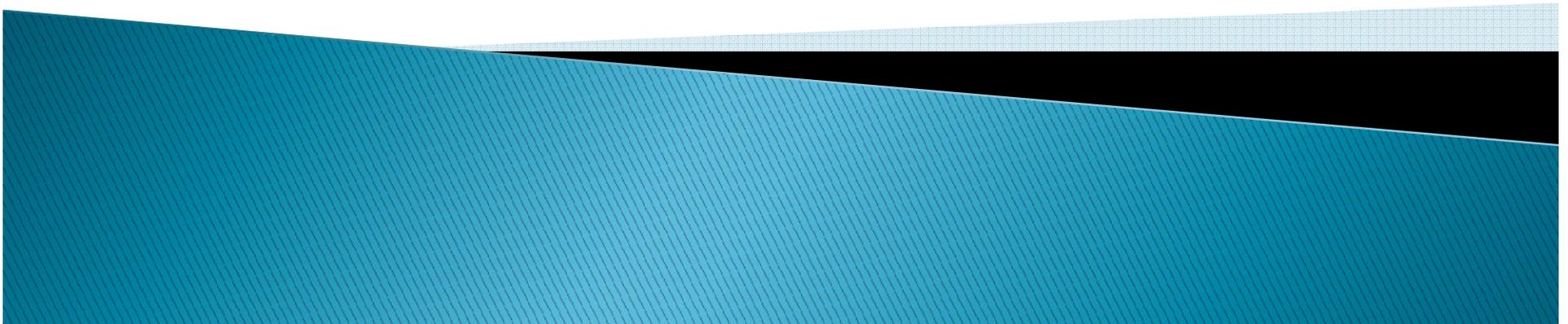


# Clock source signalling

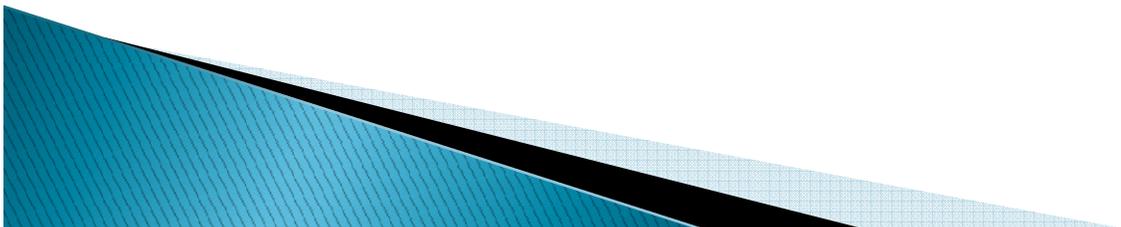
## draft-ietf-avtcore-clksrc-00

Kevin Gross  
AVA Networks  
Aidan Williams  
Audinate



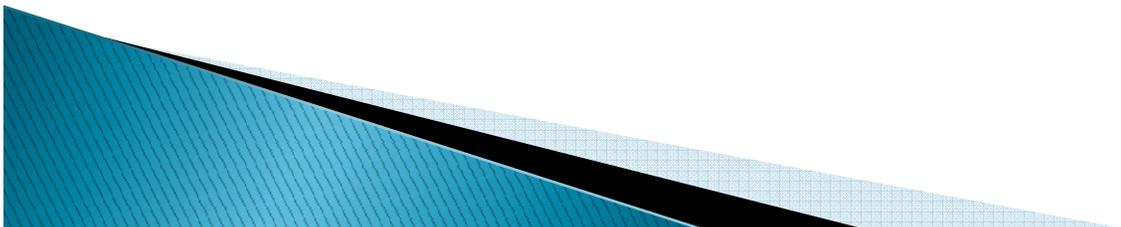
# Goals

- ▶ Explicitly signal clock information in RTP
  - Timestamp reference clock
  - Media clock
  - Fill a gap in RTP specifications
- ▶ Provides
  - Better synchronisation
  - Improved performance
- ▶ Enables applications
  - Social TV
  - Video walls
  - Networked speakers



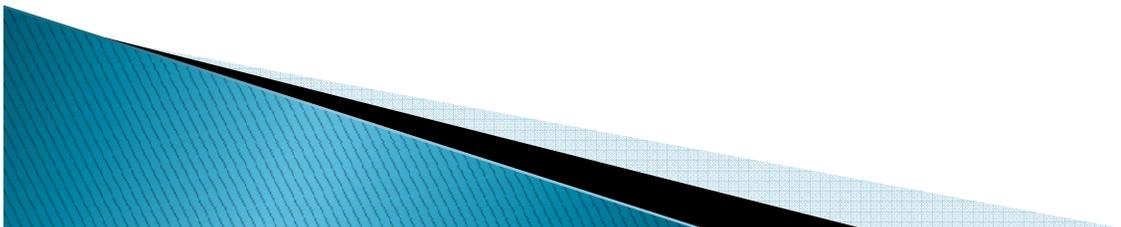
# Clocks

- ▶ Reference clock
  - Source of NTP timestamps in RTP
  - Used for time alignment of media
  - Used for RTT and other purposes
- ▶ Media clock
  - Governs production / consumption of media
  - Might be synchronised to a master (e.g. genlock)
  - Might be locally generated (i.e. not locked)
- ▶ *Signalling defines the relationship between these clocks and RTP media streams*



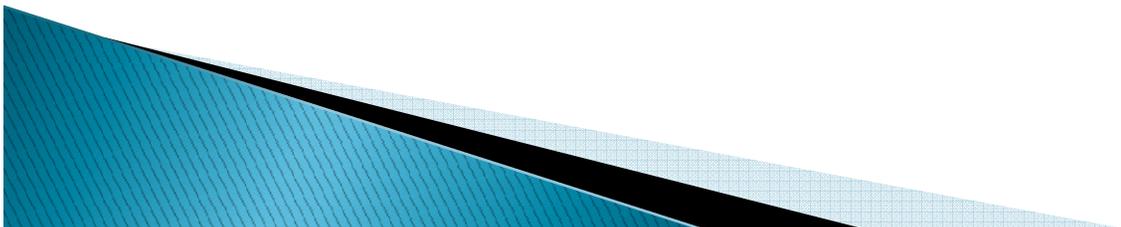
# Clock-referenced streams

- ▶ RTP clock indicates origination time
- ▶ NTP timestamp maps RTP clock to wall clock
- ▶ RFC 3550 (section 4) allows alternate timescale mapping for NTP timestamp
- ▶ No means for signalling source of NTP timestamp



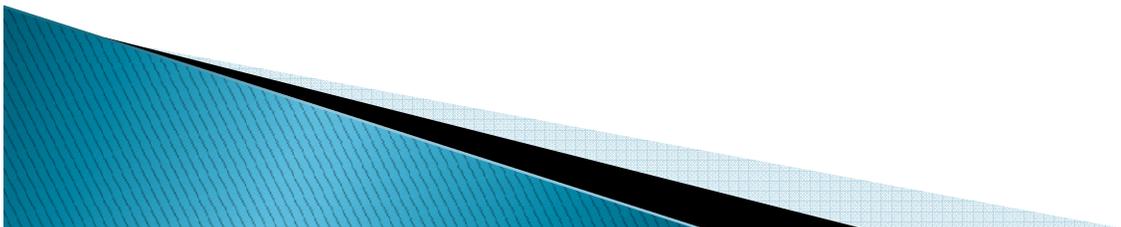
# Simple example: synchronised NTP

**v=0**  
**o=jdoe 2890844526 2890842807 IN IP4 10.47.16.5**  
**s=SDP Seminar**  
**i=A Seminar on the session description protocol**  
**u=http://www.example.com/seminars/sdp.pdf**  
**e=j.doe@example.com (Jane Doe)**  
**c=IN IP4 224.2.17.12/127**  
**t=2873397496 2873404696**  
**a=recvonly**  
**a=ts-refclk:ntp=traceable**  
**m=audio 49170 RTP/AVP 0**  
**m=video 51372 RTP/AVP 99**  
**a=rtpmap:99 h263-1998/90000**



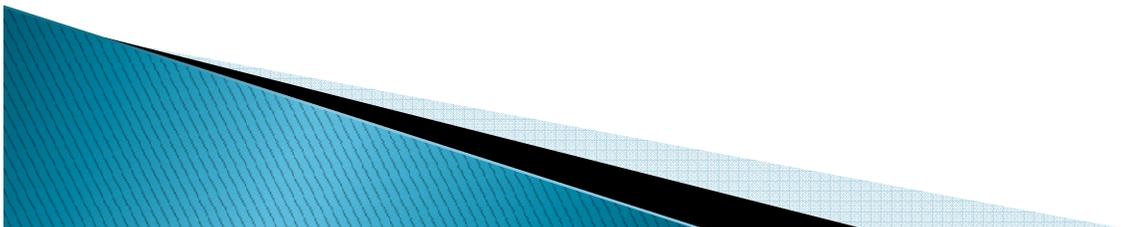
# Reference clock signalling

- ▶ `a=ts-refclk:ntp=203.0.113.10 2011-02-19 21:03:20.345+01:00`
- ▶ `a=ts-refclk:ptp=IEEE802.1AS-2011:39-A7-94-FF-FE-07-CB-D0`
- ▶ `a=ts-refclk:ptp=IEEE1588-2008:39-A7-94-FF-FE-07-CB-D0:0`



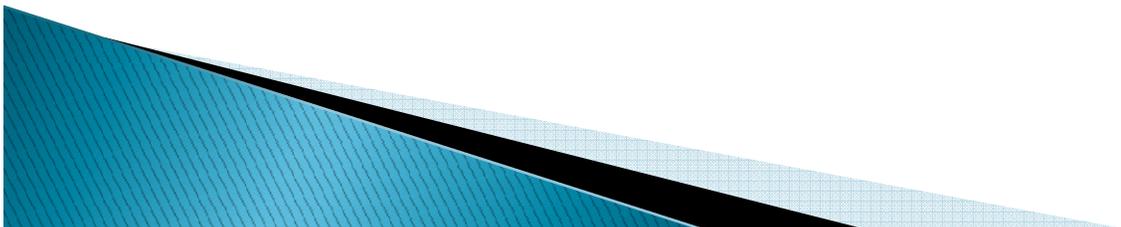
# Reference clock sources

- ▶ NTP
- ▶ IEEE 1588
  - IEEE 1588–2002, IEEE 1588–2008, IEEE 802.1AS
- ▶ GPS, Galileo
- ▶ Private
  - Assumes external means of determining clock compatibility
- ▶ *Traceable* option
  - For all but GPS, Galileo (assumed to be traceable)



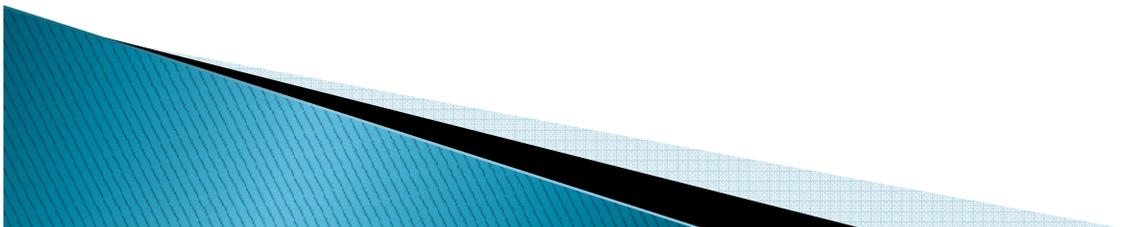
# Synchronization confidence

- ▶ Last update time
- ▶ Update frequency
- ▶ `offsetScaledLogVariance`?



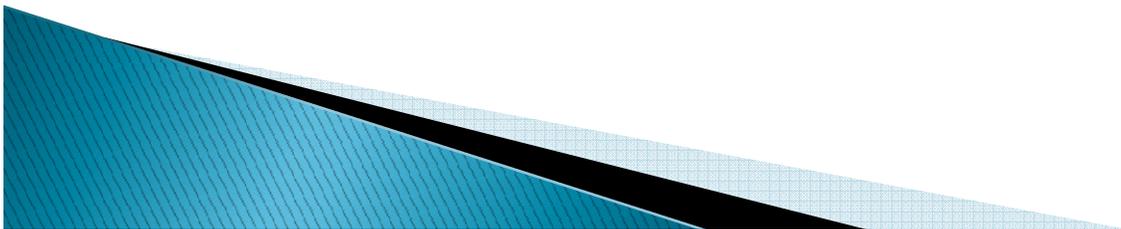
# Media clock

- ▶ Synchronisation of media clocks
  - Eases receiver processing multiple streams from different senders
  - Supports phase coherent capture/recording and playout of multiple streams
- ▶ Today
  - RTP senders typically generate their own media clock
  - No means for signalling media clock source



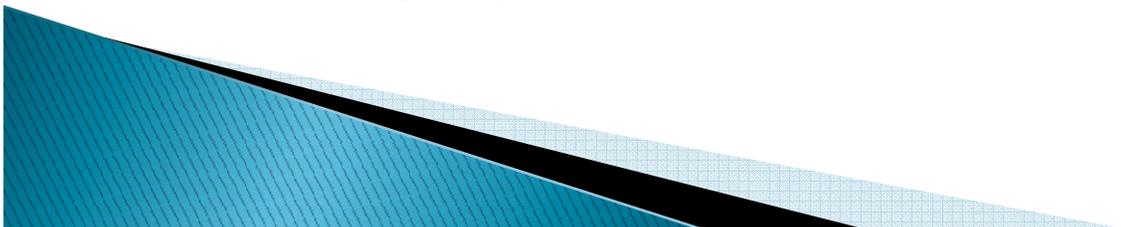
# Media clock sources

- ▶ Sender internal
  - Media clock generated locally and independently
- ▶ Direct referenced
  - Media clock derived directly from reference clock
- ▶ Stream referenced
  - Local media clock derived from incoming stream



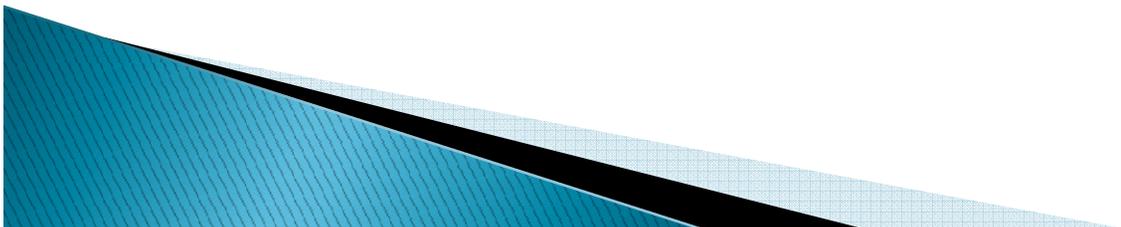
# Example: async media clock

v=0  
o=jdoe 2890844526 2890842807 IN IP4 10.47.16.5  
s=SDP Seminar  
i=A Seminar on the session description protocol  
u=http://www.example.com/seminars/sdp.pdf  
e=j.doe@example.com (Jane Doe)  
c=IN IP4 224.2.17.12/127  
t=2873397496 2873404696  
a=recvonly  
a=ts-refclk:ntp=traceable  
a=mediaclk:sender  
m=audio 49170 RTP/AVP 0  
m=video 51372 RTP/AVP 99  
a=rtpmap:99 h263-1998/90000



# Media clock signalling

- ▶ `a=mediaclock:sender`
- ▶ `a=mediaclock:offset=963214424`
- ▶ `a=mediaclock:rtp=IN IP4 239.0.0.1 5004 00:60:2b:20:12:1f`



# Open Issues

- ▶ Synchronisation confidence signaling
  - Last update
  - Update frequency
  - Estimated error
- ▶ Stream Identification
  - <connection address>:<port> <CNAME> the best way to identify a reference stream?
  - Should the stream be identified by SSRC instead?
- ▶ Stream-based media clock
  - Can you unambiguously rate-convert RTP clocks?
  - Is syntonisation alone a useful synchronization capability?

