Merging Two Worlds - Broadcast and WebRTC

WHIP and WHEP

Dan Jenkins / FOSDEM 2023
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Merging Two Worlds

Broadcast and WebRTC
Firstly, a few definitions...
WebRTC
Web Real-Time Communication
WebRTC

- Encrypted by default
- Sub-second glass to glass
- Open Source
- Two-way communications
- No signalling defined in the spec
- Required Open Source Codecs
- Embedded in every browser
- Use your own codecs in your own implementations
- Delivery over UDP
- NAT busting with ICE
- Many libwebRTC independent versions available now
"No signalling defined in the spec"

It was a good thing
SRT

Secure Reliable Transport
SRT

- Open Source
- Used heavily in the broadcast industry
- UDP based
- Requires native apps
- Can be encrypted optionally
- Codec agnostic

- Can be sub-second but usually multiple seconds for reliability
- Can be used across the internet or wide area networks or inside a LAN

https://archive.fosdem.org/2020/schedule/event/om_audio_streaming/
NDI

Network Device Interface
(what a generic name)
NDI

- Not Open Source
- Comes in multiple forms - NDI, HX, HX2 and HX3
- Designed to work within a LAN
- Not open source - but free to use
- Uses UDP
- Closed Source SDK
- Licensing is "more complicated"
RIST

Reliable Internet Stream Transport
RIST

- Open Source
- UDP based
- Encrypted
- RTP based
- Relatively new compared to the other options
- Designed to work over the internet (WAN) or LAN

https://archive.fosdem.org/2020/schedule/event/om_rist/
The other forms of media transport aren't really what I'd call real-time.
Merging two worlds
WebRTC and Broadcast
Broadcast and WebRTC
They can finally live in harmony
Maybe.
WHIP and WHEP
WHIP
WebRTC HTTP Ingestion Protocol
| WebRTC Producer | | WHIP endpoint | | Media Server | | WHIP Resource |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| HTTP POST (SDP Offer) | | 201 Created (SDP answer) | | ICE REQUEST |
| ICE RESPONSE | | DTLS SETUP | | RTP/RTCP FLOW |
| HTTP DELETE | | 200 OK | | X |
WHEP

WebRTC HTTP Egress Protocol
WHOA

WebRTC HTTP Offer Answer Protocol
WHOA

WebRTC HTTP Offer Answer Protocol

😂🤣
Those look like signalling protocols to me...
WebRTC's lack of enforced signalling was great...
Until it wasn't
No enforced signalling protocol meant lack of industry support.
How do you use WebRTC to deliver media while implementing a different API for each provider?
You don't
You use <insert other protocol here>
Whether you're a fan of WebRTC or not...
It has its uses.
And up until recently... difficult to use outside of a service with an SDK.
Interop was plain difficult.
WHIP
and
WHEP
WHIP
WebRTC HTTP Ingestion Protocol

WHEP
WebRTC HTTP Egress Protocol
WHIP
WebRTC HTTP Ingestion Protocol
Ingress (??)

WHEP
WebRTC HTTP Egress Protocol
Both drafts in the IETF

https://datatracker.ietf.org/doc/draft-ietf-wish-whip/

https://datatracker.ietf.org/doc/draft-murillo-whep/
So what are they?
Do **HTTP POST** with **SDP** offer, Get **SDP answer** in response. **Done.** Sending media to server
WHEP

Do HTTP POST with SDP offer,
Get SDP answer in response.
Done.
Receiving media from server
OK...

But what does that get us?
Hardware Encoder/Decoders

TALON HARDWARE ENCODERS

TALON 4K-SC
12G-SDI | HDMI2.0
10-bit 4:2:2
4096 x 2160P60
Status Display
16 Audio Channels SDI | 8 Audio Channels HDMI

H.265 HEVC | H.264 AVC ENCODING

TALON UHD-SC
12G-SDI
10-bit 4:2:2
3840 x 2160P60
16 Audio Channels SDI

H.265 HEVC | H.264 AVC ENCODING
Software support - OBS

#WHIP support in OBS is coming up nicely! This is a screenshot of OBS publishing to a Janus VideoRoom instance using my WHIP server. The only quirk I noticed so far is negotiation, since OBS seems to be offering many codecs but only H.264 is (currently?) implemented.

https://github.com/obsproject/obs-studio/pull/7926
Software support - GStreamer

WhipSink: A bin for WHIP

Tarunjeet Kanakamalla requested to merge [tkanakamalla/gst-plugins-rs](https://github.com/tkanakamalla/gst-plugins-rs) into main 5 months ago

All threads resolved!

Overview 44  Commits 1  Pipelines 15  Changes 9

Working version with asynchronous HTTP calls. Performs an HTTP request to exchange SDP offer/answer with a given endpoint which supports WHIP. Once the local and remote description are set to the webRTCbin (child element) the stream gets added as send-only (unidirectional)

Example Pipeline:

```bash
```

Fixes [gst-plugins-bad#1410](https://github.com/gstreamer/gst-plugins-bad/pull/1410) (closed)

Add a WebRTC WHEP source element

Sanchayan Maity requested to merge [SanchayanMaity/gst-plugins-rs](https://github.com/SanchayanMaity/gst-plugins-rs) into main 3 months ago

All threads resolved!

Overview 153  Commits 16  Pipelines 37  Changes 7

This implements WHEP specification based on [https://datatracker.ietf.org/doc/html/draft-murillo-whep-00](https://datatracker.ietf.org/doc/html/draft-murillo-whep-00)

and has been tested with Cloudflare.

Closes [237](https://github.com/gstreamer/gst-plugins-rs/pull/237) (closed).

Edited 3 months ago by Sanchayan Maity
Platform support

Dolby.io

Broadcast Bridge

Cloudflare
So yay.
Using WebRTC for ingress and egress just got easier.
Simulcast & SVC are supported
It's just HTTP transferring SDP
Yup... SDP still remains.
But it does give you freedom
Extra codecs?
OPUS RED?
RTP Header Extensions
It's not actually groundbreaking at all

(sorry Sergio)
It's just HTTP Offer Answer.

OK there's some state handling too.
It gives everyone 2 common protocols for Send and Receive.
Which leads to...
Open
Innovation
Great Open Source Projects
SRT to WHIP

SRT src -> WHIP sink
(yay 1.22 release)

github.com/Eyevinn/srt-whip-gateway
WHEP Server

github.com/meetecho/simple-whep-server (Janus)

Are there others for other SFU/MCUss?
WHEP Player

github.com/meetecho/simple-whep-client
github.com/Eyevinn/whep-video-component
WHIP Server

github.com/Eyevinn/whip
github.com/meetecho/simple-whip-server
WHIP Client

github.com/Eyevinn/whip

github.com/meetecho/simple-whip-client

github.com/ggarber/whip-go
Its a great time to start looking at using WebRTC
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Sidenote...
GStreamer
FTW.
GStreamer allows you to pipe SRT, WHIP, WHEP, RIST, NDI...
And even RTMP
You don't have to love WebRTC.
I certainly don't love it every day
But it is incredibly useful
And it is another tool in the toolbox for sub-second media
WHIP and WHEP open up those possibilities
Thanks!
OH!
One more thing...
CommCon 2023 is happening.
Announcements imminent

commcon.xyz
We're hiring (like everyone)

jobs.everycastlabs.uk