Arbitrary Frequency Clock Stream Format

Ashley Butterworth
Apple Inc.

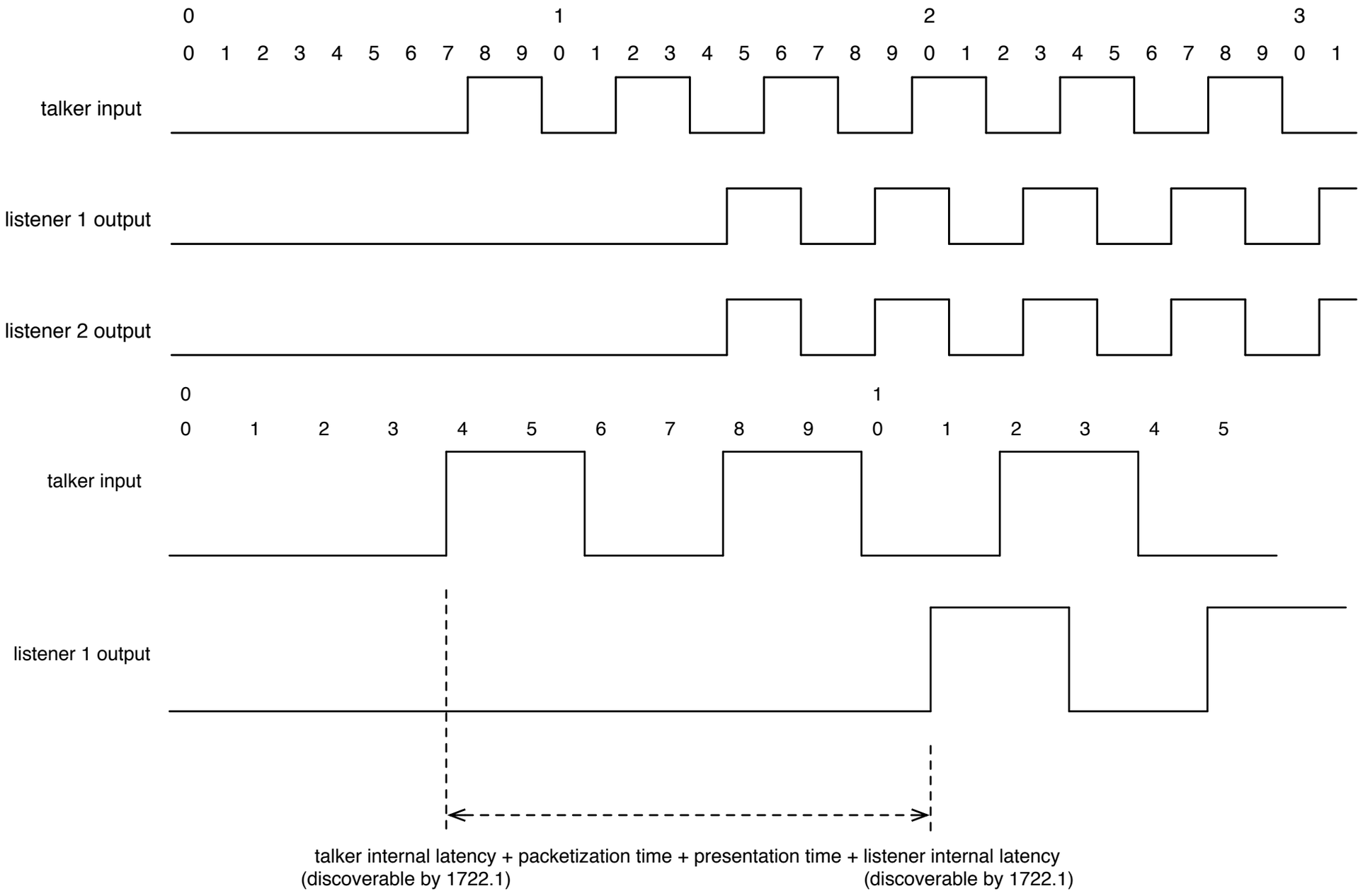
What is it

- A way to carry any arbitrary idealized digital clock across the AVB cloud
  - Generates a transposed version of the clock at all of the listeners
- Could also be used to carry an arbitrary binary input across the network

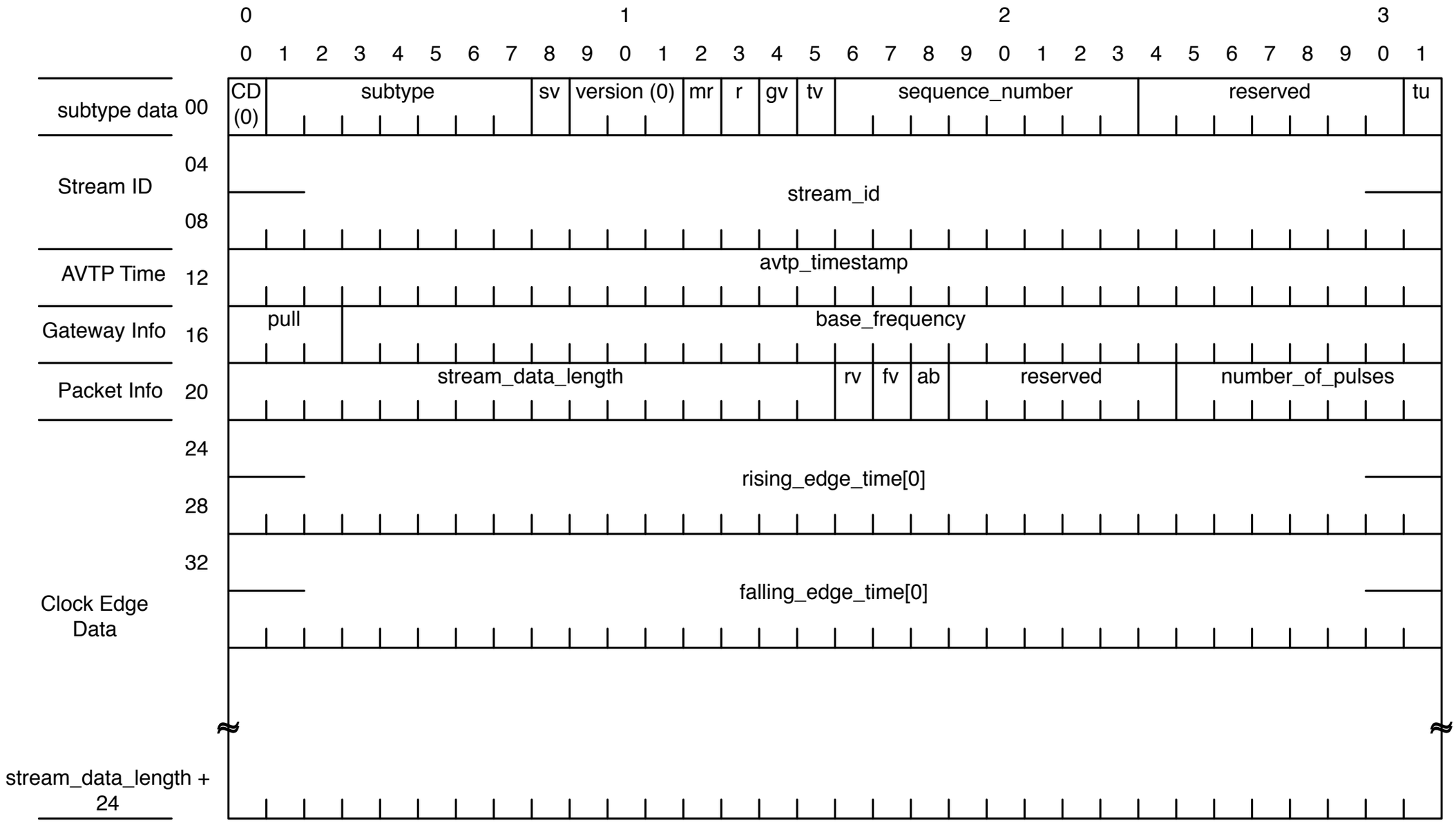
How it works

- Each stream frame carries one or more clock pulses as a set of two timestamps
  - One time stamp for the rising edge of the clock and one for the falling edge
  - Each timestamp is a 64-bit in nanoseconds gPTP based time of when the rising/falling edge of the clock crosses the listeners presentation time plane
- Source of the timestamps does not need to be a physical pin, it could be a counter within the talker

What the signals look like



Packet Format



The Fields

- gv, pull & base_frequency
  - The frequency of the clock signal
  - Same format as sampling rate in 1722.1
  - gv indicates if the pull & base_frequency contain a valid value
- tv & avtp_timestamp
  - tv is always 0
  - avtp_timestamp is not used

The Fields (cont)

- rv
  - first Rising edge time Valid, the first rising edge time in the packet contains a valid value
- fv
  - last Falling edge time Valid, the last falling edge time in the packet contains a valid value
- ab
  - Arbitrary Binary signal, rather than transporting a clock it is a single bit binary signal

The Fields (cont)

- number_of_pulses
  - The number of values (rising edge and falling edge times) contained in the frame
- rising_edge_time[N] the nth rising edge time (gPTP time of the low to high transition)
- falling_edge_time[N] the nth falling edge time (gPTP time of the high to low transition)

Timestamps

- Timestamps are in nanoseconds and based on the gPTP clock
  - similar to avtp_timestamp field but with more bits
  - $(AS\_sec \times 10^9 + AS\_ns)$ modulo 2^{64}

Pros and Cons

- Pros
  - Transports an arbitrary clock which could be used used for a media clock (but could be other clocks, such as GPS PPS, etc.)
  - Easily adapted (the ab flag) to carry an arbitrary single bit input
  - Easily fed into regeneration software or hardware
- Cons
  - Can be larger than an empty media stream

Possible Optimizations

- assume a single edge clock, add a bit which says if it is a rising edge or falling edge clock and limit timestamps to a single edge
  - single bit digital transport doesn't work with this
- make the timestamp 63 bits with the upper bit used to indicate rising or falling edge
  - a basic clock can have a single edge
  - an still transport single bit digital