

SIGNALIZACIJSKI PROTOKOLI I ANALIZA SIP JEDINICE

DRUGA DOMAĆA ZADAĆA IZ
KOMUNIKACIJSKIH PROTOKOLA

G-bear, NEKIBROJEVI

21.12.2012.

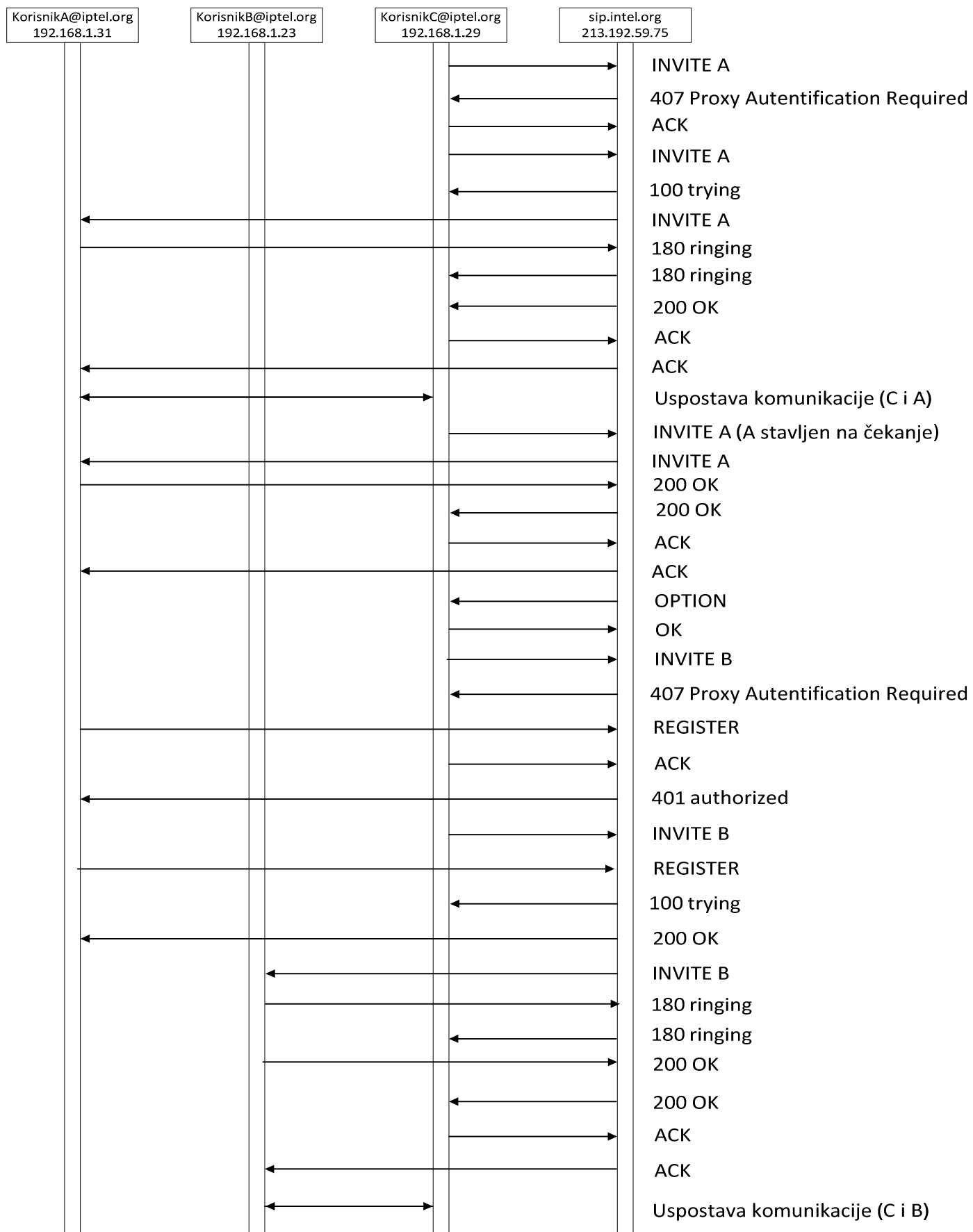
Zadatak 1

Nakon što ste iz repozitorija datoteka koji se nalazi na službenoj stranici predmeta dohvatili datoteku *Datoteke_potrebne_za_izradu_2._domace_zadace.rar*, otvorite datoteke sa snimljenim mrežnim prometom pomoću alata Wireshark. U promatranoj SIP-sjednici sudjeluju tri korisnika (korisnici A, B i C), a u spomenutoj datoteci nalazi se promet prikupljen na računalu svakog pojedinog korisnika. Proučite mrežni promet prikupljen na računalima svih triju korisnika.

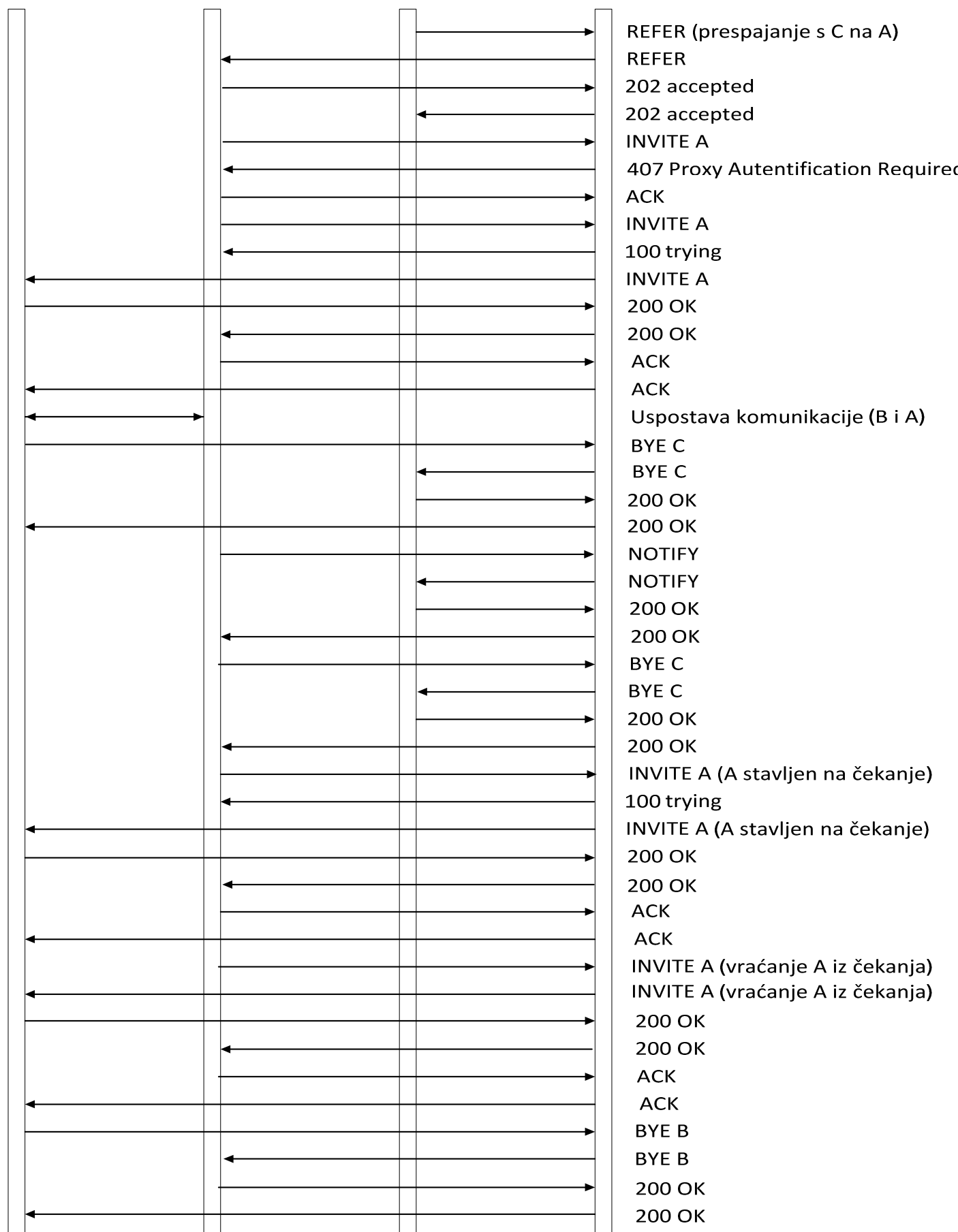
Vaš zadatak je na temelju prikupljenog prometa, uz poznatu informaciju da korisnik C započinje sjednicu, nacrtati slijedni dijagram izmjene SIP-poruka između korisnika A (IP-adresa 192.168.1.31), B (IP-adresa 192.168.1.23), C (IP-adresa 192.168.1.29) i poslužitelja *sip.intel.org* (IP-adresa 213.192.59.75) prema uputama u nastavku. Uz slijedni dijagram potrebno je navesti objašnjenje slijeda korisničkih akcija tijekom sjednice (primjerice, *Korisnik X uspostavlja sjednicu šaljući korisniku Y poruku ABC*). Za vrijeme trajanja sjednice pokrenute su usluga prebacivanja poziva i usluga stavljanja poziva na čekanje. Odredite koji korisnici pomoću kojih poruka iniciraju navedene akcije te umetnite u izvještaj sliku odgovarajućih paketa.

Nakon što ste analizirali mrežni promet, pronađite dijelove sjednice kojima su ostvareni:
Grupa A (studenti čiji JMBAG završava parnim brojem)

- a) uspostava sjednice (dovoljno je skicirati slučaj za jednog od korisnika)
- b) usluga stavljanja poziva na čekanje



Slika 1. Slijedni dijagram (prvi dio)



Slika 2. Slijedni dijagram (drugi dio)

Slijednim dijagramom opisan je vremenski slijed slanja različitih SIP-poruka (zahtjeva i odgovora) kojima komuniciraju tri korisnika (KorisnikA@iptel.org, KorisnikB@iptel.org i KorisnikC@iptel.org) preko poslužitelja sip.intel.org.

Korisnik C započinje komunikaciju. On šalje SIP poruku metode INVITE prema korisniku A. U tijelu te poruke se nalazi i SDP opis. Korisnik C šalje ACK odgovor prema korisniku A i time se uspostavlja komunikacija. Korisnik C zatim šalje novu INVITE poruku u kojoj se u SDP opisu nalazi i atribut Media Attribute čije je vrijednost *sendonly*. Tako korisnik C u principu postavlja korisnika A na čekanje. Nakon toga Korisnik C šalje INVITE korisniku B. Nakon što do korisnika B dolazi ACK odgovor, uspostavlja se komunikacija između Korisnika C i Korisnika B. Korisnik C preusmjerava promet sa sebe na Korisnika A i time prespaja poziv sa sebe na Korisnika A. Korisnik B šalje ACK prema Korisniku A i time uspostavlja komunikaciju između Korisnika B i Korisnika A. Korisniku C stiže BYE poruka od strane Korisnika A čime Korisnik A zahtjeva prekid komunikacije s Korisnikom C. Korisnik B šalje SIP poruku NOTIFY čime javlja da je došlo do promjene stanja resursa i nakon toga šalje SIP poruku BYE i zahtjeva prekid s Korisnikom C. Nakon toga Korisnik B šalje INVITE prema a s atributom Media Attribute postavljenim na *sendonly* s čime stavlja Korisnika A na čekanje. Nakon toga ga miče s čekanja tako da mu pošalje INVITE sa atributom Media Attribute postavljenim na *sendrcv*. Korisnik A prima ACK s čime više nije u stanju čekanja. Na kraju Korisnik B primi BYE od Korisnika A i nakon što primi poruku OK komunikacija između Korisnika A i Korisnika B se prekida.

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.168.1.29	213.192.59.75	SIP/SDP	873	Request: INVITE sip:KorisnikA@iptel.org , with session description
2	0.224146	213.192.59.75	192.168.1.29	SIP	700	Status: 407 Proxy Authentication Required
3	0.224827	192.168.1.29	213.192.59.75	SIP	413	Request: ACK sip:KorisnikA@iptel.org
4	0.225635	192.168.1.29	213.192.59.75	SIP/SDP	1080	Request: INVITE sip:KorisnikA@iptel.org , with session description
75	0.397105	213.192.59.75	192.168.1.31	SIP/SDP	1186	Request: INVITE sip:KorisnikA@192.168.1.31:5070 , with session description
76	0.398221	192.168.1.31	213.192.59.75	SIP	592	Status: 180 Ringing
77	0.399957	192.168.1.31	213.192.59.75	SIP	592	Status: 180 Ringing
5	0.532055	213.192.59.75	192.168.1.29	SIP	587	Status: 100 trying -- your call is important to us
6	0.838329	213.192.59.75	192.168.1.29	SIP	525	Status: 180 Ringing
7	0.838578	213.192.59.75	192.168.1.29	SIP	525	Status: 180 Ringing
78	2.409106	192.168.1.31	213.192.59.75	SIP	592	Status: 180 Ringing
8	2.681520	213.192.59.75	192.168.1.29	SIP	525	Status: 180 Ringing
79	4.408241	192.168.1.31	213.192.59.75	SIP	592	Status: 180 Ringing
9	4.832312	213.192.59.75	192.168.1.29	SIP	525	Status: 180 Ringing
80	6.363945	192.168.1.31	213.192.59.75	SIP/SDP	1119	Status: 200 OK , with session description
81	6.642294	213.192.59.75	192.168.1.31	SIP	853	Request: ACK sip:KorisnikA@192.168.1.31:5070
10	6.675316	213.192.59.75	192.168.1.29	SIP/SDP	1053	Status: 200 OK , with session description
Frame 1: 873 bytes on wire (6984 bits), 873 bytes captured (6984 bits)						
Ethernet II, Src: IntelCor_c3:c7:9c (8c:a9:82:c3:c7:9c), Dst: Thomson_40:5a:01 (00:24:17:40:5a:01)						
Internet Protocol Version 4, Src: 192.168.1.29 (192.168.1.29), Dst: 213.192.59.75 (213.192.59.75)						
User Datagram Protocol, Src Port: vtsas (5070), Dst Port: sip (5060)						
Session Initiation Protocol (INVITE)						
Request-Line: INVITE sip:KorisnikA@iptel.org SIP/2.0						
Message Header						
Via: SIP/2.0/UDP 5.154.176.243:5070;rport;branch=z9hG4bK295860						
To: <sip:KorisnikA@iptel.org>						
From: "KorisnikC" <sip:KorisnikC@iptel.org>;tag=3357						
Call-ID: 1322421641-5860-PERUN@5.154.176.243						
CSeq: 63 INVITE						
Max-Forwards: 20						
User-Agent: NCH Software Express Talk 4.20						
Contact: <sip:KorisnikC@5.154.176.243:5070>						
Allow: INVITE, ACK, CANCEL, OPTIONS, BYE, INFO, REFER, NOTIFY						
Supported: replaces						
Content-Type: application/sdp						
Content-Length: 334						
Message Body						

00000000

00 24 17 40 5a 01 8c a9 82 c3 c7 9c 08 00 45 00 .\$.@Z... ..E..


001003 5b 32 bb 00 00 80 11 32 06 c0 a8 01 1d d5 c0 .[2.... 2.....

00203b 4b 13 ce 13 c4 03 47 6f 85 49 4e 56 49 54 45 ;K.....G 0.INVITE

003020 73 69 70 3a 4b 6f 72 69 73 6e 69 6b 41 40 69 sip:Kor isnikA@i

004070 74 65 6c 2e 6f 72 67 20 53 49 50 2f 32 2e 30 ptel.org SIP/2.0

005004 05 56 60 61 2a 70 53 40 50 2f 32 2e 30 2f 55 ..2.. SIP/2.0/UD

 File: "C:\Users\Neo\AppData\Local\Temp\w..."/>

Packets: 106 Displayed: 106 Marked: 0

Profile: Default

Slika 3. Korisnik C šalje INVITE Korisniku A

```

+ Message Header
+ Message Body
  + Session Description Protocol
    Session Description Protocol Version (v): 0
    + Owner/Creator, Session Id (o): NCHSoftware-Talk 1322421636 1322421643 IN IP4 5.154.176.243
    Session Name (s): Express Talk call
    + Connection Information (c): IN IP4 5.154.176.243
    + Time Description, active time (t): 0 0
    + Media Description, name and address (m): audio 8000 RTP/AVP 0 8 96 3 13 101
    + Media Attribute (a): rtpmap:0 PCMU/8000
    + Media Attribute (a): rtpmap:8 PCMA/8000
    + Media Attribute (a): rtpmap:96 G726-32/8000
    + Media Attribute (a): rtpmap:3 GSM/8000
    + Media Attribute (a): rtpmap:13 CN/8000
    + Media Attribute (a): rtpmap:101 telephone-event/8000
    + Media Attribute (a): fmtp:101 0-16
    Media Attribute (a): sendrecv
  +
  00 00 24 17 40 5a 01 8c a9 82 c3 c7 9c 08 00 45 00 .$.@Z... ..E.
  10 03 5b 32 bb 00 00 80 11 32 06 c0 a8 01 1d d5 c0 .[2.... 2.....
  20 3b 4b 13 ce 13 c4 03 47 6f 85 49 4e 56 49 54 45 ;K.....G O.INVITE
  30 20 73 69 70 3a 4b 6f 72 69 73 6e 69 6b 41 40 69 sip:korisnika@iptel.org SIP/2.0
  40 70 74 65 6c 2e 6f 72 67 20 53 49 50 2f 32 2e 30 ptel.org SIP/2.0
  50 0d 07 56 60 61 2a 2a 53 40 50 2f 32 2e 30 2f 55

```

Slika 4. Tijelo INVITE-a Korisnika C prema Korisniku A

Kao što se vidi na slikama 3 i 4, Korisnik C šalje INVITE Korisniku A s namjerom uspostavljanja komunikacije. Kako što je vidljivo na slikama, poruka uz zaglavlja sadrži i tijelo poruke u kojemu je SDP opis.

No.	Time	Source	Destination	Protocol	Length	Info
80	6.363945	192.168.1.31	213.192.59.75	SIP/SDF	1119	Status: 200 OK , with session description
81	6.642294	213.192.59.75	192.168.1.31	SIP	853	Request: ACK sip:korisnika@192.168.1.31:5070
10	6.675216	213.192.59.75	192.168.1.29	SIP/SDF	1052	Status: 200 OK , with session description
11	6.676226	192.168.1.29	213.192.59.75	SIP	736	Request: ACK sip:korisnika@78.0.207.74:58316
82	10.680947	213.192.59.75	192.168.1.31	SIP/SDF	1194	Request: INVITE sip:korisnika@192.168.1.31:5070, in-dialog
83	10.682147	192.168.1.31	213.192.59.75	SIP/SDF	1119	Status: 200 OK , with session description

```

+ Frame 11: 736 bytes on wire (5888 bits), 736 bytes captured (5888 bits)
+ Ethernet II, Src: IntelCor_c3:c7:9c (8c:a9:82:c3:c7:9c), Dst: ThomsonsT_40:5a:01 (00:24:17:40:5a:01)
+ Internet Protocol Version 4, Src: 192.168.1.29 (192.168.1.29), Dst: 213.192.59.75 (213.192.59.75)
+ User Datagram Protocol, Src Port: vtsas (5070), Dst Port: sip (5060)
+ Session Initiation Protocol (ACK)
  Request-Line: ACK sip:korisnika@78.0.207.74:58316 SIP/2.0
  Message Header
    + Via: SIP/2.0/UDP 5.154.176.243:5070;rport;branch=z9hg4bk315860
    + To: <sip:korisnika@iptel.org>;tag=10008
    + From: "KorisnikC" <sip:korisnikc@iptel.org>;tag=3357
    Call-ID: 1322421641-5860-PERUN@5.154.176.243
    + CSeq: 64 ACK
    Max-Forwards: 20
    User-Agent: NCH Software Express Talk 4.20
    + Route: <sip:213.192.59.75;ftag=3357;avp=z10DBwBHy2Nvdw50AwB5ZXMDBgBzdGltZXIEADE4MDADCQBkawFsb2dfawQWADNlMDgtNGVkmGE4MDYtZ
    + Proxy-Authorization: Digest username="korisnikc",realm="iptel.org",nonce="TtKV1U7S1csXEtZQYPngQfXiyvwBXsg",uri="sip:kori
    Content-Length: 0

```

Slika 5. ACK poruka Korisnika C

No.	Time	Source	Destination	Protocol	Length	Info
10	6.675216	213.192.59.75	192.168.1.29	SIP/SDF	1052	Status: 200 OK , with session description
11	6.676226	192.168.1.29	213.192.59.75	SIP	736	Request: ACK sip:Korisnika@78.0.207.74:58316
82	10.680947	213.192.59.75	192.168.1.31	SIP/SDF	1104	Request: INVITE sip:Korisnika@192.168.1.31:5070, in-dialog , with session description
83	10.682147	192.168.1.31	213.192.59.75	SIP/SDF	1119	Status: 200 OK , with session description
12	10.695987	192.168.1.29	213.192.59.75	SIP/SDF	1031	Request: INVITE sip:Korisnika@78.0.207.74:58316, in-dialog , with session description

Frame 82: 1194 bytes on wire (9552 bits), 1194 bytes captured (9552 bits)
 Ethernet II, Src: ThomsonT_40:5a:01 (00:24:17:40:5a:01), Dst: IntelCor_a0:5e:99 (00:1f:3b:a0:5e:99)
 Internet Protocol Version 4, Src: 213.192.59.75 (213.192.59.75), Dst: 192.168.1.31 (192.168.1.31)
 User Datagram Protocol, Src Port: sip (5060), Dst Port: vtsas (5070)
 Session Initiation Protocol (INVITE)
 Request-Line: INVITE sip:Korisnika@192.168.1.31:5070 SIP/2.0
 Method: INVITE
 Request-URI: sip:Korisnika@192.168.1.31:5070
 Request-URI User Part: Korisnika
 Request-URI Host Part: 192.168.1.31
 Request-URI Host Port: 5070
 [Resent Packet: False]
 Message Header
 Record-Route: <sip:213.192.59.75;ftag=3357;avp=z10DBwBHY2Nvdw50Aw5ZXMDbGBzdG1tzXIEADE4MDADCQ8kawFsb2dfawQWADN1MdgtNGvkMGE4MDYTzGE1MTBjy2Q;lr=on>
 Via: SIP/2.0/UDP 213.192.59.75:5060;branch=z9hG4bKc4ad.a99e8405.0
 Via: SIP/2.0/UDP 5.154.176.243:5070;received=192.168.1.31;rport=59454;branch=z9hG4bK325860
 To: <sip:Korisnika@iptel.org>;tag=10008
 From: "Korisnik" <sip:Korisnik@iptel.org>;tag=3357
 Call-ID: 1322421641-5860-PERUN@5.154.176.243
 CSeq: 65 INVITE
 Max-Forwards: 16
 User-Agent: NCH Software Express Talk 4.20
 Contact: <sip:Korisnik@78.0.207.74:59454>
 Allow: INVITE, ACK, CANCEL, OPTIONS, BYE, INFO, REFER, NOTIFY
 Supported: replaces
 Content-Type: application/sdp
 Content-Length: 334
 P-hint: rr-enforced
 Session-Expires: 1800
 X-RTP-Proxy: YES
 Message Body
 Session Description Protocol
 Session Description Protocol Version (v): 0
 Owner/Creator, Session Id (o): NCHSoftware-Talk 1322421636 1322421644 IN IP4 5.154.176.243
 Session Name (s): Express Talk Call
 Connection Information (c): IN IP4 5.154.176.243
 Time Description, active time (t): 0 0
 Media Description, name and address (m): audio 8000 RTP/AVP 0 8 96 3 13 101
 Media Attribute (a): rtpmap:0 PCMU/8000
 Media Attribute (a): rtpmap:8 PCMA/8000
 Media Attribute (a): rtpmap:96 G726-32/8000
 Media Attribute (a): rtpmap:3 GSM/8000
 Media Attribute (a): rtpmap:13 CN/8000
 Media Attribute (a): rtpmap:101 telephone-event/8000
 Media Attribute (a): fmp:101 0-16
 Media Attribute (a): sendonly

Slika 6. Korisnik C stavlja Korinika A na čekanje

Message Body

Session Description Protocol

Session Description Protocol version (v): 0

Owner/Creator, Session Id (o): NCHSoftware-Talk 1322421636 1322421644 IN IP4 5.154.176.243

Session Name (s): Express Talk Call

Connection Information (c): IN IP4 5.154.176.243

Time Description, active time (t): 0 0

Media Description, name and address (m): audio 8000 RTP/AVP 0 8 96 3 13 101

Media Attribute (a): rtpmap:0 PCMU/8000

Media Attribute (a): rtpmap:8 PCMA/8000

Media Attribute (a): rtpmap:96 G726-32/8000

Media Attribute (a): rtpmap:3 GSM/8000

Media Attribute (a): rtpmap:13 CN/8000

Media Attribute (a): rtpmap:101 telephone-event/8000

Media Attribute (a): fmp:101 0-16

Media Attribute (a): sendonly

70	61	70	3a	31	30	31	20	74	65	6c	65	70	68	6f	6e	65	ap:101 t	elephone
30	2d	65	76	65	6e	74	2f	38	30	30	30	0d	0a	61	3d	66	-event/8	000..a=f
90	6d	74	70	3a	31	30	31	20	30	2d	31	36	0d	0a	61	3d	mtp:101	0-16..a=
a0	73	65	6e	64	6f	6e	6c	79	0d	0a							sendonly	..

Media Attribute (a) (sdp.media_attr), 10 bytes | Packets: 106 Displayed: 106 Marked: 0

Slika 7. Tijelo poruke sa s kojom Korisnik C stavlja Korisnika A na čekanje

No.	Time	Source	Destination	Protocol	Length	Info
10	6.675216	213.192.59.75	192.168.1.29	SIP/SDP	1052	Status: 200 OK , with session description
11	6.676226	192.168.1.29	213.192.59.75	SIP	736	Request: ACK sip:KorisnikA@78.0.207.74:58316
82	10.680947	213.192.59.75	192.168.1.31	SIP/SDP	1194	Request: INVITE sip:KorisnikA@192.168.1.31:5070, in-dialog , with session
83	10.682147	192.168.1.31	213.192.59.75	SIP/SDP	1119	Status: 200 OK , with session description
12	10.695987	192.168.1.29	213.192.59.75	SIP/SDP	1031	Request: INVITE sip:KorisnikA@78.0.207.74:58316, in-dialog , with session
13	10.807031	213.192.59.75	192.168.1.29	SIP	605	Status: 100 trying -- your call is important to us
84	10.887517	213.192.59.75	192.168.1.31	SIP	646	Request: ACK sip:KorisnikA@192.168.1.31:5070
14	10.932650	213.192.59.75	192.168.1.29	SIP/SDP	1052	Status: 200 OK , with session description
15	10.934404	192.168.1.29	213.192.59.75	SIP	529	Request: ACK sip:KorisnikA@78.0.207.74:58316
16	11.288039	213.192.59.75	192.168.1.29	SIP	311	Request: OPTIONS sip:192.168.1.29:5070;dstip=213.192.59.75;dstport=5060
17	11.288302	192.168.1.29	213.192.59.75	SIP/SDP	763	Status: 200 OK , with session description
85	22.151004	192.168.1.31	213.192.59.75	SIP	612	Request: REGISTER sip:iptel.org
86	22.243116	213.192.59.75	192.168.1.31	SIP	659	Status: 401 Unauthorized (0 bindings)
87	22.243843	192.168.1.31	213.192.59.75	SIP	612	Request: REGISTER sip:iptel.org
88	22.337715	213.192.59.75	192.168.1.31	SIP	625	Status: 200 OK (1 bindings)
18	28.174311	192.168.1.29	213.192.59.75	SIP/SDP	874	Request: INVITE sip:KorisnikB@iptel.org , with session description
19	28.280543	213.192.59.75	192.168.1.29	SIP	701	Status: 407 Proxy Authentication Required
20	28.281297	192.168.1.29	213.192.59.75	SIP	414	Request: ACK sip:KorisnikB@iptel.org
21	28.282099	192.168.1.29	213.192.59.75	SIP/SDP	1081	Request: INVITE sip:KorisnikB@iptel.org , with session description
22	28.406747	213.192.59.75	192.168.1.29	SIP	588	Status: 100 trying -- your call is important to us
23	28.510257	213.192.59.75	192.168.1.29	SIP	525	Status: 180 Ringing
[Frame 16: 311 bytes on wire (2488 bits), 311 bytes captured (2488 bits)]						
[Ethernet II, Src: ThomsonT_40:5a:01 (00:24:17:40:5a:01), Dst: IntelCor_c3:c7:9c (8c:a9:82:c3:c7:9c)]						
[Internet Protocol Version 4, Src: 213.192.59.75 (213.192.59.75), Dst: 192.168.1.29 (192.168.1.29)]						
[User Datagram Protocol, Src Port: sip (5060), Dst Port: vtsas (5070)]						
[Session Initiation Protocol (OPTIONS)]						
[Request-Line: OPTIONS sip:192.168.1.29:5070;dstip=213.192.59.75;dstport=5060 SIP/2.0]						
[Method: OPTIONS]						
[Request-URI: sip:192.168.1.29:5070;dstip=213.192.59.75;dstport=5060]						
[Request-URI Host Part: 192.168.1.29]						
[Request-URI Host Port: 5070]						
[Resent Packet: False]						
[Message Header]						
[Via: SIP/2.0/UDP 213.192.59.75:5060;branch=z9hG4bK-GnIp-240f062]						
[f: sip:registrar@127.0.0.1:9;tag=1]						
[t: sip:192.168.1.29:5070;dstip=213.192.59.75;dstport=5060]						
[i: 240f062]						
[CSeq: 1 OPTIONS]						
[1: 0]						

Slika 8. Posrednički poslužitelj ispituje mogućnosti Korisnika C

Korisnik A šalje poruku statusa ACK i pritom se atribut Cseq ne mijenja (slika 10). Korisnik C želi staviti Korisnika A na čekanje te mu šalje novu SIP INVITE poruku s novim SDP opisom koji ima atribut Media Attribute(a) postavljen na sendonly. Time je Korisnik A stavljen na čekanje. Na slici 8 vidi se poruka koju je poslužitelj poslao Korisniku C da mu ispita opcije.

No.	Time	Source	Destination	Protocol	Length	Info
19	28.280543	192.168.1.29	213.192.59.75	SIP	701	Status: 407 Proxy Authentication Required
20	28.281297	192.168.1.29	213.192.59.75	SIP	414	Request: ACK sip:korisnikB@iptel.org
21	28.282099	192.168.1.29	213.192.59.75	SIP/SDP	1081	Request: INVITE sip:korisnikB@iptel.org , with session description
22	28.406747	213.192.59.75	192.168.1.29	SIP	588	Status: 100 trying -- your call is important to us
23	28.510257	213.192.59.75	192.168.1.29	SIP	525	Status: 180 Ringing
[+] Frame 21: 1081 bytes on wire (8648 bits), 1081 bytes captured (8648 bits)						
[+] Ethernet II, Src: IntelCor_c3:c7:9c (8c:a9:82:c3:c7:9c), Dst: ThomsonT_40:5a:01 (00:24:17:40:5a:01)						
[+] Internet Protocol Version 4, Src: 192.168.1.29 (192.168.1.29), Dst: 213.192.59.75 (213.192.59.75)						
[+] User Datagram Protocol, Src Port: vtsas (5070), Dst Port: sip (5060)						
[+] Session Initiation Protocol (INVITE)						
[+] Request-Line: INVITE sip:korisnikB@iptel.org SIP/2.0						
[+] Message Header						
[+] Via: SIP/2.0/UDP 5.154.176.243:5070;rport;branch=z9hG4bK355860						
[+] To: <sip:korisnikB@iptel.org>						
[+] From: "KorisnikC" <sip:korisnikC@iptel.org>;tag=3358						
[+] Call-ID: 1322421642-5860-PERUN@5.154.176.243						
[+] CSeq: 269 INVITE						
[+] Max-Forwards: 20						
[+] User-Agent: NCH Software Express Talk 4.20						
[+] Contact: <sip:korisnikC@5.154.176.243:5070>						
[+] Proxy-Authorization: Digest username="KorisnikC",realm="iptel.org",nonce="TtkV8k7SlEgdXPuKYD8AFLPRVlTrUGhs",uri="sip:korisnikB@iptel.org"						
[+] Allow: INVITE, ACK, CANCEL, OPTIONS, BYE, INFO, REFER, NOTIFY						
[+] Supported: replaces						
[+] Content-Type: application/sdp						
[+] Content-Length: 334						
[+] Message Body						
[+] Session Description Protocol						
[+] Session Description Protocol Version (v): 0						
[+] Owner/Creator, Session Id (o): NCHSoftware-Talk 1322421637 1322421640 IN IP4 5.154.176.243						
[+] Session Name (s): Express Talk call						
[+] Connection Information (c): IN IP4 5.154.176.243						
[+] Time Description, active time (t): 0 0						
[+] Media Description, name and address (m): audio 8002 RTP/AVP 0 8 96 3 13 101						
[+] Media Attribute (a): rtpmap:0 PCMU/8000						
[+] Media Attribute (a): rtpmap:8 PCMA/8000						
[+] Media Attribute (a): rtpmap:96 G726-32/8000						
[+] Media Attribute (a): rtpmap:3 GSM/8000						
[+] Media Attribute (a): rtpmap:13 CN/8000						
[+] Media Attribute (a): rtpmap:101 telephone-event/8000						
[+] Media Attribute (a): fmtp:101 0-16						
[+] Media Attribute (a): sendrecv						

Slika 9. Korisnik C pokušava inicirati komunikaciju s Korisnikom B

Na slici 9 se vidi poruka poslana na Korisnika B sa zahtjevom komunikacije od Korisnika C.

No.	Time	Source	Destination	Protocol	Length	Info
20	28.281297	192.168.1.29	213.192.59.75	SIP	414	Request: ACK sip:korisnikb@iptel.org
21	28.282099	192.168.1.29	213.192.59.75	SIP/SDF	1081	Request: INVITE sip:korisnikb@iptel.org , with session description
22	28.406747	213.192.59.75	192.168.1.29	SIP	588	Status: 100 trying -- your call is important to us
23	28.510257	213.192.59.75	192.168.1.29	SIP	525	Status: 180 Ringing
24	28.550626	213.192.59.75	192.168.1.29	SIP	525	Status: 180 Ringing
41	29.037142	213.192.59.75	192.168.1.23	SIP/SDF	1187	Request: INVITE sip:korisnikb@192.168.1.23:5070 , with session description
42	29.041258	192.168.1.23	213.192.59.75	SIP	592	Status: 180 Ringing
43	29.080900	192.168.1.23	213.192.59.75	SIP	592	Status: 180 Ringing
25	30.541683	213.192.59.75	192.168.1.29	SIP	525	Status: 180 Ringing
44	31.067657	192.168.1.23	213.192.59.75	SIP	592	Status: 180 Ringing
26	32.540670	213.192.59.75	192.168.1.29	SIP	525	Status: 180 Ringing
27	32.621530	213.192.59.75	192.168.1.29	SIP/SDF	1052	Status: 200 OK , with session description
28	32.622516	192.168.1.29	213.192.59.75	SIP	736	Request: ACK sip:korisnikb@78.0.207.74:58451
45	33.067670	192.168.1.23	213.192.59.75	SIP	592	Status: 180 Ringing
46	33.118833	192.168.1.23	213.192.59.75	SIP/SDF	1119	Status: 200 OK , with session description
47	33.340507	213.192.59.75	192.168.1.23	SIP	853	Request: ACK sip:korisnikb@192.168.1.23:5070
29	36.283148	192.168.1.29	213.192.59.75	SIP	729	Request: REFER sip:korisnikb@78.0.207.74:58451, in-dialog
30	36.495375	213.192.59.75	192.168.1.29	SIP	525	Status: 202 Accepted
89	36.543863	213.192.59.75	192.168.1.31	SIP/SDF	1240	Request: INVITE sip:korisnika@192.168.1.31:5070 , with session description
90	36.544116	192.168.1.31	213.192.59.75	SIP	529	Request: BYE sip:korisnikc@78.0.207.74:59454
91	36.545763	192.168.1.31	213.192.59.75	SIP/SDF	1098	Status: 200 OK , with session description
31	36.766254	213.192.59.75	192.168.1.29	SIP	679	Request: BYE sip:korisnikc@192.168.1.29:5070
Frame 29: 729 bytes on wire (5832 bits), 729 bytes captured (5832 bits)						
Ethernet II, Src: IntelCor_c3:c7:9c (8c:a9:82:c3:c7:9c), Dst: ThomsonT_40:5a:01 (00:24:17:40:5a:01)						
Internet Protocol Version 4, Src: 192.168.1.29 (192.168.1.29), Dst: 213.192.59.75 (213.192.59.75)						
User Datagram Protocol, Src Port: vtsas (5070), Dst Port: sip (5060)						
Session Initiation Protocol (REFER)						
Request-Line: REFER sip:korisnikb@78.0.207.74:58451 SIP/2.0						
Message Header						
Via: SIP/2.0/UDP 5.154.176.243:5070;rport;branch=z9hG4bK375860						
To: <sip:korisnikb@iptel.org>;tag=2086						
From: "KorisnikB" <sip:korisnikb@iptel.org>;tag=3358						
Call-ID: 1322421642-5860-PERUN85.154.176.243						
CSeq: 270 REFER						
Max-Forwards: 20						
User-Agent: NCH Software Express Talk 4.20						
Route: <sip:213.192.59.75;ftag=3358;avp=4u4DBwBhY2Nvdw50AwB5ZXMDbG8zZGltZXIEADE4MDADCQ8kAwFsb2dfawQWADN1MgkNGVkmGE4MzETmJnM2MwYjk;Tr=on>						
Contact: <sip:korisnikc@5.154.176.243:5070>						
Refer-To: <sip:korisnika@iptel.org>;Replaces=1322421641-5860-PERUN8405.154.176.243;to-tag=10008;from-tag=3357>						
Referred-By: <sip:korisnikc@iptel.org>						
Content-Length: 0						

Slika 10. REFER poruka

Na slici 10 vidimo poruku s metodom REFER omogućava uslugu prijenosa i preusmjerenja poziva. U ovom konkretnom primjeru ona predstavlja prebacivanje kolumikacije sa Korisnika B na Korisnika A.

No.	Time	Source	Destination	Protocol	Length	Info
97	45.026211	192.168.1.31	213.192.59.75	SIP/SDF	1098	Status: 200 OK , with session description
98	45.236523	213.192.59.75	192.168.1.31	SIP	625	Request: ACK sip:korisnika@192.168.1.31:5070
63	45.659571	192.168.1.23	213.192.59.75	SIP/SDF	1049	Request: INVITE sip:korisnika@78.0.207.74:58316, in-dialog , with session des
64	45.769500	213.192.59.75	192.168.1.23	SIP	584	Status: 100 trying -- your call is important to us
Frame 63: 1049 bytes on wire (8392 bits), 1049 bytes captured (8392 bits)						
Ethernet II, Src: GemtekTe_40:7c:db (00:26:82:40:7c:db), Dst: ThomsonT_40:5a:01 (00:24:17:40:5a:01)						
Internet Protocol Version 4, Src: 192.168.1.23 (192.168.1.23), Dst: 213.192.59.75 (213.192.59.75)						
User Datagram Protocol, Src Port: vtsas (5070), Dst Port: sip (5060)						
Session Initiation Protocol (INVITE)						
Request-Line: INVITE sip:korisnika@78.0.207.74:58316 SIP/2.0						
Message Header						
Via: SIP/2.0/UDP 192.168.1.23:5070;rport;branch=z9hG4bK321396						
To: <sip:korisnika@iptel.org>;tag=10009						
From: "KorisnikB" <sip:korisnikb@iptel.org>;tag=2087						
Call-ID: 1322419088-1396-IDEAPAD@192.168.1.23						
CSeq: 487 INVITE						
Max-Forwards: 20						
User-Agent: NCH Software Express Talk 4.20						
Route: <sip:213.192.59.75;ftag=2087;avp=+lsDBwBhY2Nvdw50AwB5ZXMDbG8zZGltZXIEADE4MDADCQ8kAwFsb2dfawQWADN1MDktNGVkmGE4NTctMTUwYmMwZjZ;Tr=on>						
Contact: <sip:korisnikb@192.168.1.23:5070>						
Allow: INVITE, ACK, CANCEL, OPTIONS, BYE, INFO, REFER, NOTIFY						
Supported: replaces						
Content-Type: application/sdp						
Content-Length: 352						
Message Body						
Session Description Protocol						
Session Description Protocol Version (v): 0						
Owner/Creator, Session Id (o): NCHSoftware-Talk 1322419091 1322419112 IN IP4 192.168.1.23						
Session Name (s): Express Talk call						
Connection Information (c): IN IP4 192.168.1.23						
Time Description, active time (t): 0 0						
Media Description, name and address (m): audio 8000 RTP/AVP 0 8 96 3 13 101						
Media Attribute (a): rtptime:0 PCM/8000						
Media Attribute (a): rtptime:8 PCMA/8000						
Media Attribute (a): rtptime:96 G726-32/8000						
Media Attribute (a): rtptime:3 GSM/8000						
Media Attribute (a): rtptime:13 CN/8000						
Media Attribute (a): rtptime:101 telephone-event/8000						
Media Attribute (a): fmtp:101 0-16						
Media Attribute (a): sendonly						
Media Attribute (a): direction:active						

Slika 11. Korisnik B stavlja Korisnika A na čekanje

Isto kao i na slici 6, vidi se INVITE koji Media Attribute stavlja na *sendonly* i time stavlja korisnika na čekanje.

Nakon što ste analizirali mrežni promet, pronađite dijelove sjednice kojima su ostvareni:

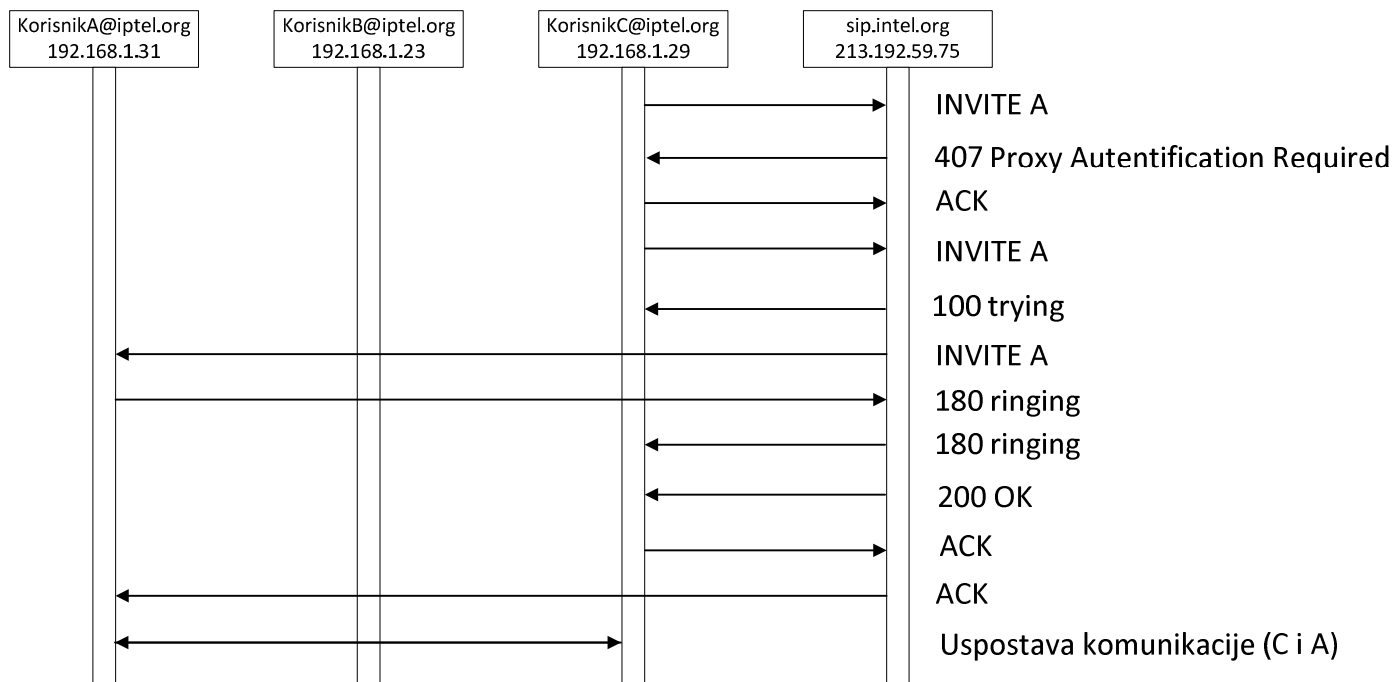
a) Uspostava sjednice

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.168.1.29	213.192.59.75	SIP/SDF	873	Request: INVITE sip:korisnikA@iptel.org , with session description
2	0.224146	213.192.59.75	192.168.1.29	SIP	700	Status: 407 Proxy Authentication Required
3	0.224827	192.168.1.29	213.192.59.75	SIP	413	Request: ACK sip:korisnikA@iptel.org
4	0.225635	192.168.1.29	213.192.59.75	SIP/SDF	1080	Request: INVITE sip:korisnikA@iptel.org , with session description
75	0.397105	213.192.59.75	192.168.1.31	SIP/SDF	1186	Request: INVITE sip:korisnikA@192.168.1.31:5070 , with session description
76	0.398221	192.168.1.31	213.192.59.75	SIP	592	Status: 180 Ringing
77	0.399957	192.168.1.31	213.192.59.75	SIP	592	Status: 180 Ringing
5	0.532055	213.192.59.75	192.168.1.29	SIP	587	Status: 100 trying -- your call is important to us
6	0.838329	213.192.59.75	192.168.1.29	SIP	525	Status: 180 Ringing
7	0.838578	213.192.59.75	192.168.1.29	SIP	525	Status: 180 Ringing
78	2.409106	192.168.1.31	213.192.59.75	SIP	592	Status: 180 Ringing
8	2.681520	213.192.59.75	192.168.1.29	SIP	525	Status: 180 Ringing
79	4.408241	192.168.1.31	213.192.59.75	SIP	592	Status: 180 Ringing
9	4.832312	213.192.59.75	192.168.1.29	SIP	525	Status: 180 Ringing
80	6.363945	192.168.1.31	213.192.59.75	SIP/SDF	1119	Status: 200 OK , with session description
81	6.642294	213.192.59.75	192.168.1.31	SIP	853	Request: ACK sip:korisnikA@192.168.1.31:5070
10	6.675216	213.192.59.75	192.168.1.29	SIP/SDF	1052	Status: 200 OK , with session description
11	6.676226	192.168.1.29	213.192.59.75	SIP	736	Request: ACK sip:korisnikA@78.0.207.74:58316
82	10.680947	213.192.59.75	192.168.1.31	SIP/SDF	1194	Request: INVITE sip:korisnikA@192.168.1.31:5070, in-dialog , with session description
83	10.682147	192.168.1.31	213.192.59.75	SIP/SDF	1119	Status: 200 OK , with session description
12	10.695987	192.168.1.29	213.192.59.75	SIP/SDF	1031	Request: INVITE sip:korisnikA@78.0.207.74:58316, in-dialog , with session description
13	10.807031	213.192.59.75	192.168.1.29	SIP	605	Status: 100 trying -- your call is important to us
84	10.887517	213.192.59.75	192.168.1.31	SIP	646	Request: ACK sip:korisnikA@192.168.1.31:5070
14	10.932650	213.192.59.75	192.168.1.29	SIP/SDF	1052	Status: 200 OK , with session description
15	10.934404	192.168.1.29	213.192.59.75	SIP	529	Request: ACK sip:korisnikA@78.0.207.74:58316
16	11.288039	213.192.59.75	192.168.1.29	SIP	311	Request: OPTIONS sip:192.168.1.29:5070;dstip=213.192.59.75;dstport=5060
17	11.288302	192.168.1.29	213.192.59.75	SIP/SDF	763	Status: 200 OK , with session description
85	22.151004	192.168.1.31	213.192.59.75	SIP	612	Request: REGISTER sip:iptel.org
86	22.243116	213.192.59.75	192.168.1.31	SIP	650	Status: 401 Unauthorized (0 bindings)


```

CSeq: 63 INVITE
Max-Forwards: 20
User-Agent: NCH Software Express Talk 4.20
Contact: <sip:korisnikC@5.154.176.243:5070>
Allow: INVITE, ACK, CANCEL, OPTIONS, BYE, INFO, REFER, NOTIFY
Supported: replaces
Content-Type: application/sdp
Content-Length: 334
Message Body
Session Description Protocol
Session Description Protocol Version (v): 0
Owner/Creator, Session Id (o): NCHSoftware-Talk 1322421636 1322421643 IN IP4 5.154.176.243
Session Name (s): Express Talk call
  
```

Slika 12. Uspostava sjednice (u Wiresharku)



Slika13. Uspostava sjednice (dijagram)

b) usluga stavljanja poziva na čekanje

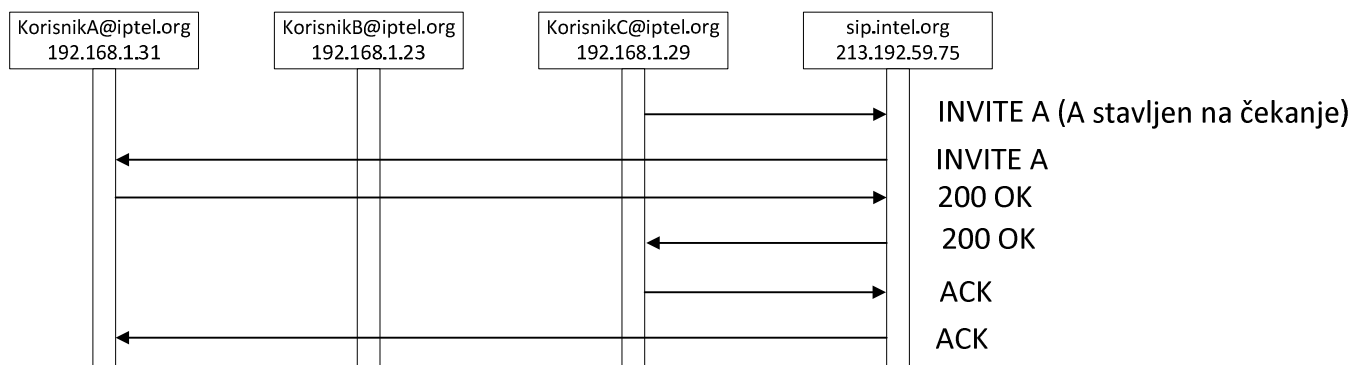
No.	Time	Source	Destination	Protocol	Length	Info
8	2.681520	213.192.59.75	192.168.1.29	SIP	525	Status: 180 Ringing
79	4.408241	192.168.1.31	213.192.59.75	SIP	592	Status: 180 Ringing
9	4.832312	213.192.59.75	192.168.1.29	SIP	525	Status: 180 Ringing
80	6.363945	192.168.1.31	213.192.59.75	SIP	1119	Status: 200 OK , with session description
81	6.642294	213.192.59.75	192.168.1.31	SIP/SDF	853	Request: ACK sip:korisnikA@192.168.1.31:5070
10	6.675216	213.192.59.75	192.168.1.29	SIP/SDF	1052	Status: 200 OK , with session description
11	6.676226	192.168.1.29	213.192.59.75	SIP	736	Request: ACK sip:korisnikA@78.0.207.74:58316
82	10.680947	213.192.59.75	192.168.1.31	SIP/SDF	1194	Request: INVITE sip:korisnikB@192.168.1.31:5070, in-dialog , with session description
83	10.682147	192.168.1.31	213.192.59.75	SIP/SDF	1119	Status: 200 OK , with session description
12	10.695987	192.168.1.29	213.192.59.75	SIP/SDF	1031	Request: INVITE sip:korisnikA@78.0.207.74:58316, in-dialog , with session description
13	10.807031	213.192.59.75	192.168.1.29	SIP	605	Status: 100 trying -- your call is important to us
84	10.887517	213.192.59.75	192.168.1.31	SIP	646	Request: ACK sip:korisnikA@192.168.1.31:5070
14	10.932650	213.192.59.75	192.168.1.29	SIP/SDF	1052	Status: 200 OK , with session description
15	10.934404	192.168.1.29	213.192.59.75	SIP	529	Request: ACK sip:korisnikA@78.0.207.74:58316
16	11.288039	213.192.59.75	192.168.1.29	SIP	311	Request: OPTIONS sip:192.168.1.29:5070;dstip=213.192.59.75;dstport=5060
17	11.288302	192.168.1.29	213.192.59.75	SIP/SDF	763	Status: 200 OK , with session description
85	22.151004	192.168.1.31	213.192.59.75	SIP	612	Request: REGISTER sip:iptel.org
86	22.243116	213.192.59.75	192.168.1.31	SIP	659	Status: 401 Unauthorized (0 bindings)
87	22.243843	192.168.1.31	213.192.59.75	SIP	612	Request: REGISTER sip:iptel.org
88	22.337715	213.192.59.75	192.168.1.31	SIP	625	Status: 200 OK (1 bindings)
18	28.174311	192.168.1.29	213.192.59.75	SIP/SDF	874	Request: INVITE sip:korisnikB@iptel.org , with session description
19	28.280543	213.192.59.75	192.168.1.29	SIP	701	Status: 407 Proxy Authentication Required
20	28.281297	192.168.1.29	213.192.59.75	SIP	414	Request: ACK sip:korisnikB@iptel.org
21	28.282099	192.168.1.29	213.192.59.75	SIP/SDF	1081	Request: INVITE sip:korisnikB@iptel.org , with session description
22	28.406747	213.192.59.75	192.168.1.29	SIP	588	Status: 100 trying -- your call is important to us
23	28.510257	213.192.59.75	192.168.1.29	SIP	525	Status: 180 Ringing
24	28.550626	213.192.59.75	192.168.1.29	SIP	525	Status: 180 Ringing
41	29.037142	213.192.59.75	192.168.1.23	SIP/SDF	1187	Request: INVITE sip:korisnikB@192.168.1.23:5070 , with session description
42	29.041758	192.168.1.23	213.192.59.75	SIP	502	Status: 180 Ringing

Allow: INVITE, ACK, CANCEL, OPTIONS, BYE, INFO, REFER, NOTIFY
 Supported: replaces
 Content-Type: application/sdp
 Content-Length: 334
 P-hint: rr-enforced
 [Expert Info (Note/Undecoded): Unrecognised SIP header (P-hint)]
 Session-Expires: 1800
 X-RTP-Proxy: YES
 [Expert Info (Note/Undecoded): Unrecognised SIP header (X-RTP-Proxy)]
 Message Body
 Session Description Protocol
 Session Description Protocol Version (v): 0
 Owner/Creator, Session Id (o): NCHSoftware-Talk 1322421636 1322421644 IN IP4 5.154.176.243

0000 00 1f 3b a0 5e 99 00 24 17 40 5a 01 08 00 45 10 ...^..\$.@Z...E.
 0010 04 9c dd 67 00 00 33 11 d3 06 d5 c0 3b 4b c0 a8 ...g..3.;K..
 0020 01 1f 13 c4 13 ce 04 88 78 f9 49 4e 56 49 54 45X.INVITE
 0030 20 73 69 70 3a 4b 6f 72 69 73 6e 69 6b 41 40 31 sip:korisnikA@1
 0040 39 32 2e 31 36 38 2e 31 2e 33 31 3a 35 30 37 30 92.168.1.31:5070
 0050 7a 52 10 50 2f 22 2a 20 04 03 53 65 62 6f 73 64 sip:192.168.1.29:5070

File: "C:\Users\Neo\AppData\Local\Temp\w... Packets: 106 Displayed: 106 Marked: 0 Profile: Default

Slika 14. Usluga stavljanja poziva na čekanje (u Wiresharku)



Slika 15. Usluga stavljanja poziva na čekanje (dijagram)

Zadatak 2

Vaš zadatak je proučiti i opisati protokol SIGTRAN definiran dokumentom RFC 27192.

SIGTRAN, skraćeno od Signaling Transport, je standardni telefonski protokol koji služi za prijenos SS7 signala u IP mrežama. SS7 signali se koriste za uspostavu te prekid telefonskih poziva, kao i za ostale mobilne usluge poput SMS-a, prevođenja brojeva, prijenos broja, itd.

Naglim povećanjem prometa koji zahtjeva sigurnu i brzu dostavu informacija na odredište, te uvođenjem multimedijских usluga, došlo je do potrebe za uvođenjem nekakve signalizacije. To je dovelo do potrebe za ispreplitanjem SS7 signala sa IP mrežama. SIGTRAN-ova glavna funkcionalnost je upravo omogućavanje međusobnog rada SS7 elemenata i IP elemenata mreže. *Signaling Gateways* (SG) su elementi koji povezuju te dvije vrste elemenata.[2] Ostale glavne komponente su *Media Gateway* (MG) koji služi za pakiranje govora u pakete i slanje istih na odredište, *Media Gateway Controller* (MGC) koji služi za održavanje veze između SG-a i MG-a i za kontroliranje prometa u IP mrežama od i do *Public Switched Telephone Networka* (PTSN). Također, tu su i *IP-enabled Service Control Point* (IP SCP) te IP telefon stručno zvan terminal. [3]

SIGTRAN mora omogućiti prijenos raznovrsnih protokola iz telekomunikacijskih mreža (PSTN), mora moći prepoznati svaki tih od protokola, mora omogućiti osnovni protokol tako da definira *headere*, sigurnosne ekstenzije, procedure za prijenos signala, te podržati ekstenzije koje su potrebne za baratanje osobno prerađenih protokola. Zbog toga što je iznad IP protokola, mora omogućiti određene funkcionalnosti koje nalaže niži sloj telekomunikacijske mreže, a ima i mogućnost raditi još raznovrsne stvari poput otkrivanja pogrešaka, retransmisiju, identifikaciju entiteta na kojima je signal nastaje ili se uništava, itd. [1]

SIGTRAN se primjenjuje pri razmjeni podataka između IP telefonije, VoIP, i drugog sugovornika koji je na telekomunikacijskoj mreži, u „običnoj“ telefoniji. Koristi se i pri pristupu nekim *dial-up* uređajima na daljinu preko Interneta, primjerice fax mašinama.

Uz te „čvrste“ stvari, SIGTRAN ima ulogu i u sigurnosti. Može se koristiti pri autentifikaciji korisnika tako da osigurava da je informacija poslana s pravog mjesta, da bi se ustvrdilo da su informacije koje se prenose enkriptirane i nepromjenjene, te da je krajnji korisnik dostupan u slučaju napada.

Literatura

- [1] Ong i drugi, „*Framework Architecture for Signaling Transport*“, October 1999.
- [2] Gradischnig, Tuxen, „*Signaling transport over IP-based networks using IETF standard*“
- [3] <http://www.javvin.com/protocolSIGTRAN.html>