

WebRTC in the Wild

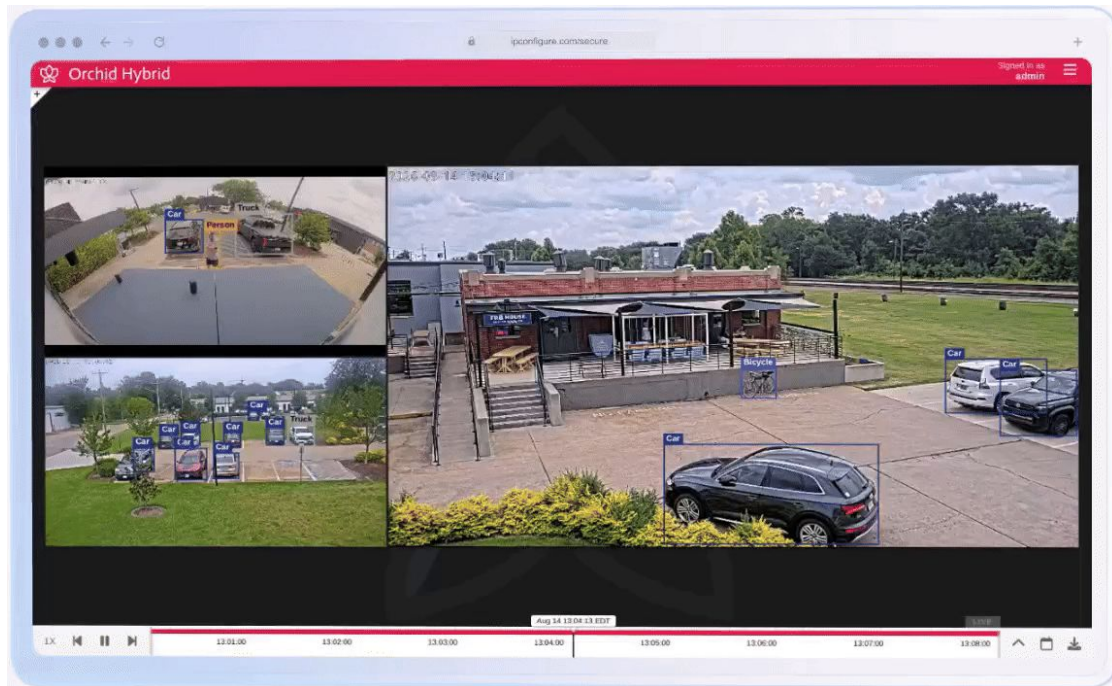
It works on my network...

IPConfigure — who are we?

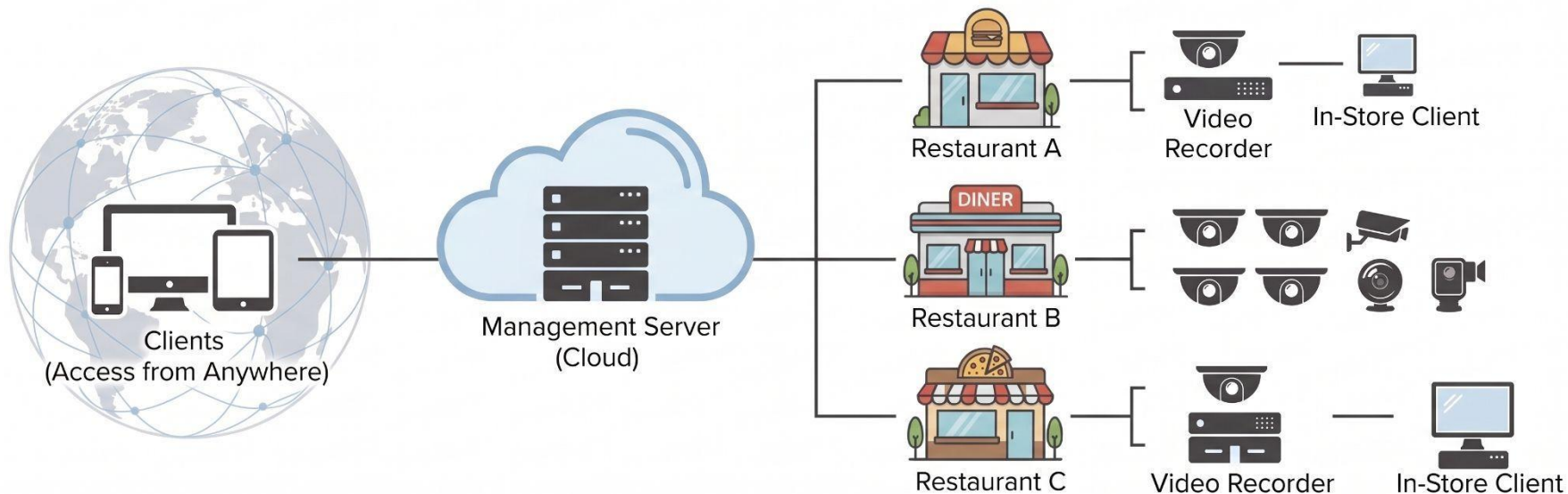
US-based software company

We build a Video Management System

- ✓ Browser based
- ✓ Multi-architecture
- ✓ Camera agnostic
- ✓ All media functionality uses GStreamer



High-level architecture



Our WebRTC implementation

2018



Initial implementation



Predates webrtcbin (barely)



Self-managed pipelines



Focused on browser compatibility and codecs

2023



Migration to webrtcbin



Motivated by audio support



Built-in feature support (SDP, RTX, etc.)



Easy path forward for future features (Audio Talkdown, Data Channel)

Findings in the Field

Customer complaints, circa 2019

Multiple customer reports 🚨



Discovery

- Relatively easy to reproduce
 - Slightly hindered by Chrome's feature-flag system
- Observe the WebRTC signaling
 - Browser host candidates now arrive as .local names

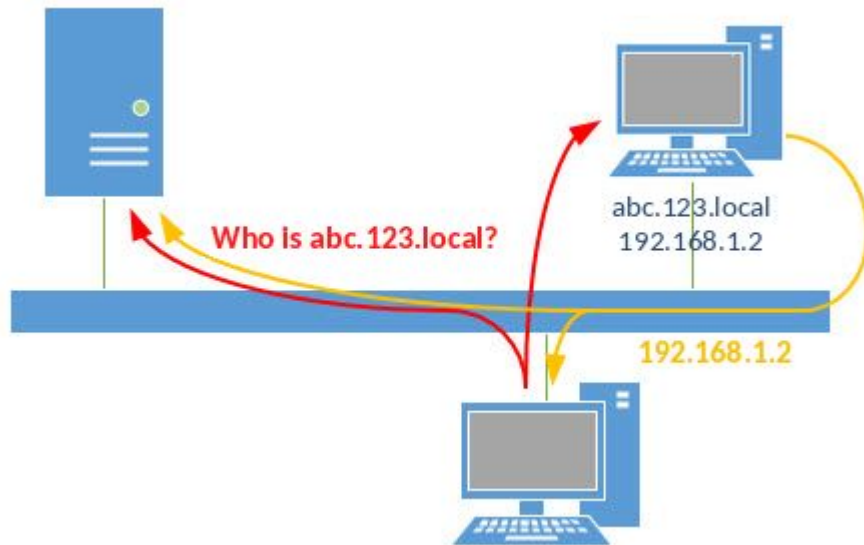
The screenshot shows a network packet capture tool with the 'Messages' tab selected. The filter is set to 'Filter using regex (example: (web)?socket)'. The list of messages shows several 'candidate' and 'ice_candidate' messages. The last message, an 'ice_candidate' from a local host, is highlighted with a red circle.

Data	Le...	Time
["candidate": "a=candidate:8 1 UDP 2015365119 fd50:e1a0:7db:de6c:bc0:1a2a:a055:8d32 40886 typ hos...	174	13:4...
{ "type": "answer", "sdp": "v=0\r\no=- 7319910875856521895 2 IN IP4 127.0.0.1\r\nns=\r\nnt=0 0\r\nna=group:..."	1...	13:4...
["candidate": "a=candidate:9 1 UDP 2015365375 fe80::f4b1:b8fe:d818:f369 36803 typ host", "messageId": "...	161	13:4...
{ "type": "ice_candidate", "candidate": "a=candidate:2426701590 1 udp 2113937151 591a8e19-e439-4bc7-b..."	193	13:4...
["candidate": "a=candidate:10 1 UDP 2015365631 fd50:e1a0:7db:de6c:905:e8b3:8527:e350 33788 typ hos...	174	13:4...
["candidate": "a=candidate:11 1 UDP 2015365887 fd50:e1a0:7db:de6c:8302:cbbf:69ee:8c9b 60241 typ ho...	175	13:4...
["candidate": "a=candidate:12 1 UDP 2015366143 fd50:e1a0:7db:de6c:615b:e827:b6e1:608e 50649 typ ho...	175	13:4...
["candidate": "a=candidate:13 1 UDP 2015366399 fe80::6da0:ca98:32d4:86fb 40186 typ host", "messageId": ...	162	13:4...
["candidate": "a=candidate:14 1 UDP 2015366655 fe80::d20f:592e:d730:33d4 32813 typ host", "messageId": ...	162	13:4...
["candidate": "a=candidate:16 1 UDP 505443887 209.145.80.227 50113 typ relay raddr: 193.168.205.45 rp...	184	13:4...

```
{ "type": "ice_candidate", ... }
  candidate: "a=candidate:2426701590 1 udp 2113937151 591a8e19-e439-4bc7-bf1c-11cc02c887bc.local 38983
  messageId: "2"
  type: "ice_candidate"
```

Multicast DNS (mDNS) refresher

- Don't send raw host candidates
- Send obfuscated `.local` host candidates
- Local WebRTC peers can resolve `.local` candidates*



Resolution

1

Get customers working immediately

Use Chrome flag to disable mDNS

2

Resolve .local candidates

- Reference how others were dealing with the issue (libnice #68)
- Added a naive mDNS resolver to our custom WebRTC stack

[libnice work item #68](#)

Resolution

Do we even need to process mDNS candidates?

PSA: WebRTC host candidate obfuscation experiment in M73

2,987 views

Subscribe ☐



Justin Uberti

to discuss-webrtc

Feb 7, 2019, 11:32:45 AM



If you don't use STUN or TURN servers, your application probably didn't work very well before...

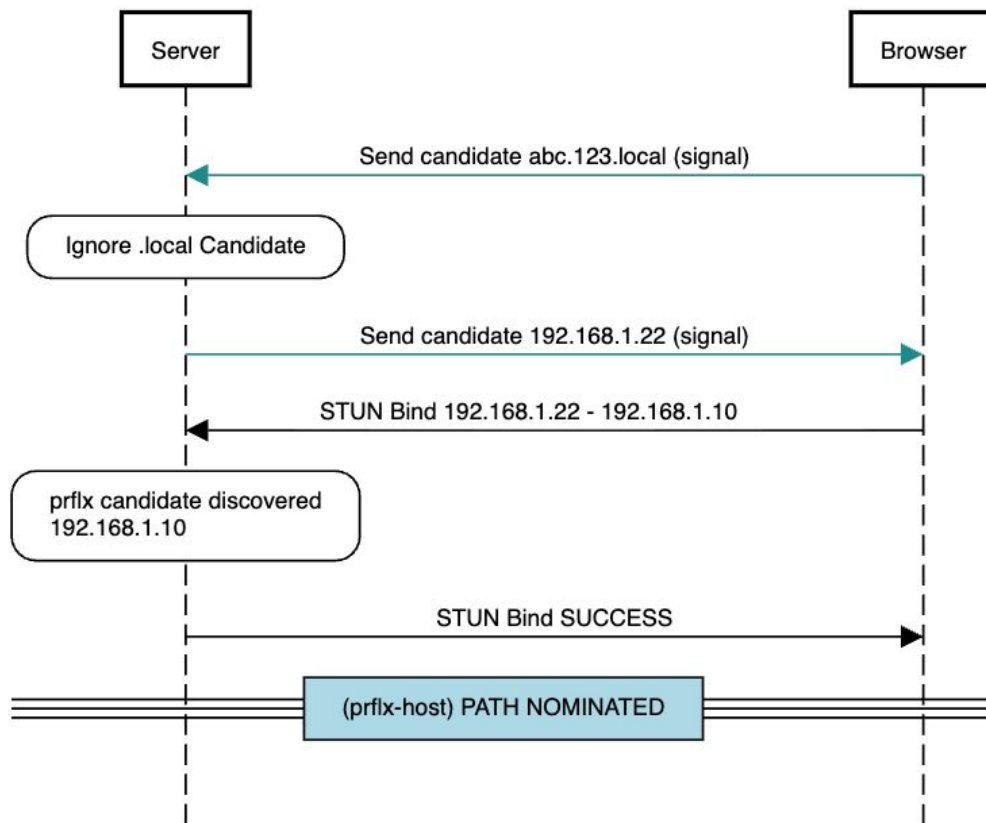
Regardless, even if one side doesn't understand mDNS, things will continue to work. The non-mDNS side will send an IP address candidate, the mDNS side will form a candidate pair with that address, and then the non-mDNS side will get an incoming connectivity check which will cause it to form a prflx candidate, and everything is good.

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You received this message because you are subscribed to the Google Groups "discuss-webrtc" group.
To unsubscribe from this group and stop receiving emails from it, send an email to discuss-webrtc@googlegroups.com.
To view this discussion on the web visit <https://groups.google.com/d/msgid/discuss-webrtc/6ae24db6-60e3-4a03-b480-a874a415809e%40googlegroups.com>.

[Source: discuss-webrtc thread \(Justin Uberti, Feb 2019\)](#)

Peer-reflexive candidate discovery



Takeaways



Stay up to date with the evolution of WebRTC



We're at the mercy of browsers!



Jan Schmidt @thaytan Dec 31, 2019

Maintainer



This would work if GLib and the underlying system are set up to resolve mDNS names, right? Is mDNS suddenly a WebRTC requirement, or just Chrome being unilaterally obnoxious?



Sebastian Dröge @slomo Dec 31, 2019

Owner



Is mDNS suddenly a WebRTC requirement, or just Chrome being unilaterally obnoxious?

Guess :)

Customer complaints, circa 2024

Some large school system 🏫

Cameras Slow/
Not Loading

Frequently seeing
ICE Timeouts

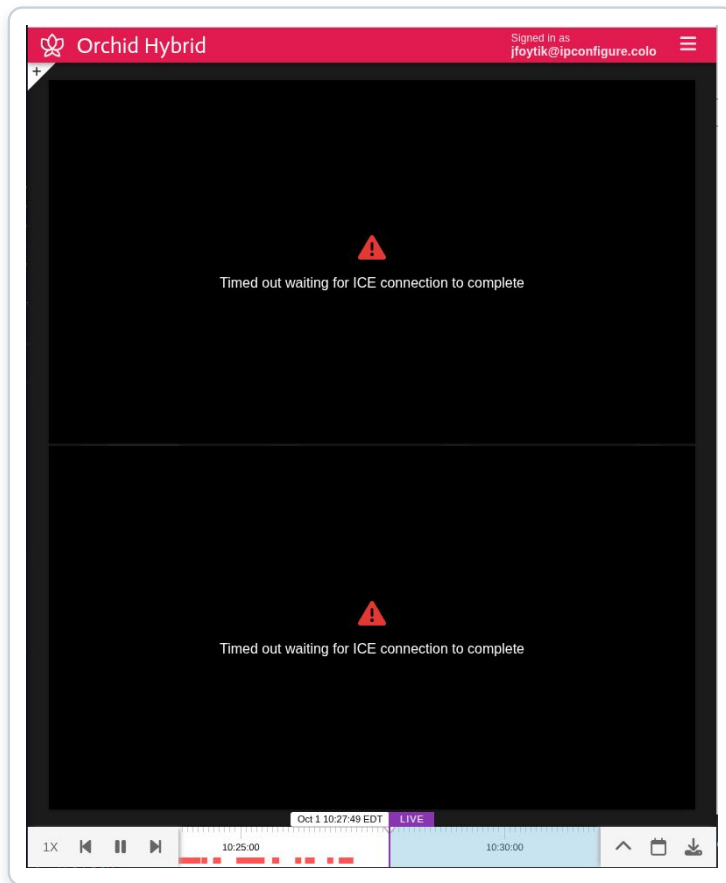
Camera streams are
slow to load

Discovery

Reproducible, but sporadic

- Some connection attempts worked, but slowly
- Customer had been using WebRTC for years with without issue

“Nothing has changed other than us swapping out all of our managed switches.” - Customer



More Discovery

- The customer's NAT issue caused us to look deeper into connection performance
- Discovered that connection times had degraded over product releases

What changed?

More discovery

Signaling was fast, but establishing a connection was slow

Data	Length	Time ▲
↑ {"type":"create","streamId":63,"time":1790887596371,"rate":1,"waitThres":2000,"videoCodecCapabilities":[{"clockRate":90000,"mimeType":"video/VP8"}],{"cl...	1897	16:50:20.713
↓ {"candidate":"a=candidate:1 1 UDP 2015363327 10.113.253.11 36801 typ host","messageId":"7eeff5bc-2f9d-416a-8d3f-116f17e5f57a","type":"ice_candidate"}	149	16:50:20.982
↓ {"messageId":"8e488098-1339-4777-9870-52f56c332d7b","sdp":"v=0\r\no=- 7369156071286925771 0 IN IP4 0.0.0.0\r\ns=-\r\nnt=0 0\r\na=ice-options:trickle/...	1585	16:50:20.983
↓ {"candidate":"a=candidate:2 1 UDP 2015363583 10.113.253.21 42696 typ host","messageId":"266b3a25-d032-489f-94c2-2ae50de098a2","type":"ice_candid..."}	149	16:50:20.984
↓ {"candidate":"a=candidate:3 1 UDP 2015363839 169.254.1.2 53252 typ host","messageId":"fa75da82-9f0b-42e7-a598-574b624c15b8","type":"ice_candidate"}	147	16:50:20.984
↓ {"candidate":"a=candidate:4 1 UDP 2015364095 10.13.0.159 40156 typ host","messageId":"3f8fce08-d337-4a17-a8a7-5199ce260a10","type":"ice_candidate"}	147	16:50:20.985
↓ {"candidate":"a=candidate:5 1 UDP 2015364351 fe80::4ed9:8fff:feb2:5213 38640 typ host","messageId":"54716dae-1719-4b3a-bb11-8d5a737b491c","type":"i..."}	161	16:50:20.985
↓ {"candidate":"a=candidate:6 1 UDP 2015364607 fe80::4ed9:8fff:feb2:5214 55484 typ host","messageId":"d5a2c0da-f1c6-4b84-8927-047fdb82c6a2","type":"i..."}	161	16:50:20.986
↓ {"candidate":"a=candidate:7 1 UDP 2015364863 fde1:53ba:e9a0:de11:4ed9:8fff:feb2:5210 48840 typ host","messageId":"63fa42ca-0914-4ead-ae1-52e08e..."}	175	16:50:20.986
↓ {"candidate":"a=candidate:8 1 UDP 2015365119 fe80::4ed9:8fff:feb2:5210 58502 typ host","messageId":"7ce2aff4-a0eb-4bc9-a7dd-c9fd65ff8784","type":"ic..."}	161	16:50:20.987
↑ {"type":"answer","sdp":"v=0\r\no=- 6255155075365123524 2 IN IP4 127.0.0.1\r\ns=-\r\nnt=0 0\r\na=group:BUNDLE video application1\r\na=msid-semantic: ...	1127	16:50:20.998
↑ {"type":"ice_candidate","candidate":"a=candidate:437017216 1 udp 2113937151 926d8191-f5a2-4ef6-81db-47a9929a6e3a.local 34450 typ host generation ...	192	16:50:21.000
↓ {"candidate":"a=candidate:9 1 UDP 2015365375 fe80::ec96:f9b3:2840:ffe5 54075 typ host","messageId":"0b7ee246-2ca9-40a9-bb4e-c94d7f47eacb","type":"i..."}	161	16:50:21.005
↓ {"candidate":"a=candidate:10 1 UDP 1679819007 152.26.89.218 36801 typ srflx raddr 10.113.253.11 rport 36801","messageId":"f1833cf0-d0f5-452f-aae2-f7..."}	183	16:50:21.010
↑ {"type":"ice_candidate","candidate":"a=candidate:1529866480 1 udp 1677729535 209.145.80.227 34450 typ srflx raddr 0.0.0.0 rport 0 generation 0 ufrag g..."}	188	16:50:21.019

A small change in the 1.20 release

GStreamer 1.20 Release Notes

GStreamer 1.20.0 was originally released on 3 February 2022.

The latest bug-fix release in the now old-stable 1.20 series is [1.20.7](#) and was released on 26 July 2023.

GstWebRTC library + webrtcbin

- Change the way in which sink pads and transceivers are matched together to support easier usage. If a pad is created without a specific index (i.e. using `sink_%u` as the pad template), then an available compatible transceiver will be searched for. If a specific index is requested (i.e. `sink_1`) then if a transceiver for that m-line already exists, that transceiver must match the new sink pad request. If there is no transceiver available in either scenario, a new transceiver is created. If a mixture of both `sink_1` and `sink_%u` requests result in an impossible situation, an error will be produced at pad request time or from create offer/answer.
- `webrtcbin` now uses regular ICE nomination instead of libnice's default of aggressive ICE nomination. Regular ICE nomination is the default recommended by various relevant standards and improves connectivity in specific network scenarios.
- Add support for limiting the port range used for RTP with the addition of the `min-rtp-port` and `max-rtp-port` properties on the ICE object.
- Expose the SCTP transport as a property on `webrtcbin` to more closely match the WebRTC specification.
- Added support for taking into account the data channel transport state when determining the value of the

Aggressive vs. regular nomination

ICE nomination modes in RFC 5245

Aggressive

- Controlling agent includes the USE-CANDIDATE flag in every STUN connectivity check
- Immediately nominates successful pairs
- Default libnice behavior

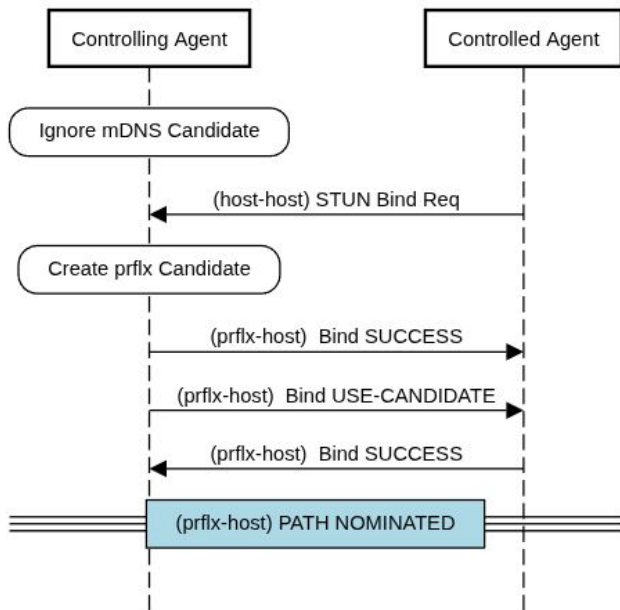
Regular

- Controlling agent is more strategic about nominating the right candidate pair
- webrtcbin's default since GStreamer 1.20

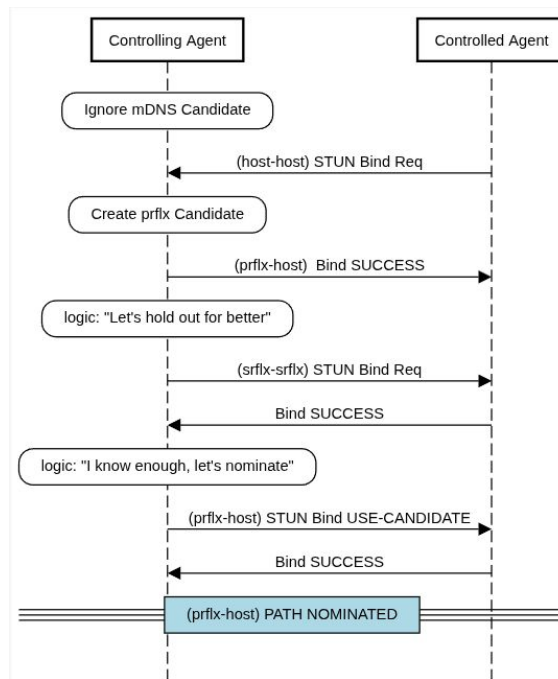
Aggressive vs. regular nomination

Local scenario

Aggressive



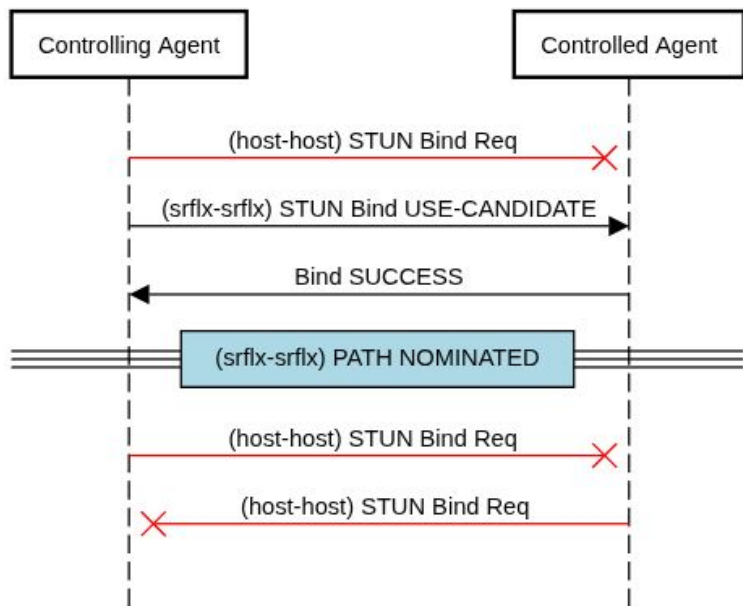
Regular



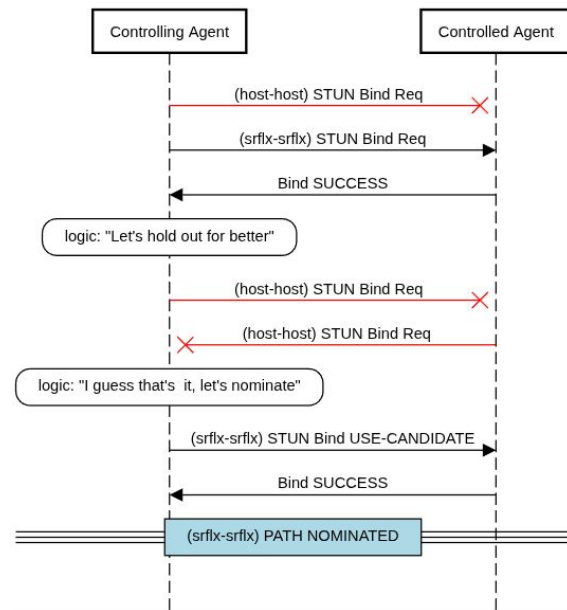
Aggressive vs. regular nomination

STUN-only scenario

Aggressive



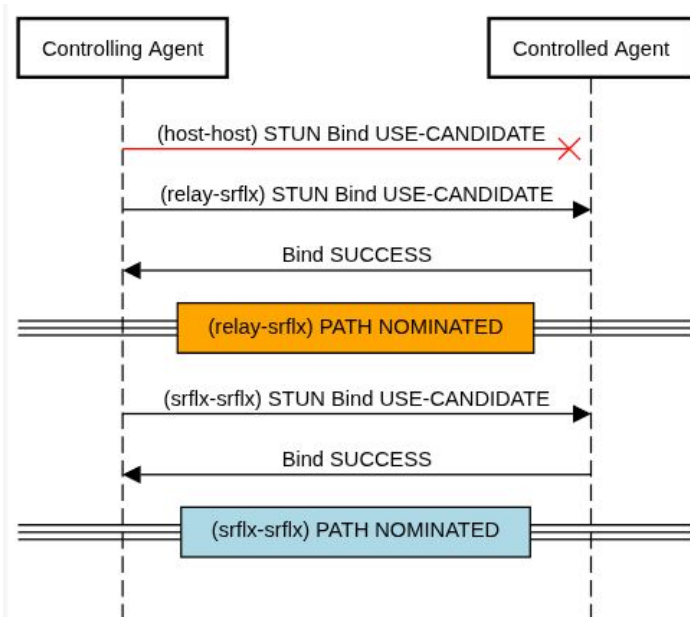
Regular



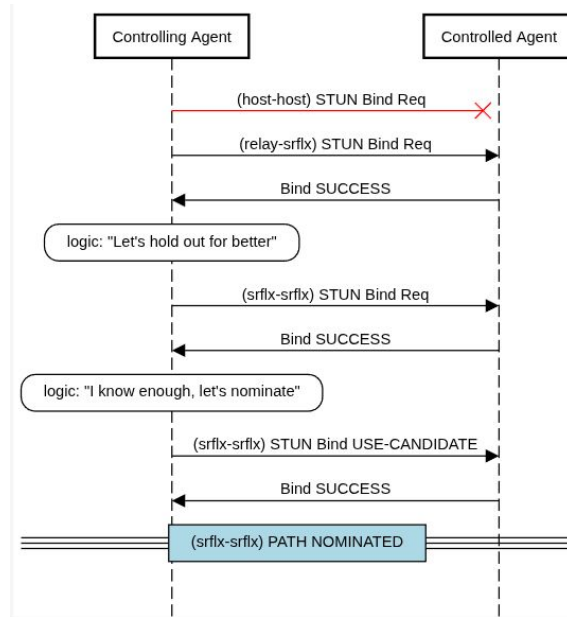
Aggressive vs. regular nomination

STUN + TURN scenario

Aggressive



Regular



Resolution



We patched webrtcbin to configure libnice into aggressive mode

Takeaways

- RFC 5245 is deprecated and replaced by RFC 8445
- The new standard provides optimizations that eliminate the need for aggressive mode
 - Data can be transmitted on candidate pairs before they are formally nominated
 - Switching between candidate pairs during the early-media phase will be less jarring



librice implements RFC 8445!

Takeaways

The nomination stopping criterion is left to the implementation

It would be nice if webrtcbin and the ICE implementations (libnice, librice) allowed configuring the ICE nomination stopping criterion.

RFC 5245 (libnice)

complete, each of which omit the USE-CANDIDATE attribute. Once one or more checks complete successfully for a component of a media stream, valid pairs are generated and added to the valid list. The agent lets the checks continue until some stopping criterion is met, and then picks amongst the valid pairs based on an evaluation criterion. **The criteria for stopping the checks and for evaluating the valid pairs is entirely a matter of local optimization.**

When the controlling agent selects the valid pair, it repeats the check that produced this valid pair (by enqueueing the pair that generated the check into the triggered check queue), this time with the USE-CANDIDATE attribute. This check should succeed (since the

RFC 8445 (librice)

selected pair for that agent and is used for sending and receiving data for that component of the data stream.

If an agent is not able to produce selected pairs for each component of a data stream, the agent **MUST** take proper actions for informing the other agent, e.g., by removing the stream. The exact actions are outside the scope of this specification.

The criteria for stopping the connectivity checks and for picking a pair for nomination are outside the scope of this specification. They are a matter of local optimization. The only requirement is that the agent **MUST** eventually pick one and only one candidate pair and generate a check for that pair with the USE-CANDIDATE attribute set.

Once the controlling agent has successfully nominated a candidate pair ([Section 7.2.5.3.4](#)), the agent **MUST NOT** nominate another pair for same component of the data stream within the ICE session. Doing so violates an ICE constraint.

Customer complaints, circa 2026

Some national restaurant chain 🐼

ICE Connection
Timeout

I was able to bring up the site on my Android and older iPhone. However, the manager had socket issues with their phone.

Camera streams are
not loading on iPhone

Discovery



Urgent issue



Non-technical end users



High feedback latency from the customer



Some iPhones were working, others were not

Safari issue?
Cell network issue?

Discovery

- Long-standing issue with iPhone, WebRTC, and some carriers
- Able to reproduce the issue on a MacBook tethered to the carrier

Connectivity	Browser	Plays WebRTC
IPC Wifi	Safari v18.6 (Macbook)	Yes
LTE Hotspot tether (Mint Mobile)	Safari v18.6 (Macbook)	No
IPC Wifi	Safari v26.0.1 (Macbook)	Yes
LTE Hotspot tether (Mint Mobile)	Safari v26.0.1 (Macbook)	No
IPC Wifi	Chrome 141 (Macbook)	Yes
LTE Hotspot tether (Mint Mobile)	Chrome 141 (Macbook)	Yes
IPC Wifi	Firefox 144.0 (Macbook)	Yes
LTE Hotspot tether (Mint Mobile)	Firefox 144.0 (Macbook)	Yes
IPC Wifi	Safari (iOS 18.6.2)	Yes
LTE (Mint Mobile)	Safari (iOS 18.6.2)	No
LTE Hotspot tether (Google Fi running on Android)	Safari v26.0.1 (Macbook)	Yes
LTE Hotspot tether (Visible Wireless running on Android)	Safari v26.0.1 (Macbook)	Yes
LTE (AT&T)	Safari (iOS 18.7.1)	No

Discovery

- Server-reflexive candidates should work
- They do on Chrome and Firefox, but not Safari

<pre>{ "candidate": "a=candidate:4 1 UDP 2015364095 fdda:3d25:973c:13bd:6af8:2395:ff56:87f5 38525 typ host", "messageId": "75eaae27-16aa-4663-8ec8-0a717fcd9ada", "type": "ice_candidate" }</pre>	8:13:35 AM
<pre>{ "candidate": "a=candidate:5 1 UDP 2015364351 fdda:3d25:973c:13bd:ae2f:8427:5465:ecd5 46353 typ host", "messageId": "54204df1-0265-4619-bf84-fb1b63887a4f", "type": "ice_candidate" }</pre>	8:13:35 AM
<pre>{ "candidate": "a=candidate:6 1 UDP 2015364607 fdda:3d25:973c:13bd:9713:832d:c61c:9f8d 43661 typ host", "messageId": "0cc6b462-721e-4596-bf72-8e3cc52afe7e", "type": "ice_candidate" }</pre>	8:13:35 AM
<pre>{ "candidate": "a=candidate:7 1 UDP 2015364863 fdda:3d25:973c:13bd:dd83:c72d:2f12:b460 62025 typ host", "messageId": "9b27f50c-3338-4326-9388-c26996392293", "type": "ice_candidate" }</pre>	8:13:35 AM
<pre>{ "candidate": "a=candidate:8 1 UDP 2015365119 fdda:3d25:973c:13bd:2c2f:2b5a:f526:8bbd 52819 typ host", "messageId": "dc4dd3ee-d9de-4862-8f59-bac042f3040c", "type": "ice_candidate" }</pre>	8:13:35 AM
<pre>{ "candidate": "a=candidate:9 1 UDP 2015365375 fdda:3d25:973c:13bd:50d6:cd79:3c9c:a7a7 43248 typ host", "messageId": "2d53c3e5-34e4-41b7-a138-45f10a7591a1", "type": "ice_candidate" }</pre>	8:13:35 AM
<pre>{ "candidate": "a=candidate:10 1 UDP 2015365631 fe80::5585:d653:b4c9:27cb 52932 typ host", "messageId": "13188565-ff17-4358-909a-974633469fa8", "type": "ice_candidate" }</pre>	8:13:35 AM
<pre>↑ { "type": "answer", "sdp": "v=0\r\no=- 5215270791047787048 2 IN IP4 127.0.0.1\r\ns=-\r\nnt=0 0\r\na=group:BUNDLE video application1\r\na=msid-semantic: WMS\r\nm=video 9 UDP/TLS/RTP/SAVPF 96 97\r\nnc=IN IP4 0.0.0.0\r\na=rtpcp:9 IN IP4 0.0.0.0\r\na=ice-ufrag:bHH6\r\na=ice-pwd:tlr9TFgADBLmlthQDfR4lfeol\r\na=ice-options:trickle\r\na=fingerprint:sha-256 1A:B4:9E:75:96:1A:93:30:12:2D:19:24:2B:F7:1F:36:C4:D2:1B:B2:85:C2:B6:9B:1D:85:4F:17:FE:02:A7:C1\r\na=setup:active\r\na=mid:video\r\na=recvonly\r\na=rtpcp-mux\r\na=rtpcp-size\r\na=rtpmap:96 H264/90000\r\na=rtpcp-fb:96 transport-cc\r\na=rtpcp-fb:96 ccm fir\r\na=rtpcp-fb:96 nack\r\na=rtpcp-fb:96 nack pli\r\na=fmtp:96 level-asymmetry-allowed=1;packetization-mode=1;profile-level-id=42e01f\r\na=rtpmap:97 rtcp/90000\r\na=fmtp:97 apt=96\r\na=rtpmap:98 application 9 UDP/DTLS/SCTP webrtc-datachannel\r\nnc=IN IP4 0.0.0.0\r\na=ice-ufrag:bHH6\r\na=ice-pwd:tlr9TFgADBLmlthQDfR4lfeol\r\na=ice-options:trickle\r\na=fingerprint:sha-256 1A:B4:9E:75:96:1A:93:30:12:2D:19:24:2B:F7:1F:36:C4:D2:1B:B2:85:C2:B6:9B:1D:85:4F:17:FE:02:A7:C1\r\na=setup:active\r\na=mid:application1\r\na=sctp-port:5000\r\n", "messageId": "1" }</pre>	8:13:35 AM
<pre>{ "candidate": "a=candidate:11 1 UDP 1679819007 72.58.144.207 4005 typ srflx raddr 192.168.1.22 rport 56253", "messageId": "3c0dbd72-ce8d-427c-90db-15e976db8c1e", "type": "ice_candidate" }</pre>	8:13:35 AM
<pre>↑ { "type": "ice_candidate", "candidate": "a=candidate:169754556 1 udp 2113939711 3233606c-e1f6-4335-ba47-38b257b543fc.local 64932 typ host generation 0 ufrag bHH6 network-cost 999", "messageId": "2" }</pre>	8:13:35 AM
<pre>↑ { "type": "ice_candidate", "candidate": "a=candidate:2638727912 1 udp 2113937151 6799b972-1e28-41e4-a6d9-507c5be69931.local 49254 typ host generation 0 ufrag bHH6 network-cost 999", "messageId": "3" }</pre>	8:13:35 AM
<pre>↑ { "type": "ice_candidate", "candidate": "a=candidate:3781090898 1 udp 1677729535 172.56.2.15 31595 typ srflx raddr 0.0.0.0 rport 0 generation 0 ufrag bHH6 network-cost 999", "messageId": "4" }</pre>	8:13:35 AM
<pre>↑ { "type": "ice_candidate", "candidate": "a=candidate:2471240353 1 udp 1677729535 172.56.2.15 18143 typ srflx raddr 0.0.0.0 rport 0 generation 0 ufrag bHH6 network-cost 999", "messageId": "5" }</pre>	8:13:35 AM

Discovery

- srflx candidates are confirmed in signaling and at the browser's addIceCandidate calls
- Browser WebRTC stats indicate that the srflx candidates are being checked

```
ℹ Add ice candidate : a=candidate:2 1 UDP 2015363583 fdda:3d25:973c:13bd:8ddd:3755:bb97:82ab 53923 typ host
ℹ Add ice candidate : a=candidate:3 1 UDP 2015363839 fdda:3d25:973c:13bd:7191:4305:658a:df7e 45137 typ host
ℹ Add ice candidate : a=candidate:4 1 UDP 2015364095 fdda:3d25:973c:13bd:6af8:2395:ff56:87f5 44650 typ host
ℹ Add ice candidate : a=candidate:5 1 UDP 2015364351 fdda:3d25:973c:13bd:ae2f:8427:5465:ecd5 33034 typ host
ℹ Add ice candidate : a=candidate:6 1 UDP 2015364607 fdda:3d25:973c:13bd:9713:832d:c61c:9f8d 37241 typ host
ℹ Add ice candidate : a=candidate:7 1 UDP 2015364863 fdda:3d25:973c:13bd:dd83:c72d:2f12:b460 50442 typ host
ℹ Add ice candidate : a=candidate:8 1 UDP 2015365119 fdda:3d25:973c:13bd:2c2f:2b5a:f526:8bbd 39537 typ host
ℹ Add ice candidate : a=candidate:9 1 UDP 2015365375 fdda:3d25:973c:13bd:50d6:cd79:3c9c:a7a7 56877 typ host
ℹ Add ice candidate : a=candidate:10 1 UDP 2015365631 f80::5585:d653:b4c9:27cb 42429 typ host
ℹ Add ice candidate : a=candidate:11 1 UDP 1679819007 72.58.144.207 3963 typ srflx raddr 192.168.1.22 rport 56687
❗ ▶ PlayingSource: - "Notify error: Play failure: Play request cancelled"
❗ ▶ Player: - {isRecoverable: true, mediaType: undefined, message: "Play failure: Play request cancelled", ...}
```

Discovery

NAT64 prefix: 2607:7700:0:6:0:2::/96

2607:7700:0:6:0:2:483a:90cf → 72.58.144.207

Safari

Chrome

Time	Source	Destination	Protocol	Info
4.316523	2607:f90e:aee2:186f:b596:f468:b83d:2abe	2607:7700:0:6:0:2:c0a8:116	STUN	Binding Request user: FPI96Q08
4.317586	2607:f90e:aee2:186f:b596:f468:b83d:2abe	2607:7700:0:6:0:2:d80c:3d0a	STUN	Binding Request
4.364696	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:50d6:c079:3c9c:a7a7	STUN	Binding Request user: FPI96Q08
4.368948	2607:7700:0:6:0:2:d80c:3d0a	2607:f90e:aee2:186f:b596:f468:b83d:2abe	STUN	Binding Success Response XOR-
4.418113	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:2c2f:2b5a:f526:8bbd	STUN	Binding Request user: FPI96Q08
4.469940	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:d083:c72d:2f12:b460	STUN	Binding Request user: FPI96Q08
4.523028	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:9713:832d:c61c:9f8d	STUN	Binding Request user: FPI96Q08
4.572871	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:aef2:8427:5465:ecd5	STUN	Binding Request user: FPI96Q08
4.649411	fd08:976a:d5d1:2c10::1c	2607:f90e:aee2:186f:b596:f468:b83d:2abe	ICMPv6	Destination Unreachable (Admini
4.626926	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:6af8:2395:f56:87f5	STUN	Binding Request user: FPI96Q08
4.675151	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:7191:4305:058a:d7fe	STUN	Binding Request user: FPI96Q08
4.785540	fd08:976a:d5d1:2c10::1c	2607:f90e:aee2:186f:b596:f468:b83d:2abe	ICMPv6	Destination Unreachable (Admini
4.782223	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:8dd3:375b:b97:82ab	STUN	Binding Request user: FPI96Q08
4.828420	2607:f90e:aee2:186f:b596:f468:b83d:2abe	2607:7700:0:6:0:2:c0a8:116	STUN	Binding Request user: FPI96Q08
4.879999	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:50d6:c079:3c9c:a7a7	STUN	Binding Request user: FPI96Q08
4.932484	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:2c2f:2b5a:f526:8bbd	STUN	Binding Request user: FPI96Q08
4.986678	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:d083:c72d:2f12:b460	STUN	Binding Request user: FPI96Q08
4.931398	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:9713:832d:c61c:9f8d	STUN	Binding Request user: FPI96Q08
5.089990	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:aef2:8427:5465:ecd5	STUN	Binding Request user: FPI96Q08
5.131485	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:6af8:2395:f56:87f5	STUN	Binding Request user: FPI96Q08
5.232281	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:7191:4305:058a:d7fe	STUN	Binding Request user: FPI96Q08
5.285665	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:8dd3:375b:b97:82ab	STUN	Binding Request user: FPI96Q08
5.399448	2607:f90e:aee2:186f:b596:f468:b83d:2abe	2607:7700:0:6:0:2:c0a8:116	STUN	Binding Request user: FPI96Q08
5.441720	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:50d6:c079:3c9c:a7a7	STUN	Binding Request user: FPI96Q08
5.454093	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:2c2f:2b5a:f526:8bbd	STUN	Binding Request user: FPI96Q08
5.529343	fd08:976a:d5d1:2c10::1c	2607:f90e:aee2:186f:b596:f468:b83d:2abe	ICMPv6	Destination Unreachable (Admini
5.545742	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:d083:c72d:2f12:b460	STUN	Binding Request user: FPI96Q08
5.598813	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:9713:832d:c61c:9f8d	STUN	Binding Request user: FPI96Q08
5.652606	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:aef2:8427:5465:ecd5	STUN	Binding Request user: FPI96Q08
5.743454	fd08:976a:d5d1:2c10::1c	2607:f90e:aee2:186f:b596:f468:b83d:2abe	ICMPv6	Destination Unreachable (Admini
5.784952	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:6af8:2395:f56:87f5	STUN	Binding Request user: FPI96Q08
5.738933	fd08:976a:d5d1:2c10::1c	2607:f90e:aee2:186f:b596:f468:b83d:2abe	ICMPv6	Destination Unreachable (Admini
5.756088	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:7191:4305:058a:d7fe	STUN	Binding Request user: FPI96Q08
5.869450	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:8dd3:375b:b97:82ab	STUN	Binding Request user: FPI96Q08
5.912429	2607:f90e:aee2:186f:b596:f468:b83d:2abe	2607:7700:0:6:0:2:c0a8:116	STUN	Binding Request user: FPI96Q08
5.964650	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:50d6:c079:3c9c:a7a7	STUN	Binding Request user: FPI96Q08
6.015434	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:2c2f:2b5a:f526:8bbd	STUN	Binding Request user: FPI96Q08
6.067598	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:d083:c72d:2f12:b460	STUN	Binding Request user: FPI96Q08
6.120956	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:9713:832d:c61c:9f8d	STUN	Binding Request user: FPI96Q08
6.172823	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:aef2:8427:5465:ecd5	STUN	Binding Request user: FPI96Q08
6.221971	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:6af8:2395:f56:87f5	STUN	Binding Request user: FPI96Q08

Time	Source	Destination	Protocol	Info
16.858785	2607:f90e:aee2:186f:b596:f468:b83d:2abe	2607:7700:0:6:0:2:c0a8:116	STUN	Binding Request user: W9T24QvSg
16.858810	2607:f90e:aee2:186f:b596:f468:b83d:2abe	2607:7700:0:6:0:2:d80c:3d0a	STUN	Binding Request
16.858973	2607:f90e:aee2:186f:b596:f468:b83d:2abe	2607:7700:0:6:0:2:d80c:3d0a	STUN	Binding Request
16.983796	2607:7700:0:6:0:2:d80c:3d0a	2607:f90e:aee2:186f:b596:f468:b83d:2abe	STUN	Binding Success Response XOR-
16.986599	2607:7700:0:6:0:2:d80c:3d0a	2607:f90e:aee2:186f:b596:f468:b83d:2abe	STUN	Binding Success Response XOR-
16.914568	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:50d6:c079:3c9c:a7a7	STUN	Binding Request user: W9T24QvSg
16.977126	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:2c2f:2b5a:f526:8bbd	STUN	Binding Request user: W9T24QvSg
17.038620	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:d083:c72d:2f12:b460	STUN	Binding Request user: W9T24QvSg
17.103606	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:9713:832d:c61c:9f8d	STUN	Binding Request user: W9T24QvSg
17.197727	fd08:976a:d5d1:2c10::1c	2607:f90e:aee2:186f:b596:f468:b83d:2abe	ICMPv6	Destination Unreachable (Admini
17.165361	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:aef2:8427:5465:ecd5	STUN	Binding Request user: W9T24QvSg
17.283180	fd08:976a:d5d1:2c10::1c	2607:f90e:aee2:186f:b596:f468:b83d:2abe	ICMPv6	Destination Unreachable (Admini
17.278804	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:8dd3:375b:b97:82ab	STUN	Binding Request user: W9T24QvSg
17.257580	fd08:976a:d5d1:2c10::1c	2607:f90e:aee2:186f:b596:f468:b83d:2abe	ICMPv6	Destination Unreachable (Admini
17.291078	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:50d6:c079:3c9c:a7a7	STUN	Binding Request user: W9T24QvSg
17.354317	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:8dd3:375b:b97:82ab	STUN	Binding Request user: W9T24QvSg
17.388457	fd08:976a:d5d1:2c10::1c	2607:f90e:aee2:186f:b596:f468:b83d:2abe	ICMPv6	Destination Unreachable (Admini
17.46737	2607:f90e:aee2:186f:b596:f468:b83d:2abe	2607:7700:0:6:0:2:483a:90cf	STUN	Binding Request user: W9T24QvSg
17.466193	2607:7700:0:6:0:2:483a:90cf	2607:f90e:aee2:186f:b596:f468:b83d:2abe	STUN	Binding Success Response XOR-
17.476784	2607:7700:0:6:0:2:483a:90cf	2607:f90e:aee2:186f:b596:f468:b83d:2abe	STUN	Binding Success Response XOR-
17.476852	2607:f90e:aee2:186f:b596:f468:b83d:2abe	2607:7700:0:6:0:2:b161:12ef:6db	STUN	Binding Request user: W9T24QvSg
17.473731	2607:f90e:aee2:186f:b596:f468:b83d:2abe	2607:7700:0:6:0:2:483a:90cf	STUN	Binding Success Response XOR-
17.534190	2607:7700:0:6:0:2:483a:90cf	2607:f90e:aee2:186f:b596:f468:b83d:2abe	STUN	Binding Success Response XOR-
17.534194	2607:7700:0:6:0:2:483a:90cf	2607:f90e:aee2:186f:b596:f468:b83d:2abe	STUN	Binding Request user: V0Ax:W9T2
17.535120	2607:f90e:aee2:186f:b596:f468:b83d:2abe	2607:7700:0:6:0:2:b161:12ef:6db	STUN	Binding Success Response XOR-
17.537931	2607:f90e:aee2:186f:b596:f468:b83d:2abe	2607:7700:0:6:0:2:483a:90cf	STUN	Binding Request user: W9T24QvSg
17.583756	2607:7700:0:6:0:2:483a:90cf	2607:f90e:aee2:186f:b596:f468:b83d:2abe	STUN	Binding Success Response XOR-
17.609536	2607:f90e:aee2:186f:b596:f468:b83d:2abe	2607:7700:0:6:0:2:b161:12ef:6db	STUN	Binding Request user: W9T24QvSg
17.629584	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:50d6:c079:3c9c:a7a7	STUN	Binding Request user: W9T24QvSg
17.629584	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:d083:c72d:2f12:b460	STUN	Binding Request user: W9T24QvSg
17.726688	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:9713:832d:c61c:9f8d	STUN	Binding Request user: W9T24QvSg
17.774456	fd08:976a:d5d1:2c10::1c	2607:f90e:aee2:186f:b596:f468:b83d:2abe	ICMPv6	Destination Unreachable (Admini
17.789736	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:8dd3:375b:b97:82ab	STUN	Binding Request user: W9T24QvSg
17.852318	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:50d6:c079:3c9c:a7a7	STUN	Binding Request user: W9T24QvSg
17.913727	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:aef2:8427:5465:ecd5	STUN	Binding Request user: W9T24QvSg
17.972113	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:9713:832d:c61c:9f8d	STUN	Binding Request user: W9T24QvSg
18.039198	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:7191:4305:058a:d7fe	STUN	Binding Request user: W9T24QvSg
18.101742	2607:f90e:aee2:186f:b596:f468:b83d:2abe	fd3a:3d25:973c:13bd:8dd3:375b:b97:82ab	STUN	Binding Request user: W9T24QvSg
18.114294	fd08:976a:d5d1:2c10::1c	2607:f90e:aee2:186f:b596:f468:b83d:2abe	ICMPv6	Destination Unreachable (Admini
18.165292	2607:f90e:aee2:186f:b596:f468:b83d:2abe	2607:7700:0:6:0:2:c0a8:116	STUN	Binding Request user: W9T24QvSg

Safari Bug 278672

Resolution

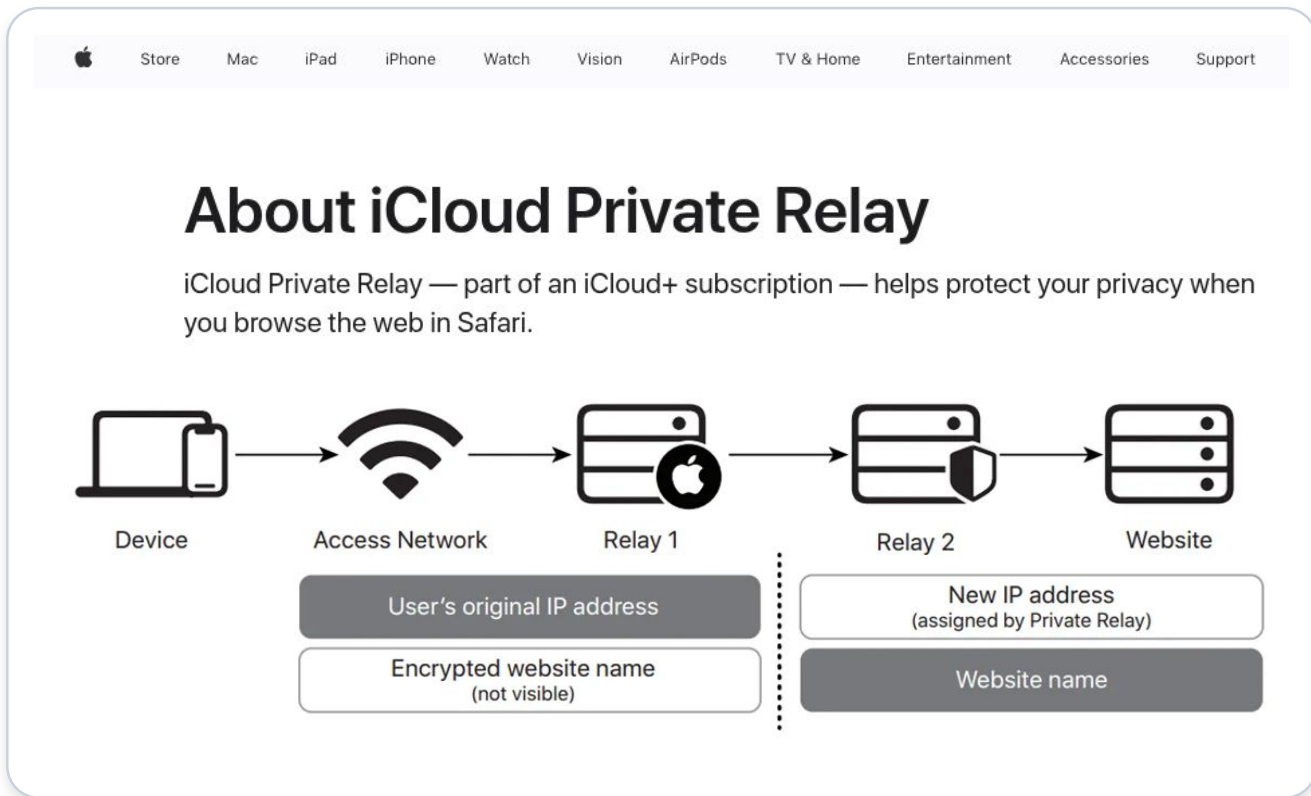


Enable TURN

Fleet-wide TURN roll out for the customer

The customer is still reporting viewing problems on iPhone. The TURN server didn't resolve the issue...

More Discovery

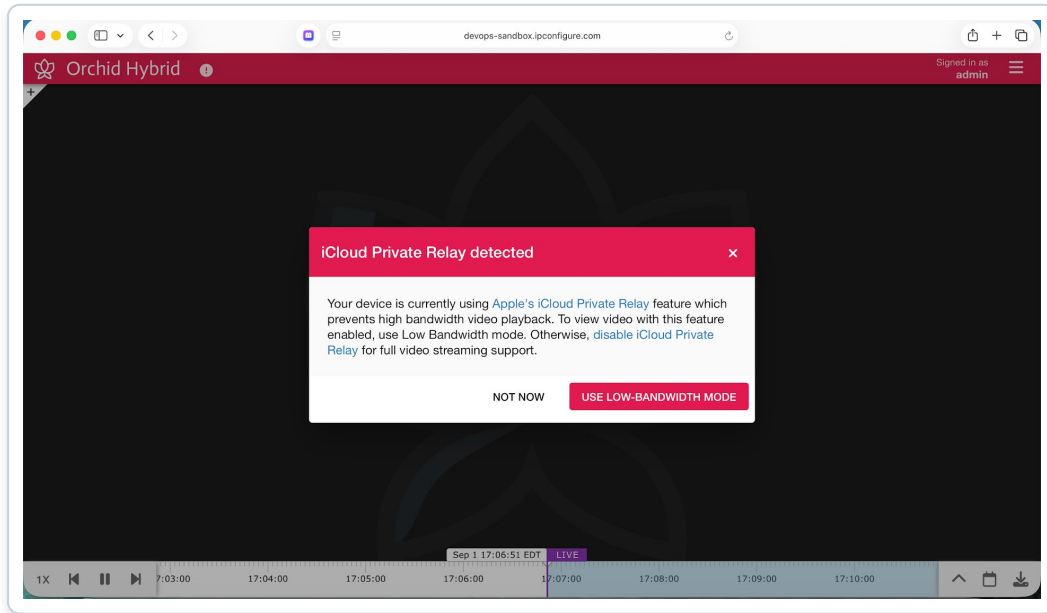


Resolution

Warn users who have iCloud Private Relay enabled

- Detect iCloud Private Relay in the client
- Warn the user and offer a different mode for video streaming
- Guide them to disable Private Relay for WebRTC streaming

(very unfulfilling)



Takeaways



2019 · mDNS

- Stay up to date with the evolution of WebRTC
- We're at the mercy of browsers!



2024 · ICE nomination

- A one-line default change in 1.20 had a big impact on connection times
- RFC 8445 removes the need for aggressive mode
- Configurable nomination criteria would be nice



2026 · Safari & IPv6

- TURN helps, until the client platform fights you
- iCloud Private Relay: sometimes the best you can do is warn the user

Thank you

Questions?

Jake Foytik · IPConfigure · GStreamer 2026