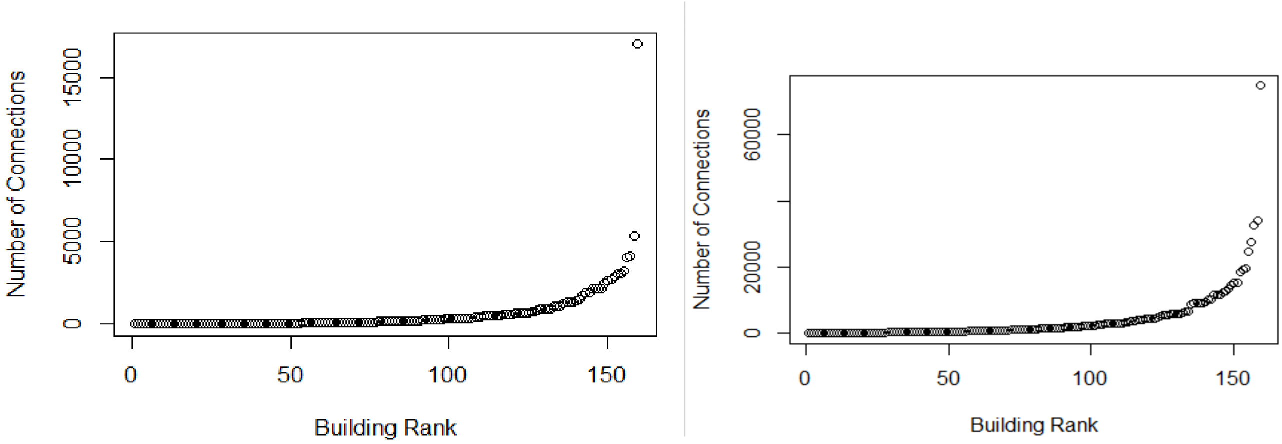
For each map, the points of each building will be plotted via the r, base function plot() with the “x” column as the latitude and the “y” column as the longitude. Each building point will be plotted on the graph as circle with size (using the parameter “cex”) will be scaled as the ratio relative to the arithmetic mean of that field.

The data for the maps will include all devices as well as both staff and students. For many of the maps, 82 buildings will be included and the geographical parameters will be:

$-33.97 < \text{Longitude} < -33.82$
$151.179 < \text{Latitude} < 151.97$

1

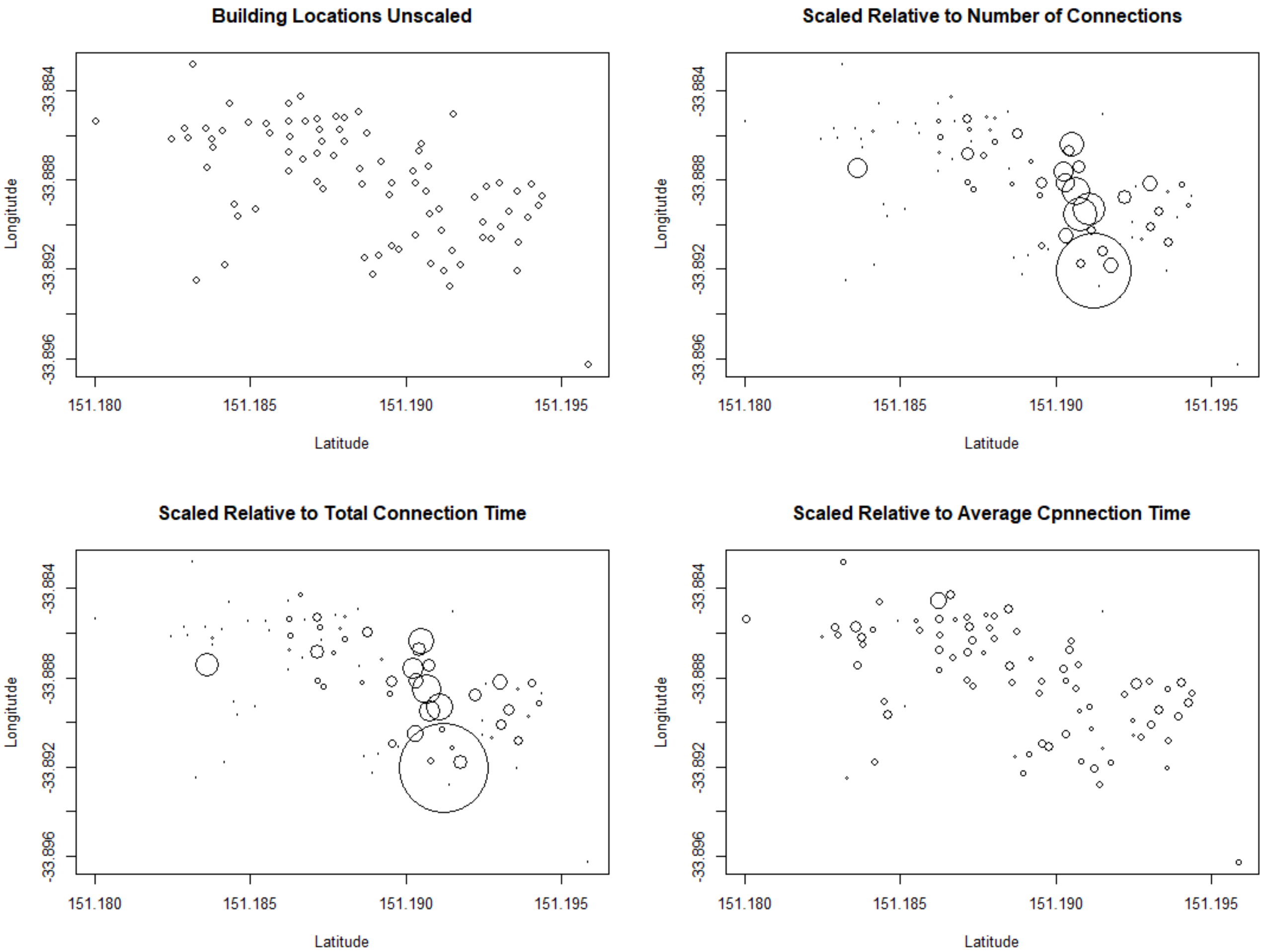
The data being analysed: Wifi data filtering for only students and only durations greater than 30 minutes. The number of connections peaks at 16971 for H70 Abercrombie, three times more than the second most frequent f07 Carslaw.



When one considers all connections from everyone from any duration the ordering changes

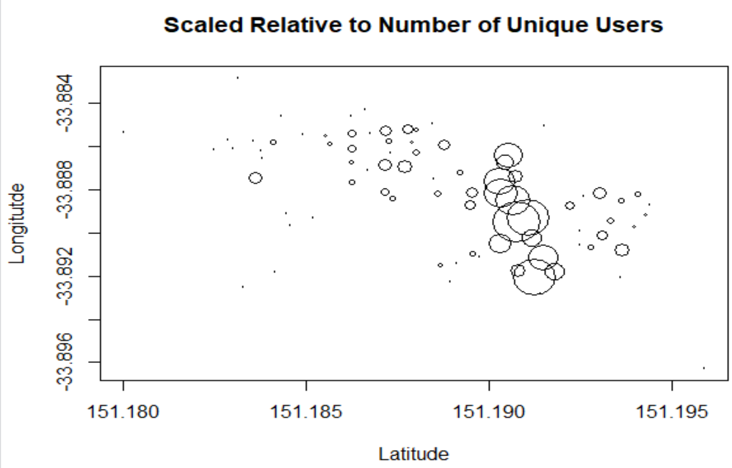
g01 SRC and g02 Wentworth both come between Carslaw and Abercrombie.

The wifi data and the building geometry data were then compiled such that each geometry location had wifi specific information such as number of connections, total time of connection and average



time of connection. As some of the building codes were missing from each of the wifi and building data sets, only the building codes that existed in both tables were taken for analysis. The buildings being analysed were those on and around the Camperdown campus.

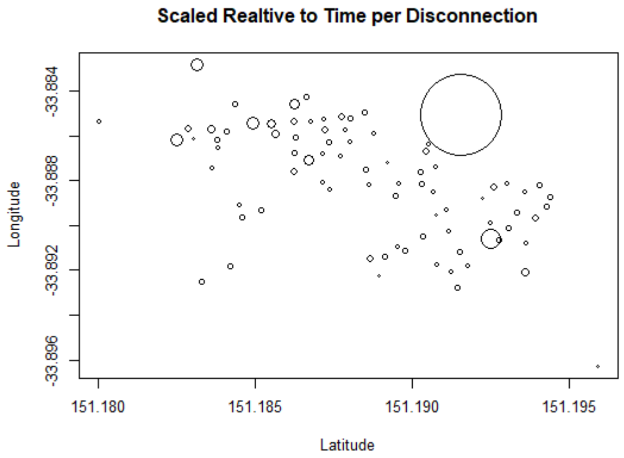
The Circles represent the buildings under analysis and the size of the circles are proportional to the relative magnitude of the measure.
The graphs seem to suggest that the Eastern Avenue buildings, Wentworth and Abercrombie all have a lot of passing by foot traffic without significantly more extended periods as the average connection time does not appear disproportionate.

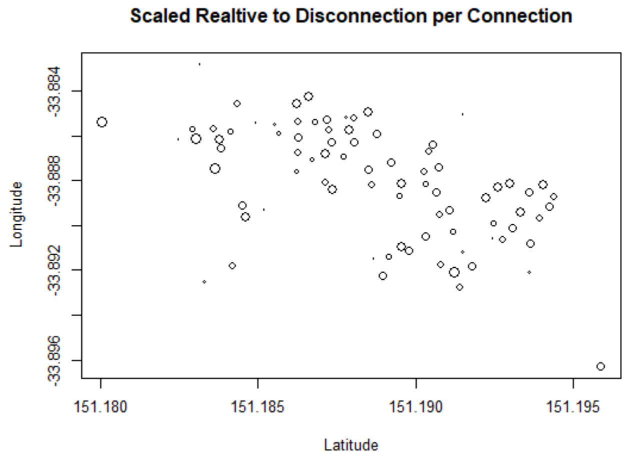


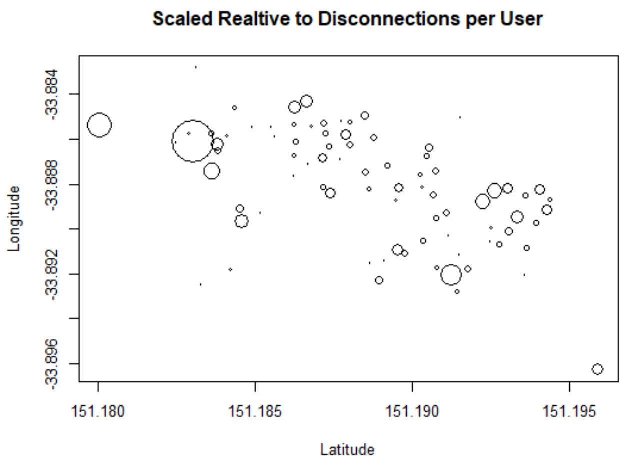
When scaled relative to the number of unique users, the map indicates that Abercrombie does not receive the same number of unique users as would have been expected, Wentworth gets the highest number of unique users indicating it actually receives the most foot traffic. All Buildings along eastern avenue maintain their dominance.

One interesting feature is that the average connection time at K01, the Mackie Building is on average 46 minutes, a little over 40% more than the second highest, 32.77 minutes at G06A the WH Maze Building. The Mackie Building has the 4th lowest connection count at 89 suggesting that people passing by is infrequent and people purposefully travel there.

The excessive foot traffic that occurs around Abercrombie is potentially a result of poor public transport networks coercing university members into travelling via the Redfern Station train.







The maps above show relatively little variance in the measure of disconnection per connection, however time per disconnection has an outlier at building f02, Baxter's Lodge which has an average time of 485.7 minutes before a disconnection occurs which is incredibly stable at over 300% more than the second highest time per disconnection is j14, Gordon Yu-Hoi Chiu Building at 116.3 minutes.

As the average connection time at f02, Baxters Lodge is 5.4 minutes, this suggests that users will walk past an connect then continue past without reconnecting a second time in a row (which is the given measure for disconnects). The high value of the "time per disconnect" measure is not seen in the surrounding buildings. This may suggest that many students enter or exit from the nearest gate to Baxters Lodge, however will often come or go from differing direction indicating that many students may choose to walk through Victoria park rather than go past Fisher Library or the New Law building/library.

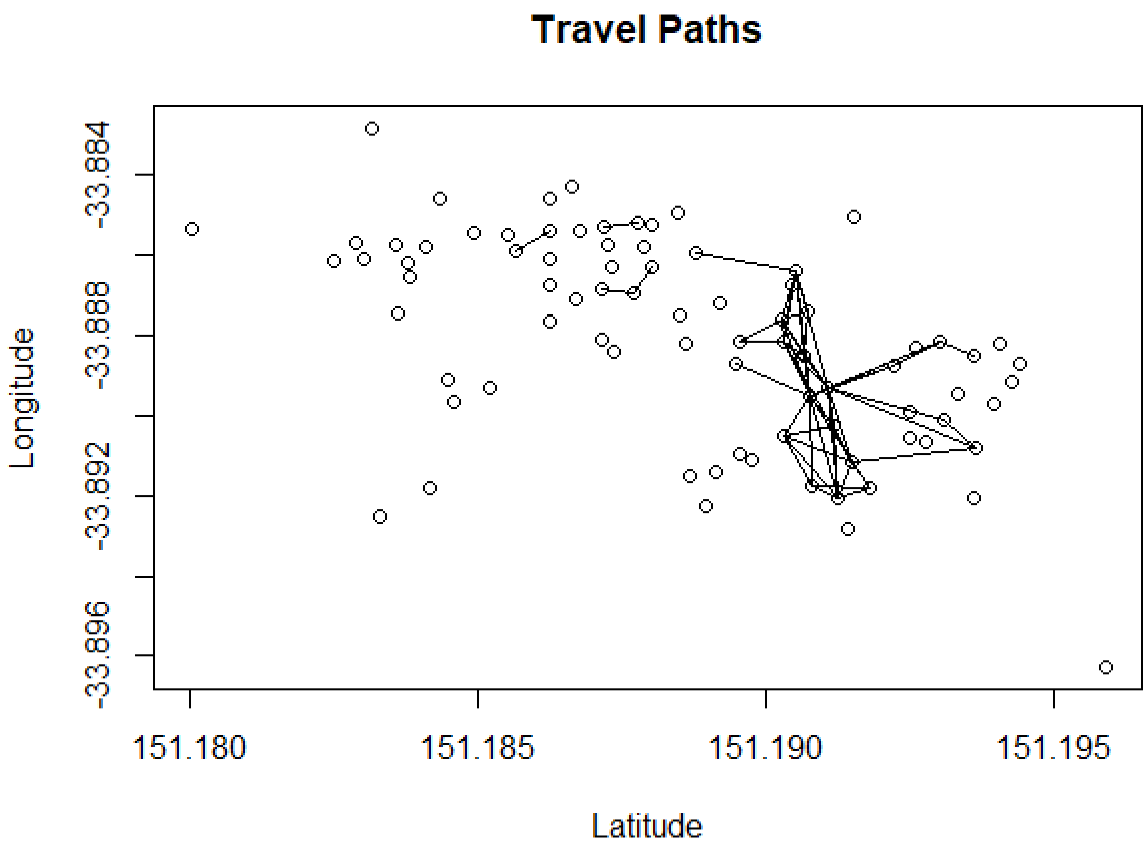
The highest amount of disconnects per user occurs at b10, Evelyn Williams Building at 13.9 disconnects per user and k25, Medical Foundation Building at 8.3 disconnects per user. Both of these buildings have an average connection time of 19.7 and 23 respectively implying that many users are not leaving these buildings between connections and are either purposefully disconnecting or the wifi is dropping out frequently.

The Wifi data was ordered chronologically and the sequence of connections for each user was mapped. Wifi Data with Null values in the "building" field were excluded, reducing the number of Wifi data points to 662845 from the original 678390. The number of buildings being considered in this analysis set is 82.

If sequential Wifi Connections from the same user were at the same building, one could consider this as disconnect and reconnecting which may be an indicator of instability in the network or of high relocating within the same building.

An 83 by 83 Data Frame was created with each cell representing the number of movements from the "Source" building in the rows to the "Destination" Building in the columns. The 83rd Row is the number of times the building in the respective column is a destination and the 83rd column is the number of times the building in the respective row is a source.

The travelling paths were then mapped, only considering those paths with over 500 trips and with width log scaled.



From the above map, one can see that the overwhelming majority of journeys taken are through the main eastern avenue walkway and through down towards Abercrombie. There are also some frequented paths up City Road.

The most common source and destination buildings are g01 and g02, Wentworth and the Jane Foss Russell Building.

__2__

- **Problem:**

  High amounts of disconnects per user are occurring in buildings b10 and k25.

- **Solutions:**
- **1.** Upgrade wifi infrastructure if problem is deemed to be on the router end.

- **2.** Increase surveillance, security or number of classes in the buildings if users are purposefully disconnecting in order to take their laptop with them as they move within the building to access food or water or bathroom.

3

As the number of unique users for each building b10 and k25 are 149 and 183 respectively, compared to the average of 1887 for the buildings being assessed, it is possible that there are not enough students in these buildings to provide students the sense of security for their belongings. This suggests that the problem does not lie with the wifi infrastructure but rather that students are purposefully shutting down their laptops and bringing their possessions with them as they perform tasks such as eating, drinking or frequenting the bathroom. This suggests that Solution 2 would be a more efficient solution as it would likely fix them problem and merely requires more classes to be hosted in the respective buildings rather than implementing any non-zero cost infrastructure or employment.

UNIT OF STUDY	ITLS	6	1	0	7	STREAM	
STUDENT NAME							
STUDENT NUMBER							

MARKING CRITERIA

ASSIGNMENT 2: 6 pages including title page, maps, tables and any appendices.
Note: Pages in excess of the page limit will not be marked.

CATEGORY	CRITERIA	WEIGHT	MARK	COMMENTS
Introduction, Objectives, Methods	Clear description of what you are trying to do and how you are doing it	5%		
Task 1	Analysis of the current situation including the R map	40%		
Task 2	Identification, analysis and evaluation of your possible options	30%		
Task 3	Final recommendations including how persuasive your argument is.	10%		
Readability/Style	Report structure, extent to which it reads as one coherent document, spelling and grammar	15%		
TOTAL MARK		**100%**		**GRADE:**
Comments:				

Appendix:

```
###Counts number of wifi connections per building

for (i in 1:678390){
	if(!is.na(USYD_Wifi[[i,17]])){
		WifiBuildings[[as.integer(match(USYD_Wifi[[i,17]],WifiBuildings[[2]])),4]] =
WifiBuildings[[as.integer(match(USYD_Wifi[[i,17]],WifiBuildings[[2]])),4]] + USYD_Wifi[[i,12]]
	}
}

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###Attatching geometry to the Building+Wifi Data Framne

for(i in 1:159){
	if(!is.na(match(WifiBuildings_sf[[i,1]],USYD_Buildings_sf[[29]]))){
		WifiBuildings[[i,5]] =
USYD_Buildings_sf[[match(WifiBuildings[[i,1]],USYD_Buildings_sf[[29]]),30]]
	}
}

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###Adds a list of sequential locations of each user
### 662845 is the number of connections in the wifi data with an associated building

for(i in 1:662845){
	if (is.na(match(USYD_Wifi_sf[[i,2]],WifiUsers[[1]]))){
		WifiUsers[[match(0,WifiUsers[[1]]),1]] = USYD_Wifi_sf[[i,2]]
	}
	WifiUsers[[match(USYD_Wifi_sf[[i,2]],WifiUsers[[1]]),2]] =
c(WifiUsers[[match(USYD_Wifi_sf[[i,2]],WifiUsers[[1]]),2]],USYD_Wifi_sf[[i,17]])
}

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###Calculates Number of disconnects for each building location

for(i in 1:42240){
	if(length(WifiUsers[[i,2]]) >= 2){
		for(j in 2:length(WifiUsers[[i,2]])){
			if(WifiUsers[[i,2]][[j]] == WifiUsers[[i,2]][[j-1]]){
				if(WifiUsers[[i,2]][[j]] %in% WifiBuildings_sf[[1]]){
					WifiBuildings[[match(WifiUsers[[i,2]][[j]],WifiBuildings[[1]]),7]] =
WifiBuildings[[match(WifiUsers[[i,2]][[j]],WifiBuildings[[1]]),7]]+1
				}
			}
		}
	}
}

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###Sets Unique Building Connection Order for each User

for(i in 1:42240){
	WifiUsers[[i,3]] = c(WifiUsers[[i,3]],WifiUsers[[i,2]][[1]])
	if(length(WifiUsers[[i,2]]) >= 2){
		for(j in 2:length(WifiUsers[[i,2]])){
			if(WifiUsers[[i,2]][[j]] != WifiUsers[[i,2]][[j-1]]){
				WifiUsers[[i,3]] = c(WifiUsers[[i,3]],WifiUsers[[i,2]][[j]])
			}
		}
	}
}

###

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###Counts number of unique users in each building

for(i in 1:42240){
	for(j in 1:82){
		if(WifiBuildings[[j,1]] %in% WifiUsers[[i,3]]){
			WifiBuildings[[j,10]] = WifiBuildings[[j,10]]+1
		}
	}
}

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###Set up a "Source" and "Destination" DataFrame with 0 for each element; Source = Row, Destination = Col

SourceDest = data.frame(1:82)
for(i in 1:82){
	SourceDest[[i]] = 0
}
colnames(SourceDest) = WifiBuildings[[1]]

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###Add number of trips from source to destination; Source = Row, Destination = Col

for(i in 1:42240){
	if(length(WifiUsers[[i,3]]) >= 2){
		for(j in 2:length(WifiUsers[[i,3]])){
			if((WifiUsers[[i,3]][[j]] %in% WifiBuildings[[1]]) && (WifiUsers[[i,3]][[j-1]] %in%
WifiBuildings[[1]])){
				SourceDest[[match(WifiUsers[[i,3]][[j-
1]],WifiBuildings[[1]]),match(WifiUsers[[i,3]][[j]],WifiBuildings[[1]])]] = SourceDest[[match(WifiUsers[[i,3]][[j-
1]],WifiBuildings[[1]]),match(WifiUsers[[i,3]][[j]],WifiBuildings[[1]])]] + 1
			}
		}
	}
}

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###Adds total number of times each building is a source and a destination to the SourceDest dataframe

SourceDest[[83]] = 0
for(i in 1:82){
	SourceDest[[i,83]] = sum(SourceDest[i,])
}
SourceDest[83,] = 0
for(j in 1:83){
	SourceDest[83,j] = sum(SourceDest[[j]])
}

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###Computes ratio of how often the building is a source to how often it is a destination and the inverse

for(i in 1:82){
	WifiBuildings[[i,12]] = as.numeric(SourceDest[[i,83]])/as.numeric(SourceDest[[83,i]])
}

for(j in 1:82){
	WifiBuildings[[j,13]] = as.numeric(SourceDest[[83,j]])/as.numeric(SourceDest[[j,83]])
}

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###Adds lines between destinations with line width scaled relative to number of journeys between the two destinations

for(i in 1:82){
	for(j in 1:82){
		if(SourceDest[[i,j]]+SourceDest[[j,i]] >= 500){
			segments(WifiBuildings[[i,5]],WifiBuildings[[i,6]],x1 = WifiBuildings[[j,5]], y1 = 
WifiBuildings[[j,6]], lwd = log(SourceDest[[i,j]]+SourceDest[[j,i]], base = 500))
		}
	}
}

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