

Design Project FAQ

6.033 2016

Last update: 3/16/2016, 12:30pm

Questions about General Communication

- **Can clients communicate with each other?**

A client could send packets to the broadcast address, and every device (APs and clients) in range would hear them. A client could send a frame with the dst addr set to that of another client (assuming it was able to get that address). If that second client was in range and using the same channel, it would process it the frame.

- **Can AP's communicate with each other?**

They could use channel 12 (in this case sending and receiving APs can't be using their specific data channels).

They could also use the wired network, but note that it would require you to learn the AP's IP addresses, which IS&T doesn't have initially. So your system would need to define how that happens.

- **Can clients communicate directly with IS&T?**

Their only Internet connection is via the AP. They can communicate with IS&T by sending data over that connection, but they don't have a direct secondary link to IS&T.

- **Can APs communicate simultaneously with the server over the wired network while also communicating on their data or broadcast channels?**

Yes.

- **Will clients always send a disconnect message when they leave?**

If you want clients to send such a message, you will have to specify that in your protocol (as well as how the AP should respond, if at all). But it is certainly possible that a client may exit the system "ungracefully" (e.g., a user's laptop crashes), although that is not the common case.

Questions about Wireless Channels and Heartbeats

- **Why are there so many channels?**

Each AP can use one data channel and the broadcast channel. There are many channels to ensure that there aren't a lot of collisions on any single channel.

- **Can an AP send and receive on multiple channels simultaneously?**

No.

- **Can clients listen on all channels?**

A client can listen on any of the 12 channels, but only on a single channel at any given time (i.e., it can't listen on all twelve at once).

- **What is channel 12 *for*?**

Whatever you want!

- **Why is there a “broadcast channel” but also the ability for APs to broadcast on their data channels?**

Wireless is a broadcast medium, and so an AP can broadcast on any channel. Channel 12 is reserved exclusively for broadcasts; data channels can be used for point-to-point communication (AP sends to a specific client MAC address, e.g.) or for broadcast (AP sends to FF:FF:FF:FF:FF:FF).

- **Since only control data can be communicated on channel 12, does that mean that clients connected to an AP that for some reason switches to channel 12 are essentially left without Internet?**

Yes, for the time period that that AP is using channel 12. So if you use channel 12, you'd want to keep this time period short.

- **Do we have to worry about collisions on channel 12?**

No. Assume that the link-layer reliability protocol in place on the data channels also exists on channel 12.

- **Can we change the heartbeat messages?**

No. They're meant for AP discovery, and so need to be as small as possible -- think of them as being a frame that contains zero data.

You can have your APs broadcast data via sending to the broadcast address or via using channel 12, but you should design a separate mechanism for this rather than piggybacking onto the heartbeats.

- **How long does it take for a client to switch channels?**

Assume that it can take up to 5ms.

Questions about Signal Strength

- **Can 802.033 clients measure the signal strength?**

Yes. We've updated the DP write-up to reflect this.

- **How does signal strength related to throughput?**

For this project, assume it doesn't. The client's throughput will be affected by congestion at the AP, though.

- **So should we ignore signal strength?**

We're not limiting your design in this regard, so you can do whatever you want with it. But recall the motivation of the project: clients want to connect to an AP that gives them adequate throughput, and this is *not* necessarily the AP with the best signal strength.

Question about Geolocating the Clients

- **How can there be no acceptable APs in range of the client while there is an acceptable AP within 500ft?**

The average range of an AP is only 125ft; an AP that is 500ft away from a client is almost certainly not in its range. Your system will need to figure out that the client exists with 500ft of some AP.

- **How do we direct the user to a new AP?**

It's okay to tell them a reasonably useful position (say, building number and room number, rather than GPS lat and lon).

- **Do we know the exact location of the user?**

You know, presumably, what AP they are communicating with, and IS&T knows the location of each AP (section 4.4 in the write-up).

- **What do we do with a user that is only in-range of a single AP (which might make that user's location more difficult to pinpoint)?**

We updated the DP write-up to clarify this point: assume that if there's an acceptable AP within *approximately* 500ft of the client, then your system should recommend it. You don't need to do super-accurate client geolocation.

- **What about if there is no APs at all in-range of the client?**

Then that client isn't even part of the system! Don't worry about that case.

Questions about User Unhappiness

- **Are we allow to bandwidth-throttle users?**

Have we explicitly prohibited this? No. Are users going to be unhappy about it? Yes.

- **If a client is downloading a file, won't their desired throughput be infinite, and in which case, won't they always be unhappy?**

You can assume that a client never desires more throughput than an AP can possibly provide (i.e., no more than 54Mbit/sec).

- **The design project description states that we can assume that clients will wait at least 15 seconds between clicks. Can you clarify?**

The "clicks" there only refer to reports of unhappiness. The user will report unhappiness at most once every fifteen seconds. They may be interacting with applications (i.e., sending data to the APs) more frequently.

We just don't want you to have to deal with the degenerate case, where a user is unhappy with their service and mashes the "I'm unhappy!" button multiple times in a row before your system even has a chance to improve their service.

Miscellaneous

- **What is the size of a data frame in 802.033?**

Assume a reasonable size. For context, frames in 802.11 can be up to ~2300 bytes.

- **What is the processing power of the server?**

You can assume that it's a standard, modern server. If your design requires specific numbers, do a little bit of google-ing to come up with a reasonable estimate.

- **Can we assume that within a category (large or small), all clients have identical requirements?**

No.

- **Can and AP be congested when the total bandwidth it serves to clients is below its maximum capacity?**

For this project, we're concerned with clients being able to get their desired throughput. So if 128 clients were connected, and all able to achieve the amount of throughput that they need, then no, I would not consider that congested.

You might find other problems in this scenario, though. For example, that AP might be underutilized (not transporting much traffic as it is able), but since it's at the max number of connections, it can't increase its utilization by adding more users.

- **Why is the number of filters eight?**

In the real-world, this type of filtering is expensive and has to be done quickly. We've limited you to eight filters to reflect that.

- **Can we just set one filter to capture every frame?**

The AP can only process 150 frames per second in total from the filters. So you could have a filter that matched every frame, but you would most likely not be able to process every frame from that match.

- **Do the clients have storage?**

Yes. Assume the clients have a reasonable amount of storage for you to use.

- **What's the latency between the client and the AP?**

This will be different for each client, but anywhere from 1-10ms is a reasonable estimate of the round-trip-time between the client and the AP.

- **What is the value of G before the client has connected?**

Assume zero.

- **Do APs keep track of who is connected to them?**

Not initially, no. They keep track of how many clients are connected. Enforcing the total number of connections should be part of your system design, and if you want to keep track of which clients are connected, you'll need to design that part too.

- **Should we worry about misbehaving clients? E.g., a client who sends data through an AP that it's not "connected" to?**

No. Assume clients conform to the protocol that you are specifying.