Writing a new open source WebRTC stack in a week.

whipie - an open source WHIP client for the raspberry pi.

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Tim Panton

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- |pipe| licenses a lightweight cleanroom WebRTC stack for IoT devices.
- cofounded a web-based telephony company, sold the IPR to Tropo Inc., which was then acquired by Cisco.
- technical cofounder of Westpoint, a web security company acquired by Capita.
- writes |pipe| software
- helps define WebRTC standards at the W3C and IETF

photo by Neda Navaee

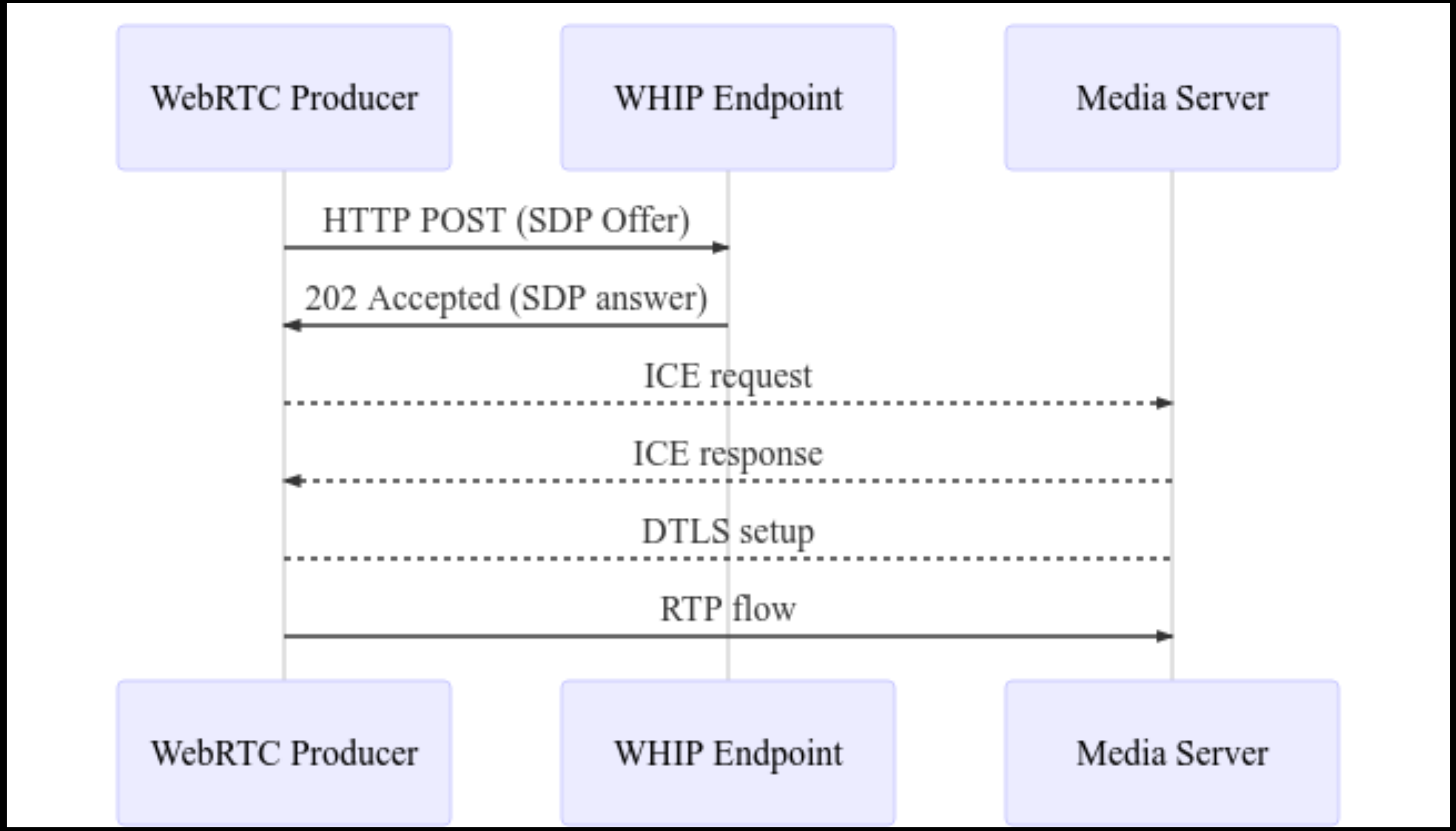
“Yeah, sure, I’ll do a WHIP implementation for the IETF Hackathon.”

Me - in a moment of madness.

WHIP

WebRTC ingest protocol

- WebRTC for broadcast
- Replace RTMP ingest
  - Lower latency
  - Bandwidth estimation
  - Etc.
- Without some of the complexity
- Listen to Lorenzo’s talk for more
  I stole his diagram from
  https://www.meetecho.com/blog/whip-janus/



“We need to test if WHIP works on small dedicated hardware - e.g. a WHIPcam”

Me - in a moment of madness.

Why not use the |pipe| stack?

	|pipe|	**WHIP**
WebRTC	YES	YES(modified)
DataChannel usage	Requires labeled data channel to start	Not supported
Security	Keys held at edge	WebAuth bearer tokens
Architecture	P2P	Client Server

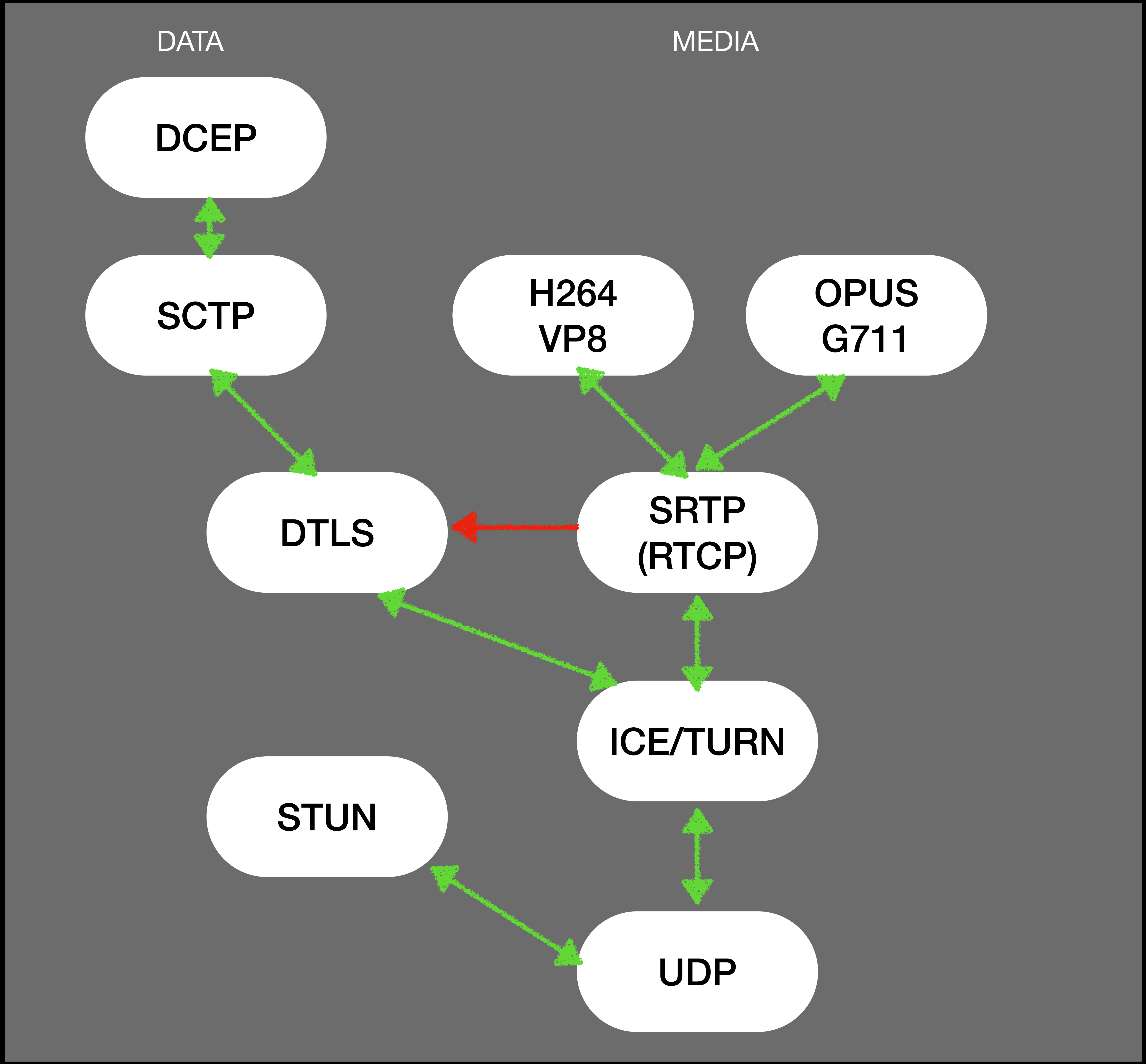
Hmm. This looks like a bad fit.

> “I’ve written 2 special purpose WebRTC stacks, why not do a third?”

Me - in a moment of madness.

What is WebRTC anyway?

“Frankly, the WebRTC spec reads like an earmark US Senate bill full of lost and forgotten ideas and proposals once brushed aside to live on the isle of misfit RFCs, but now jammed into the spec to speed up their ratification.”



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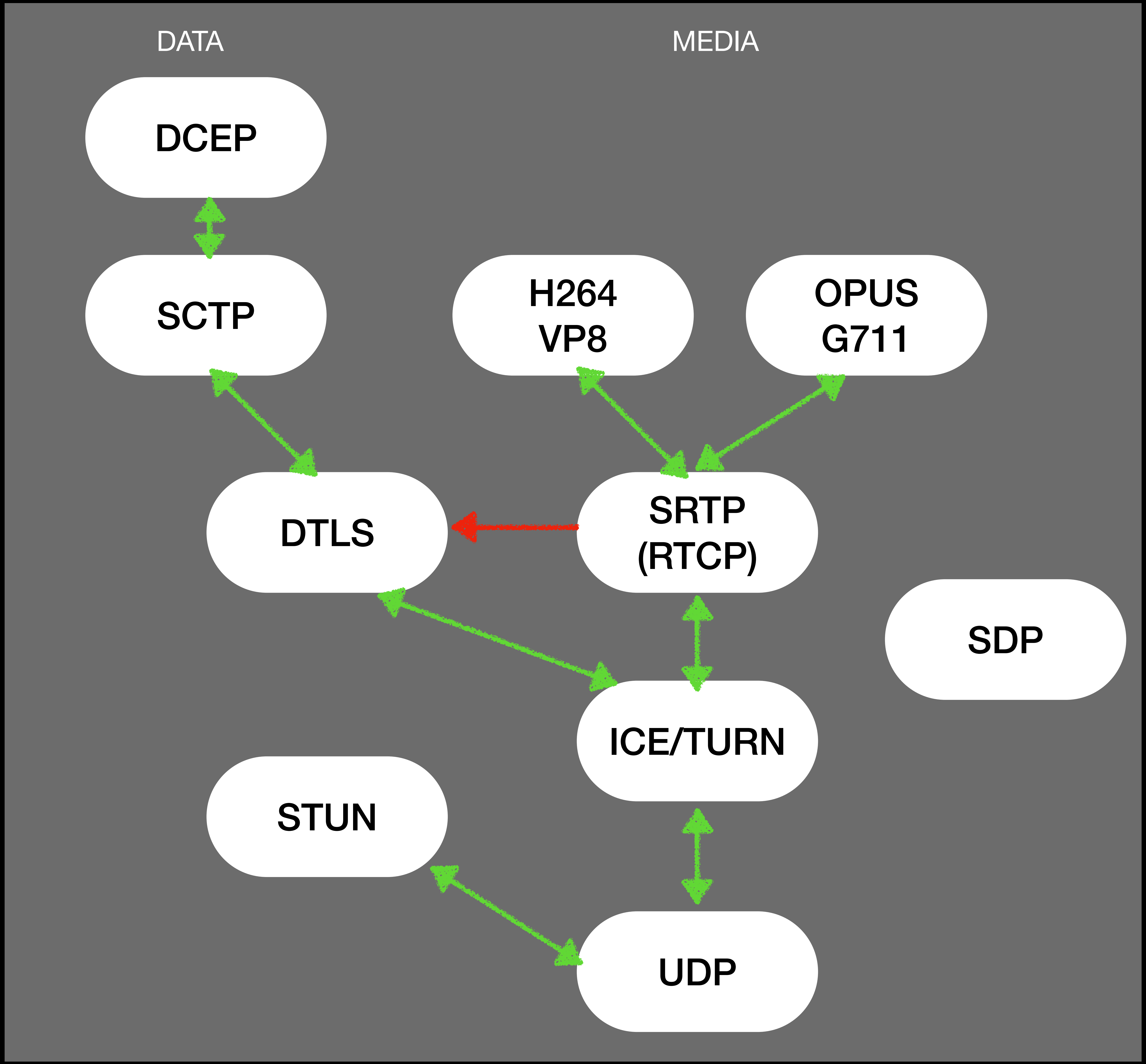

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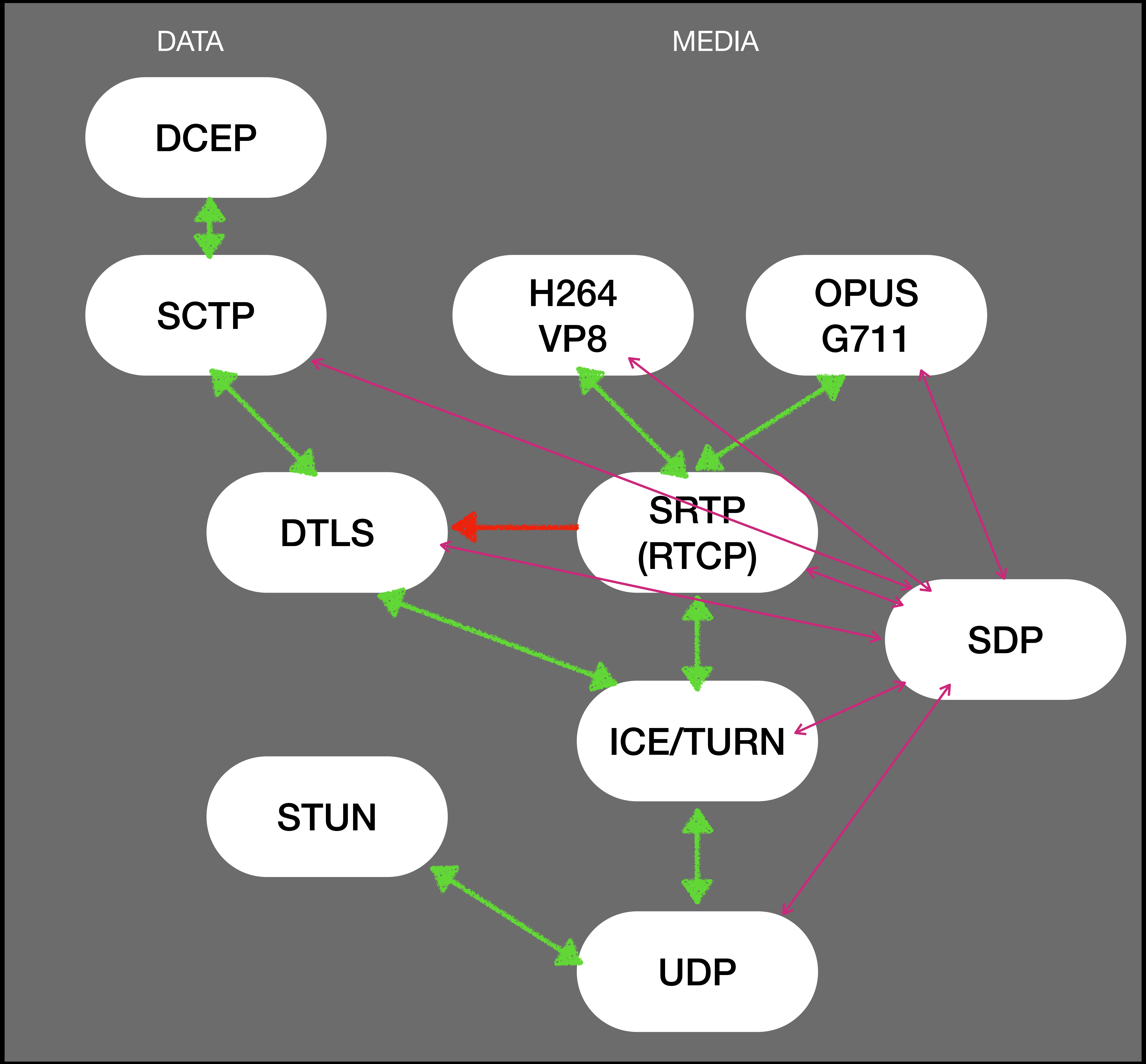
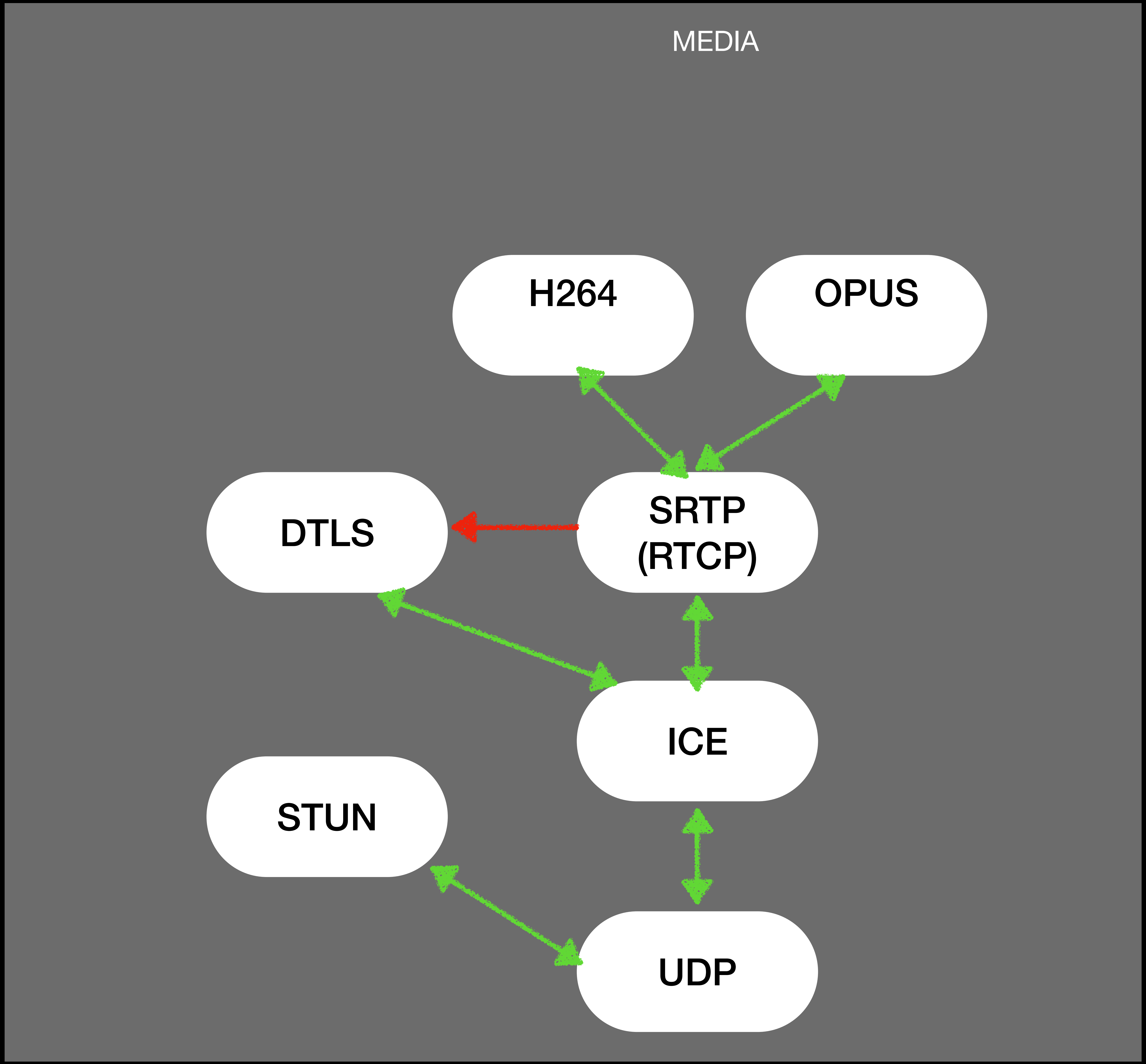


What does WHIP need at minimum?

- STUN/ICE
- SRTP
- DTLS
- OPUS
- H264
- All available as open source libs



So just glue them together…
How hard can it be?

Use libs you know.

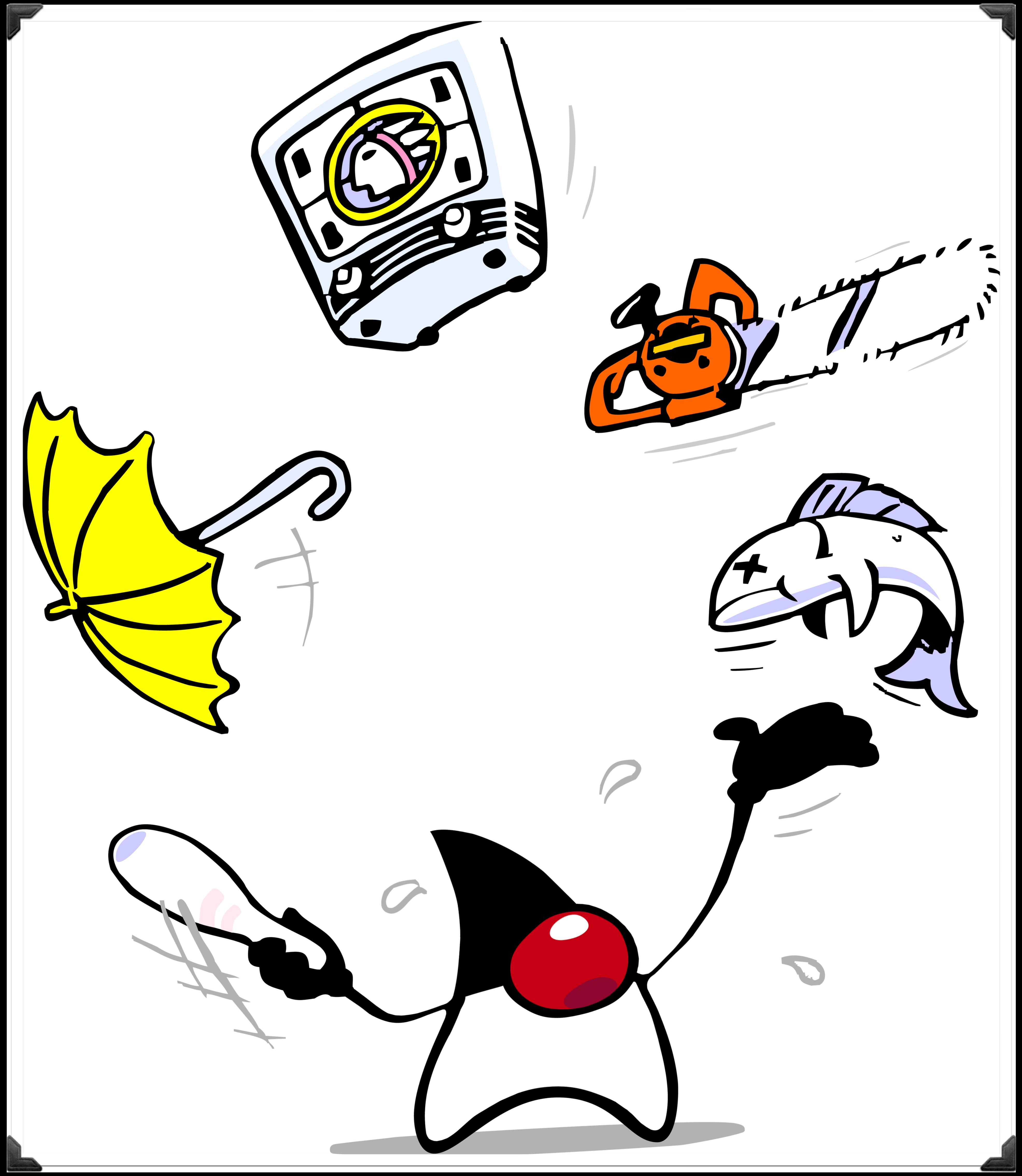
You are trusting the maintainer

- ICE/STUN
  https://github.com/steely-glint/slice
- DTLS
  https://github.com/bcgit/bc-java
- SRTP
  https://github.com/steely-glint/srtplight
- OPUS
  https://github.com/lostromb/concentus

Why Java?

Because you'll ask anyway

- Memory/Type safe
- Efficient on small processors
- Lots of open source libs
- OpenJDK11 != Java 6
    - Modern idioms
    - Good tooling
- JavaFx



Whipi

An implementation of WHIP for the Raspberry pi

- Take all the available WHIP shortcuts
  - Minimal SDP - Not a negotiation.
    Offer is a statement of intent.
  - No Trickle ICE no TURN
  - Passive DTLS
  - Assume 1 audio + 1 video track
  - Fixed codecs
- Thin shim to audio/video hardware
- No external dependencies (JNI, gstreamer, ffmpeg, avcodec etc)

Code Walkthrough

https://github.dev/pipe/whipi

Whipi

What we have…

- Open source:
  code available at https://github.com/pipe/whipi
- GPL
- Assumes Raspi hardware - but could support others
- Missing a lot of features as compared to |pipe|’s stack
- Works though.
- Issues, PRs, forks etc super welcome.

Whipi

Interop

- Tested against 3 whip servers:
  - Millicast content distribution service - Had to change cnames in SDP
  - Galène videoconference server - Had to change mids
  - Janus/Broadcaster NDI
- Tested on Raspi 3 and 4 with raspicam

What did we learn ?

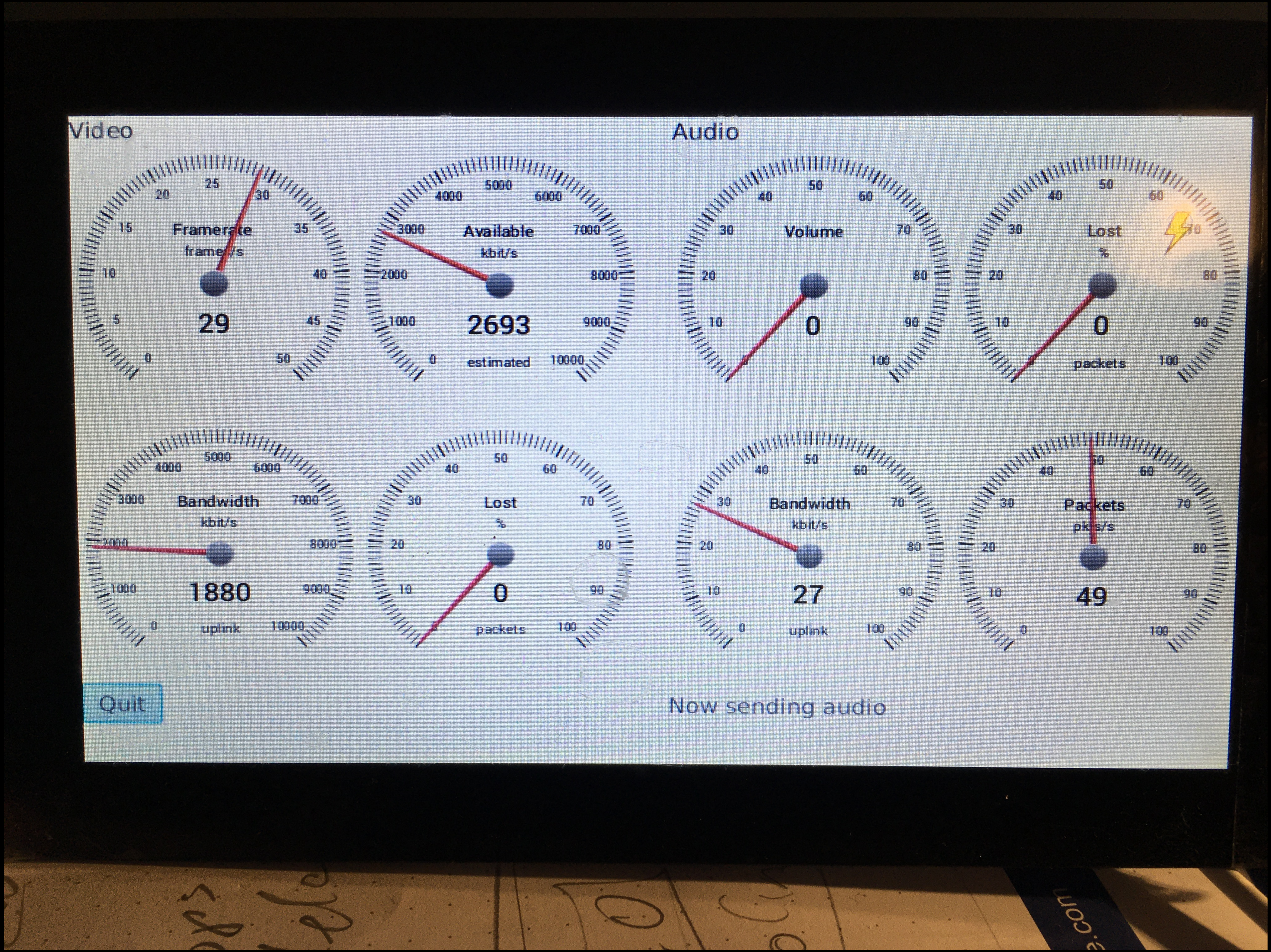
- WHIP works on small devices
- WebRTC is still extending it’s reach
  especially into dedicated hardware
- There are more WebRTC stacks than just libwebRTC
- Building a single purpose WebRTC stack is doable in a reasonable timeframe
  provided you know:
  - What you want
  - What you are doing
  - Which opensource libs to use

Bonus:

Proprietary GUI on Pi

Using javaFX

For dedicated remote feed devices.



Now sending audio

Questions and contacts

- tim@pi.pe
- https://pi.pe
- Twitter: @pipe_iot
- GitHub: https://github.com/pipe