

# Trickle ICE

Incremental Provisioning of Candidates for the  
Interactive Connectivity Establishment (ICE) Protocol

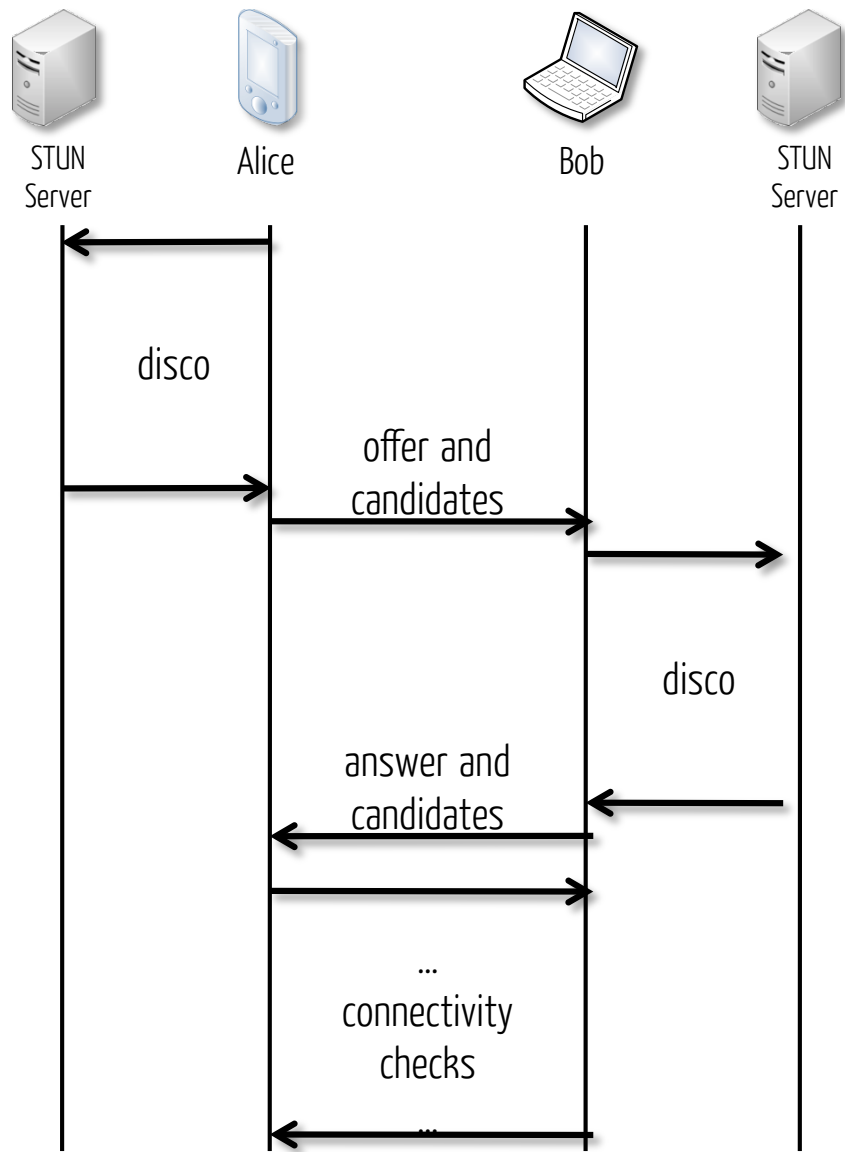
draft-ivov-mmusic-trickle-ice

Eric Rescorla

Justin Uberti

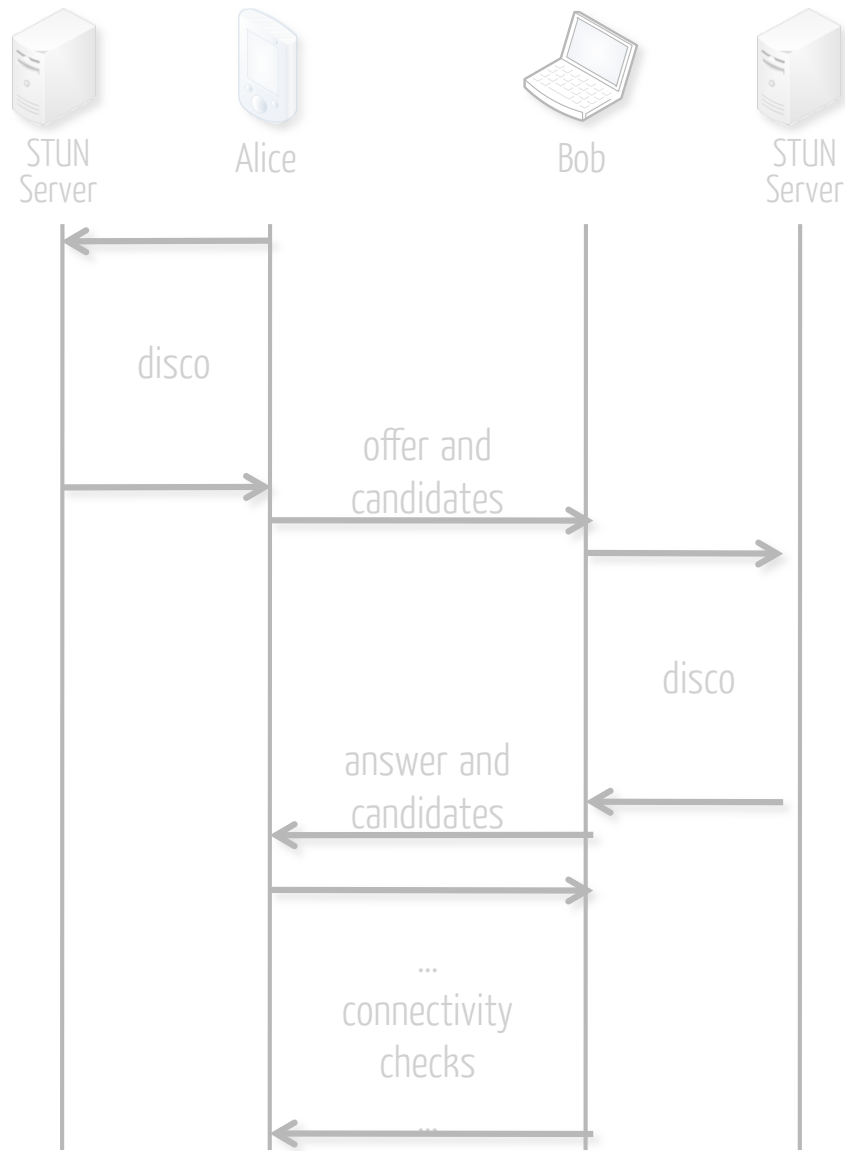
Emil Ivov

# Reminder: Vanilla ICE

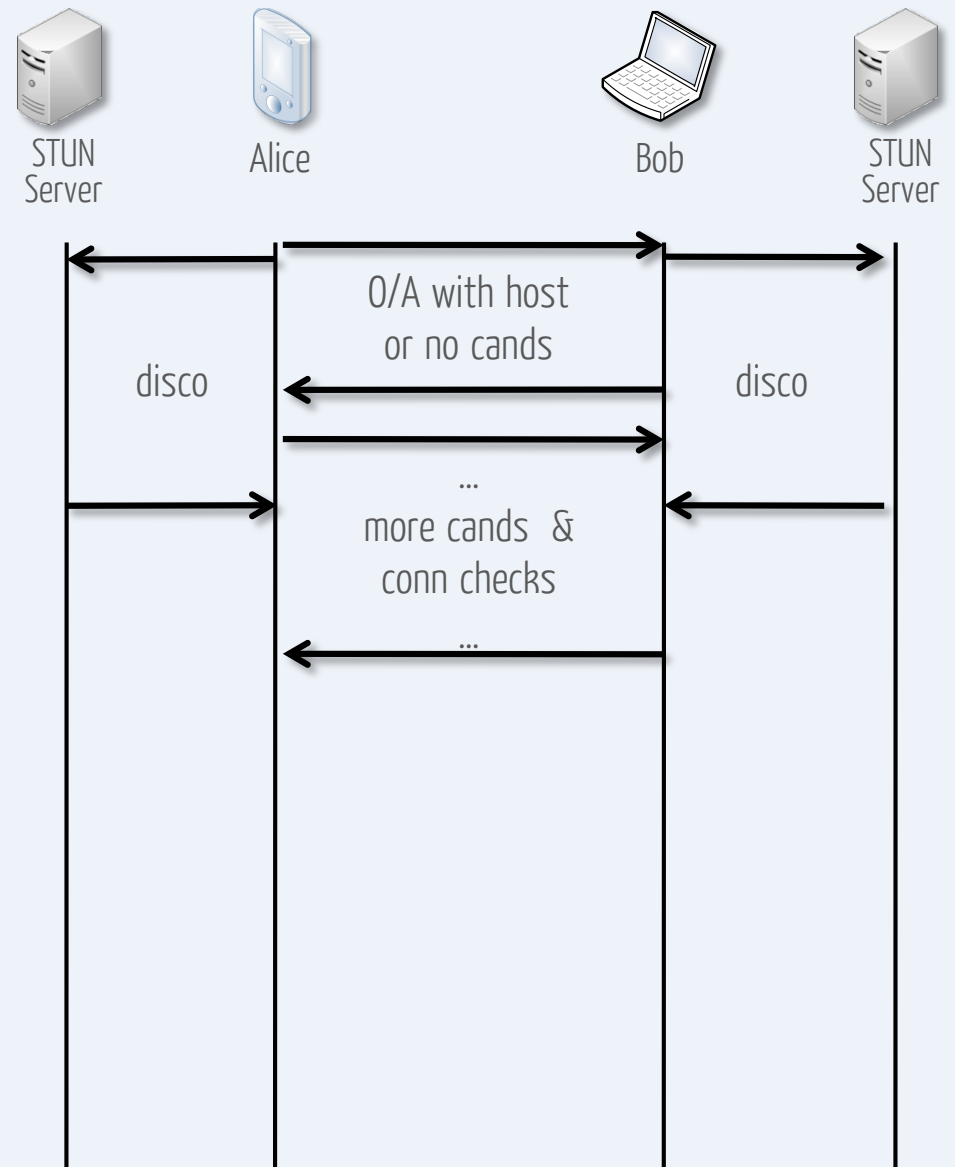


Vanilla ICE as per RFC 5245

# Reminder: Vanilla ICE vs Trickle ICE



Vanilla ICE as per RFC 5245



Trickle ICE

# One Main Remaining Issue

How do we handle candidate unfreezing?

# Unfreezing Pairs

Alice Host: A1  
Bob Host: B1

Alice STUN: A2  
Bob STUN: B2

Audio.RTP: 5000  
Video.RTP: 5002

Audio.RTCP: 5001  
Video.RTCP: 5003

# Unfreezing Pairs

Alice Host: A1  
Bob Host: B1

Alice STUN: A2  
Bob STUN: B2

Audio.RTP: 5000  
Video.RTP: 5002

Audio.RTCP: 5001  
Video.RTCP: 5003

A's lists		Host/Host	Host/Srflx	Srflx/Host	Srflx/Srflx
	Str.Cmp	Foundation A1B1	Foundation A1B2	Foundation A2B1	Foundation A2B2
CheckList.1	Audio.1	A1:5000/B1:5000	A1:5000/B2:5000	A2:5000/B1:5000	A2:5000/B2:5000
	Audio.2	A1:5001/B1:5001	A1:5001/B2:5001	A2:5001/B1:5001	A2:5001/B2:5001
CheckList.2	Video.1	A1:5002/B1:5002	A1:5002/B2:5002	A2:5002/B1:5002	A2:5002/B2:5002
	Video.2	A1:5003/B1:5003	A1:5003/B2:5003	A2:5003/B1:5003	A2:5003/B2:5003

B's lists		Host/Host	Host/Srflx	Srflx/Host	Srflx/Srflx
	Str.Cmp	Foundation B1A1	Foundation B1A2	Foundation B2A1	Foundation B2A2
CheckList.1	Audio.1	B1:5000/A1:5000	B1:5000/A2:5000	B2:5000/A1:5000	B2:5000/A2:5000
	Audio.2	B1:5001/A1:5001	B1:5001/A2:5001	B2:5001/A1:5001	B2:5001/A2:5001
CheckList.2	Video.1	B1:5002/A1:5002	B1:5002/A2:5002	B2:5002/A1:5002	B2:5002/A2:5002
	Video.2	B1:5003/A1:5003	B1:5003/A2:5003	B2:5003/A1:5003	B2:5003/A2:5003

# Initial Unfreeze

Alice Host: A1  
Bob Host: B1

Alice STUN: A2  
Bob STUN: B2

Audio.RTP: 5000  
Video.RTP: 5002

Audio.RTCP: 5001  
Video.RTCP: 5003

A's lists		Host/Host	Host/Srflx	Srflx/Host	Srflx/Srflx
	Str.Cmp	Foundation A1B1	Foundation A1B2	Foundation A2B1	Foundation A2B2
CheckList.1	Audio.1	<b>A1:5000/B1:5000</b>	<b>A1:5000/B2:5000</b>	A2:5000/B1:5000	A2:5000/B2:5000
	Audio.2	A1:5001/B1:5001	A1:5001/B2:5001	A2:5001/B1:5001	A2:5001/B2:5001
CheckList.2	Video.1	A1:5002/B1:5002	A1:5002/B2:5002	A2:5002/B1:5002	A2:5002/B2:5002
	Video.2	A1:5003/B1:5003	A1:5003/B2:5003	A2:5003/B1:5003	A2:5003/B2:5003

B's lists		Host/Host	Host/Srflx	Srflx/Host	Srflx/Srflx
	Str.Cmp	Foundation B1A1	Foundation B1A2	Foundation B2A1	Foundation B2A2
CheckList.1	Audio.1	<b>B1:5000/A1:5000</b>	<b>B1:5000/A2:5000</b>	B2:5000/A1:5000	B2:5000/A2:5000
	Audio.2	B1:5001/A1:5001	B1:5001/A2:5001	B2:5001/A1:5001	B2:5001/A2:5001
CheckList.2	Video.1	B1:5002/A1:5002	B1:5002/A2:5002	B2:5002/A1:5002	B2:5002/A2:5002
	Video.2	B1:5003/A1:5003	B1:5003/A2:5003	B2:5003/A1:5003	B2:5003/A2:5003

# Check List Unfreeze

Alice Host: A1  
Bob Host: B1

Alice STUN: A2  
Bob STUN: B2

Audio.RTP: 5000  
Video.RTP: 5002

Audio.RTCP: 5001  
Video.RTCP: 5003

A's lists		Host/Host	Host/Srflx	Srflx/Host	Srflx/Srflx
	Str.Cmp	Foundation A1B1	Foundation A1B2	Foundation A2B1	Foundation A2B2
CheckList.1	Audio.1	<b>A1:5000/B1:5000</b>	<b>A1:5000/B2:5000</b>	A2:5000/B1:5000	A2:5000/B2:5000
	Audio.2	A1:5001/B1:5001	<b>A1:5001/B2:5001</b>	A2:5001/B1:5001	A2:5001/B2:5001
CheckList.2	Video.1	A1:5002/B1:5002	A1:5002/B2:5002	A2:5002/B1:5002	A2:5002/B2:5002
	Video.2	A1:5003/B1:5003	A1:5003/B2:5003	A2:5003/B1:5003	A2:5003/B2:5003

B's lists		Host/Host	Host/Srflx	Srflx/Host	Srflx/Srflx
	Str.Cmp	Foundation B1A1	Foundation B1A2	Foundation B2A1	Foundation B2A2
CheckList.1	Audio.1	<b>B1:5000/A1:5000</b>	<b>B1:5000/A2:5000</b>	B2:5000/A1:5000	B2:5000/A2:5000
	Audio.2	B1:5001/A1:5001	<b>B1:5001/A2:5001</b>	B2:5001/A1:5001	B2:5001/A2:5001
CheckList.2	Video.1	B1:5002/A1:5002	B1:5002/A2:5002	B2:5002/A1:5002	B2:5002/A2:5002
	Video.2	B1:5003/A1:5003	B1:5003/A2:5003	B2:5003/A1:5003	B2:5003/A2:5003



# Foundation Unfreeze, All Lists

Alice Host: A1  
Bob Host: B1

Alice STUN: A2  
Bob STUN: B2

Audio.RTP: 5000  
Video.RTP: 5002

Audio.RTCP: 5001  
Video.RTCP: 5003

A's lists		Host/Host	Host/Srflx	Srflx/Host	Srflx/Srflx
	Str.Cmp	Foundation A1B1	Foundation A1B2	Foundation A2B1	Foundation A2B2
CheckList.1	Audio.1	<b>A1:5000/B1:5000</b>	<b>A1:5000/B2:5000</b>	A2:5000/B1:5000	A2:5000/B2:5000
	Audio.2	A1:5001/B1:5001	<b>A1:5001/B2:5001</b>	A2:5001/B1:5001	A2:5001/B2:5001
CheckList.2	Video.1	A1:5002/B1:5002	<b>A1:5002/B2:5002</b>	A2:5002/B1:5002	A2:5002/B2:5002
	Video.2	A1:5003/B1:5003	<b>A1:5003/B2:5003</b>	A2:5003/B1:5003	A2:5003/B2:5003

B's lists		Host/Host	Host/Srflx	Srflx/Host	Srflx/Srflx
	Str.Cmp	Foundation B1A1	Foundation B1A2	Foundation B2A1	Foundation B2A2
CheckList.1	Audio.1	<b>B1:5000/A1:5000</b>	<b>B1:5000/A2:5000</b>	B2:5000/A1:5000	B2:5000/A2:5000
	Audio.2	B1:5001/A1:5001	<b>B1:5001/A2:5001</b>	B2:5001/A1:5001	B2:5001/A2:5001
CheckList.2	Video.1	B1:5002/A1:5002	<b>B1:5002/A2:5002</b>	B2:5002/A1:5002	B2:5002/A2:5002
	Video.2	B1:5003/A1:5003	<b>B1:5003/A2:5003</b>	B2:5003/A1:5003	B2:5003/A2:5003

# Unfreezing Pairs with Trickle

Alice Host: A1      Alice STUN: A2      Audio.RTP: 5000      Audio.RTCP: 5001  
 Bob Host: B1      Bob STUN: B2      Video.RTP: 5002      Video.RTCP: 5003

A's lists		Host/Host	Host/Srflx	Srflx/Host	Srflx/Srflx
	Str.Cmp	Foundation A1B1	Foundation A1B2	Foundation A2B1	Foundation A2B2
CheckList.1	Audio.1	<b>A1:5000/B1:5000</b>		A2:5000	A2:5000
	Audio.2	A1:5001/B1:5001	<b>A1:5001/B2:5001</b>		
CheckList.2	Video.1	A1:5002/B1:5002			
	Video.2	A1:5003/B1:5003			

B's lists		Host/Host	Host/Srflx	Srflx/Host	Srflx/Srflx
	Str.Cmp	Foundation B1A1	Foundation B1A2	Foundation B2A1	Foundation B2A2
CheckList.1	Audio.1	<b>B1:5000/A1:5000</b>	<b>B1:5000/A2:5000</b>		
	Audio.2	B1:5001/A1:5001		B2:5001	B2:5001
CheckList.2	Video.1	B1:5002/A1:5002			
	Video.2	B1:5003/A1:5003			

# Unfreezing Pairs with Trickle: Failure

Alice Host: A1      Alice STUN: A2      Audio.RTP: 5000      Audio.RTCP: 5001  
 Bob Host: B1      Bob STUN: B2      Video.RTP: 5002      Video.RTCP: 5003

A's lists		Host/Host	Host/Srflx	Srflx/Host	Srflx/Srflx
	Str.Cmp	Foundation A1B1	Foundation A1B2	Foundation A2B1	Foundation A2B2
CheckList.1	Audio.1	<b>A1:5000/B1:5000</b>		A2:5000	A2:5000
	Audio.2	A1:5001/B1:5001	<b>A1:5001/B2:5001</b>		
CheckList.2	Video.1	A1:5002/B1:5002			
	Video.2	A1:5003/B1:5003			

B's lists		Host/Host	Host/Srflx	Srflx/Host	Srflx/Srflx
	Str.Cmp	Foundation B1A1	Foundation B1A2	Foundation B2A1	Foundation B2A2
CheckList.1	Audio.1	<b>B1:5000/A1:5000</b>	<b>B1:5000/A2:5000</b>		
	Audio.2	B1:5001/A1:5001		B2:5001	B2:5001
CheckList.2	Video.1	B1:5002/A1:5002			
	Video.2	B1:5003/A1:5003			

# Two ways to address this

- We forget about freezing (Chrome, Firefox)

Slim(?) chance of timeouts if STUN & sign lag

- We preserve component order

May slow delay ICE processing a bit in some cases

Now to the fun stuff:

# Trickle ICE with SIP

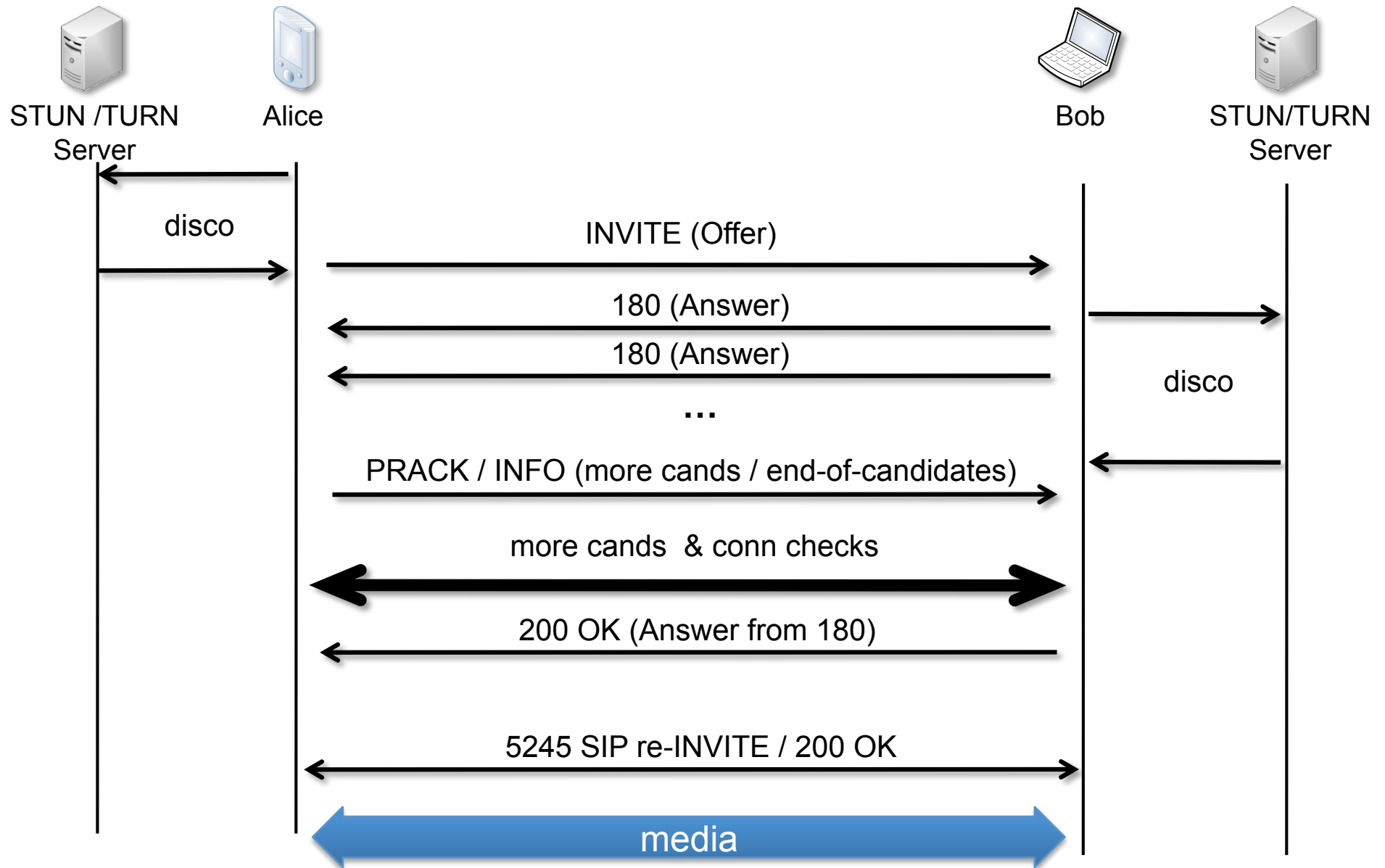
draft-ivov-mmusic-trickle-ice-sip

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# Vague consensus on the following:



# Summary of trickle ICE for SIP

- PRACK is optional
- Can be replaced with INFO: end-of-candidates
  
- Candidates are trickled with INFOs

## **Cumulatively or sequentially?**

- Cumulative: allows not to care for INFO delivery but
- Sequential: easier mapping on top of current WebRTC API

# application/sdpfrag

```
INFO sip:alice@example.com SIP/2.0
```

```
...
```

```
Info-Package: trickle-ice
```

```
Content-type: application/sdpfrag
```

```
Content-Disposition: Info-Package
```

```
Content-length: ...
```

```
a=mid:1
```

```
a=candidate:1 1 UDP 1658497328 192.168.100.33 5000 typ host
```

```
a=candidate:2 1 UDP 1658497328 96.1.2.3 5000 typ srflx
```

```
a=mid:2
```

```
a=candidate:2 1 UDP 1658497328 96.1.2.3 5002 typ srflx
```

```
a=end-of-candidates
```

Content type is application/sdpfrag defined in draft-ivov-mmusic-sdpfrag

(help needed)