



UNIVERSIDADE DO VALE DE ITAJAÍ - UNIVALI

Campus de Itajaí

Ciência da Computação

Redes de Computadores

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Camada de Enlace

Itajaí

2022

Contexto

A camada de enlace é responsável pela transmissão e recepção de quadros nos canais de comunicação. As responsabilidades dela são:

- **Enquadramento:** Recebe pacotes e encapsula em **quadros** para transmissão nos canais. Os quadros são enviados da camada de rede da máquina transmissora até a camada de rede da máquina receptora, então os quadros são remontados em forma de pacotes.
- **Controle de erros:** A camada de enlace também é responsável pela detecção e, opcionalmente, a correção deles, pois pode acontecer erros durante a transmissão de bits devido as características da camada física, como por exemplo a troca física de um bit, que devem ser detectados e resolvidos usando algum algoritmo.
- **Controle de fluxo:** A máquina transmissora pode enviar quadros mais rápido e o receptor pode não ser capaz de conseguir aceitá-los a tempo, podendo perder alguns quadros, mesmo sem haver erros durante a transmissão.

Resultados

Wireshark

ROTEIRO 1 – 802.11

1R - "30 Munroe St" e "linksys32"

Wireshark_802.11.pcap

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter ... <Ctrl-F>

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2854, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
2	0.062101	8c:c1:ae:c0:ea:2c	8c:c1:ae:c0:ea:2c (-	802.11	1624	PV1 Management [Malformed Packet]
3	0.085474	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2855, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
4	0.187919	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2856, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
5	0.188100	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	54	QoS Null function (No data), SN=1482, FN=0, Flags=.....TC
6	0.188201	IntelCor_d1:b6:4f	IntelCor_d1:b6:4f (-	802.11	38	Acknowledgement, Flags=.....C
7	0.188935	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	54	QoS Null function (No data), SN=1483, FN=0, Flags=...P...TC
8	0.189934	IntelCor_d1:b6:4f	IntelCor_d1:b6:4f (-	802.11	38	Acknowledgement, Flags=.....C
9	0.290284	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2857, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
10	0.294432	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3077, FN=0, Flags=.....C, BI=62, SSID=6c69ee0104e2273a32
11	0.393174	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2858, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
12	0.396690	00:ae:93:3d:0a:4a	00:ae:93:3d:0a:4a (-	802.11	90	PV1 Reserved
13	0.495032	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2859, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
14	0.499197	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3074, FN=0, Flags=.....C, BI=100, SSID="linksys12"
15	0.597382	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2860, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
16	0.601687	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3075, FN=0, Flags=.....C, BI=100, SSID="linksys12"
17	0.699847	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2861, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
18	0.802226	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2862, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
19	0.904619	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2863, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
20	1.007015	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2864, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
21	1.010949	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3079, FN=0, Flags=.....C, BI=100, SSID="linksys12"
22	1.109406	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2865, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
23	1.113691	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3080, FN=0, Flags=.....C, BI=100, SSID=2cdc6eb737973313
24	1.211043	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2866, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
25	1.211992	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	54	QoS Null function (No data), SN=1484, FN=0, Flags=.....TC
26	1.212089	IntelCor_d1:b6:4f	IntelCor_d1:b6:4f (-	802.11	38	Acknowledgement, Flags=.....C
27	1.212185	Cisco-Li_f7:1d:51	IntelCor_d1:b6:4f	802.11	177	Probe Response, SN=2867, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
28	1.212282	Cisco-Li_f7:1d:51	IntelCor_d1:b6:4f (-	802.11	38	Acknowledgement, Flags=.....C
29	1.212941	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	54	QoS Null function (No data), SN=1485, FN=0, Flags=...P...TC
30	1.213040	IntelCor_d1:b6:4f	IntelCor_d1:b6:4f (-	802.11	38	Acknowledgement, Flags=.....C
31	1.215947	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3081, FN=0, Flags=.....C, BI=100, SSID="linksys12"
32	1.314223	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2868, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
33	1.416593	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2869, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"

> Frame 4: 183 bytes on wire (1464 bits), 183 bytes captured (1464 bits)

> Radiotap Header v0, Length 24

> 802.11 radio information

> IEEE 802.11 Beacon frame, Flags:

- Type/Subtype: Beacon frame (0x0008)
- > Frame Control Field: 0x0000
 - .0000 0000 0000 0000 = Duration: 0 microseconds
 - Receiver address: Broadcast (ff:ff:ff:ff:ff:ff)
 - Destination address: Broadcast (ff:ff:ff:ff:ff:ff)
 - Transmitter address: Cisco-Li_f7:1d:51 (00:16:b6:f7:1d:51)
 - Source address: Cisco-Li_f7:1d:51 (00:16:b6:f7:1d:51)
 - BSS Id: Cisco-Li_f7:1d:51 (00:16:b6:f7:1d:51)
 - 0000 = Fragment number: 0
 - 1011 0010 1000 = Sequence number: 2856
 - Frame check sequence: 0xe5bf6054 [unverified]
 - [FCS Status: Unverified]
- > IEEE 802.11 Wireless Management
 - > Fixed parameters (12 bytes)
 - > Tagged parameters (119 bytes)
 - > Tag: SSID parameter set: "30 Munroe St"
 - > Tag: Supported Rates 1(B), 2(B), 5.5(B), 11(B), [Mbit/sec]
 - > Tag: DS Parameter set: Current Channel: 6

Wireshark_802.11.pcap

0000 00 00 18 00
0010 58 00 00 47
0020 ff ff 00 16
0030 82 01 3c 96
0040 20 4d 75 6e
0050 03 01 06 05
0060 1a 0c 12 0f
0070 00 62 32 2f
0080 60 6c dd 15
0090 0e 04 ff 00
00a0 01 0f 00 03
00b0 32 2f 00 54

Wireshark_802_11.pcap

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7	0.188935	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	54	QoS Null function (No data), SN=1483, FN=0, Flags=...P...TC
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11	0.393174	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2858, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
12	0.396900	00:ae:93:3d:0a:4a	00:ae:93:3d:0a:4a	802.11	90	PV1 Reserved
13	0.495032	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2859, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
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19	0.904619	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2863, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
20	1.007815	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2864, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
21	1.010949	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3079, FN=0, Flags=.....C, BI=100, SSID="linksys12"
22	1.109406	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2865, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
23	1.113691	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3080, FN=0, Flags=.....C, BI=100, SSID=2cdc6e6b7379733132
24	1.211843	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2866, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
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29	1.212941	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	54	QoS Null function (No data), SN=1485, FN=0, Flags=...P...TC
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> Frame 14: 90 bytes on wire (720 bits), 90 bytes captured (720 bits)

> Radiotap Header v0, Length 24

> 802.11 radio information

IEEE 802.11 Beacon frame, Flags=.....C

Type/Subtype: Beacon frame (0x0008)

> Frame Control Field: 0x0000

.0000 0000 0000 0000 = Duration: 0 microseconds

Receiver address: Broadcast (ff:ff:ff:ff:ff:ff)

Destination address: Broadcast (ff:ff:ff:ff:ff:ff)

Transmitter address: LinksysG_67:22:94 (00:06:25:67:22:94)

Source address: LinksysG_67:22:94 (00:06:25:67:22:94)

BSS ID: 50:2b:25:67:22:94 (50:2b:25:67:22:94)

..... 0000 = Fragment number: 0

1100 0000 0010 = Sequence number: 3074

Frame check sequence: 0x5d5654a6 [unverified]

[FCS Status: Unverified]

IEEE 802.11 Wireless Management

> Fixed parameters (12 bytes)

> Tagged parameters (26 bytes)

Tag: SSID parameter set: "linksys12"

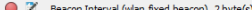
Tag Number: SSID parameter set (0)

Tag length: 9

Tag (vlan.tag), 11 byte(s)

0000 00 00 18 00 ee 58
0010 05 00 00 00 a6 54
0020 ff ff 00 06 25 67
0030 0a 83 a2 05 ac 08
0040 6a 6b 73 79 73 31
0050 05 04 02 03 00 00

2R – Ambos possuem um intervalo de 0,1024 segundos



Wireshark_802.11.pcap

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23	1.113691	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3080, FN=0, Flags=.....C, BI=100, SSID=2cdc6e6b73797
24	1.211843	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2866, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St
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> Frame 14: 90 bytes on wire (720 bits), 90 bytes captured (720 bits)

> Radiotap Header v0, Length 24

> 802.11 radio information

IEEE 802.11 Beacon frame, Flags:

Type/Subtype: Beacon frame (0x0008)

Frame Control Field: 0x8000

.000 0000 0000 0000 = Duration: 0 microseconds

Receiver address: Broadcast (ff:ff:ff:ff:ff:ff)

Destination address: Broadcast (ff:ff:ff:ff:ff:ff)

Transmitter address: LinksysG_67:22:94 (00:06:25:67:22:94)

Source address: LinksysG_67:22:94 (00:06:25:67:22:94)

BSS Id: 50:2b:25:67:22:94 (50:2b:25:67:22:94)

.... 0000 = Fragment number: 0

1100 0000 0010 = Sequence number: 3074

Frame check sequence: 0x5d5654a6 [unverified]

[FCS Status: Unverified]

IEEE 802.11 Wireless Management

Fixed parameters (12 bytes)

Timestamp: 953402133572

Beacon Interval: 0.102400 [Seconds]

Capabilities Information: 0x0011

Tagged parameters (26 bytes)

Fixed parameters (wlan.fixed.all), 12 byte(s)

0000 00 00 1
0010 05 00 0
0020 ff ff 0
0030 0a 83 a
0040 6e 6b 7
0050 05 04 0

3R – 00:16:b6:f7:1d:51

Wireshark_802.11.pcap

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1	0.000000	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2854, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
2	0.002101	8c:c1:ae:c0:ea:2c	8c:c1:ae:c0:ea:2c (-	802.11	1624	PV1 Management[Malformed Packet]
3	0.005474	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2855, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
4	0.187919	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2856, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
5	0.188100	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	54	QoS Null function (No data), SN=1482, FN=0, Flags=.....TC
6	0.188201	IntelCor_d1:b6:4f	IntelCor_d1:b6:4f (-	802.11	38	Acknowledgement, Flags=.....C
7	0.188935	IntelCor_d1:b6:4f	IntelCor_d1:b6:4f (-	802.11	54	QoS Null function (No data), SN=1483, FN=0, Flags=...P...TC
8	0.189034	IntelCor_d1:b6:4f	IntelCor_d1:b6:4f (-	802.11	38	Acknowledgement, Flags=.....C
9	0.290284	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2857, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
10	0.294432	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3072, FN=0, Flags=.....C, BI=62, SSID=6c69ee0104e2273a32[Malformed Pack
11	0.393174	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2858, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
12	0.396690	00:ae:93:3d:0a:4a	00:ae:93:3d:0a:4a (-	802.11	90	PV1 Reserved
13	0.495032	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2859, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
14	0.499197	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3074, FN=0, Flags=.....C, BI=100, SSID="linksys12"
15	0.597382	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2860, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
16	0.601687	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3075, FN=0, Flags=.....C, BI=100, SSID="linksys12"
17	0.699847	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2861, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
18	0.802226	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2862, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
19	0.904619	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2863, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
20	1.007015	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2864, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
21	1.010949	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3079, FN=0, Flags=.....C, BI=100, SSID="linksys12"
22	1.109406	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2865, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
23	1.113691	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3080, FN=0, Flags=.....C, BI=100, SSID=2cdc6e6b7379733132
24	1.211843	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2866, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
25	1.211992	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	54	QoS Null function (No data), SN=1484, FN=0, Flags=.....TC
26	1.212089	IntelCor_d1:b6:4f	IntelCor_d1:b6:4f (-	802.11	38	Acknowledgement, Flags=.....C
27	1.212185	Cisco-Li_f7:1d:51	IntelCor_d1:b6:4f	802.11	177	Probe Response, SN=2867, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
28	1.212282	Cisco-Li_f7:1d:51	Cisco-Li_f7:1d:51 (-	802.11	38	Acknowledgement, Flags=.....C
29	1.212941	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	54	QoS Null function (No data), SN=1485, FN=0, Flags=...P...TC
30	1.213040	IntelCor_d1:b6:4f	IntelCor_d1:b6:4f (-	802.11	38	Acknowledgement, Flags=.....C
31	1.215947	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3081, FN=0, Flags=.....C, BI=100, SSID="linksys12"
32	1.314223	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2868, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
33	1.416593	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2869, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"

> Frame 13: 183 bytes on wire (1464 bits), 183 bytes captured (1464 bits)

> Radiotap Header v0, Length 24

> 802.11 radio Information

IEEE 802.11 Beacon frame, Flags:

Type/Subtype: Beacon frame (0x0000)

> Frame Control Field: 0x0000

.0000 0000 0000 0000 = Duration: 0 microseconds

Receiver address: Broadcast (ff:ff:ff:ff:ff:ff)

Destination address: Broadcast (ff:ff:ff:ff:ff:ff)

Transmitter address: Cisco-Li_f7:1d:51 (00:16:b6:f7:1d:51)

Source address: Cisco-Li_f7:1d:51 (00:16:b6:f7:1d:51)

BSS Id: Cisco-Li_f7:1d:51 (00:16:b6:f7:1d:51)

.... 0000 = Fragment number: 0

1011 0010 1011 = Sequence number: 2859

Frame check sequence: 0xbc03354d [unverified]

[FCS Status: Unverified]

> IEEE 802.11 Wireless Management

Source Hardware Address (vlan.sa), 6 byte(s)

0000 00 00 18 00 ee 58 00 00 1
0010 64 00 00 46 4d 35 03 bc 0
0020 ff ff 00 16 b6 f7 1d 51 0
0030 82 b1 40 96 28 00 00 00 6
0040 20 4d 75 6e 72 6f 65 20 5
0050 03 01 06 05 04 00 01 00 0
0060 1a 0c 12 0f 00 03 a4 00 0
0070 00 62 32 2f 00 2a 01 00 3
0080 00 6c dd 15 00 0a f5 0a 0
0090 0e 04 ff 00 03 00 11 01 0
00a0 01 0f 00 03 a4 00 00 27 a
00b0 32 2f 00 4d 35 03 bc

4R – ff:ff:ff:ff:ff:ff

Wireshark_802.11.pcap

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Apply a display filter <Ctrl-F>

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2854, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
2	0.002101	8c:c1:ae:c0:ea:2c	8c:c1:ae:c0:ea:2c (-	802.11	1624	PV1 Management[Malformed Packet]
3	0.005474	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2855, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
4	0.187919	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2856, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
5	0.188100	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	54	QoS Null function (No data), SN=1482, FN=0, Flags=.....TC
6	0.188201	IntelCor_d1:b6:4f	IntelCor_d1:b6:4f (-	802.11	38	Acknowledgement, Flags=.....C
7	0.188935	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	54	QoS Null function (No data), SN=1483, FN=0, Flags=...P...TC
8	0.189034	IntelCor_d1:b6:4f	IntelCor_d1:b6:4f (-	802.11	38	Acknowledgement, Flags=.....C
9	0.290284	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2857, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
10	0.294432	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3072, FN=0, Flags=.....C, BI=62, SSID=6c69ee0104e2273a32[Malformed P
11	0.393174	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2858, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
12	0.396690	00:ae:93:3d:0a:4a	00:ae:93:3d:0a:4a (-	802.11	90	PV1 Reserved
13	0.495032	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2859, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
14	0.499197	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3074, FN=0, Flags=.....C, BI=100, SSID="linksys12"
15	0.597382	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2860, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
16	0.601687	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3075, FN=0, Flags=.....C, BI=100, SSID="linksys12"
17	0.699847	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2861, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
18	0.802226	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2862, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
19	0.904619	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2863, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
20	1.007015	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2864, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
21	1.010949	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3079, FN=0, Flags=.....C, BI=100, SSID="linksys12"
22	1.109406	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2865, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
23	1.113691	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3080, FN=0, Flags=.....C, BI=100, SSID=2cdc6e6b7379733132
24	1.211843	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2866, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
25	1.211992	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	54	QoS Null function (No data), SN=1484, FN=0, Flags=.....TC
26	1.212089	IntelCor_d1:b6:4f	IntelCor_d1:b6:4f (-	802.11	38	Acknowledgement, Flags=.....C
27	1.212185	Cisco-Li_f7:1d:51	IntelCor_d1:b6:4f	802.11	177	Probe Response, SN=2867, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
28	1.212282	Cisco-Li_f7:1d:51	Cisco-Li_f7:1d:51 (-	802.11	38	Acknowledgement, Flags=.....C
29	1.212941	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	54	QoS Null function (No data), SN=1485, FN=0, Flags=...P...TC
30	1.213040	IntelCor_d1:b6:4f	IntelCor_d1:b6:4f (-	802.11	38	Acknowledgement, Flags=.....C
31	1.215947	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3081, FN=0, Flags=.....C, BI=100, SSID="linksys12"
32	1.314223	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2868, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
33	1.416593	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2869, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"

> Frame 13: 183 bytes on wire (1464 bits), 183 bytes captured (1464 bits)

> Radiotap Header v0, Length 24

> 802.11 radio Information

IEEE 802.11 Beacon frame, Flags:

Type/Subtype: Beacon frame (0x0000)

> Frame Control Field: 0x0000

.0000 0000 0000 0000 = Duration: 0 microseconds

Receiver address: Broadcast (ff:ff:ff:ff:ff:ff)

Destination address: Broadcast (ff:ff:ff:ff:ff:ff)

Transmitter address: Cisco-Li_f7:1d:51 (00:16:b6:f7:1d:51)

Source address: Cisco-Li_f7:1d:51 (00:16:b6:f7:1d:51)

BSS Id: Cisco-Li_f7:1d:51 (00:16:b6:f7:1d:51)

.... 0000 = Fragment number: 0

1011 0010 1011 = Sequence number: 2859

Frame check sequence: 0xbc03354d [unverified]

[FCS Status: Unverified]

> IEEE 802.11 Wireless Management

Destination Hardware Address (vlan.da), 6 byte(s)

0000 00 00 18 00 ee 58 00 00
0010 64 00 00 46 4d 35 03 bc
0020 ff ff 00 16 b6 f7 1d 51
0030 82 b1 40 96 28 00 00 00
0040 20 4d 75 6e 72 6f 65 20
0050 03 01 06 05 04 00 01 00
0060 1a 0c 12 0f 00 03 a4 00
0070 00 62 32 2f 00 2a 01 00
0080 00 6c dd 15 00 0a f5 0a
0090 0e 04 ff 00 03 00 11 01
00a0 01 0f 00 03 a4 00 00 27
00b0 32 2f 00 4d 35 03 bc

5R – 00:16:b6:f7:1d:51

Wireshark_802_11.pcap

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No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2854, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
2	0.062101	8c:c1:ae:c0:ea:2c	8c:c1:ae:c0:ea:2c	802.11	1624	PV1 Management [Malformed Packet]
3	0.085474	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2855, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
4	0.187919	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2856, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
5	0.188100	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	54	QoS Null function (No data), SN=1482, FN=0, Flags=.....TC
6	0.188201	IntelCor_d1:b6:4f	IntelCor_d1:b6:4f	802.11	38	Acknowledgement, Flags=.....C
7	0.188935	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	54	QoS Null function (No data), SN=1483, FN=0, Flags=...P...TC
8	0.189034	IntelCor_d1:b6:4f	IntelCor_d1:b6:4f	802.11	38	Acknowledgement, Flags=.....C
9	0.290284	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2857, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
10	0.294432	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3072, FN=0, Flags=.....C, BI=62, SSID=6c69ee8104e2273a
11	0.393174	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2858, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
12	0.396690	00:ae:93:3d:0a:4a	00:ae:93:3d:0a:4a	802.11	90	PV1 Reserved
13	0.495032	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2859, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
14	0.499197	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3074, FN=0, Flags=.....C, BI=100, SSID="linksys12"
15	0.597382	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2860, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
16	0.601687	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3075, FN=0, Flags=.....C, BI=100, SSID="linksys12"
17	0.699847	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2861, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
18	0.802226	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2862, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
19	0.904619	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2863, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
20	1.007815	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2864, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
21	1.010949	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3079, FN=0, Flags=.....C, BI=100, SSID="linksys12"
22	1.109406	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2865, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
23	1.113691	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3080, FN=0, Flags=.....C, BI=100, SSID=2cdc6eb7379733
24	1.211843	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2866, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
25	1.211992	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	54	QoS Null function (No data), SN=1484, FN=0, Flags=.....TC
26	1.212089	IntelCor_d1:b6:4f	IntelCor_d1:b6:4f	802.11	38	Acknowledgement, Flags=.....C
27	1.212185	Cisco-Li_f7:1d:51	IntelCor_d1:b6:4f	802.11	177	Probe Response, SN=2867, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
28	1.212282	Cisco-Li_f7:1d:51	IntelCor_d1:b6:4f	802.11	38	Acknowledgement, Flags=.....C
29	1.212941	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	54	QoS Null function (No data), SN=1485, FN=0, Flags=...P...TC
30	1.213940	IntelCor_d1:b6:4f	IntelCor_d1:b6:4f	802.11	38	Acknowledgement, Flags=.....C
31	1.215947	LinksysG_67:22:94	Broadcast	802.11	90	Beacon frame, SN=3081, FN=0, Flags=.....C, BI=100, SSID="linksys12"
32	1.314223	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2868, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
33	1.416593	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=2869, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"

> Frame 13: 183 bytes on wire (1464 bits), 183 bytes captured (1464 bits)

> Radiotap Header v0, Length 24

> 802.11 radio information

IEEE 802.11 Beacon frame, Flags:

Type/Subtype: Beacon frame (0x0000)

> Frame Control Field: 0x8000

.0000 0000 0000 0000 = Duration: 0 microseconds

Receiver address: Broadcast (ff:ff:ff:ff:ff:ff)

Destination address: Broadcast (ff:ff:ff:ff:ff:ff)

Transmitter address: Cisco-Li_f7:1d:51 (00:16:b6:f7:1d:51)

Source address: Cisco-Li_f7:1d:51 (00:16:b6:f7:1d:51)

BSS Id: Cisco-Li_f7:1d:51 (00:16:b6:f7:1d:51)

.... .. 0000 = Fragment number: 0

1011 0010 1011 = Sequence number: 2859

Frame check sequence: 0xc03354d [unverified]

[FCS Status: Unverified]

> IEEE 802.11 Wireless Management

Basic Service Set ID (wlan.bssid), 6 byte(s)

6R - As taxas suportadas são 1, 2, 5.5, 11 Mbps. E as estendidas são 6, 9, 12, 18, 24, 36, 48 e 54 Mbps

> Capabilities Information: 0x8601

Tagged parameters (119 bytes)

> Tag: SSID parameter set: "30 Munroe St"

> Tag: Supported Rates 1(B), 2(B), 5.5(B), 11(B), [Mbit/sec]

Tag Number: Supported Rates (1)

Tag length: 4

Supported Rates: 1(B) (0x82)

Supported Rates: 2(B) (0x84)

Supported Rates: 5.5(B) (0x8b)

Supported Rates: 11(B) (0x96)

> Tag: DS Parameter set: Current Channel: 6

> Tag: Traffic Indication Map (TIM): DTIM 0 of 1 bitmap

> Tag: Country Information: Country Code US, Environment Indoor

> Tag: EDCA Parameter Set

> Tag: ERP Information

> Tag: Extended Supported Rates 6(B), 9, 12(B), 18, 24(B), 36, 48, 54, [Mbit/sec]

Tag Number: Extended Supported Rates (50)

Tag length: 8

Extended Supported Rates: 6(B) (0x8c)

Extended Supported Rates: 9 (0x12)

Extended Supported Rates: 12(B) (0x98)

Extended Supported Rates: 18 (0x24)

Extended Supported Rates: 24(B) (0xb0)

Extended Supported Rates: 36 (0x48)

Extended Supported Rates: 48 (0x60)

Extended Supported Rates: 54 (0x6c)

7R - O TCP SYN é enviado em t = 24,811093 segundos para o vestígio. O endereço MAC do host que envia o TCP SYN é 00:13:02:d1:b6:4f. O endereço MAC para o destino, que é o roteador do primeiro salto ao qual o host está conectado, é 00:16:b6:f4:eb:a8. O endereço MAC para o BSS é 00:16:b6:f7:1d:51. O endereço IP do host que envia o TCP SYN é 192.168.1.109.

O endereço de destino é 128.199.245.12. Isso corresponde ao servidor gaia.cs.umass.edu.

474	24.811093	192.168.1.109	128.119.245.12	TCP	110 2538 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM
475	24.811231		IntelCor_d1:b6:4f (...	802.11	38 Acknowledgement, Flags=.....C
476	24.827751	128.119.245.12	192.168.1.109	TCP	110 80 → 2538 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 SACK_PERM
477	24.827922		Cisco-Li_f7:1d:51 (...	802.11	38 Acknowledgement, Flags=.....C
478	24.828024	192.168.1.109	128.119.245.12	TCP	102 2538 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
479	24.828140		IntelCor_d1:b6:4f (...	802.11	38 Acknowledgement, Flags=.....C
480	24.828253	192.168.1.109	128.119.245.12	HTTP	537 GET /wireshark-labs/alice.txt HTTP/1.1
481	24.828352		IntelCor_d1:b6:4f (...	802.11	38 Acknowledgement, Flags=.....C
482	24.846898	128.119.245.12	192.168.1.109	TCP	108 80 → 2538 [ACK] Seq=1 Ack=436 Win=6432 Len=0
483	24.847058		Cisco-Li_f7:1d:51 (...	802.11	38 Acknowledgement, Flags=.....C
484	24.847171	128.119.245.12	192.168.1.109	TCP	108 [TCP Dup ACK 482#1] 80 → 2538 [ACK] Seq=1 Ack=436 Win=6432
485	24.847267		Cisco-Li_f7:1d:51 (...	802.11	38 Acknowledgement, Flags=.....C
486	24.848829	128.119.245.12	192.168.1.109	TCP	415 80 → 2538 [PSH, ACK] Seq=1 Ack=436 Win=6432 Len=313 [TCP ;

> Frame 474: 110 bytes on wire (880 bits), 110 bytes captured (880 bits)

> Radiotap Header v0, Length 24

> 802.11 radio information

> IEEE 802.11 QoS Data, Flags:TC

Type/Subtype: QoS Data (0x0028)

> Frame Control Field: 0x8801

.....0000 0010 1100 = Duration: 44 microseconds

Receiver address: Cisco-Li_f7:1d:51 (00:16:b6:f7:1d:51)

Transmitter address: IntelCor_d1:b6:4f (00:13:02:d1:b6:4f)

Destination address: Cisco-Li_f4:eb:a8 (00:16:b6:f4:eb:a8)

Source address: IntelCor_d1:b6:4f (00:13:02:d1:b6:4f)

BSS Id: Cisco-Li_f7:1d:51 (00:16:b6:f7:1d:51)

STA address: IntelCor_d1:b6:4f (00:13:02:d1:b6:4f)

.....0000 = Fragment number: 0

0000 0011 0001 = Sequence number: 49

Frame check sequence: 0xad57fce0 [unverified]

[FCS Status: Unverified]

> Qos Control: 0x0000

> Logical-Link Control

> Internet Protocol Version 4, Src: 192.168.1.109, Dst: 128.119.245.12

> Transmission Control Protocol, Src Port: 2538, Dst Port: 80, Seq: 0, Len: 0

8R - O TCP SYNACK é recebido em $t = 24,827751$ segundos no rastreamento. O endereço MAC do remetente do quadro 802.11 contendo o segmento TCP SYNACK é 00:16:b6:f4:eb:a8, que é o roteador do 1º salto ao qual o host está conectado. O endereço MAC para o destino, que é o próprio host, é 91:2a:b0:49:b6:4f. O endereço MAC para o BSS é 00:16:b6:f7:1d:51. O endereço IP do servidor que envia o TCP SYNACK é 128.199.245.12. O endereço de destino é 192.168.1.109.

476	24.827751	128.119.245.12	192.168.1.109	TCP	110 80 → 2538 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 SACK_PERM
477	24.827922		Cisco-Li_f7:1d:51 (...	802.11	38 Acknowledgement, Flags=.....C
478	24.828024	192.168.1.109	128.119.245.12	TCP	102 2538 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
479	24.828140		IntelCor_d1:b6:4f (...	802.11	38 Acknowledgement, Flags=.....C
480	24.828253	192.168.1.109	128.119.245.12	HTTP	537 GET /wireshark-labs/alice.txt HTTP/1.1
481	24.828352		IntelCor_d1:b6:4f (...	802.11	38 Acknowledgement, Flags=.....C
482	24.846898	128.119.245.12	192.168.1.109	TCP	108 80 → 2538 [ACK] Seq=1 Ack=436 Win=6432 Len=0
483	24.847058		Cisco-Li_f7:1d:51 (...	802.11	38 Acknowledgement, Flags=.....C
484	24.847171	128.119.245.12	192.168.1.109	TCP	108 [TCP Dup ACK 482#1] 80 → 2538 [ACK] Seq=1 Ack=436 Win=6432
485	24.847267		Cisco-Li_f7:1d:51 (...	802.11	38 Acknowledgement, Flags=.....C
486	24.848829	128.119.245.12	192.168.1.109	TCP	415 80 → 2538 [PSH, ACK] Seq=1 Ack=436 Win=6432 Len=313 [TCP ;

> Frame 476: 110 bytes on wire (880 bits), 110 bytes captured (880 bits)

> Radiotap Header v0, Length 24

> 802.11 radio information

> IEEE 802.11 QoS Data, Flags: ..mP..F.C

Type/Subtype: QoS Data (0x0028)

> Frame Control Field: 0x8832

Duration/ID: 11560 (reserved)

Receiver address: 91:2a:b0:49:b6:4f (91:2a:b0:49:b6:4f)

Transmitter address: Cisco-Li_f7:1d:51 (00:16:b6:f7:1d:51)

Destination address: 91:2a:b0:49:b6:4f (91:2a:b0:49:b6:4f)

Source address: Cisco-Li_f4:eb:a8 (00:16:b6:f4:eb:a8)

BSS Id: Cisco-Li_f7:1d:51 (00:16:b6:f7:1d:51)

STA address: 91:2a:b0:49:b6:4f (91:2a:b0:49:b6:4f)

.....0000 = Fragment number: 0

1100 0011 0100 = Sequence number: 3124

Frame check sequence: 0xecd407d [unverified]

[FCS Status: Unverified]

> Qos Control: 0x0100

9R - Em $t = 49.583615$, um DHCP Release é enviado pelo host para o servidor DHCP (IP 192.168.1.1) na rede da qual o host está saindo. Em $t = 49,609617$, o host envia um quadro DEAUTHENTICATION (Frametype = 00 [Management], subframe type = 12 [Deauthentication]). Era esperado que um pedido de DISASSOCIATION fosse enviado.

1733	49.583615	192.168.1.109	192.168.1.1	DHCP	390 DHCP Release - Transaction ID 0xea5a526
1734	49.583771		IntelCor_d1:b6:4f (- 802.11	38 Acknowledgement, Flags=.....C	
1735	49.609617	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	54 Deauthentication, SN=1605, FN=0, Flags=.....C
1736	49.609770		IntelCor_d1:b6:4f (- 802.11	38 Acknowledgement, Flags=.....C	
1737	49.614478	IntelCor_d1:b6:4f	Broadcast	802.11	99 Probe Request, SN=1606, FN=0, Flags=.....C, SSID="lii
1738	49.615869		Cisco-Li_f5:ba:bb (- 802.11	38 Acknowledgement, Flags=.....C	
1739	49.617713		Cisco-Li_f5:ba:bb (- 802.11	38 Acknowledgement, Flags=.....C	
1740	49.638857	IntelCor_d1:b6:4f	Cisco-Li_f5:ba:bb	802.11	58 Authentication, SN=1606, FN=0, Flags=.....C
1741	49.639700	IntelCor_d1:b6:4f	Cisco-Li_f5:ba:bb	802.11	58 Authentication, SN=1606, FN=0, Flags=....R...C
1742	49.640702	IntelCor_d1:b6:4f	Cisco-Li_f5:ba:bb	802.11	58 Authentication, SN=1606, FN=0, Flags=....R...C
1743	49.641910		Cisco-Li_f5:ba:bb (- 802.11	38 Acknowledgement, Flags=.....C	
1744	49.642315	IntelCor_d1:b6:4f	Cisco-Li_f5:ba:bb	802.11	58 Authentication, SN=1606, FN=0, Flags=....R...C
1745	49.644710	Cisco-Li_f7:1d:51	Broadcast	802.11	183 Beacon frame, SN=3589, FN=0, Flags=.....C, BI=100, S
1746	49.645319	IntelCor_d1:b6:4f	Cisco-Li_f5:ba:bb	802.11	58 Authentication, SN=1606, FN=0, Flags=....R...C
1747	49.646711		Cisco-Li_f5:ba:bb (- 802.11	38 Acknowledgement, Flags=.....C	
1748	49.647827		Cisco-Li_f5:ba:bb (- 802.11	38 Acknowledgement, Flags=.....C	

```

> Frame 1735: 54 bytes on wire (432 bits), 54 bytes captured (432 bits)
> Radiotap Header v0, Length 24
> 802.11 radio information
> IEEE 802.11 Deauthentication, Flags: .....C
  Type/Subtype: Deauthentication (0x000c)
    > Frame Control Field: 0xc000
      .... ..00 = Version: 0
      .... 00.. = Type: Management frame (0)
      1100 .... = Subtype: 12
    > Flags: 0x00
      .000 0000 0010 1100 = Duration: 44 microseconds
      Receiver address: Cisco-Li_f7:1d:51 (00:16:b6:f7:1d:51)
      Destination address: Cisco-Li_f7:1d:51 (00:16:b6:f7:1d:51)
      Transmitter address: IntelCor_d1:b6:4f (00:13:02:d1:b6:4f)
      Source address: IntelCor_d1:b6:4f (00:13:02:d1:b6:4f)
      BSS Id: Cisco-Li_f7:1d:51 (00:16:b6:f7:1d:51)
      .... .... 0000 = Fragment number: 0
      0110 0100 0101 .... = Sequence number: 1605
      Frame check sequence: 0x3b4a8b9c [unverified]
      [FCS Status: Unverified]
    > IEEE 802.11 Wireless Management
      > Fixed parameters (2 bytes)
        Reason code: Unspecified reason (0x0001)

```

10R – O primeiro AUTHENTICATION é enviado em t = 49.638857, ao todo são enviados 15 quadros.

No.	Time	Source	Destination	Protocol	Length	Info
1729	49.440041	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=3587, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
1730	49.440146	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	54	QoS Null function (No data), SN=1604, FN=0, Flags=...P...TC
1731	49.440243		IntelCor_d1:b6:4f (- 802.11	38 Acknowledgement, Flags=.....C		
1732	49.542481	Cisco-Li_f7:1d:51	Broadcast	802.11	183	Beacon frame, SN=3588, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
1733	49.583615	192.168.1.109	192.168.1.1	DHCP	390	DHCP Release - Transaction ID 0xea5a526
1734	49.583771		IntelCor_d1:b6:4f (- 802.11	38 Acknowledgement, Flags=.....C		
1735	49.609617	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	54	Deauthentication, SN=1605, FN=0, Flags=.....C
1736	49.609770		IntelCor_d1:b6:4f (- 802.11	38 Acknowledgement, Flags=.....C		
1737	49.614478	IntelCor_d1:b6:4f	Broadcast	802.11	99	Probe Request, SN=1606, FN=0, Flags=.....C, SSID="linksys_SE5_24086"
1738	49.615869		Cisco-Li_f5:ba:bb (- 802.11	38 Acknowledgement, Flags=.....C		
1739	49.617713		Cisco-Li_f5:ba:bb (- 802.11	38 Acknowledgement, Flags=.....C		
1740	49.638857	IntelCor_d1:b6:4f	Cisco-Li_f5:ba:bb	802.11	58	Authentication, SN=1606, FN=0, Flags=.....C
1741	49.639700	IntelCor_d1:b6:4f	Cisco-Li_f5:ba:bb	802.11	58	Authentication, SN=1606, FN=0, Flags=....R...C
1742	49.640702	IntelCor_d1:b6:4f	Cisco-Li_f5:ba:bb	802.11	58	Authentication, SN=1606, FN=0, Flags=....R...C
1743	49.641910		Cisco-Li_f5:ba:bb (- 802.11	38 Acknowledgement, Flags=.....C		
1744	49.642315	IntelCor_d1:b6:4f	Cisco-Li_f5:ba:bb	802.11	58	Authentication, SN=1606, FN=0, Flags=....R...C
1745	49.644710		Cisco-Li_f5:ba:bb	802.11	183	Beacon frame, SN=3589, FN=0, Flags=.....C, BI=100, SSID="30 Munroe St"
1746	49.645319	IntelCor_d1:b6:4f	Cisco-Li_f5:ba:bb	802.11	58	Authentication, SN=1606, FN=0, Flags=....R...C
1747	49.646711		Cisco-Li_f5:ba:bb (- 802.11	38 Acknowledgement, Flags=.....C		
1748	49.647827		Cisco-Li_f5:ba:bb (- 802.11	38 Acknowledgement, Flags=.....C		
1749	49.649705	IntelCor_d1:b6:4f	Cisco-Li_f5:ba:bb	802.11	58	Authentication, SN=1606, FN=0, Flags=....R...C
1750	49.651078	IntelCor_d1:b6:4f	Cisco-Li_f5:ba:bb	802.11	107	Association Request, SN=1607, FN=0, Flags=.....C, SSID="linksys_SE5_24086"
1751	49.653218	IntelCor_d1:b6:4f	Cisco-Li_f5:ba:bb	802.11	107	Association Request, SN=1607, FN=0, Flags=....R...C, SSID="linksys_SE5_24086"
1752	49.662857		Cisco-Li_f5:ba:bb (- 802.11	38 Acknowledgement, Flags=.....C		
1753	49.663950		Cisco-Li_f5:ba:bb (- 802.11	38 Acknowledgement, Flags=.....C		
1754	49.665704		Cisco-Li_f5:ba:bb (- 802.11	38 Acknowledgement, Flags=.....C		
1755	49.669072		Cisco-Li_f5:ba:bb (- 802.11	38 Acknowledgement, Flags=.....C		
1756	49.671321		Cisco-Li_f5:ba:bb (- 802.11	38 Acknowledgement, Flags=.....C		
1757	49.673449		Cisco-Li_f5:ba:bb (- 802.11	38 Acknowledgement, Flags=.....C		

11R - O host está solicitando que a associação seja aberta.

```

> Frame 1740: 58 bytes on wire (464 bits), 58 bytes captured (464 bits)
> Radiotap Header v0, Length 24
> 802.11 radio information
> IEEE 802.11 Authentication, Flags: .....C
  Type/Subtype: Authentication (0x000b)
    > Frame Control Field: 0xb000
      .... ..00 = Version: 0
      .... 00.. = Type: Management frame (0)
      1011 .... = Subtype: 11
    > Flags: 0x00
      .000 0001 0011 1010 = Duration: 314 microseconds
      Receiver address: Cisco-Li_f5:ba:bb (00:18:39:f5:ba:bb)
      Destination address: Cisco-Li_f5:ba:bb (00:18:39:f5:ba:bb)
      Transmitter address: IntelCor_d1:b6:4f (00:13:02:d1:b6:4f)
      Source address: IntelCor_d1:b6:4f (00:13:02:d1:b6:4f)
      BSS Id: Cisco-Li_f5:ba:bb (00:18:39:f5:ba:bb)
      .... .... 0000 = Fragment number: 0
      0110 0100 0110 .... = Sequence number: 1606
      Frame check sequence: 0xed30374c [unverified]
      [FCS Status: Unverified]
    > IEEE 802.11 Wireless Management
      > Fixed parameters (6 bytes)
        Authentication Algorithm: Open System (0)
        Authentication SEQ: 0x0001
        Status code: Successful (0x0000)

```

12R - Não é encontrado nenhuma resposta do AP, provavelmente por estar esperando uma chave e ignorando autenticações abertas.

13R - Em t = 63,168087, há um quadro de AUTHENTICATION enviado de 00:13:02:d1:b6:4f (host) para 00:16:b7:f7:1d:51 (BSS). Em t = 63,169071, há uma AUTHENTICATION enviada na direção oposta, do BSS para o host.

2156	63.168087	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	58 Authentication, SN=1647, FN=0, Flags=.....C
2157	63.168222		IntelCor_d1:b6:4f (-	802.11	38 Acknowledgement, Flags=.....C
2158	63.169071	Cisco-Li_f7:1d:51	IntelCor_d1:b6:4f	802.11	58 Authentication, SN=3726, FN=0, Flags=.....C

14R - Em t = 63,169910, é enviado um quadro ASSOCIATE REQUEST de 00:13:02:d1:b6:4f (o host) para 00:16:b7:f7:1d:51 (o BSS). Em t = 63,192101, há uma ASSOCIATE RESPONSE enviada na direção reversa do BSS para o host sem fio.

2162	63.169910	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	89 Association Request, SN=1648, FN=0, Flags=.....C, SSID="30 Munroe St"
2163	63.170008		IntelCor_d1:b6:4f (-	802.11	38 Acknowledgement, Flags=.....C
2164	63.170692	Cisco-Li_f7:1d:51	IntelCor_d1:b6:4f	802.11	58 Authentication, SN=3727, FN=0, Flags=.....C
2165	63.171000		Cisco-Li_f7:1d:51 (-	802.11	38 Acknowledgement, Flags=.....C
2166	63.192101	Cisco-Li_f7:1d:51	IntelCor_d1:b6:4f	802.11	94 Association Response, SN=3728, FN=0, Flags=.....C

15R - No quadro ASSOCIATE REQUEST, as taxas suportadas são anunciadas como 1, 2, 5,5, 11, 6, 9, 12, 18, 24, 32, 48 e 54 Mbps. As mesmas taxas são anunciadas na ASSOCIATE RESPONSE.

```
> Frame 2162: 89 bytes on wire (712 bits), 89 bytes captured (712 bits)
> Radiotap Header v0, Length 24
> 802.11 radio information
> IEEE 802.11 Association Request, Flags: .....C
▼ IEEE 802.11 Wireless Management
  > Fixed parameters (4 bytes)
  ▼ Tagged parameters (33 bytes)
    > Tag: SSID parameter set: "30 Munroe St"
    ▼ Tag: Supported Rates 1(B), 2(B), 5.5(B), 11(B), 6(B), 9, 12(B), 18, [Mbit/sec]
      Tag Number: Supported Rates (1)
      Tag length: 8
      Supported Rates: 1(B) (0x82)
      Supported Rates: 2(B) (0x84)
      Supported Rates: 5.5(B) (0x88)
      Supported Rates: 11(B) (0x96)
      Supported Rates: 6(B) (0x8c)
      Supported Rates: 9 (0x12)
      Supported Rates: 12(B) (0x98)
      Supported Rates: 18 (0x24)
    > Tag: QoS Capability
    > Tag: Extended Supported Rates 24(B), 36, 48, 54, [Mbit/sec]
```

16R - Em t = 2,297613, há uma PROBE REQUEST enviada com origem 00:12:f0:1f:57:13, destino: ff:ff:ff:ff:ff:ff e um BSSID de ff:ff:ff:ff: f: f. Em t = 2,300697, há uma PROBE RESPONSE enviada com origem: 00:16:b6:f7:1d:51, destino e um BSSID de 00:16:b6:f7:1d:51.

Uma PROBE REQUEST é usada por um host em varredura ativa para encontrar um ponto de acess. Uma RESPOSTA DE SONDAGEM é enviada pelo ponto de acesso ao host que está enviando a solicitação.

50	2.297613	IntelCor_1f:57:13	Broadcast	802.11	79 Probe Request, SN=576, FN=0, Flags=...
51	2.300697	Cisco-Li_f7:1d:51	IntelCor_1f:57:13	802.11	177 Probe Response, SN=2878, FN=0, Flags=...
52	2.302191	Cisco-Li_f7:1d:51	IntelCor_1f:57:13	802.11	177 Probe Response, SN=2878, FN=0, Flags=...
53	2.304063	Cisco-Li_f7:1d:51	IntelCor_1f:57:13	802.11	177 Probe Response, SN=2878, FN=0, Flags=...
54	2.305562	Cisco-Li_f7:1d:51	IntelCor_1f:57:13	802.11	177 Probe Response, SN=2878, FN=0, Flags=...
55	2.308563	Cisco-Li_f7:1d:51	IntelCor_1f:57:13	802.11	177 Probe Response, SN=2878, FN=0, Flags=...
56	2.310072	Cisco-Li_f7:1d:51	IntelCor_1f:57:13	802.11	177 Probe Response, SN=2878, FN=0, Flags=...
57	2.338148	Cisco-Li_f7:1d:51	Broadcast	802.11	183 Beacon frame, SN=2879, FN=0, Flags=...
58	2.440572	Cisco-Li_f7:1d:51	Broadcast	802.11	183 Beacon frame, SN=2880, FN=0, Flags=...
59	2.453941	Cisco-Li_f7:1d:51	IntelCor_1f:57:13	802.11	177 Probe Response, SN=2881, FN=0, Flags=...
60	2.542945	Cisco-Li_f7:1d:51	Broadcast	802.11	183 Beacon frame, SN=2882, FN=0, Flags=...
61	2.645319	Cisco-Li_f7:1d:51	Broadcast	802.11	183 Beacon frame, SN=2883, FN=0, Flags=...
62	2.747697	Cisco-Li_f7:1d:51	Broadcast	802.11	183 Beacon frame, SN=2884, FN=0, Flags=...
63	2.850114	Cisco-Li_f7:1d:51	Broadcast	802.11	183 Beacon frame, SN=2885, FN=0, Flags=...
64	2.952572	Cisco-Li_f7:1d:51	Broadcast	802.11	183 Beacon frame, SN=2886, FN=0, Flags=...
65	3.054945	Cisco-Li_f7:1d:51	Broadcast	802.11	183 Beacon frame, SN=2887, FN=0, Flags=...
66	3.157343	Cisco-Li_f7:1d:51	Broadcast	802.11	183 Beacon frame, SN=2888, FN=0, Flags=...
67	3.260366	Cisco-Li_f7:1d:51	Broadcast	802.11	183 Beacon frame, SN=2889, FN=0, Flags=...
68	3.260500	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	54 QoS Null function (No data), SN=1488, f...

> Frame 50: 79 bytes on wire (632 bits), 79 bytes captured (632 bits)
 > Radiotap Header v0, Length 24
 > 802.11 radio information
 > IEEE 802.11 Probe Request, Flags:C
 > Type/Subtype: Probe Request (0x0004)
 > Frame Control Field: 0x4000
 .000 0000 0000 0000 = Duration: 0 microseconds
 Receiver address: Broadcast (ff:ff:ff:ff:ff:ff)
 Destination address: Broadcast (ff:ff:ff:ff:ff:ff)
 Transmitter address: IntelCor_1f:57:13 (00:12:f0:1f:57:13)
 Source address: IntelCor_1f:57:13 (00:12:f0:1f:57:13)
 BSS Id: Broadcast (ff:ff:ff:ff:ff:ff)
 0000 = Fragment number: 0
 0010 0100 0000 = Sequence number: 576
 Frame check sequence: 0xa373c5ff [unverified]
 [FCS Status: Unverified]
 > IEEE 802.11 Wireless Management

50	2.297613	IntelCor_1f:57:13	Broadcast	802.11	79 Probe Request, SN=576, FN=0, Flags=...
51	2.300697	Cisco-Li_f7:1d:51	IntelCor_1f:57:13	802.11	177 Probe Response, SN=2878, FN=0, Flags=...
52	2.302191	Cisco-Li_f7:1d:51	IntelCor_1f:57:13	802.11	177 Probe Response, SN=2878, FN=0, Flags=...
53	2.304063	Cisco-Li_f7:1d:51	IntelCor_1f:57:13	802.11	177 Probe Response, SN=2878, FN=0, Flags=...
54	2.305562	Cisco-Li_f7:1d:51	IntelCor_1f:57:13	802.11	177 Probe Response, SN=2878, FN=0, Flags=...
55	2.308563	Cisco-Li_f7:1d:51	IntelCor_1f:57:13	802.11	177 Probe Response, SN=2878, FN=0, Flags=...
56	2.310072	Cisco-Li_f7:1d:51	IntelCor_1f:57:13	802.11	177 Probe Response, SN=2878, FN=0, Flags=...
57	2.338148	Cisco-Li_f7:1d:51	Broadcast	802.11	183 Beacon frame, SN=2879, FN=0, Flags=...
58	2.440572	Cisco-Li_f7:1d:51	Broadcast	802.11	183 Beacon frame, SN=2880, FN=0, Flags=...
59	2.453941	Cisco-Li_f7:1d:51	IntelCor_1f:57:13	802.11	177 Probe Response, SN=2881, FN=0, Flags=...
60	2.542945	Cisco-Li_f7:1d:51	Broadcast	802.11	183 Beacon frame, SN=2882, FN=0, Flags=...
61	2.645319	Cisco-Li_f7:1d:51	Broadcast	802.11	183 Beacon frame, SN=2883, FN=0, Flags=...
62	2.747697	Cisco-Li_f7:1d:51	Broadcast	802.11	183 Beacon frame, SN=2884, FN=0, Flags=...
63	2.850114	Cisco-Li_f7:1d:51	Broadcast	802.11	183 Beacon frame, SN=2885, FN=0, Flags=...
64	2.952572	Cisco-Li_f7:1d:51	Broadcast	802.11	183 Beacon frame, SN=2886, FN=0, Flags=...
65	3.054945	Cisco-Li_f7:1d:51	Broadcast	802.11	183 Beacon frame, SN=2887, FN=0, Flags=...
66	3.157343	Cisco-Li_f7:1d:51	Broadcast	802.11	183 Beacon frame, SN=2888, FN=0, Flags=...
67	3.260366	Cisco-Li_f7:1d:51	Broadcast	802.11	183 Beacon frame, SN=2889, FN=0, Flags=...
68	3.260500	IntelCor_d1:b6:4f	Cisco-Li_f7:1d:51	802.11	54 QoS Null function (No data), SN=1488, f...

> Frame 51: 177 bytes on wire (1416 bits), 177 bytes captured (1416 bits)
 > Radiotap Header v0, Length 24
 > 802.11 radio information
 > IEEE 802.11 Probe Response, Flags:C
 > Type/Subtype: Probe Response (0x0005)
 > Frame Control Field: 0x5000
 .000 0001 0011 1010 = Duration: 314 microseconds
 Receiver address: IntelCor_1f:57:13 (00:12:f0:1f:57:13)
 Destination address: IntelCor_1f:57:13 (00:12:f0:1f:57:13)
 Transmitter address: Cisco-Li_f7:1d:51 (00:16:b6:f7:1d:51)
 Source address: Cisco-Li_f7:1d:51 (00:16:b6:f7:1d:51)
 BSS Id: Cisco-Li_f7:1d:51 (00:16:b6:f7:1d:51)
 0000 = Fragment number: 0
 1011 0011 1110 = Sequence number: 2878
 Frame check sequence: 0x6ed851bb [unverified]
 [FCS Status: Unverified]
 > IEEE 802.11 Wireless Management

ROTEIRO 2 – Ethernet e ARP

1R – O endereço Ethernet do meu computador é 70:85:c2:be:5c:35

```

> Frame 928: 560 bytes on wire (4480 bits), 560 bytes captured (4480 bits) on 0
▼ Ethernet II, Src: ASRockIn_be:5c:35 (70:85:c2:be:5c:35), Dst: Tellesco_50:b7:25 (94:ea:ea:50:b7:25)
  Destination: Tellesco_50:b7:25 (94:ea:ea:50:b7:25)
    Address: Tellesco_50:b7:25 (94:ea:ea:50:b7:25)
      .... ..0. .... = LG bit: Globally unique address (unicast)
      .... ..0 .... = IG bit: Individual address (unicast)
  Source: ASRockIn_be:5c:35 (70:85:c2:be:5c:35)
    Address: ASRockIn_be:5c:35 (70:85:c2:be:5c:35)
      .... ..0. .... = LG bit: Globally unique address (unicast)
      .... ..0 .... = IG bit: Individual address (unicast)
  Type: IPv4 (0x0800)
> Internet Protocol Version 4, Src: 192.168.15.3, Dst: 128.119.245.12
> Transmission Control Protocol, Src Port: 59107, Dst Port: 80, Seq: 1, Len: 52
> Hypertext Transfer Protocol

```

2R - O endereço de destino 94:ea:ea:50:b7:25 não é o endereço Ethernet de gaia.cs.umass.edu. É o endereço do meu roteador, que é o link usado para sair da sub-rede.

3R - O valor hexadecimal do campo frame type é 0x0800 e isso corresponde ao protocolo IP.

```

> Frame 928: 560 bytes on wire (4480 bits), 560 bytes captured (4480 bits) on 0
▼ Ethernet II, Src: ASRockIn_be:5c:35 (70:85:c2:be:5c:35), Dst: Tellesco_50:b7:25 (94:ea:ea:50:b7:25)
  Destination: Tellesco_50:b7:25 (94:ea:ea:50:b7:25)
  Source: ASRockIn_be:5c:35 (70:85:c2:be:5c:35)
  Type: IPv4 (0x0800)
> Internet Protocol Version 4, Src: 192.168.15.3, Dst: 128.119.245.12
> Transmission Control Protocol, Src Port: 59107, Dst Port: 80, Seq: 1, Len: 52
> Hypertext Transfer Protocol

```

4R - O ASCII "G" aparece 52 bytes a partir do início do quadro Ethernet. Há um quadro Ethernet de 14 B e, em seguida, 20 bytes de cabeçalho IP seguidos por 20 bytes de cabeçalho TCP antes que os dados HTTP sejam encontrados.

0000	94 ea ea 50 b7 25 70 85 c2 be 5c 35 08 00 45 00	...P·%p· ..\5·E·
0010	02 22 a0 15 40 00 80 06 13 91 c0 a8 0f 03 80 77	·"··@········w
0020	f5 0c e6 e3 00 50 e5 18 45 d5 50 c1 2c 0c 50 18	·····P· E·P·, ·P·
0030	02 04 1a b9 00 00 47 45 54 20 2f 77 69 72 65 73	·····GE T /wires
0040	68 61 72 6b 2d 6c 61 62 73 2f 48 54 54 50 2d 77	hark-lab s/HTTP-w
0050	69 72 65 73 68 61 72 6b 2d 66 69 6c 65 33 2e 68	ireshawk -file3.h
0060	74 6d 6c 20 48 54 54 50 2f 31 2e 31 0d 0a 48 6f	tml HTTP /1.1·Ho
0070	73 74 3a 20 67 61 69 61 2e 63 73 2e 75 6d 61 73	st: gaia .cs.umass
0080	73 2e 65 64 75 0d 0a 43 6f 6e 6e 65 63 74 69 6f	s.edu·C onnectio
0090	6e 3a 20 6b 65 65 70 2d 61 6c 69 76 65 0d 0a 55	n: keep-alive·U
00a0	70 67 72 61 64 65 2d 49 6e 73 65 63 75 72 65 2d	pgrade-I nsecure-
00b0	52 65 71 75 65 73 74 73 3a 20 31 0d 0a 55 73 65	Requests : 1·Use
00c0	72 2d 41 67 65 6e 74 3a 20 4d 6f 7a 69 6c 6c 61	r-Agent: Mozilla
00d0	2f 35 2e 30 20 28 57 69 6e 64 6f 77 73 20 4e 54	/5.0 (Wi ndows NT
00e0	20 31 30 2e 30 3b 20 57 69 6e 36 34 3b 20 78 36	10.0; W in64; x6
00f0	34 29 20 41 70 70 6c 65 57 65 62 4b 69 74 2f 35	4) Apple WebKit/5
0100	33 37 2e 33 36 20 28 4b 48 54 4d 4c 2c 20 6c 69	37.36 (K HTML, li
0110	6b 65 20 47 65 63 6b 6f 29 20 43 68 72 6f 6d 65	ke Gecko) Chrome
0120	2f 31 31 30 2e 30 2e 30 2e 30 20 53 61 66 61 72	/110.0.0 .0 Safar
0130	69 2f 35 33 37 2e 33 36 20 4f 50 52 2f 39 36 2e	i/537.36 OPR/96.

5R - O endereço de origem 94:ea:ea:50:b7:25 não é o endereço Ethernet de gaia.cs.umass.edu nem o endereço do meu computador. É o endereço do meu roteador, que é o link usado para entrar na minha sub-rede.

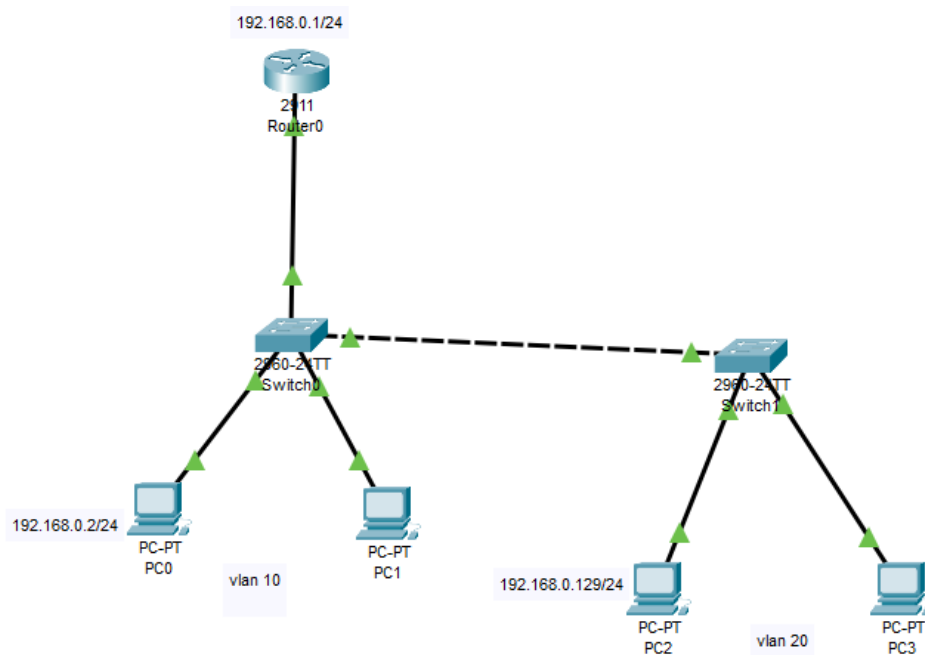
6R - O endereço Ethernet 70:85:c2:be:5c:35 é o do meu computador.

7R - O valor hexadecimal do campo frame type é 0x0800 e isso corresponde ao protocolo IP.

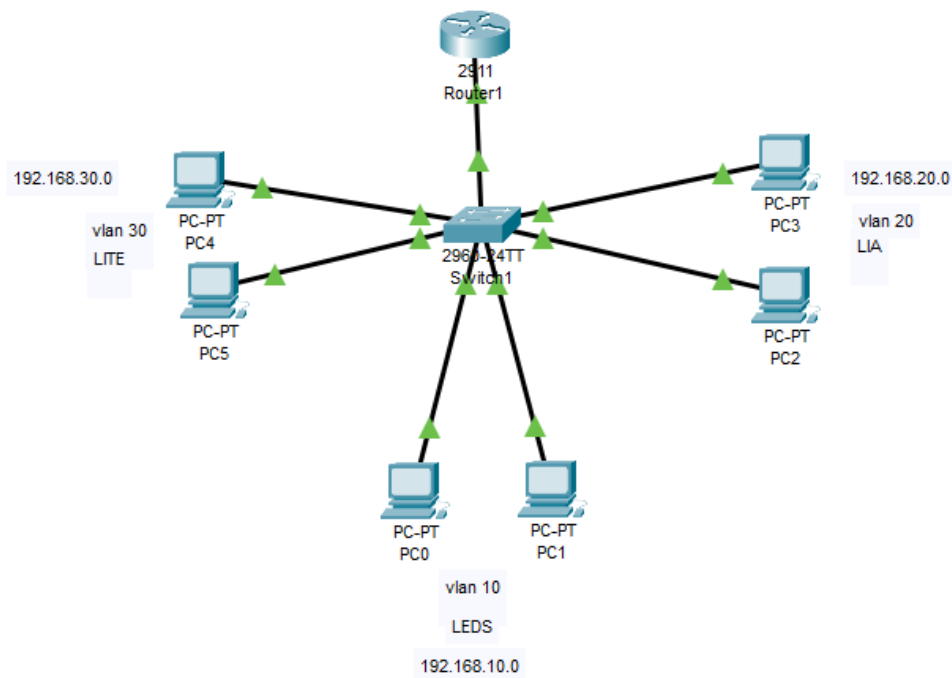
8R - O ASCII "O" aparece 52 bytes a partir do início do quadro Ethernet. Novamente, há 14 bytes de quadro Ethernet e, em seguida, 20 bytes de cabeçalho IP seguidos por 20 bytes de cabeçalho TCP antes que os dados HTTP sejam encontrados.

Cisco Packet Tracer

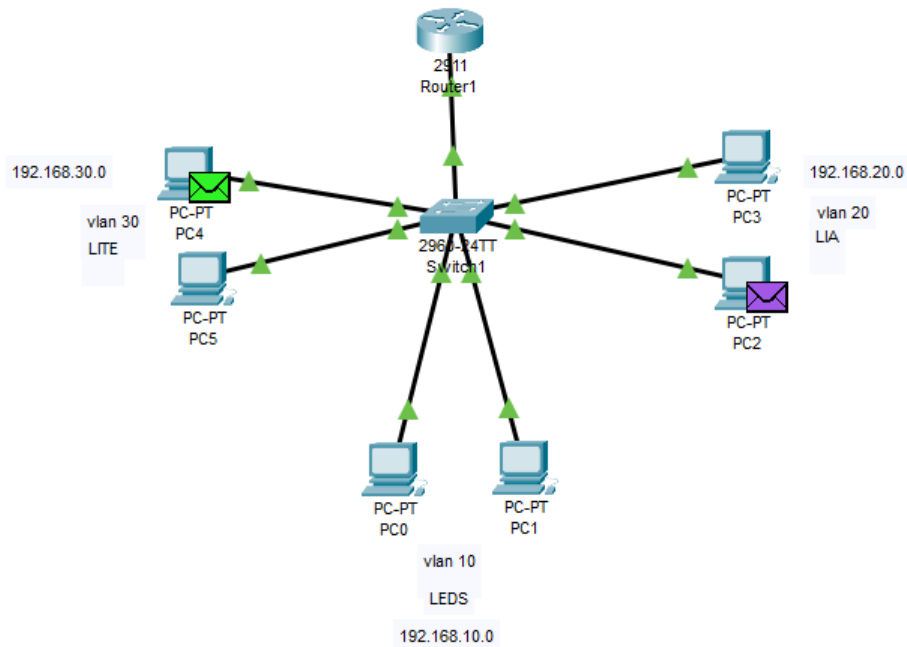
Sem fio



Com fio

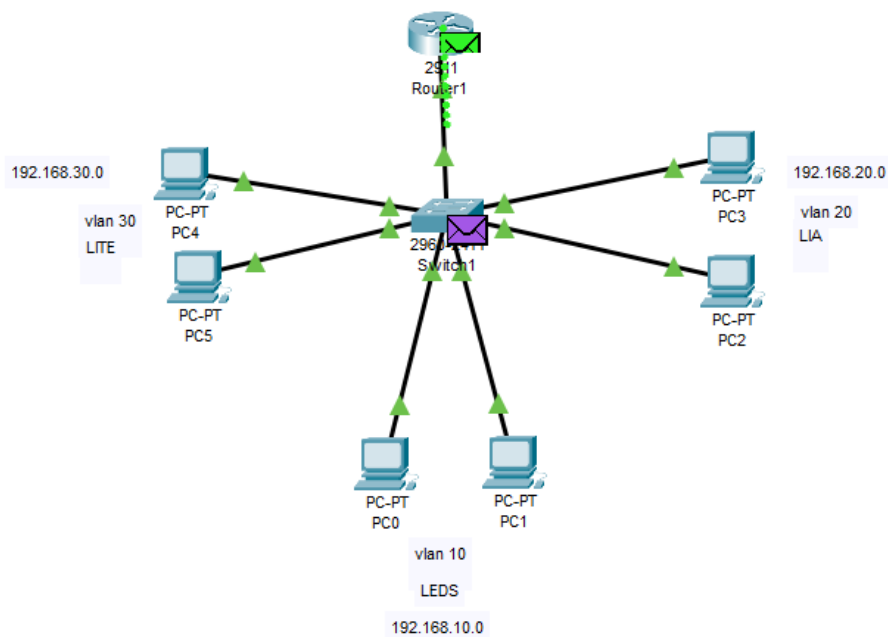


Etapa 1: Mensagem verde com origem o PC4 e destino a PC2 e mensagem roxa com origem o PC2 e destino a PC5.



As mensagens saem dos PCs de origem encapsulados em quadros para transmissão correta nos meios e vão em direção ao switch.

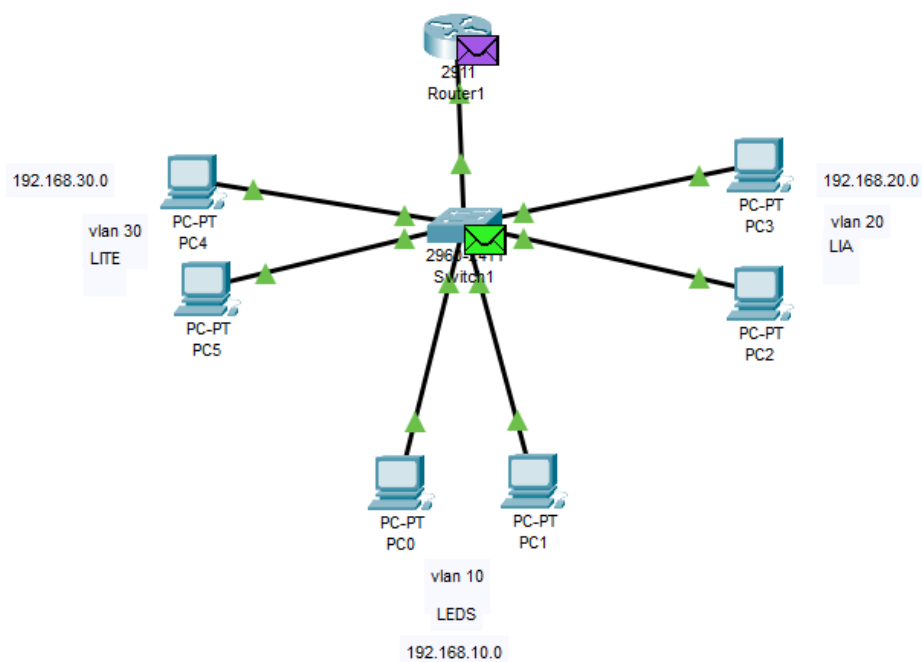
Etapa 2: Controle de fluxo no switch



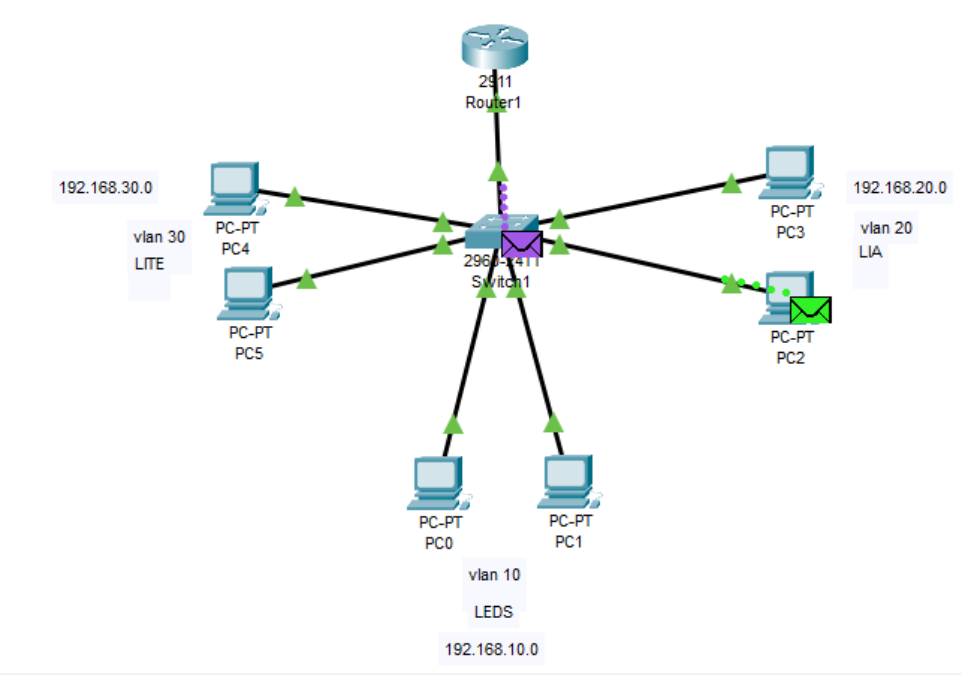
Enquanto o roteador está em uso o switch/camada de enlace controla o fluxo da rede para não ocorrer colisões e perda de quadros, assim que o roteador terminar sua tarefa é enviado a próxima mensagem. O roteador está com uma conexão do tipo trunk, a qual consegue transmitir quadros de várias vlans em uma única porta.

```
UNIVALI#sh int status
```

Port	Name	Status	Vlan	Duplex	Speed	Type
Fa0/1		connected	10	auto	auto	10/100BaseTX
Fa0/2		connected	10	auto	auto	10/100BaseTX
Fa0/3		connected	20	auto	auto	10/100BaseTX
Fa0/4		connected	20	auto	auto	10/100BaseTX
Fa0/5		connected	30	auto	auto	10/100BaseTX
Fa0/6		connected	30	auto	auto	10/100BaseTX
Fa0/7		connected	trunk	auto	auto	10/100BaseTX
Fa0/8		notconnect	1	auto	auto	10/100BaseTX



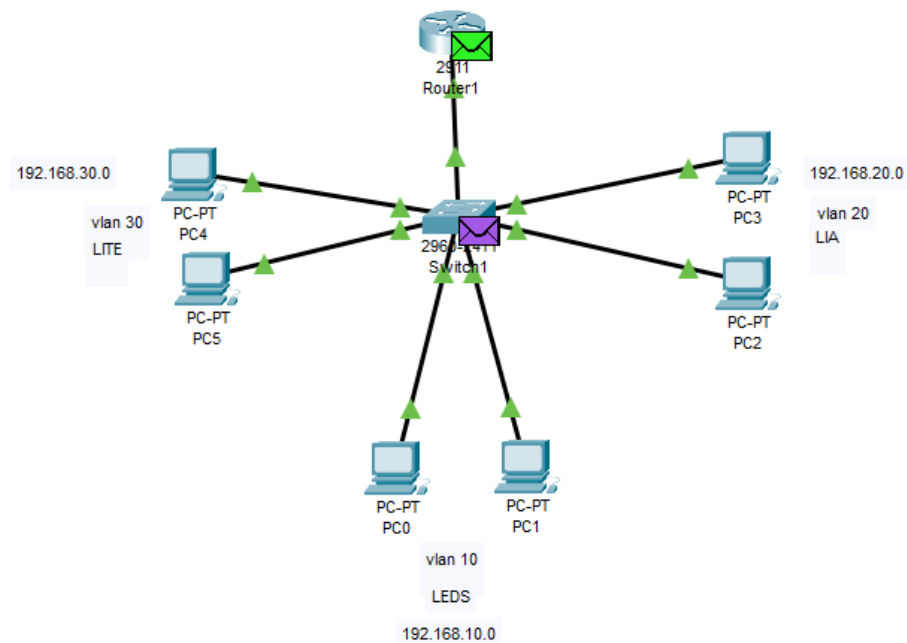
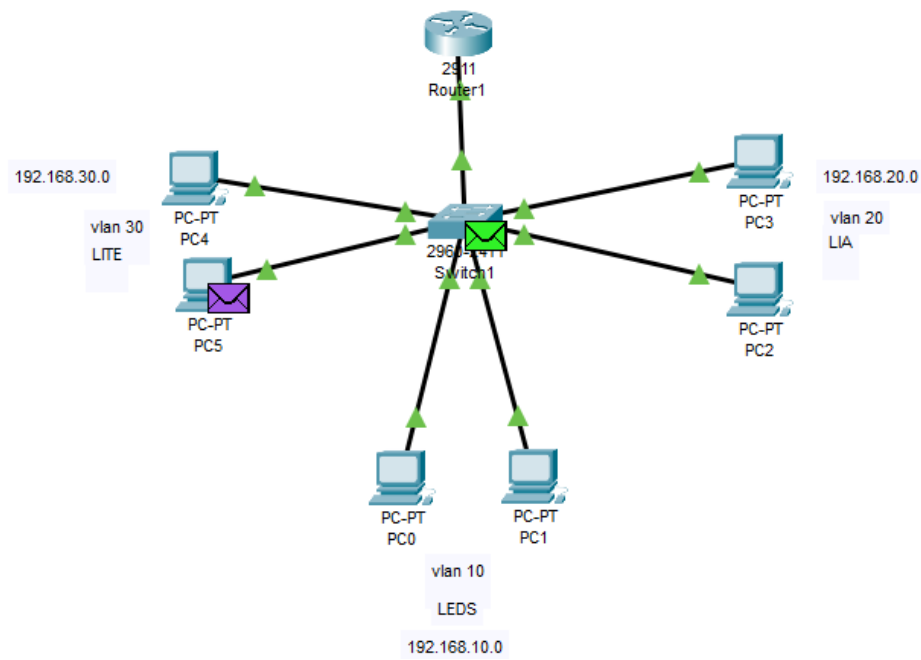
Etapa 3: A vlan destino é diferente da vlan de origem, o roteador consegue fazer essa comunicação entre vlans e fazer a mensagem verde chegar até ao PC2.



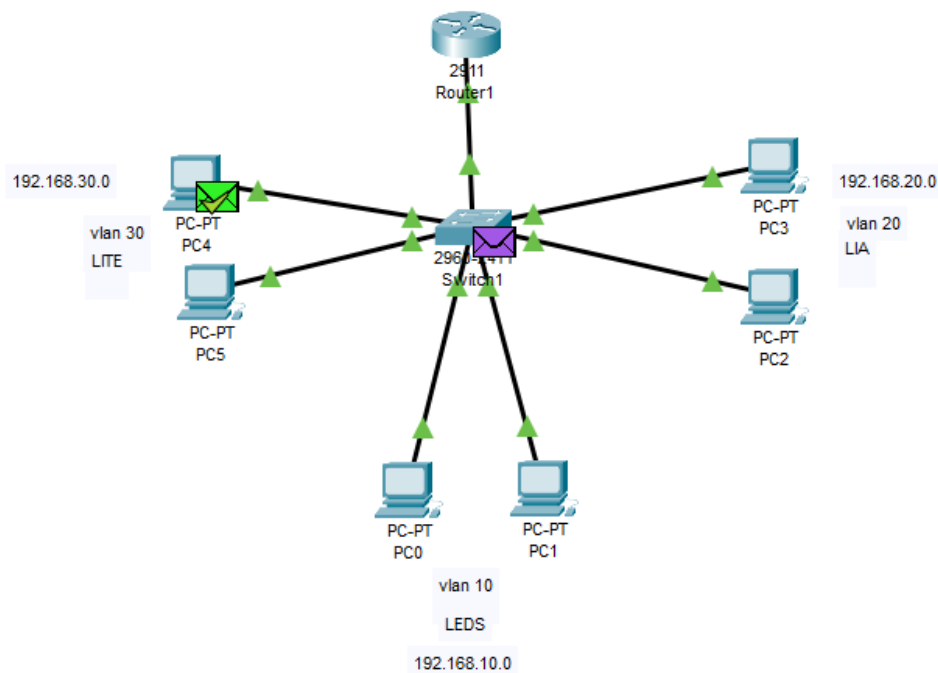
O roteador usa o endereço ip para indicar o endereço mac do computador destino, possibilitando a mensagem verde chega ao seu destino em outra vlan.

```
-----
UNIVALI#sh mac address-table dynamic
      Mac Address Table
-----
Vlan    Mac Address      Type      Ports
----    -
1       0009.7c35.0601    DYNAMIC   Fa0/7
10      0001.6323.437c    DYNAMIC   Fa0/2
10      0005.5e0c.d95b    DYNAMIC   Fa0/1
10      0009.7c35.0601    DYNAMIC   Fa0/7
20      0009.7c35.0601    DYNAMIC   Fa0/7
20      00d0.5838.c731    DYNAMIC   Fa0/3
30      0009.7c35.0601    DYNAMIC   Fa0/7
30      00d0.ba36.ded9    DYNAMIC   Fa0/6
30      00e0.a303.929b    DYNAMIC   Fa0/5
```

Etapa 4: Mensagem verde voltando ao switch para achar o caminho de volta no roteador. Enquanto a mensagem roxa chega ao seu destino após descobrir o caminho correto.

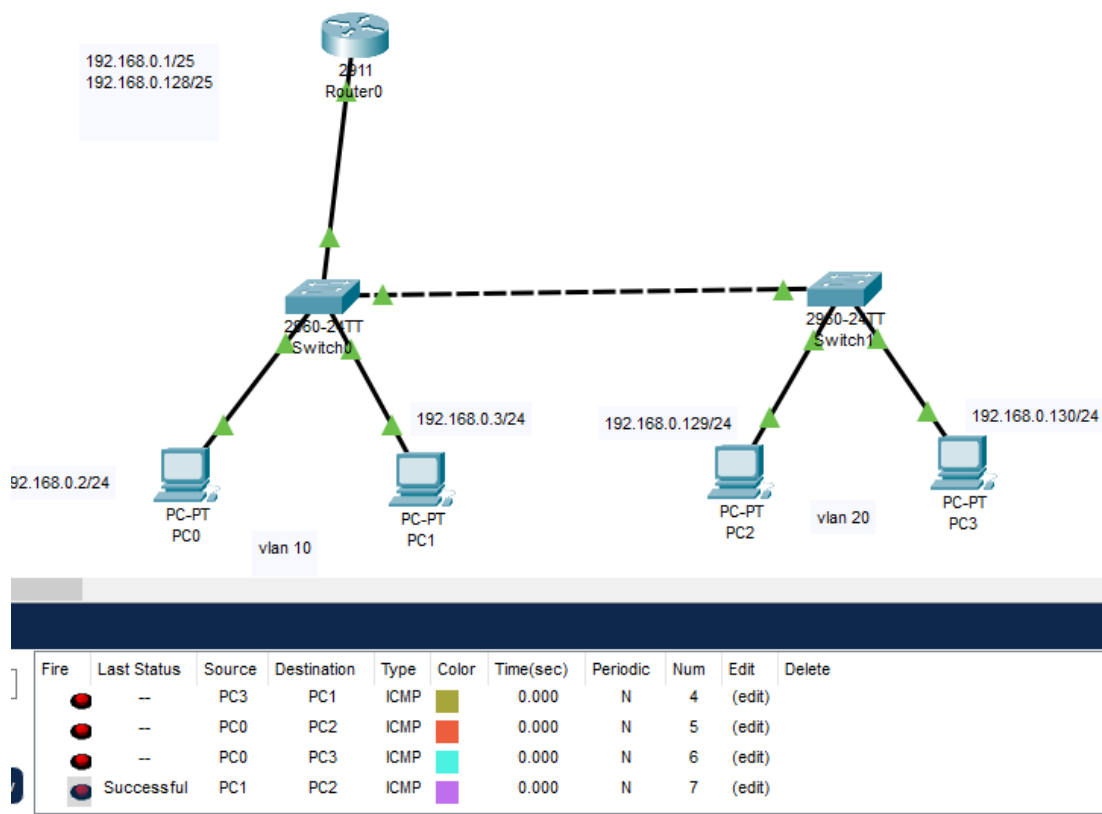


Etapas 5: Mensagem verde voltou ao remetente confirmando a entrega. Enquanto isso a mensagem roxa passa pelo switch para descobrir o caminho de volta ao remetente.



Para o sem fio a comunicação com os dois switch's e a quase a mesma coisa onde ambos têm que ir ao roteador para achar um ao outro, porém, o cabeçalho do protocolo de enquadramento tem algumas informações adicionais que remetem a ordem dos quadros. Pois devido a sua natureza, as conexões sem fio, as ondas eletromagnéticas são refletidas nos objetos e no solo tomando diferentes direções entre um emissor e um receptor, ocasionando um embaralhamento do sinal recebido.

Erros de bits são mais comuns em enlaces sem fio que em enlaces com fio, por isso são empregados poderosos códigos de detecção erros por CRC e protocolos de confirmação de recebimento.



Código CRC

Primeiramente é necessário um rápido contexto sobre o CRC, o código feito abaixo utiliza da técnica do polinômio gerador do CRC na hora de receber a informação lida pelo usuário, que deverá informar o tamanho de bits (dígitos) da mensagem binária, e a mensagem após o mesmo, mesma coisa para o tamanho do polinômio, e também deve passar o binário do polinômio. Após isso o programa irá mostrar o resultado inserindo o CRC gerado na mensagem. **O input do usuário deve ser feito por caracter de “espaço” entre os bits**

Abaixo segue a parte central do código onde ocorre a divisão polinomial do CRC e operação XOR.

```

class CRC {
public: int nf,
       ng,
       frame[20],
       gen[10],
       temp[20],
       b;
       char a;
       int * divide(int n, int g, int temp[10], int gen[10]) {
           for (int i = 0; i < n; i++) {
               if (gen[0] == temp[i]) {
                   for (int j = 0, k = i; j < g + 1; j++, k++) {
                       if (temp[k] ^ gen[j] == 1)
                           temp[k] = 1;
                       else
                           temp[k] = 0;
                   }
               }
           }
           return temp;
       }
}

```

Aqui temos uma execução para um polinômio de 6 bits e mensagem de transmissão de 48 bits.

```

input
Enter length of your frame:48
Enter your frame:1 0 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 1 1 1 1 1 0 1 1 1 0 1 0 1 1 1 1 1 1 1 1 1 1
Enter length of your generator:6
Enter your generator:1 0 1 0 1 0

-----Senders Side-----
CRC:1 0 1 1 0
Transmitted frame:1 0 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 0 1 0 1 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 1 0

```

GITHUB:

<https://github.com/victortdc/Redes2M1>