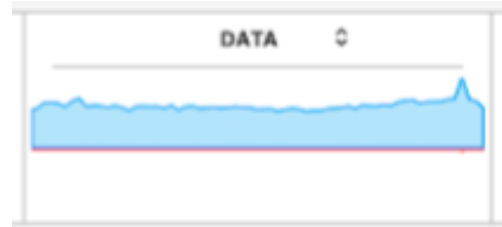


Airplay (referred to here as “Airplay 1”)

How streaming works ...

- “real-time” streaming mode
- fixed 2 sec buffer, delays playback start/stop
- sender gets app audio, transcodes and transmits continuous ALAC stream to receiver
- (example graph, network traffic at MacOS receiver)



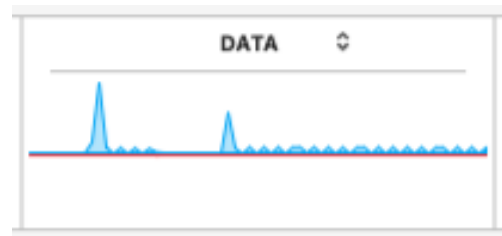
User experience ...

- higher battery usage vs Airplay 2 (continuous network transmit)
- 2 sec delay perceived as slow app response
- more prone to dropouts during playback (limited/fixed buffer)
- lossless ALAC (CD quality, if available from streaming service/server)

Airplay 2

How streaming works ...

- “buffered” streaming mode
- reduced delay for playback start/stop
- app/sender/receiver must ALL support Airplay 2 (else “real-time” streaming mode is used)
- sender gets app audio, transcodes to AAC 256 kbps
- sender transmits initial burst/buffer (~ 3 MB total, sent at ~ 10 Mbps) to receiver, then additional data (~ 320 KB) at 10 sec intervals, and more buffering at track breaks (or ~ 4 minute intervals during long tracks)



User experience ...

- lower battery usage vs Airplay 1 (lower duty cycle for network transmit)
- improved app response (shorter delay for playback start/stop)
- less prone to gaps/dropouts during playback (larger data buffer)
- buffered streaming limited to lossy AAC 256 kbps (reduced audio quality)

Airplay mode used by various streaming apps (as of May 2023) ...

Airplay 1 - Spotify*, Qobuz, Amazon, Deezer (?), Roon, Plex/Plexamp, Soundcloud*

Airplay 2 - Apple Music, Tidal, YouTube Music*, Bandcamp*, Prism (for Plex Media Server)

* = streaming service/app does not have lossless content

Compare various Airplay app/sender/receiver combinations ...

App support	Sender**	Receiver	Streaming mode	Max audio quality	Multi-room support
Airplay 1	Airplay 2	Airplay 1	Real-time	Lossless ALAC	No
Airplay 1	Airplay 2	Airplay 2	Real-time	Lossless ALAC	Yes
Airplay 2	Airplay 2	Airplay 1	Real-time	Lossless ALAC	No
Airplay 2	Airplay 2	Airplay 2	Buffered	Lossy AAC 256 kbps	Yes
Airplay 1 (Roon)	Roon core	Airplay 1 or 2	Real-time	Lossless ALAC	Yes
Airplay 2 (Apple Music, other?)	n/a (Handoff?)	Airplay 2 (Homepod, other?)	Buffered?	Lossless ALAC (CD+)?	?

** = excluding Airplay 1 senders here (uncommon/old/legacy devices?)

Why no lossless for Airplay 2 buffered streaming?

educated guess ... with lossless ALAC (> 3x bitrate vs AAC 256), the sender bitrate for initial multi-room buffering might be too large for an iOS device in a typical home wireless network environment ... might lead to issues such as audio dropouts (example ... ~ 30 Mbps peak buffering rate per room x 4 rooms = ~ 120 Mbps)

Notes on Airplay 2 receivers

- Airplay 2 receivers include current Apple devices and many third party devices
- shairport-sync is open source receiver software ... versions < 4.1 only support Airplay 1, versions ≥ 4.1 (Oct '22) support Airplay 2 ... type `shairport-sync --version` to confirm